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AN 01-90KC-1

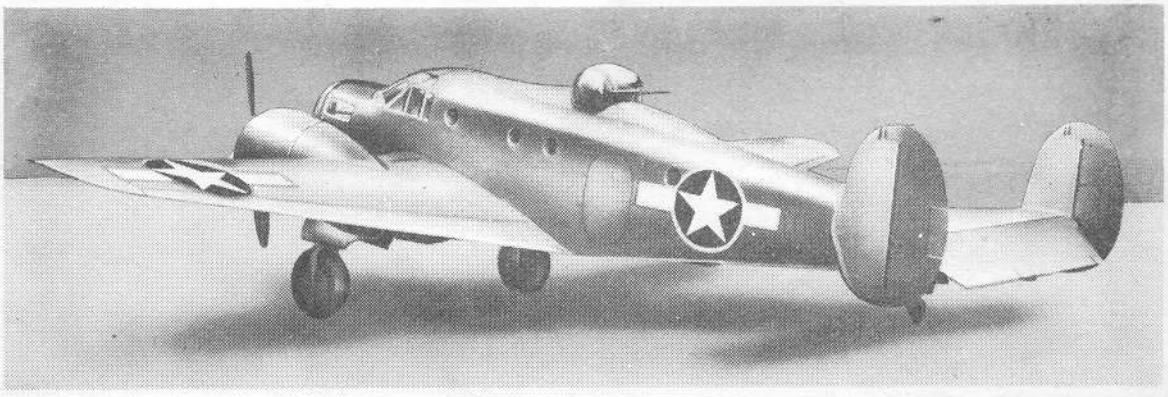
PILOT'S HANDBOOK

FOR

ARMY MODEL
AT-11

NAVY MODEL
SNB-1

AIRPLANES



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WF-O-5 DEC 46 1500

25 JULY 1944
REVISED 2 JANUARY 1946

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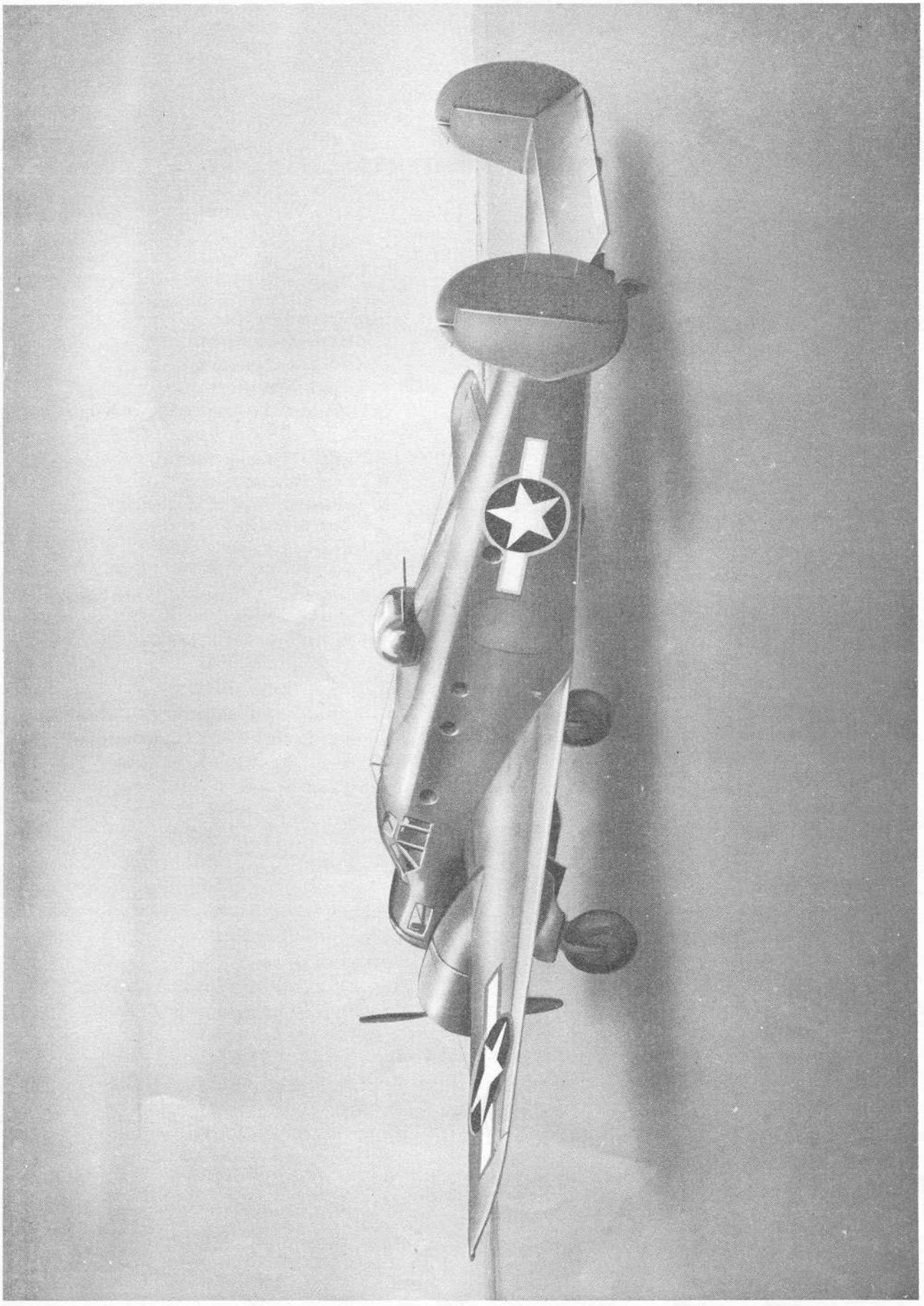


Figure 1—Three-Quarter Rear View, AT-11 and SNB-1

SECTION I
DESCRIPTION

1. AIRPLANE.

a. GENERAL.

(1) The models AT-11 and SNB-1 advanced bombing and training airplanes are twin-engine, low-wing, land monoplanes of all-metal, semi-monocoque construction, powered with two radial, air-cooled, model R985-AN-1 or R985-AN-3, Pratt and Whitney engines. Each engine drives a two-blade, Hamilton Standard, constant-speed propeller. Electrically operated landing gear, tail wheel, wing flaps, gun turret, and bomb bay doors are provided. Brakes are hydraulically operated.

(2) AT-11 airplanes are equipped with AUTOMATIC FLIGHT CONTROL EQUIPMENT and provisions are made for installing this equipment in SNB-1 airplanes.

(3) THE FUSELAGE is divided into four separate compartments accessible during flight; bombardier's compartment, pilot's compartment, cabin or turret compartment, and tunnel gun compartment. On airplanes serial No. 42-37694 and after, a navigator's station is provided in right rear corner of the cabin compartment. The airplanes may be used for bombing, gunnery, or navigation training.

(4) BOMB RACKS, for carrying ten 100-pound bombs, are provided.

(5) The TURRET GUN installation is designed, on AT-11 airplanes, Army serial AC41-27332 and after, and all SNB-1 airplanes, so that it may be removed when not on a gunnery-training mission and a cover fastened over the tunnel gun opening.

(6) THE CREW, in bombing training, consists of pilot, bombardier instructor, and one or two student bombardiers. In gunnery training, the crew consists of pilot, gunner instructor, and two student gunners.

(7) Approximate OVERALL DIMENSIONS are as follows:

Length .....34 ft, 1⅞ in.
Height ..... 9 ft, 7¾ in.
Span .....47 ft, 7¾ in.

b. FUEL AND OIL.

(1) FUEL: Specification No. AN-F-26, grade 91/96.

(2) OIL: AN Specification No. AN-VV-0-446; grade 1120 for summer and grade 1100 for winter.

c. LANDING GEAR.—Landing gear consists of two main landing wheels and a tail wheel. The main wheels and tail wheel have air-oleo type shock absorber units and are retracted simultaneously by an electric motor driving a series of shafts and chains.

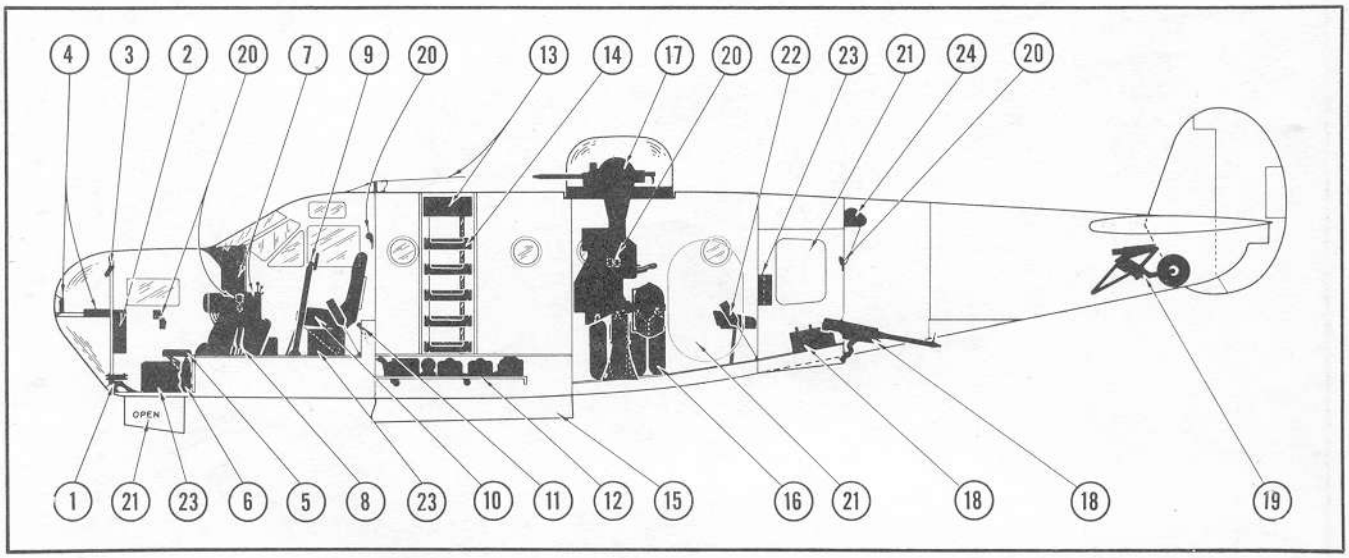


Figure 2—Fuselage Contents Arrangement, AT-11 and SNB-1

1. Bomb Sight Mount
2. Bombardier's Bomb Release Panel
3. Bombardier's Salvo Release Handle
4. Bombardier's Instrument Panels
5. Bombardier's Jump Seat
6. Engine Fire Extinguisher Bottle
7. Instrument Panel and Control Pedestal
8. Rudder Pedals
9. Control Column
10. Pilots' Seats
11. Pilot's Salvo Release
12. Automatic Flight Control Equipment
13. Radio Installation
14. Bomb Racks
15. Bomb Doors (Open)
16. Oxygen Bottles
17. Turret Installation
18. Tunnel Gun and Ammunition Case
19. Tail Wheel (Retracted)
20. Interphone Installations
21. Emergency Exits
22. Gunners' Jump Seats
23. Data Cases
24. Photo Observer (Some Airplanes)

d. HYDRAULIC SYSTEM. *(See figure 3.)*—The wheel brakes are the only units operated hydraulically. Other units are either manually or electrically operated.

e. OIL SYSTEM. *(See figure 4.)*—Oil is carried in two hopper tanks, one in each nacelle, of 8 U.S. (6⅔ Imp.) gallons capacity each. Oil dilution equipment for cold-weather starting is provided. For quick warm-up and temperature control in extremely cold weather, air intake for each oil temperature regulator is equipped with a butterfly valve operated from pilots' control pedestal. Each oil system is also equipped with an oil cooler bypass, manually operated, by means of which the oil may be bypassed around the cooler in very cold weather.

f. FUEL SYSTEM *(See figure 5.)*—The two main tanks, each with a capacity of 78 U.S. (65 Imp.) gallons are located in the center section, one on each side just outboard of fuselage. Two auxiliary tanks, each with a capacity of 25 U.S. (20.8 Imp.) gallons, are also located in center section, one immediately aft of each main tank. All tanks have electrically operated liquidometer gages. A tank selector valve, wobble pump, cross-feed valve, and primer are provided in the fuel system and all may be operated by either pilot or copilot.

g. HEATING AND VENTILATING SYSTEM.

(1) HEATING SYSTEM.—Hot air for pilots' compartment and cabin is provided from the intensifier tube installed in engine exhaust tail pipe. Conductor tubes also carry hot air to pilots' windshield and bombardier's compartment for defrosting purposes.

(2) VENTILATING SYSTEM.—Cold air enters openings in the leading edge of center section wing and is conducted by conduits to pilots' compartment and cabin. Exhaust ports in roof of cabin provide escape for old air.

h. OXYGEN SYSTEM. *(See figures 6 and 7.)*—Oxygen equipment is installed for five people.

(1) HIGH PRESSURE SYSTEM. *(See figure 6.)*—An oxygen bottle, type B-1, for each crew member, is strapped on right side of cabin, except for turret gunner. His oxygen bottle is located on the turret. Regulators for bombardier instructor and student bombardier are located on instrument panel guard rail. A

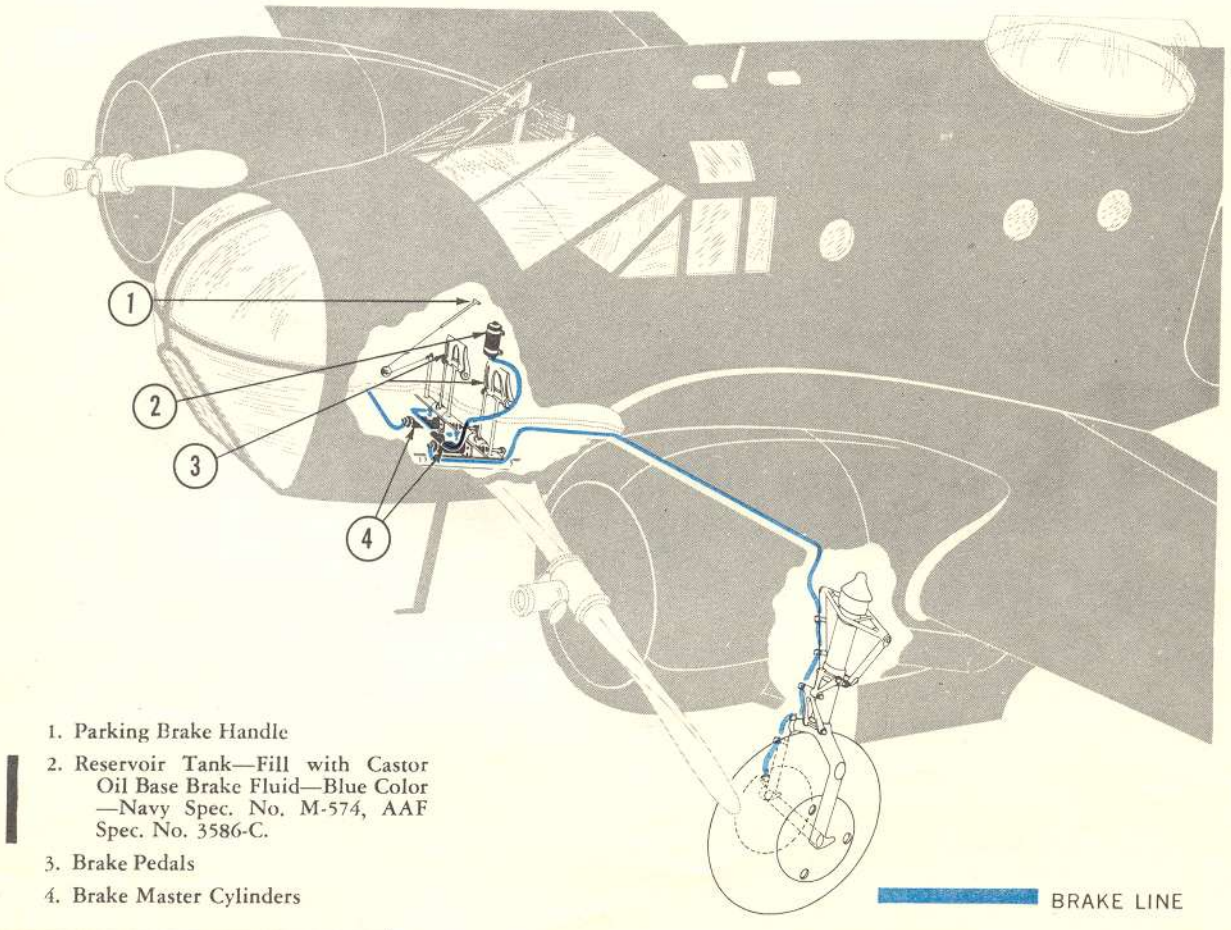
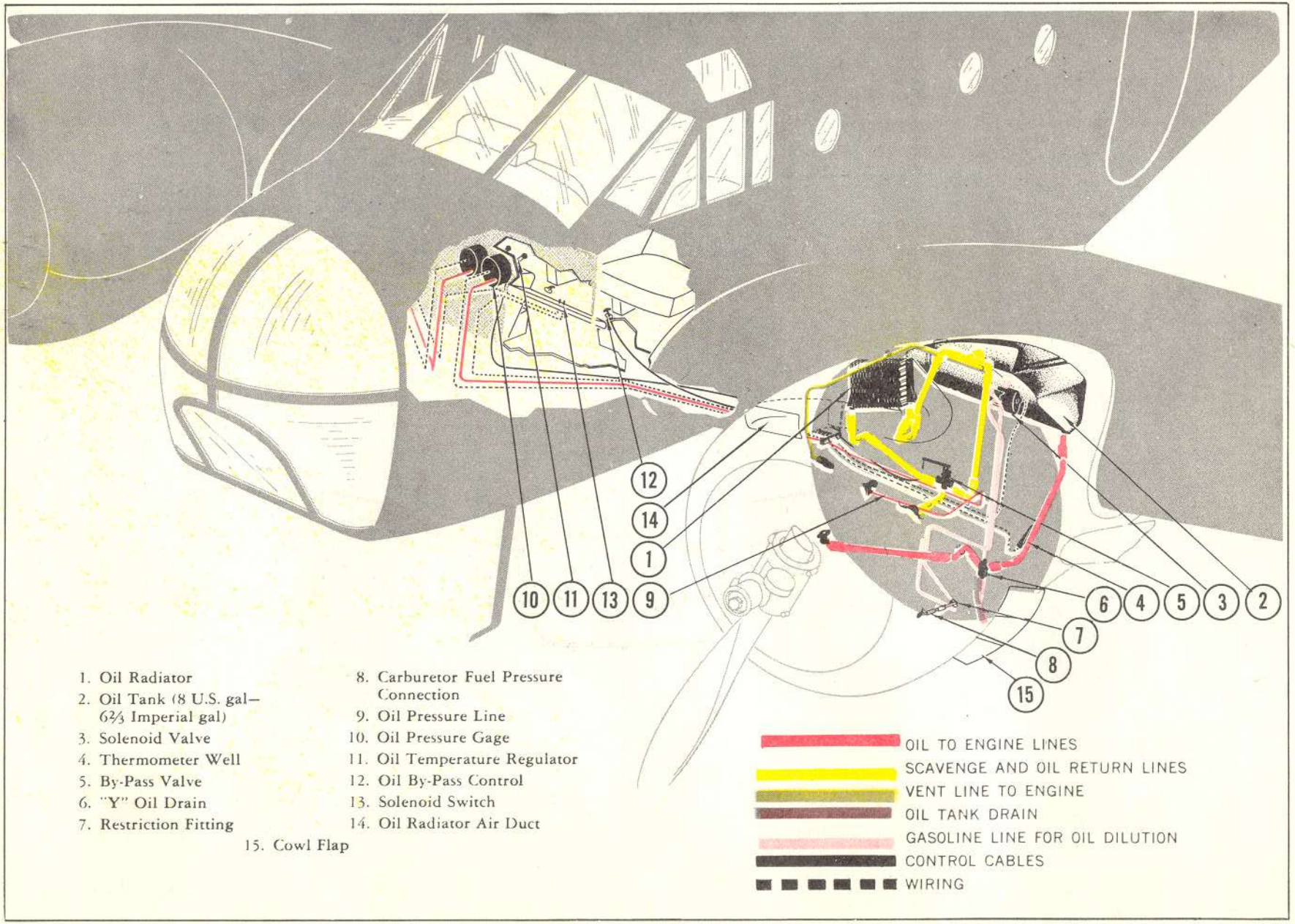


Figure 3—Hydraulic Brake System Diagram, AT-11 and SNB-1



1. Oil Radiator
2. Oil Tank (8 U.S. gal—6⅔ Imperial gal)
3. Solenoid Valve
4. Thermometer Well
5. By-Pass Valve
6. "Y" Oil Drain
7. Restriction Fitting
8. Carburetor Fuel Pressure Connection
9. Oil Pressure Line
10. Oil Pressure Gage
11. Oil Temperature Regulator
12. Oil By-Pass Control
13. Solenoid Switch
14. Oil Radiator Air Duct
15. Cowl Flap

Figure 4—Oil System Diagram, AT-11 and SNB-1

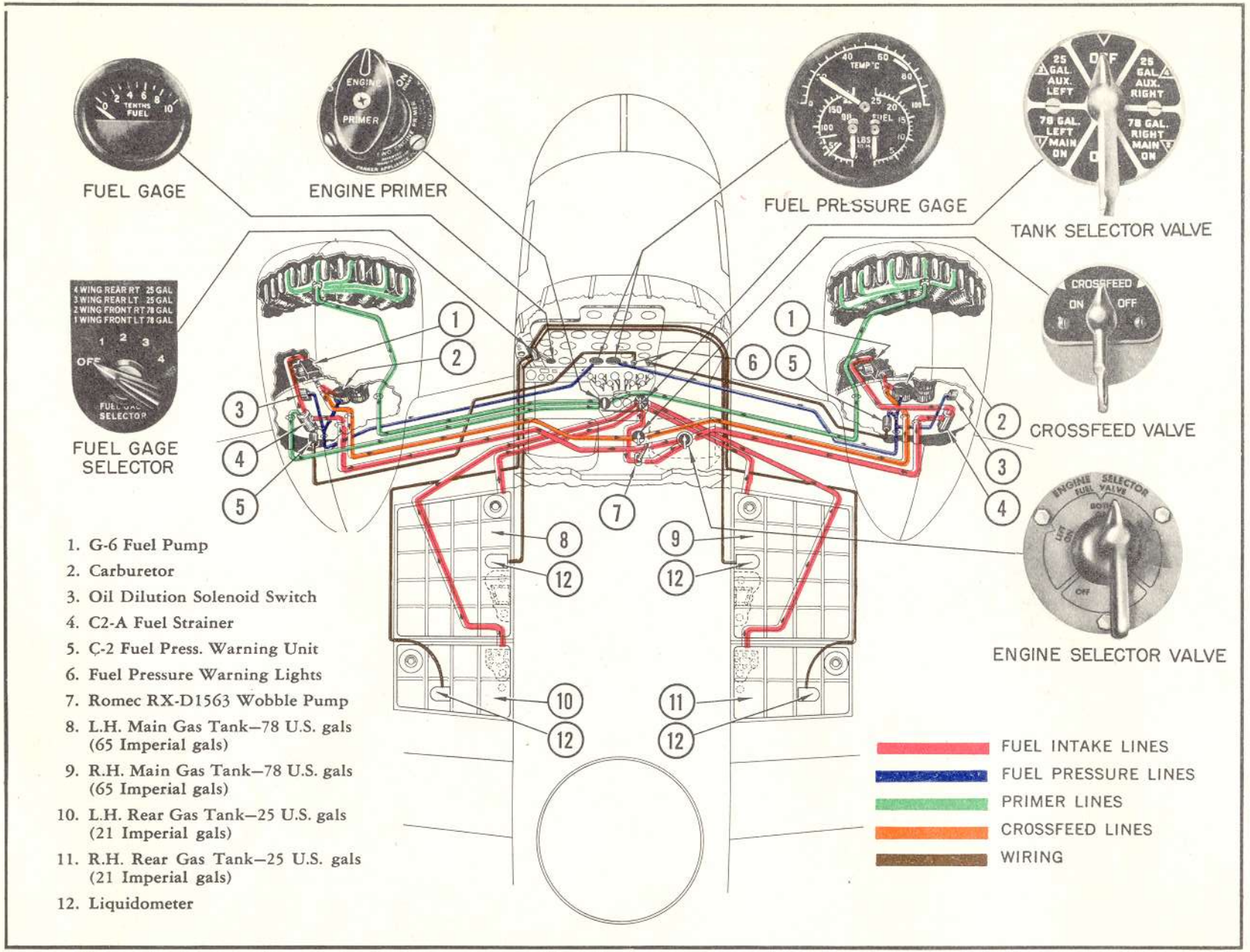


Figure 5—Fuel System Diagram, AT-11 and SNB-1

regulator is also provided on left side of pilots' compartment for the instructor when he is in copilot's position. The pilot's regulator is on left side of the airplane just under pilot's electrical panel. A regulator for turret gunner is installed on the Crocker-Wheeler turret and one for the tunnel gunner is installed directly on rear oxygen bottle.

(2) LOW PRESSURE SYSTEM. *(See figure 7.)*—On airplanes Army serial No. 42-37694 and after, a LOW-PRESSURE oxygen system is installed, which provides oxygen for five people but has a different arrangement of regulators and oxygen bottles. Two supply tanks are located in rear gunnery compartment above the door. Two portable supply tanks, to be used when it is necessary to go from one station to another at altitudes requiring use of oxygen, are provided. One is on right side of cabin between navigator's station and bomb bay, the other to right of bombardier's compartment. Navigator's regulator is directly in front of his seat on right side of cabin. Pilot's and copilot's regulators are located on the bulkhead directly behind and to outboard of their respective seats. Instructor's regulator is located on extreme right side of the guard rail and bombardier's regulator is on its left. A hose and fitting is provided near each portable supply tank, making it possible to fill them from main supply lines.

i. PROTECTIVE ARMOR.—No protective armor is provided on AT-11 and SNB-1 airplanes.

j. ARMAMENT.

(1) BOMBING EQUIPMENT.—The bombardier's compartment is in the transparent, enclosed nose of the airplane and is equipped with bomb sight mount, bombardier's controls, and instrument panels. The two bomb bays are located in the belly of fuselage at forward end of cabin. Two doors on each bay open downward and outward. They are operated electrically or, in any emergency, may be operated manually. Two bomb racks, equipped with type A-2 releases and type B-7 shackles, are located on the sides of the fuselage. Each rack carries five 100-pound bombs.

(2) MACHINE GUNS.

(a) TUNNEL GUN.—A flexible gun (figure 9), located in the belly of the airplane, is mounted on the lower frame of second bulkhead aft of cabin door. The .30-caliber machine gun is fired through a tunnel opening extending from the bulkhead on which the gun is

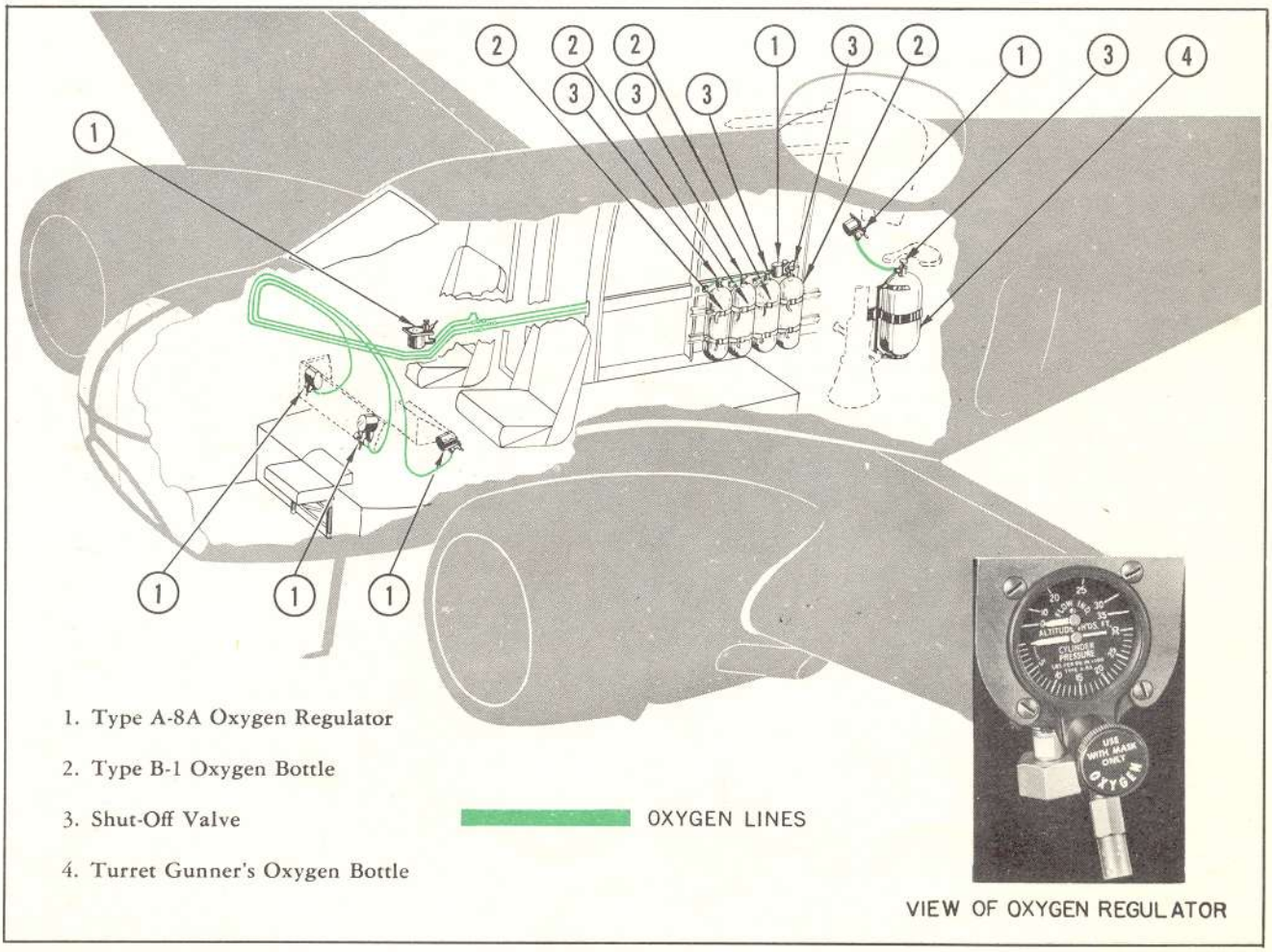


Figure 6—High-Pressure Oxygen System

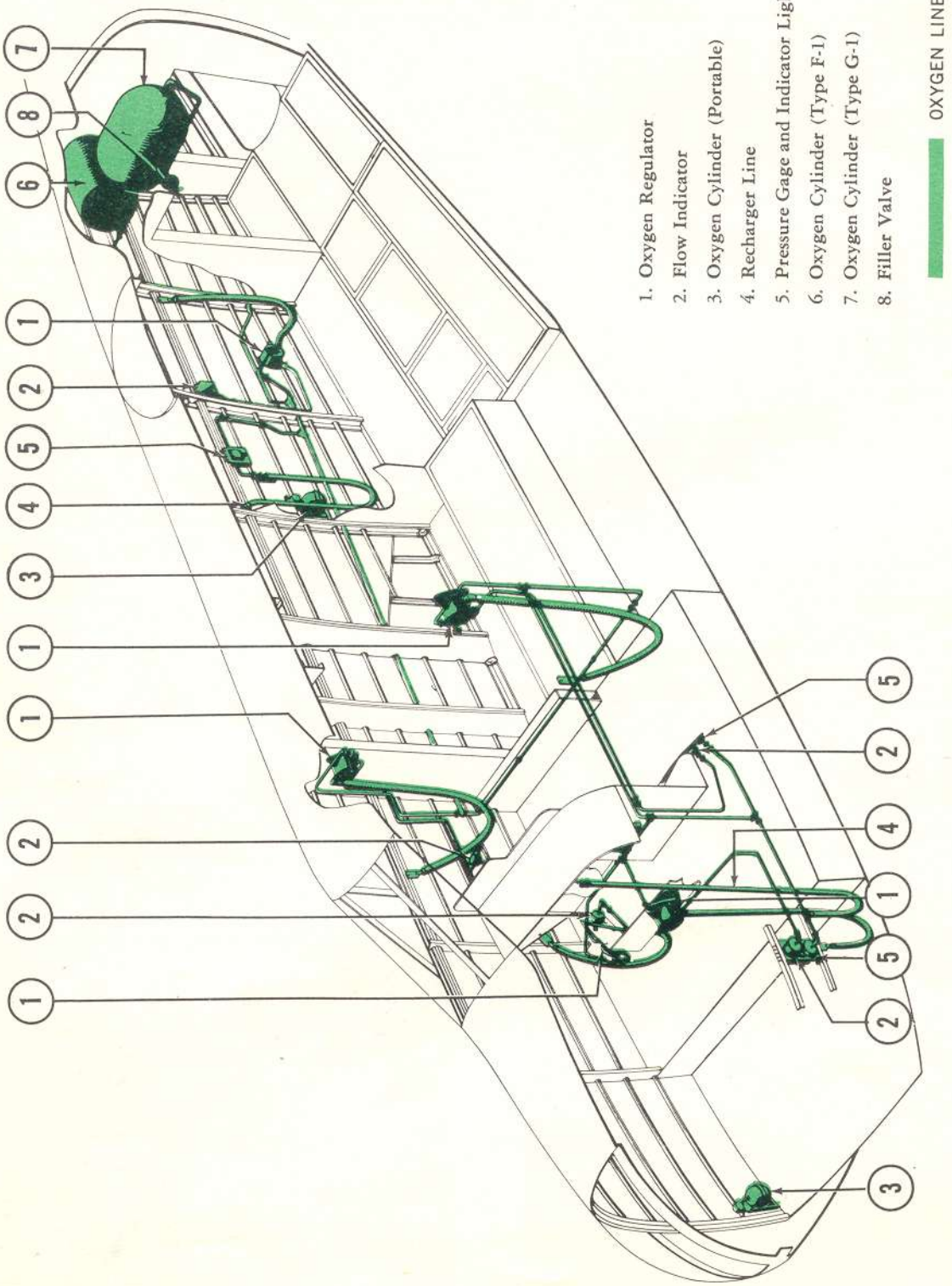
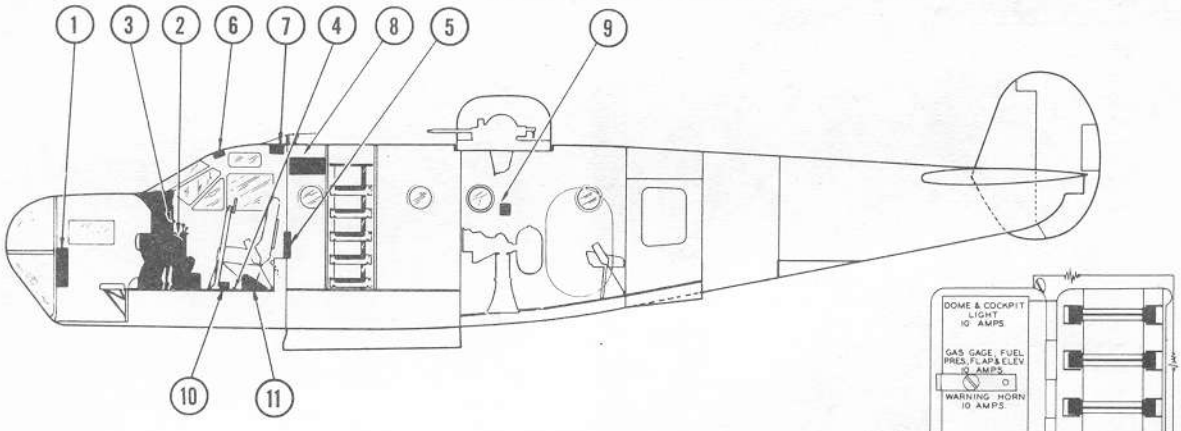


Figure 7—Low-Pressure Oxygen System

mounted to the second bulkhead aft. When the gun is removed, as it would be in case the airplane is on a bombing-training mission, opening may be covered by a metal cover (figure 10) and a plywood cover, placed on the access opening in the bulkhead. Three ammunition racks are fastened to the floor on left of gun, and a kneeling pad is supplied for the gunner.



1. Bombardier's Switch Panel Box
   Bomb Circuit Fuse (30 amp.)
   Bomb Bay Motor Fuse (20 amp.)
2. Left Sub-Panel Fuse Box
   See drawing at right
3. Fixed Instrument Panel
   AFCE Fuse (30 amp.) NOTE: On earlier models this fuse located in ignition switch Box
4. Landing Gear Circuit Breaker
   (50 amp.)
5. Generator Control Boxes
   Left Generator Fuse (100 amp.)
   Right Generator Fuse (100 amp.)
6. Ignition Switch Box
   Starter Fuse (15 amp.)
7. Radio Junction Box
   Note: On earlier models, radio main power fuse was located in this box
8. Radio Junction Box
   Radio Main Power Fuse (50 amp.)
   Spare Fuse (50 amp.)
   Radio Interphone Fuse (15 amp.)
   Spare Fuse (15 amp.)
9. Turret Breaker Switch
   (100 amp.)
10. Utility Box
    Spare Fuses
11. Landing Gear Hand Crank Pedestal
    On earlier models, landing gear fuse (50 amp.) and spare fuse (50 amp.) located in front end of pedestal before circuit breaker (4) was installed

Figure 8—Fuse Location Diagram

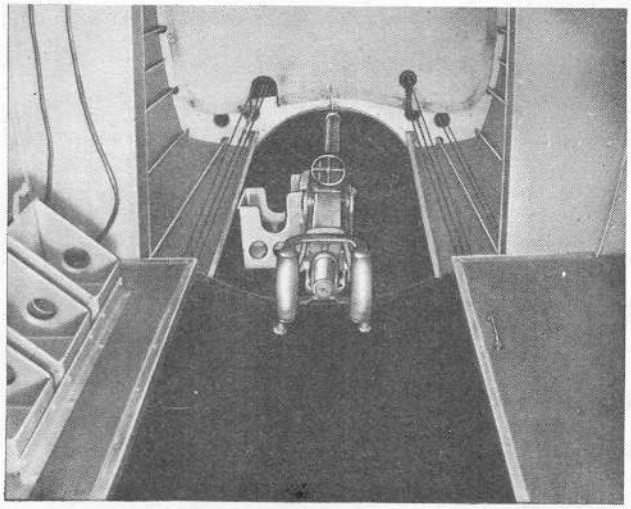


Figure 9—Tunnel Gun, Installed

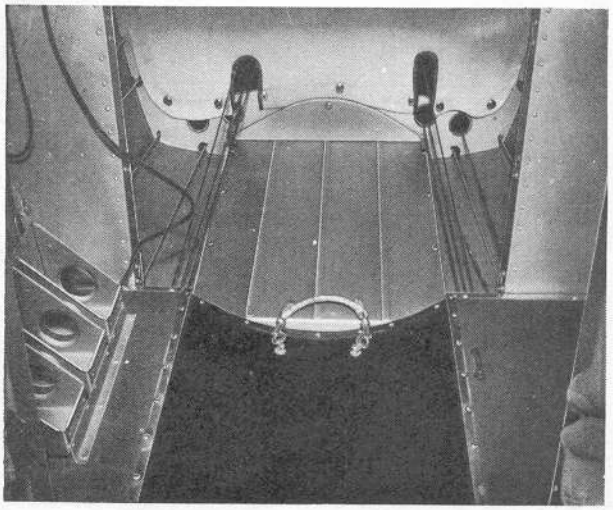


Figure 10—Tunnel Gun Opening, Covered

(b) GUN TURRET.—The gun turret is located on top of cabin near center of the airplane.

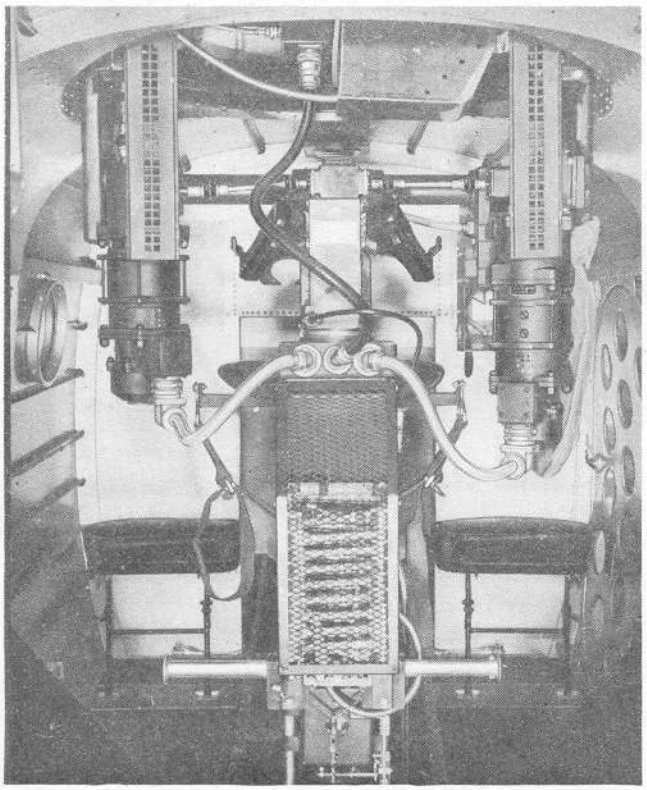


Figure 11—Crocker-Wheeler Turret Installation

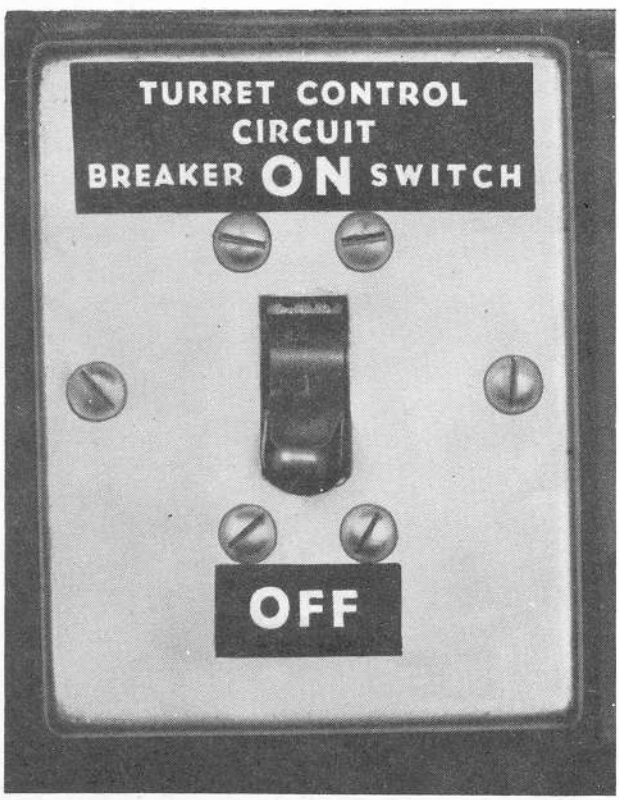


Figure 12—Turret Circuit-Breaker Switch

1. On AT-11 airplanes Army Serial No. 41-9437 through 41-9586, a Beech-manufactured turret is used. On AT-11 airplanes No. 41-27332 and after, and all SNB-1 airplanes, a Crocker-Wheeler 35-inch, crew-training turret is installed, or provisions for installation are made. The Beech-manufactured turret, electrically operated, has provisions for mounting one .30-caliber machine gun and has a continuous rotating

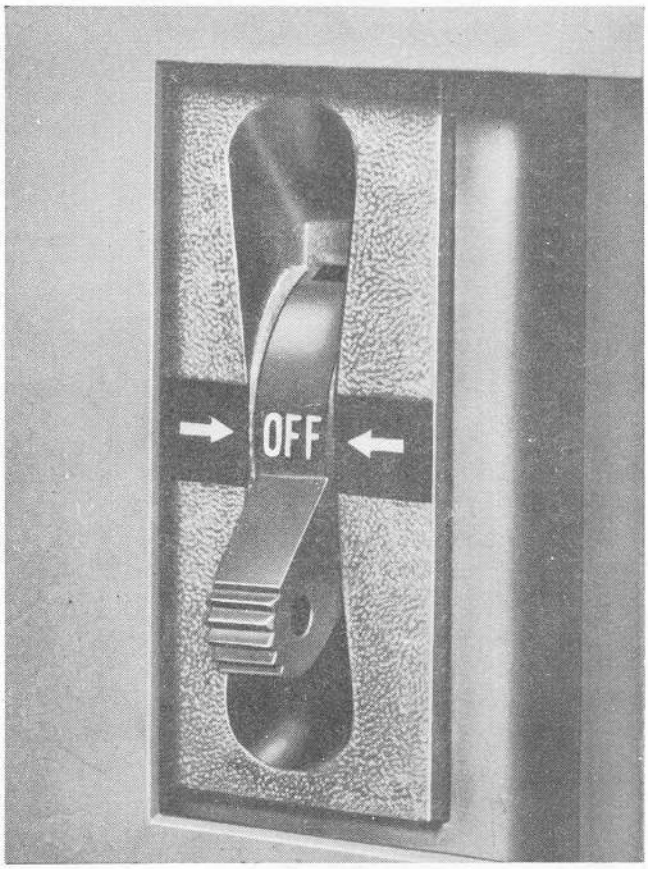


Figure 13—Turret Switch

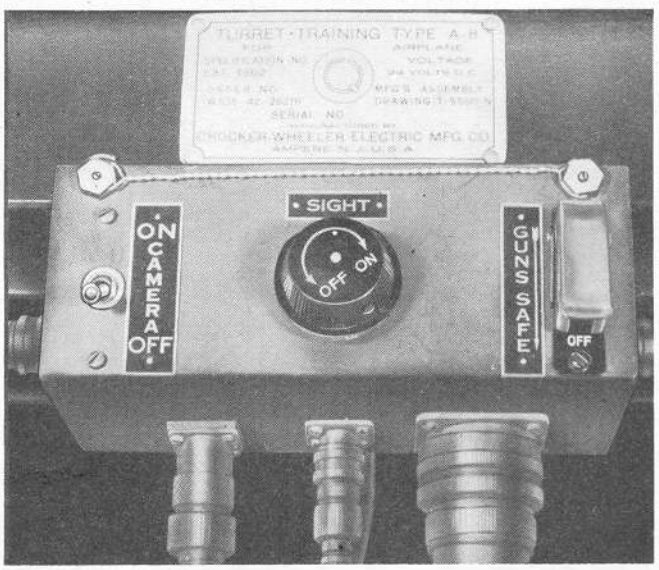


Figure 14—Turret Gun and Camera Controls

movement of 360 degrees.

2. The Crocker-Wheeler turret (figure 11), also electrically operated, is equipped with one .30-caliber Browning aircraft machine gun. The gun is equipped with an electric firing solenoid and an ammunition magazine. An S. F. Bowser Co. reflex gun sight (N-6) and a 16 mm gun sight aiming-point camera is mounted rigidly on the gun carriage. The turret has a continuous rotating movement of 360 degrees and the gun has an elevation of 0 to 85 degrees. The Crocker-Wheeler turret has a cam arrangement which prevents machine gun from firing when pointing at any portion of the airplane. The Beech turret makes no provisions for this and care has to be exercised in firing the machine gun in the directions of the vertical stabilizers, wing tips, propellers, and forward portion of fuselage.

k. AUTOMATIC FLIGHT CONTROL EQUIPMENT.—Automatic flight control units are mounted on a board assembly located between the two bomb bays. A walkway covers the equipment. Pilots' operating controls (figure 17) on early AT-11 airplanes, are located in upper right corner of pilots' compartment entrances and switches for the units are located in a switch box on the roof of pilots' compartment. On later AT-11 and all SNB-1 airplanes, controls and switches are located in the lower part of pilots' control pedestal.

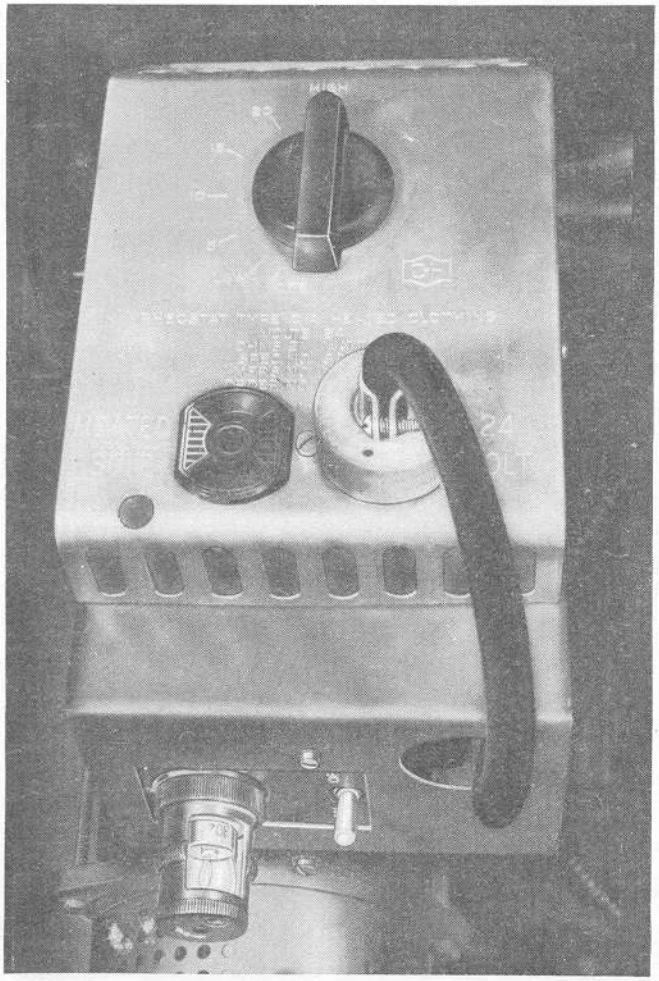


Figure 15—Turret Gunner's Clothing Heater Control and Trouble Light

l. FLIGHT CONTROLS.—Conventional wheel-and-rudder-pedal type controls are provided. To provide easier access to bombardier's compartment, the right control column may be released by use of the clutch (figure 30) provided between pilot's and copilot's seats. Copilot's rudder pedals may be easily removed and stowed on the wall just ahead of copilot's seat.

m. MOVEMENT OF FLIGHT PERSONNEL.

(1) BOMBING-TRAINING MISSION.—The bombing-training mission may be made with a crew of either three or four. During take-off and landing, the instructor occupies copilot's seat and student bombardiers occupy jump seats at rear of cabin. During action of bombing, the instructor and one of the students occupy bombardier's compartment. If two students are on the mission, one student REMAINS IN CABIN JUMP SEAT.

(2) GUNNERY-TRAINING MISSION.—The gunnery-training mission is made with a crew of four. During take-off and landing the instructor occupies copilot's seat and two students occupy jump seats at rear of cabin. During action, each student moves to his station at machine guns, and instructor returns from copilot's seat to cabin to give instruction.

n. EMERGENCY EXITS AND EQUIPMENT.—See figure 37, diagram of emergency exits and equipment.

o. RADIO EQUIPMENT.—AT-11 and SNB-1 airplanes are equipped with the following radio equipment:

Command Set	Type SCR-AQ-283
Interphone Equipment	Type RC-36
Filter Equipment	Type RC-32

2. POWER PLANT.

AT-11 and SNB-1 airplanes are equipped with two Pratt & Whitney, model R985-AN-1 or R985-AN-3, nine-cylinder, air-cooled, radial-type engines, having a direct propeller drive. Each engine has a normal rated

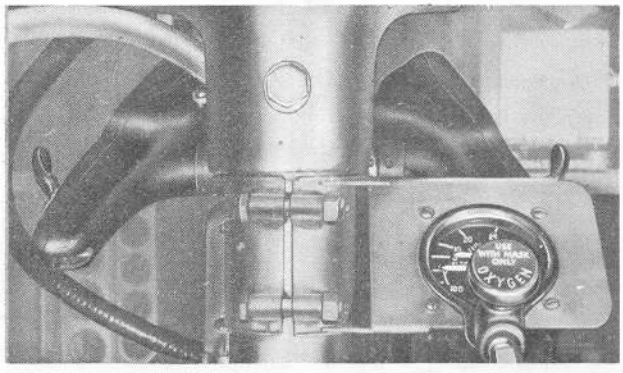


Figure 16—Turret Control Handles

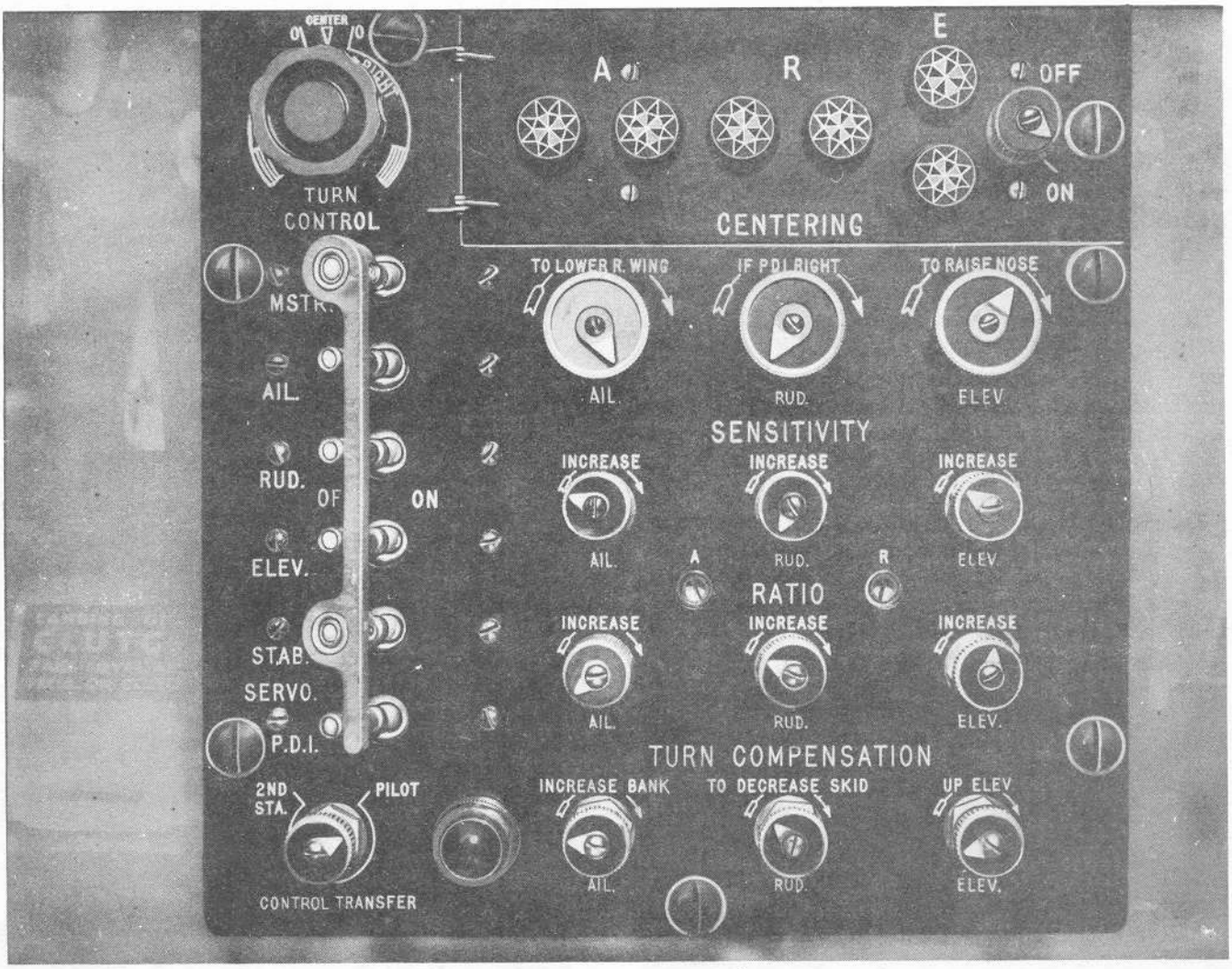


Figure 17—Automatic Flight Equipment Controls

and take-off power at sea level of 450 H.P. at 2300 rpm and a maximum diving speed of 2650 rpm for a period of 30 seconds. The engines have a single-stage, single-speed, engine-driven supercharger having a 10.12:1 gear ratio and are equipped for operation of a Hamilton Standard, constant-speed propeller which utilizes engine oil pressure for changing propeller pitch. Propellers are 99-inch, two-bladed propellers having a blade setting ranging between 14 degrees low pitch and 29 degrees high pitch. For normal operation, engine speeds may be controlled by means of constant-speed governors, set by propeller controls located on the pilots' control pedestal.

3. FLIGHT CONTROLS.

a. GENERAL.—Control surfaces consist of two ailerons, two rudders, and an elevator. Trimming tabs are provided, one on left rudder, one on left aileron, and two on elevator.

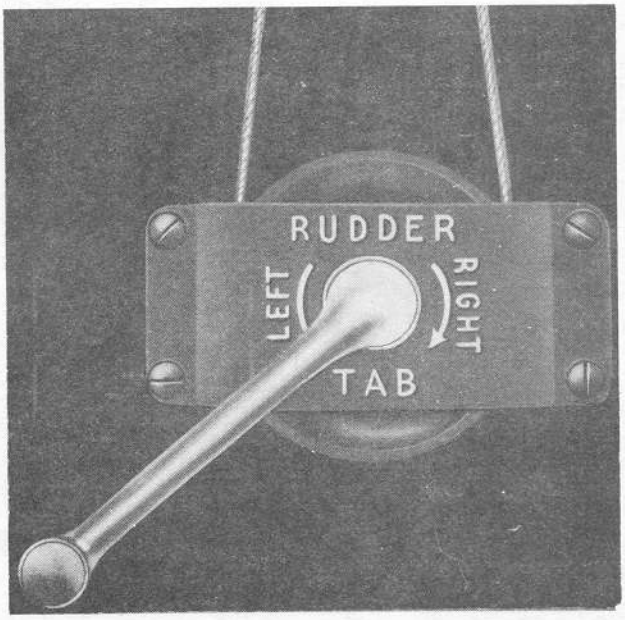


Figure 18—Rudder Tab Control

b. TRIM TAB CONTROLS.

(1) RUDDER TAB.—The rudder tab control (figure 18) is located on ceiling of pilots' compartment. The hand crank is turned to left for trimming tab to left and to right to trim right.

(2) ELEVATOR TAB.—The elevator tab control (figure 19) is mounted at right of the pilot's seat. Turn wheel forward for nose-down position and backward for nose-up position. An elevator tab position indicator (figure 33) is mounted on control pedestal.

(3) AILERON TAB. – The aileron tab control (figure 33) is located on the control pedestal directly below throttle levers. Turn to right to raise left wing and to left to raise right wing.

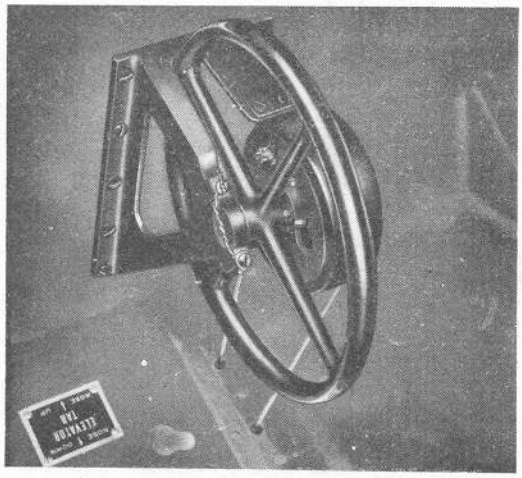


Figure 19—Elevator Tab Control

Figure 20—Landing Gear Clutch Pedal, Covered

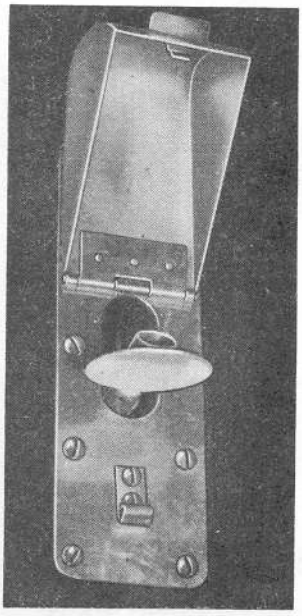


Figure 21—Landing Gear Clutch Pedal, Uncovered

4. LANDING GEAR AND TAIL WHEEL CONTROLS.

a. MAIN LANDING GEAR.

(1) For normal operation of gear, push switch lever (figure 33) to "DOWN" position to extend gear, and to "UP" position to retract. Gear may be stopped in any intermediate position by returning switch lever to CENTER poistion.

WARNING

Never move switch lever from one operational position to the other without first allowing gear to come to rest with switch lever in center position. Switch should be in "DOWN" position at all times that gear is extended, and in the center position when the airplane is parked.

(2) To operate gear manually, place operation switch in "CENTER" or "OFF" position, lift clutch pedal cover (figures 20 and 21) on the floor to left of control pedestal base, and disengage clutch by depressing clutch pedal with the foot. Pull out crank (figure 22) at right of pilot's seat to engage it and rotate clockwise to extend gear, counterclockwise to retract.

Note

The same hand crank is used for manual operation of FLAPS. It is necessary that crank be pushed towards pilot, to operate flaps.

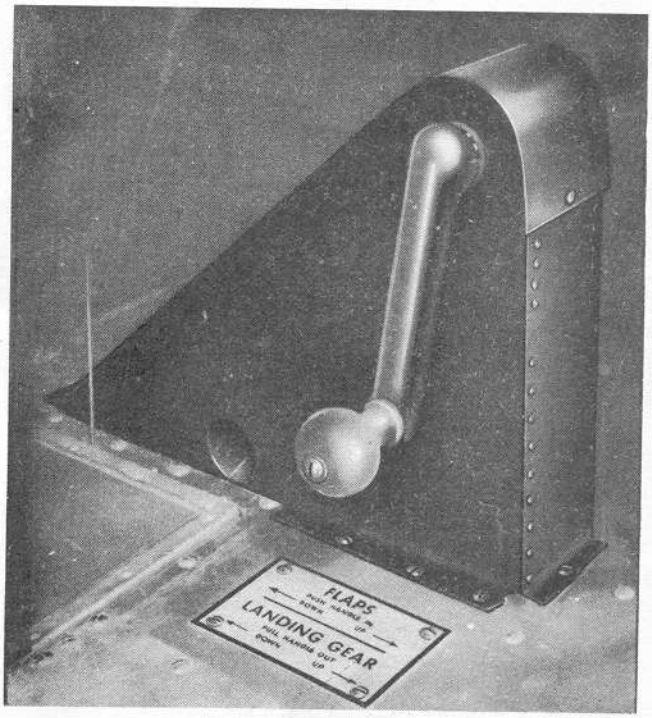


Figure 22—Landing Gear and Flap Hand Crank

IMPORTANT

THE CLUTCH MUST BE DISENGAGED IN ORDER TO OPERATE GEAR MANUALLY and gear may be held in any position by merely reengaging the clutch. When retracting gear by hand, always remove foot from clutch pedal before releasing the pull on hand crank.

(3) With gear fully extended, the green warning light (figure 29) will show on electrical control panel; with gear fully retracted, the red warning light will show; in any intermediate position, no light will show. On the first AT-11 airplanes, warning lights are dimmed as navigation lights are turned on. On later AT-11's and the SNB-1's, warning lights are dimmed by turning the jewels on the lights.

(4) At any time throttles are closed with gear in any position except fully extended, a warning horn will operate. The warning horn may be shut off by a warning horn silencer switch (figure 34) located on top of the control pedestal directly in front of throttle levers.

Note

Early model AT-11 airplanes are not equipped with these warning horn silencer switches.

(5) On the first AT-11 airplanes, fuses for landing gear electrical system are mounted in the hand crank box. Access for replacing fuses is made by opening the small door on forward side of box. On later AT-11 and SNB-1's a circuit breaker (figure 35), located beneath pilot's chair, is provided.

b. TAIL WHEEL CONTROLS.—The tail wheel is retracted as main gear is retracted. The tail wheel is of the full-swivel type and may be locked in center position for take offs and landings. On first AT-11 airplanes, the tail wheel lock control is mounted on the elevator tab control mounting bracket. On later AT-11's and SNB-1's, the control is on the control pedestal. (See figure 33.)

c. PARKING BRAKE.—The parking brake (figure 33) is mounted on the left side of the control pedestal. To engage, depress brakes, pull handle out and turn clockwise. To release, give handle a quarter turn and push in.

5. WING FLAP CONTROLS.

a. For normal operation of flaps, push switch lever (figure 33) to "DOWN" position to lower flaps and to "UP" position to raise them. Flaps may be stopped in any intermediate position by returning switch to "CENTER" position. Maximum deflection of flap is 45 degrees and the electrical position indicator (figure 33) on control pedestal indicates flap position.

WARNING

DO NOT LOWER WING FLAPS WHEN IAS EXCEEDS 117 MPH (101 KNOTS).

b. To operate flaps manually, use the hand crank (figure 22) at right side of pilot's seat. Push crank in and rotate clockwise to lower flaps, counterclockwise to raise them.

6. HEAT AND VENTILATING CONTROLS.

a. COLD AIR.—Controls for cold air supply to pilots' compartment and cabin are located on side walls next to seats in pilots' compartment (figure 23). Screw valve handles inboard to increase cold air supply. Outlets in front of valve handles may be turned to control supply and direction of cold air flow into pilots' compartment.

b. HOT AIR.—Controls for hot air supply are located on the floor of pilots' compartment, one under pilot's seat and one under copilot's seat. (See figures 30 and 35.) Hot air supply is regulated by pulling out the controls and locking them in desired position. A control is locked by turning to right. Outlets on pilots' compartment floor and just forward of control columns may be turned to regulate direction and supply of hot air in pilots' compartment.

c. DEFROSTERS.—To regulate the force of air into defroster tubes for windshield and bombardier's window, fully or partially close hot air outlets into pilots' compartment.

7. LIGHTS.

a. COCKPIT LIGHTS. – Two dome lights are mounted just above the windshield, one on left side of pilots' compartment and one on right. Control switches are located at the lights.

b. FLUORESCENT INSTRUMENT LIGHT (figure 32) is mounted on the ceiling of pilots' compartment, directly in front of pilot. The light is equipped with an ultra-violet, light-transmitting filter and by turning the lens, either direct or ultra-violet light may be obtained for reading of luminous dials of instruments. The rheostat and switch control for the light is mounted on the bulkhead just aft of copilot. On early model AT-11 airplanes, a fluorescent light similar to the one described above, was mounted on pilots' control column.

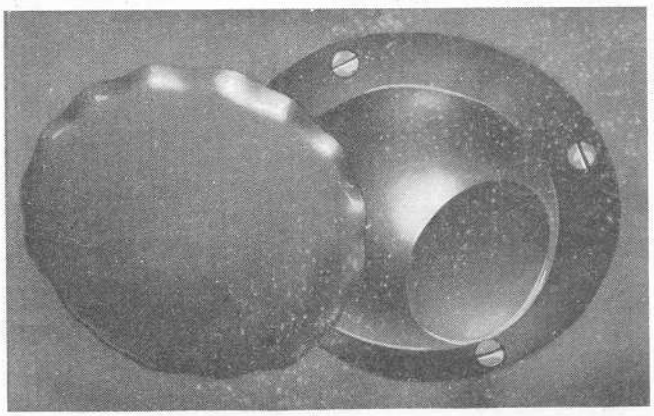


Figure 23—Cold Air Valve Control

c. AN EXTENSION LIGHT (figure 24) is mounted on the bulkhead just aft of pilots' compartment. On first AT-11 airplanes, the light is mounted on the threshold of the door in the bulkhead. On Later AT-11's and SNB-1's which have generator control panel mounted on the threshold, the light is mounted on the bulkhead directly behind copilot's seat. The light has a reel-type extension and may be used in cockpit for map reading and other purposes.

d. CABIN LIGHTS.—There are three dome lights on the cabin ceiling. Switch control levers are located at the lights. On later AT-11 airplanes that do not have a photo-observer installed, and on all SNB-1 airplanes, there is a similar dome light mounted on tunnel gun compartment ceiling.

e. OPERATIONAL LIGHTS.—The AT-11 and SNB-1 airplanes are equipped with recognition lights, passing lights (red passing light in wing and amber passing light in tail), landing lights, and navigation lights. The control box for recognition lights is mounted on ceiling of pilot's compartment. (See figure 32.) The wing passing light is controlled by separate switch and tail amber passing light is controlled by the wing position light switch. Switches (figure 29) for navigation lights, passing lights, and landing lights are located on the electrical panel. It should be noted that the tail position light and the wing position light are wired separately and may be operated separately. Do not operate recognition lights longer than 10 seconds.

Note

Landing lights will not glow until they have extended to "OPERATING" position. Do not operate landing light while flying at above 135 mph IAS. It is also important to retract landing lights as soon as possible.

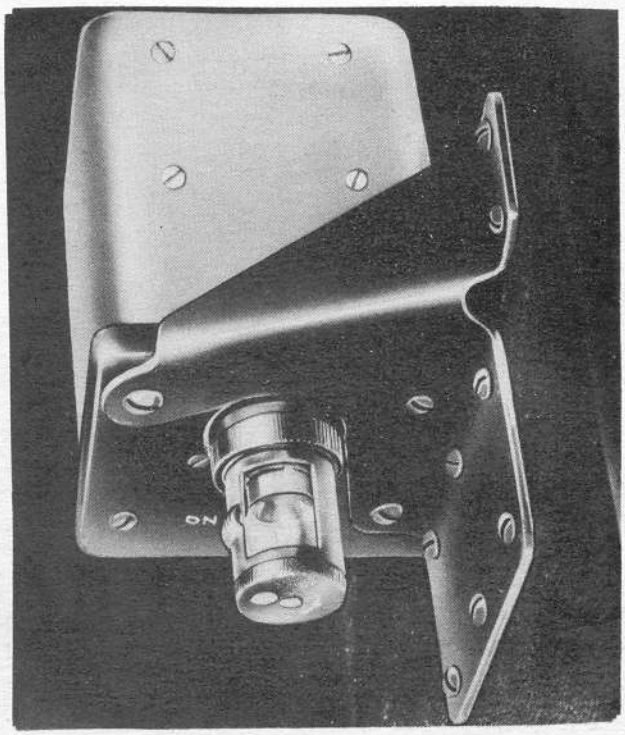


Figure 24—Map Reading Light, Pilots' Compartment

8. SEAT ADJUSTMENTS.

Pilot's and copilot's seats are adjustable fore and aft, to accommodate pilot's stature, by means of a hand crank on forward side of seats. (See figure 35.)

9. FLIGHT CONTROL LOCK.

The control locking device lies on pilots' compartment floor between pilot's rudder pedals when not in use. To lock control surfaces, move ailerons, rudders, and elevator to neutral position. Raise aft end of control lock and let it rest on pilot's seat. Install forward end of lock between rudder pedals by inserting the plungers into the ends of rudder pedal cross tubes. The aft end of the lock may then be clamped to the control wheel. (See figure 25.)

Note

In case neutral position of rudder pedals has been changed by variation in rigging, the control lock may be adjusted by turning threaded shaft at lower end of lock in desired direction to compensate for the variation.

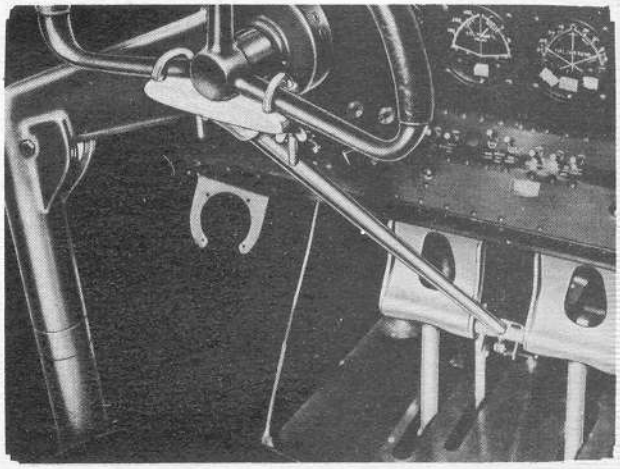


Figure 25—Installation of Control Lock

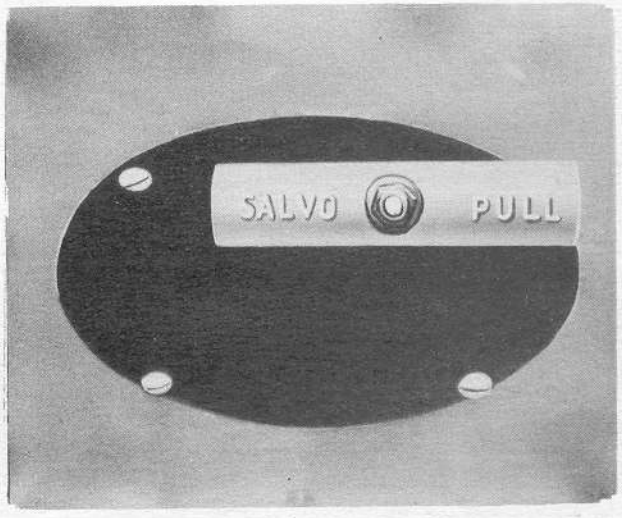


Figure 26—Pilot's Salvo-Release Handle

10. PILOT'S SALVO RELEASE.

Pilot's salvo release, used for dropping all bombs simultaneously, is located on the bulkhead just under the entrance to pilots' compartment. (See figure 26.) By pulling the handle, bomb doors are opened, salvo-release safety catch is disengaged and bombs are dropped "unarmed" unless the arming wires on the bombs have been unhooked by hand.

11. VACUUM SELECTOR VALVE.

The vacuum selector valve (figure 30) is located under left rear corner of copilot's seat.

12. PITOT HEAT SWITCH.

The pitot heat switch (figure 29) is located on the electrical sub-panel. It should be switched to "ON" when flying under icy conditions.

13. ICE ELIMINATING EQUIPMENT.

No de-icer or anti-icer equipment is provided on the AT-11 or SNB-1.

14. ELECTRICAL SYSTEM CONTROLS.

a. MASTER BATTERY SWITCH.—Master battery switches (figure 29) are located on electrical sub-panel. The switches, when in "OFF" position, disconnect all battery circuits.

Figure 27—Left Generator Control Box and Switch

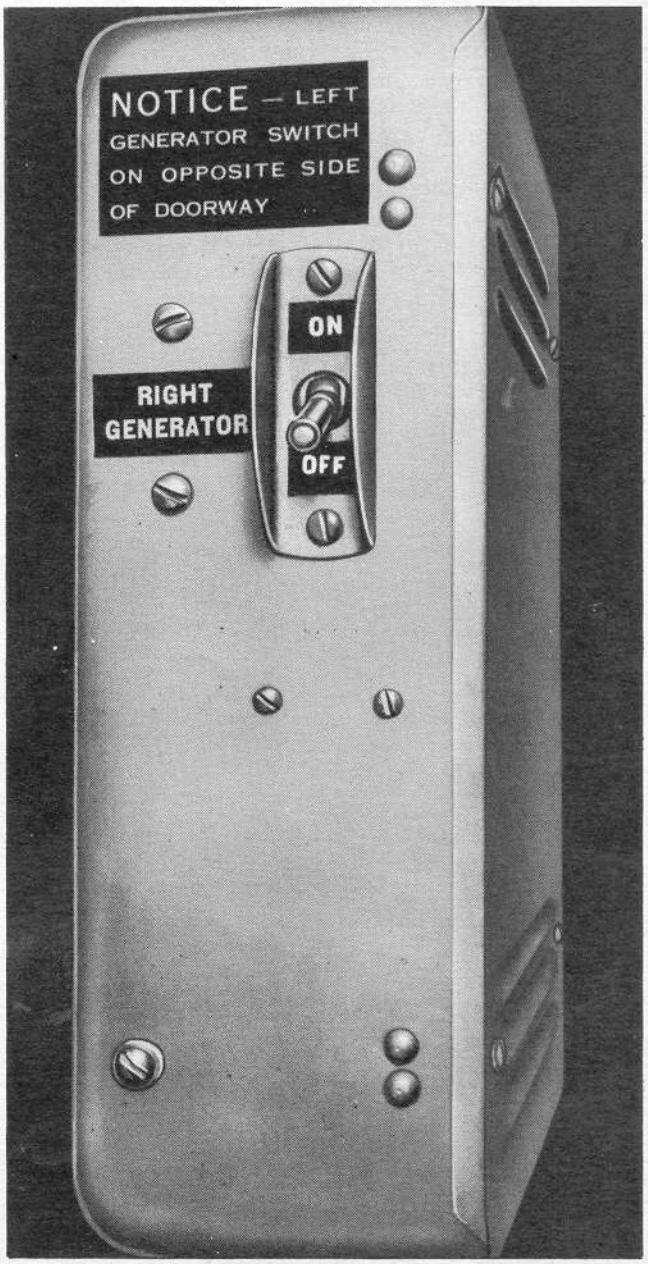


Figure 28—Right Generator Control Box and Switch

b. GENERATOR CONTROL SWITCHES.—On early model AT-11's, these switches are located on the sub-panel next to the battery master switch. On later model AT-11's and SNB-1's, the generator control switches, along with generator control boxes, are mounted on the threshold of the door into pilot's compartment. Closing these switches will close the reverse current cutout if the generator voltage is 26.5 volts or above. In order for the generators to supply power to the aircraft electrical system, these switches must be left closed. Otherwise, the battery alone will supply power and will discharge in a short time.

c. IGNITION SWITCHES. *(See figure 32.)*—Ignition switches are on the ignition box located on ceiling of cockpit enclosure just above windshield. The center toggle or master switch has to be "ON" before either ignition switch will operate. Ignition switches can be turned to either left or right magneto on the engine, or to both.

d. VOLTMETER SWITCH. *(See figure 29.)*—Turning voltmeter switch on "LEFT" or "RIGHT" gives voltage reading for left or right generator. (See figure 29.)

e. TURRET CIRCUIT BREAKER SWITCH. *(See figure 12.)*—The turret control switch is a circuit-breaker mounted on right side of airplane under the turret. The switch turns off electrical power to turret when turret is not in operation.

15. POWER PLANT CONTROLS.

a. FUEL SYSTEM.

(1) WOBBLE PUMP.—The fuel auxiliary hand pump (figure 30) or wobble pump, is mounted on the floor between pilot's and copilot's seat. It may be used to build up necessary fuel pressure in the fuel system after airplane has been idle; or in event of failure of both engine-driven fuel pumps during flight, hand pump may be operated and flight maintained.

(2) ENGINE SELECTOR VALVE.—The engine selector valve (figure 30) is mounted on pilots' compartment floor under front of copilot's seat. During normal operation of both engines, valve should be turned to "BOTH." In case one engine is inoperative, turn valve to other engine.

(3) CROSS-FEED VALVE.—The cross-feed valve (figure 30) is located on the floor near the wobble pump, between pilot's and copilot's seats. The valve may be used to cross-feed fuel from one engine to the other in case of failure of one engine-driven fuel pump.

(4) FUEL TANK SELECTOR VALVE.—The fuel tank selector valve (figure 33) is mounted on the control pedestal step. Fuel may be used from any one tank by turning the valve to designated tank as shown on the placard. Take-offs and landings should be made on fullest main tank. Auxiliary tanks should be used first in flight.

(5) ENGINE PRIMER PUMP.—The engine primer pump (figure 33) is mounted on the control pedestal step. Pushing in on pump handle, turning to left-engine position, and pumping will prime left engine in preparation for starting. Turning to right-engine position and pumping, primes right engine.

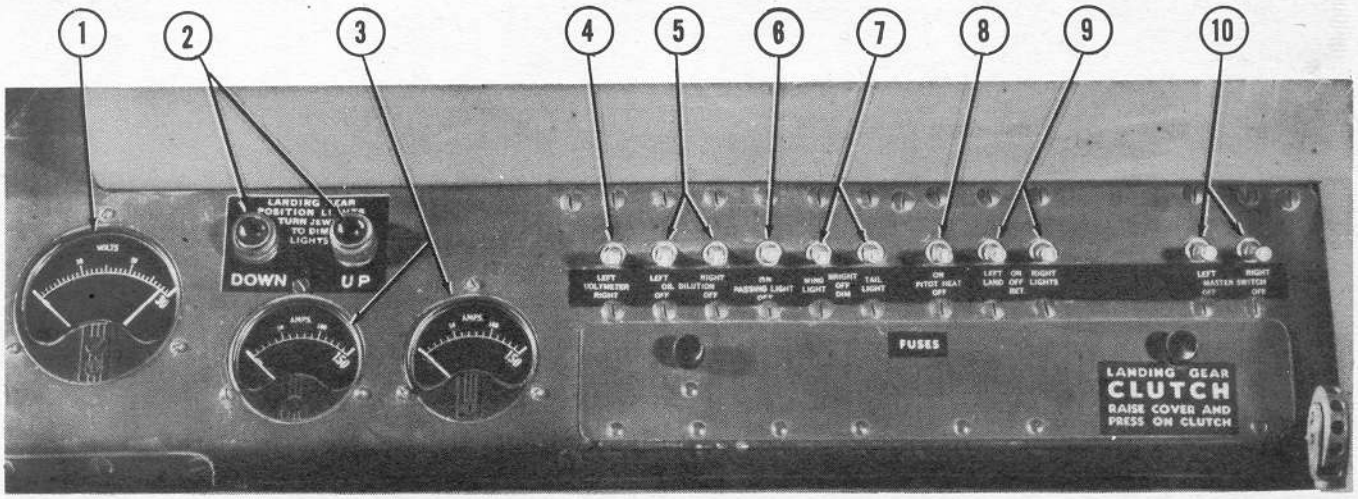


Figure 29—Pilot's Electrical Sub-Panel

1. Voltmeter
2. Landing Gear Warning Lights
3. Ammeters
4. Voltmeter Switch
5. Oil Dilution Switches
6. Passing Light Switch
7. Navigation Light Switches
8. Pitot Heat Switch
9. Landing Light Switches
10. Master Switches

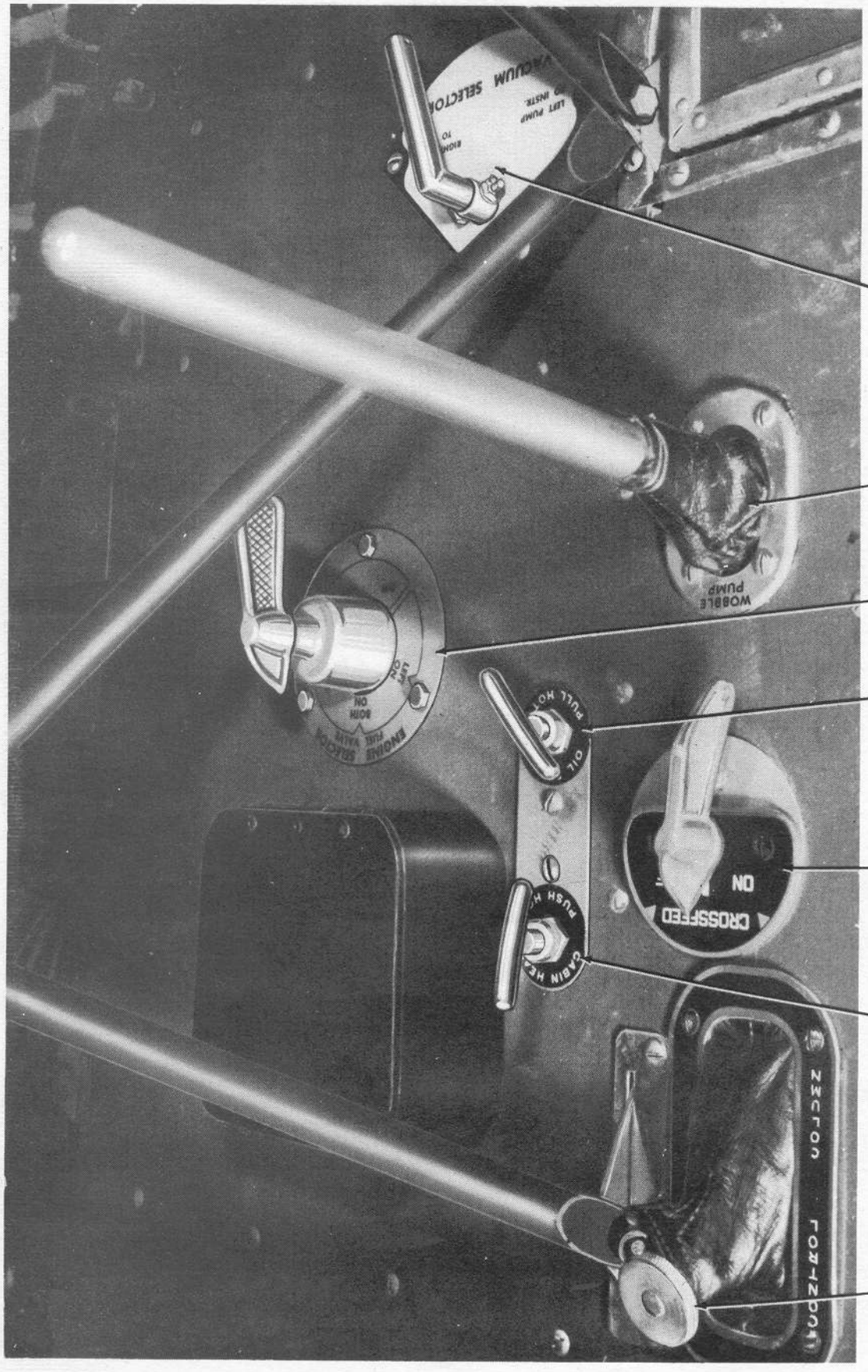


Figure 30—Controls Under Copilots' Seat

1. Control Column Clutch Release
2. Cabin Heater Control (Right Side)
3. Crossfeed Valve
4. Oil By-Pass Control (Right Engine)
5. Engine Selector Fuel Valve
6. Wobble Pump
7. Vacuum Selector Valve

(6) FUEL SELECTOR GAGE.—The fuel selector gage (figure 31) is located to pilot's left on fixed instrument panel. By turning switch to desired tank, the amount of fuel in that tank can be read from fuel gage. (See figure 36.)

(7) MIXTURE CONTROLS. — Mixture control levers (figure 34) are located on control pedestal. Push forward for "RICH" mixture.

(8) FUEL WARNING LIGHTS.—Fuel warning lights (figure 36) are red and are located in lower right corner of floating instrument panel. If fuel pressure is too low for left engine, left light will light; if too low on right engine, right light will light.

b. OIL SYSTEM.

(1) OIL BYPASS VALVES.—Oil bypass valve controls (figures 30 and 35), used for bypassing oil around the oil cooler in very cold weather, are located on pilots' compartment floor beneath pilot's and copilot's seats. The control under pilot's seat is for left engine oil system and that under copilot's seat is for right engine oil system.

(2) OIL SHUTTER CONTROLS. — For quicker warm-up and temperature control, air intake for each oil temperature regulator is equipped with a butterfly valve operated by levers on control pedestal. Lift levers (figure 34) to cool oil.

(3) OIL DILUTION SWITCHES.—Oil dilution switches (figure 29) for AT-11 and SNB-1 airplanes are located on electrical sub-panel. See section II, paragraph 19, of this Handbook for information on use of oil dilution system.

c. COWL FLAP CONTROLS.—Cowl flap controls (figure 33) are located on left side of control pedestal. Turn and pull to open, turn and push to close.

d. ENGINE FIRE EXTINGUISHER CONTROLS. —On early model AT-11 airplanes, engine fire extinguisher controls are mounted near pilots' compartment floor in base of control pedestal. On later-model AT-11's and SNB-1's, the controls are located under pilot's seat. (See figure 35.) In case of fire on one engine, TURN SELECTOR VALVE TO DESIRED ENGINE AND PULL RELEASE HANDLE.

e. THROTTLE CONTROLS. (*See figure 34.*)—Conventional throttle controls are provided. Push forward to open.

f. PROPELLER CONTROLS. (*See figure 34.*)—Propeller constant-speed governor controls are located on control pedestal. Push forward for low pitch (high rpm) and pull back for high pitch (low rpm).

g. MANIFOLD HEAT CONTROL.—The manifold heat controls (figure 34) are located on control pedestal. Push down to heat, up to cool.

h. FRICTION ADJUSTMENTS.—Friction adjustment (figure 34) for propeller and manifold heat controls is located on left side of the pedestal. Rotate counterclockwise to tighten controls. Friction adjustment (figure 34) for oil shutter and mixture controls is on right side. Rotate clockwise to tighten. Adjustment of these controls can be made by changing position of pegs. Throttle controls may be locked by lifting the lever (figure 34) between the two throttles.

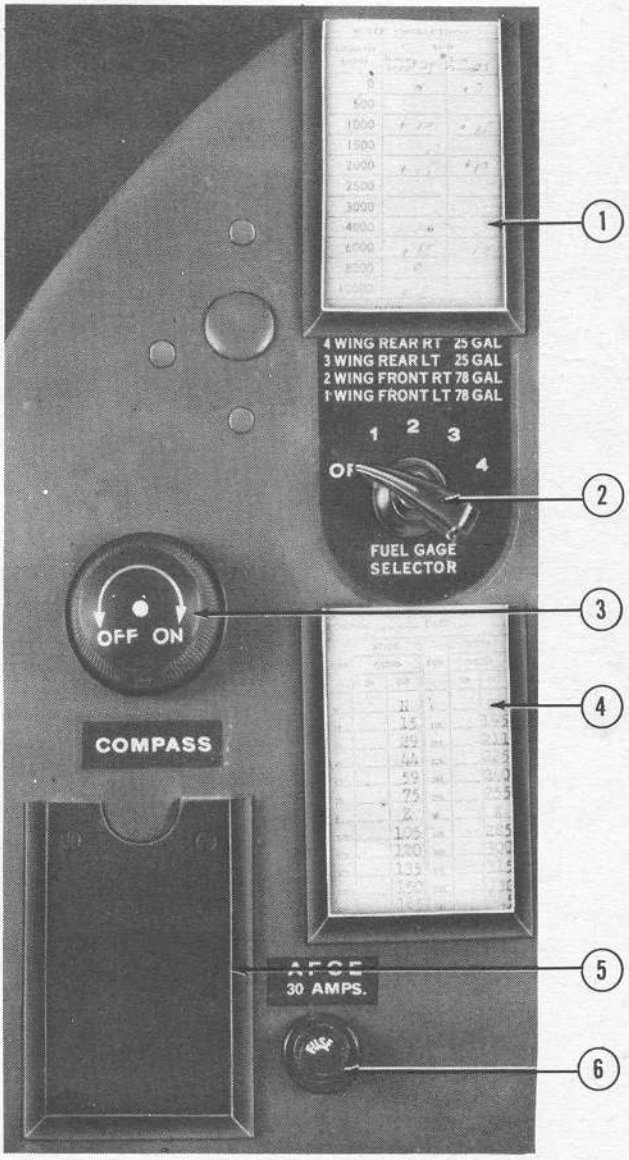


Figure 31—Pilot's Fixed Instrument Panel

1. Altimeter Correction Card
2. Tank Selector Switch
3. Compass Light Rheostat
4. Compass Correction Card
5. Airspeed Correction Card Holder
6. AFCE Fuse

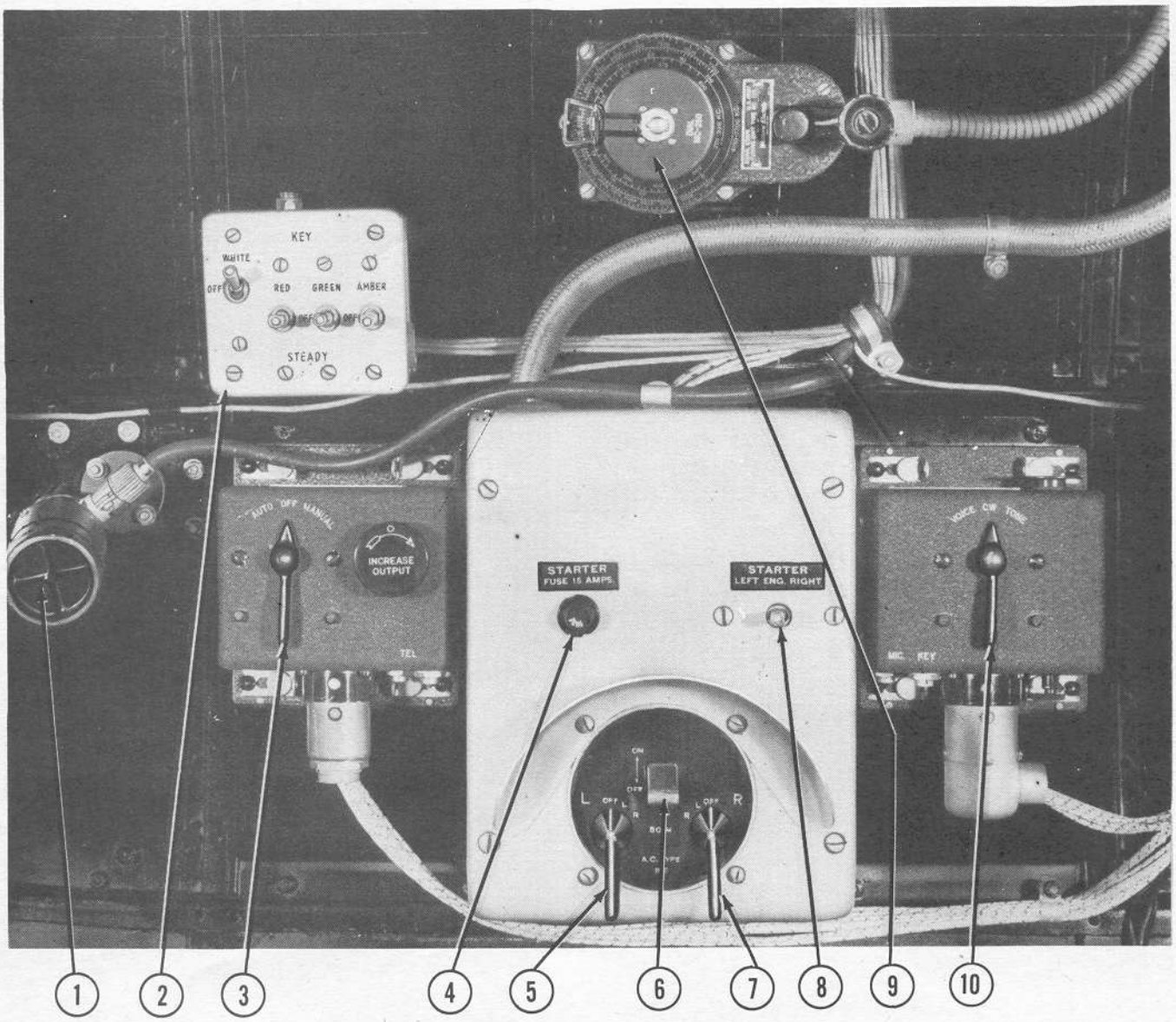


Figure 32—Pilot's Overhead Controls

1. Fluorescent Instrument Light
2. Recognition Light Control Box
3. Radio Receiver Control Box
4. Starter Fuse
5. Ignition Switch—Left Engine
6. Master Ignition Switch
7. Ignition Switch—Right Engine
8. Starter Switch
9. Radio Tuning Control
10. Radio Transmitter Control Box

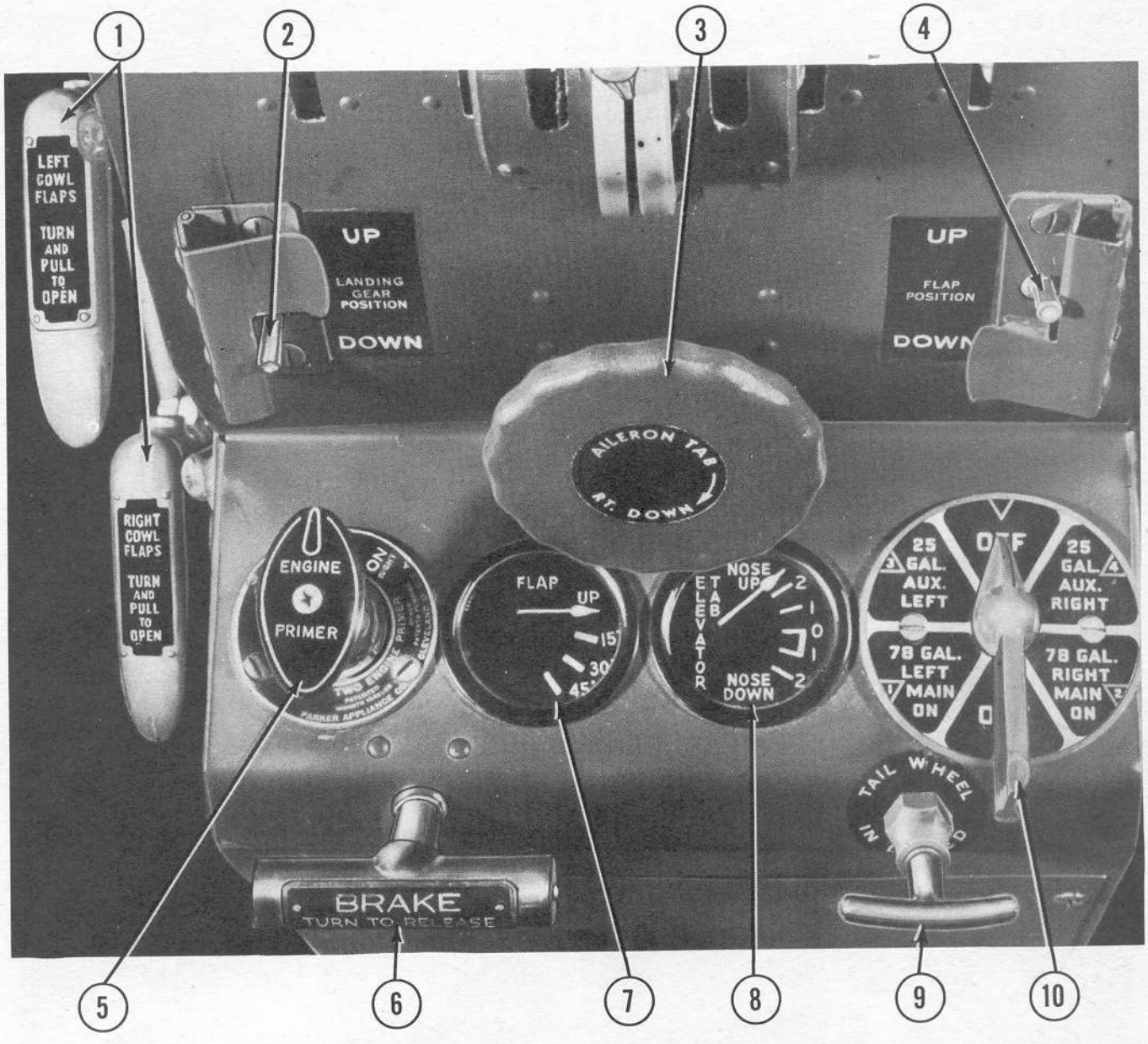


Figure 33—Pilot's Control Pedestal Step

1. Cowl Flap Controls
2. Landing Gear Switch
3. Aileron Tab Control
4. Wing Flap Switch
5. Engine Primer Pump
6. Parking Brake Handle
7. Wing Flap Position Indicator
8. Elevator Tab Position Indicator
9. Tail Wheel Lock Control
10. Fuel Tank Selector Valve

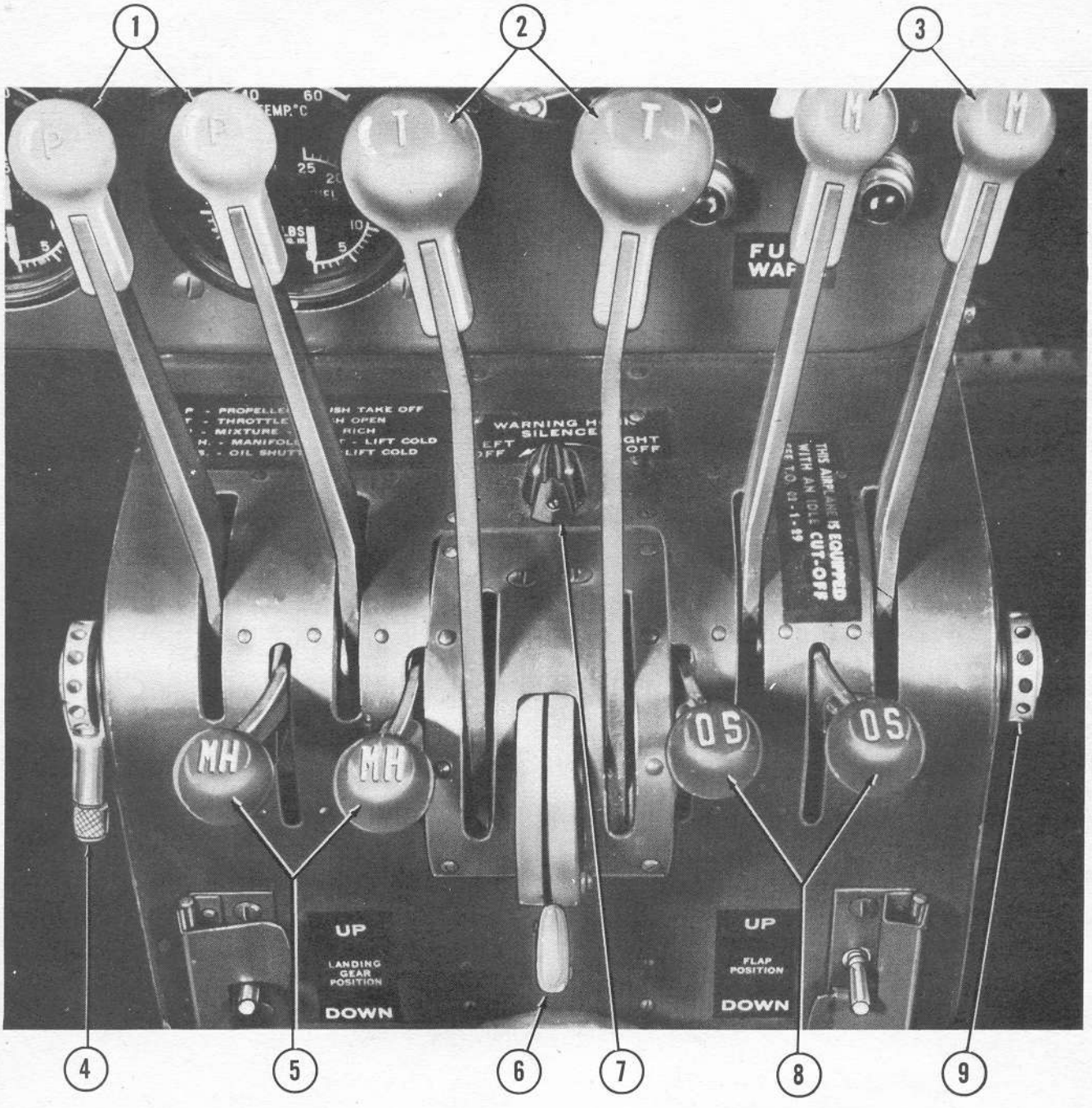


Figure 34—Engine Controls on Pilot's Control Pedestal

1. Propeller Controls
2. Throttle Controls
3. Fuel Mixture Controls
4. Propeller and Manifold Heat Controls Friction Adjustment
5. Manifold Heat Controls
6. Throttle Control Friction Adjustment
7. Warning Horn Silencer Switch
8. Oil Shutter Controls
9. Mixture and Oil Shutter Controls Friction Adjustment

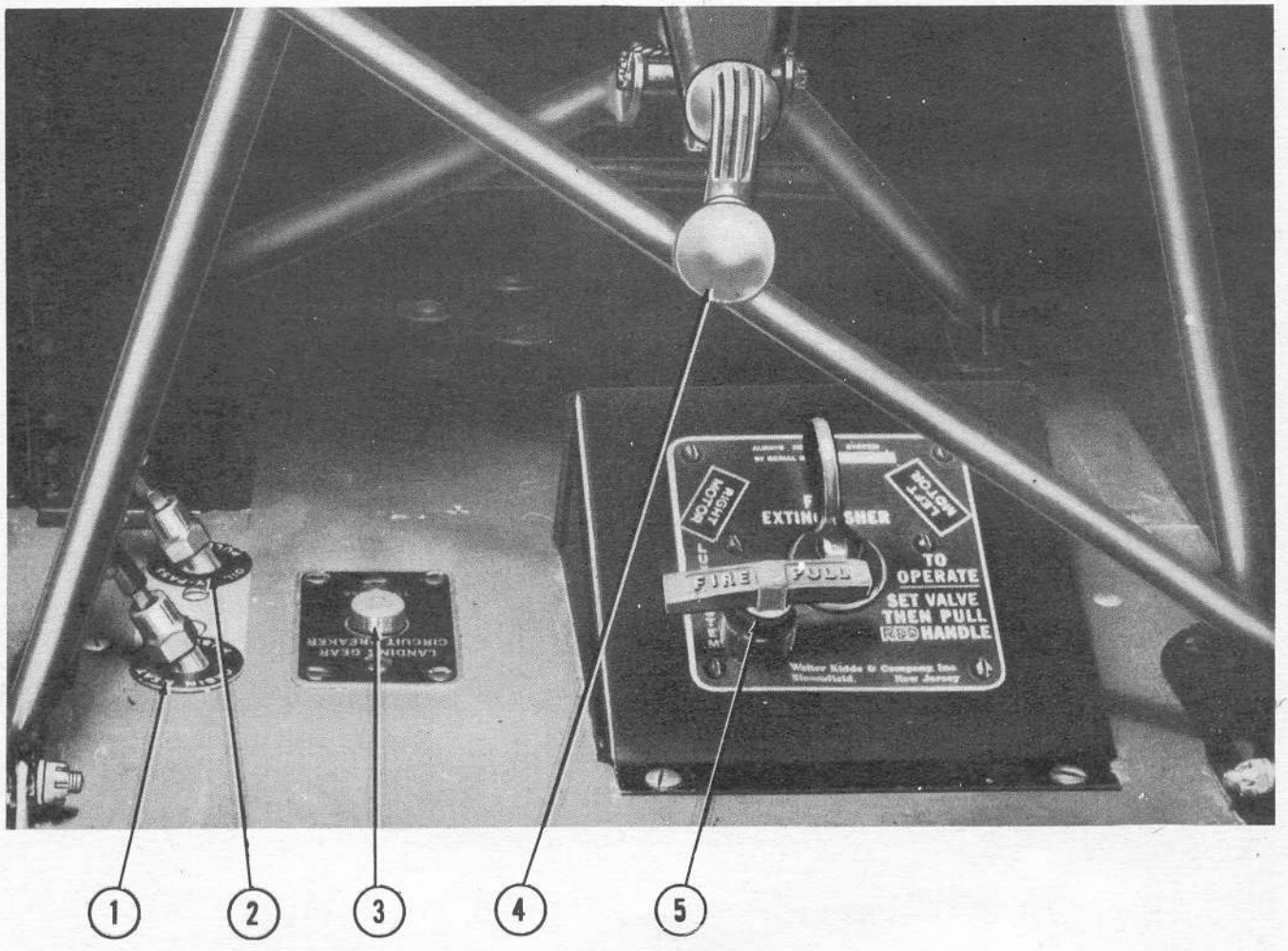


Figure 35—Controls Under Pilot's Seat

1. Cabin Heater Control (Left Side)
2. Oil By-Pass Control (Left Engine)
3. Landing Gear Circuit Breaker Switch
4. Seat Adjustment Handcrank
5. Engine Fire Extinguisher Controls

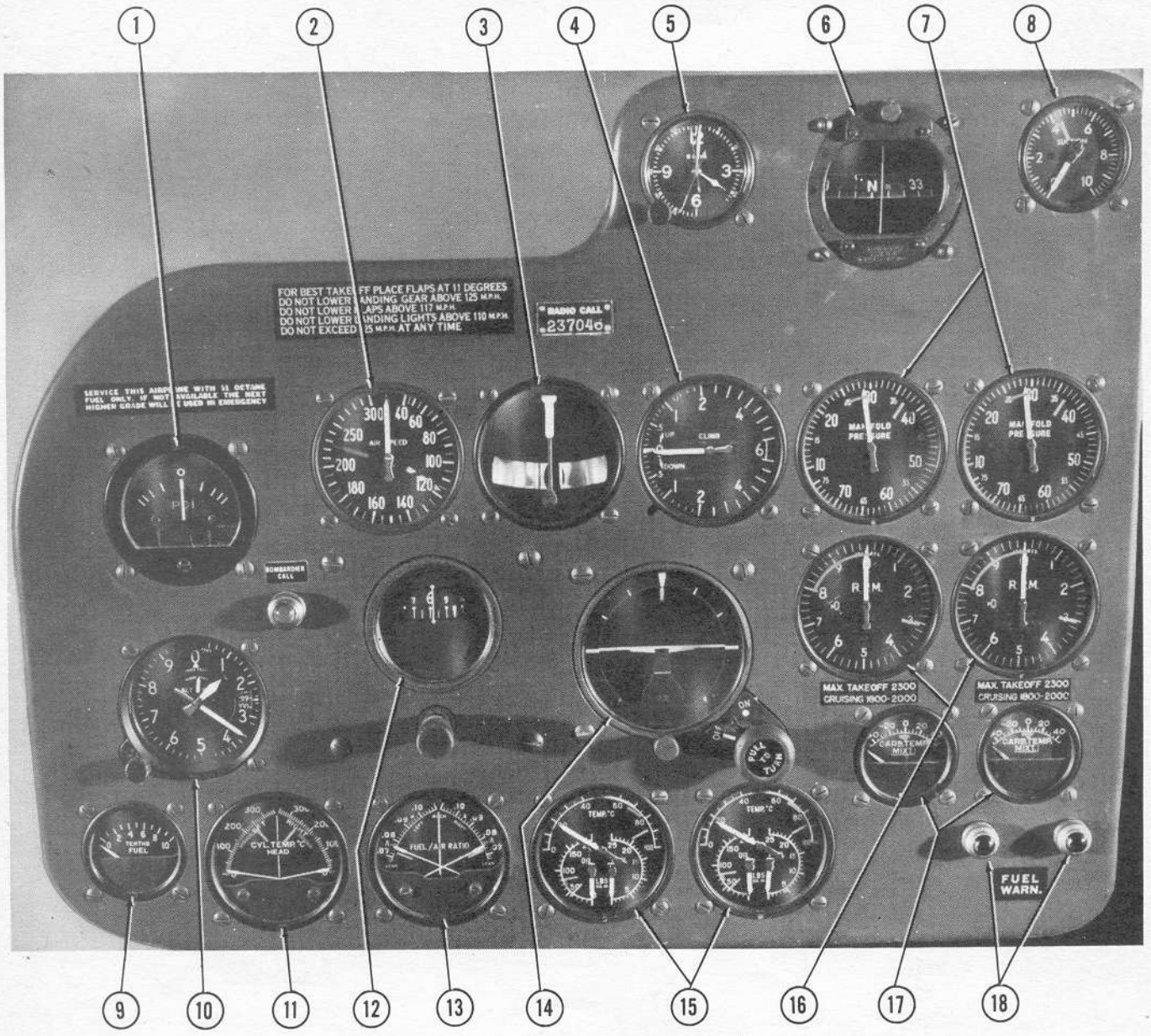


Figure 36—Pilot's Instrument Panel

1. Pilot's Directional Indicator
2. Airspeed Indicator
3. Bank and Turn Indicator
4. Rate of Climb Indicator
5. Clock
6. Compass
7. Manifold Pressure Gages
8. Suction Gage
9. Fuel Gage
10. Altimeter
11. Cylinder Head Temperature Gages
12. Directional Gyro
13. Fuel Indicator Air Ratio Gage
14. Artificial Horizon
15. Oil Temperature and Pressure and Fuel Pressure Gages
16. Engine Tachometers
17. Carburetor Temperature Mixture
18. Fuel Warning Lights

SECTION II

PILOT OPERATING INSTRUCTIONS

1. FLIGHT RESTRICTIONS.

a. MANEUVERS.—All acrobatic maneuvers such as spins, slow rolls, snap rolls, loops, and inverted flight are prohibited.

b. DIVING.—The limited diving speed of the airplane is 225 mph (195 knots) IAS. Do not exceed engine speed of 2650 rpm in over-speed dive for more than 30 seconds. The cowl flaps should be closed during a dive. Use the elevator tab throughout the diving maneuvers.

c. Avoid violent use of the throttle or propeller controls in a dive, as engines will over-rev considerably.

2. BEFORE ENTERING PILOTS' COMPARTMENT.

a. Check Form 1 and "STATUS TODAY."

b. Check Form F, "Weight and Balance Clearance" (AN 01-1B-40).

3. ON ENTERING PILOTS' COMPARTMENT.

a. Check operation of radio equipment.

b. Check fuel level in fuel tanks.

c. SPECIAL CHECK FOR NIGHT FLYING.

(1) Check functioning of fluorescent and all other interior lighting.

(2) Check functioning of landing lights.

(3) Check warning and recognition lights.

(4) Turn on navigation lights.

d. CHECK FOR ALL FLIGHTS.

(1) Pull engines through 4 or 5 times, slowly, by hand, in direction of normal rotation. (If engines have been stopped less than 30 minutes, this is not necessary.)

(2) Manifold heat (carburetor air) controls (figure 34) on "COLD" (up position).

(3) Oil shutter controls (figure 34) on "HOT" (down position) for winter and on "COLD" (up position) for summer.

(4) Oil bypass valves (figures 30 and 35) on "HOT" (pulled out) for winter and on "COLD" (pushed in) for summer.

(5) Vacuum selector switch (figure 30) on either engine pump.

(6) Engine selector valve (figure 30) on "BOTH."

(7) Cross-feed valve (figure 30) "OFF."

(8) Fuel tank selector valve (figure 33) on fullest main tank.

(9) Manifold pressure selector valve on position No. 2. The valve is located on the instrument panel support bracket on left of instructor's seat. For normal operation, place valve on position No. 2. For checking gages to atmospheric pressure, place valve in position No. 1. To clean out lines through open vent, place valve in position No. 3. To check right engine to left manifold pressure gage and left engine to right manifold pressure gage, place valve to position No. 4. These instructions are on a placard adjacent to valve.

Note

Manifold pressure valves are not provided on later-model AT-11 and SNB-1 airplanes.

(10) Cowl flaps open.

(11) Parking brake on.

4. FUEL SYSTEM MANAGEMENT.

a. NORMAL OPERATION.

(1) Fuel tank selector valve to either main tank for warm-up and take-off. Use auxiliary tanks while in flight. Use either fuel tank for landing.

WARNING

Turn valve until it seats itself in new position. Never allow a fuel tank to run dry during flight as detonation and engine failure may result.

(2) Set engine selector valve on "BOTH" for all normal operation.

(3) Use wobble pump to build up pressure in fuel system prior to starting. Pressure should be at least 3 pounds per square inch but not over 4 pounds per square inch. A fuel pressure warning unit operates a warning light on the instrument panel when pressure falls below 1¾ pounds per square inch. Use wobble pump immediately if fuel pressure drops during flight.

(4) Turn cross-feed OFF for starting, and warming-up engines. Turn cross-feed "ON" for take-off, and landing. Turn cross-feed "OFF" for normal flight operation.

b. ONE-ENGINE OPERATION.

(1) Engine selector valve to operating engine.

(2) Cross-feed valve "OFF."

c. FAILURE OF BOTH ENGINES DURING FLIGHT.—Turn fuel tank selector valve "OFF."

5. STARTING ENGINES.

a. Use external power supply if available.

b. Mixture controls (figure 34) full "RICH" (forward position).

c. Throttle controls (figure 34) one-fourth open.

d. Propeller controls (figure 34) full "HIGH PITCH" (full back position).

e. Operate wobble pump to obtain 3 to 4 pounds fuel pressure.

f. Prime each engine. Seven full strokes for cold engine and 3 or 4 for warm engine.

WARNING

DO NOT OVER-PRIME ENGINES.

Note

Do not pump throttles in an effort to prime engines.

g. Master switches (figure 29) "ON."

h. Generator switches (figures 27 and 28) "ON."

Note

Master switches and generator switches should be left "ON" at all times when engines are running.

i. Master ignition switch (figure 32) "ON."

j. Start engines by engaging starter switch. (See figure 32.) Start either engine first. Allow engine to turn over four or five revolutions before turning ignition switch "ON."

CAUTION

IF ENGINE BACKFIRES, open throttle fully and immediately return it to closed position to prevent fire in carburetor. IN CASE OF FIRE keep engine turning with starter and attempt to start engine. If this does not put out fire, use airplane CO_2 extinguisher or hand fire extinguisher.

6. ENGINE WARM-UP.

a. Check oil pressure at once. If not 20 pounds per square inch in 30 seconds shut off engine.

b. Warm up at 1000 rpm, after approximately 1 minute, with cowl flaps full open.

c. Do not exceed 1000 rpm until the oil temperature gage shows a definite increase.

d. Avoid prolonged ground running. Do not exceed a cylinder head temperature of 205°C for warm-up, 232°C for ground test, or the maximum cylinder head temperature of 260°C for take-off. Keep cowl flaps full open during all ground operation.

e. Maximum oil pressure during warm-up: 100 pounds per square inch.

f. Normal oil pressure: 70 to 90 pounds per square inch.

g. Normal oil temperature: 60° to 75°C (140° to 167°F); maximum 85°C (185°F).

h. Normal fuel pressure: 3 to 4 pounds per square inch.

7. EMERGENCY TAKE-OFF.

a. Leave cowl flaps open.

b. If oil dilution was used prior to stopping last, use oil dilution as necessary to produce proper oil pressure at moderate power.

c. Take-off may be made as soon as oil pressure is steady and does not fluctuate and oil temperature has reached 40°C.

8. ENGINE AND ACCESSORY TEST.

a. Check magnetos after engines are warmed up (oil temperature at least 40°C and oil pressure steady and not over 100 lb/sq in. when throttle is advanced). Propellers shall be in full low pitch (high rpm) and the throttles shall be set for 28″ Hg., maximum, manifold pressure. Switch from "BOTH" to "L" and note drop in rpm. Return switch to "BOTH" until rpm stabilizes, and then switch to "R" and note rpm drop. A drop of more than 100 rpm on either magneto is indication of ignition trouble. Complete check as rapidly as possible to avoid ground running at this power any longer than necessary. Running time on single magneto should be as short as possible, and in no case longer than 15 seconds.

b. Make idle mixture check with throttle set for 600 rpm. Move the mixture control lever smoothly and steadily into the "IDLE CUT-OFF" position and observe the tachometer for any change in rpm. Return the mixture control lever to the full "RICH" position before the engine cuts out. A rise of more than 10 rpm indicates too rich an idle mixture, and no change or a drop in rpm indicates that the mixture is too lean. A rise of 5 to 10 rpm is recommended in order to permit idling at low speeds without danger of fouling plugs and at the same time to afford good acceleration characteristics.

c. With propellers in full low pitch, retard throttles to get approximately 1700 rpm. Then operate propeller control levers through full range several times, leaving the control in each position until rpm stabilizes.

d. GENERATOR SYSTEM CHECK.

(1) Have ground crew disconnect external electrical power.

(2) Start with both engines idling, voltmeter switch thrown to left generator, both generator switches "ON," and battery master switches "ON."

(3) Slowly increase the rpm of the left engine and observe the voltmeter. The voltmeter reading should increase to a value at which it indicates the closing of the reverse current cutout. This closing shows up as a dip in voltage and should occur at approximately 26.5 volts. A current reading on the left generator ammeter also indicates that the cutout has closed.

(4) As the left engine rpm is further increased, the voltage should increase to about 28.0 volts and remain at this value independent of any further increase in rpm.

(5) Decrease the left engine rpm to idling and repeat (2), (3), and (4) preceding for right generator.

(6) Increase the rpm of both engines, turn some additional electrical loads on, and observe the generator system paralleling as indicated by the ammeters. At full load (25 amperes/generator) the generators should parallel within 10 amperes. At the light load, neither ammeter should read reverse current.

(7) During extended taxiing and running up of the engines individually, it is recommended that one generator be left "OFF" to prevent too much relay chatter. Leave generator switches "ON" for take-off and flight.

e. AUTOMATIC PILOT CHECK. (Applies only to airplanes equipped with AFCE.)

(1) Turn automatic pilot master control switch "ON."

(2) Check pilot's directional indicator (PDI) for proper operation.

(3) Engage elevator, aileron, and rudder units, checking operation of each.

(4) Disengage automatic pilot.

(5) Turn automatic pilot master switch "OFF."

WARNING

Maximum allowable cylinder head temperature 232°C (450°F) before starting take-off.

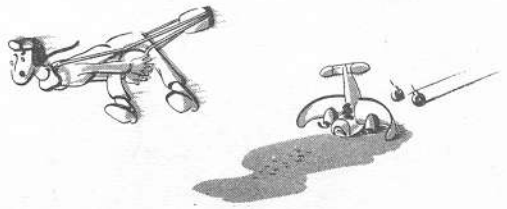
9. TAXYING INSTRUCTIONS.

a. Always unlock tail wheel for turning.

b. Visibility is fair when taxying. The airplane should be swung from side to side to check for obstacles.

c. Use engines and surface controls to control direction of airplane when taxying and avoid excessive use of brakes.

d. If airplane is empty or lightly loaded, the brakes should be used with caution due to remote possibility of airplane nosing over.



GO EASY ON THE BRAKES

e. Cowl flaps full open.

f. Wing flaps up. DO NOT TAXI WITH WING FLAPS DOWN.

10. TAKE-OFF.

(See "Take-off, Climb, and Landing Chart" in appendix II.)

a. Before turning into the wind for take-off, check the following:

(1) Fuel tank selector valve on fullest main tank.

(2) Cross-feed valve "OFF."

(3) Engine fuel selector valve on "BOTH."

(4) Check to see that control lock has been disengaged and check for free movement of all controls.

(5) Trim tabs at take-off position. Elevator tab should be set so that indicator needle (figure 33) shows in the green approximately between "0" and "1."

(6) Propellers in full low pitch (controls in forward position).

(7) Mixture controls full RICH (forward).

(8) Primer pump locked in "OFF" position.

(9) Manifold heat (carburetor air) controls full "COLD" (up position).

WARNING

If icing conditions are prevalent, blow out carburetors immediately prior to take-off, with controls in "HOT" position. Then take off with controls in "COLD" position and adjust for carburetor ice immediately after take-off.

(10) Oil bypass valves closed (in).

(11) Regulate oil shutters to maintain proper oil temperatures.

(12) Minimum oil temperature: 40°C (104°F); maximum oil temperature: 85°C (185°F).

(13) Minimum oil pressure: 50 pounds per square inch; maximum oil pressure: 100 pounds per square inch.

(14) Minimum fuel pressure: 3 pounds per square inch; maximum fuel pressure: 4 pounds per square inch.

(15) Cowl flaps "OPEN."

b. Turn straight down the runway, move forward slightly and lock tail wheel. Always lock tail wheel prior to take-off.

c. Wing flaps "UP" for normal take-off. For best take-off over obstacle, one-fourth deflected (11 degrees).

WARNING

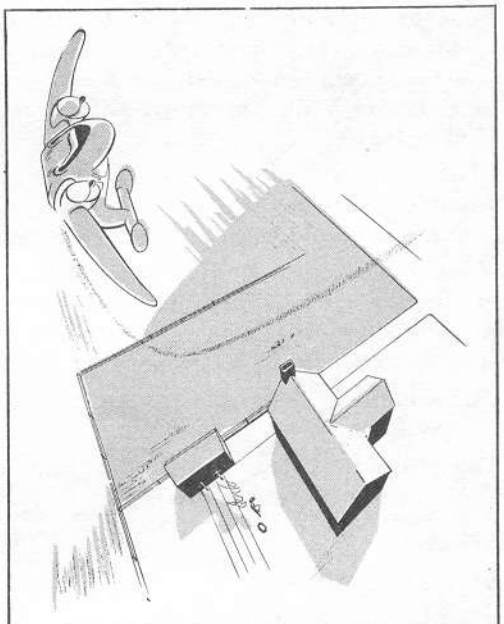
Do not retract flaps until 110 mph (95 knots) IAS has been attained. When flaps are fully extended, do not retract them all at once. Retract about 4 or 5 degrees at a time. Never exceed 117 mph (101 knots) IAS with wing flaps extended.

d. Retract landing gear as soon as ship is airborne.

WARNING

Be sure that sufficient speed has been attained so that airplane will not settle back to ground after landing gear has started retracting, as retraction mechanism will probably be damaged if wheels are allowed to touch ground after they have been started up. Landing gear should be retracted as soon as possible, as the AIRPLANE HAS NO SINGLE-ENGINE PERFORMANCE WITH EITHER LANDING GEAR OR WING FLAPS EXTENDED.

e. Manifold pressure: 37 inches Hg, maximum. Reduce throttles immediately upon clearing all obstacles to avoid exceeding 33.5 inches Hg. After reducing throttles, reduce propeller controls to show less than 2200 rpm. Maximum allowable head temperature: 260°C.



DON'T TRY TO GET HIGH TOO FAST

11. CLIMB.

a. Best climbing speed at sea level: 110 to 120 mph (95 to 104 knots) IAS. (Refer to "Take-off, Climb and Landing Chart" in appendix II.)

b. Keep cowl flaps "OPEN." Check cylinder head temperatures frequently. If over allowable (260°C or 500°F), increase IAS. Check oil and carburetor air temperatures.

12. FLIGHT OPERATION AND GENERAL FLYING CHARACTERISTICS.

a. Stability is good under all normal loading conditions and flight maneuvers. No take-off or landing should be attempted with the gun tunnel compartment and/or bombardier's compartment occupied.

b. Always warm up and take off on either main fuel tank, and run out both auxiliary tanks in flight. (Refer to "Specific Flight Chart" in section III for limits of engine operation.)

c. Leave cross-feed valve "OFF" during flight.

d. Trim tabs should be used to ease control pressures at all times. The elevator tab has a position indicator (figure 33) and rudder and aileron tabs are visible from pilot's seat.

e. Lowering landing gear or wing flaps causes airplane to be slightly nose-heavy.

f. In diving, the airplane becomes tail-heavy as speed increases, but has no tendency to yaw.

g. Maximum cruising economy may be achieved with mixtures set at .085, manifold pressures of 25 to 28 inches Hg, and propellers adjusted to between 1800 and 2000 rpm. All maximum power operation should be done with mixtures set at .100. Head temperatures should be checked constantly.

h. Cowl flaps should be "OPEN" for all operation under 140 mph (121 knots) IAS. However, this is a matter of judgment throughout all flying, with constant reference to head temperatures. (See Specific Engine Flight Chart.)

i. Under icing conditions, use just enough manifold (carburetor) heat to prevent icing, in order to maintain constant manifold pressure for level flight.

j. When switching to another fuel tank, be careful to stop valve on "click." Watch fuel pressure indicators and be ready to use wobble pump if fuel pressure does not build up to 3 pounds per square inch immediately.

k. Full control of the airplane is easily maintained at slow speeds.

l. The position of flaps and landing gear will not introduce additional error in the IAS.

13. STALLS.

a. STALLING SPEEDS

(1) Flaps and landing gear "UP," power "OFF": 80 mph (90 knots) IAS.

(2) Flaps and landing gear "UP," power "ON": 70 mph (59 knots) IAS.

(3) Flaps and landing gear "DOWN," power "OFF": 60 mph (52 knots) IAS.

b. Stall characteristics are good. There is no tendency to spin and ample stall warning is manifested by controls becoming "sloppy" and elevator's "buffeting." Aileron and rudder controls are good throughout entire stall and the airplane will mush considerably before the nose drops.

14. SPINS.

Intentional spins are prohibited. However, if accidental, normal spin recovery should be used.

15. APPROACH AND LANDING.

a. BEFORE LANDING.

(1) Fuel tank selector valve to fullest main tank.

(2) Cross-feed valve "OFF" (unless fuel pump has failed during flight).

(3) Engine fuel selector valve on "BOTH."

(4) Mixture controls in full rich (forward) position.

(5) Propeller controls in low pitch (forward) position.

(6) Manifold heat (carburetor air) controls on "COLD" (up) position.

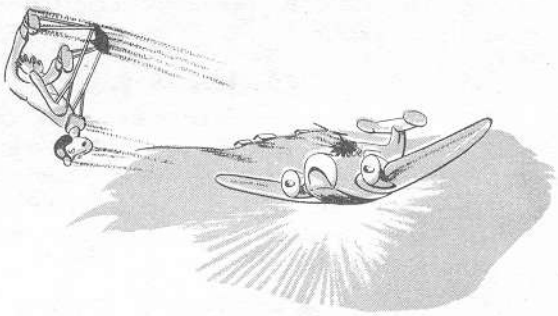
Note

When icing conditions are prevalent and a long glide is necessary, the manifold heat control should be on "HOT" position during glide but upon landing approach it should be changed to "COLD" position so as to have full power available.

(7) Regulate cowl flaps to maintain proper head temperatures.

(8) Tail wheel locked (control in).

(9) Landing gear "DOWN." Leave landing gear switch in "DOWN" position.



LOWER LANDING GEAR BEFORE LANDING

(a) Red light showing and warning horn sounding, with closed throttles, indicates that gear has NOT STARTED DOWN.

(b) No light showing and horn sounding, with closed throttles, indicates gear is only PARTIALLY DOWN.

(c) Green light showing and horn not sounding, with closed throttles, indicates gear is COMPLETELY DOWN. The design of the landing gear mechanism eliminates the need of a landing gear lock control.

(10) Wing flaps "DOWN."

(11) Trim airplane with landing gear and flaps "DOWN" and power "OFF," to glide "hands-off" at 100 to 110 mph (87 to 95 knots) IAS.

(12) Normal, power-off, three-point landing is best.

(13) The airplane has no tendency to swing after landing.

(14) BRAKES SHOULD BE USED WITH CAUTION, particularly if the airplane is not loaded.

b. CROSS-WIND LANDINGS.—Avoid cross-wind landings whenever practicable. If necessary to make a cross-wind landing, keep airplane straight with the runway and take all side drift out before wheels touch the ground.

16. STOPPING ENGINES.

a. Run propellers to full high pitch (full back position).

b. For cold-weather operation, refer to paragraph 19., this section, on the oil dilution system.

c. Move mixture controls to "IDLE CUT-OFF" position (closed) at 600 to 800 rpm.

d. Turn "OFF" all switches and valves.

e. Leave cowl flaps full open until engine has cooled.

17. BEFORE LEAVING PILOTS' COMPARTMENT.

a. Set parking brake.

b. Set flight control lock to prevent damage to control surfaces.

c. Turn master switches "OFF."

18. TYING DOWN.

An arrow-head mooring kit is provided with loose equipment, to be used in securing airplane when hangar facilities are not available. Mooring lugs are provided on under side of each wing near wing tip. Drive steel anchors from mooring kit into the ground approximately 3 feet fore and aft and in line with each mooring lug. Loop a rope through each mooring lug and tie the ends securely through the eyes in the steel anchors, leaving a small amount of slack between steel anchors and mooring lugs. Drive a steel anchor into the ground on each side of and in line with the tail wheel strut. Loop a rope around tail wheel strut, tying its ends securely to the eyes in the steel anchors.

19. OIL DILUTION.

a. GENERAL REQUIREMENTS.

(1) Allow engines to cool, either by idling or stopping after flight, before using oil dilution for an anticipated cold-weather start.

(2) In starting engines, a normal start should be made before using oil dilution. A high, fluctuating oil pressure reading will indicate heavy, viscous oil. If time or extreme temperature conditions do not permit normal engine warm-up, use of the dilution system is recommended.

(3) To prevent over-dilution, operating personnel must exercise care and judgment. Over-dilution will generally not occur if the diluting operation is done immediately after flight. Otherwise, proper dilution will rely mainly on past experience under similar conditions of engine and weather.

(4) If an engine shows a loss of oil pressure or throws oil through the breather during flight, it should be checked upon landing to insure that the oil dilution valve is in "CLOSED" position.

b. OIL DILUTION PROCEDURE.

(1) Operate engine at 800 rpm.

(2) Maintain oil temperature at 5° to 50°C (41° to 122°F).

(3) For ground temperatures from 5° to —7°C (40° to —20°F), hold oil dilution switch "ON" for 4 minutes, stop engine, and release oil dilution switch.

(4) For temperatures from —7° to —29°C (20° to —20°F), dilute for a second 4-minute period 15 minutes after first dilution.

(5) For temperatures below —29°C (—20°F), dilute for a third 4-minute period 15 minutes after second dilution.

SECTION III

FLIGHT OPERATING DATA

1. AIR-SPEED LIMITATIONS.

a. MAXIMUM SPEEDS.

(1) Do not exceed 225 mph (195 knots) IAS at any time.

(2) Do not lower landing gear at above 125 mph (108 knots) IAS.

(3) Do not lower wing flaps at above 117 mph (101 knots) IAS.

(4) Do not lower landing lights at above 110 mph (95 knots) IAS.

b. ENGINE OPERATION.

(1) Do exceed 33.5 inches Hg or 2200 rpm for continuous operation.

(2) Do not exceed 37 inches Hg for take-off.

(3) Do not exceed 2650 rpm in a dive for more than 30 seconds.

c. AVOID violent use of the throttle or propeller controls in a dive as engines will over-rev considerably.

2. AIR-SPEED CORRECTION.

The position of flaps and landing gear will not introduce additional error in the IAS.

3. BALANCE COMPUTER.

A load adjuster and carrying case will be found on a mounting clip located on the right side of the entrance door to the pilots' compartment.

4. DEFINITIONS FOR ENGINE POWER RATINGS.

(As shown on the following "Specific Flight Chart.")

a. TAKE-OFF:—Maximum recommended for take-off under specified time limit.

b. WAR EMERGENCY:—The rating established by the manufacturer and accepted by the Government, specifically for combat use under the specified time limit.

c. MILITARY:—Maximum recommended for operation, limited to 30 minutes duration, unless otherwise specified.

d. NORMAL RATED (MAXIMUM CONTINUOUS):—Maximum recommended for unlimited operation with rich mixture, in level flight and in climb.

e. MAXIMUM CRUISE:—Maximum recommended for operation with lean mixture.

f. MINIMUM SPECIFIC CONSUMPTION:—The power at which greatest range can be attained.

SPEC. AN-H-8
DEC. 18, 1942

AIRPLANE MODELS
AT-11
SNB-1

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS
P & W R-985-AN-1 (SINGLE SPEED BLOWER)
P & W R-985-AN-3 (SINGLE SPEED BLOWER)

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	31-2	70-90	60-75	140-167				
MAXIMUM	4	100	85	185				
MINIMUM	3	50	40	104				
IDLING	2	10						

MAX. PERMISSIBLE DIVING RPM: 2650

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	5.3 U.S.QT/HR 8.8 IMP.PT/HR
MAX. CRUISE	4.6 U.S.QT/HR 7.7 IMP.PT/HR
MIN. SPECIFIC	U.S.QT/HR IMP.PT/HR

OIL GRADE: (S) 1120 (W) 1100

SUPERCHARGER TYPE:

FUEL GRADE: SPEC. NO. AN-F-26, GRADE 91/96

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.	FUEL FLOW (GAL/HR/ENG.) IMP.	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	2300	37	450		2000			FULL RICH	49	41	260	500	5
WAR EMERGENCY													
MILITARY													
MAXIMUM CONTINUOUS	2200	33.5	400		4500			FULL RICH	39	32	260	500	
MAXIMUM CRUISE	2000	28	300		8300			085	25	21	232	450	
MINIMUM SPECIFIC CONSUMPTION	1800 1700	28 26	270 240		7200 8700			080 080	22 21	18 17	232 232	450 450	

REMARKS: AVOID OVERSPEED DIVE OF 2650 R.P.M. FOR OVER 30 SECONDS

SECTION IV

EMERGENCY OPERATING INSTRUCTIONS

1. POWER FAILURES.

a. ONE-ENGINE FAILURE DURING TAKE-OFF.

(1) Open both throttles.

(2) Both propeller controls in low pitch (full forward).

(3) LANDING GEAR UP.

(4) Hold airplane as level as possible until 105 mph (90 knots) IAS has been attained.

(5) Climb at 105 mph (90 knots) IAS (best one-engine climbing speed).

(6) Reduce throttle on good engine to 33.5 inches Hg.

(7) Reduce propeller control on good engine to 2200 rpm. Place dead engine's propeller to full high pitch (back position).

(8) Place mixture control on good engine to .100 and on dead engine to "IDLE CUT-OFF" position (back position).

(9) Keep cowl flaps full open on good engine and close them on dead engine.

(10) Trim airplane. The airplane can be trimmed to fly "hands-off" with either engine inoperative.

(11) Turn engine selector valve to good engine and turn cross-feed valve "OFF."

b. FAILURE OF BOTH ENGINES DURING TAKE-OFF.—Land airplane on the field STRAIGHT AHEAD. Do not attempt to lower landing gear if it has been retracted, unless there is enough altitude and plenty of field. As soon as engines quit, cut off master switches, generator switches, master ignition switch, and shut off fuel tank selector valve.

c. ONE-ENGINE FAILURE DURING FLIGHT.

(1) Hold airplane STRAIGHT AND LEVEL.

(2) Open both throttles.

(3) Place propeller control on good engine to 2200 rpm and on inoperative engine to full high pitch.

(4) Place both mixture controls in full rich position (forward position).

(5) Reduce throttle on good engine to 33.5 inches Hg.

(6) Place mixture control on good engine to .100 and on dead engine to "IDLE CUT-OFF" position.

(7) Open cowl flaps on good engine and close them on inoperative engine.

(8) Trim airplane. The airplane can be trimmed to fly "hands-off" with either engine inoperative.

(9) Turn engine selector valve to good engine and turn cross-feed valve "OFF."

(10) Turn vacuum selector valve to good engine.

(11) Reduce manifold pressure and rpm to a MINIMUM on good engine to maintain flight.

WARNING

WATCH HEAD TEMPERATURES. If in excess of maximum allowable (260°C or 500°F), use richer mixture on good engine.

(12) One-engine ceiling, with gross load, is 5000 feet density altitude. Best climbing speed for one engine is 105 mph (90 knots) IAS.

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

a. Open engines to FULL POWER. Do not exceed 37 inches Hg manifold pressure or 2300 rpm.

b. RAISE LANDING GEAR AT ONCE.

c. Open cowl flaps fully.

d. Raise wing flaps.

WARNING

Wing flaps should be raised only 4 or 5 degrees at a time, and 100 to 110 mph (87 to 95 knots) IAS should be maintained.

e. DO NOT PULL AIRPLANE UP TOO STEEPLY, as loss of air speed will result in trouble in event of engine failure.

3. EMERGENCY LANDING.

a. FORCED LANDING ON LAND.—The pilot must decide in event of a forced landing whether landing gear will be retracted or lowered. IF IN DOUBT, LAND WITH GEAR RETRACTED.

(1) Turn fuel tank selector valve "OFF."

(2) Turn ignition master switch "OFF."

(3) Turn master and generator switches "OFF."

(4) Lower wing flaps.

b. FORCED LANDING ON WATER (DITCHING).—In event a forced landing on water becomes necessary, the following general instructions will apply; however, each organization will draw up a "Ditching Bill" giving ditching stations for crew and passengers, and listing the duties of each crew member.

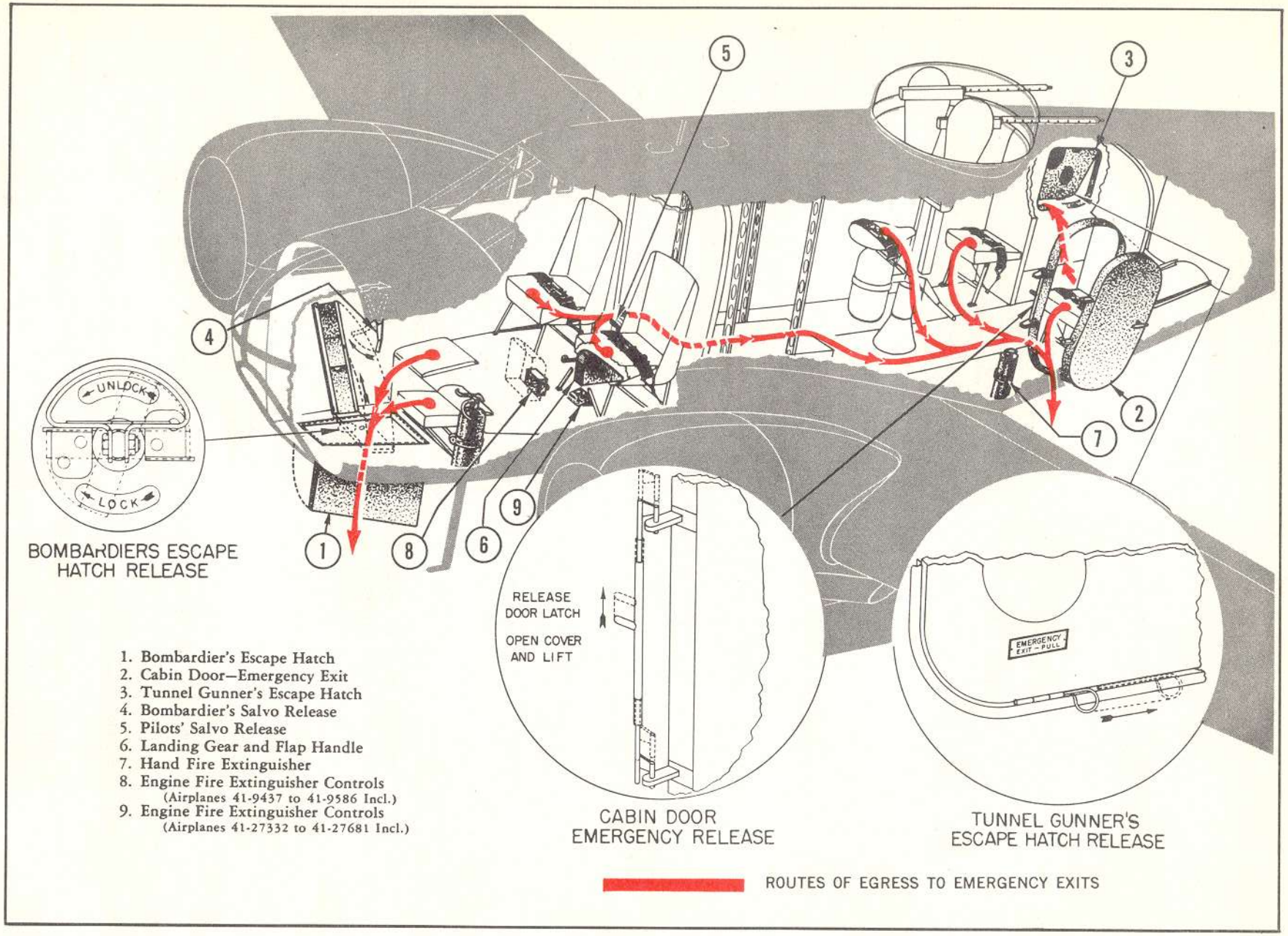


Figure 37—Emergency Exits and Equipment

(1) SEND DISTRESS SIGNAL.—If existing orders permit, send distress signal on designated frequency, including time and position signals. Also transmit course, altitude, ground speed, and estimated position of landing.

(2) DUMP BOMBS.—Open bomb bay doors and dump bombs. Close the bomb bay doors. Should there be any doubt as to time for dumping bomb load, leave the doors closed and check that the bombs are "SAFE."

(3) PREPARE LIFE RAFT.—The life raft (if carried) is stowed in rear compartment. It should be brought into the cabin NEAR THE EXIT. Prepare raft for use but do not inflate it until landing has been made and raft is outside of airplane.

(4) SAFETY BELTS will be secured but ready for instant removal.

(5) PARACHUTE HARNESS shall be unfastened.

(6) LANDING GEAR will be retracted.

(7) LOWER FULL FLAPS to reduce the speed of the approach.

(8) LANDING.—The airplane should be set down on the water SLIGHTLY TAIL FIRST. If there is little or no wind, ditching will be made with as low IAS as possible. Waves are created and maintained by wind, consequently ditching would be made into wind, across waves. Swells on surface of water do not necessarily move with the prevailing wind, so when wind is across the swell, landing must be made along the swell and as nearly into the wind as possible. Deep troughs between swells should be avoided at the moment of contact. In a very strong cross-wind it may be necessary to land across swells. If so, the airplane should be set down on the up-slope toward the top.

Note

USE OF POWER IS ADVISABLE. Even one engine will aid in flattening out the approach. If it is certain land cannot be reached, always DITCH BEFORE FUEL IS EXHAUSTED in order to have power available.

4. EMERGENCY OPERATION OF LANDING GEAR.

a. If landing gear does not operate electrically, reset circuit breaker by pressing down on the reset button. (The circuit breaker is located on the floorboard below front edge of pilot's seat.)

Note

On early-model airplanes the landing gear electrical circuit is protected by a fuse in place of a circuit breaker. The fuse is located in a box at the base of the hand crank box. If the gear does not operate electrically, turn off master and generator switches and replace fuse.

b. TRY AGAIN to lower landing gear electrically. If the gear does not go down:

(1) Place landing gear switch in "OFF" position.

(2) Raise landing gear clutch pedal cover and depress landing gear clutch pedal. HOLD PEDAL DOWN WHILE TURNING CRANK. (See figures 20 and 21.)

(3) Engage landing gear hand crank by pulling out (away from pilot.)

(4) Turn hand crank, as directed on placard directly under hand crank, until gear is down.

Note

When landing gear is fully down it can be seen from the cockpit.

(5) Release landing gear clutch pedal.

5. EMERGENCY OPERATION OF WING FLAPS.

In event flaps do not operate electrically, they may be OPERATED MANUALLY;

a. Place flap switch in "OFF" position.

b. Engage flap hand crank by pushing in (toward the pilot).

c. Turn hand crank, as directed on the placard directly under it, until flaps are in desired position.

6. EMERGENCY EXITS.

The airplane has three emergency exits. (See figure 37.)

a. THE CABIN DOOR, by which entry to the airplane is made, is equipped with an emergency-release lever, located at forward edge of door frame. Door is released from its hinges by pulling back the safety guard and lifting the lever.

b. THE EMERGENCY ESCAPE EXIT is located in right side of fuselage in the tunnel gunner's compartment. It is opened by pulling out two pins at the lower hinge and pushing outward on the panel.

c. THE BOMBARDIER'S ESCAPE HATCH is located in the floor of the bombardier's compartment. Exit is made by lifting the guard bar, turning the latch, and allowing the door to swing open.

7. FIRE EXTINGUISHER EQUIPMENT.

a. THE ENGINE (CO_2) FIRE EXTINGUISHER is controlled from a panel located under the front of the pilot's seat. (See figure 35.) To operate:

(1) Turn selector valve handle to desired engine.

(2) Pull out release handle. (Pull firmly, as far as possible.)

b. THE HAND FIRE EXTINGUISHER is located on left side of cabin just forward of cabin door. (See figure 37.) To operate:

(1) Flip open fastener and pull extinguisher from supporting bracket.

(2) Turn handle and pump.

SECTION V

OPERATIONAL EQUIPMENT

1. BOMBARDIER'S COMPARTMENT.

a. DESCRIPTION.

(1) GENERAL.—The bombardier's compartment is located in the glass-enclosed nose of the airplane and contains bomb-release controls and instruments. Provision is made for seating the student bombardier and bombardier instructor. Access to the compartment is made from pilots' compartment. To make entrance easier, copilot's rudder pedals may be removed and stowed on the side wall, just forward of copilot. An emergency exit from bombardier's compartment may be made by lifting the safety bar across the door in the floor of the compartment and turning the handle in the door. (See figure 37.)

b. BOMBARDIER'S EQUIPMENT.

(1) BOMBARDIER'S INSTRUMENT PANELS.

(a) COMPASS. *(See figure 38.)*

(b) CLOCK. *(See figure 38.)*

(c) FREE AIR TEMPERATURE INDICATOR. *(See figure 39.)*

(d) ALTIMETER. *(See figure 39.)*

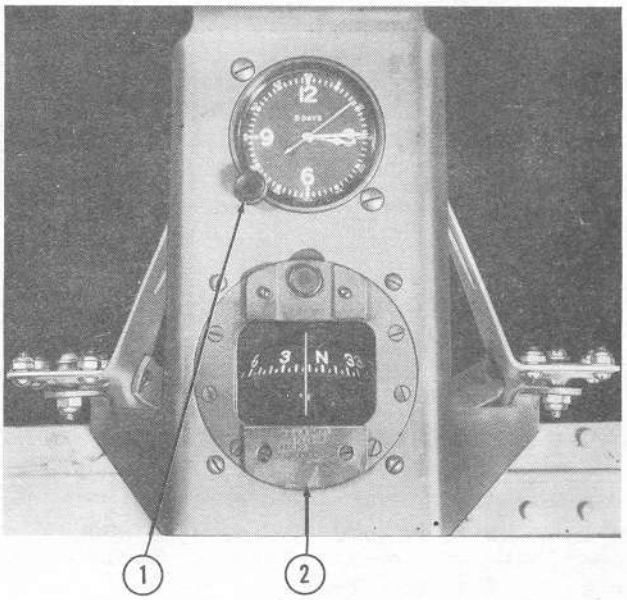


Figure 38—Bombardier's Compass Panel

1. Clock 2. Compass

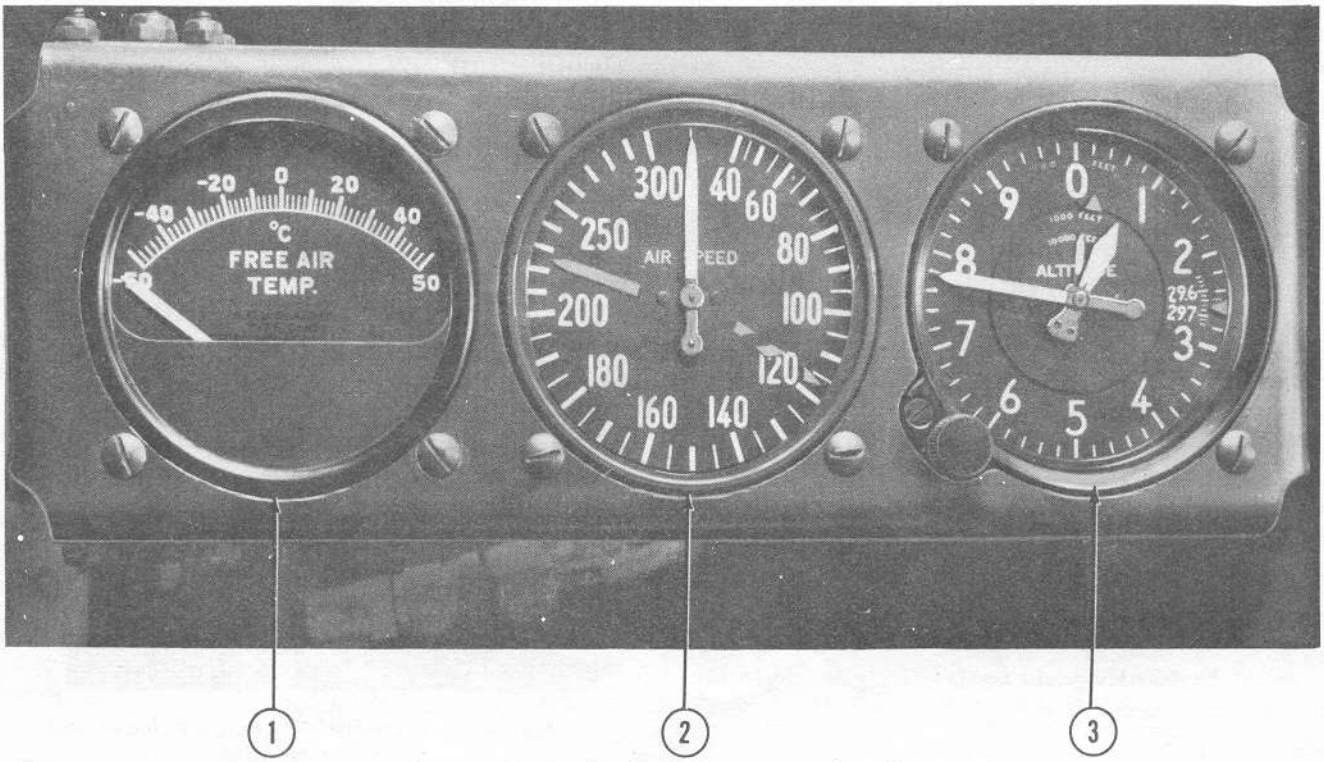


Figure 39—Bombardier's Instrument Panel

1. Free Air Temperature Gage 2. Airspeed Indicator 3. Altimeter

(2) BOMB SIGHT MOUNT.
(3) ELECTRICAL CONTROL PANEL. *(See figure 40.)*
(4) BOMB-RELEASE AND SALVO HANDLES. *(See figure 41.)*
(5) VENTILATING OPENING.
(6) BOMBARDIER'S WINDOW DEFROSTER. *(See figure 44.)*

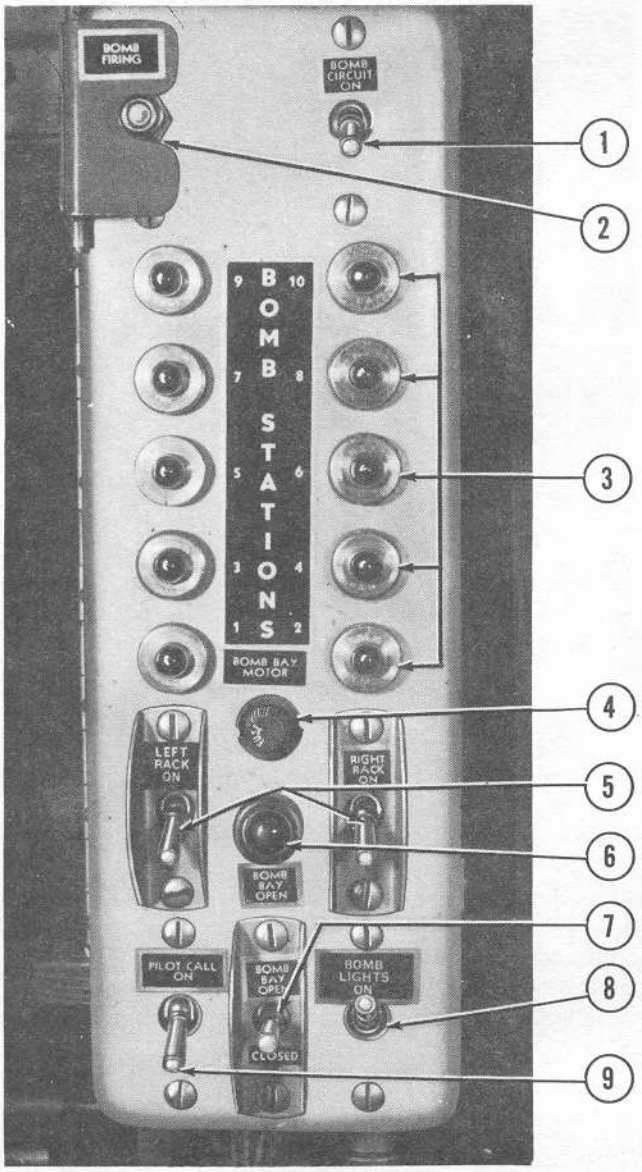


Figure 40—Bombardier's Electrical Control Panel

1. Bomb Circuit Switch
2. Bomb Firing Switch
3. Bomb Indicator Lights
4. Bomb Circuit Fuse
5. Rack Selector Switches
6. Bomb Bay Door Red Indicator Light
7. Bomb Bay Door Switch
8. Bomb Indicator Light Switch
9. Pilot's Call Switch

c. OPERATING CONTROLS.

(1) TO COCK BOMB RELEASE:

(a) Push bomb-release handle (figure 41) in bombardier's compartment forward to "SELECT" position.

(b) Cock bomb releases on bomb racks. Push both arms away from center to "arm" or cock the releases.

(c) Pull bomb-release handle back to "SAFE" position.

(d) Turn bomb indicator light switch "ON." (See figure 40.)

(2) TO RELEASE BOMBS:

(a) Turn on bomb circuit switch on bombardier's electrical control panel. (See figure 40.) Indicator lights (figure 40) on the control panel will come on if releases are cocked and system is functioning properly.

Note

Instructor's cut-off switch (figure 44), located on right side of bombardier's compartment, must be "ON" in order that bomb circuit switch on control panel becomes effective.

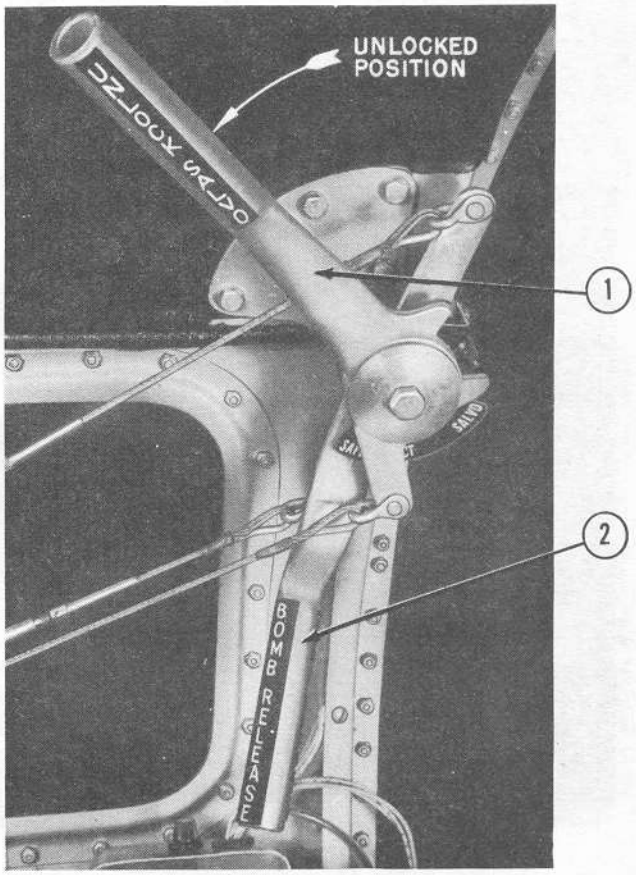


Figure 41—Bombardier's Bomb Release and Salvo Handle

1. Salvo Unlock Handle
2. Bomb Release Handle

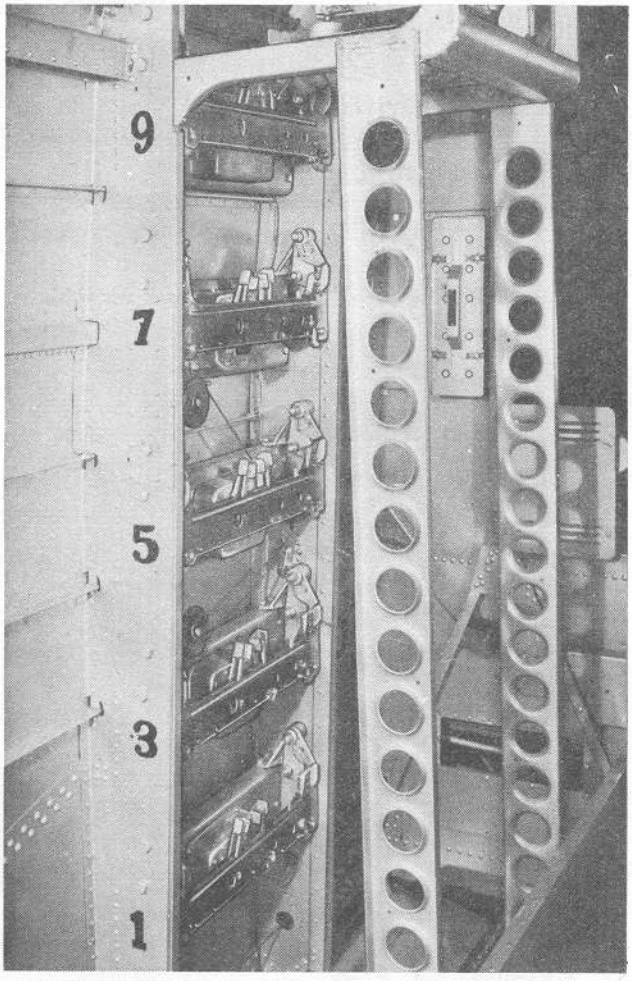


Figure 42—Bomb Rack Installation, Left Side

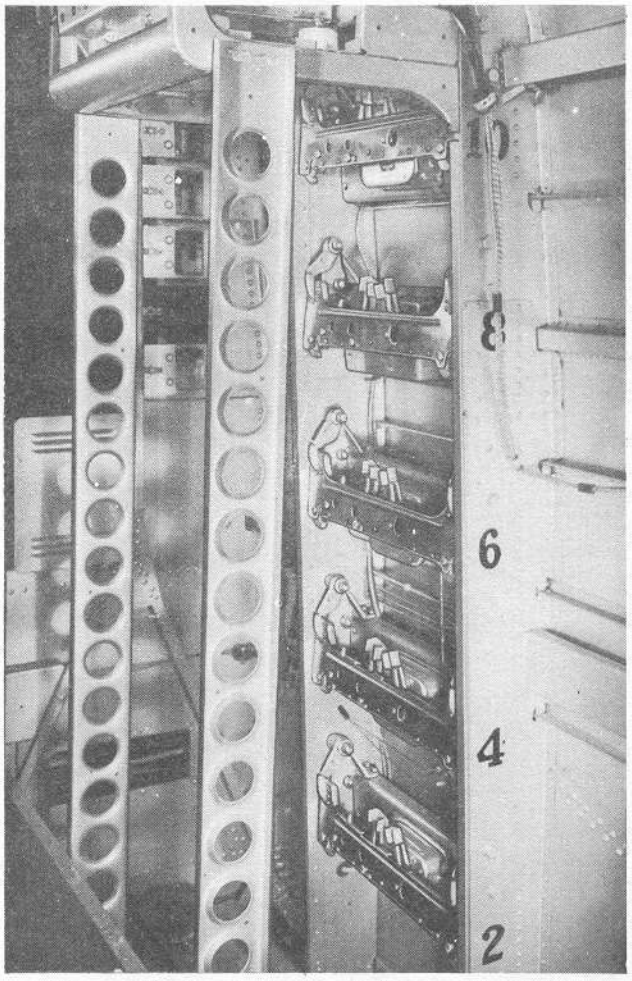


Figure 43—Bomb Rack Installation, Right Side

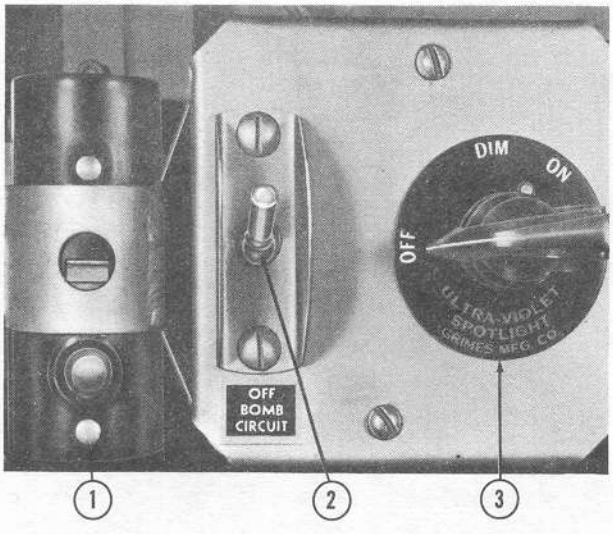


Figure 44—Bombardier's Fluorescent Light Control and Cut-Off Switch

1. Bombardier's Window Defroster Tube
2. Bombardier's Instructor's Cut-Off Switch
3. Bombardier's Fluorescent Light Control

(b) Turn "ON" bomb bay door switch. (See figure 40.) This switch is located in bombardier's control panel; the red indicator light (figure 40) on the control panel will come on when doors are fully open. If light fails to come on, it may be necessary to crank doors down by hand. (See figure 46.) On early-model AT-11 airplanes, the crank for manual operation of bomb doors is stowed on the oxygen bottle racks. On later AT-11 and SNB-1 airplanes, crank is stowed on wind baffle at rear of right bomb bay. (See figure 45.)

(c) Push handle marked "BOMB RELEASE" forward to "SELECT" position.

(d) Turn "ON" the rack selector switch. (See figure 40.) Choose right or left rack, as desired.

(e) Push bomb-firing switch to drop bombs. (See figure 40.) The amber indicator light (green indicator lights on first AT-11's), corresponding to the station number of the bomb, will go out when bomb is dropped.

The guard must be raised to throw the bomb-firing switch, which is a double-throw switch and will fire bombs when pushed either up or down—providing all previous operations have been performed.

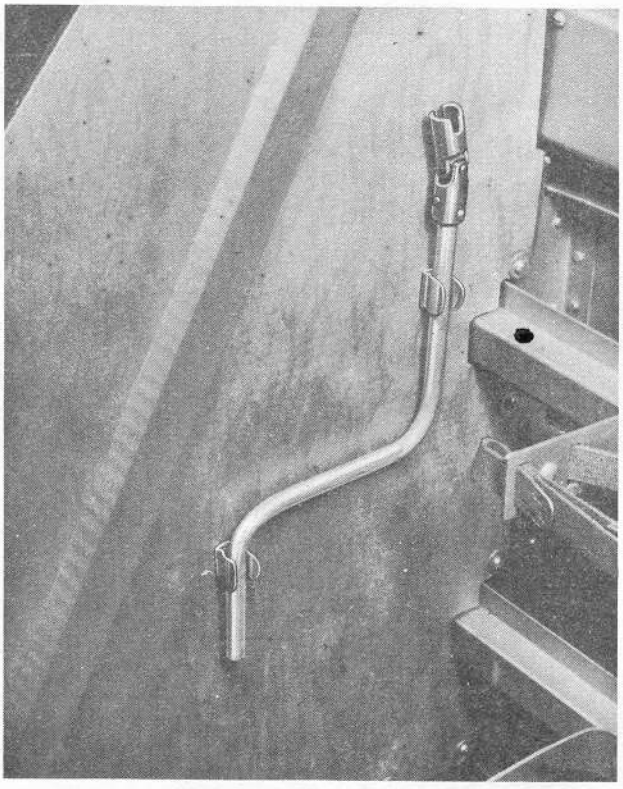


Figure 45—Bomb Doors Emergency Hand Crank, Stowed

WARNING

OBSERVE THE INSTRUCTIONS GIVEN ON "GLIDE AND CLIMB" PLACARD IN THE BOMBARDIER'S COMPARTMENT. (See figure 47.) The instructor may prevent releasing of bombs electrically, by cutting off the bomb circuit with his cut-off switch. (See figure 44.)

(3) TO SALVO BOMBS:

(a) BOMBARDIER'S SALVO (EMERGENCY USE ONLY).

1. Pull salvo-unlock handle back to "SALVO" position. This handle (figure 41), when in this position, opens bomb doors and disengages salvo-release safety catch.

2. Push bomb-release handle forward to "SALVO" position. This will release all bombs "unarmed" unless arming wires have been disconnected.

(b) ELECTRICAL SALVO.

1. To salvo bombs electrically, operation *(a)* to *(e)* under paragraph (2) of this section, must be accomplished; except in operation *(d),* turn on both rack selector switches and then bombs will be dropped two at a time when bomb-firing switch is thrown. Throw firing switch as rapidly as possible as many times as necessary to salvo all bombs. Bombs will be dropped ARMED.

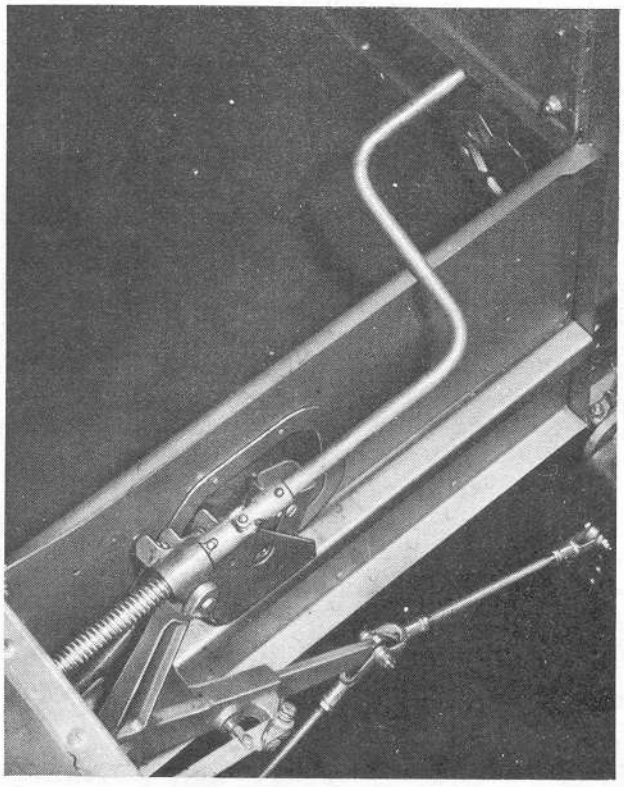


Figure 46—Bomb Doors Emergency Hand Crank, in Operation

AIRPLANE MODEL AT-11.
WITH WHEELS AND FLAPS UP MAXIMUM ALLOWABLE AIRSPEED IS 225 M.P.H.
WITH WHEELS AND FLAPS DOWN MAXIMUM ALLOWABLE AIRSPEED IS 117 M.P.H.

NOTE 1. WHILE THE MAJORITY OF BOMB STATIONS WILL PERMIT RELEASE OF BOMBS AT AN ANGLE WHICH WILL PRODUCE AN INDICATED AIRSPEED GREATER THAN THAT DESIGNATED, UNDER NO CONDITIONS SHALL THE MAXIMUM ALLOWABLE INDICATED AIRSPEED BE EXCEEDED.
2. ANGLES SHOWN ALLOW 10° FOR SAFETY, HOWEVER, UNDER PERFECTLY SMOOTH FLYING CONDITIONS, IF IN THE AIRPLANE COMMANDER'S OPINION CONDITIONS WARRANT IT, THESE GIVEN ANGLES MAY BE EXCEEDED BY NOT MORE THAN 5°.

THE ANGLES (BETWEEN THE FUSELAGE CENTER LINE AND THE EARTH'S SURFACE) LISTED BELOW ARE THE MAXIMUM AT WHICH BOMBS MAY BE RELEASED WITH A 10° CLEARANCE ANGLE MAINTAINED IN THE BOMB BAY.

STATION	ANGLES PERMISSIBLE WITH RESPECT TO CLEARANCE.			
	GLIDE		CLIMB	
	M38A2 BOMB	M30 BOMB	M38A2 BOMB	M30 BOMB
9 10	0	0	0	9°
7 8	2½°	2°	2½°	13°
5 6	7°	6°	7°	20°
3 4	12°	14°	15°	30°
1 2	35°	34°	38°	48°

Figure 47—Bombardier's Glide and Climb Chart

(c) TO ENGAGE BOMB-RELEASE SYSTEM AFTER EMERGENCY SALVO:

1. Engage release system. Pull bomb-release handle back to "SAFE" position. Push salvo handle forward to "LOCK" position. Run bomb doors down electrically a little way or give hand crank four or five turns and put release pins on bomb door actuating levers back in place to hold doors in position. Close doors.

CAUTION

Before using bomb-release mechanism again, make certain salvo-release safety catch, located on right bomb rack, is in place.

2. OPERATION OF OXYGEN EQUIPMENT.

a. HIGH-PRESSURE OXYGEN EQUIPMENT.

(1) GENERAL DESCRIPTION.—The oxygen installation consists of four type B-1 oxygen bottles, four type A-8B oxygen masks, and five type A8A oxygen regulators. (See figure 6.)

(2) OPERATION.

(a) Oxygen will be used when operating above 10,000 feet pressure altitude and from the ground up on all flights at night.

(b) The oxygen mask hose may have a rubber bayonet or metal connector. Be absolutely sure the mask connector will fit the regulator output connections before starting airplane engines.

(c) OXYGEN FLOW to pilot, instructor, and students is controlled by a regulator at each of their respective stations. A small knurled knob is provided for adjustment and a gage, calibrated in thousands of feet, indicates rate of flow. When oxygen is being taken, the knurled knob should be adjusted so the gage registers equal to the pressure altitude at which the airplane is flying. Some individuals require more oxygen than others and flow should be increased if the individual feels any extremity of his body (feet, fingers, or lobes of ears), lacking in sensitivity or if he has any "tingling" sensation.

(3) OXYGEN DURATION.—The following table lists the approximate oxygen supply per man hour, assuming the B-1 supply cylinder for each station is fully charged at 1800 pounds per square inch.

Altitude	*Hours Supply per Man (A-8A Regulator)*
20,000 ft.....	4½
15,000 ft.....	5
10,000 ft.....	5½

b. LOW-PRESSURE OXYGEN EQUIPMENT.

(1) GENERAL DESCRIPTION.

(a) On airplanes 42-37694 and after, DEMAND SYSTEM low-pressure oxygen equipment is installed. The demand oxygen system (figure 7) consists of low-pressure, shatter-proof oxygen cylinders, manifolded together, using check valves and distribution lines, type A-12 oxygen regulator, pressure gage, pressure signal assembly, indicator lamp, and flow indicator. The system is provided with a filler valve for recharging. Two portable tanks are provided, one in cabin and one in bombardier's compartment. A recharger hose is attached to the main supply system near each portable tank so that they may be conveniently filled. A demand-type mask must be used with this system.

(b) The system is fully automatic and provides the user with the proper amount of oxygen at all altitudes and under all conditions. A demand system, as the name implies, furnishes oxygen only upon demand, that is, every time the user inhales, a sufficient amount of oxygen is delivered to the mask. An oxygen regulator, pressure gage, pressure signal assembly, indicator lamp, and flow indicator are provided for each crew member, namely: the bombardier, instructor, pilot, copilot, and navigator.

(2) OPERATION.

(a) Oxygen will be used on all flights at 10,000 feet and above and from the ground up on all flights at night.

(b) FLOW OF OXYGEN TO A MASK is regulated by the demand regulator, type A-12, which automatically supplies user with proper mixture of air and oxygen at all altitudes every time he inhales, shutting it off when he exhales. The percentage of oxygen delivered to user increases with increasing altitude, becoming approximately 100 percent at 30,000 feet, making adjustment during flight unnecessary.

(c) TWO MANUAL CONTROLS, however, are provided for use in special instances. One of these is labeled "AUTO-MIX" and the other "EMERGENCY." "AUTO-MIX" stands for automatic mixing of air with oxygen. The normal position of this control is "ON," in which case the regulator automatically mixes the proper amount of air with oxygen at all altitudes. When "AUTO-MIX" is "OFF," the regulator will automatically furnish pure oxygen on demand. On some of the latest-type A-12 regulators, wording of positions has been changed to "NORMAL" and "DENITRO," "NORMAL" corresponding to "ON" and "DENITRO" corresponding to "OFF." The "EMERGENCY" valve, when turned on, provides a continuous flow of oxygen into the mask, which rapidly diminishes the oxygen supply. This valve will be turned off at all times except in cases of emergency.

(d) FLOW INDICATORS (type A-3) show only that oxygen is flowing from regulator, and do not indicate the amount. This type indicator blinks open and shut with each breathing cycle of user if oxygen is flowing to the mask.

(e) THE PRESSURE GAGE AND INDICATOR are mounted on the same panel with the flow indicator. The pressure gage shows pressure of oxygen in supply cylinders, and the indicator lamp is lighted when the supply pressure falls to approximately 100 pounds per square inch. Safe minimum working pressure is 50 pounds per square inch.

(f) THE OXYGEN MASK used with the demand system is of a special type that requires very careful selection of size and fit. It contains a flapper valve which remains closed when inhaling, so that oxygen from regulator may be taken. Upon exhalation, this valve opens, permitting exhaled gases to exhaust. There are four types of demand masks, namely; types A-9, A-10, A-10 revised, and A-14. Regardless of which type is used, extreme care must be taken in obtaining correct fit. The routine procedure of determining mask leakage is to hold the thumb over the end of inspiratory tube and inhale gently. If mask does not leak, it will offer resistance to inhalation and tend to collapse on the face. Keep mask in clean, sanitary condition by frequent washing with clean cloth and water.

(3) OXYGEN DURATION.—The following table lists the approximate oxygen supply per man hour, assuming that the system is fully charged at 400 pounds per square unit.

Altitude	*Auto-Mix "ON" (A-12 "Pioneer" Regulator)*	*Hours Supply per Man Auto-Mix "ON" (A-12 "AIRCO" Regulator)*	*Auto-Mix "OFF"*
20,000 ft.....	11½	7	4
15,000 ft.....	11	8½	3
10,000 ft.....	11	14	2½
5,000 ft.....	8½	...	2
0 ft.....	9	...	1½

3. OPERATION OF COMMUNICATIONS EQUIPMENT.

a. GENERAL DESCRIPTION.

(1) The radio installation consists of a type SCR-AQ-283 command set, RC-36 interphone equipment, and RC-32 filter equipment. A T-17 microphone is located at pilot's, bombardier's, bombardier instructor's and turret gunner's stations. Later-model airplanes do not have either jack boxes or microphones at tunnel gunner's position.

(2) RECEIVER.—The receiver (figure 48) is calibrated and adjusted to receive radio-range frequencies between 201 and 398 kilocycles and tactical-communication range between 2500 and 7700 kilocycles. Provisions for receiving other frequencies can be made by a radio technician.

(3) TRANSMITTER. – The transmitter (figure 49) operates on any frequency between 2500 and 7700 kilocycles. It is capable of transmitting voice, modulated CW (MCW), or straight CW signals. The effective range of the transmitter for dependable voice transmission is approximately 25 miles.

(4) INTERPHONE.—Pilot's jack box is located on the bulkhead just aft of pilot and about shoulder height. Locations of jack boxes for other crew members are as follows:

(a) Bombardier.—On left side of bombardier's compartment, under the window frame.

(b) Bombardier Instructor.—On guard rail in passage between pilots' compartment and bombardier's compartment.

(c) Turret Gunner.—On right side of airplane, directly to right of turret.

(d) Tunnel Gunner.—On right side of airplane in tunnel gun compartment, adjacent to emergency exit.

(5) MARKER BEACON (Provided only on army airplanes Serial No. 42-37662 and after.—The marker beacon unit is an ultra-high frequency radio receiving set, having a frequency range of from 62 to 80 megacycles. The unit is adjusted to receive 75 megacycle marker-beacon signals that are used in the Army instrument-landing system of the Civil Aeronautics Administration. The output indication is made visible by an indicator lamp on the pilot's instrument panel.

b. OPERATING INSTRUCTIONS.

(1) RECEIVER.

(a) Turn receiver control box selector switch (figure 32) on "MANUAL." Plug receiver phones in

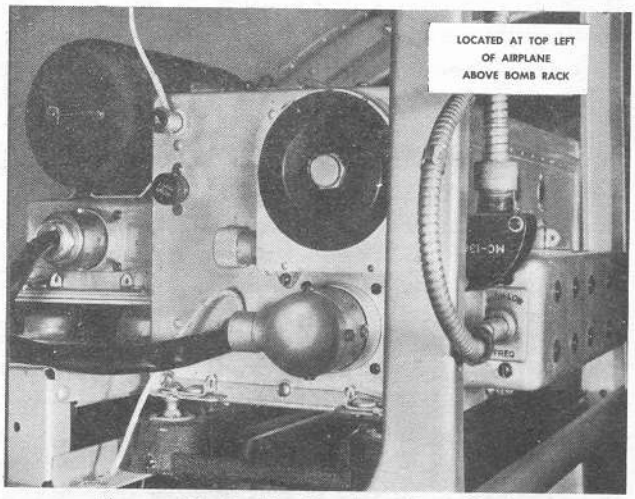


Figure 48—Radio Receiver Installation

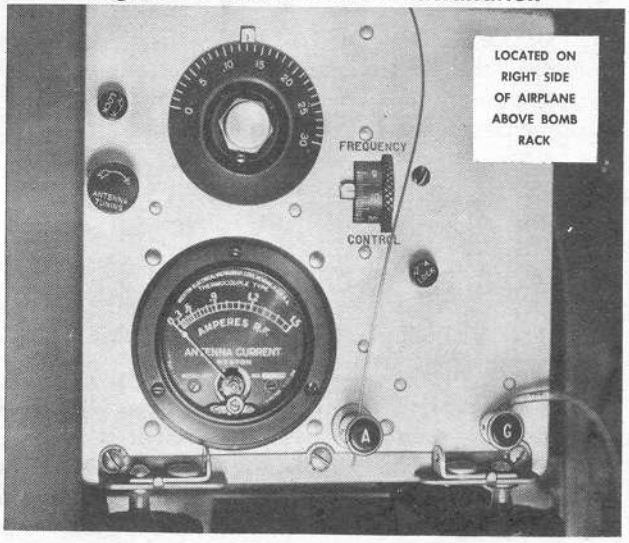


Figure 49—Radio Transmitter Installation

jack No. "JK-26" and turn "INCREASE OUTPUT" control knob to right until a frying noise or signal is heard in receiver.

CAUTION

For all normal (voice or MCW) reception, radio receiver filter selector switch (figure 50) should be set at "BOTH." To receive radio range (MCW) with less possibility of voice interference, set selector switch to "RANGE." To receive voice with less possibility of radio range interference, set selector switch to "VOICE." It is possible to receive when selector switch is set on "RANGE."

(b) To receive radio ranges and control tower on 201 to 398 kilocycles, set "HI-LO" selector switch (figure 53) to "LO." (Refer to "CAUTION" under paragraph b.(1).) Adjust tuning dial knob for desired frequency as calibrated on inner scale of tuning dial. (See figure 32.)

Note

When turning receiver for a definite frequency, always turn dial a little to each side of the frequency calibration mark to find the point where the signal is strongest. This procedure is to be followed when receiver selector switch is set on "MANUAL."

(c) To receive tactical frequencies, turn "HI-LO" selector switch to "HI." Adjust tuning dial knob for desired frequency, as calibrated on outer scale of tuning dial. The intermediate scale on tuning dial (0 to 100 scale) is used only in special instances when special frequency ranges are being used, and require installation of special coils by radio maintenance personnel. In this case, there will be found a metal "FREQUENCY IN KC" calibrated chart installed in cockpit near tuning dial.

Note

The "HI-LO" selector switch is connected to receiver by a spring cable and must be operated by "click-and-feel." Care must be taken to insure proper contact in either "HI" or "LO" position, since position of pointer does not accurately indicate setting.

(d) TO RECEIVE CODE:

1. Straight continuous-wave signals (CW) cannot be heard on this receiver as it is not equipped with a beat-frequency oscillator.

2. Tone (MCW) signals may be heard on this receiver by tuning in the same manner as for voice reception with radio-range filter selector switch set on "BOTH."

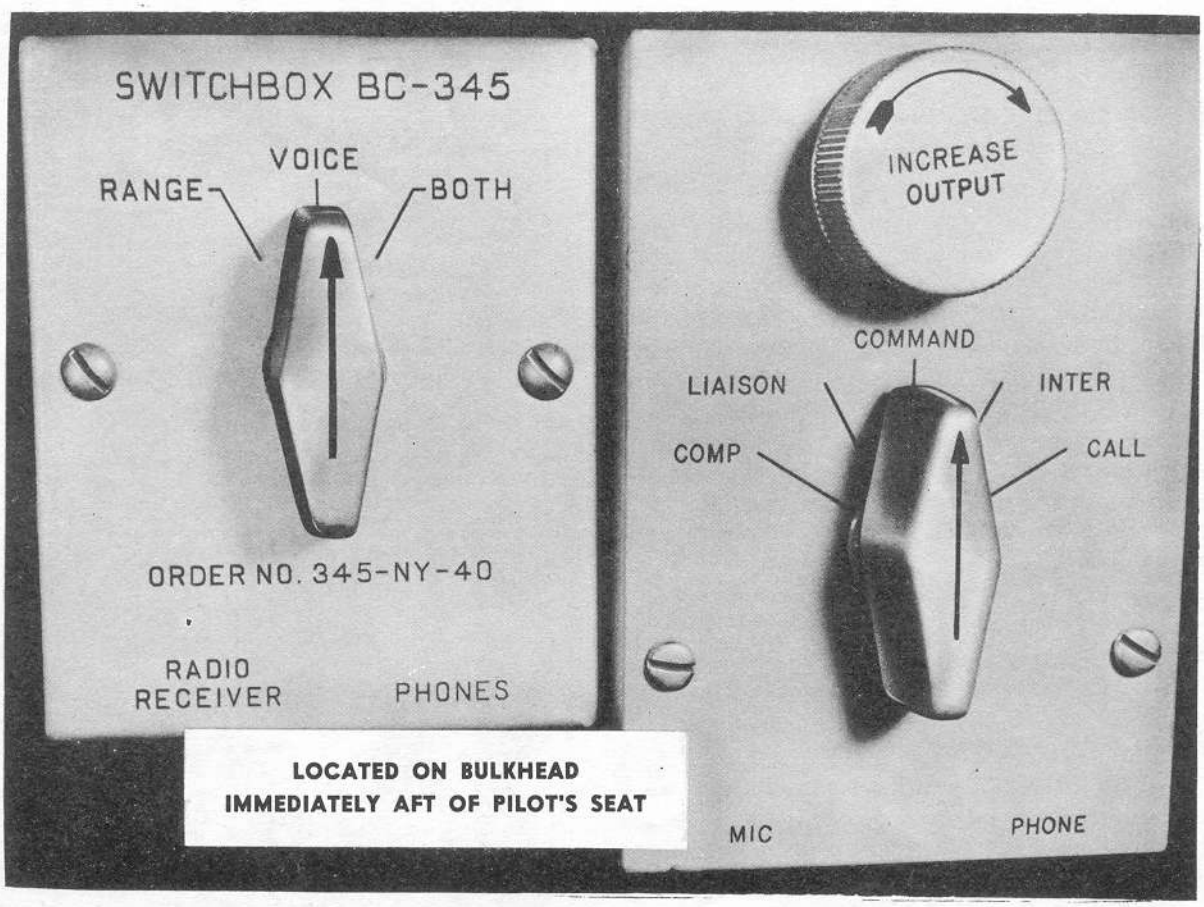


Figure 50—Pilot's Radio Switch Box and Jack Box

(e) Receiver (and transmitter) filaments may be turned off by placing control box selector switch in "OFF" position.

(2) TRANSMITTER.

(a) MICROPHONE INSTRUCTIONS.

1. HAND MICROPHONE. *(See figure 51.)*—Place microphone in either hand, holding mouthpiece upright and close to the mouth. By pressing the round black knob on upper side of microphone, voice will be transmitted.

2. THROAT MICROPHONE. *(See figure 52.)*—Place throat microphone around neck and adjust band so that its two circular elements are held snugly against each side of the throat just above the "Adam's apple."

(b) TRANSMITTING ETIQUETTE. – Before transmitting, adjust radio receiver to same frequency as that of station you desire and "listen in" to be sure the operator is not talking to someone else. If the station is transmitting, take advantage of the opportunity to more accurately set receiver on assigned frequency, and when other operator is through, proceed with transmission.

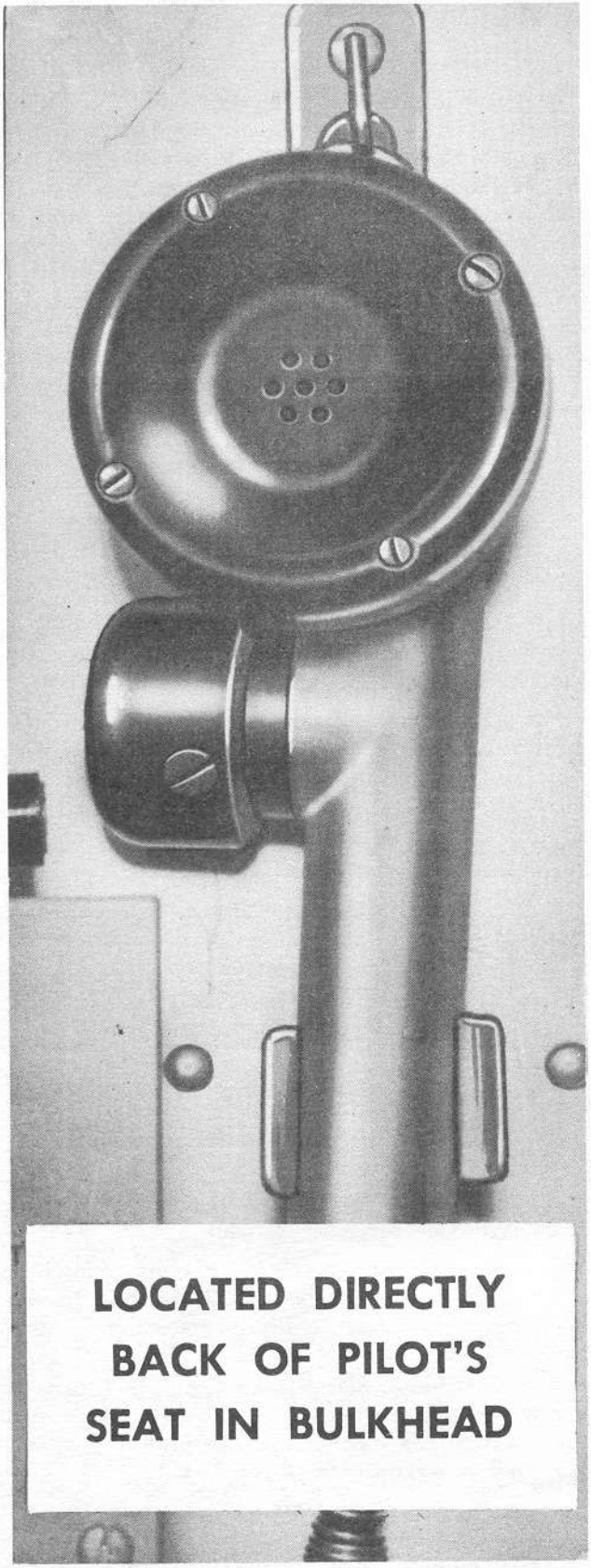


Figure 51—Radio Hand Microphone

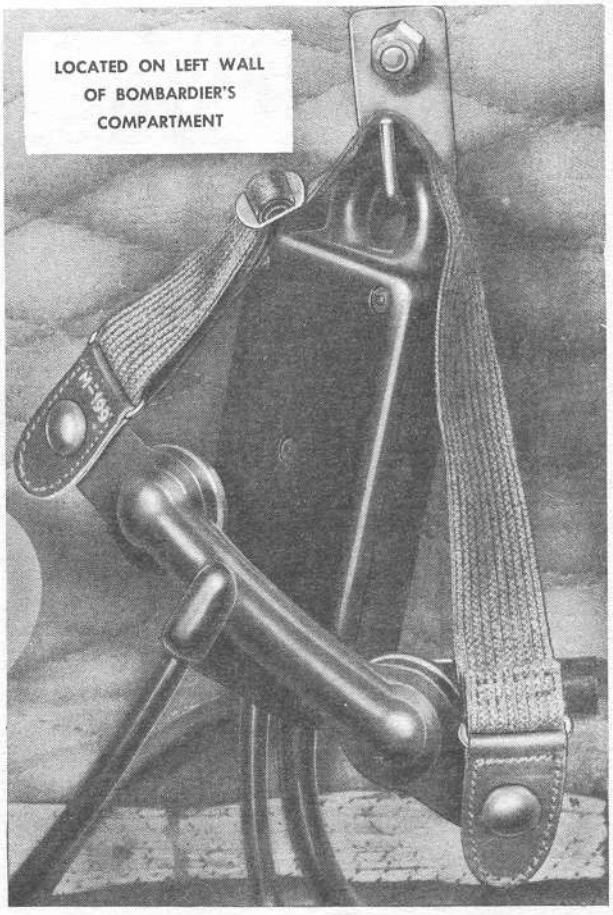


Figure 52—Radio Throat Microphone

(c) VOICE TRANSMISSION.

1. Set transmitter-emission selector switch to "VOICE."

2. When receiver control box selector switch is set on "AUTO" or "MANUAL," press microphone button and start talking. Speak slowly, distinctly, and in a normal tone of voice. Shouting will seriously distort the voice signal.

3. Release microphone button when through talking.

(d) CODE TRANSMISSION.

1. TONE (MCW.)—Set transmitter-emission selector switch to "TONE" and operate transmitter key.

2. CW.—Set transmitter-emission selector switch to "CW" and operate transmitter key.

Note

Any receiving station "standing by" a particular frequency expecting voice signals will hear any "TONE" (MCW) code transmissions. However, this station will not hear "CW" signals unless his receiver is equipped with a beat-frequency oscillator, and the oscillator is turned on.

(e) INTERPHONE JACK BOXES. *(See figure 50.)*—Each jack box has five selective positions which are marked on face of box as follows:

1. "COMP."—This position is not used.

2. "LIAISON."—This position is not used.

3. "COMMAND."—In this position, if command transmitter is modulated, audio output of receiver may be heard.

Figure 53—Radio HI-LO Switch

4. "INTER."—In this position, operator may communicate with any other crew member having his jack box switch at "INTER" position.

5. "CALL."—This is an emergency position which enables operator to call any members of the crew, regardless of the position on their jack box switch.

(3) MARKER BEACON.—Place the "ON-OFF" switch, located on the pilot's left fixed panel, to the "ON" position. This is the only adjustment necessary while the receiver is in use. The receiver will respond to any 75-megacycle signal which is horizontally polarized and modulated at an audio rate. The interval, during which the marker beacon lamp on the pilots' instrument panel will indicate, varies from a few seconds to as long as several minutes. This is due to the type of marker, altitude, and speed of the airplane.

c. OPERATION NOTES FOR PILOT.

(1) IF UNABLE TO RECEIVE:

(a) Ascertain that receiver selector switch is on "MANUAL" or "AUTO."

(b) Ascertain that "HI-LO" switch is in proper position and making good contact. Refer to "NOTE" under paragraph *b.*(1)*(c).* Test receiver operation on band known to be in use.

(c) Systematically check for secure connections in all cables and wires about radio controls, starting with head set and ending at receiver control box.

(d) Turn range filter switch pointer to all positions to be sure internal contact points are making good electrical connections.

(e) Turn volume control through its entire range to test for an intermittent short circuit or some isolated position where receiver is inoperative.

(2) IF UNABLE TO TRANSMIT:

(a) Ascertain that receiver (and transmitter) filament selector switch is set on "MANUAL" or "AUTO."

(b) Be sure transmitter-emission selector switch is not set between positions.

(c) Carefully inspect microphone for evidence of damage due to rough treatment.

(d) Systematically check for secure connections in all cables and wires about radio controls, starting with microphone and ending at transmitter control box.

(e) If transmitter does not "come on" for voice transmission when "press-to-talk" button is operated, hold transmitter key down: operate "press-to-talk" button if failure was on "TONE" or "CW."

Note

The key and "press-to-talk" button may be substituted for each other for any three positions of transmitter-emission control.

APPENDIX I

GLOSSARY OF NOMENCLATURE (U. S. A.-BRITISH)

U. S. A.	BRITISH
Air Filter	Air Cleaner
Airplane	Aeroplane
Airport, Airfield, or Airdrome	Aerodrome
Antenna	Aerial
Battery, storage	Storage battery or electrical accumulator
Bombardier	Bomb-aimer
Capacity, fuel or gasoline capacity	Fuel volume or petrol volume
Carburetor	Carburettor or carburetter
Ceiling	Cloud height
Command set	Pilot controller set
Control cables	Flying controls
Controllable propeller	Controllable-pitch airscrew
Copilot	Second pilot
Course	Track angle
Documents, classified	Protected papers
Drift	Drift angle
Fill or Inflate	Fill or Top Up
Flare, signal	Signal projectile or Signal Star
Flight or direction indicator	Gyroscopic turn indicator or directional gyro
Fuel (gasoline)	Petrol
Fuel gage	Fuel level indicator
Generator	Dynamo
Ground (electrical)	Earth or ground
Gross weight	All-up weight
Gyro horizon	Artificial Horizon
Gyro pilot	Automatic pilot
Indicated air speed (IAS)	Air-speed-indicator reading
Interphone	Intercommunication
Land	Alight
Landing field	Landing ground
Landing gear	Alighting gear or undercarriage
Lean (fuel mixture)	Weak
Left	Port
Level off	Flatten out
Line, mooring	Mooring guy
Manifold pressure	Boost pressure
Mast, radio	Rod aerial
Meter, drift	Drift sight
Muffler	Silencer
Navigation, air or aerial	Avigation
Outboard wing panel	Outer plane
Pressure, manifold	Boost pressure or boost
Prime	Prime or dope
Propeller	Airscrew
Radio	Wireless
Reticule (gun sight, etc.)	Graticule
	Reversal
Right	Starboard
Rings, mooring or mooring lugs	Picketing rings
Roll, snap	Flick roll
Set, command	Pilot controller set
Set, Liaison	General purpose set
Snap roll	Flick roll
Stabilizer, horizontal	Tail plane
Stabilizer, vertical	Fin
Take-off distance	Take-off run
Tachometer	Engine speed indicator
Turn indicator	Direction indicator
Valve (fuel or oil)	Cock
Wall, fire	Fireproof bulkhead
Weight, empty	Tare weight
Window, inspection	Inspection port
Windshield	Windscreen
Wing	Main Plane

APPENDIX II

FLIGHT OPERATING CHARTS, TABLES, CURVES, AND DIAGRAMS

1. FLIGHT PLANNING.

The following outline may be used as a guide to assist personnel in the use of the "FLIGHT OPERATION INSTRUCTION CHART" for flight planning purposes.

a. If the flight is to be continuous and desired cruising power and air speed are to be reasonably constant after take-off and climb to 9000, the fuel required and the flight time may be computed as a "single-section flight."

(1) Within limits of the airplane, fuel required, and flying time for a given mission depend largely upon speed desired. With all other factors remaining equal, speed is obtained at a sacrifice of range and range is obtained at a sacrifice of speed. Speed is usually determined after considering urgency of the flight plotted against range desired.

(2) On the "Flight Operation Instruction Chart," locate the largest figure entered under "gph" (gallons per hour) in column I on lower half of chart. It is noted that this figure is "86." This is the maximum amount of fuel consumed per hour when operating under MAXIMUM CONTINUOUS POWER and is the maximum fuel consumption for any other condition given on the chart. Use this number to determine the necessary amount of fuel for a desired reserve flying time.

For example: If a half-hour reserve flying time is desired, 43 gallons of fuel should be allotted as reserve fuel. Add to this the 22 gallons necessary for warm-up, take-off, initial climb, etc. (See footnote on chart.) Subtract the total from the amount of fuel in the airplane prior to starting engines.

The figure obtained from this computation will represent amount of fuel available and applicable for flight-planning purpose on the "RANGE IN AIR-MILES" section of the "Flight Operation Instruction Chart."

For example: If 43 gallons are allowed for reserve, 22 gallons are allowed for warm-up, take-off, climb, etc., and 195 gallons are in the airplane prior to starting engines, there is a total of 130 gallons of fuel available for actual flight-planning purposes.

(3) Select a figure in the fuel column equal to, or the next entry less than, the available amount of fuel in the airplane, as determined in paragraph (2) above. Continuing with the example given above, it is noted that "120 gallons" is the next entry less than the 130 gallons of fuel available for flight. Move horizontally to the right or left and select a figure equal to, or the next entry greater than, the air-miles (with no wind) to be flown. Operating values, contained in the numbered column in which this figure appears, represent "highest cruising speed possible at range desired."

If 445 statute miles is the range, by moving to the right from figure "120" in the fuel column, it is seen that "454" is the entry just greater than the 445 miles to be flown. This figure appears in column IV.

By operating the airplane in accordance with "OPERATING DATA" in column IV, the airplane will arrive at its destination in quickest possible time with amount of fuel available.

By operating in accordance with "OPERATING DATA" in column I, II, or III, it is seen that the 445 mile range could not be covered.

By operating in accordance with "OPERATING DATA" in column V, the flight may be made at a sacrifice of speed but an increase in fuel economy.

(4) Using the same column number, selected by application of instructions contained in the last paragraph, determine the IAS and gallons per hour listed at sea level in lower section of the chart under the subtitle "OPERATING DATA." Divide this IAS into the air-miles to be flown and obtain the calculated flight duration in minutes, which can then be converted into hours and minutes and deducted from the desired arrival time at destination, in order to obtain the take-off time (without consideration for wind). To allow for wind, calculate a new corrected ground speed with the aid of the flight calculator, or by a navigator's triangle of velocities.

(5) The airplane and engine operating values listed below "OPERATING DATA" in any single-numbered column are calculated to give constant miles per gallon at any altitude listed. Therefore, the airplane may be operated at any altitude and at any corresponding set of values so long as they are in the same column listing the range desired.

AIRCRAFT MODEL(S)
AT-11 AND SNB-1

ENGINE(S): P&W R-985-AN-1 OR -3

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 9300 TO 8727 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 2

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS, SEE SPECIFIC ENGINE FLIGHT CHART.
TAKE-OFF	2300	37	-	FULL RICH	5	260°C	98	

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 GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).(1) TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STATUTE		NAUTICAL		FUEL U.S. GAL.	COLUMN II (2) RANGE IN AIRMILES STATUTE	NAUTICAL	COLUMN III (2) RANGE IN AIRMILES STATUTE	NAUTICAL	COLUMN IV (2) RANGE IN AIRMILES STATUTE	NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	NAUTICAL
S.L.	10,000	S.L.	10,000	206	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)						206		
401	599	348	520	184	654	568	670	582	696	604	184	745	647
327	489	284	425	150	534	464	547	475	567	492	150	608	528
294	440	255	382	135	480	417	492	427	510	443	135	547	475
261	391	227	340	120	427	371	437	379	454	394	120	486	422
229	342	199	297	105	374	325	383	333	397	345	105	426	370
196	293	170	254	90	320	278	329	287	340	295	90	365	317
164	245	142	213	75	266	231	274	238	284	247	75	304	264
131	195	114	169	60	213	185	219	190	227	197	60	243	211
98	147	85	128	45	160	139	164	142	170	148	45	183	159
66	98	57	85	30	107	93	110	96	113	98	30	122	106
32	49	28	43	15	53	46	54	47	57	49	15	61	53

MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
2200	F.T.	.10	51	193	168	15000	2000	22	.08	50	182	158	1800	21	.08	44	164	142							15000						
2200	F.T.	.10	57	206	179	10000	2000	26.3	.08	49	196	170	1800	25.3	.08	44	180	156	1700	24	.08	40	164	142	10000						
2200	F.T.	.10	78	214	186	5000	2000	28.5	.08	49	192	167	1800	28	.08	43	180	156	1700	26	.08	37	159	138	5000	1700	24.5	.08	33	150	130
2200	33.5	.10	86	208	181	S.L.	2000	28.5	.08	44	174	151	1800	29.5	.08	41	169	147	1700	28.5	.08	37	158	137	S.L.	1700	25.5	.08	31	140	122

(1) ALLOW 22 GAL. FOR WARM-UP, TAKE-OFF AND INITIAL CLIMB PLUS ALLOWANCE FOR WIND AND RESERVE AS REQUIRED.

(2) RANGE VALUES DO NOT APPLY AT 15,000 FEET.

EXAMPLE

AT 9300 LB. GROSS WEIGHT WITH 184 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 22 GAL.) TO FLY 670 STAT. AIRMILES AT 5000 FT. ALTITUDE MAINTAIN 1800 RPM AND 28 IN. MANIFOLD PRESSURE WITH MIXTURE SET: .08

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AN-H-8 Dec. 18, 1942 FORM ASC-510

AIRPLANE MODELS
AT-11
SNB-1

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS
P. & W. R985 AN-1
P. & W. R985 AN-3

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
9300	0	0	1337	2215	1535	2522	1850	3014	1378	2255	1581	2568	1907	3070	1479	2356	1697	2684	2047	3211
	17	15	912	1603	1048	1848	1263	1848	940	1631	1079	1879	1301	2286	1008	1700	1158	1958	1396	2382
	34	30	661	1166	7579	1372	914	1705	681	1186	781	1395	942	1733	730	1235	838	1452	1012	1803
	51	45	501	820	576	1004	695	1300	516	835	593	1021	715	1320	554	873	637	1065	767	1372
8727	0	0	999	1611	1148	1835	1383	2194	1024	1635	1175	1863	1417	2228	1081	1693	1241	1929	1496	2307
	17	15	674	1152	774	1328	933	1610	690	1168	1022	1577	956	1632	729	1207	837	1392	1009	1686
	34	30	484	829	557	977	670	1214	497	842	570	991	687	1231	524	869	603	1024	726	1270
	51	45	365	576	419	706	505	915	374	585	429	716	516	927	394	606	453	741	546	957
7850	0	0	761	1191	874	1357	1053	1624	785	1216	902	1385	1087	1657	830	1260	953	1436	1149	1719
	17	15	519	850	578	963	697	1168	536	867	597	981	720	1191	566	897	631	1015	760	1232
	34	30	376	608	411	696	495	867	388	620	423	708	511	883	411	643	447	733	539	912
	51	45	285	419	306	492	368	642	294	428	315	501	381	654	312	445	334	520	401	675

NOTE: INCREASE DISTANCE 10 % FOR EACH 10°C ABOVE 0°C (11 % FOR EACH 20°F ABOVE 32°F)

ENGINE LIMITS FOR TAKE-OFF 2300 RPM & 37 IN. HG

CLIMB DATA

COMBAT MISSIONS USE 2200 RPM & 33.5 IN. HG

FERRY MISSIONS USE 2000 RPM & 28 IN. HG

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S. L. TO 3000 FT. ALT.				5000 FT. ALT.						10000 FT. ALT.						15000 FT. ALT.						FT. ALT.						BLOWER CHANGE
		BEST I.A.S.		FT/MIN	TIME FROM S. L.	BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		BEST I.A.S.		FT/MIN	TIME FROM S. L.	FUEL FROM S.L.		
		MPH	KNOTS			MPH	KNOTS			U. S.	IMP.	MPH	KNOTS			U. S.	IMP.	MPH	KNOTS			U.S.	IMP.	MPH	KNOTS			U.S.	IMP.	
9300	COMBAT	124	108	965	3.1	123	107	905	5.2	21.2	17.7	116	101	603	11.8	27.6	23.0	108	94	295	22.9	40.5	33.7							
	FERRY	119	103	340	8.6	118	102	376	14.1	20.3	16.9	111	96	367	26.7	31.1	25.9	103	89	118	45.5	45.3	37.7							
8727	COMBAT	120	104	1135	2.64	120	104	1070	4.4	20.1	16.7	112	97		10	26.4	22.0	104	90	425	18.8	34.2	28.5	96	83	100	41.3	52.2	43.5	
	FERRY	115	100	415	7.2	115	100	442	11.9	18.5	15.4	107	93	500	23.8	28.7	23.9	99	86	237	29.5	41.5	34.6							
7850	COMBAT	116	101	1510	1.9	116	101	1454	3.3	18.7	15.6	108	94	1028	7.3	23.2	19.3	104	90	652	13.3	28.5	23.7	100	87	286	24	37.2	31.0	
	FERRY	112	97	707	4.2	112	97	757	7.0	14.6	12.2	105	91	749	13.6	20.1	16.7	98	85	442	23	26.9	22.4	95	83	91	40.8	43.2	36.0	

NOTE: INCREASED ELAPSED CLIMBING TIME 10 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (11 % FOR EACH 20°F ABOVE 32°F) FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT IN LBS.	BEST I. A. S. APPROACH		HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
			AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
	MPH	KNOTS	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL
8727	110	96	1590	1040	1710	1140	1850	1250	1680	1130	1810	1240	1950	1360	2960	2420	3210	2650	3490	2900
8000	100	87	1480	950	1590	1050	1730	1150	1580	1050	1700	1150	1850	1260	2710	2190	2940	2390	3200	2620

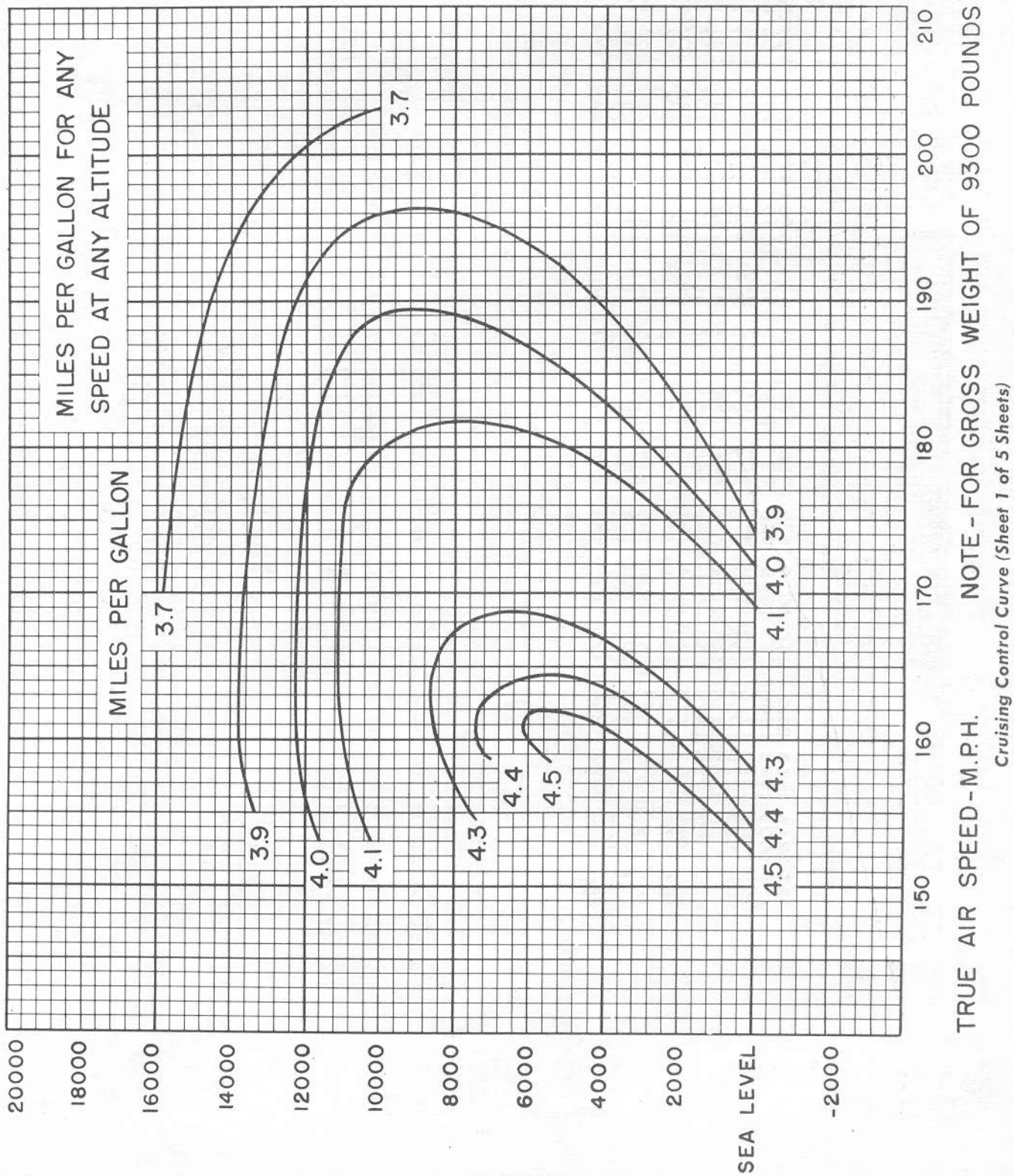
NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

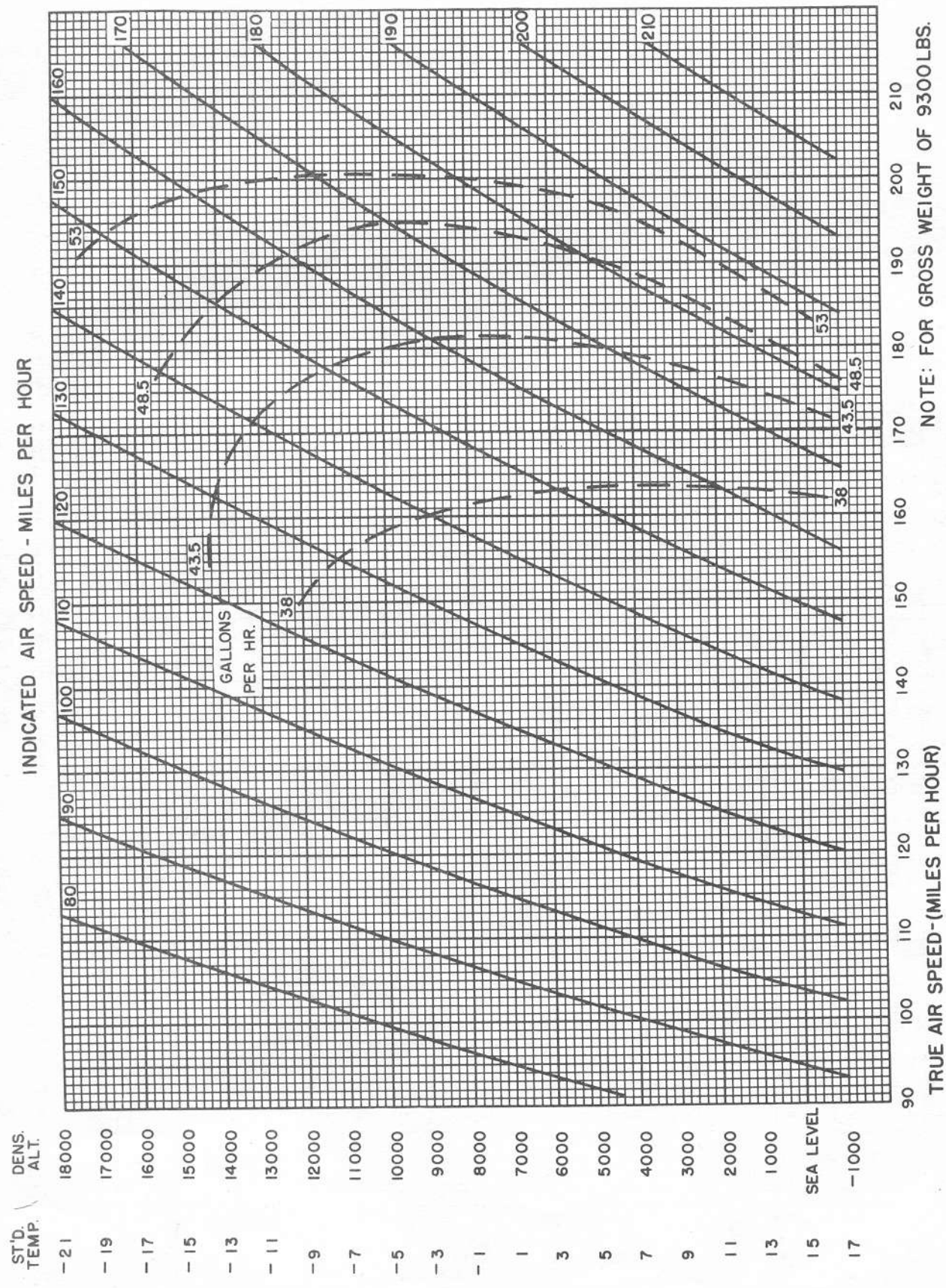
REMARKS

LEGEND
I.A.S.: Indicated Air Speed
M.P.H.: Miles Per Hour
S.L.: Sea Level
U.S.: U. S. Gallons
IMP.: Imperial Gallons
NOTE: All Distances are Average

APPENDIX IIN

"FOR NAVY USE ONLY"





Cruising Control Curve (Sheet 2 of 5 Sheets)

WEIGHT CORRECTION TABLE

THIS TABLE SHOWS THE VARIATION OF AIRSPEED WITH WEIGHT AT A CONSTANT POWER AND ALTITUDE.

AT 5000 FEET

WEIGHT	INDICATED AIR SPEED						
7200	136	146	155	164	172	182	191
7850	130	140	150	160	170	180	190
8727	120	131	143	155	166	177	187
9300	—	124	139	152	163	175	185

AT 5000 FEET

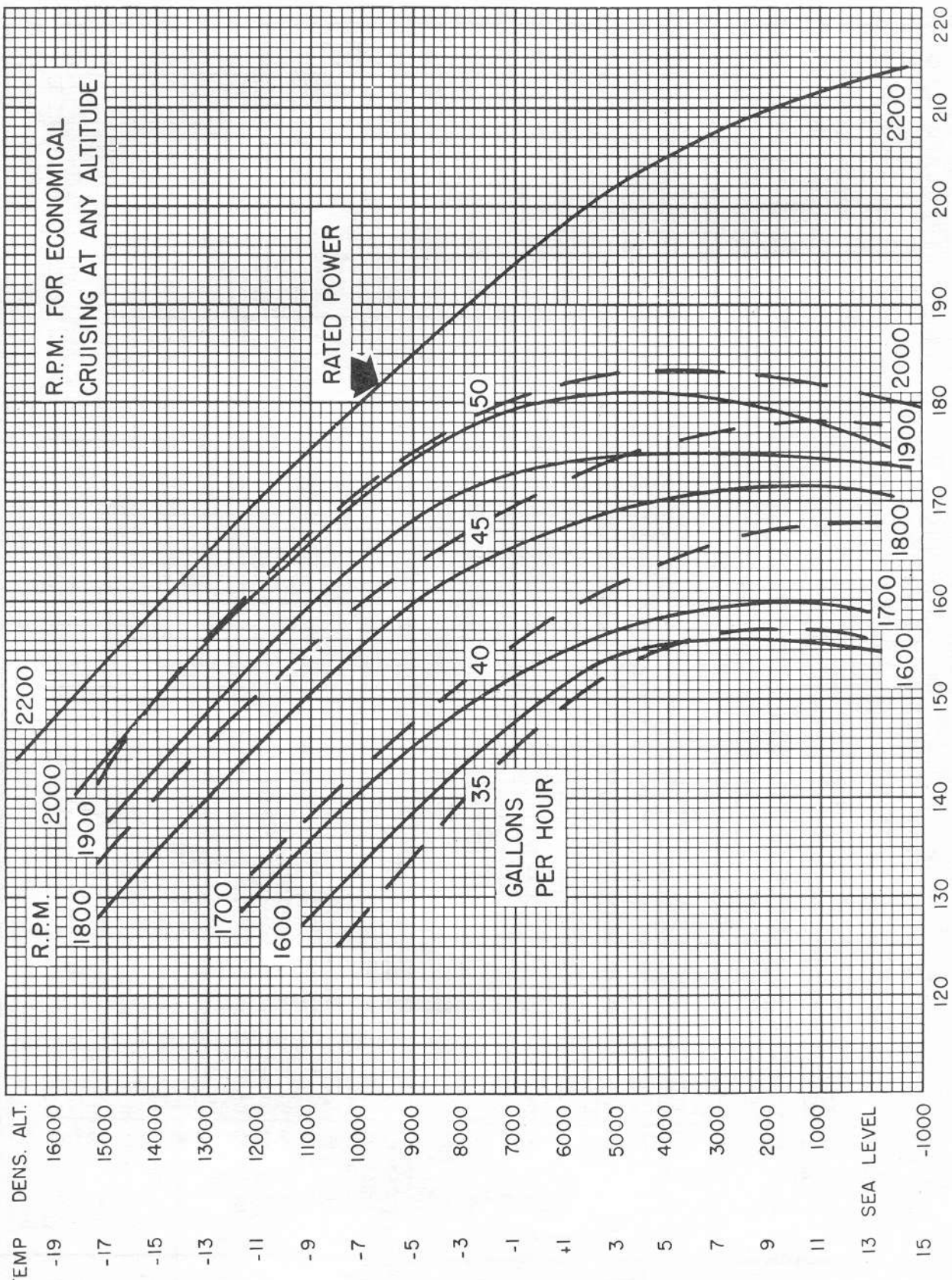
WEIGHT	I.A.S. FOR MAX. RANGE	I.A.S FOR MAX. ENDURANCE
7200	139	90
7850	136	93
8727	136	96
9300	139	100

NOTE: FOR MAXIMUM RANGE USE 1700 R.P.M.
FOR MAXIMUM ENDURANCE USE 1600 R.P.M.

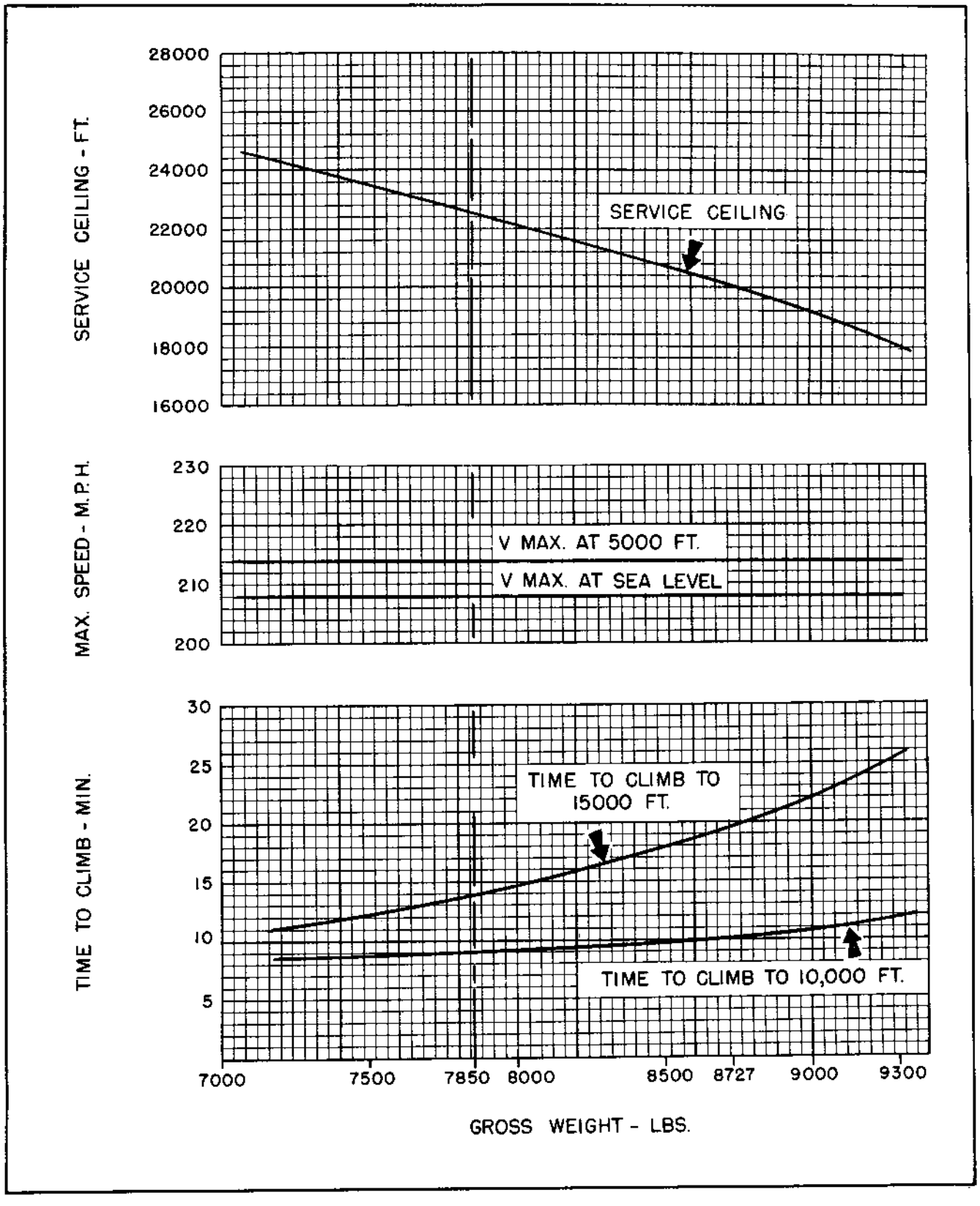
Cruising Control Curve (Sheet 3 of 5 Sheets)

INDICATED AIR SPEED	TRUE AIR SPEED			
	SEA LEVEL	5000'	10000'	15000'
80	85.5	92	99.5	108
90	94.5	102	110	119
100	103.5	111.5	120.5	130.5
110	112.5	121	131	142
120	121.5	131	141.5	153
130	131	141	152.5	165
140	140	151	163	176.5
150	149.5	161	174	188.5
160	158.5	171	184.5	200
170	168	181	195.5	212
180	177	190.5	206	223
190	186.5	201	217	
200	196	211	228	
210	205	221	238.5	

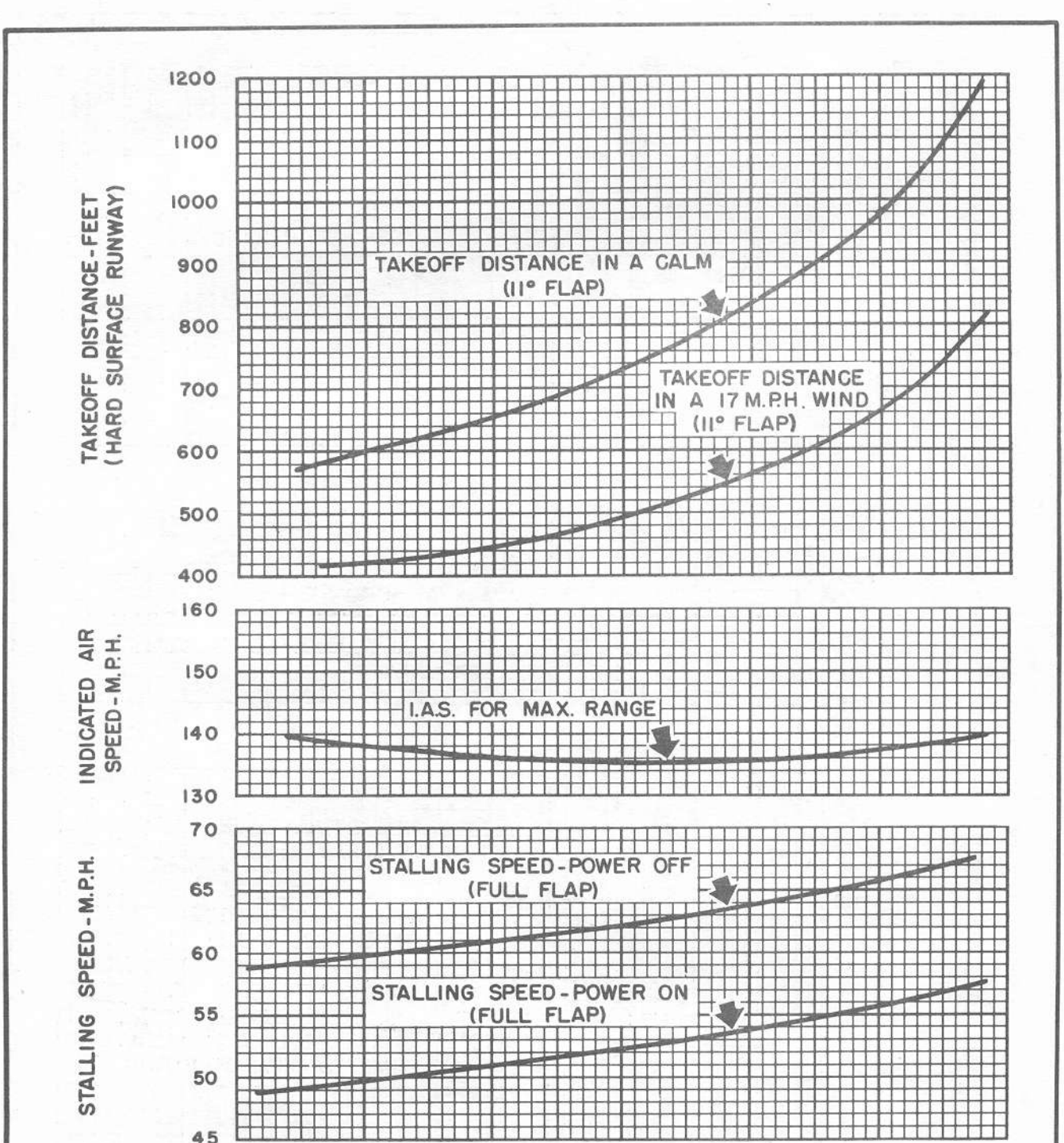
Cruising Control Curve (Sheet 4 of 5 Sheets)



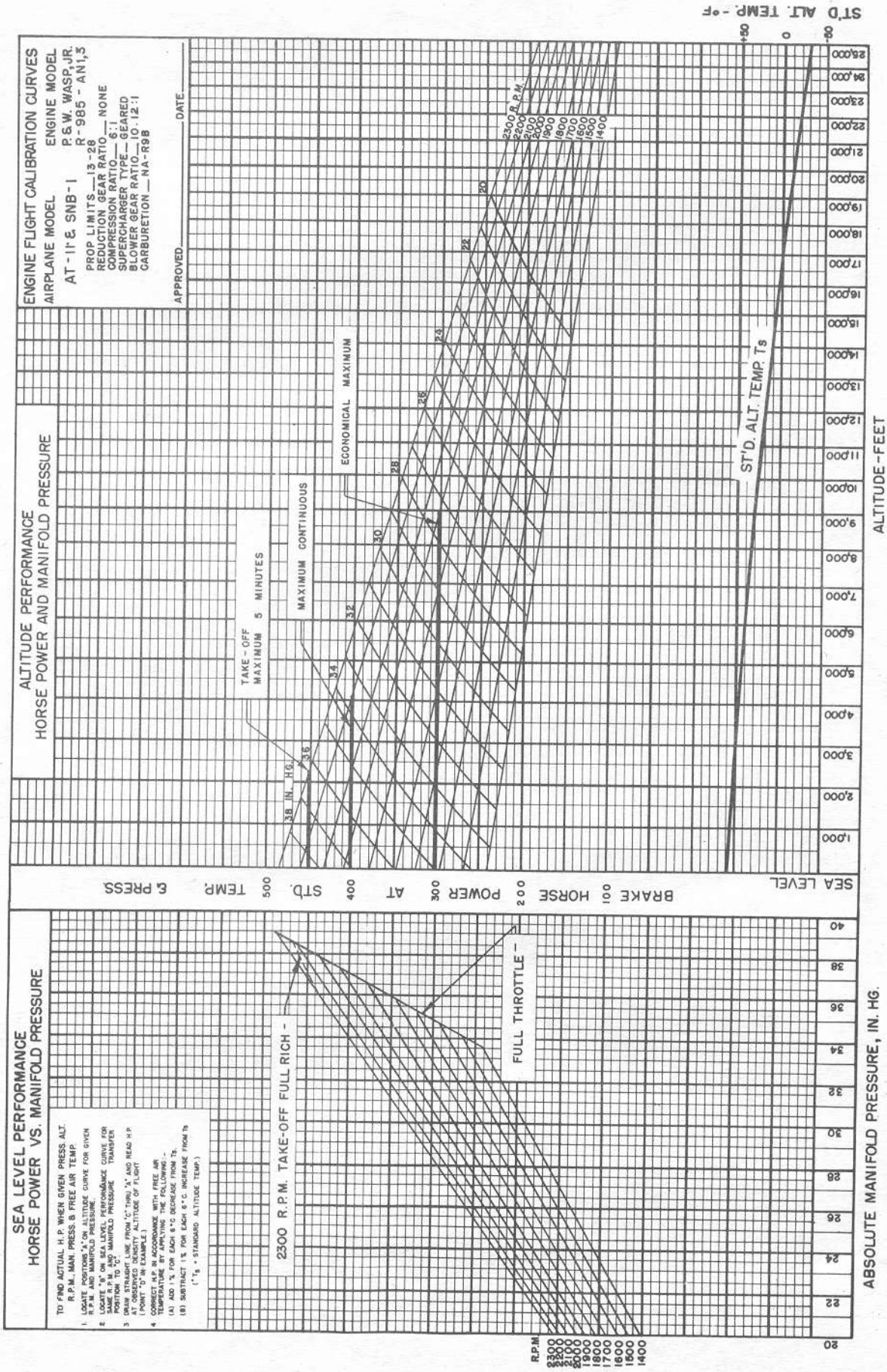
Cruising Control Curve (Sheet 5 of 5 Sheets)



Performance vs. Gross Weight Chart (Sheet 1 of 2 Sheets)



Performance vs. Gross Weight Chart (Sheet 2 of 2 Sheets)


ENGINE FLIGHT CALIBRATION CURVES
AIRPLANE MODEL AT-11 & SNB-1
ENGINE MODEL P. & W. WASP, JR. R-985 - AN1,3
PROP LIMITS 13-28
REDUCTION GEAR RATIO NONE
COMPRESSION RATIO 6:1
SUPERCHARGER TYPE GEARED
BLOWER GEAR RATIO 10.12:1
CARBURETION NA-R98
APPROVED
DATE
ALTITUDE PERFORMANCE
HORSE POWER AND MANIFOLD PRESSURE
TAKE-OFF MAXIMUM 5 MINUTES
MAXIMUM CONTINUOUS
ECONOMICAL MAXIMUM
38 IN. HG.
36
34
32
30
28
26
24
22
20
2300 R.P.M.
2200
2100
2000
1900
1800
1700
1600
1500
1400
ST'D. ALT. TEMP. Ts
SEA LEVEL
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
13,000
14,000
15,000
16,000
17,000
18,000
19,000
20,000
21,000
22,000
23,000
24,000
ALTITUDE-FEET
BRAKE HORSE POWER AT STD. TEMP. E. PRESS.
100
200
300
400
500
STD ALT. TEMP. -°F
-80
0
+80
SEA LEVEL PERFORMANCE
HORSE POWER VS. MANIFOLD PRESSURE
TO FIND ACTUAL H.P. WHEN GIVEN PRESS. ALT. R.P.M., MAN. PRESS. & FREE AIR TEMP.
1. LOCATE POSITION "A" ON ALTITUDE CURVE FOR GIVEN R.P.M. AND MANIFOLD PRESSURE.
2. LOCATE "B" ON SEA LEVEL PERFORMANCE CURVE FOR SAME R.P.M. AND MANIFOLD PRESSURE
3. DRAW STRAIGHT LINE FROM "C" THRU "A" AND READ H.P. AT OBSERVED DENSITY ALTITUDE OF FLIGHT (POINT "D" IN EXAMPLE.)
4. CORRECT H.P. IN ACCORDANCE WITH FREE AIR TEMPERATURE BY APPLYING THE FOLLOWING:-
(A) ADD 1% FOR EACH 6°C DECREASE FROM Ts
(B) SUBTRACT 1% FOR EACH 6°C INCREASE FROM Ts
(°Ts = STANDARD ALTITUDE TEMP.)
2300 R.P.M. TAKE-OFF FULL RICH -
FULL THROTTLE -
R.P.M
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
20
22
24
26
28
30
32
34
36
38
40
ABSOLUTE MANIFOLD PRESSURE, IN. HG.