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PILOT'S FLIGHT OPERATING INSTRUCTIONS

FOR

ARMY MODEL

PT-13D

AND

NAVY MODEL

N25-5

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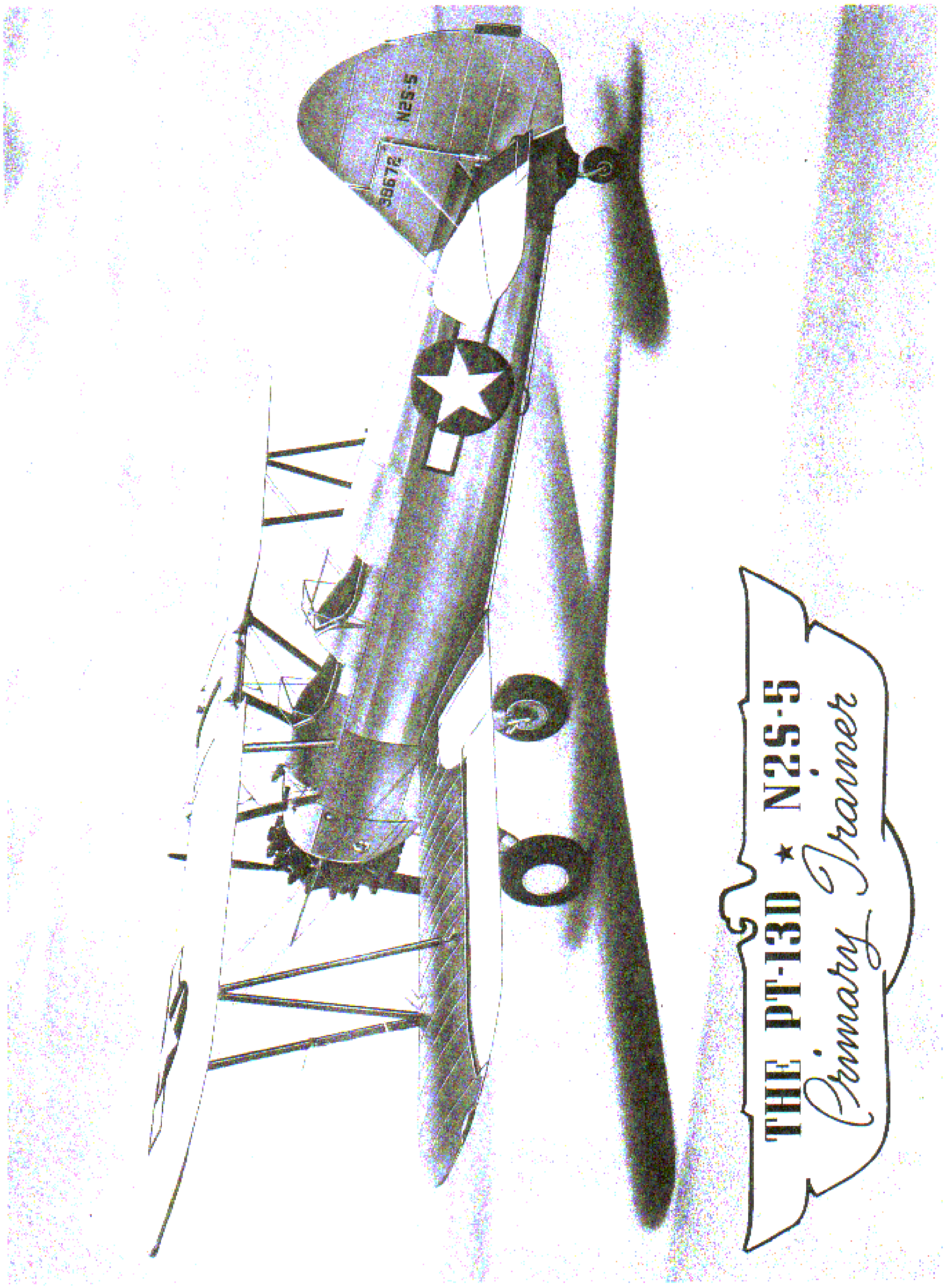

Figure 1—Three-Quarter Left Rear View of Airplane

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SECTION I
DESCRIPTION

1. AIRPLANE.

a. GENERAL.—Model numbers PT-13D and N2S-5 are respective designations for the Boeing built Army-Navy standardized primary trainer. This trainer is an open cockpit, two-place, biplane specifically designed to afford a maximum number of flying hours with a minimum number of maintenance hours.

The fuselage and empennage are constructed from chrome-molybdenum steel tubing. Wings are of two-beam wood construction.

The PT-13D/N2S-5 is fabric covered with aluminum alloy cowling, aluminum alloy fairing and has a cantilever wheel type landing gear.

Approximate dimensions:

Upper wing span ....32 ft 2 in.
Lower wing span ....31 ft 2 in.
Overall length ....25 ft 0 in.

2. POWER PLANT.

a. DESCRIPTION.—Lycoming Model R-680-17 direct drive, nine cylinder, air cooled radial engine powers this trainer. The engine drives an 8-foot, 6-inch fixed pitch steel propeller and is rated @ 220 bhp @ 2100 rpm @ sea level.

b. FUEL AND OIL.—Grade 73 octane fuel conforming to Spec. AN-F-23 should be used for this engine. In an emergency, fuel of a higher rating may be used.

Oil used in this engine, should conform to Spec. AN-VV-O-446, Grade 1120, for summer use and Grade 1100 for winter use.

3. CONTROLS AND OPERATING EQUIPMENT.

a. COCKPIT SEATS.—Front and rear cockpit seats are attached by sliding clamps to two support tubes clamped to the main fuselage structure. Each seat may be vertically adjusted, to any one of eleven positions, by pulling up on the seat adjustment lever on the lower right side of the seat, moving the seat to the desired position, and releasing the lever. If the locking pin does not engage the seat should be moved slightly upward or downward until the pin snaps into place.

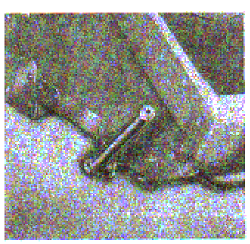

Figure 2—Seat Adjustment Lever

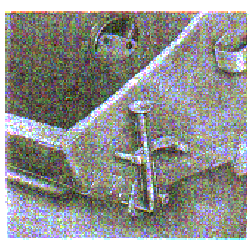

Figure 3—Shoulder Harness Release Lever

A type B-11 safety belt and an Air Corps type shoulder harness are installed on each seat. The harness links slip over and are secured by the safety belt catch assembly as shown in figure 4. Freedom of movement is possible for the occupant when the control handle on the lower left side of the seat is in the aft position. When the handle is in the forward position, freedom of movement is possible until the occupant sits erect at which time the locking device will snap into place, holding the occupant in an erect position.

b. ELEVATOR CONTROLS.—The elevator is operated by inter-connected control sticks, mounted on a large diameter, chrome-molybdenum steel torque tube supported at the front and rear by self-aligning bearings in housings bolted to the bottom fuselage truss. Each control stick is made from one piece solid or laminated turned hickory mounted in aluminum alloy sockets. Interconnecting push-pull tubes extend from front to rear stick, from rear stick to an idler located midway back in the fuselage and from the idler to a single horn bolted between the end fittings of the elevator spars. Rubber Lord Bushings are incorporated in the connection of the rear push-pull tube and the elevator horn to prevent control stick vibration.

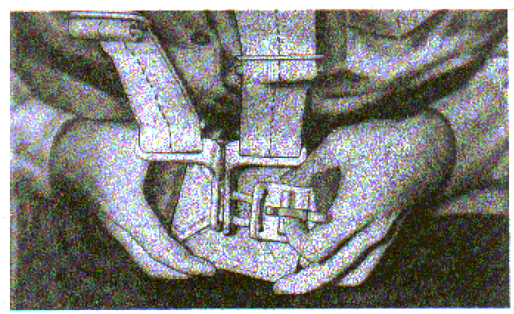

Figure 4—Safety Belt Catch Assembly

c. AILERON CONTROLS.—The aileron control system is comprised of interconnected push-pull tubes attached at their inboard end to a control horn bolted to the control stick torque tube. The push-pull tubes extend from the aileron control horn outboard to an idler in the lower wing and to a bellcrank at the aileron semi-span. The bellcrank and aileron are connected by a short link. Right and left controls are entirely independent.

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d. TRIM TAB CONTROLS.—Trimming of the airplane for nose heavy or tail heavy conditions is effected with trim tabs located in the trailing edge of the elevators. The tabs are cable operated through a drive mechanism located near the front stabilizer spar. Tab control handles are located on the left side

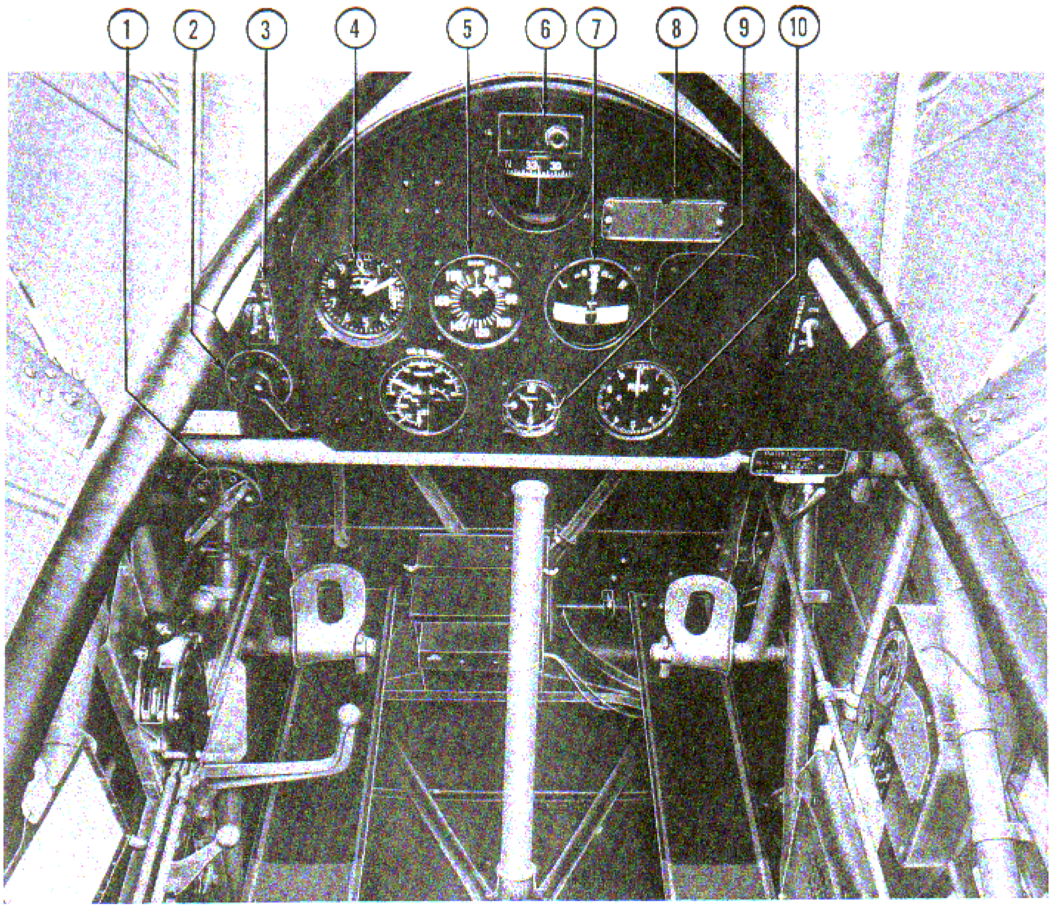

Figure 5—Front Cockpit

1. Fuel Valve Control
2. Ignition Switch
3. Oil Dilution Switch
4. Altimeter
5. Air-Speed Indicator (Army)
6. Compass
7. Bank and Turn Indicator
8. Compass Correction Card Holder
9. Clock
10. Tachometer

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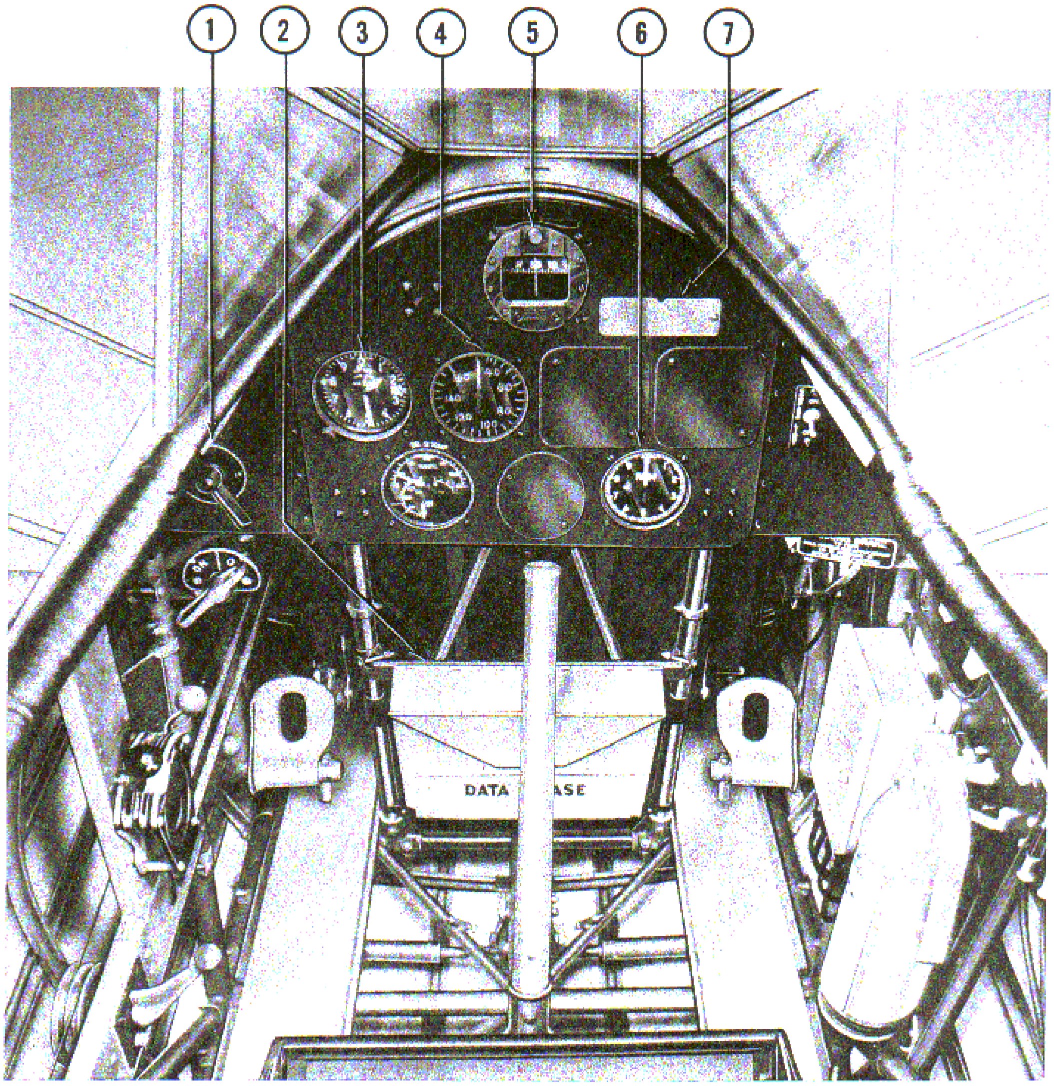

Figure 6—Rear Cockpit

1. Ignition Switch
2. Data Case
3. Altimeter
4. Air-Speed Indicator (Navy)
5. Compass
6. Tachometer
7. Compass Correction Card Holder

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1. Battery Junction Box
2. Instrument Light
3. Pilot's Switch Box
4. Flight Report Holder
5. Head Set Disconnect Jack
6. Microphone Disconnect Jack
7. Carburetor Air Control Handle

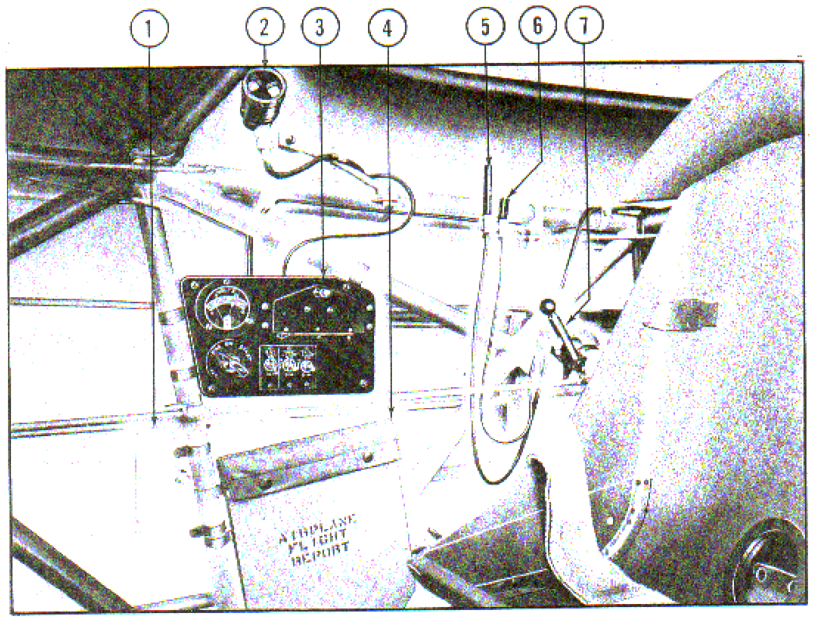
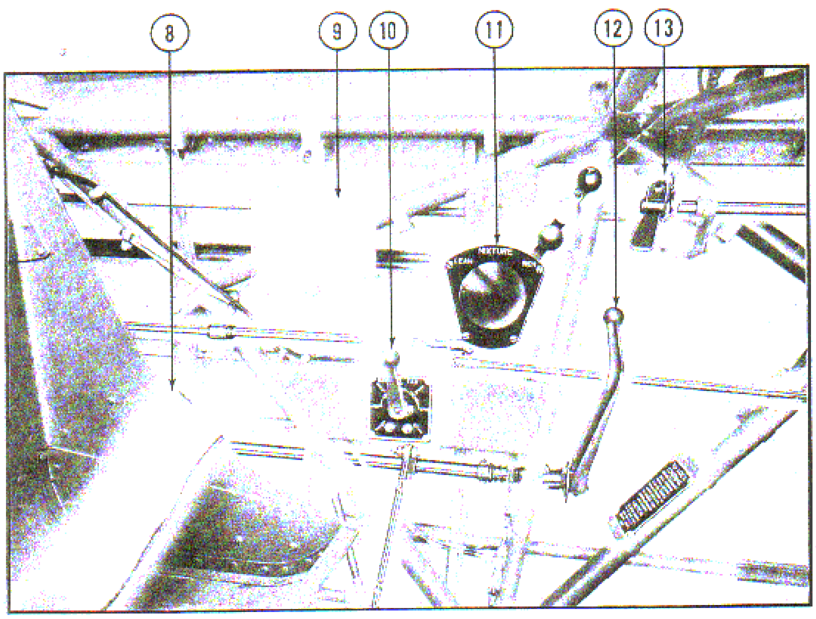


Figure 7—Front Cockpit, Right Side



8. Safety Belt
9. Pilot's Check List
10. Tab Control Handle
11. Engine Control Unit
12. Flight Control Lock Handle
13. Fuel Valve Control

Figure 8—Front Cockpit, Left Side

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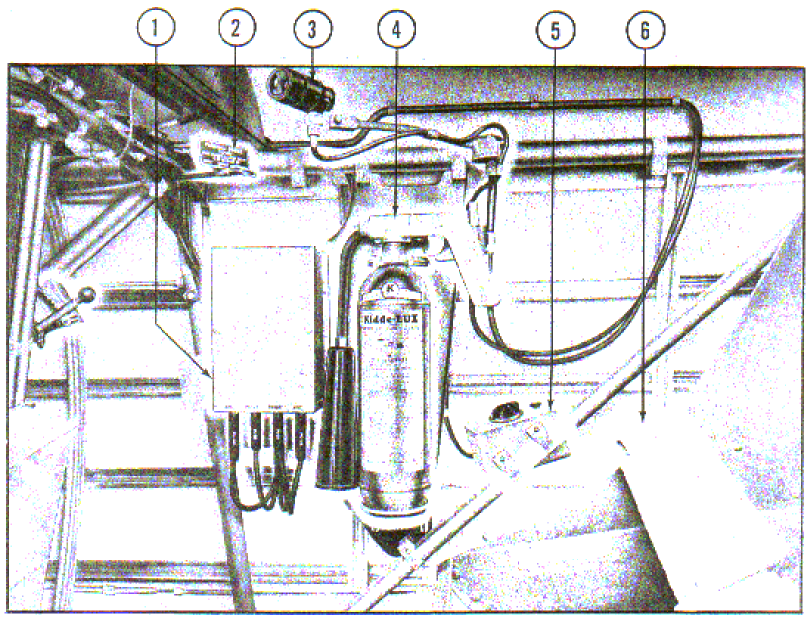
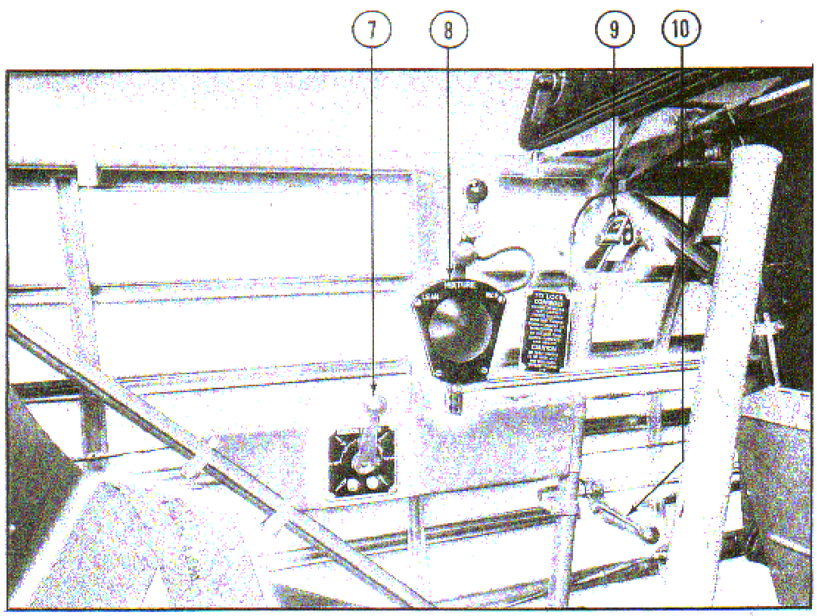


1. Interphone Amplifier
2. Parking Brake Handle
3. Instrument Light
4. Fire Extinguisher
5. Light Switch Box

Figure 9—Rear Cockpit, Right Side



6. Safety Belt
7. Tab Control Handle
8. Engine Control Unit
9. Fuel Valve Control
10. Flight Control Lock Handle

Figure 10—Rear Cockpit, Left Side

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of each cockpit and show in degrees the tab position with respect to the elevator. Full tab range of 15 degrees up and 15 degrees down is sufficient to trim the airplane under all normal load and flight conditions. "AFT" movement of the control handle corrects tail heaviness.

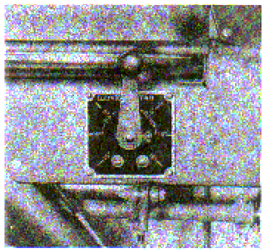

Figure 11—Trim Tab Control

e. RUDDER CONTROLS.—Rudder control is effected through a system of cables and pulleys, by interconnected rudder pedals in each cockpit. Each rudder pedal can be adjusted to compensate for difference in pilot's stature by pushing the pedal adjustment lever inboard thus allowing the pedal to move freely. After the pedal has been moved to the desired location, the lever should be released. Slight movement of the pedal will allow the locking pin to snap into position. Both pedals should be adjusted to the same setting.

Hydraulic brake controls are incorporated on each rudder pedal. Right and left brakes may be applied independently or simultaneously by exerting toe pressure to the respective rudder pedals.

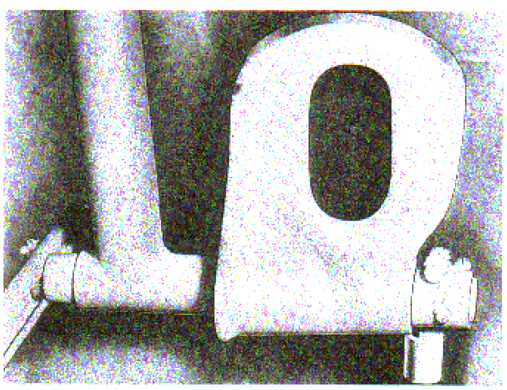

Figure 12—Rudder Pedal Adjustment Lever

f. TAIL WHEEL.—A steerable tail wheel is provided to facilitate taxiing. The rudder pedals give positive control over the tail wheel through 30 degrees left and 30 degrees right, beyond these limits a throwout latch permits the tail wheel to become full swiveling.

The wheel mounts a 10-inch smooth contour tire and incorporates an air-oil type shock absorber.

g. FUEL GAGE.—A sight type fuel gage extending from the underside of the fuel tank is visible from both front and rear cockpits. Calibrations are in fourths of tank capacity and may be read accurately only when the airplane is in level flight. A rear view mirror is provided for the flight instructor's convenience.

h. PARKING BRAKE.—A parking brake handle is located below the instrument panel on the right side of each cockpit. To set the parking brakes pull the handle out, apply toe pressure to both rudder pedals simultaneously, and release the handle. Brakes are released by exerting additional toe-pressure to each rudder pedal.

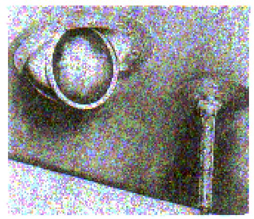

Figure 13—Fuel Gage and Rear View Mirror

Figure 14—Parking Brake Handle

CAUTION

Parking brakes should never be operated while in flight.

i. FLIGHT CONTROLS LOCK.—All flight controls may be locked by operating the flight control handle located on the left side of each cockpit. The control handles are so designed and located that operation of rudder pedals becomes very difficult when the control handles are in their "locked" position, thus eliminating the possibility of attempting a take-off with flight controls locked. Each handle is painted red as a further safety precaution. Flight controls are locked in the following manner:

(1) Aileron controls should be neutralized and the control stick placed in its forward position.

(2) Right rudder should be applied.

(3) Red handle should be pushed forward and down to its locked position.

(4) Left rudder should be applied until locking pin snaps into place.

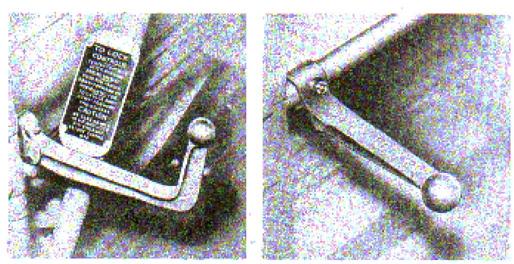

Figure 15—Flight Control Lock Handles, Front and Rear Cockpits

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The flight controls are unlocked by pushing down and forward on the control handle, simultaneously applying pressure to the left rudder pedal until the handle is free of the lock, then releasing the handle to return to its unlocked position.

CAUTION

The control surface lock handle should never be kicked or operated with the feet; hand operation *only* is permissible.

j. ENGINE CONTROLS.

(1) THROTTLE.—The throttle control lever is incorporated in the B-13 engine control unit mounted on the left side of each cockpit. Forward movement of this lever increases engine rpm; aft movement decreases engine rpm.

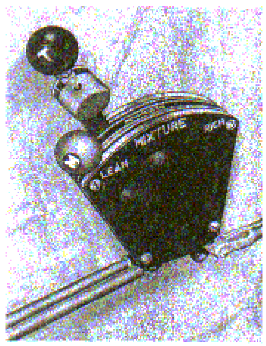

Figure 16—Throttle and Mixture Control Unit

(2) CARBURETOR MIXTURE CONTROL.—The carburetor mixture control lever is incorporated in the B-13 engine control unit adjacent to the throttle control lever. Forward movement of the lever enriches the mixture; aft movement leans the mixture.

(3) FUEL VALVE CONTROL.—Fuel flow from the fuel tank to the engine is controlled by a fuel shut-off valve. This valve is operated by a control handle mounted on the left side of each cockpit, directly below the instrument panel. A dial is provided for each control handle to indicate open or closed position of the fuel valve. To insure proper fuel flow the control handle should be set in the full "ON" position as indicated on the dial.

(4) CARBURETOR AIR CONTROL.—The volume of heated air to the carburetor is determined by a set of butterfly valves in the carburetor air intake housing. The butterfly valves are controlled by a handle mounted on a bracket attached to the right side of the main fuselage structure in an easily accessible position between the front and rear cockpits. Cold air only is admitted to the carburetor when the control handle is placed in its full forward position. Progressive aft movement of the control handle proportionally increases the volume of heated air and decreases the volume of cold air. Heated air only is admitted to the carburetor when the handle is placed in its full aft position. A spring loaded latch is incorporated in the control handle which locks the handle in any desired position. The handle must be depressed to move; when released, the handle automatically locks.

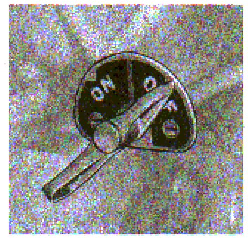

Figure 17—Fuel Valve Control Handle

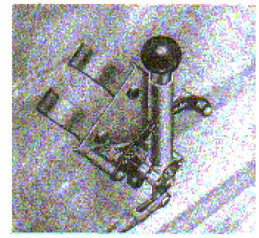

Figure 18—Carburetor Air Control Lever

WARNING

The carburetor air control should be placed in "full hot" position *only* when icing conditions are suspected.

(5) STARTING EQUIPMENT.—Starting equipment consists of a hand operated inertia starter, a starter clutch control and a primer. The starting equipment controls are mounted on a panel in the left side of the engine cowling. When starting the engine, the primer handle should be pushed in, turned to the "ON" position and normally pumped four strokes; on the last stroke, the handle should be fully depressed and turned to the "OFF" position. The handcrank should then be inserted in the starter extension and turned until the inertia wheel is fully energized.

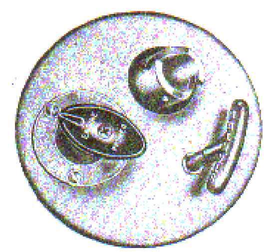

Figure 19—Starting Equipment Controls

With the inertia wheel fully energized, the starter clutch handle should be pulled and not released until the engine fires. This handle, when pulled, engages the starter clutch; when released, disengages the starter clutch.

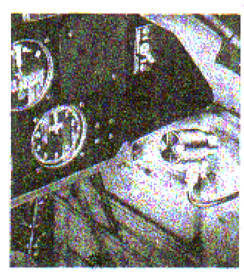

Figure 20—Instrument Light and Compass Light Switch

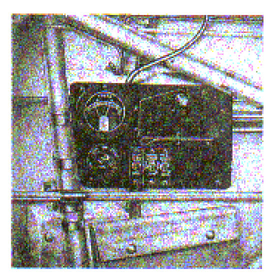

Figure 21—Pilot's Switch Box—Front Cockpit

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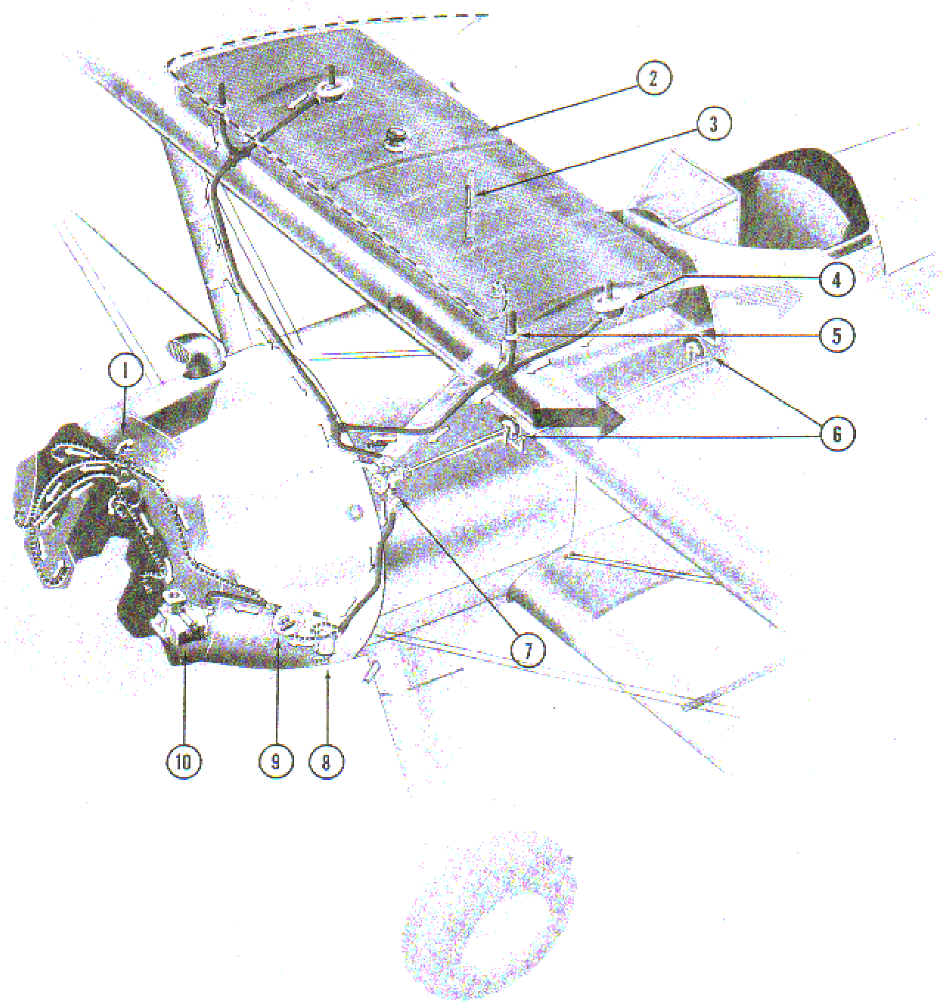

Figure 22—Fuel System Diagram

COLOR CODE

Fuel Tank Vent Line — — — —
Primer Line ....
Fuel Line ▬▬▬▬

1. Primer Distributor
2. Fuel Tank
3. Fuel Gage
4. Fuel Sump
5. Fuel Outlet Strainer
6. Fuel Shut-off Valve Controls
7. Fuel Shut-off Valve
8. Fuel Strainer
9. Primer
10. Carburetor

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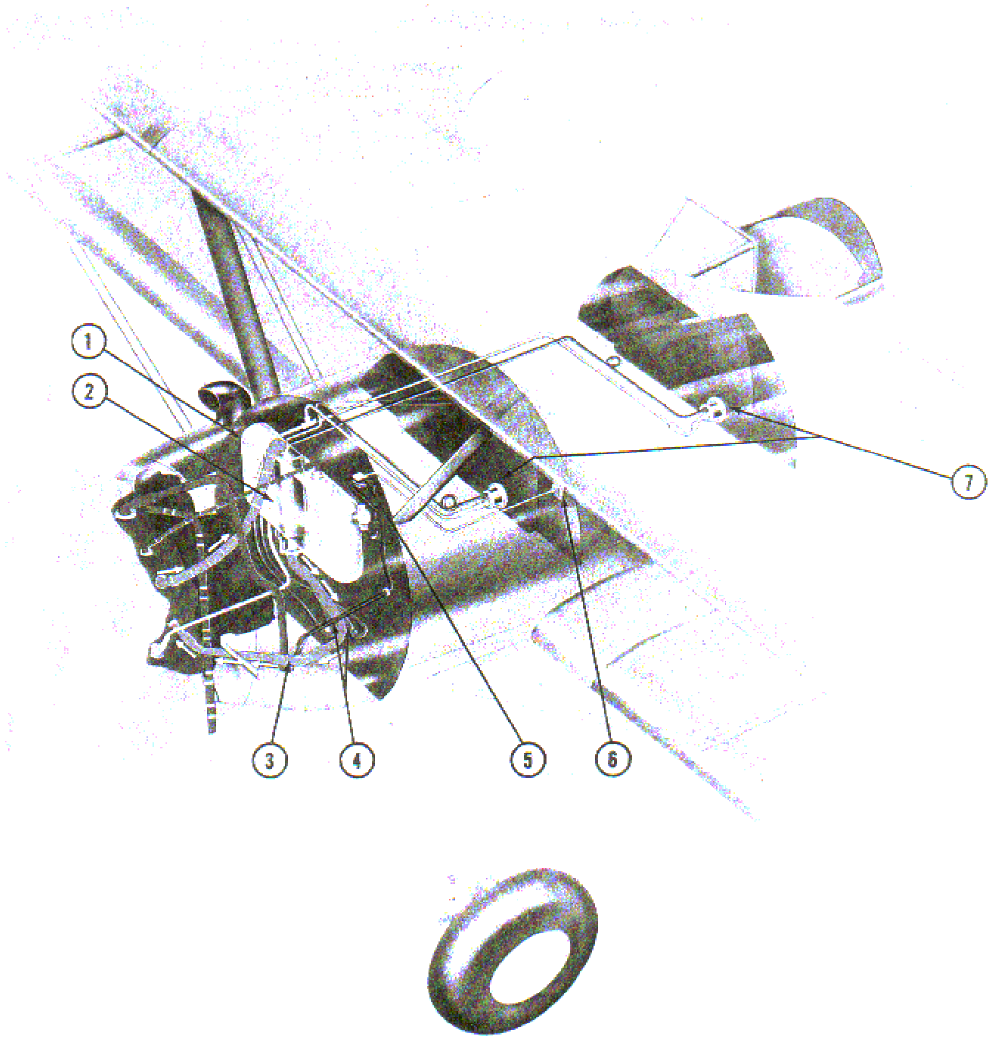

Figure 23—Oil System Diagram

COLOR CODE

Oil Inlet Valve
Oil Outlet Valve
Engine Breather Line
Oil Tank Vent Line
Engine Vent Line
Oil Dilution Fuel Lines
Oil Temperature Lines
Oil Pressure Lines

1. Oil Tank
2. Hopper Tank
3. "Y" Drain
4. Oil Temperature Wells
5. Oil Dilution Solenoid Valve
6. Oil Dilution Switch
7. Engine Gage Units

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k. IGNITION SWITCH.—A four position "off-left-right-both" ignition switch control is provided on the left side of each instrument panel. Magnetos are selected in the respective order as indicated on the ignition switch nameplate. (See figure 5.)

l. FLIGHT REPORT HOLDER.—A wooden type A-2 flight report holder with fabric retaining lid is mounted on a fuselage cross tube on the right side of the front cockpit. (See figure 7.)

m. INSTRUMENT LIGHTS.—An ultra-violet-fluorescent instrument lamp is mounted on a swinging bracket attached to the upper longeron on the right side of each cockpit.

A switch box is mounted on the right side of each cockpit. The switch box in the front cockpit contains: an instrument light rheostat switch, battery disconnect switch, wing light switch, tail light switch, voltmeter, and spare lamps and fuses. The switch box in the rear cockpit contains an instrument light rheostat switch only.

The instrument lights are turned "ON" by holding the rheostat knob in its "START" position. As soon as the light is illuminated, the knob should be released. Intensity of light is controlled with the rheostat knob. Ultra violet light is obtained by clockwise rotation of the instrument light lens. Counterclockwise rotation of the lens produces fluorescent light.

n. FUEL SYSTEM.—The PT-13D/N2S-5 has a gravity feed type fuel system including an aluminum alloy tank, fuel strainer, fuel valve and aluminum alloy fuel lines. The fuel tank mounted in the upper wing center section has a 46-gallon capacity with a 1.38-gallon expansion space. Supply lines are attached to each corner of the fuel tank to insure continuous fuel flow in all flight attitudes. Sumps are provided at the two aft corners incorporating cocks to drain accumulated sediment and water. The sight type fuel gage extending from the underside of the tank incorporates a drain for drawing off collected sediment. (See figure 13.) The fuel strainer is located at the lowest point in the fuel system just ahead of the fire wall and is easily accessible for servicing. A fuel valve controlled by a control unit in either cockpit, is installed in the fuel line at the fire wall. (See figure 22 for fuel system diagram.)

o. OIL SYSTEM.—The oil system consists of an oil tank, "Y" drain, oil temperature wells and incorporates an oil dilution system.

The oil tank is fabricated of aluminum alloy and has an oil capacity of 4.76 gallons with an additional 1.6 gallons expansion space. A standpipe sump in the bottom of the tank prevents sediment in the oil tank from flowing into the engine. A hopper installed within the tank in conjunction with the oil dilution system aids in starting and warm-up of the engine.

The oil dilution system consists of an oil dilution solenoid valve with a fuel line extending to the "Y" drain in the oil-in line of the oil system. The oil dilution valve is controlled by a toggle switch mounted on the left side of the instrument panel in the front cockpit. Oil dilution should be employed when starting the engine in cold weather, and before stopping the engine when a cold weather start is anticipated. See Pilot's Operating Instructions, section II, for detail of oil dilution operations. (See figure 23 for Oil System diagram.)

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SECTION II
PILOT OPERATING INSTRUCTIONS

1. FLIGHT RESTRICTIONS.

Inverted flight.
Inverted spins.
Outside loops.
Snap rolls at more than 106 mph (92 knots).
Slow rolls at more than 124 mph (108 knots).

2. CHECK BEFORE ENTERING COCKPIT.

a. Gross weight—2810 pounds.

b. Operating limits (consult flight operation instruction charts, Appendix II).

c. Flight maneuvers. (See maneuvers prohibited.)

d. Flying characteristics. (Operating with other than normal load, Appendix II.)

3. CHECK ON ENTERING COCKPIT.

a. Ignition switch—"OFF."

b. Parking brake—"ON."

c. Controls—"LOCKED."

d. Throttle—"CLOSED."

e. Mixture control—"FULL LEAN."

f. Carburetor air control—"COLD."

g. Safety belt—"SECURE."

h. Shoulder harness—"SECURE."

i. Clock—"Wind and set with operations office time."

j. Altimeter—"Set with operations office barometric reading."

k. Fuel gage—"FULL."

4. FUEL SYSTEM MANAGEMENT.

a. OIL DILUTION SYSTEM.—An oil dilution system is installed on the PT-13D/N2S-5 airplane to facilitate cold weather starting.

When a cold weather start is anticipated, and oil dilution is desired, the lengths of the dilution periods should be specified each day by the engineering officer. They will be based on weather reports and the engineering officer's judgment for the needs of the engine in that particular locality. Oil dilution is more effective at low oil temperatures because of the low rate of evaporation of the fuel introduced into the oil. For this reason a shorter dilution period can be used if the engine is stopped until the oil cools to 40°C or 50°C (104°F or 122°F) and then restarted and dilution of the oil executed.

When stopping the engine in cold weather, the oil dilution switch should be in the "ON" position for approximately 2 to 4 minutes. The general procedure for diluting the oil before stopping the engine is as follows:

(1) The engine should be idled at 500 rpm.

(2) For ground temperatures from 5.0°C to —7°C (41°F to 19°F) the oil dilution switch should be held in the "ON" position for 4 minutes.

(3) For temperatures from —7°C to —30°C (19°F to —22°F) oil should be diluted for a second 4-minute period 15 minutes after the first dilution.

(4) For temperatures below —30°C (—22°F) the oil should be diluted for a third 4-minute period, 15 minutes after second dilution.

(5) When diluting the oil, the engine should be stopped in the normal manner with the oil dilution switch "ON" until the engine stops turning.

CAUTION

While the oil dilution switch is "ON," note that oil pressure remains normal or has but a small drop.

WARNING

Excessive dilution may increase the amount of fluid in the complete lubrication system to a quantity greater than the capacity of the oil tank. The excess oil and fuel overflows from the oil tank into the accessory drive housing and can easily find its way into the distributor, causing hard starting and injury to distributor parts.

5. ENGINE GROUND OPERATION.

a. REGULAR STARTING AND WARMING UP PROCEDURE.

(1) Ignition switch—"OFF."

(2) Fuel supply—"ON."

(3) Engine should be pulled through several revolutions with the throttle closed in order to suck the fuel mixture into the cylinders and to insure that cylinders are not partially filled with oil or liquid fuel.

(4) Throttle—"OPEN" approximately half. Retard to three quarters inch open as soon as the engine starts.

(5) Mixture control—"FULL RICH."

(6) Carburetor air control—"COLD."

(7) Primer—"Normally 2 strokes in fairly warm weather and 4 strokes in cold weather.

CAUTION

Avoid excessive priming as it has a tendency to wash the oil off the cylinder walls causing scoring of the barrels or seizing of the pistons.

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(8) Energize starter.

(9) Ignition switch—"ON."

(10) Engage engine starter clutch.

(11) Set throttle to attain an indicated engine speed of from 700 to 800 rpm for warm-up.

CAUTION

If oil pressure gage does not register within 30 seconds, stop engine.

(12) Begin taxiing when oil temperature is at least 20°C (68°F) with an oil pressure of 50 pounds per square inch and engine does not misfire when accelerated rapidly.

NOTE

Oil pressure during warm-up should not exceed 80 pounds per square inch maximum.

CAUTION

Excessive ground operation should be avoided as engine will become too hot for take-off.

b. FAILURE OF ENGINE TO START.

(1) Excessive priming is probably the most general cause of difficulty in starting and often results in damage to the engine. Should the engine be overprimed, open the throttle and pull the engine through backwards several revolutions with the ignition switch "OFF" to clear the cylinders of excess fuel.

(2) If the engine does not start the first attempt, another attempt should be made without additional priming.

c. ENGINE AND ACCESSORY GROUND OPERATION TEST.

(1) After warm-up, as indicated by oil temperature of 20°C to 70°C (68°F to 158°F), the throttle should be advanced to obtain full ground rpm.

(2) Test the ignition by switching from "BOTH" to either magneto and back to "BOTH," allowing the engine to pick up loss in rpm. Each magneto should be tested in the same manner. Speed as indicated by tachometer should not be less than 1550 rpm or decrease more than 50 rpm when on either magneto.

WARNING

Never exceed 10 seconds on either magneto when testing.

(3) Oil pressure should be checked for 50 to 75 pounds per square inch.

(4) Oil temperatures should be checked for 20°C to 70°C (68°F to 158°F). Maximum temperature is 85°C (185°F).

6. TAXIING INSTRUCTIONS.

a. Unlock flight controls.

b. The airplane should be taxied in zig zag fashion at a moderate rate of speed. By swinging the nose from side to side, visibility directly ahead can be maintained, thus preventing collision with ground obstacles. The airplane should be taxied slowly in high wind. Brakes should be applied smoothly while making a turn; free swiveling of the tail wheel can be accomplished by applying full rudder in either direction.

7. TAKE-OFF.

a. PREFLIGHT CHECK.

(1) Flight controls—"UNLOCKED" (up).

(2) Elevator trim tab—"NEUTRAL."

(3) Mixture control—"FULL RICH."

(4) Carburetor air control—"COLD" (under icing conditions "HOT").

(5) Altimeter, clock and air-speed indicator: check for proper operation and indication.

(6) Throttle—take off on full throttle.

(7) Oil pressure—desired 50 to 75 pounds per square inch with a minimum of 35 pounds per square inch.

(8) Oil temperature desired 50°C to 70°C (122°F to 158°F) with absolute maximum of 85°C (185°F).

(9) If in warm weather the engine has been running for over 10 minutes continuous ground operation, the engine should be shut down and allowed to cool for 5 minutes before taking off.

8. ENGINE FAILURE DURING TAKE-OFF.

a. Close throttle.

b. Ignition switch should be turned to "OFF" position.

c. Nose should be lowered so that the airplane can maintain a gliding speed of approximately 75 mph (65 knots) straight ahead. Do not attempt to turn back into the field.

9. FLIGHT.

a. AFTER TAKE-OFF.—When obstructions are cleared after take-off, engine speed should be reduced to cruising rpm, 1785.

NOTE

Maximum cruising rpm, 1840; high speed rpm, 2100.

b. CLIMB.— Except in an emergency, a climbing air speed of at least 10 to 15 miles (8 to 13 knots) per hour faster than best climbing speed of the airplane should be maintained for satisfactory cooling. The climbing air speed should not be less than 90 miles per hour (76 knots).

c. ENGINE PERFORMANCE—CHECK.—The engine rpm, oil pressure and oil temperature give the most satisfactory indication of engine performance. If the indicators appear irregular, the engine should be throttled and if the cause cannot be eliminated, a landing should be made to investigate the trouble.

d. USE OF MIXTURE CONTROL.

(1) During take-off, climb (at or near maximum rate), and during high speed level flight, below 3000 feet altitude the mixture control should be maintained in "FULL RICH" position.

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(2) All operations above 3000 feet altitude, mixture should be leaned sufficiently to maintain smooth engine operation and best power.

(3) Cruising operations at or below 70 percent normal rated power where low specific fuel consumption is of major importance the mixture may be leaned sufficiently to give a drop of 25 rpm in engine speed.

e. USE OF CARBURETOR AIR CONTROL.— The carburetor air control should be used in the following manner:

(1) Carburetor icing occurs when outside temperatures are between 6°C and 20°C (43°F and 68°F); thus carburetor heat should be used as required.

(2) When outside temperatures are below 6°C (43°F) use of heat is not necessarily required; however, it is recommended that carburetor heat be used, to prevent the possibility of ice forming in the carburetor venturi and to improve the vaporization and distribution of fuel to the cylinders.

(3) In warm weather the control should be kept in the full cold position to permit the engine to develop maximum power.

WARNING

Watch your tachometer. If the rpm is dropping even though the temperature is outside the specified limits, the probable cause is carburetor icing.

f. USE OF THROTTLE.

(1) After such maneuvers as a stall or spin, the engine should be cleared by opening the throttle. In a long glide the throttle should be opened at least every 250 feet of lost altitude or about every 20 seconds. A throttle between one-third and one-half open clears the spark plugs and develops sufficient heat to prevent overcooling of the engine.

10. CLIMB.

Initial rate of climb—710 feet per minute at sea level.

11. GENERAL FLYING CHARACTERISTICS.

a. Normally loaded, the airplane is stable about all axes.

b. Longitudinal control can be effected with trim tabs.

12. MANEUVERS PROHIBITED.

a. Inverted flight.

b. Inverted spins.

c. Outside loops.

d. Snap rolls at more than 106 mph (92 knots).

e. Slow rolls at more than 124 mph (108 knots).

WARNING

Do not exceed an indicated air speed of 186 mph (163 knots).

13. STALLS.

a. The airplane stalls at 55 mph (48 knots) with normal load.

b. The airplane stalls with power on at approximately 51 mph (44 knots).

14. SPINS.

Spin characteristics are normal.

15. DIVING.

a. Do not exceed a diving speed of 186 mph (163 knots) indicated air speed.

b. Maximum allowable diving rpm—2520.

16. APPROACH AND LANDING.

a. Preparatory to landing, controls should be set in the following manner:

(1) The mixture control—"FULL RICH."

(2) Care should be exercised to prevent overcooling of the engine during long glides.

(3) Airplane should normally be trimmed slightly tail heavy.

b. Avoid cross wind landings when possible.

c. To take off when landing is not completed, the airplane should be leveled off straight ahead and flying speed regained before the climb is started.

17. STOPPING ENGINE.

a. Gradually close the throttle to a normal idling position.

b. Dilute oil if cold weather start is anticipated. See "Fuel Management" of this section.

c. "Cut" the ignition switch and the instant the engine stops firing, open the throttle fully.

d. Close fuel supply line shut-off valve.

CAUTION

Do not attempt to line up the propeller while the engine is hot, since movement of the propeller may result in injury to personnel.

18. BEFORE LEAVING PILOT'S COCKPIT.

a. Fuel—"OFF."

b. Ignition switch—"OFF."

c. Parking brakes—"SET."

d. Flight controls—"LOCKED."

19. MOORING.

Mooring eyes are provided underneath each lower wing panel.

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SECTION III
FLIGHT OPERATING DATA

1. AIR-SPEED LIMITATIONS.

a. Do not exceed an indicated air speed of 186 mph (163 knots).

b. Do not exceed a diving speed of 186 mph (163 knots) indicated air speed.

2. SPECIFIC ENGINE FLIGHT CHART.

SPEC. AN-H-8
DEC. 18, 1942
FORM ASC-512

SPECIFIC ENGINE FLIGHT CHART

AIRPLANE MODELS: PT-13D/N2S-5 (Standardized)

ENGINE MODELS: R-680-17

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F
DESIRED	GRAVITY FEED	50-75	50-70	149°	AIR COOLED	
MAXIMUM		80	85	185°		
MINIMUM		35	20	68°		
IDLING		15	15	59°		

MAX. PERMISSIBLE DIVING RPM: 2520

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	2.94 U.S.QT/HR 4.88 IMP.PT/HR
MAX. CRUISE	2.66 U.S.QT/HR 4.43 IMP.PT/HR
MIN. SPECIFIC	U.S.QT/HR IMP.PT/HR

OIL GRADE: (S) 1120 (W) 1100

SUPERCHARGER TYPE: None

FUEL OCTANE:—73

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	Full Throttle	NO Manifold Supercharger on this airplane	220	—	Sea Level	—	—	Full Rich below 3000 feet (See Remarks)	22.0	18.3	—	—	60
WAR EMERGENCY	—		—	—	—	—	—		—	—	—	—	—
MILITARY	—		—	—	—	—	—		—	—	—	—	—
MAXIMUM CONTINUOUS	Full Throttle		220	—	Sea Level	—	—		22.0	18.3	—	—	60
MAXIMUM CRUISE	1840		163	—	Sea Level	—	—		11.8	9.8	—	—	Continuous
MINIMUM SPECIFIC CONSUMPTION	1780		149	—	Sea Level	—	—		10.75	8.95	—	—	—

REMARKS: Above 3000 altitude lean mixture for drop of 50 RPM; then enrichen for increase of 25 RPM.

WF-1-1-44-5M

Figure 24—Specific Engine Flight Chart

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SECTION IV
EMERGENCY OPERATING INSTRUCTIONS

There are no emergency instructions applicable to this airplane.

SECTION V
OPERATIONAL EQUIPMENT

1. FIRE EXTINGUISHER.

A two pound, type 2TA or type 2TB carbon dioxide hand fire extinguisher is mounted on the right side of the rear cockpit just forward of the seat. The fire extinguisher should be operated in the following manner:

a. Open the catch which attaches the fire extinguisher in its bracket and remove the fire extinguisher.

b. The horn should be swung into position so that the discharge will be directed close to the base of the flame.

c. The discharge is controlled by the trigger on the handle. (See figure 9.)

2. INTERPHONE SYSTEM.

Two-place, type RC-73 interphone equipment has been installed incorporating a BC-709-A interphone amplifier located forward of the fire extinguisher. This amplifier does not incorporate a volume control. Two pairs of plugs may be inserted into the four jacks on the under side of the amplifier with microphone plugs in the outside jacks and phone plugs in the center jacks. This amplifier is designed for two sets of microphones and two head sets, but may be used with a single microphone and either one or two head sets. Clips, mounted on the fuselage structure just aft of the instrument light in the front cockpit and aft of the fire extinguisher in the rear cockpit, secure the head set and microphone jacks when not in use. A "push-to-talk" microphone switch, type SW-210, is mounted on each throttle control handle. (See figure 16.)

3. BAGGAGE COMPARTMENT.

The baggage compartment is located just aft of the rear cockpit and is accessible from the left side of the airplane through a hinged metal door, locked by a Sesamee combination lock. Combination for the Sesamee lock is 000 when the airplane leaves the factory. If a new combination setting is desired, see instructions in the Erection and Maintenance Manual of this airplane.

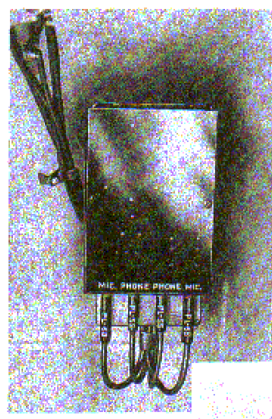

Figure 25—Interphone Amplifier

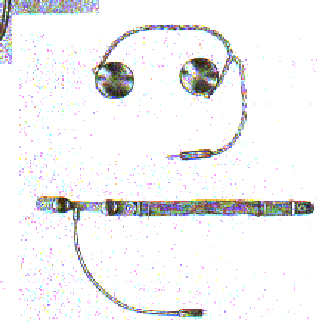

Figure 26—Throat Microphone and Head Sets

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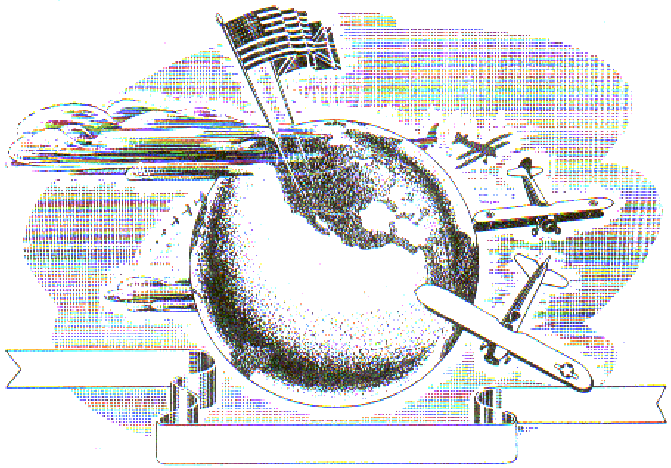
APPENDIX I

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



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U. S. A.	BRITISH	U. S. A.	BRITISH
Air Controls	Flying Controls	Left	Port
Air Field	Landing Ground	Level off	Flatten out
Airplane, without engine	Airframe	Mooring Eyes	Picketing Eyes
Area, Effective landing	Landing Area	Oleo Strut	Compression Leg
Baggage	Luggage	Overload	Non-standard Load
Battery, Storage	Accumulator	Oil Tank (Main)	Service Tank
Carburetor	Carburetter or carburettor	Propeller	Airscrew
Ceiling	Cloud Height	Right	Starboard
Cotter Pin	Split Pin	Roll, Snap	Flick Roll
Course	Track Angle	Shock Cord	Shock Absorber Cord
Empennage	Tail Unit	Air Controls	Flying Controls
Engine or Power Plant	Aero-Engine	Stabilizer:	
Exit	Egress	Horizontal	Tail Plane
Fire Wall	Fire Proof Bulkhead	Vertical	Fin
Gage, Fuel	Fuel Contents Gage or Fuel Level Indicator	Tachometer	Engine Speed Indicator
Ground (Electrical)	Earth	Take-off distance	Take-off run
Gasoline, "gas," or fuel	Petrol	Truck	Lorry
Hand Crank	Hand Starter	Turn Indicator	Direction Indicator
Interphone	Inter-communication	Weight, Empty	Tare
Landing Gear	Alighting Gear	Weight, Gross	All-up Weight
Lean	Weak	Windshield	Windscreen
		Wing	Main plane

★

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APPENDIX II
FLIGHT OPERATING CHARTS, TABLES, CURVES AND DIAGRAMS

1. WEIGHT DISTRIBUTION AND BALANCE OF THE AIRPLANE.

The purpose of the weight and balance portion of this book is to introduce and acquaint the pilot with weight distribution and its resultant effect on the location of the center of gravity. It should be kept in mind that every airplane, regardless of the type, should be so loaded at all times as to keep the center of gravity within certain recommended limits which are predetermined from calculations and flight tests. The curves on the following pages may be used for determining if this airplane is loaded within recommended limits.

Before considering these curves, the following paragraphs, which explain the derivation of the basic weight and corresponding index, should be studied. The basic weight of this airplane is the weight of the airplane empty and does not include instructor, student, gasoline, oil or special equipment. In order that the student may quickly determine whether the airplane is in proper balance, the recommended range of center of gravity given in percent of mean aero-dynamic chord is plotted on a chart, figure 30. On this same chart is plotted the "Gross Weight vs. Index Unit." The index unit is derived from the following equation:

$$\frac{WA}{1000} = I$$

Where W = Weight (in pounds)
A = Distance from forward reference line (in inches)
I = Index Unit

The basic weight and index are listed on figure 27. From the above equation, the curves on figures 29 and 28, "Fuel vs. Index Unit" and "Oil vs. Index Unit," were constructed. If the amount of fuel in the airplane is known, the corresponding index unit may be found from figure 29. The corresponding index unit for any quantity of oil may be found by reference to figure 28. The crew weight and their respective locations, along with the location of baggage and its weight, in increments of ten pounds, are shown on the Balance Diagram, figure 27, with the corresponding Index Unit. By use of the above mentioned equation an index may be calculated for each item at its specified location. The weight and index unit for all items to be carried should be tabulated and the totals obtained for each. The next step for determining final balance of the airplane is to refer to "Gross Weight vs. Index Unit," figure 30, and by use of total weight and total index unit determined above, check the location of the "balance point." This point should fall in the "Recommended Balance Area" of the chart.

The following example illustrates the use of the charts and balance diagram, figures 27, 28, 29, and 30.

A typical loading for ferry purposes will consist of:

	Pounds
Basic Weight (Typical Actual)	2075.0
Pilot (Front Cockpit)	200.0
Oil (4.76 gallons)	35.7
Fuel (46.0 gallons)	276.0
Baggage	50.0

Refer to the Balance Diagram, figure 27, for the index units corresponding to the above listed items. The index units taken from the diagram and their corresponding weights should be tabulated as shown below:

	Index	Weight
Basic Weight	164.1	2075.0
Pilot (Front Cockpit)	20.0	200.0
Oil (4.76 gallons)	1.8	35.7
Fuel (46.0 gallons)	20.8	276.0
Baggage	8.3	50.0
Total Index and Gross Weight	215.0	2636.7

Refer to figure 30, "Gross Weight vs. Index Unit." The "balance point," which is the intersection of the "Index Unit" line and the "Gross Weight" line, falls within the "Recommended Balance Area." Under this loading condition, the airplane is therefore loaded within recommended limits.

The following example will show the effect on balance of expended fuel and oil upon the completion of a typical ferry flight with oil and fuel, remaining in tanks, as shown below:

Oil (3.2 gallons)	24.0
Fuel (3.0 gallons)	18.0

All other items remain constant.

The simplest manner for determining balance at the end of a ferry flight is to deduct expended weight and corresponding index from the original Gross Weight and Index Unit.

Oil expended:	4.8 — 3.2 = 1.6 gallons or 12.0 lbs
Fuel expended:	46.0 — 3.0 = 43.0 gallons or 258.0 lbs

Refer to figure 29, "Fuel vs. Index Unit," for the index unit corresponding to 258.0 pounds of gasoline. Refer to figure 28, "Oil vs. Index Unit," for the index unit corresponding to 12.0 pounds of oil. The index units taken from the charts and their corresponding weights should be tabulated along with Gross Weight and Index Unit, as shown.

				Weight in pounds
Total Index and Gross Weight		215.0		2636.7
Oil	0.6		12.0	
Fuel (expended)	19.4		258.0	
Total expended fuel and oil		20.0		270.0
Resultant Index Unit & Gross Weight		195.0		2366.7

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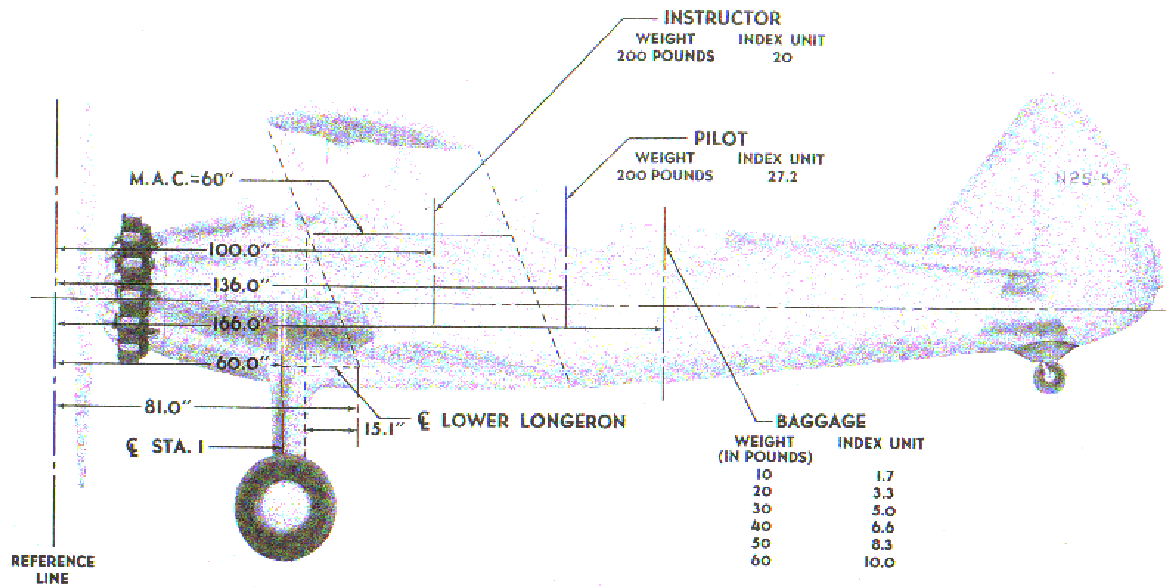

	WEIGHT (IN POUNDS)	INDEX UNIT
BASIC WEIGHT	2075	164.1
FUEL (FULL TANK 46 GALLONS)	276.0	20.8
OIL (FULL TANK 4.76 GALLONS)	35.7	1.8

NOTE: REFER TO FIGURES 27 AND 28 FOR WEIGHT AND INDEX UNIT FOR SMALLER QUANTITIES OF FUEL AND OIL.

SPECIAL EQUIPMENT

ITEM	WHERE STOWED	WEIGHT (IN POUNDS)	INDEX UNIT
ENGINE COVER	BAGGAGE COMPARTMENT	9.5	1.6
COCKPIT COVER	" "	7.2	1.2
TOOL KIT	" "	9.2	1.5
E&M MANUAL	DATA CASE	1.0	.3
PILOT'S HANDBOOK	" "	.7	.2
BATTERY		34.0	2.2

Figure 27—Balance Diagram

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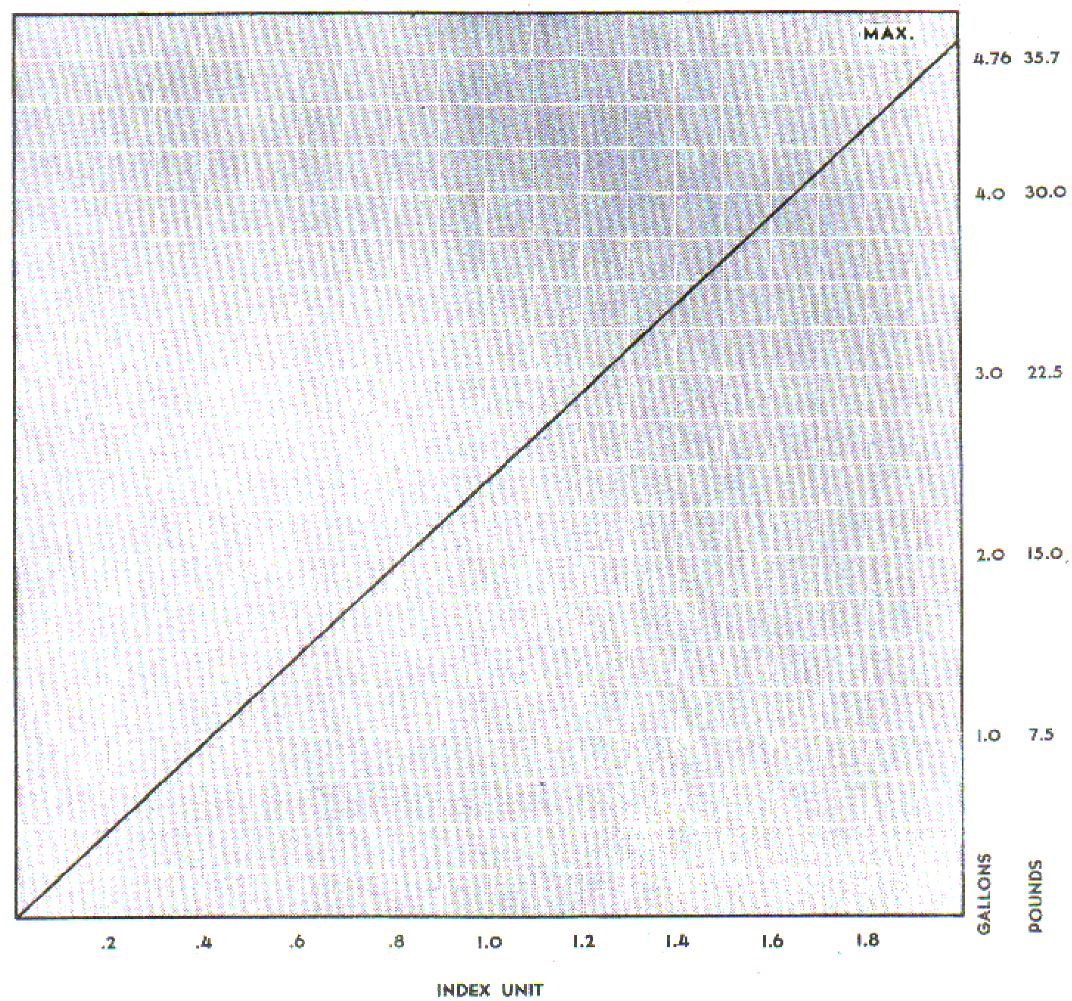

Figure 28—Oil vs. Index Unit

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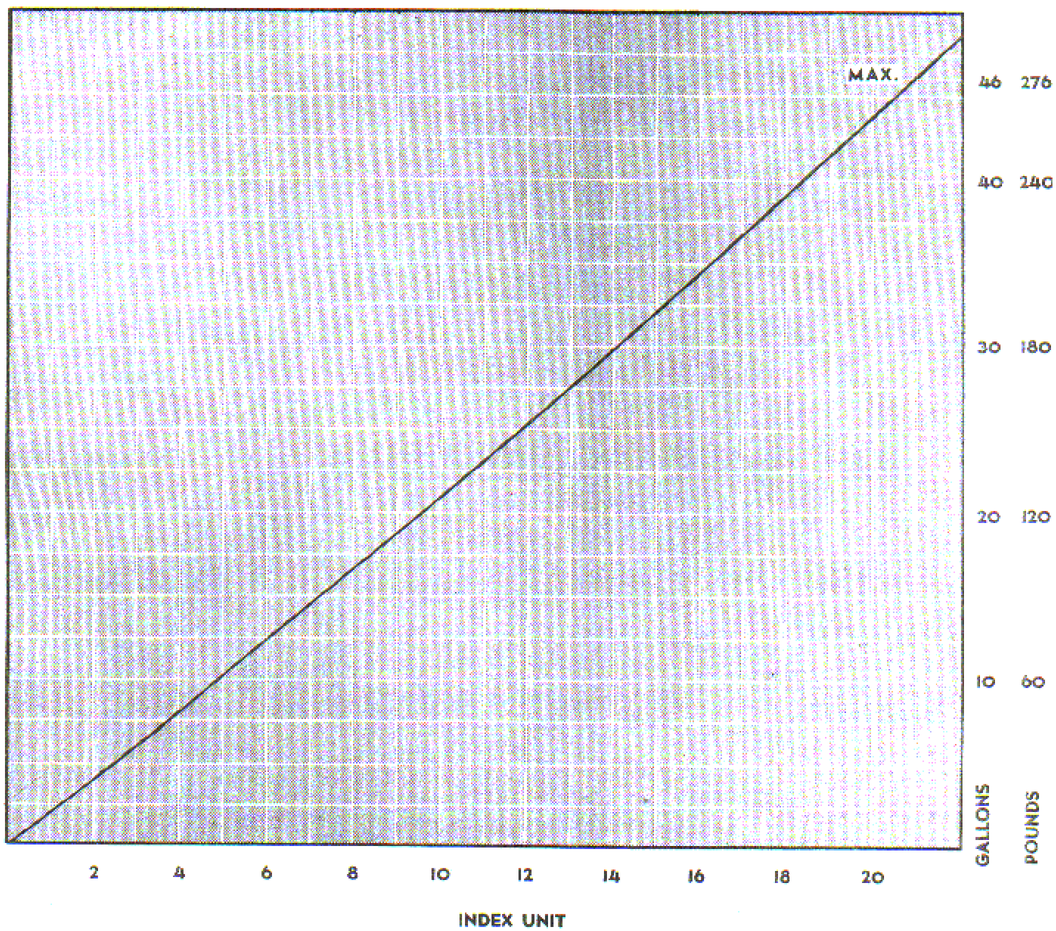

Figure 29—Fuel vs. Index Unit

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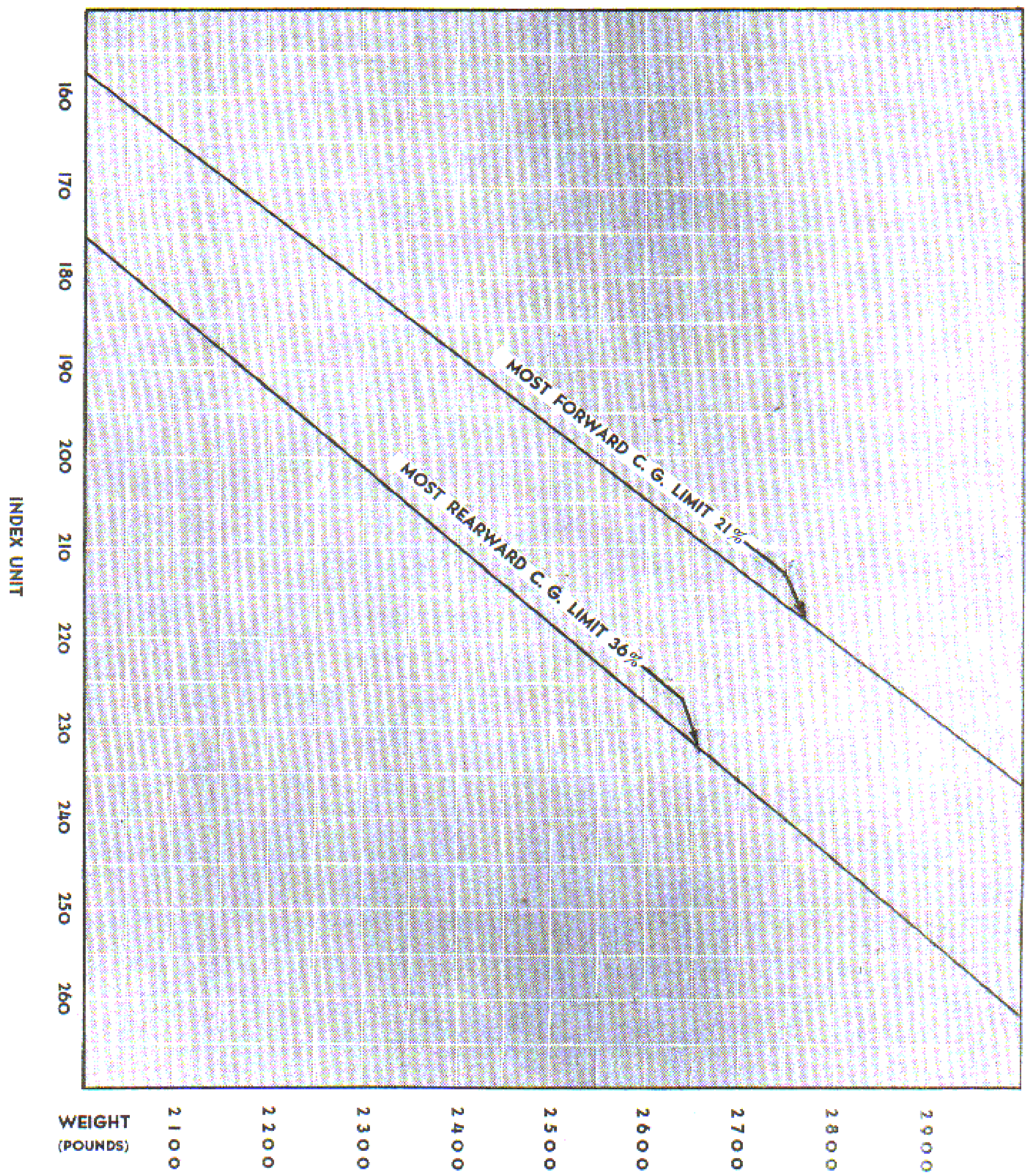

Figure 30—Gross Weight vs. Index Unit

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Refer to figure 30, "Gross Weight vs. Index Unit." The "balance point" falls within the "recommended balance area." Under this loading condition, the airplane is, therefore, loaded within recommended limits.

More advanced types of aircraft contain removable armor and fuel tanks, or other removable weight empty items. For such airplanes, the Weight and Balance section of the Erection and Maintenance Manual lists the items in detail, giving Weight and Index Unit for each. This airplane has no removable equipment; therefore, the weight data herein is identical to that appearing in the Erection and Maintenance Manual.

2. AIRPLANE USEFUL LOAD.

Crew (2 at 200 pounds each)	400	pounds
Fuel (46.0 gallons)	276	
Oil (4.76 gallons)	35.7	
Total Useful Load	711.7	pounds

3. TAKE-OFF, CLIMB AND LANDING CHART.

The Take-off, Climb and Landing Chart (figure 31) is composed of three tables.

a. The Take-off Distance Chart lists for various weights, wind velocities, surface conditions and altitudes, the approximate number of feet required to take-off and also the total distance required to clear a fifty foot obstacle. Example: At full gross weight with slight wind near sea level, the distance required to take-off from a sod runway and clear a fifty foot obstacle such as a power line, should be at least 1060 feet, if the temperature is near freezing. Assume the temperature on the field is ninety-two degrees F (92°F) a correction of 30 percent (92° — 32° = 60°, which is three twenty-degree increments, thus requiring thirty percent increase in distance) additional distance will be required, increasing the ground run, and take-off distance to clear 50 foot object, to approximately 728′ and 1378′ respectively. As shown on the chart, full throttle is used for all take-offs.

b. The landing distance chart lists data similar to the take-off chart, except the best indicated air speed for landing approach replaces the head wind column since the wind velocity is seldom known prior to the landing. It should be noted that temperature corrections are only necessary in very hot weather. While it is possible to take-off or land in distances somewhat shorter than those shown, it is unwise not to take advantage of the entire field.

c. Climb data lists the best indicated air speed, approximate rate of climb, time and fuel required to reach the altitude shown for light and heavy take-off weight. No values are listed opposite "ferry" climb since climb at reduced power is not recommended. In planning a flight to reach a certain altitude at a given time, it is necessary to apply the temperature correction shown.

4. FLIGHT OPERATION INSTRUCTION CHART.

The Flight Operation Instruction Chart (figure 32) is included to illustrate the standard form on which cruising control data is presented. In the upper half of the chart, typical fuel quantities are listed in the "fuel" columns. On a line with each fuel quantity, various ranges are listed in both statute and nautical miles. Directly below each column of ranges the rpm and mixture setting are set forth on a line with the altitude of flight. Indicated air speed, true air speed and fuel consumptions are listed. The column on the extreme left shows conditions for high speed cruising. Columns to the right progressively show increase in range at sacrifice in speed. The extreme right column lists maximum range data. Conditions shown on this chart apply when the gross weight is between 2810 and 2450 pounds as shown in the title block. Example to illustrate the use of the flight operation instruction chart:

Assume (A) No head wind. (B) Full load solo flight (gross weight 2610 pounds). (C) Desired range 300 statute miles plus 25 miles reserve. (D) Flight altitude 6000 feet. Solution: 300 plus 25 is 325 miles required. Total fuel 46 gallons less three gallons, take-off allowances, leaves 43 gallons available (7/8 tank). Select column II showing 325 statute miles. In this column opposite 6000 feet read 1970 rpm, with lean mixture as indicated. Upon reaching 6000 feet in full rich, reduce rpm to 1995 by throttle, "establish course and trim." With mixture control "lean out" for 50 rpm drop and carefully "rich up" 25 rpm or to 1970 rpm. Under these conditions the fuel consumption will be about 14 gallons per hour and indicated air speed 102 mph. It will be noted that the same range may be obtained at 3000 feet, 1820 rpm, "Full Rich" or at 9000 feet, 1960 rpm, leaned out as explained above whereas 1860 rpm, with lean mixture at 6000 feet in column III will give increased range but with decreased speed. The maximum range of the PT-13D/N2S-5 is obtained at sea level with 1660 rpm, and "Full Rich" mixture.

NOTE

On each of the charts red figures have been entered to indicate values which have not been verified in flight. All chart values are conservative.

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

AIRPLANE MODELS
PT-13D/N2S-5
(Standardized)

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS
R-680-17

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.
2810	0	0	475	975	630	1300	840	1820	560	1060	765	1330	1200	2185	785	1285	1100	1765	1680	2660
	17	15	235	580	310	770	410	1090	280	620	380	840	595	1275	390	735	550	1010	840	1515
	34	30	85	275	115	390	150	525	95	285	130	405	205	575	125	315	175	450	270	640
	51	45	10	45	15	65	20	85	15	50	20	70	25	95	20	55	25	75	35	105
2450	0	0	360	695	480	900	635	1215	425	755	580	1000	915	1495	595	925	835	1255	1275	1855
	17	15	175	405	235	525	310	710	210	440	290	580	465	860	300	525	415	705	640	1035
	34	30	65	190	85	260	115	335	75	200	100	270	155	375	95	220	135	305	205	425
	51	45	5	30	10	40	15	55	10	35	15	45	20	60	15	40	20	50	25	65
	0	0																		
	17	15																		
	34	30																		
	51	45																		

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

ENGINE LIMITS FOR TAKE-OFF Full Throttle RPM

CLIMB DATA

COMBAT MISSIONS USE Full Throttle RPM

FERRY MISSIONS USE Full Throttle RPM

GROSS WEIGHT IN LBS.	TYPE OF CLIMB	S. L. TO				3000 FT. ALT.						6000 FT. ALT.						9000 FT. ALT.						11,600 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.	
2810	COMBAT FERRY	77	67	710	—	76	66	550	5	5	4	73	63	400	11	6	5	69	60	240	21	8	6	67	58	100	37	11	9	—
2450	COMBAT FERRY	77	67	1070	—	76	66	870	4	4	4	73	63	680	7	5	4	69	60	490	12	7	6	67	58	320	19	8	7	—
	COMBAT FERRY																													

NOTE: INCREASED ELAPSED CLIMBING TIME 5 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (10 % FOR EACH 20°F ABOVE 32°F) 3.0 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
2810	85	74	1125	440	1200	485	1275	525	1170	490	1245	530	1330	580	1710	1025	1835	1120	1975	1225
2450	85	74	1055	415	1120	455	1180	495	1095	455	1165	500	1240	545	1585	945	1760	1095	1825	1130

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
RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

Figure 31—Take-Off, Climb and Landing Chart

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WF-8-17-43-5M

MODEL(S)
PT-13D/N2S-5
(Standardized)

ENGINE(S): Lycoming R-680-17

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 2810 TO 2450 POUNDS

EXTERNAL LOAD ITEMS

None

LIMITS	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G.P.H.
WAR MAX	—	—	—	—	—	—
MILITARY POWER	—	—	—	—	—	—
NORMAL RATED	220	②	—	F.R.	—	22

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. 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. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I: RANGE IN AIR MILES STATUTE	I: NAUTICAL	FUEL U.S. GAL.		II: RANGE IN AIR MILES STATUTE	II: NAUTICAL	III: RANGE IN AIR MILES STATUTE	III: NAUTICAL	IV: RANGE IN AIR MILES STATUTE	IV: NAUTICAL	FUEL U.S. GAL.		V: RANGE IN AIR MILES STATUTE	V: NAUTICAL
		46	Full	① 3 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ○						46	Full		
190	158	43	7/8	325	282	362	314			43	7/8	376	326
153	127	35	3/4	261	226	290	251			35	3/4	302	262
102	85	23	1/2	174	151	193	167			23	1/2	201	174
51	42	12	1/4	87	75	96	85			12	1/4	100	87

MAXIMUM CONTINUOUS R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. In. Hg.	G.P.H.	T.A.S.	ALT. Feet	OPERATING DATA (II) R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. In. Hg.	G.P.H.	T.A.S.
						30000						
						25000						
						20000						
						15000						
						12000	Cruising above 10,000 feet is not recommended					
						9000	1960	95	L.	②	12.5	109
						6000	1970	102	L.		13.5	111
						3000	1920	97	F.R.		12.5	101
2100	122	F.R.	②	22	122	S.L.	1900	109	F.R.		13.3	109

ALT. Feet	OPERATING DATA (III) R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. In. Hg.	G.P.H.	T.A.S.	OPERATING DATA (IV) R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. In. Hg.	G.P.H.	T.A.S.
30000												
25000												
20000												
15000												
12000	Cruising above 10,000 feet is not recommended											
9000	1880	91	L.	②	11.25	104						
6000	1860	94	L.		11.25	103						
3000	1915	104	L.		11.5	109						
S.L.	1800	112	F.R.		11.1	112						

ALT. Feet	MAXIMUM RANGE R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. In. Hg.	G.P.H.	T.A.S.
30000						
25000						
20000						
15000						
12000						
9000						
6000						
3000						
S.L.	1660	92	F.R.	②	9.5	92

NOTES

① ALLOW 3 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.
② NO INSTRUMENTS INSTALLED.

EXAMPLE

AT 2810 LB. GROSS WT. WITH 43 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 3 GAL.) TO FLY 325 STAT. AIRMILES AT 6000 FT. ALT. MAINTAIN 1970 RPM AND 102 MPH IND. AIRSPEED WITH MIXTURE SET LEAN POSITION.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
L.: LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 32—Flight Operation Instruction Chart

Fig. 32—Flight Operation Instruction Chart

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APPENDIX III
FLIGHT OPERATION CHARTS

(For Navy Use Only)

1. The cruising control curves included in this appendix are provided for Navy use only. These curves are applicable to the PT-13D/N2S-5 (standardized) airplane only and should be consulted when planning cruising flights.

2. All curves are drawn for 2810 pounds gross weight under standard altitude and temperature conditions. When the airplane is flown at less than gross weight and under other than standard altitude and temperature conditions, corrections must be made as explained in the following example:

3. The following typical flight problem will demonstrate the use of the cruising control curves and tables:

a. Given:

Weight of the airplane for the intended trip	2610 lbs
Desired ground speed	85 knots
Pressure altitude	6000′
Reported free air temperature at 6000′ altitude	10° C
Reported relative headwind at 6000′ altitude	10 knots

b. Find:

(1) The fuel consumption in miles per gallon.
(2) The indicated air speed.
(3) The fuel consumption in gallons per hour.
(4) Cruising RPM.

c. Solution:

(1) On the "True Air Speed vs. Density Altitude" curve, (indicating indicated air speed in knots and fuel consumption in gal/hr) find the standard temperature at 6000′ altitude to be 3° C. Since the actual reported temperature at 6000′ altitude is 10° C a difference of 7° C above the standard temperature exists. For each 1° C increase in temperature, 110′ of altitude must be added to the pressure altitude to obtain actual density altitude; thus, 7 × 110′ = 770′ makes the density altitude reading 6770′. To make a ground speed of 85 knots with 10 knots relative headwind a true air speed of 95 knots must be maintained. On the Weight Correction table at 2600 pounds find the true air speed nearest 95 knots, which will be 96 knots found in column three. Since the airplane requires less power to fly at 2610 pounds, as indicated by the Weight Correction table, fuel consumption will correspond to 1 knot less than the desired true air speed. On the "True Air Speed vs. Density Altitude" curve (indicating miles per gallon) find density altitude 6770′ and true air speed 94 (95 — 1) knots which will give a fuel consumption reading of approximately 7.65 miles per gallon.

(2) On the "True Air Speed vs. Density Altitude" curve (indicating indicated air speed in knots and fuel consumption in gal/hr) find 6770′ density altitude and 95 knots true air speed which will give an *indicated* air speed reading of 85 knots. The air-speed indicator in the airplane has an inherent error of 1 knot slow as shown on the "Air-Speed Error" table; thus an air-speed indicator reading of 84 knots must be maintained to obtain the desired 85 knots indicated air speed.

(3) In the Weight Correction table at 2600 pounds find the indicated air speed nearest 85 knots, which will be 86 knots, found in column five. Since the airplane requires less power to fly at 2610 pounds, as is indicated by the Weight Correction table, fuel consumption will correspond to 1 knot less than the desired indicated air speed. Thus on the "Indicated Air Speed vs. Density Altitude" curve (indicating engine RPM and fuel consumption in gal/hr) find 6770′ density altitude and 84 (85 — 1) knots indicated air speed which will give a fuel consumption reading of approximately 16 gal/hr.

(4) On the "Indicated Air Speed vs. Density Altitude" curve (indicating engine RPM and fuel consumption in gal/hr) find 6770′ density altitude and 84 knots indicated air speed which will give a reading of approximately 1930 RPM.

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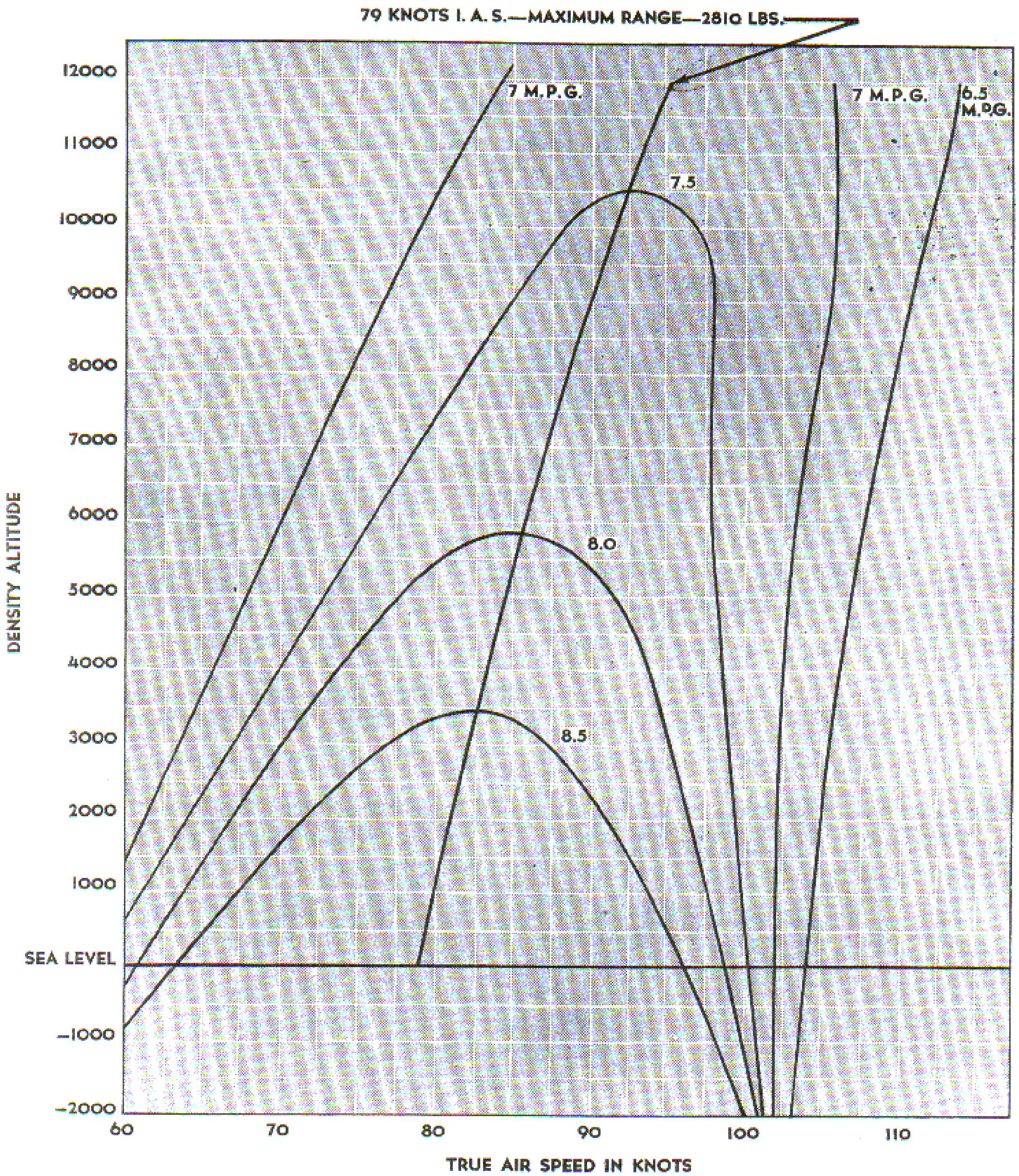

Figure 33—True Air Speed vs. Density Altitude (Indicating Miles/Gal)

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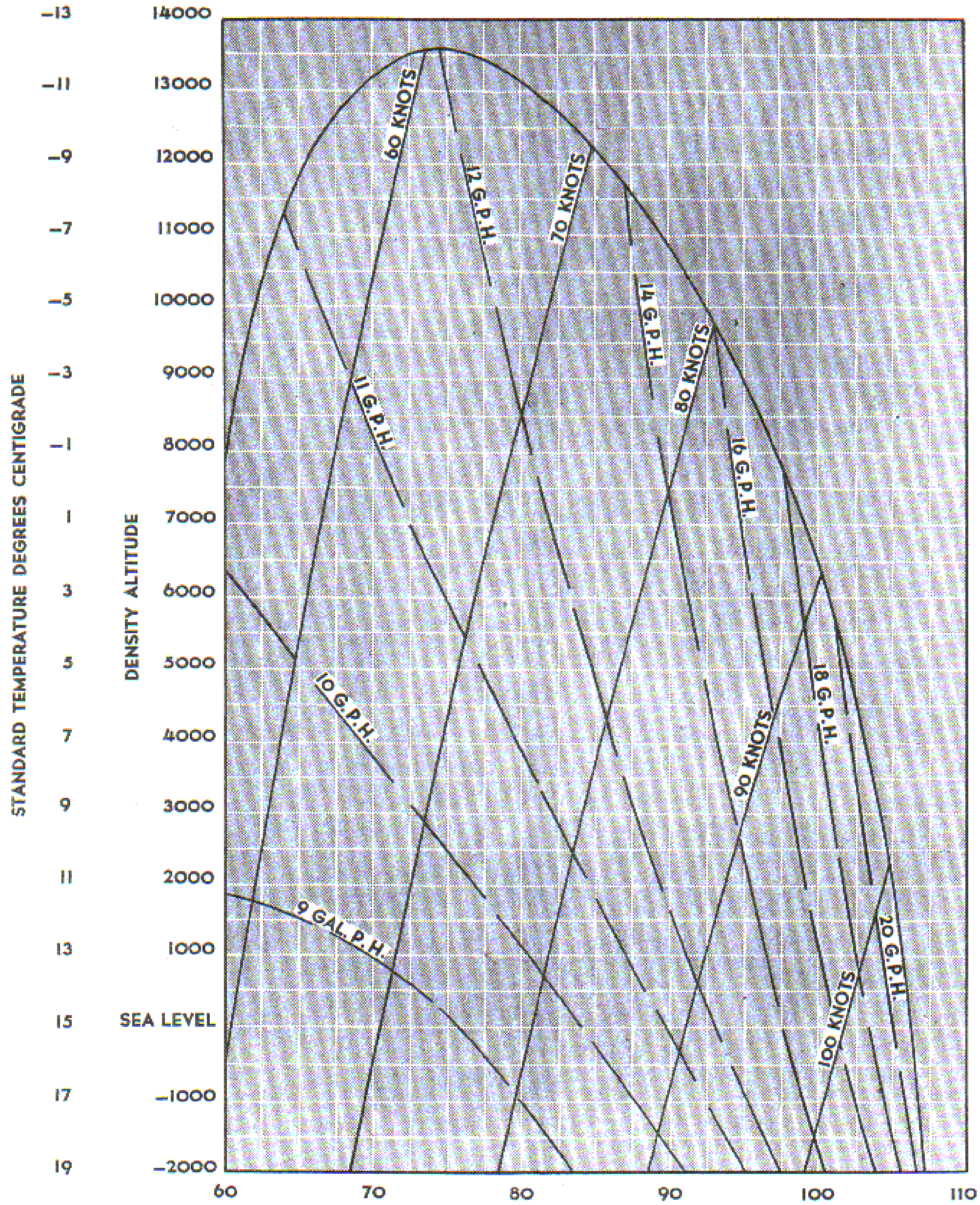

Figure 34—True Air Speed vs. Density Altitude (Indicating Knots and Gal/Hr)

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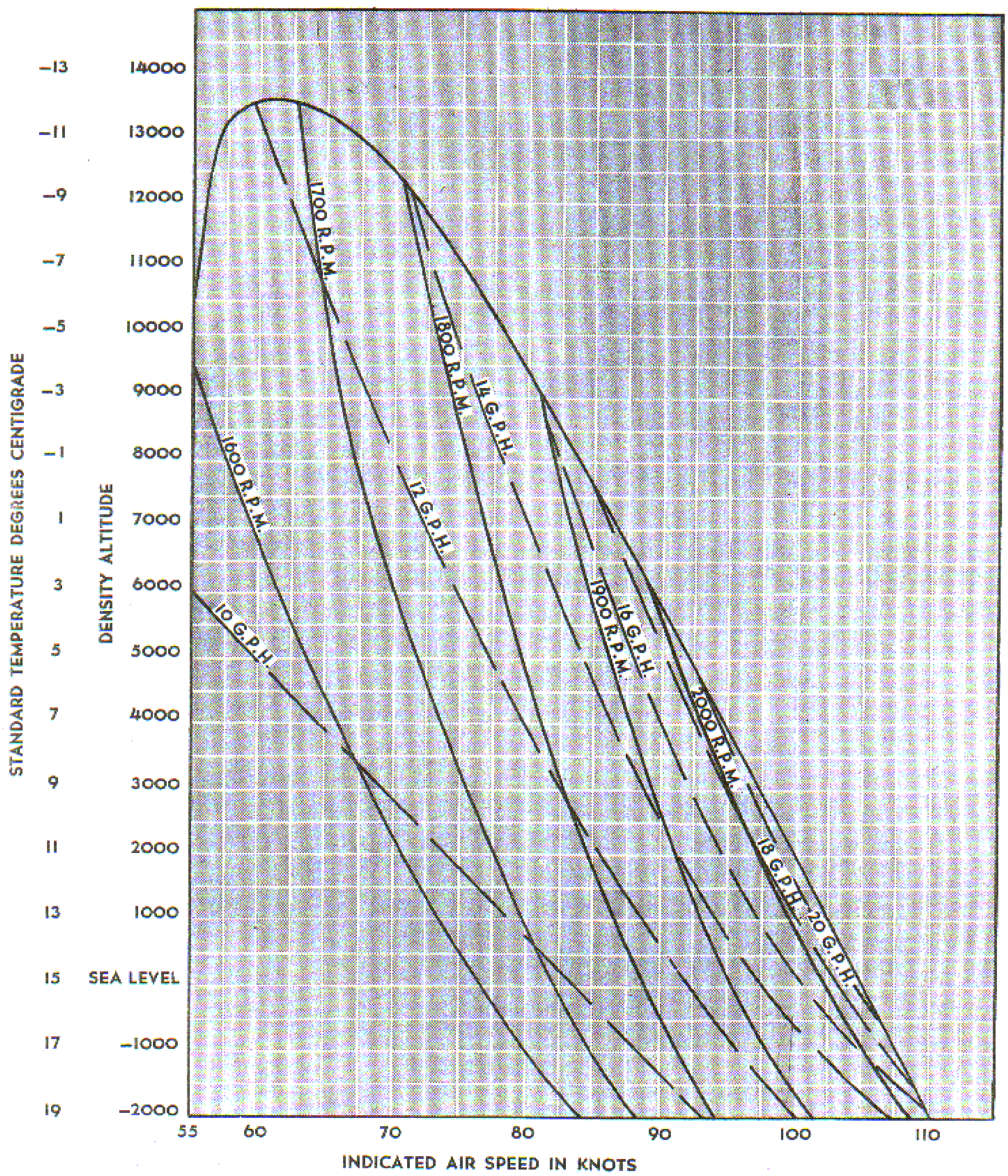

Figure 35—Indicated Air Speed vs. Density Altitude (Indicating Gal/Hr and RPM)

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WEIGHT CORRECTION TABLE

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

WEIGHT	TRUE AIRSPEED AND/OR INDICATED AIRSPEED IN KNOTS							I.A.S. FOR MAXIMUM RANGE-ENDURANCE	
2900	102	98	95	90	85	79	72	80	73
2800	102	99	95	90	85	80	74	79	71
2700	103	99	96	90	86	81	74	78	70
2600	103	100	96	91	86	81	74	76	69
2500	104	100	96	91	87	82	75	75	68
2400	104	100	96	92	87	82	76	73	66

Figure 36—Weight Correction Table

AIRSPEED ERROR

The Indicated Airspeeds on this graph include the inherent Airspeed Error of the PT-13D/N2S-5 Airspeed Meter installation. They vary from correct Indicated Airspeeds as follows:

CORRECT KNOTS	TYPE PT-13D/N2S-5 KNOTS	CALIBRATION FOR PLANE NO.
66	65	
71	70	
81	80	
91	90	
101	100	
112	110	
122	120	

Figure 37—Air-Speed Error

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