RESTRICTED

NAVAER 01-85VF-1

Pilot's Handbook of Flight Operating Instructions

NAVY MODEL

JRF-5 Airplane

THIS PUBLICATION SUPERSEDES ALL PREVIOUS ISSUES OF NAVAER 01-85VF-1 AND NAVAER 01-85E-1

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FOREWORD

This Handbook is prepared for the purpose of familiarizing flying personnel with the take-off, flying, and landing characteristics of the model JRF-5 airplane; the functions of particular systems and installations, and the operation of the various automatic and manual controls.

For service and overhaul instructions, refer to the Erection and Maintenance Instructions Manual.

The JRF-5 is a twin engine, six place, dual control, cantilever monoplane amphibian. It is designed for utility, transport, and photographic use.

The engines are Pratt & Whitney Wasp Model R-985-AN6, nine cylinder, air cooled radial, each rated 450 hp. at 2,300 r. p. m., at sea level, for take-off, and 400 hp. at 2,200 r. p. m. from sea level to 5,000 feet.

The hull is an integral part of the body. The wing center section includes the engine nacelles and the two built-in fuel tanks. Each tank has a capacity of 110 gallons. Each engine has a single oil tank with a capacity of 7.5 gallons and 1.5 gallons foaming space.

The main wheels and tail wheel are retracted manually by the pilot and locked automatically in the UP and DOWN positions. The tail wheel assembly is of the self-aligning, full swivel type fitted with a controllable caster lock mechanism.

The split balanced type wing flaps are operated by vacuum. The control surfaces are statically and dynamically balanced. The airplane is equipped with an automatic pilot, wing and tail surface de-icing equipment and propeller anti-icing equipment.

Provision is made for the installation of radio equipment in the cabin. A camera hatch is built into the bottom of the hull with provisions for mounting the camera below the cabin floor.

Provision is made to carry one bomb or depth charge under each outer wing panel.

Six seats are installed, for pilot, copilot and four cabin seats; a special auxiliary seat is also installed in the cabin. The cabin is heated and ventilated. A chemical toilet, wash basin, drinking water tank, and propeller anti-icer fluid tank, are installed in the rear baggage compartment.

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COCKPIT ARRANGEMENT AND CONTROLS

The arrangement of the cockpit and the locations of the various controls are shown on the accompanying photographic illustrations. In general, the controls and their operation are indicated by adjacent name plates.

1. FLYING CONTROLS.

a. AILERON AND ELEVATOR CONTROLS.—Standard dual type column and wheel. The co-pilot's control wheel and shaft may be removed; however, in this case the fork end and universal block must also be removed to prevent fouling the stop on the control column.

b. ELEVATOR TRIMMING TAB CONTROLS.—Handcrank on right hand side of pilot's seat. (*See* Sec. II, par. 1, *a.*)

CLOCKWISE—NOSE DOWN.

c. RUDDER CONTROL.—Standard over-hung dual pedals. Pilot's pedals are adjustable to three positions, by toe levers on pedals. Co-pilot's pedals fold aft and into the floor when not in use. (*See* Sec. II, par. 1, *c.*)

d. RUDDER TRIMMING TAB CONTROL.—Handwheel on pilot's left hand shelf. (*See* Sec. II, par. 1, *b.*)

CLOCKWISE—NOSE RIGHT.

e. WING FLAP CONTROL.—The vacuum operated flaps are controlled by the three position control lever on the overhead instrument panel. (*See* Sec. II, par. 1, *d.*)

FLAPS-UP, 30° DOWN AND 60° DOWN.

CAUTION

Do not lower flaps when cabin door is open.

f. AUTOMATIC PILOT.—T handle control on center of main instrument panel above the gyro-pilot panel.

PUSH—OFF.
PULL—ON.

Directional Gyro control unit panel consists of a gyro indicator, a caging knob and a rudder knob.

Bank and Climb gyro control unit panel consists of a bank, climb and glide indicator, a caging knob, a level flight knob, aileron and elevator knob and a vacuum gage.

Three speed valves and an oil pressure gage are on a separate panel directly below the two control panels.

Control Valve on left hand side of the main instrument panel shuts off flow of hydraulic oil to gyro-pilot.

CONTROL VALVE DOWN—OFF.
CONTROL VALVE UP—ON.

Wobble pump, on left hand side of pilot's compartment, is used to return accumulated oil, (which leaks by the gyro oil valves into the drain tank) back to the oil sump. Pump oil back to oil sump when sigh gage on drain tank indicates half full.

2. LANDING GEAR CONTROLS.

a. RETRACTING CONTROL.—Handcrank between pilot's and co-pilot's seat. Clockwise rotation lowers both main wheels and tail wheel—approximately 41 turns.

Main ratchet release controlled by the small lever to the left of the handcrank. Move ratchet lever UP to raise wheels and DOWN to lower.

IMPORTANT

Keep handle ratchet within the handle in the center position to lower or raise the wheels under normal circumstances. (*See* Sec. II, par. 2, *a.*)

b. WARNING INDICATORS.—Red jeweled warning light, with hinged night flap, on pilot's instrument panel, illuminates when the wheels are not fully extended and locked and either engine is throttled below 1,200 r. p. m.

c. TAIL WHEEL LOCK CONTROL.—Control lever on left hand side of pilot's instrument panel. When in the LOCKED position, the tail wheel caster is locked in the trailing position; and when UNLOCKED, the wheel can swivel through a radius of 360°.

Lock for take-off and landing and unlock for taxiing.

3. POWER PLANT CONTROLS.

a. CARBURETOR AIR CONTROLS.—Dual control levers on overhead instrument panel.

PUSH FORWARD—COLD AIR.
PULL AFT—HOT AIR.

Carburetor air temperature gages on overhead instrument panel.

b. ENGINE PRIMER.—Prime engine by pumping throttle levers with mixture control in IDLE CUT-OFF position, red sector.

c. FUEL TANK SELECTOR VALVE.—Standard dial and handle located on bulkhead behind co-pilot.

d. PUMP CROSS-FEED VALVE.—On upper center of bulkhead behind pilot. OFF for starting and check-

ing fuel pumps and ON for take-off, flying and landing. (*See* Sec. II, par. 3, *q*.)

e. ENGINE FUEL CUT-OFF VALVES.—On the bulkhead behind the pilot. These valves shut-off the fuel supply to their respective engines.

f. FIRE EXTINGUISHER CONTROL (CO_2).—Controls located on the right hand side of the main instrument panel. Set the selector valve to desired engine then pull the release handle to discharge the CO_2 into the engine compartment. The CO_2 cylinder is equipped with an outboard discharge fitting on the right hand side of the hull. If the red disc is missing, the cylinder has been discharged and must be replaced with a fully charged cylinder.

Note

In warm climates, the red disc often shrinks; and is liable to fall out even though the cylinder is still fully charged.

g. IGNITION SWITCHES.—Two switches and emergency switch knob located on overhead instrument panel. The emergency switch knob must be ON [full up position] for operating the engines.

h. PROPELLER CONTROLS.—Dual control levers on overhead instrument panel.

LOW PITCH forward and down to increase engine revolutions; HIGH PITCH up and aft to decrease engine revolutions.

Knurled knob at the left hand side of the propeller control levers adjusts the friction.

i. THROTTLE AND MIXTURE CONTROLS.—Dual unit engine control quadrant on upper instrument panel (*See* Sec. II, par. 3, *b*).

THROTTLE FORWARD—OPEN.
THROTTLE AFT—CLOSED.
Mixture: AFT—IDLE CUT-OFF.
CENTER AFT—FULL RICH.
CENTER FORWARD—AUTO RICH.
FORWARD—AUTO LEAN.

j. THROTTLE AND MIXTURE FRICTION ADJUSTMENT.—Knurled knob, on side of control quadrant, adjusts friction on levers.

k. STARTER CONTROLS.—Push buttons on upper instrument panel.

PUSH TO START ENGINE.

l. PROPELLER ANTI-ICER CONTROL.—The propeller anti-icing system consists of a 3-gallon fluid supply tank, feed lines, an electrically driven pump and a slinger ring located on the aft side of each propeller The rheostat control for the pump's motor is located on the right-hand side of the main instrument panel.

4. AUXILIARY CONTROLS.

a. BRAKE PEDAL CONTROLS.—The hydraulic brakes are operated by pressing on the upper part of the pilot's rudder pedals. The parking brake lock arms are located forward of the pilot's pedals. Pull lock arms aft and hook over the top of the pedals to lock brakes for parking. For brake pedal adjustment (*See* Sec. II, par. 1, *c*.)

b. HEATING AND VENTILATING.—The heating and ventilating system includes cold air inlet ports in the leading edge of the wing and on exhaust manifold heat collector tube in each engine nacelle. The mixing valves, for controlling the temperature of the incoming air, are located above the pilot's left-hand side window. The distributing valves are located at the upper rear section of the pilot's compartment.

Air of the proper temperature enters near the pilot's feet and also through a register in the passenger cabin. Air is exhausted through a fitting in the rear baggage compartment.

To control the cabin air move the distributing valves in or out. To control cockpit air turn the distributing valves to the right or left.

c. ELECTRICAL CONTROLS.

(1) SWITCH PANEL—MAIN INSTRUMENT PANEL.

Position lights switch.
Anchor light switch.
Pitot tube heater switch.
Receptacle.
Tail light switch.
Instrument panel light rheostat.
Landing light switch.
Radio light rheostat.

(2) OVERHEAD INSTRUMENT PANEL.—Instrument panel light's rheostat.

(3) RECOGNITION LIGHTS SWITCHES.—Located on switch box under pilot's left-hand cabin wall. Contains the following:

Recognition lights switches (4).
Recognition lights keying switch.

(4) CABIN.—Camera signal light switch on the left-hand side of the cabin wall. Signal light on main instrument panel.

(5) DOME LIGHTS.—Two in cabin—switches on left hand side of the cabin and on forward bulkhead. One in baggage compartment—switch on aft wall. One in the bow compartment—switch on aft wall.

(6) DISTRIBUTION BOX.—Located on bulkhead behind co-pilot, contains the following:

Two battery switches.
Generator switch.
Generator circuit breaker.
Volt-ammeter.
Spare fuses and bulbs.
Auxiliary switch.

Note

The auxiliary switch must be ON in order for current to be supplied to the pitot heater and electrically operated instruments.

A battery is installed in each engine compartment and a generator on the right engine.

d. STATIC PRESSURE SELECTOR VALVE.—Selector valve located on the main instrument panel. Valve control handle UP—connected to airspeed tube; Valve control handle DOWN—connected to pilot's compartment atmosphere vent.

e. DE-ICER CONTROL VALVE.—ON—OFF valve located on the bulkhead behind the co-pilot. An outside air temperature gage is provided on the overhead instrument panel.

The wing and tail surfaces de-icer system functions automatically once the valve is turned ON. An integral switch starts the electric motor which in turn rotates the valve, alternately distributing air pressure and suction to the overshoes on the wing and tail surfaces leading edges.

f. VACUUM PUMP SELECTOR VALVE.—Selector valve control located on pilot's compartment rear bulkhead.

LEVER UP—LEFT ENGINE.
LEVER DOWN—RIGHT ENGINE.

g. HATCHES, DOORS, AND EMERGENCY EXIT.—Water-tight doors are installed between bow compartment and pilot's compartment, pilot's and cabin, and cabin and baggage compartment. A lock is provided at the bottom of the door to anchor compartment and baggage compartment. The main cabin door and the emergency exit door at the rear of the cabin are released for emergency exit by pulling the red painted tubular handle on the cabin ceiling adjacent to each door. The bow compartment is equipped with double outwardly hinged water-tight doors.

h. SEAT TILTING LEVER.—A lever, on the inboard side of each of the four passenger seats, controls the movement of the seat back to a reclining position.

5. USEFUL LOAD CONTROLS.

a. CHARTBOARD.—A chartboard is installed under the main instrument panel.

b. BILGE PUMP.—Stowed in the bow compartment.

c. ANCHOR AND ROPE.—A Northill 12 pound folding anchor and 150 feet of anchor rope are stowed in the bow compartment.

d. LIFE RAFTS.—A type D Mark IV life raft is strapped to the floor on the right hand side of the rear baggage compartment. A second life raft is strapped on left hand side of the bow compartment.

e. BOARDING LADDER.—Stowed in the rear baggage compartment.

f. FIRE EXTINGUISHER—PORTABLE.—A portable CO_2 (2-pound charge) hand fire extinguisher is located on the cabin floor aft of the rear left-hand seat.

g. CAMERA EQUIPMENT.—Camera switch with jewel signal light is located on the left hand side of the cabin. A jewel signal light is also located on the main instrument panel. A receptacle for main camera is located in the camera well and for the oblique camera on the aft cabin bulkhead. Camera hatch opening plug is stowed below the aft right hand cabin window. View finder opening plug is stowed on the camera hatch rear bulkhead. A spare camera magazine and lens container is located below the right hand cabin door.

h. PYROTECHNICS.

(1) PISTOL AND AMMUNITION.—A signal pistol is mounted above the pilot's seat and may be fired through the cockpit dome. The opening is covered by a hinged door operated by a lever which latches in the open and closed positions. 12 rounds of signal pistol ammunition may be carried in belts (3 rounds on 1 belt, 9 rounds on the other) located adjacent to the pistol in the pilot's compartment.

(2) FLOAT LIGHTS.—Provision is made to carry eight night drift signals (float lights); four on the left-hand side of the bow compartment and four in the pilot's cockpit adjacent to the co-pilot's feet.

(3) SMOKE GRENADES.—Two smoke grenades are stowed adjacent to the co-pilot's seat.

(4) PARACHUTE FLARES.—Two parachute flare containers are installed on left- and right-hand side of the rear baggage compartment. The two release handles are located at the rear of the overhead instrument panel. PULL TO RELEASE.

i. FIRST-AID KIT.—One 10-unit first-aid kit is located under the auxiliary seat in the forward left-hand corner of the cabin.

j. BOMB CONTROLS.—The bomb arming-release control is mounted above the left-hand seat in the pilot's compartment.

(1) ARM-SAFE LEVER.

FORWARD—ARMED.
AFT—SAFE.

(2) RELEASE LEVER.

FORWARD—LOCK.
AFT—RELEASE.
SELECTIVE RIGHT—RIGHT BOMB.
SELECTIVE LEFT—LEFT BOMB.
CENTER—SALVO.

1 - TAIL WHEEL CASTER LOCK
2 - GYRO PILOT OIL SHUT-OFF VALVE
3 - DE-ICER PRESSURE GAGE
4 - ALTIMETER
5 - AIRSPEED INDICATOR
6 - TURN & BANK INDICATOR
7 - RATE OF CLIMB INDICATOR
8 - DIRECTIONAL GYRO
9 - ELAPSED TIME CLOCK
10 - GYRO PILOT CONTROL
11 - GYRO HORIZON
12 - LANDING GEAR WARNING LIGHT
13 - CAMERA SIGNAL LIGHT
14 - I.F.F. WARNING LIGHT
15 - GYRO PILOT VACUUM GAGE
16 - FIRE EXTINGUISHER CONTROLS
17 - ANTI-ICER CONTROL
18 - ELECTRICAL SWITCH PANEL
19 - GYRO PILOT OIL PRESSURE GAGE
20 - GYRO PILOT SERVO UNIT CONTROLS
21 - CHART BOARD
22 - I.F.F. KEY
23 - STATIC PRESSURE SELECTOR VALVE
24 - COMPASS

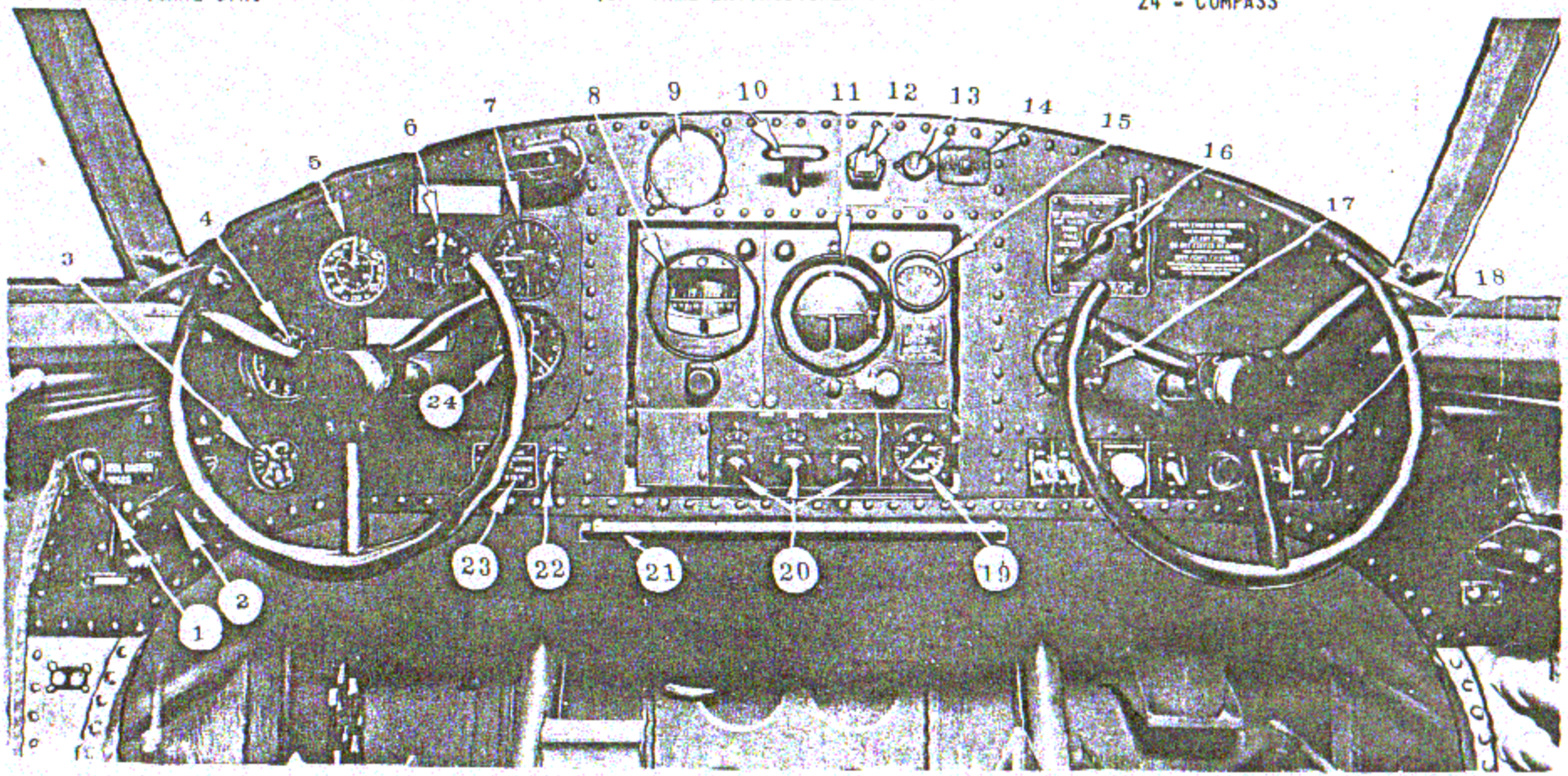
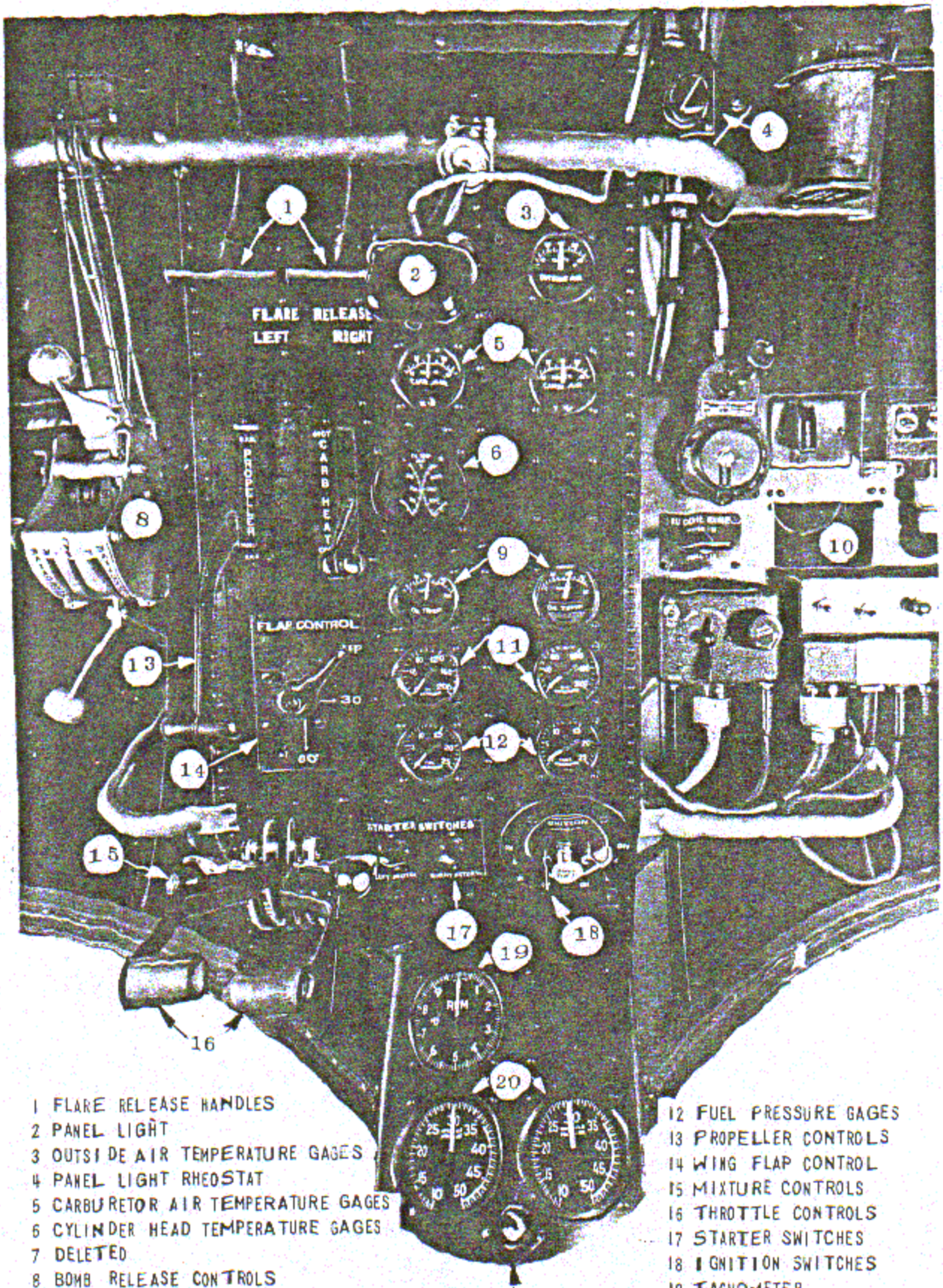


Figure 1—Main Instrument Panel



1 FLARE RELEASE HANDLES
2 PANEL LIGHT
3 OUTSIDE AIR TEMPERATURE GAGES
4 PANEL LIGHT RHEOSTAT
5 CARBURETOR AIR TEMPERATURE GAGES
6 CYLINDER HEAD TEMPERATURE GAGES
7 DELETED
8 BOMB RELEASE CONTROLS
9 OIL TEMPERATURE GAGES
10 RADIO CONTROL PANEL
11 OIL PRESSURE GAGES
12 FUEL PRESSURE GAGES
13 PROPELLER CONTROLS
14 WING FLAP CONTROL
15 MIXTURE CONTROLS
16 THROTTLE CONTROLS
17 STARTER SWITCHES
18 IGNITION SWITCHES
19 TACHOMETER
20 MANIFOLD PRESSURE GAGES
21 PANEL LIGHT

Figure 2—Overhead Instrument Panel

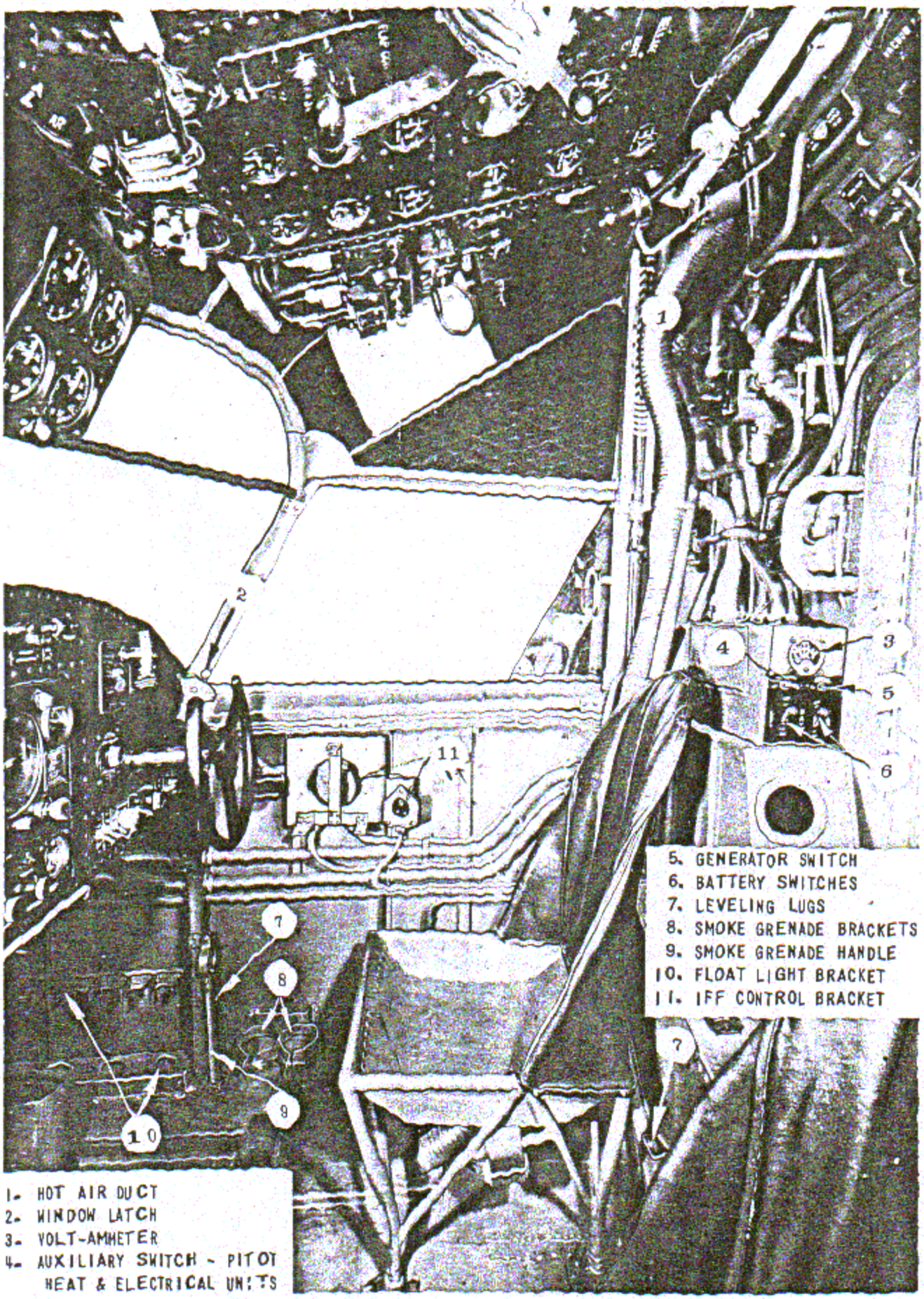


Figure 3—Pilot's Compartment—Right-hand Side

1. LANDING GEAR INSPECTION WINDOW
2. FUEL TANK SUMP DRAIN VALVE
3. SIGNAL PISTOL INSTALLATION
4. PISTOL AMMUNITION CONTAINERS
5. RECOGNITION LIGHTS CONTROL SWITCH
6. FILE BOX
7. RUDDER TAB CONTROL
8. GYRO PILOT HAND PUMP
9. GYRO PILOT DRAIN TANK & GAGE
10. HOT AIR DUCT
11. ELEVATOR TAB CONTROL

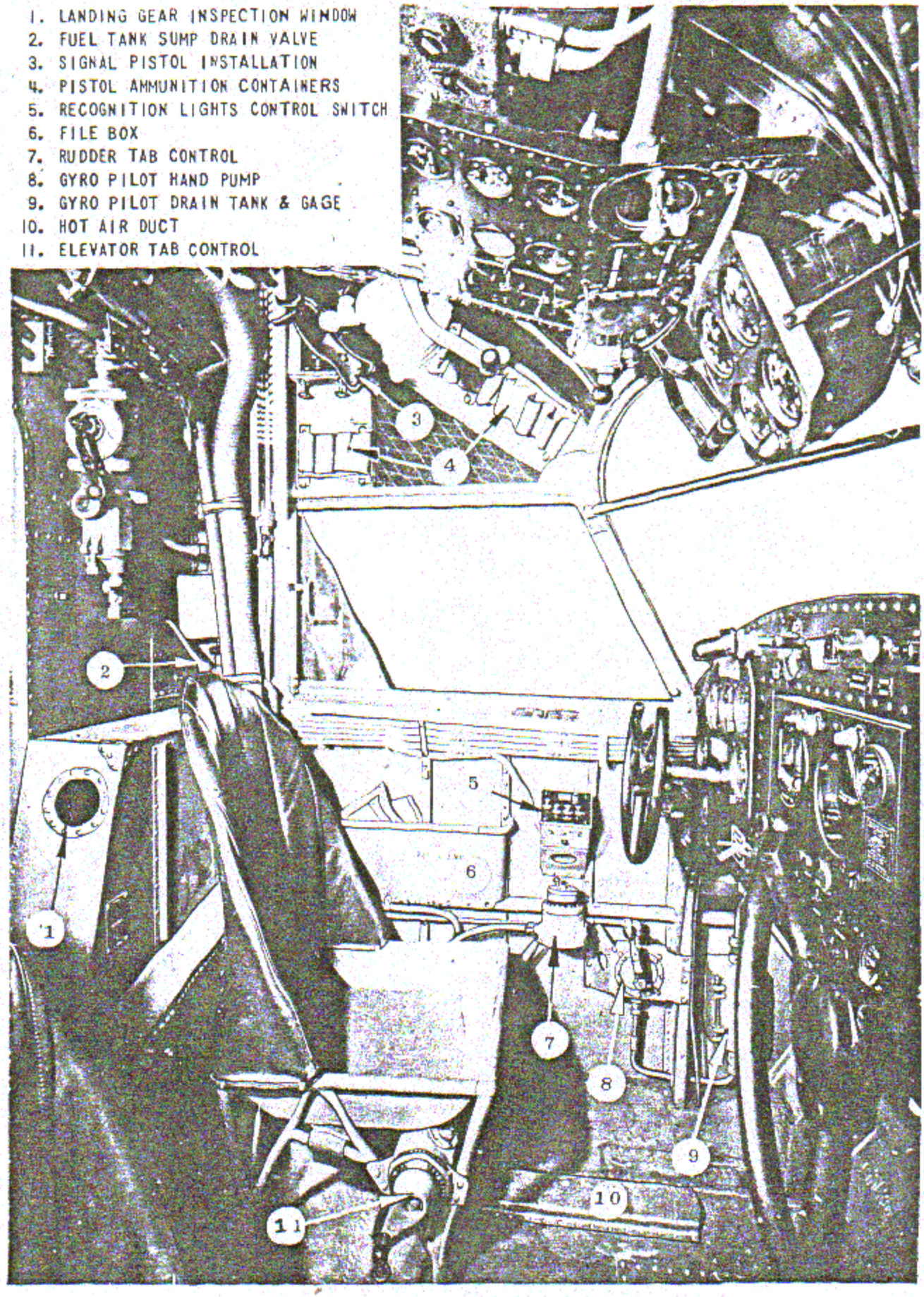
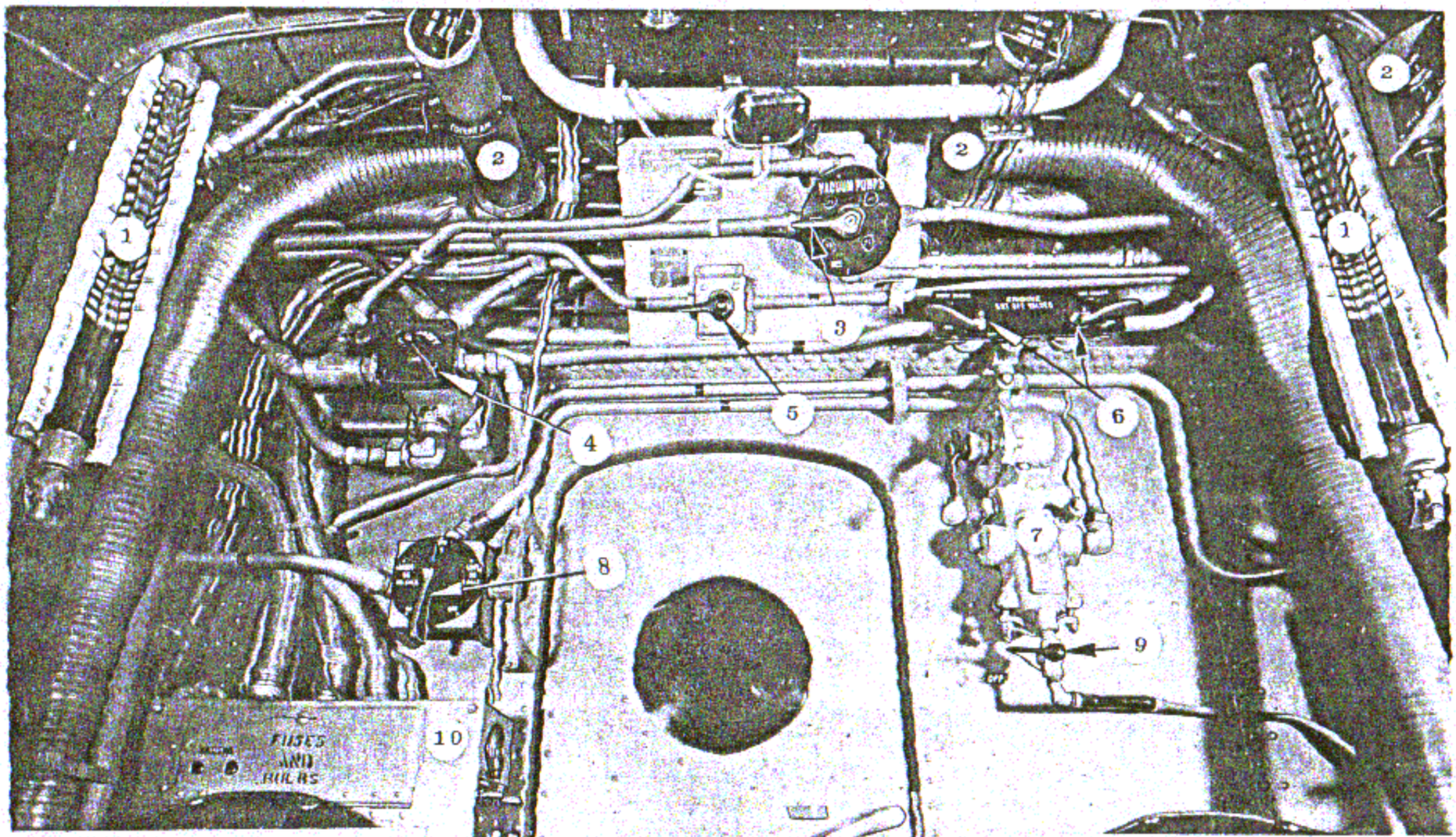


Figure 4—Pilot's Compartment—Left-hand Side



1. FUEL QUANTITY GAGES
2. CABIN & COCKPIT AIR CONTROLS
3. VACUUM PUMP SELECTOR VALVE
4. DE-ICING CONTROL VALVE
5. FUEL CROSS-FEED VALVE
6. FUEL CUT-OFF VALVES
7. WOBBLE PUMP & STRAINER
8. FUEL TANK SELECTOR VALVE
9. DRAIN VALVE
10. FUSE PANEL - SPARE FUSES & BUL

Figure 5—Pilot's Compartment—Rear Bulkhead

SECTION II
OPERATION INSTRUCTIONS

1. FLYING CONTROLS

a. ELEVATOR TRIMMING TAB CONTROL.—The elevator trimming tabs are adjustable in flight from 10° up to 30° down with respect to the center line of the elevator. The control is accomplished by means of a handcrank and gear box on the right-hand side of the pilot's seat, a flexible shaft to a drum under the pilot's floor; cables to a drum at the aft end of the hull, a flexible shaft, tab actuator and adjustable push rod to each tab.

TURN CLOCKWISE—NOSE DOWN.
TURN COUNTER CLOCKWISE—NOSE UP.

When taking off with full load the tab should be in neutral.

b. RUDDER TRIMMING TAB CONTROL.—The rudder trimming tab is adjustable in flight from 25° left to 15° right with respect to the centerline of the rudder. The control is accomplished by means of a handwheel to the left of the pilot's seat, a vertical shaft, a flexible shaft to a drum under the pilot's floor, cables to a drum at the aft end of the hull, a flexible shaft, tab actuator and adjustable push rod to the tab.

TURN CLOCKWISE—NOSE RIGHT.
TURN COUNTER CLOCKWISE—NOSE LEFT.

Set the tab in neutral before taking off.

c. RUDDER AND BRAKE PEDAL ADJUSTMENT.—The pilot's rudder pedals are adjustable to three positions; FORWARD, NEUTRAL and AFT. Adjustment is accomplished as follows: To move pedals forward away from the seat, depress the kick lever and push the pedals forward to the desired position. To bring pedals aft, nearer the seat, hook the toes under the pedals and pull aft to the desired position. The three positions of the ratchet can be felt as the pedal clicks in the ratchet. Check to see that each pedal has ratcheted past the same number of notches.

d. WING FLAPS SYSTEM.—The vacuum system for operating the flaps includes a storage tank (in the bow compartment) sufficiently large for operating the flaps twice with both engines inoperative. The source of vacuum is a connection in the carburetor adaptor plate on each engine, fitted with individual check valves so that a source is assured with one engine completely stopped. An engine will produce vacuum for this purpose with the throttle closed and the switch off until it no longer rotates.

To lower the flaps, rotate the flap control valve located on the overhead instrument panel. A 90° clockwise rotation will lower the flaps to the 30° position—135° clockwise rotation lowers the flaps to the full down or 60° position. The reverse of this operation will raise the flaps. The flap operating mechanism is so designed that the flaps will not stay down fully at speeds above 90 knots (approximately). As a result, in going around again for another attempt, after a landing approach has been interrupted, it is not necessary to first raise the flaps. As the throttles are opened and the airspeed increases, the flaps will gradually come up to about a 10° position at about 110 knots. At this point the flap control valve can then be operated to allow the flaps to go to the full-up position without a "sinking" effect.

Note

With the vacuum system, the operating efficiency of the flaps will be reduced with the decreased atmospheric pressure at altitudes.

CAUTION

Do not lower the flaps above 95 knots true indicated airspeed.

2. LANDING GEAR CONTROLS.

a. RETRACTING MECHANISM.—The main wheels and tail wheel are retracted or extended simultaneously by means of the selective ratchet type handcrank unit located between pilot's and co-pilot's seats. Approximately 41 turns of the crank are required to raise or lower the gear. The crank is turned clockwise to lower and counter-clockwise to raise the gear.

The handcrank is automatically latched by the main ratchet within the housing, acting on the handcrank shaft while the wheels are being raised or lowered. The ratchet is reversed by operating the small knob just to the left of the handcrank. The knob has two positions: TO RAISE and TO LOWER. After reversing the ratchet, the crank remains locked until pressure is exerted on the crank opposite to the desired rotation.

A handle ratchet is located in the crank handle and permits operation of the crank without the necessity of making complete revolutions. This unit has three positions; namely, to RAISE, to LOWER and

NEUTRAL. In NEUTRAL the handle is engaged for rotation in either direction. For normal use, it is recommended that the handle ratchet be kept in NEUTRAL and used only as required when necessary to extend the landing gear in the water.

b. WHEEL LOCK.—When the wheels are cranked to the DOWN position, spring counterbalance units on compression links come into action preventing all possibility of the wheels retracting during take-off and landing on ground. No control is necessary for these counterbalances, since they are so located and designed that they will always exert the proper force.

c. WARNING LIGHT.—A red jewel landing gear warning light, with hinged night shutter, is located on the pilot's main instrument panel. The light is ON when the wheels are up and either throttle is closed below 1,200 R. P. M.; and OFF under all other circumstances. This installation is intended to warn the pilot against inadvertently landing on land or on water with the wheels not in the proper position.

The wheel position may also be checked by looking through the small inspection windows.

d. SAFETY BOLTS.—The landing gear will not take any load unless it is in the fully down position. To save the operating mechanism from being damaged, in case load is inadvertently put on the gear by hitting bottom in shallow water while extending the gear or from any other cause, there are three safety bolts at the top of each compression strut that will fail in shear. Six spare safety bolts #12646 should be carried in the airplane at all times to be installed in case of such an emergency. Hand holes are provided to permit installation of these bolts, if necessary from the pilot's cockpit. The bolt holes in the compression strut flange and the holes in the operating torque tube flange are so located that it is impossible to connect up the system out of synchronization.

Stress analysis investigations have shown that failures can occur to these safety bolts during landing or take-off only when there is an abnormal side load with no vertical component, or in the air when the pilot imposes a heavy load on the handcrank, which causes severe stress in the subject bolts. Some pilots give the handcrank a last hard pull to insure complete housing and locking of the wheels in the UP position. This can impose very severe stresses if the crank ends up in an advantageous position for an efficient pull. This last pull or jerk is detrimental and is not necessary to the proper securing of the gear in the UP position. Pilots are warned of the danger of using this method of completing the retraction of the landing gear.

Operating units are directed to inspect the three safety bolts in each landing gear during the 120-hour check. Bolts showing signs of wear or deformation should be replaced by new bolts.

e. JACKING.—The axles serve as jacking points. If the hull rests on the ground, the quickest and easiest method to put the airplane on its wheels is as follows:

1. Remove both wheels.
2. Crank the gear all the way out.
3. Jack up each side of the ship, under the axles.
4. When just high enough, put the wheels back on.
5. Jack the ship down and remove the jacks.

f. TAIL WHEEL CASTER LOCK.—The tail wheel drag link is provided with a lock-pin which locks the caster and wheel in the trailing position. The lock-pin is controlled by cable from a lever on the left hand side of the main instrument panel. The lock position is UP as plainly marked by the nameplate. The primary purpose of this unit is to reduce the possibility of ground looping in landing.

It is essential for land operation that pilots lock the tail wheel immediately after taxiing into position for take-off. It may be unlocked by the pilot after the landing run has been completed, in order to facilitate taxiing. The tail wheel is 360° swivel type, equipped with a spring loaded self-centering device.

3. POWER PLANT.

a. ENGINES.—This airplane is powered with two Pratt & Whitney Wasp Junior Model R-985-AN6 nine cylinder, radial, direct drive engines.

RATING.

Take-off—450 B. H. P. at 2,300 R. P. M.
Normal—400 B. H. P. at 2,200 R. P. M.—S. L. to 5,500'.

Maximum Dive R. P. M. 2,860.

Designed to operate on—
Fuel—91 octane, Spec. ZN-VV-F-776.
Oil—Grade 1120, Spec. AN9532.

b. MIXTURE.—The mixture selector control on the Stromberg Bendix carburetor NAR-9C-2 has four positions: FULL RICH, AUTOMATIC RICH, AUTOMATIC LEAN and IDLE CUT-OFF. These four positions are plainly marked on the mixture control quadrant.

FULL RICH is for emergency use only in the event of failure of the automatic features.

See Fig. 6, Engine Operating Table for mixture control positions to be used for the various operating conditions.

Note

For IDLE CUT-OFF place the mixture control lever in the full aft position, red sector. Use

AUTOMATIC RICH mixture for all operations above the line entitled Maximum Recommended cruising limits on the ENGINE POWER CURVES, Fig. 7.

c. PROPELLERS.—The propellers are Hamilton Standard, two blade 8'6", constant speed controllable pitch, blade #6167A-12, hub #2D30-235 and governor unit Model #1C2G-5.

The low pitch limit stop is set at 11° and the high pitch at 26° at the 42" station. The Low Pitch, INCREASE RPM or take-off position of the control handle, is DOWN and FORWARD; and the High Pitch, DECREASE RPM position, is UP and AFT.

The operating range of the constant speed governor unit is between 1,200 and 2,700 R. P. M. The R. P. M. adjustable stop is set for 2,300 R. P. M.

When the control is put in the High Pitch, Decrease RPM position, while engine is turning at 1,400 R. P. M. or more, it will remain locked in the high pitch position.

d. STARTERS.—The starters are Eclipse Type 400 Model 17 direct cranking electric equipped with booster coils and starter solenoids. Handcrank operation is provided.

e. STARTING ENGINE.—If the engine has been standing idle for more than one hour, make sure the ignition emergency switch knob is OFF and rotate the engine four or five revolutions by pulling the propeller through by hand to expel oil from the lower cylinders. If necessary, remove a spark plug from each of the lower cylinders and drain.

To start the engines, the two engine fuel cut-off valves should be turned ON. The cross-feed valve OFF and the tank selector set for desired tank. With the mixture control in IDLE CUT-OFF position (red sector), operate the wobble pump to obtain a fuel pressure of 3 to 4 p. s. i.; then prime the engine, which is to be started, by pumping the throttle. About eight strokes will be required when cold but over priming should be avoided. Place propeller control in DECREASE RPM position. Place ignition switch on ON position and engage engine starter. Place mixture control in AUTOMATIC RICH as engine fires.

Always start the right engine first as the generator is located in this engine nacelle thus the generator will be producing current while the left engine is being started.

f. STARTING CHECK-OFF—RIGHT ENGINE FIRST.

(1) Emergency ignition switch.	OFF.
(2) Mixture	IDLE CUT-OFF.
(3) Rotate engine manually.	4 or 5 revolutions.
(4) Battery and generator switches.	ON.
(5) Carburetor air	COLD.
(6) Propeller control	DECREASE R. P. M.
(7) Tank selector valve	On Desired Tank.
(8) Engine fuel cut-off valves.	ON.
(9) Fuel cross-feed valve	OFF.
(10) Wobble pump	3 to 4 p. s. i. Fuel Pressure.
(11) Prime engine being started.	Pump Throttle approx. 4 strokes normal conditions; 8 for cold weather starting.
(12) Throttle	500-600 R. P. M.
(13) Emergency ignition switch.	ON—Switch must be in extreme UP position.
(14) Ignition switch	On BOTH for engine being started.
(15) Starter	ENGAGE.
(16) Mixture control	Place in AUTOMATIC RICH as soon as engine fires. Return to IDLE CUT-OFF if engine fails to continue running.
(17) Idle	At 500-600 R. P. M. or less for 30 seconds until oil pressure registers.

If the oil pressure gage does not indicate pressure within ½ minute, the engine should be stopped and an investigation made. To prevent damage to the oil pressure gages, avoid high oil pressure when engine is still cold by holding down engine R. P. M.

g. ENGINE GROUND TEST.—During the warm up, the engines shall be run at approximately 800 to 1,000 R. P. M, with the propellers in low pitch, INCREASED R. P. M. position. The change from high to low pitch should be made about one minute after starting.

Watch the oil pressure gage for a positive indication that pressure is being maintained in the engine. The oil inlet temperature should be brought up to at least 30°C in accordance with T. O. 24-41 before take-off. This temperature will be reached quite

rapidly due to the action of the automatic oil temperature control unit located at the bottom of the tank.

Oil pressure will vary with R. P. M. and need cause no alarm by falling as low as 25 p. s. i. at low R. P. M.

GROUND TEST CHECK-OFF.

(1) Propeller.....	INCREASE R. P. M. Low Pitch.
(2) Mixture.....	AUTO RICH.
(3) Manifold pressure.....	30" Hg.
(4) Maximum cylinder head temp.	205° C. (400° F.).
(5) Oil pressure.....	Minimum Idling 25 p. s. i. Desired—70-90 p. s. i.
(6) Oil inlet temperature.....	60°–102° C. Desired.
(7) Fuel pressure (Pump cross-feed valve OFF).	4–6 p. s. i.
(8) Check magnetos.....	40–60 R. P. M. drop on single magneto.

h. TAKE-OFF.—Shoulder type throttle stops are provided on the control quadrant for limiting the throttle opening at sea level. The stop is set so that with the throttle lever opened to it, the manifold pressure will be 35.5" Hg. Maximum allowable manifold pressure for take-off and initial climb is 35.5" Hg. at 2,300 R. P. M.

i. CLIMB.—After take-off reduce power and climb in accordance with Engine Operating Table, page 13.

Climb with propeller control in either a high or intermediate R. P. M. setting. For a rapid climb use an intermediate R. P. M. setting and use a high R. P. M. setting for a gradual climb. Cylinder head temperatures should be considered when deciding which method is most desirable.

Under conditions of maximum climb performance, it is preferable to maintain cold carburetor air. However, under icing conditions use 90° C. carburetor heat.

j. HIGH SPEED LEVEL FLIGHT.—Maximum allowable engine R. P. M. is 2,200, with propellers in high pitch and with manifold pressure as follows:

Sea level to 3,000 ft.—33.5" Hg.
3,000 to 5,500 ft.—32.5" Hg.
Do not exceed 32" Hg. above 5,500 ft.

k. CRUISING.—Cruising operations may be conducted at any power below normal rated power. However, for maximum efficiency it is recommended that the conditions shown by the line titled Maximum Recommended Cruising Limits, Fig. 7, not be exceeded. AUTOMATIC LEAN carburetor control setting may be used for cruising operation on or below the line titled Maximum Recommended Cruising Limits.

l. MANIFOLD PRESSURES.—The pilot's overhead instrument panel is provided with a manifold pressure gage for each engine. The manifold pressures and corresponding engine R. P. M. for various flight conditions are given in the ENGINE OPERATING TABLE, Fig. 6.

m. STOPPING ENGINES.—In stopping, the propeller controls should be placed in the DECREASE R. P. M. position, and the engines allowed to turn over at 800 to 1,000 R. P. M. for a few minutes, especially after flying at full throttle, to allow the engines to cool and the propellers to go high pitch. Then the mixture control levers shall be placed in the IDLE CUT-OFF position. The carburetors are fitted with IDLE FUEL CUT-OFFS which provide for stopping the flow of fuel to the carburetor jets when the mixture control levers are in the last 10 degrees of the mixture segment. This portion of the control unit is painted red. Afterwards shut off the fuel valve and turn the emergency ignition switch to BOTH ENGINES-OFF.

Note

Before stopping the engines, the propeller should be shifted to full high pitch, DECREASE RPM, to empty the propeller cylinder of oil as any oil left in the cylinder is subject to congealing in cold weather.

n. CYLINDER TEMPERATURES.—One thermocouple instrument for each engine is located on the overhead instrument panel and connected to cylinder head No. 5. These instruments are calibrated in degrees centigrade (° C).

MAXIMUM ALLOWABLE CYLINDER HEAD TEMPERATURES

Ground Test.....	205° C.
Take-Off and Maximum Climb 5 mins. duration.	260° C.
Continuous—Normal Rated Power...	260° C.
Cruising—At or below Line of maximum Recommended Cruising Limits.	232° C.
Stopping—Cool Engine.....	140° C.

o. CARBURETOR AIR PREHEAT CONTROLS.—The carburetor air preheat scoop, mounted below the carburetor, is fitted with a valve arrangement, consisting of two interconnected flap doors and levers; and is controlled from the lever handles on the pilot's overhead instrument panel.

Hot air is taken from the exhaust manifold muffs

and cold air through a duct on the outboard side of each nacelle. Hot or cold air or any desired mixture of both may be supplied to the carburetor. The excess hot air is by-passed automatically to the atmosphere.

The thermometer bulbs are situated in the carburetor scoops and the carburetor air temperature gages are located on the overhead instrument panel.

For use of preheat see Bureau Aeronautics Manual 14-207.

p. NORMAL INSTRUMENT READINGS.—The following instrument readings were taken on a cruising flight at 5,000 ft. altitude:

Propeller	Governing.
R. P. M.	1,950.
Manifold Pressure	27.5" Hg.
Cylinder Head Temp. (No. 5)	185° C.
Carburetor Air Temp.	32° C.
Outside Air Temp.	25° C.
Fuel Pressure	4 p. s. i.
Mixture	Best Power.
Oil Pressure	70 p. s. i.
Oil Temperature	70° C.
Airspeed	146 M. P. H.
Elevator Tab Setting	0°.
Rudder Tab Setting	0°.
Fuel Consumption	42 gals./hr.

q. FUEL SYSTEM.—The fuel is carried in two built-in wing tanks. The fuel supply is as follows:

Left Wing Tank—110 U. S. gals.
Right Wing Tank—110 U. S. gals.
91 Octane, Specification AN-VV-F-776.

Each tank is fitted with a glass boiler type fuel gage located in the upper rear corners of the pilot's compartment. The gages are calibrated for the three-point position and level flight attitudes.

The normal operating fuel pressure is 4 to 6 p. s. i. The fuel pressure indicators are on the overhead instrument panel. The fuel tank selector valve, located on the pilot's rear bulkhead, has five positions:

BOTH—ON.
LEFT—ON.
RIGHT—ON.
OFF (2 POSITIONS).

Either of the two OFF positions turns BOTH TANKS OFF.

The AEL-1 fuel system unit and integral hand pump handle are located on the pilot's rear bulkhead. Drain this unit every day before flying then lock wire the valve in the closed position.

The engine fuel shut-off valves are located above the AEL-1 unit.

Each tank suction line is fitted with a fuel sump and drain valve located on the pilot's rear bulkhead. The lines, connected to each sump, empty just forward of the wheel wells through the fuselage skin.

PUMP CROSS-FEED VALVE.—The pump cross-feed valve is located on a panel just aft of the overhead instrument panel. The cross feed line interconnects the two engine-driven fuel pumps so that one pump may supply both engines if the other pump fails.

This valve should be in the ON position for take-off. However, in the remote event of fuel line failure near a pump, both pumps might discharge through the broken line resulting in failure of both engines. If so, the cross-feed valve should be turned OFF immediately. The engine shut-off valve, leading to a damaged engine driven fuel pump or line, should be turned OFF as soon as practical.

At least once in each flight the cross-feed valve should be turned OFF momentarily to determine that both fuel pumps are operating satisfactorily.

Refer to Tech. Order No. 53-36 or Tech. Note No. 4-39.

ENGINE OPERATING TABLE

DENSITY ALTITUDE (No Ram)	*B. H. P. EACH ENGINE*	*MAXIMUM MANIFOLD PRESSURE*	*R. P. M.*	*PROPELLER*	*MIXTURE CONTROL*
Take-off at Sea Level (5 minutes only).	450	35.5" Hg.	2,300	Increase R. P. M.	Auto Rich.
At Sea Level to 3,000 ft.	400	33.5" Hg.	2,200	Governing	Auto Rich.
Climb 3,000 to 5,500 ft.	400	32.5" Hg.	2,200	Governing	Auto Rich.
Climb above 5,500 ft.*	.....	Full Throttle	.....	Governing	Auto Rich.
Cruising	.....	See Curve on p. 14	.....	Decrease R. P. M.	Auto Lean for operation at or below Max. Recommended Cruising Limits Line, p. 14.
Oil Pressure					Desired 70-90 p. s. i. Idling 25 p. s. i. Minimum.
Oil Temperature					Desired 60°-102° C.
Fuel Pressure					Desired 4-6 p. s. i.

*Do not exceed 32" Hg. above 5,500 ft.

Figure 6

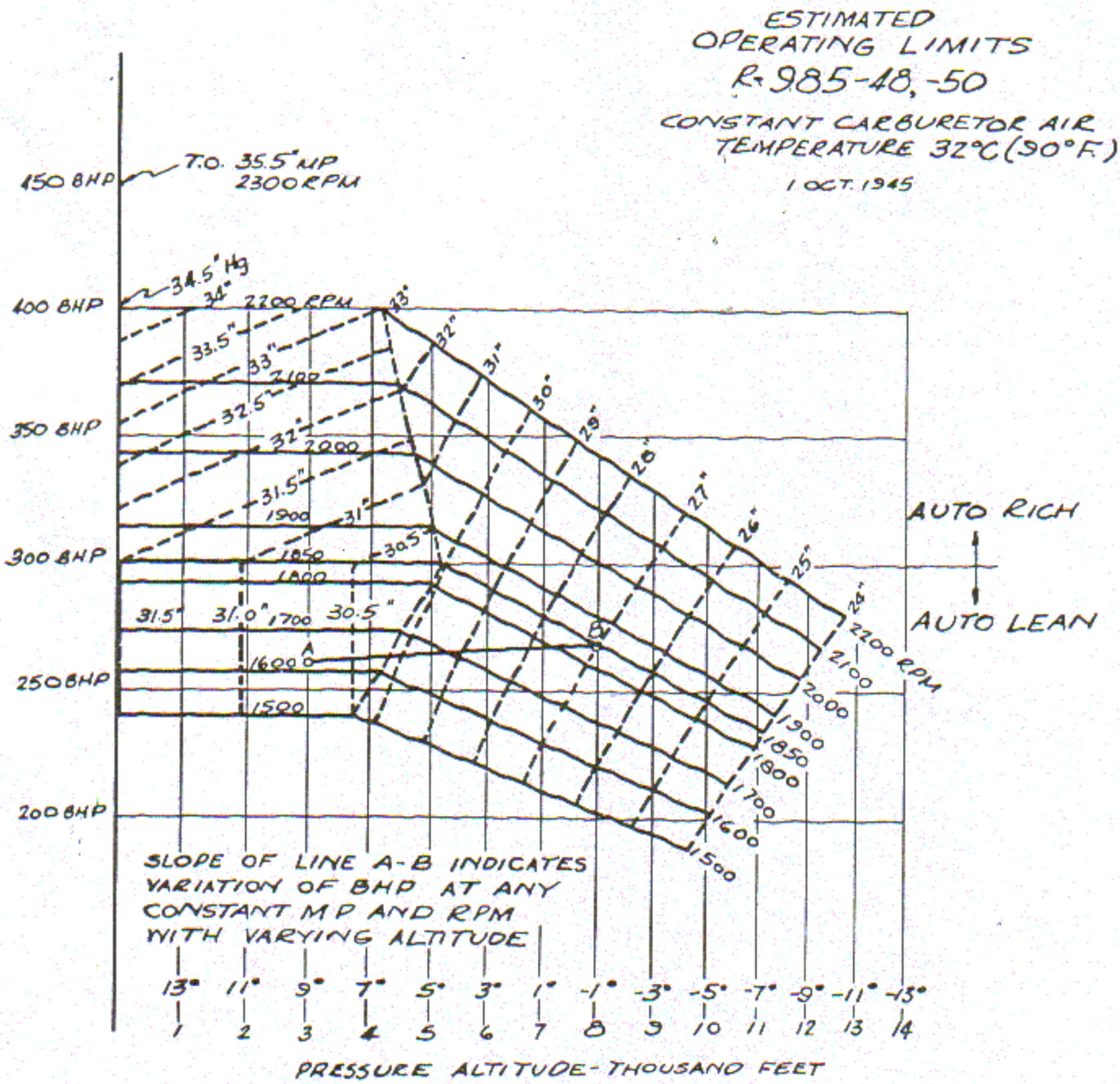


Figure 7—Engine Power Curve

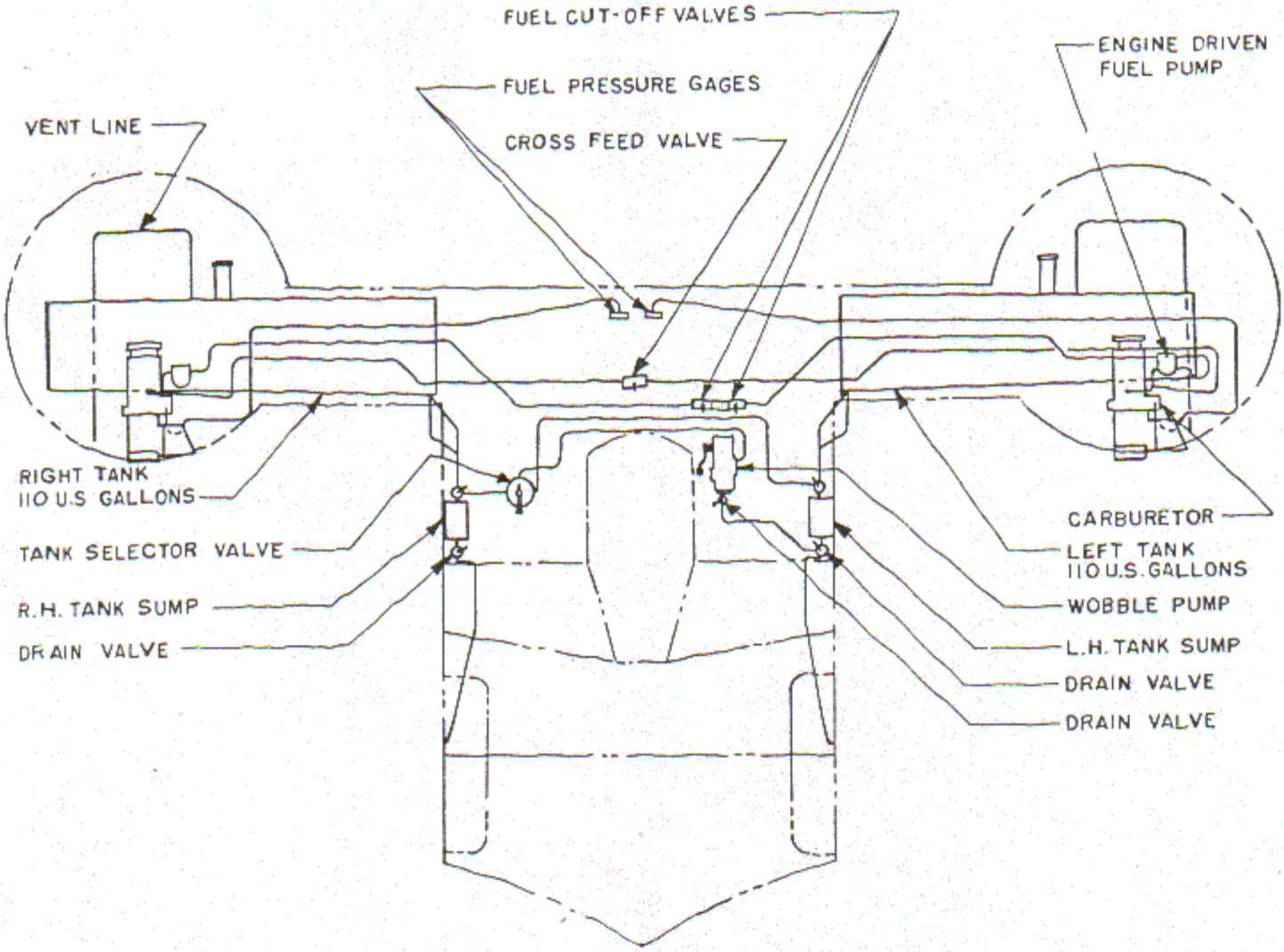


Figure 8.—Fuel System Diagram.

r. OIL SYSTEM.—The oil for each engine is carried in a single tank located in the engine nacelle compartment. The tank capacity is as follows:

6 U. S. gals. Normal.
7½ U. S. gals. Maximum.
9½ U. S. gals. Tank Volume.

Each independent system incorporates an automatic oil temperature control and check valve attached to the bottom of the oil tank, which, in conjunction with the oil cooler, maintains the oil-in temperature at approximately 65° to 76° C. The control valve causes the oil to bypass the cooler when the oil-in temperature is below approximately 65° C. directing the outlet oil from the engine back to the bottom of the oil tank in close proximity to the suction outlet. Consequently, the tank supply of oil is virtually bypassed when starting the engine until the oil-in temperature reaches approximately 65° C. The check valve unit prevents flow of oil into the engine from the tank and back through the oil-out line from the engine to the control valve when the engine is not operating.

The engine return line at the bottom of the tank extends upward into the tank forming a sump. The riser prevents the circulation of ½ gallon of oil. The arrangement is such that all oil in the tank is drainable through the large drain valve.

Temperature—Desired 60°–102° C.
Pressure—Desired 70–90 p. s. i.
Idling—25 p. s. i., Minimum.

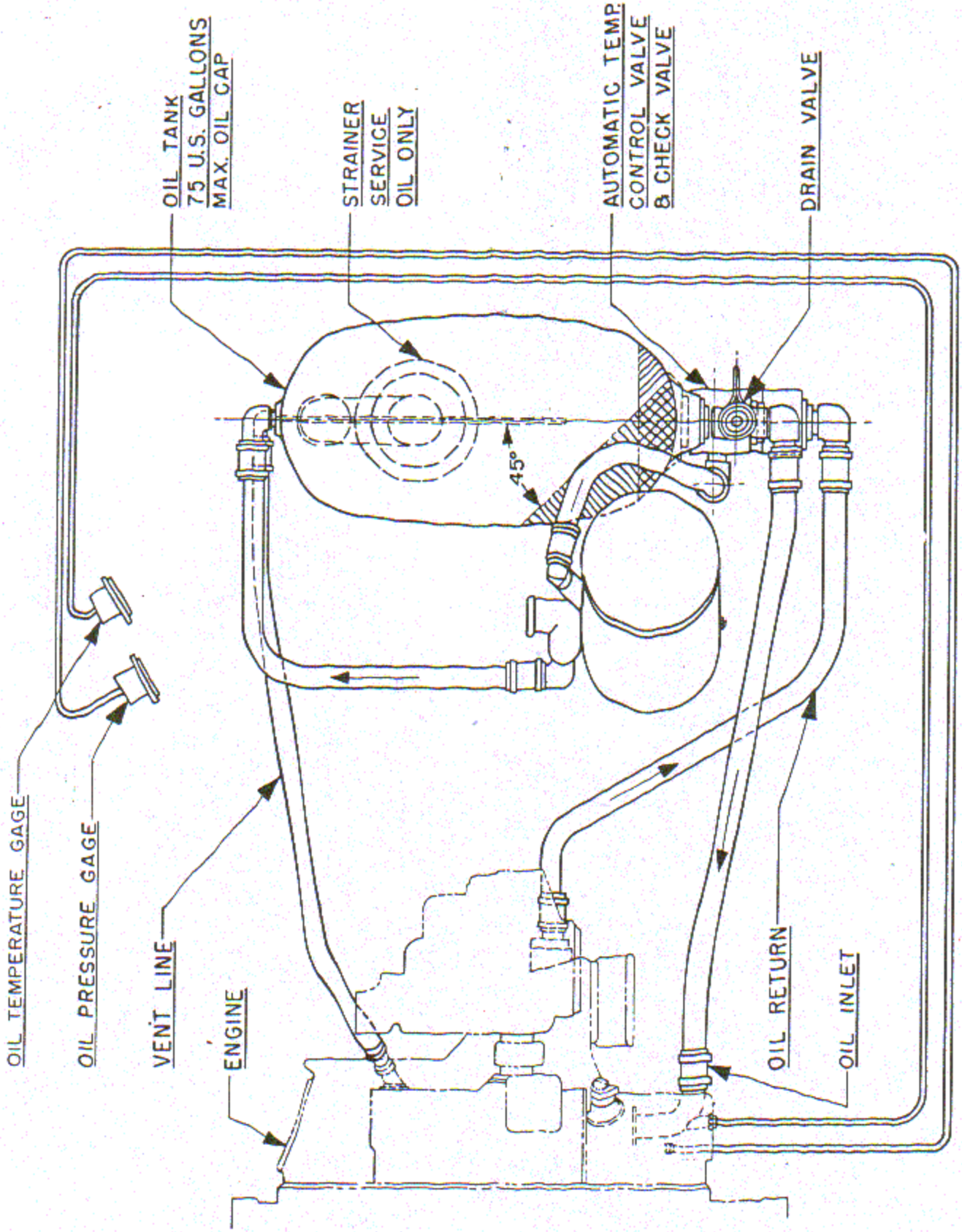


Figure 9—Oil System Diagram

SECTION III
FLYING CHARACTERISTICS

1. WEIGHT AND BALANCE.

This airplane is designed to operate as a utility airplane and when so loaded will balance satisfactorily without the use of ballast. When flown empty, carry 100 pounds of ballast in the rear baggage compartment. Refer to the Weight and Balance Book for this airplane.

2. MANEUVERS.

Although this airplane, Class VJR amphibian is not designed for combat work, its excellent maneuverability has been successfully demonstrated. However, except in emergencies, maneuvers shall be limited to those permitted for Class VJR airplanes by existing Navy publications. Refer to T. O. 55-40.

a. TAKE-OFF—WATER.—A take-off from water with full load, 8,000 lbs., under no wind conditions can be made in approximately 15 seconds. The best trim angle for take-off can be determined readily with experience. To reduce the spray on take-off, it is advisable to use maximum take-off manifold pressure by opening the throttles with a non-hesitating, smooth motion and at the same time holding the elevator control full back. With this technique, the airplane will get on the step, with minimum delay. After getting on the step, take-off procedure is normal.

The take-off is excellent without the flaps, however, it can be improved further by lowering the flaps to the 30° position. Pilots are cautioned to keep the windows closed to keep out the spray. When full fuel load is not carried, it is recommended that the right tank carry 30 gallons more than the left tank to counteract engine take-off torque.

b. CLIMB.—Climbing is recommended to be done at 95 knots. A rapid climb will be obtained at airspeeds between 95-105 knots (110-120 M. P. H.). This climbing condition should insure sufficient cooling together with maximum rate of climb, and a minimum danger in case of failure of one engine.

CLIMB DATA WITH GROSS WEIGHT OF 7,930 LBS.

Standard Altitude (Feet)	*S. L.*	*5,000*	*10,000*	*15,000*
Climbing Speed, M. P. H....	125	127	129	131
Engine Speed, R. P. M.....	2,200	2,200	2,200	2,200
Total Power, B. H. P.....	750	790	670	560
Maximum Rate, F. P. M.....	1,285	1,260	860	525
Minimum Time, Minutes.....	0	3.9	8.7	16

c. GLIDE AND LANDING.—During familiarization flights it is recommended that a gliding speed of 90 M. P. H. be maintained. With practice the gliding speed will probably be reduced somewhat by each pilot. Even with the 90 M. P. H. speed there is very little tendency to over-shoot because the high drag from the flaps give the airplane a steep gliding angle and practically eliminates any tendency to float. Attention is invited to the fact that the forward deck of the airplane is just level when in the 3 point landing attitude, hence during a normal glide with flaps DOWN the airplane appears to be diving slightly. This attitude should be maintained until within a few feet of the ground, as speed is lost quickly when the nose is brought up.

It is recommended that the 30° flap setting be used for the first two or three landings on familiarization flights. Since the flaps are extremely effective on this airplane, the use of full flaps produces an unusually steep glide unless part power is used. For land landings it is immaterial whether 30° or 60° flap setting is used provided a gliding speed of at least 90 M. P. H. is maintained until leveling off close to the ground. When leveling off from this approach speed, the actual landing will be found to occur at about 70 to 75 M. P. H. This applies to land as well as water operation.

The wing of this airplane is designed so that a stall occurs first in the center section of the wing and gradually spreads out along the wing toward the tips but the tips never stall. Thi. airplane, therefore, will not fall off if it is stalled but the nose will drop until speed is picked up. This is a very desirable characteristic but care should be taken that the airplane is not stalled too high off the ground when coming in for landings or it will tend to drop in on the wheels. When it is necessary to bring the airplane in slow for any reason, it is recommended that a power-stall landing be made.

d. WATER LANDING.—Use either 30° or 60° flap setting. Use part throttle, about 15 inches manifold pressure, during the approach and until sound contact is made with water. Then throttle back completely.

If a bad bounce is made, use power to either recover to a normal position to land, or to go around

for a new approach. This ship has sufficient power to recover from almost any position into which it might bounce.

e. TAXIING.—By extending the landing gear when taxying on water, the maneuvering characteristics are improved; forward speed is reduced and sharper turns can be made, however; the wheels should not be lowered in water less than 3 feet deep.

When approaching a beach with the intention of taxiing out—it is considered good practice to come in slowly and at an oblique angle (not straight on) in order to determine if the surface is sufficiently firm to support the wheels.

f. OPERATING CHARTS.—The operating charts, Figures 10-13, are based on the uncamouflaged airplane; therefore when flying a camouflaged airplane, a slight decrease in performance will be noted due to the surface roughness.

g. SINGLE ENGINE FLIGHT.—With 8,000-pound gross load, without de-icer boots, with smooth paint, and smooth air, the single engine ceiling can be maintained at 6,000 feet although the plane will not climb up to this ceiling. Any unfavorable change to these conditions greatly reduces the ceiling.

To secure best single engine flight, increase the operating engine to maximum, except take-off power; 2,200 R. P. M. and full throttle, except manifold pressure should not exceed 33.5", unless in an emergency.

Immediately lock inoperative propeller in maximum high pitch by placing control lever in full aft or Decrease RPM position. It is important to do this quickly in cold weather before oil stiffens and before the R. P. M. drops below 1,400. If the inoperative propeller is allowed to attain the low pitch position which it will seek when the power decreases, a very high windmilling drag results with serious decrease in single engine ceiling. (See sec. II, 3c., par. 4.)

Retrim elevator and rudder tabs and fly at air speed for best rate of climb. This decreases with altitude but is approximately 85 knots.

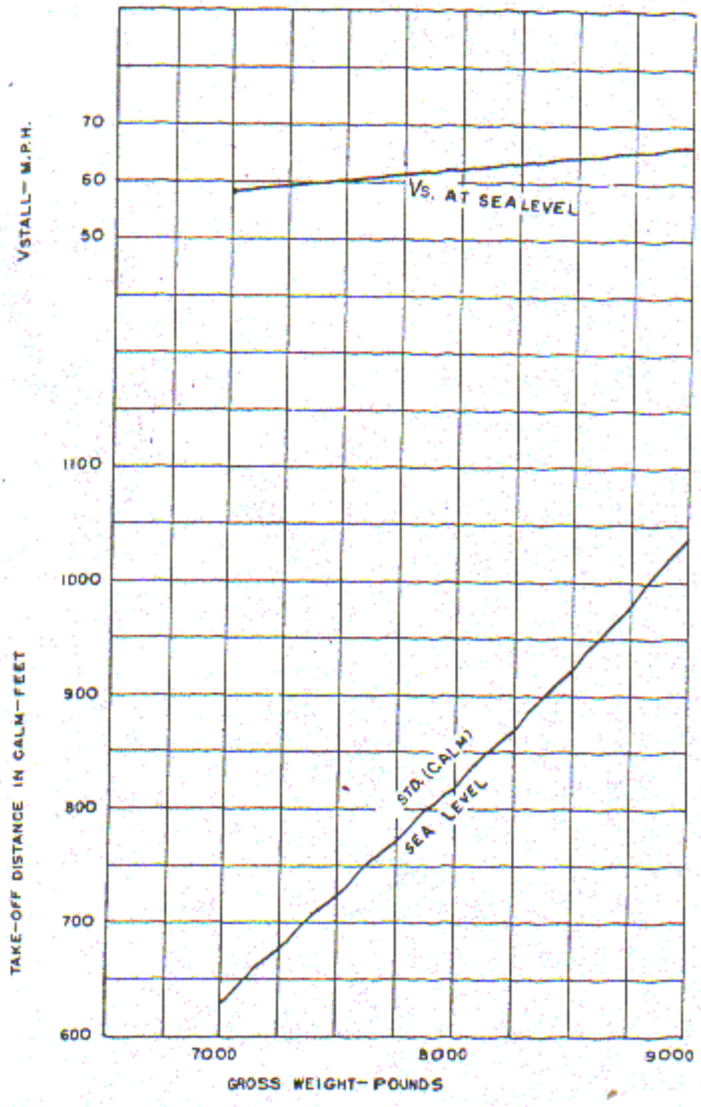


Figure 10—Take-off Run and Stalling Speed Chart.

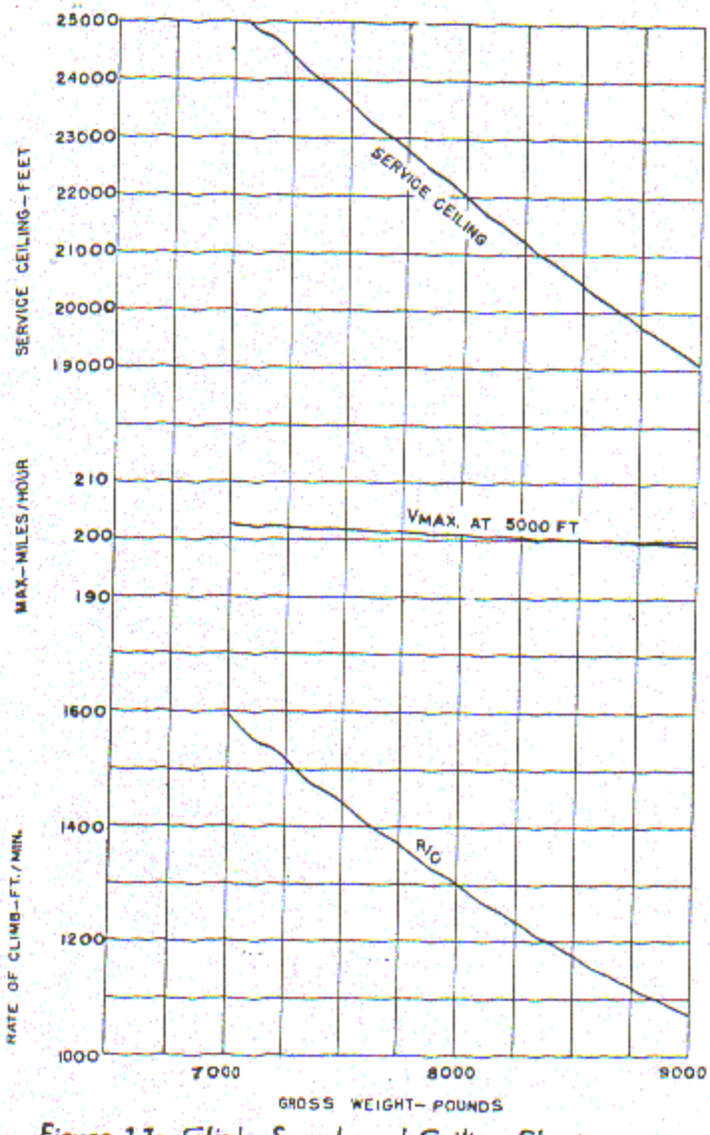


Figure 11—Climb, Speed, and Ceiling Chart.

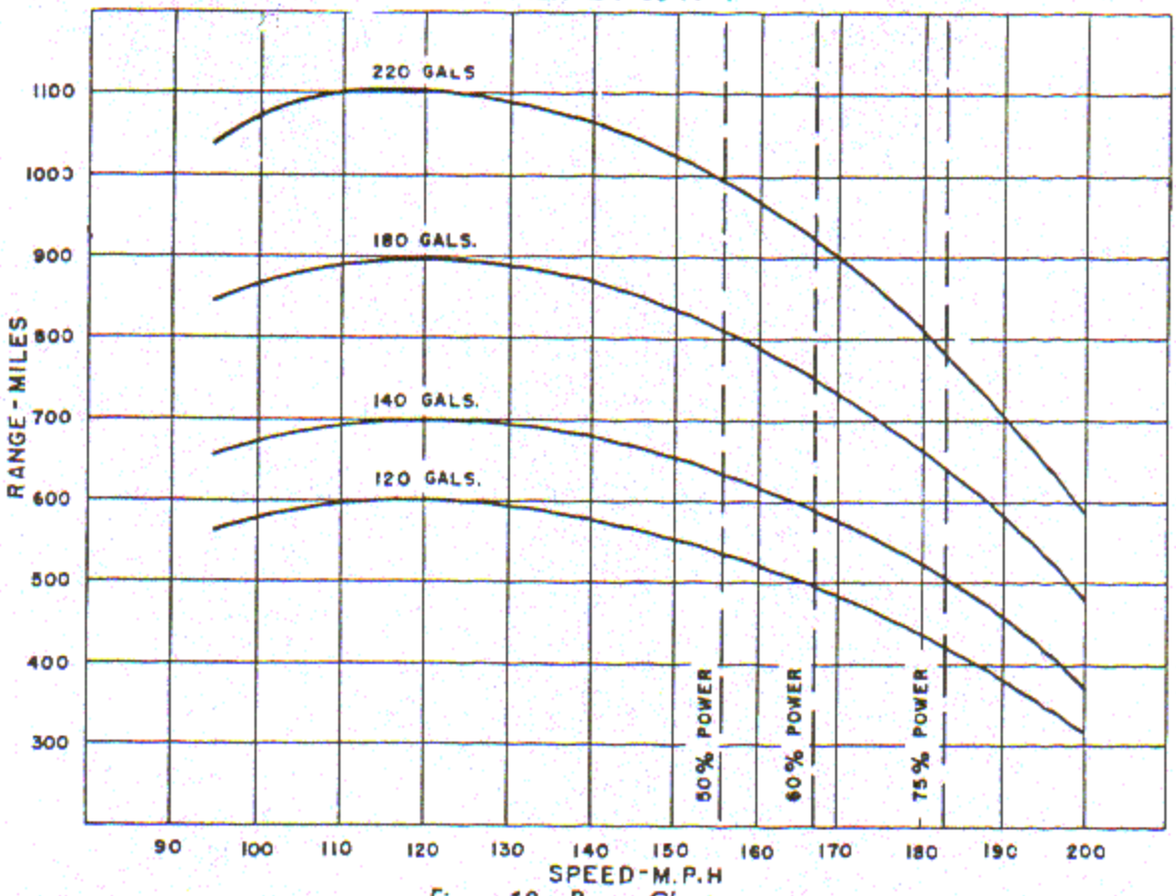


Figure 12—Range Chart.

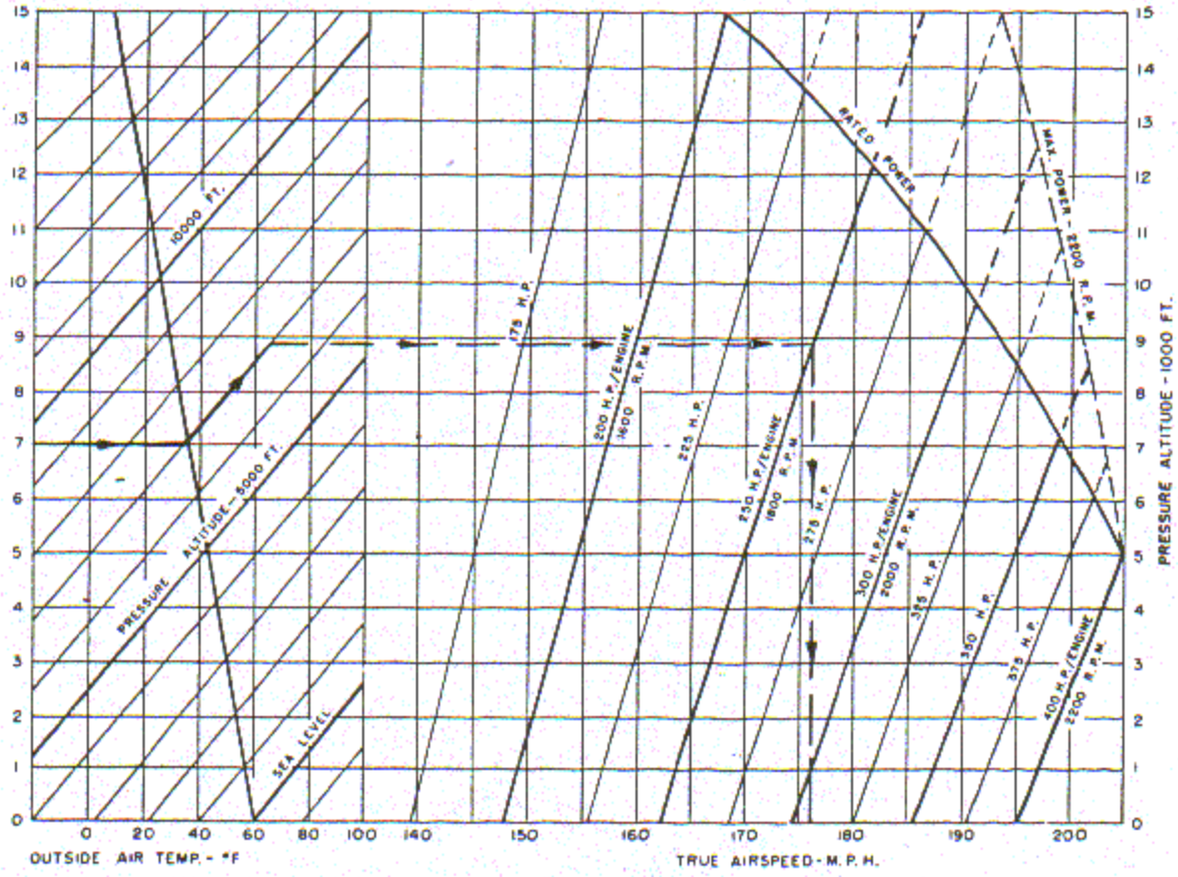


Figure 13—Cruising Chart.

3. CHECK-OFF LISTS.

(1) TAKE-OFF.

1. Propeller..... INCREASE R. P. M., 2,300.
2. Carburetor air temp... COLD (except when damp).
3. Mixture..... AUTO RICH.
4. Fuel valve..... BEST TANK.
5. Manifold pressure..... 35.5" HG.
6. Elev. tab..... NEUTRAL.
7. Rudder tab..... NEUTRAL.
8. Tail wheel caster..... LOCKED.

(2) FLIGHT (CRUISING).

1. Wheels..... RETRACTED.
2. Propeller..... GOVERNING.
3. R. P. M..... SEE ENGINE CHART.
4. Mixture control..... AUTO RICH—70% POWER OR LESS AUTO LEAN.
5. Manifold pressure..... SEE ENGINE CHART.
6. Cyl. head temp..... 232° C. MAX.
7. Oil pressure..... 70 P. S. I.
8. Oil-in temp..... 70° C.
9. Fuel pressure..... 4–6 P. S. I.
10. Carb. air temp..... AS REQUIRED.

(3) LANDING.

1. Wheels..... DOWN (on land) UP (water).
2. Tail wheel caster..... LOCKED.
3. Propeller..... INCREASE R. P. M.
4. Mixture..... AUTO RICH.
5. Fuel valve..... BEST TANK.
6. Elevator tab..... TRIM AS REQUIRED.
7. Flaps..... DOWN—30° or 60°

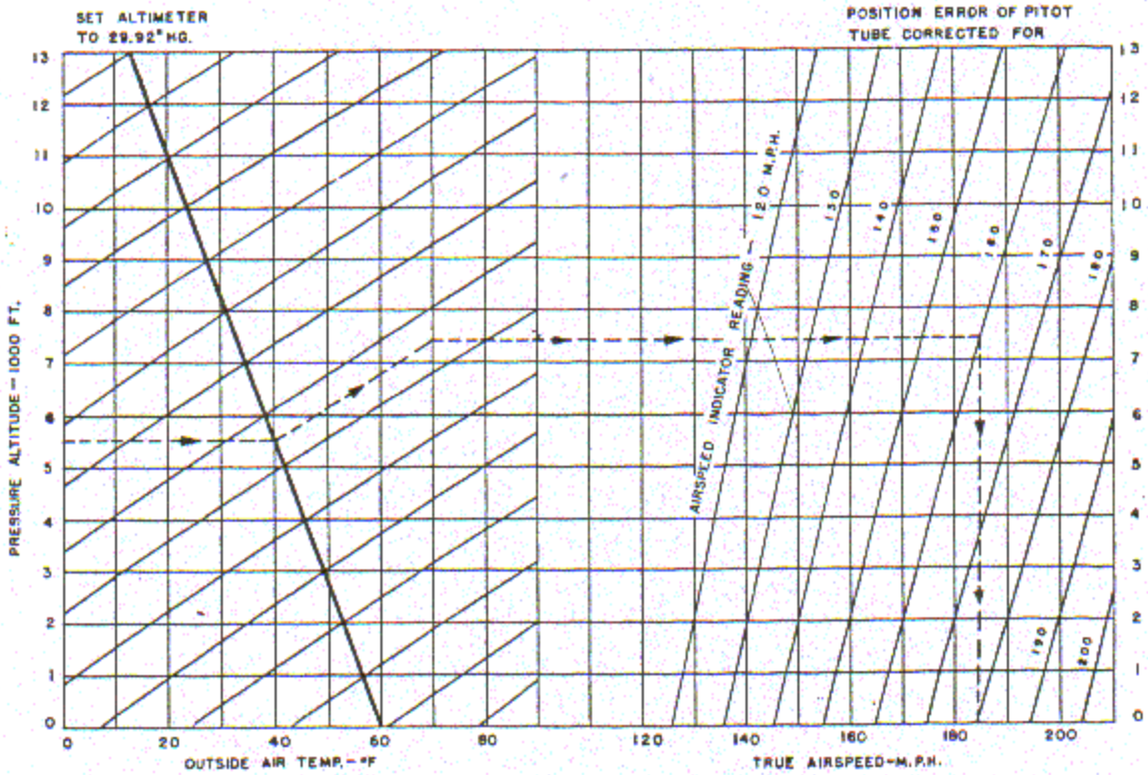


Figure 14—Airspeed Correction Chart.