



PILOT'S HANDBOOK OF  
Flight Operating Instructions  
*FOR*  
Models B-25C and B-25D  
*November 1, 1942*

PILOT'S HANDBOOK OF  
Flight Operating Instructions  
FOR  
Models B-25C and B-25D

*AIRPLANES POWERED WITH 2 MODEL R-2600-13 ENGINES*



*Manufactured by North American Aviation, Inc., Inglewood, California*

*Contract: W535 ac-16070, 23471 (B-25C)*

*Spec. Type C-213, Model NA-954*

*Contract: W535 ac-19341 (B-25D)*

*Spec. Type C-213, Model NA-5106*

*NOTE: This Technical Order replaces T.O. No. 01-60GB-1 dated March 10, 1942.*

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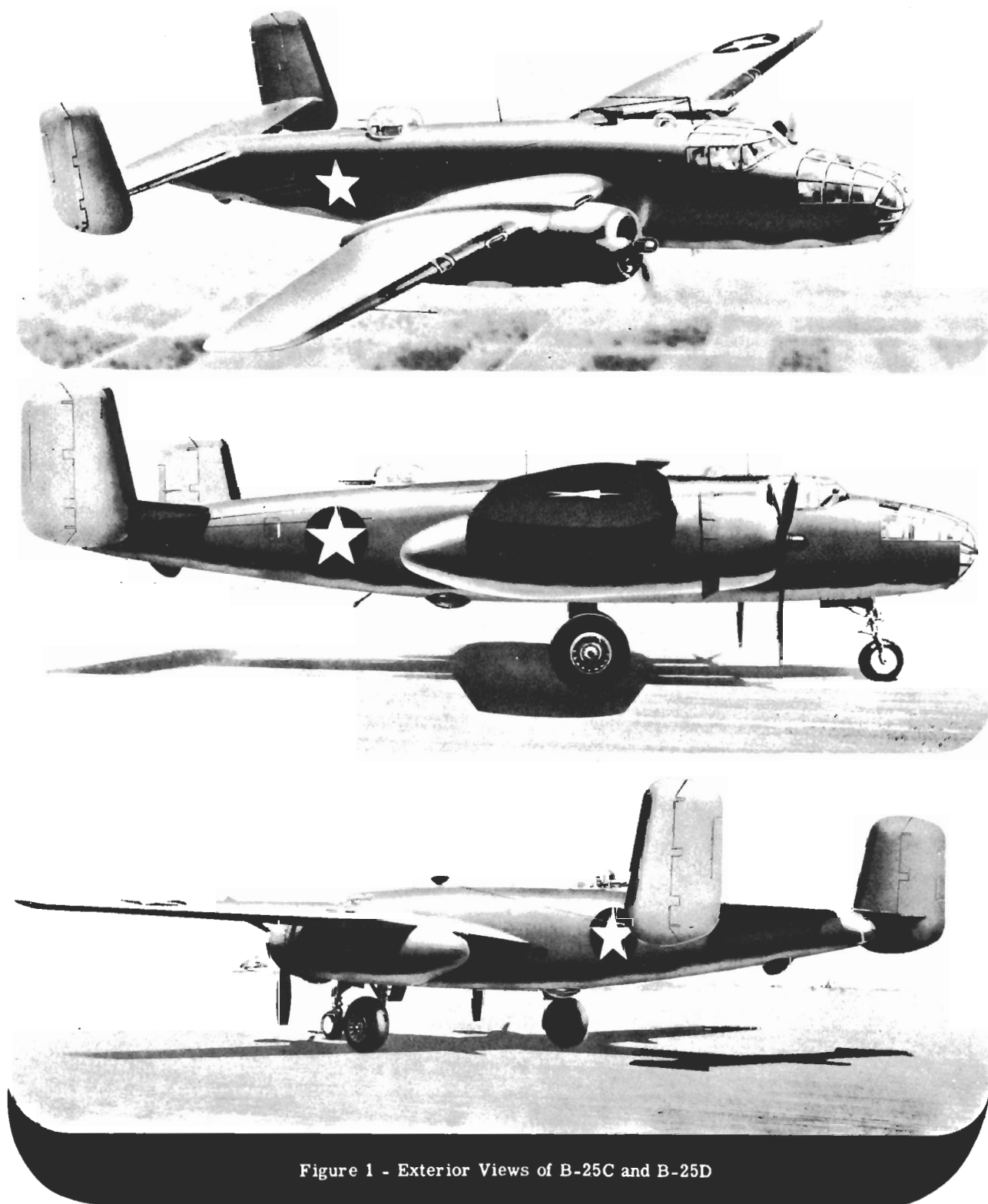


Figure 1 - Exterior Views of B-25C and B-25D

## SECTION I

### DESCRIPTION

#### 1. AIRPLANE

a. General. - The model B-25C and B-25D bombardment airplanes are mid-wing, land monoplanes, each powered by two Wright Cyclone R-2600-13 engines. Propellers are the three blade type, hydro-matic, and full-feathering. Hydraulically operated tricycle landing gear, wing flaps, engine cowl flaps, bomb bay doors, and brakes are provided. The crew consists of the pilot, copilot, bombardier, radio operator, and photographer. The approximate over-all dimensions are:

Span	67 ft 6 in.
Length	53 ft
Height	15 ft 9 in

b. Landing Gear. - A fully retractable, hydraulically operated, tricycle type landing gear is provided. Doors cover the gear openings in both retracted and extended positions. The swivel type nose gear strut has a centering device which operates when the strut is fully extended (wheel off ground). An emergency air brake system is provided and consists of an air pressure storage tank in the navigator's compartment, an automatic transfer valve for each wheel, and an air valve controlled by a lever, accessible to pilot and copilot. The air pressure tank is provided with a gage and can be recharged from the ground only.

c. Indicators. - When either throttle is retarded for landing and the landing gear is not locked down, a warning horn will sound to warn of an unsafe landing condition. A release switch (figure 16-94) is provided to render the horn inoperative during one-engine or closed-throttle maneuvers. Opening the throttle automatically reinstates the warning horn. A position indicator (figure 16-111) for the landing gear, landing gear down-position locks, and wing flaps is provided on the pilot's instrument panel.

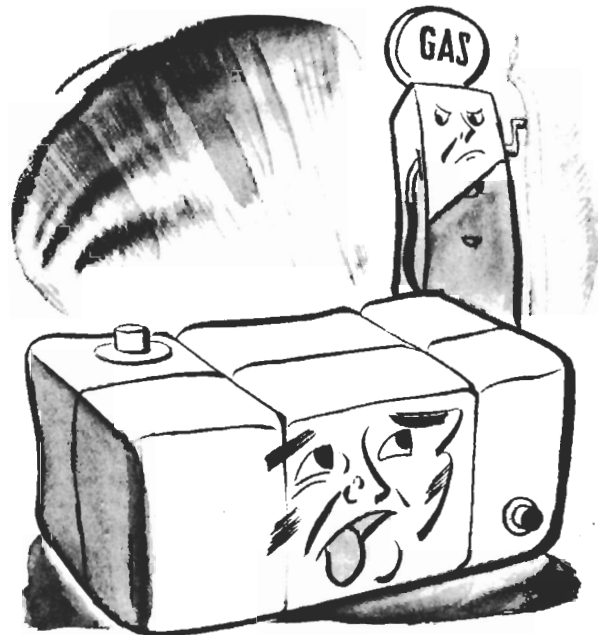
d. Hydraulic System. - Pressure for the system is supplied by two engine-driven pumps connected in parallel, one mounted on each engine. A hand pump for emergency operation is provided. (See figures 2, 3, and 4.)

e. Fuel System. - Each engine is provided with an independent system. The four main fuel tanks have a capacity of 658 U.S. gallons (548 Imperial gallons). A droppable bomb bay tank with a capacity of 418.8 U.S. gallons (348.9 Imperial gallons) is provided and is usable only as a reserve tank. Its fuel can be transferred only into the wing fuel compartments. (See figures 5 and 6.)

f. Fuel Transfer System. - (Applicable to B-25C airplanes, serial Nos. AC-41-12817 and higher, only, and B-25D airplanes, serial Nos. AC-41-29848 and higher only.) A fuel transfer system with electrically operated auxiliary transfer pumps and a manually

controlled cross-feed shut-off valve is provided. (See figures 5 and 6.) No provision is made for returning fuel to the bomb bay tank.

g. Fuel Transfer System. - (Applicable to B-25C airplanes, serial Nos. AC-41-12434-12816 inclusive, only, and B-25D airplanes, serial Nos. AC-41-29648-29847 inclusive.) These earlier airplane models have a fuel transfer system with manually controlled selector valves and an electrically operated reversible pump. Fuel may be returned from the front wings to the bomb bay droppable tank. (See figures 5 and 6.)



*Do not allow one fuel tank to run completely dry before switching to another tank!*

h. Electrical System. - The electrical system is a 24-volt, single wire circuit. Two 24-volt batteries are provided, one inside each engine nacelle, immediately aft of the fire wall. Either battery operates the system, including starters. The batteries are charged by engine-driven 30-volt, 200-ampere generators. A generator control panel located at the right rear of the navigator's compartment controls the charging voltage of the generators.

i. Interphone System. - The RC-36 interphone system installed in these airplanes consists of a type BC-347 amplifier, one BC-366 jack box for each station, and one T-30 throat microphone for each crew member. The power for this equipment is furnished by a PE-86 dynamotor. For detailed radio operating instructions, refer to section V.

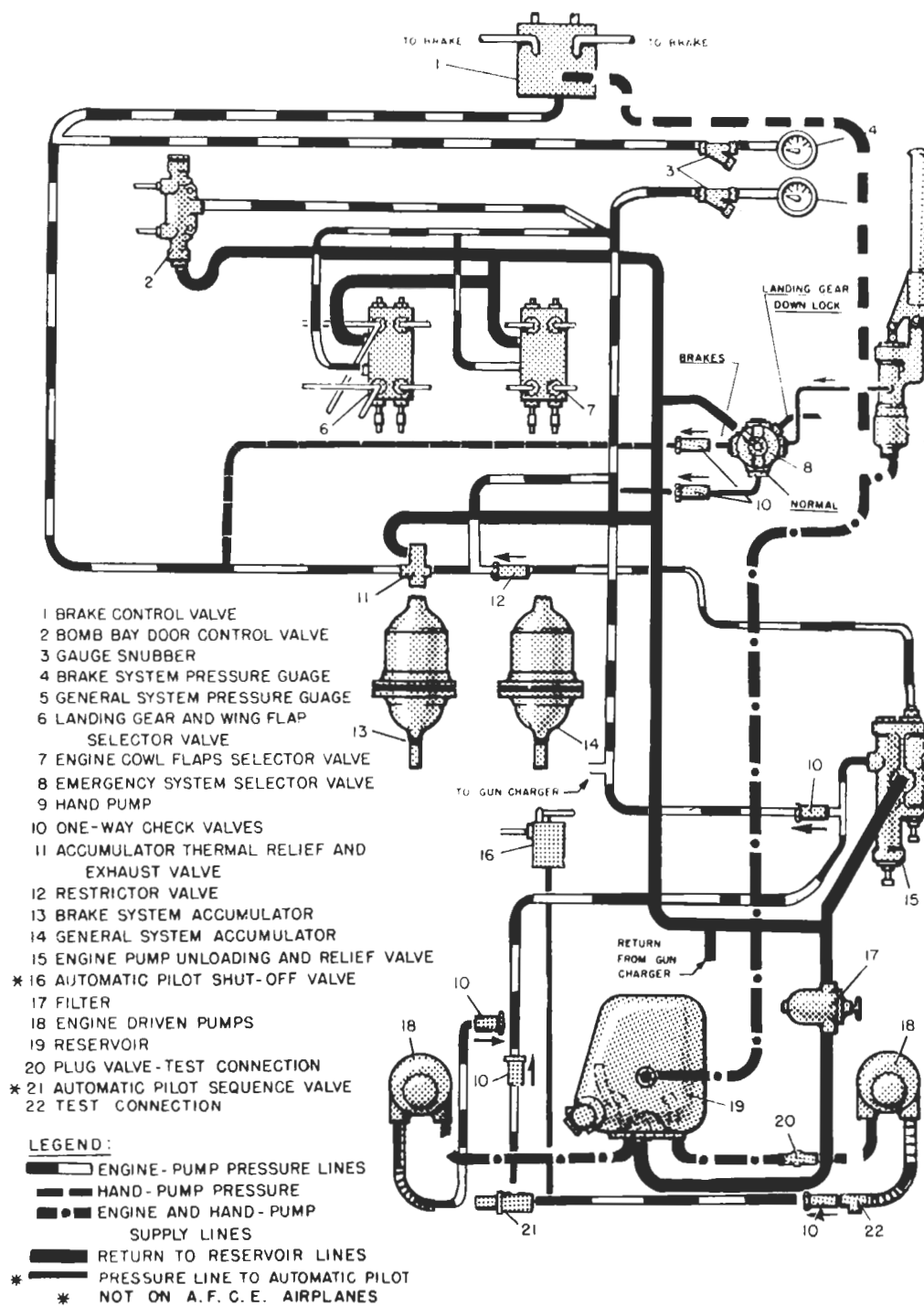


Figure 2 - Hydraulic System Lines Diagram (Power Lines System)

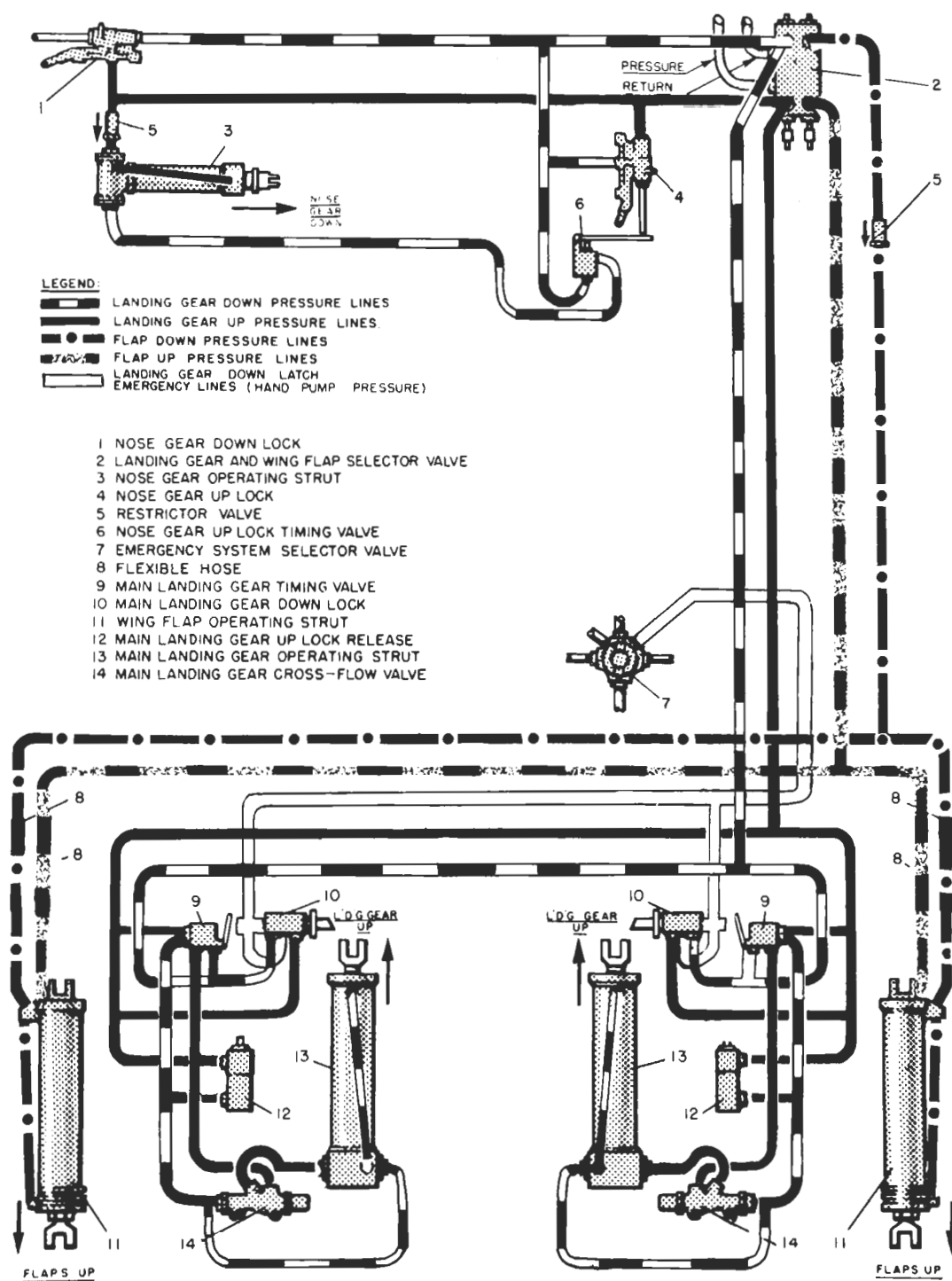


Figure 3 - Hydraulic System Lines Diagram (Landing Gear and Wing Flaps System)

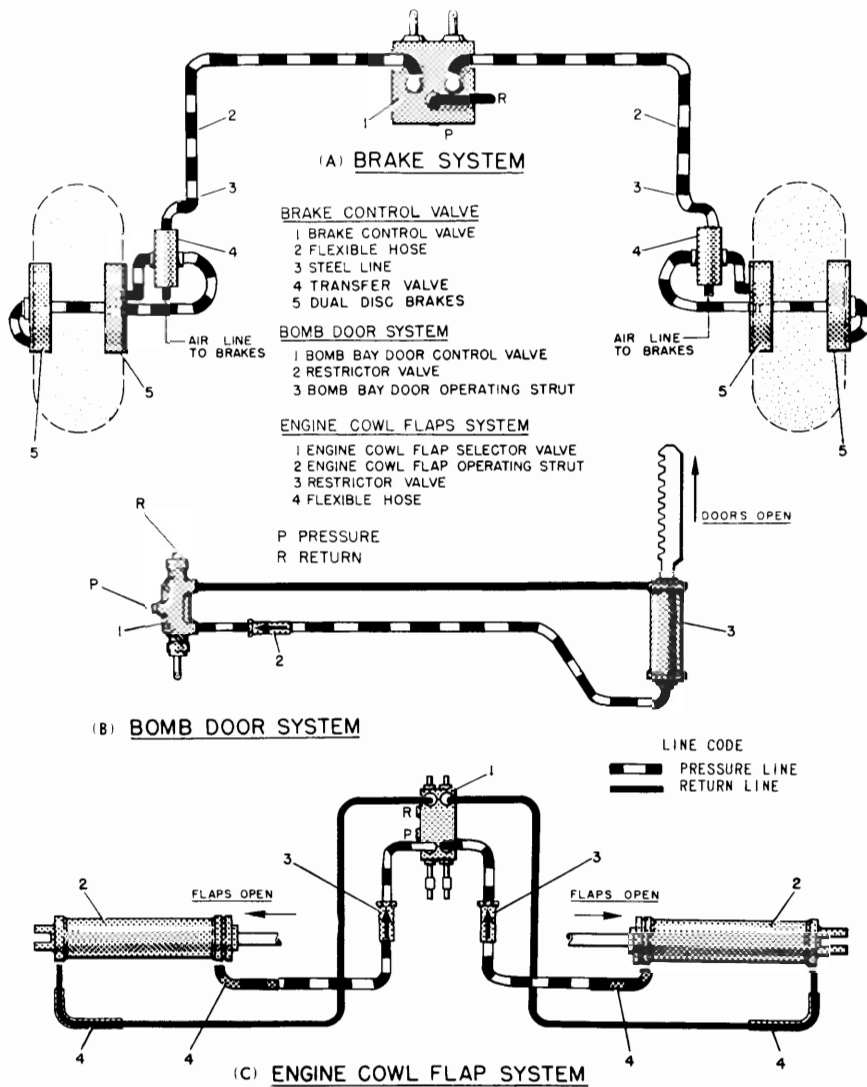


Figure 4 - Hydraulic System Lines Diagram (Engine Cowl Flap, Bomb Door, and Brake System)

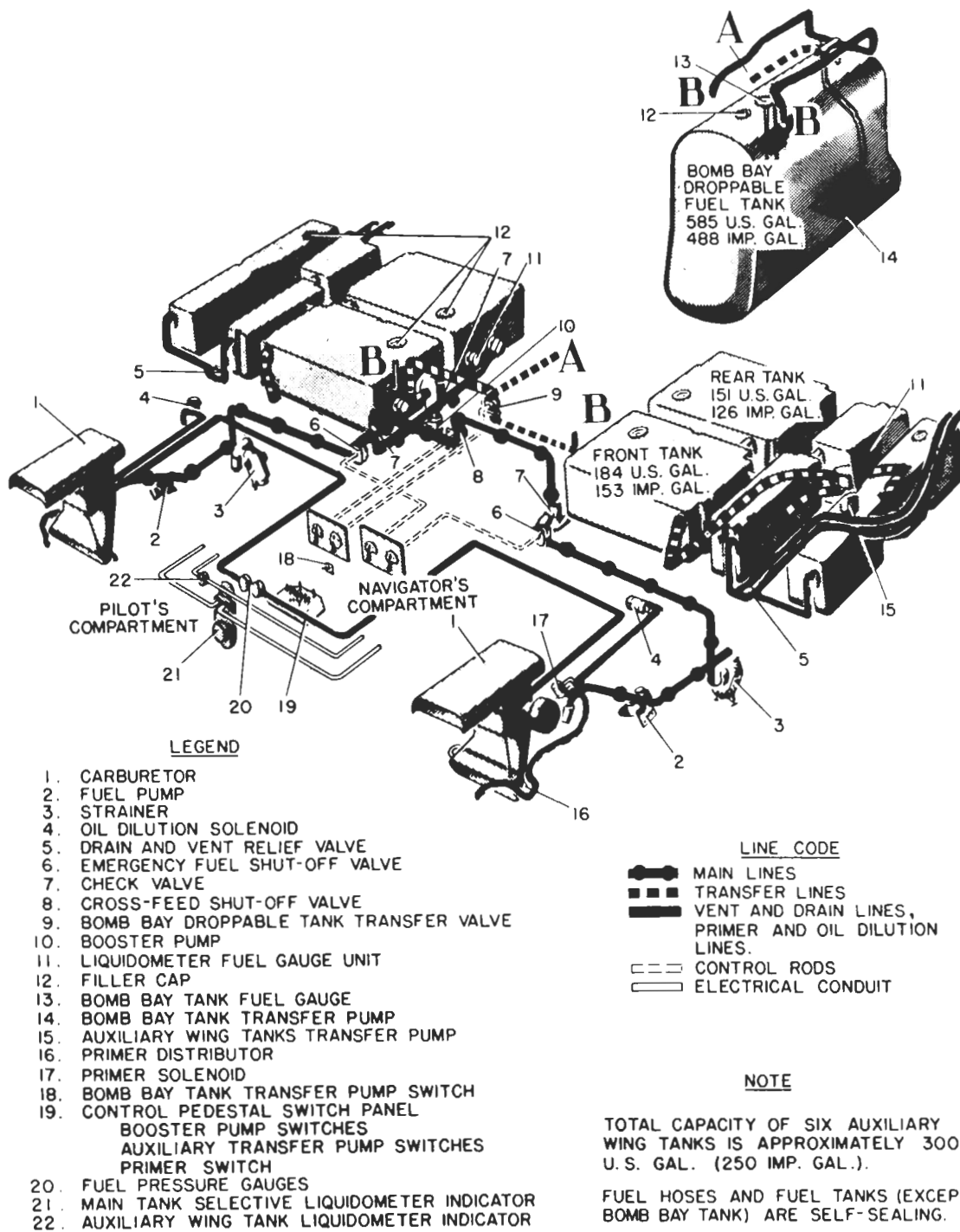


Figure 5 - Fuel System Diagram (Applicable to B-25C Airplanes, Serial Nos. AC-41-12817 and Subsequent, and B-25D Airplanes, Serial Nos. AC-41-29848 and Subsequent)

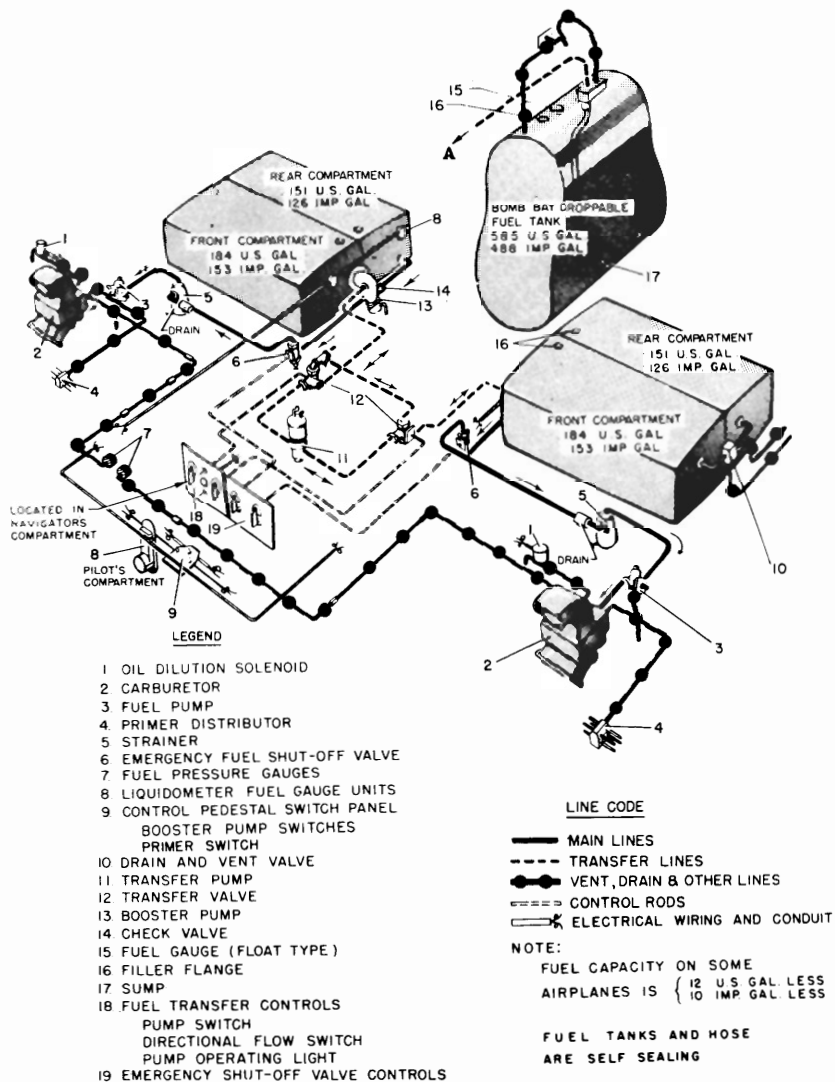


Figure 6 - Fuel System Diagram (Applicable to B-25C Airplanes, Serial Nos. AC-41-12434-12816 Inclusive, only, and B-25D Airplanes, Serial Nos. AC-41-29648-29847 Inclusive, only)

j. Heating and Ventilating System.

(1) A hot air heater is located in the left wing center section, and operates only on the left engine. (See figure 7.)

(2) The flow of cold or warm air is controlled by the pilot. The navigator regulates the temperature of the air. Controllable cold air scoops are provided for the pilot, copilot, and bombardier. Do not open bombardier's, pilot's, or side escape hatches for ventilation.

(3) Defrosting System. - The pilot's windshield sections, the bomb sight window and bomb sight may be defrosted by warm air from the airplane heating system. Each outlet is controllable, except bomb sight window, which receives heat whenever heating system is on. A door is provided for cleaning bomb sight window. On airplanes equipped with the type A-3 automatic pilot, pilot's windshield also receives heat whenever system is on.

k. Oxygen Equipment. - Three low pressure G-1 oxygen bottles are installed in each nacelle. Eight type A-9 regulators (figure 8) are provided at the following stations:

Bombardier at bomb sight seat and riding seat.  
Pilot on left side wall.

Copilot on right side wall.  
Navigator on right side wall.  
Radio operator on right side wall.  
Upper turret operator on left side wall.  
Camera operator on aft bulkhead.

l. Ice Eliminating Equipment. - De-icer shoes for the control surfaces and anti-icer slinger rings for the propellers are provided. (See figures 9 and 10.) The fluid capacity of the anti-icer tank is 4.5 U.S. gallons (3.8 Imperial gallons). Tank is located in rear of navigator's compartment. Fill with 85 percent denatured alcohol and 15 percent glycerine. When the de-icer shoes are not in operation, a vacuum pump prevents raising of the de-icer shoes. A pressure gage for the de-icer system is located in the rear of the navigator's compartment.

m. Protective Armor. - Armor plate is provided on the seat and back of the bombardier's seat. Armor plate is attached to the rear of pilot's and copilot's seats. An armor plate bulkhead is provided aft of turret gun. The armor plate door should be kept closed in flight. (See figure 11).

2. POWER PLANT.

The B-25C and B-25D airplanes are equipped with two 14-cylinder, double row, two-speed supercharged R-2600-13 air-cooled engines.

ENGINE LIMITATIONS B-25C and D AIRPLANES

<u>Take-off</u>	<u>Low Blower</u>	<u>High Blower</u>
RPM	2600 (for one minute)	DO
MP	44	NOT
Mixture	Full Rich	USE
Cowl Flaps and Oil Cooler Shutters	Open	
Cylinder Head Temperature (260° C (500° F) (5 minutes)		
Oil Temperature - 95° C (203° F)		
<u>Climb</u>	<u>Below 11,000 ft</u>	<u>Above 11,000 ft</u>
RPM	2400	2400
MP	38	39
Mixture	Full Rich	Full Rich
Cowl Flaps and Oil Cooler Shutters	Open	
Cylinder Head Temperature - 260° C (500° F) (5 minutes)		
Oil Temperature - 95° C (203° F)		
<u>High Speed</u>	<u>Below 11,000 ft</u>	<u>Above 11,000 ft</u>
RPM	2400	2400
MP	38	39
Mixture	Full Rich	Full Rich
Cowl Flaps - Closed (Slightly open on warm days)		
Oil Cooler Shutters - Adjust to 60° C - 85° C (140° F - 185° F) Oil Temperature		
Cylinder Head Temperature - 218° C (428° F)		
Oil Temperature - 85° C (185° F)		
<u>Cruising</u>	<u>Below 13,000 ft</u>	<u>Above 13,000 ft</u>
RPM	2100	2100
MP	29.5 to 31.5 Max.	29.0 to 31.5 Max.
Mixture	Full Rich	Full Rich
Cylinder Head Temperature - 205° C (396° F)		



<u>Cruising - Desired</u>	<u>Below 16,000 ft</u>	<u>Above 16,000 ft</u>
RPM	2000	2000
MP	27	27
Mixture	Full Rich	Full Rich
Cylinder Head Temperature - 205° C (396° F)		
<u>Cruising - Long Range</u>	<u>Below 13,000 ft</u>	<u>Above 13,000 ft</u>
RPM	1550	1550
MP	27.5	26.5
Mixture	Cruising Lean	Cruising Lean
Cylinder Head Temperature - 205° C (396° F)		
Oil Pressure - 80° C to 90° C (176° F - 194° F)	<u>Idle 25 Minimum</u>	
Fuel Pressure - 6-7 lb/sq in.		

### 3. SUPERCHARGERS.

Two-speed turbo superchargers with a low blower ratio of 7.06:1 and a high blower ratio of 10.06:1 are provided. Type AF regulators are used.

### 4. PROPELLERS.

Two three-blade, hydromatic, full-feathering propellers with a diameter of 12 ft 7 in. are provided. A reserve oil supply is always available for feathering the propellers regardless of the exhaustion of the engine oil supply. The propeller pitch settings are 23 degrees and 90 degrees high.

### 5. OIL SYSTEM.

Each engine is provided with an independent oil system consisting of an oil tank, two automatic temperature regulators, an engine-driven pump, an oil dilution system, and pressure and temperature indicators. B-25C airplanes, serial Nos. AC-41-12817 and higher, and B-25D airplanes, serial Nos. AC-41-29848 and higher, are provided with self-sealing oil tanks and supply lines. Each oil compartment has a capacity of 37.5 U. S. gallons (31.2 Imperial gallons). (See figure 12.)

### 6. EMERGENCY EQUIPMENT. (See figures 46, 47, and 48, section X, Emergency Operations and Instructions.)

### 7. AUTOMATIC FLIGHT CONTROL SYSTEMS.

a. B - 25C Airplane. - Automatic flight control equipment is installed on all B-25C airplanes except serial Nos. AC-41-12457, -12459, -12461, -12463, -12465, -12467, -12469, -12471, -12473, -12475, -12477, -12479, -12517 and higher, which have the type A-3 automatic pilot installed.

b. B- 25D Airplane. - Automatic flight control equipment is installed on all B-25D airplanes except serial Nos. AC-41-29848 and higher, which have the type A-3 automatic pilot installed.

### 8. MOVEMENT OF FLIGHT PERSONNEL. - (See figure 48, section X, Emergency Operations and Instructions.)

### 9. MOORING.

a. Block main landing gear wheels, engage parking brakes, lock surface controls, and install hydraulic control locking plate. Also see that nose wheel tow pin is engaged.

b. Install the four wing mooring shackles, the one in the fuselage and the one on the underside of the tail skid. Type D-1 mooring kit will be used. (See figure 15.)

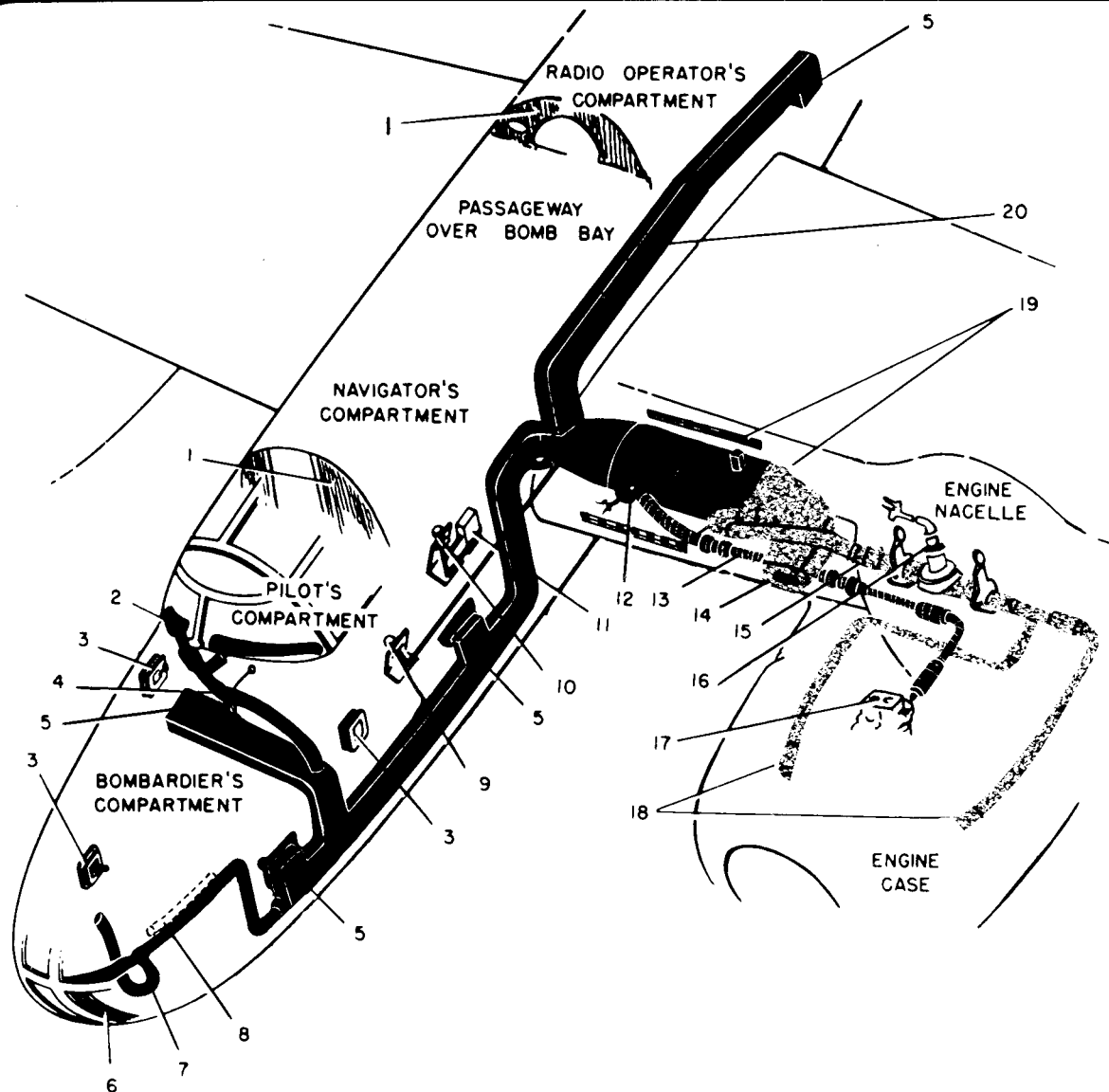
### 10. FLYING CHARACTERISTICS.

a. The general flying characteristics of the B-25C and B-25D airplanes are conventional for bi-motored bombardment airplanes.

#### b. Taxying Instructions.

(1) While taxying, the airplane should be turned by a gentle use of the brakes and engines, to avoid pivoting on one wheel. The minimum radius of turn of the inside wheel can be approximately ten feet (3 meters).

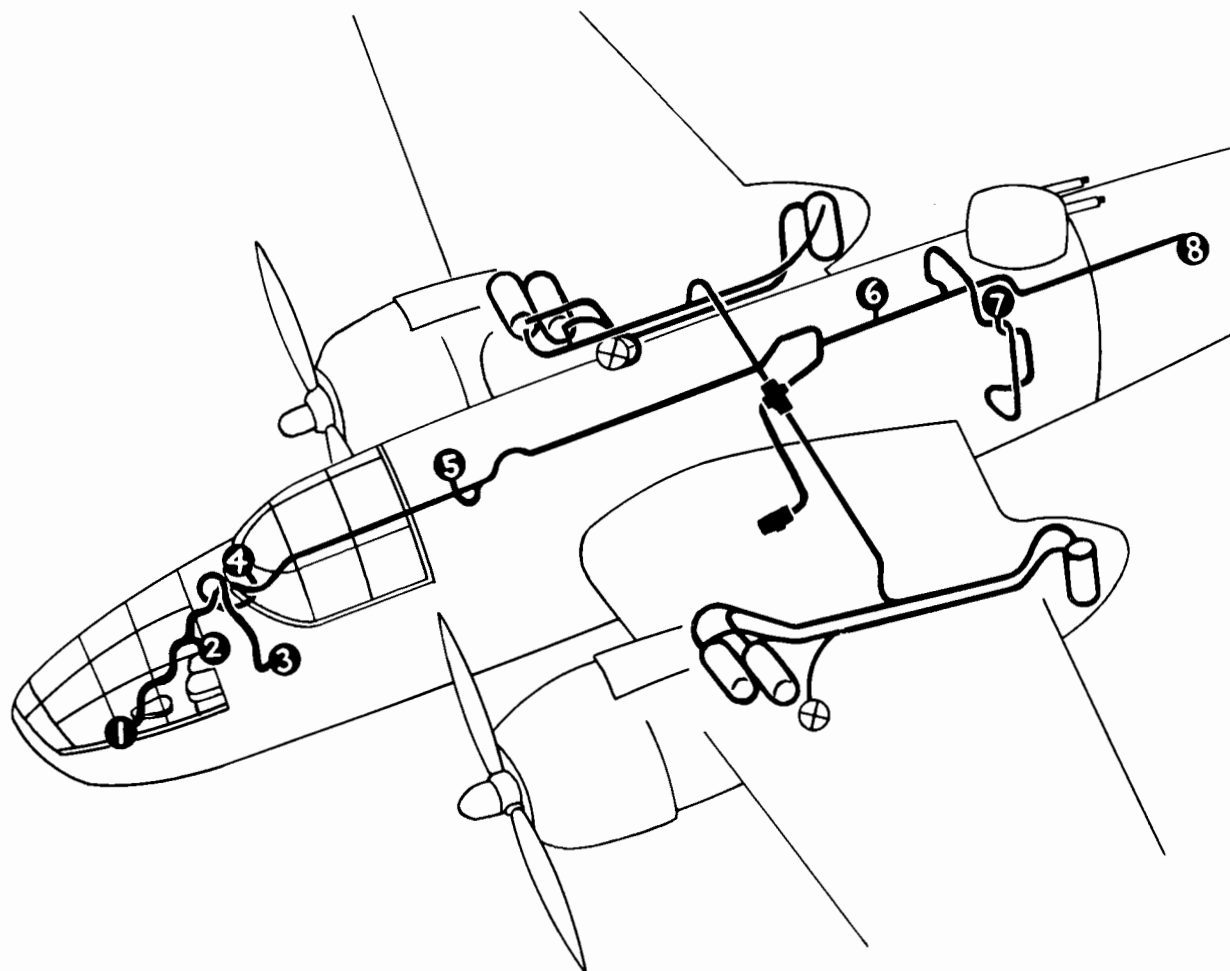




## LEGEND

- |   |                                      |
|---|--------------------------------------|
| 1 CURTAIN (ANTI-HEAT INFILTRATION)            | 9 PILOT'S AIR FLOW CONTROL           |
| 2 WINDSHIELD DEFROSTER                        | 10 AIR TEMPERATURE CONTROL           |
| 3 VENTILATOR                                  | 11 HEATER SWITCH BOX                 |
| 4 PILOT'S AIR OUTLET CONTROL                  | 12 HEATER UNIT                       |
| 5 CABIN AIR OUTLET                            | 13 EXHAUST LINE                      |
| 6 BOMB SIGHT WINDOW DEFROSTER                 | 14 AIR INTAKE                        |
| 7 BOMB SIGHT DEFROSTER TUBE                   | 15 ONE-WAY CHECK VALVE               |
| 8 BOMB SIGHT DEFROSTER TUBE (STOWED POSITION) | 16 SOLENOID                          |
|   | 17 CARBURETOR                        |
|   | 18 FUEL AIR MIXTURE LINES            |
|   | 19 OVERHEAT FUSES SURROUNDING HEATER |
|   | 20 AIR DUCT                          |

Figure 7 - Heating and Ventilating System Diagram



OXYGEN REGULATORS  
AC94-40319 (TYPE-A9)

1 BOMBARDIER-BOMB SIGHT SEAT	3 PILOT	6 RADIO OPERATOR
2 BOMBARDIER-RIDING SEAT	4 CO-PILOT	7 UPPER TURRET OPERATOR
	5 NAVIGATOR	8 CAMERA OPERATOR

Figure 8 - Oxygen System Diagram

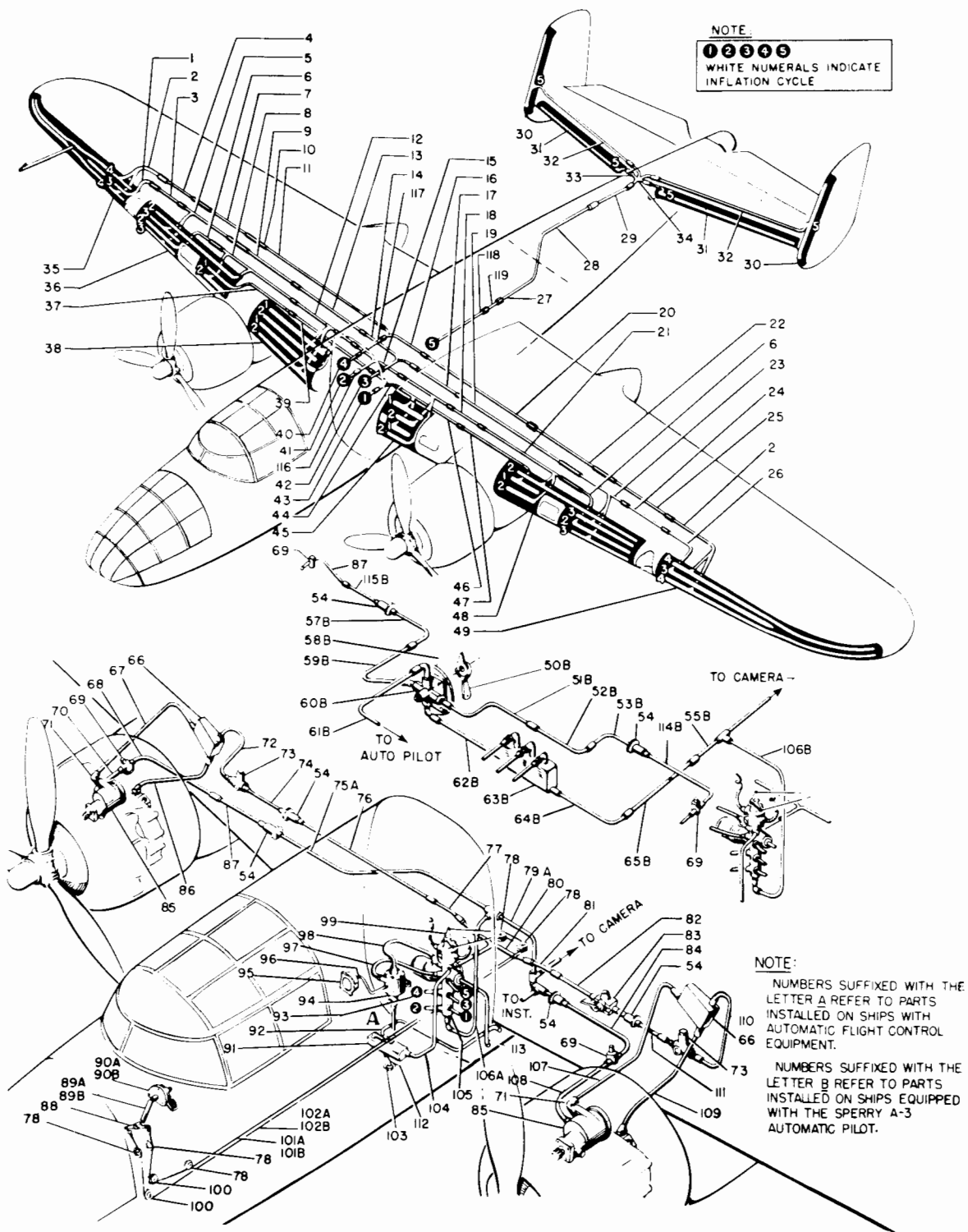
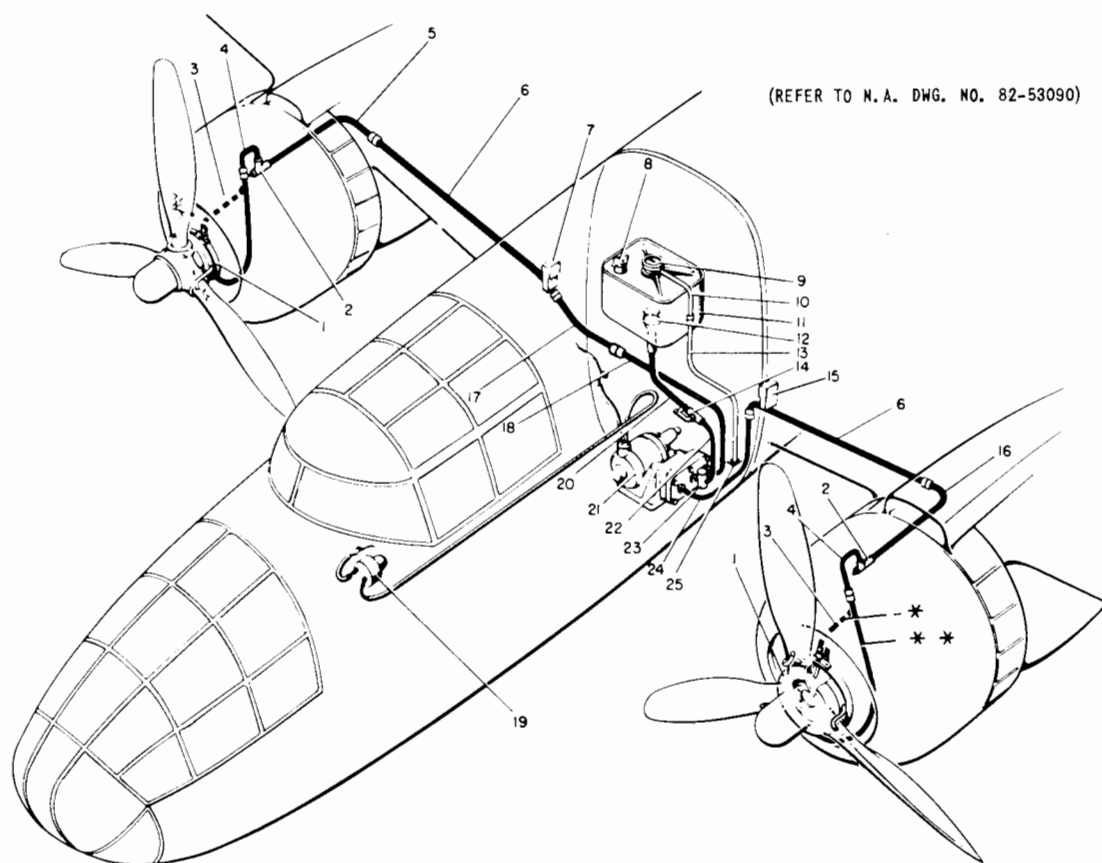


Figure 9 - De-icer System Diagram



- |   |   |
|---|---|
| 1. SLINGER RING (HAMILTON STANDARD)                       | 13. LINE - TANK DRAIN 2ND SECTION                             |
| 2. CHECK VALVE - ANTI-DRAIN (PARKER)                      | 14. VALVE - SHUT-OFF (PARKER)                                 |
| 3. LINE - NACELLE CHECK VALVE TO SLINGER RING 2ND SECTION | 15. SUPPORT ASSEMBLY WING CENTER-SECTION LINE RIGHT           |
| 4. LINE - NACELLE CHECK VALVE TO SLINGER RING 1ST SECTION | 16. LINE ASSEMBLY WING STATION 96 TO NACELLE CHECK VALVE LEFT |
| 5. LINE - WING STA. 96 TO NACELLE CHECK VALVE RIGHT       | 17. LINE - UNION TO WING BLOCK RIGHT                          |
| 6. LINE - WING STA. 27-96                                 | 18. LINE - FLUID PUMP TO UNION RIGHT                          |
| 7. SUPPORT - WING CENTERSECTION LINE LEFT                 | 19. RHEOSTAT, ANTI-ICER (OHMITE)                              |
| 8. CAP - RESERVOIR FILLER                                 | 20. LINE - TANK TO VALVE                                      |
| 9. FLANGE - FLUID GAGE DIAL RETAINING                     | 21. PUMP (ECLIPSE)  |
| 10. LINE ASSEMBLY - TANK DRAIN 1ST SECTION                | 22. LINE - VALVE TO FLUID PUMP                                |
| 11. TANK ASSEMBLY - SUPPLY                                | 23. FILTER (ECLIPSE)  |
| 12. FLOAT ASSEMBLY - SUPPLY TANK FLUID GAGE               | 24. LINE - FLUID PUMP TO UNION LEFT                           |
|   | 25. DRAIN - SUPPLY TANK FLUID                                 |

Figure 10 - Anti-icer System Diagram

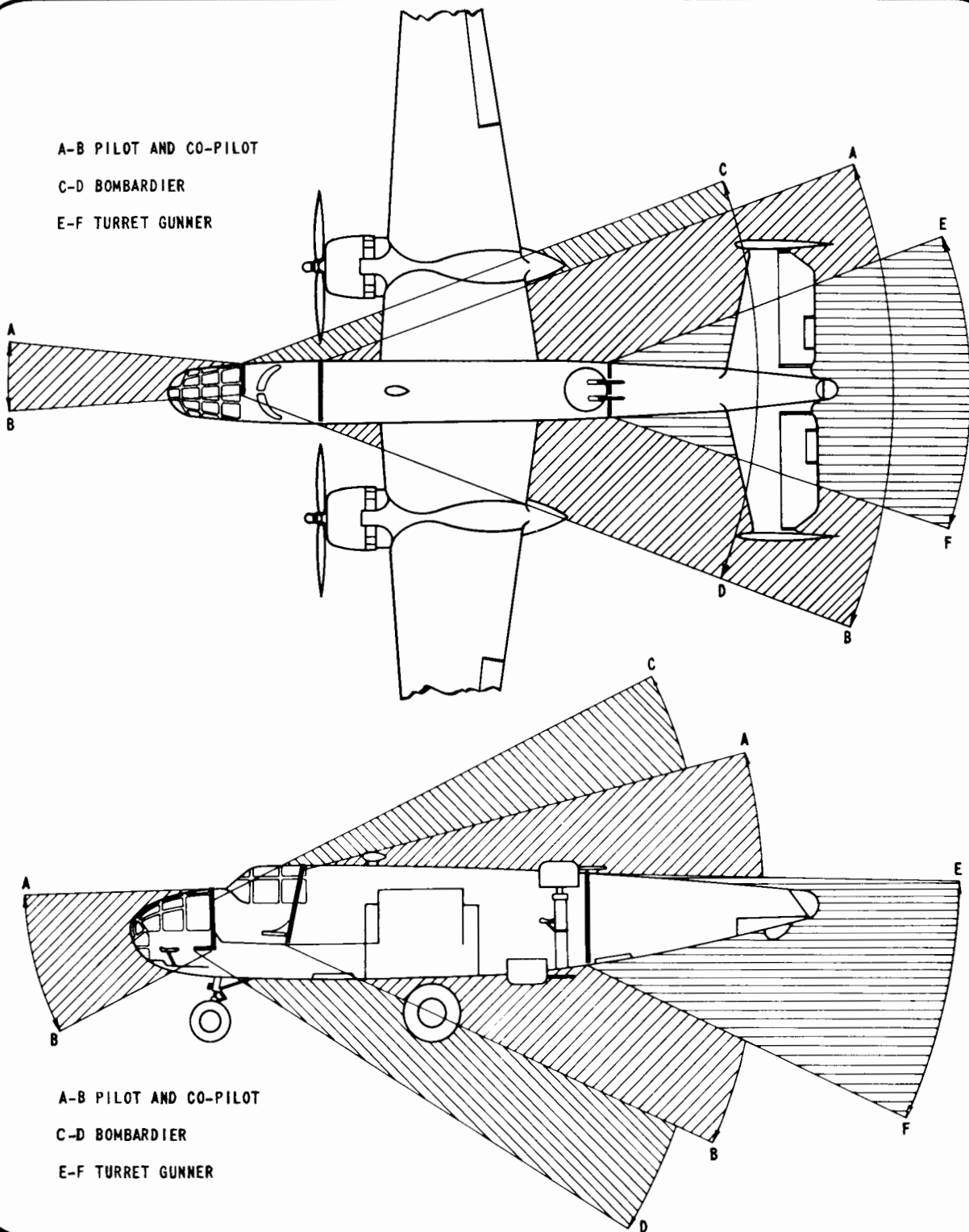


Figure 11 - Angles of Armor Protection

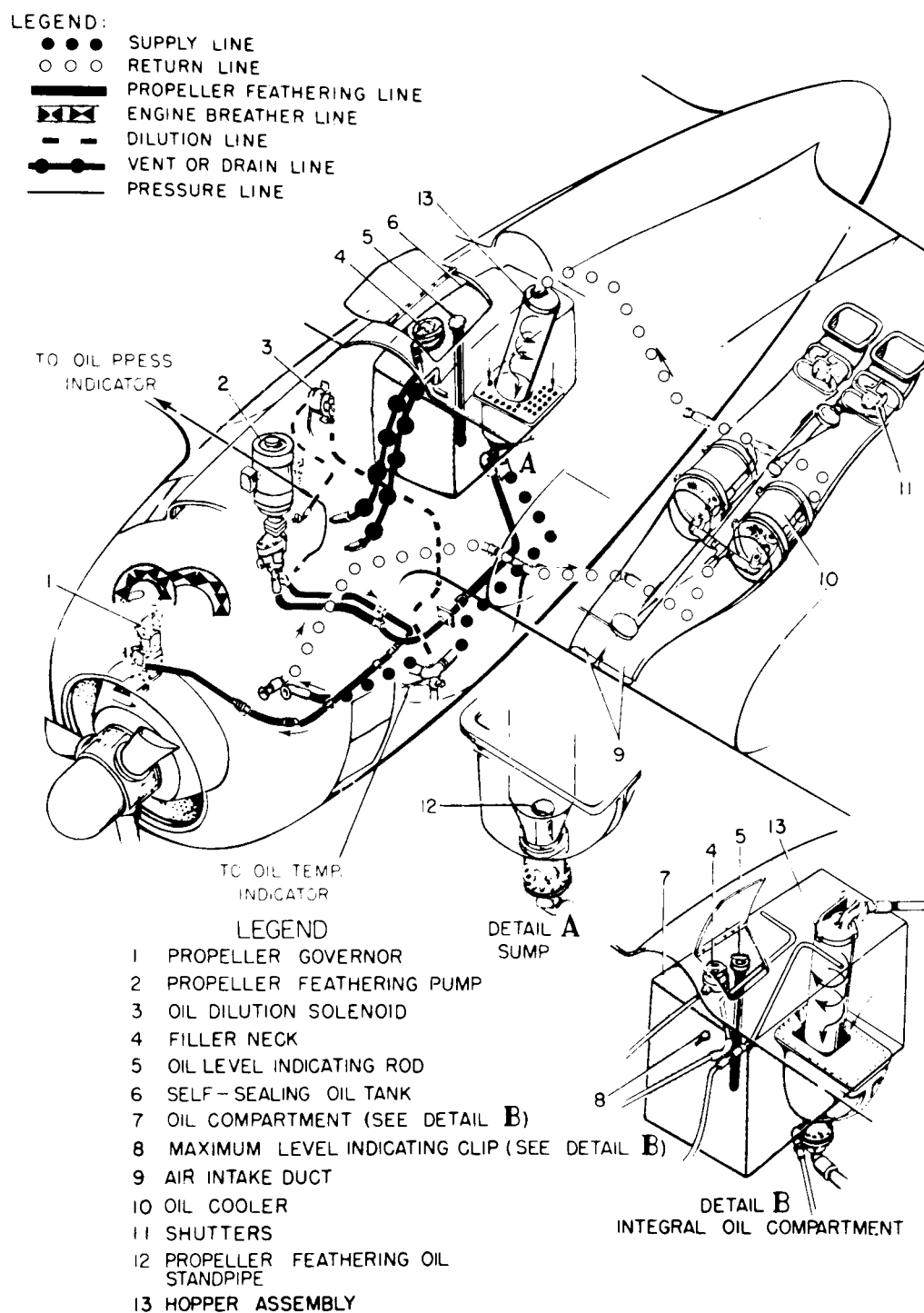
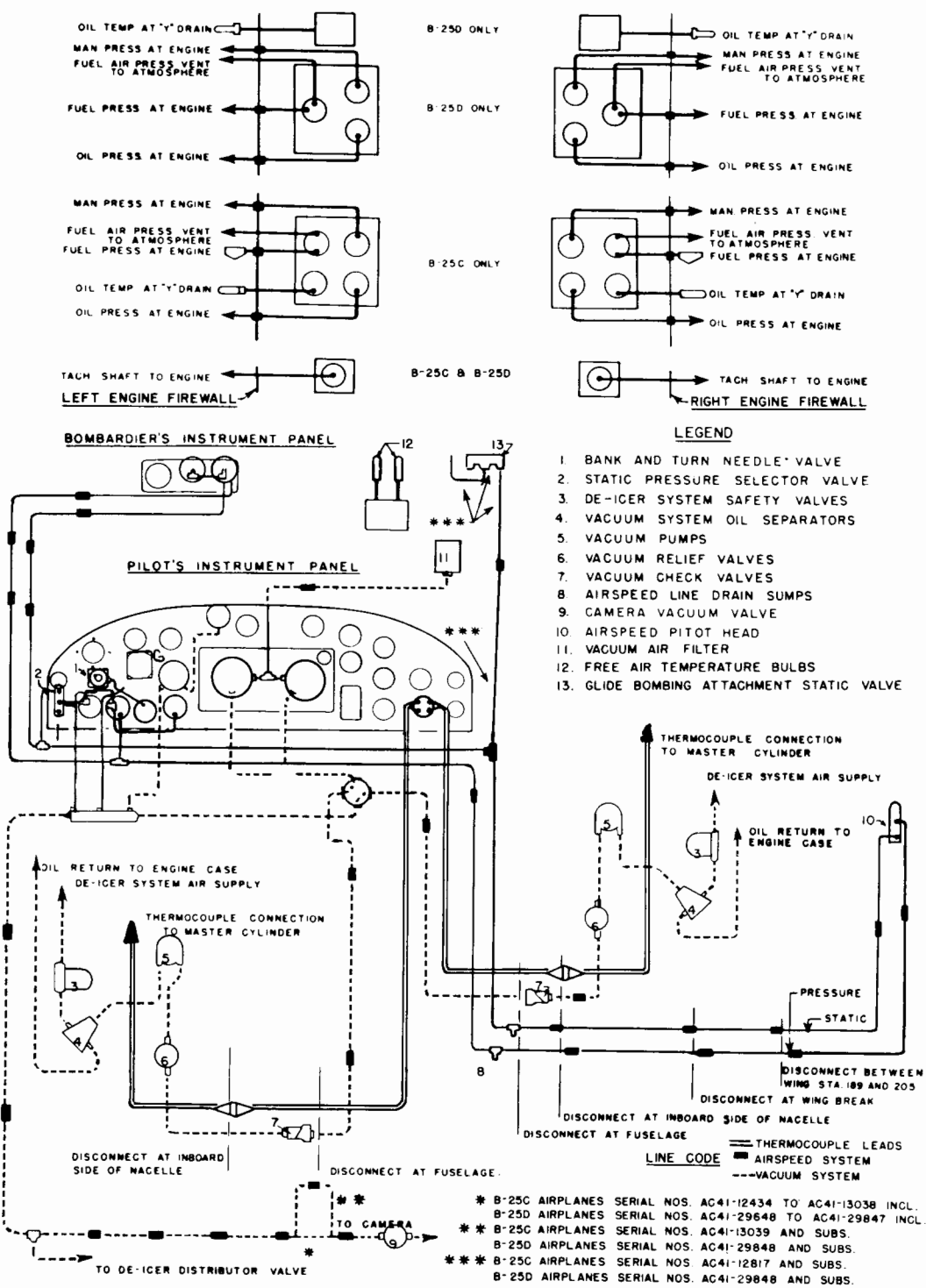


Figure 12 - Oil System Diagram



**Figure 13 - Instrument and Vacuum System Diagram (A-3 Sperry)**



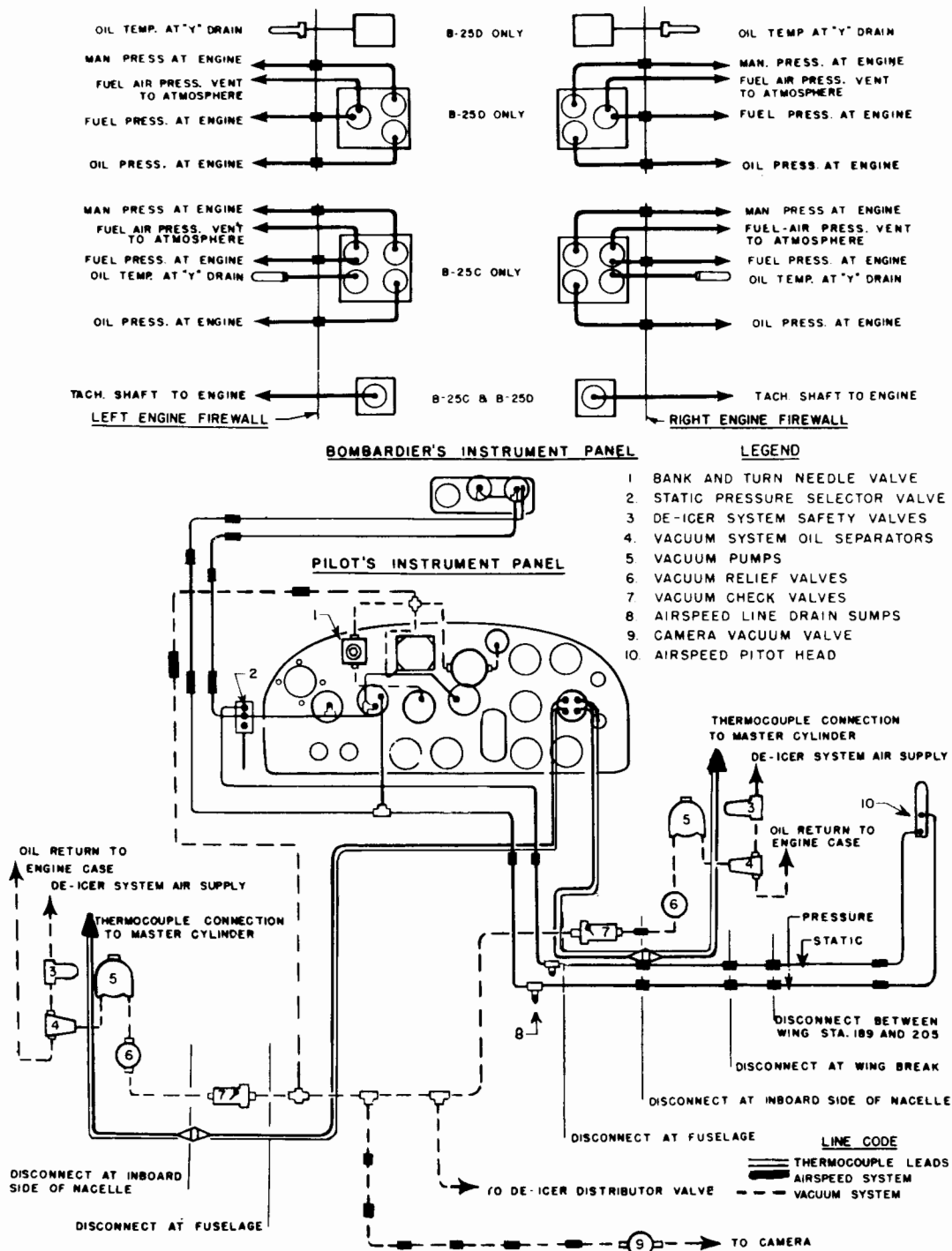


Figure 14 - Instrument and Vacuum System Diagram (A.F.C.E.)

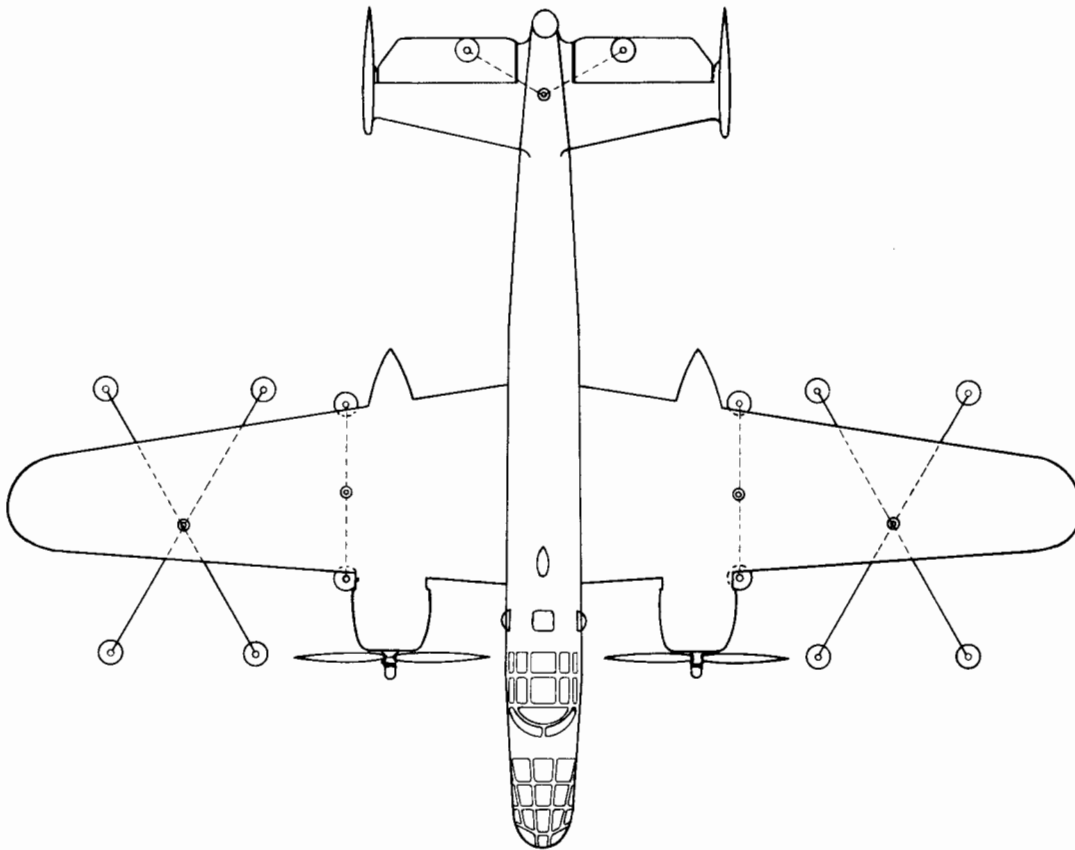


Figure 15 - Mooring Diagram



(2) When attempting to straighten the airplane out of a turn it will be found that the nose wheel has less tendency to trail properly as the depth of the tire sink increases. A tire sink in excess of 2 in. (5cm) causes a negative trailing reaction on the nose wheel, and, rather than straighten out, it will attempt to reverse its position and trail 180 degrees to its normal angle. If the tire sink exceeds 2 in. (5cm), one member of the crew should walk ahead of the airplane and signal to the pilot the position of the nose wheel and advise whether the nose wheel tends to trail properly or is attempting to reverse its position. If the airplane is pivoted on one wheel, the nose wheel will assume a sharp angle toward the rear, and the stationary pivot wheel will mire itself.

(3) If the airplane becomes mired:

(a) Manually turn nose wheel in line with the airplane fuselage by the use of a towing bar or a piece of iron pipe.

(b) If either of the mainwheels sinks to a depth of 4 or 5 in. (10 or 12 cm), dig a shallow trench in front

of each wheel with a forward slope of 10 to 20 degrees. Then run engines to take-off power and release brakes quickly. If main wheels sink more than 5 in. (12 cm) move airplane by tractor. Do not attempt to tow airplane over soft ground by means of the nose wheel tow bar.

**CAUTION:** Considerable care should be exercised in manually turning the nose wheel because of danger from propellers.

c. **Recovery from a stall** can be made by dropping the nose of the airplane. A rolling tendency is counteracted by the application of the opposite aileron control and a slight amount of rudder.

(1) With the wing flaps fully down 45 degrees, the indicated stalling speed is reduced 20 mph at normal gross weight (25,450 lb; 11,542 kg).

(2) For stalling speeds refer to paragraph 10.m.

d. **Trim Tab Changes Are Conventional.**

e. **Dives.** - The maximum indicated diving air speed is 340 mph (295 knots) at normal gross weight.

f. **Climbing.** - An indicated air speed of at least 155 mph (133.3 knots).

g. **Center of Gravity.** - These airplanes have an allowable CG range from a maximum forward position of 20 percent (gear down) to a maximum rearward position of 32.6 percent (gear up).

h. **Air Speed Restrictions.**

(1) Do not exceed an air speed of 340 mph (295 knots) indicated.

(2) Do not lower landing gear at a speed in excess of 170 mph (148 knots) indicated.

(3) With landing gear down and wing flaps up do not exceed an air speed of 200 mph (174 knots) indicated.

(4) Do not lower main landing gear or nose gear by hand (mechanically) at a speed over 150 mph (130 knots) indicated.

(5) Do not lower wing flaps or fly with wing flaps down over 170 mph (148 knots) indicated.

(6) Do not lower wing flaps by hand or fly after the flaps are mechanically operated, at indicated air speeds over 150 mph (130 knots).

**CAUTION:** Do not attempt to operate the wing flap mechanically or even install crank except when a complete failure of the hydraulic system exists, since the hydraulic and mechanical systems oppose each other. For complete instructions refer to section X.

(7) Do not open bomb bay doors at an air speed over 290 mph (252 knots) indicated.

(8) Do not operate de-icer system at speeds above 230 mph (200 knots) indicated.

(9) Do not operate de-icer system during take-off or landing.

i. **Single Engine Operation.** - The minimum controllable speed with one engine is 140 mph (122 knots). Fly with dead engine high.

j. **Power Plant Restrictions.**

(1) Do not exceed an engine speed of 2880 rpm.

(2) Do not idle engines on ground below 450 rpm.

(3) Do not turn on high blower during take-off.

**CAUTION:** Use air pressure brake system in an emergency only. After using, hydraulic brake system must be bled.

k. **Restricted Use of Automatic Pilot.**

(1) Do not operate airplane by automatic pilot in extremely turbulent air, when de-icer system is operating, or when one or more engines are not delivering normal power output.

(2) Do not place airplane under control of the automatic pilot at any speed or altitude until the pilot has determined by manual operation that the existing flight conditions permit safe control by the automatic pilot, and in no case will automatic pilots be used when the airplane is flying at less than an indicated air speed of 40 mph (35 knots) above the stalling speed.

(3) Do not use automatic pilot unless one rated pilot remains "on watch" and maintains a close check of the airplane and instruments.

(4) Do not engage automatic pilot when follow-up indexes are not lined up.

(5) Do not make course and altitude changes by rapid knob movements. Turn slowly and smoothly.

(6) Do not allow airplane to get too far out of trim.

(7) Do not turn any of the three speed controls to "OFF" or lowest speed when automatic pilot is engaged, as this would lock the corresponding surface controls in whatever position they happen to be.

**CAUTION:** Automatic pilot can be overpowered.

l. **Loading Limitations.** - Only straight flying is permitted when airplane is loaded to specified maximum loaded weight for safe flight. Refer to paragraph p. for maneuvers prohibited.

m. **Stalls.** - The stalling speeds for these airplanes with flaps up are as follows:

Level flight	101 mph; 87.7 knots
30 degree bank	134 mph; 116.3 knots
60 degree bank	154 mph; 133.7 knots

(1) Recovery from a stall may be made by dropping the nose.

(2) Stalling characteristics are not affected by changes of the gross weight, amount of power used, the setting of the wing flaps, or the operation of the

de-icer shoes. However the indicated stalling speed is raised 4 mph by operation of the de-icer. With the wing flaps fully down (45 degrees) the indicated stalling speed is reduced 20 mph at normal gross weight (25,450 lb; 11,542 kg.). A slight buffeting on the elevator and the horizontal stabilizer warns of a stall.

n. Spins. - Intentional spins are prohibited. However if an unintentional spin develops recovery may be made in the conventional manner.

**CAUTION:** These airplanes are very clean aerodynamically and will accelerate very rapidly in a dive. Recovery from any dive position should be without delay and accomplished as smoothly as possible.

o. Acrobatics. - All acrobatics are prohibited.

p. Maneuvers Prohibited.

Loop	Inverted Flight
Spin	Vertical Bank
Roll	Immelman

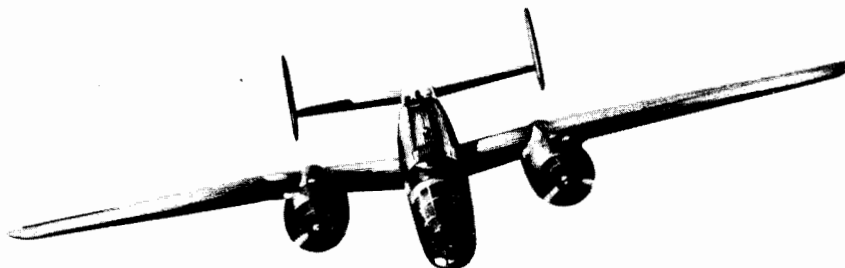
q. Diving.

(1) The maximum indicated air speed is 340 mph (295 knots) at normal gross weight.

(2) Recovery from dives should not be too abrupt.

(3) The following table gives maximum accelerations and diving speeds according to basic weight conditions:

Gross Weight	lb.	20,000	23,000	26,000	29,302	32,000	34,000
	kg.	9,070	10,430	11,791	13,291	14,512	15,419
Maximum allowable pull-out and push-over acceleration "g"		+3.67	+3.67	+3.67	+2.67	+2.67	+2.67
		-2.00	-2.00	-2.00	-1.67	-1.67	-1.67
Maximum allowable during speed (indicated)	mph	340	340	340	340	332	303
	knots	295	295	295	295	288	263



## SECTION II

### PILOT'S OPERATING INSTRUCTIONS

#### Pilot

#### Copilot

#### 1. BEFORE ENTERING THE PILOT'S COMPARTMENT.

a. Check that nose gear towing pin is engaged.

b. To enter front entrance hatch:

(1) Verify that the lock on the front entrance hatch is unlocked.

(2) Depress flush type spring latch by pushing upward.

(3) Enter navigator's compartment.

c. While still in navigator's compartment:

(1) Check fuel cross-feed shut-off valve. (See figure 23-221.)

(2) Check fuel transfer valves. (See figure 23-222.)

Pilot

- (3) Check generator main line switches. (See figure 23-224.)
- (4) Check generator voltage switch. (See figure 23-225.)
- (5) Check emergency nose gear operating pawl control (figure 25-239) "OFF."

Copilot**2. ON ENTERING THE PILOT'S COMPARTMENT****a. Check for all flights.**

- (1) Check with radio operator that the main landing gear and wing flap emergency cranks are stowed.
- (2) Check with navigator that bomb door emergency cranks are stowed.
- (4) Check with crew members to see that the three emergency ground escape hatches are unlocked.

- (3) Check emergency brake air pressure at 400-425 lb/sq in. (28.1 to 29.9 kg/sq cm)

- (5) Ignition switches (figure 18-156) "OFF."
- (6) Set parking brakes. (See figure 17-153.)
- (7) Unlock surface controls by pulling up on lock handle (figure 18-161) and check operation.
- (8) Remove snap wire hook attached to floor below landing gear control lever from the control handle (figure 21-192) and stow.
- (9) Remove locking plate from wing and cowl flap control levers (figure 17-149) and stow the lock.
- (10) See that automatic pilot or automatic flight control equipment is "OFF."
- (11) If engines are inoperative for over two hours have propellers turned by hand three or four revolutions with the ignition "OFF."
- (12) Crack open throttle 1/2 inch (1.27 cm) at (700-800 rpm).
- (13) Set propeller control (figure 18-165) to "INCREASE RPM."
- (14) Set mixture control (figure 18-167) to "FULL RICH."
- (15) Lock supercharger control (figure 17-146) at "LOW."
- (16) See that oil cooler shutter controls (figure 17-151) are "CLOSED."
- (17) Set carburetor air (figure 16-141) to "NORMAL."
- (18) Set cowl flaps (figure 17-149) to "OPEN."

- (19) Phone navigator to set emergency fuel shut-off valves to "ON."

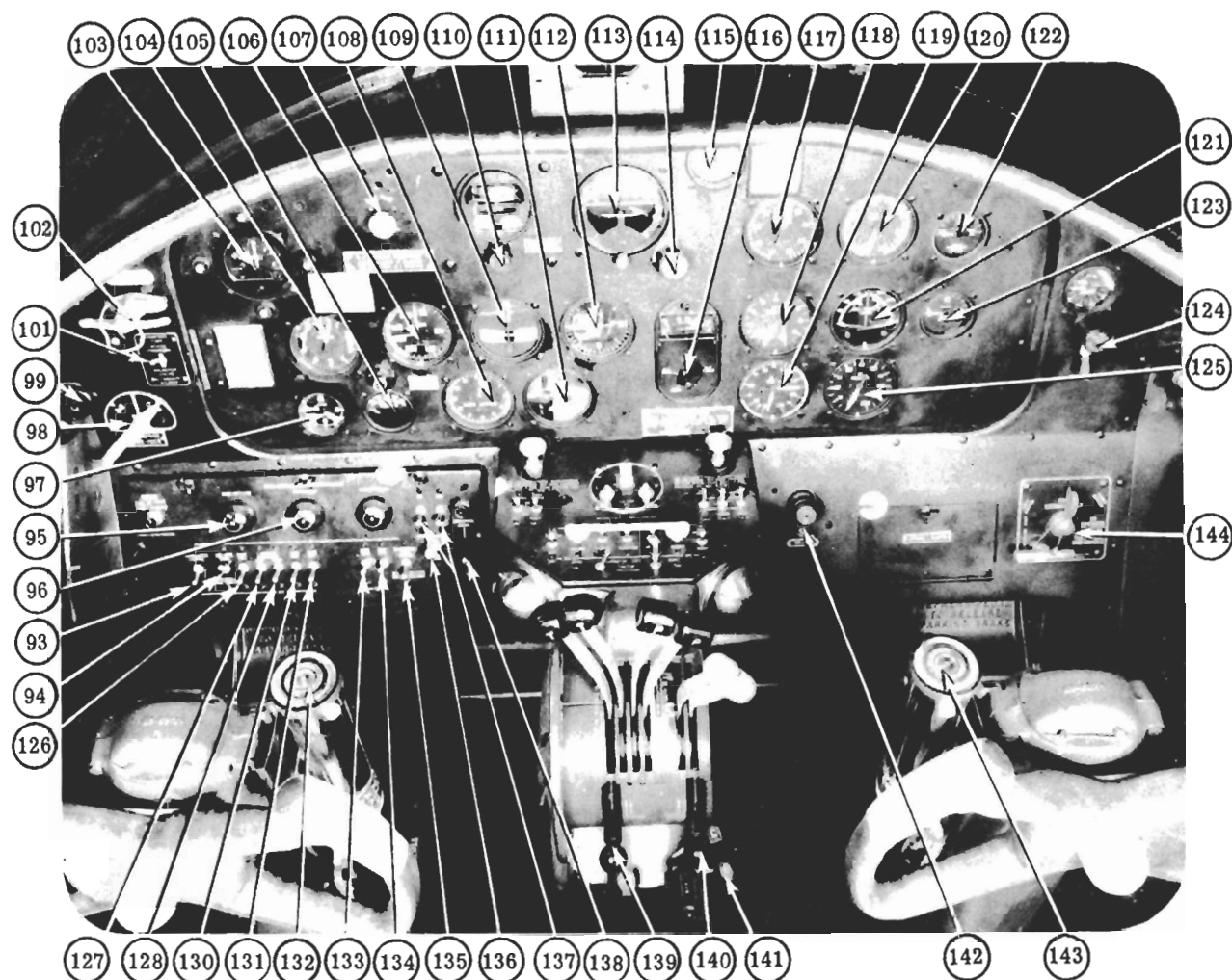


Figure 16 - Pilot's Instruments and Control Panel

- |  |  |  |
|--|--|--|
| 93 Fluorescent Lights Switch   | 111 Landing Gear and Wing Flap Indicator | 129 Compass Light Rheostat                           |
| 94 Landing Gear Warning Horn Release Switch                          | 112 Climb Indicator                      | 130 Pitot Heater                                     |
| 95 Propeller Anti-Icer Rheostat                                      | 113 Flight Control (Artificial Horizon)  | 131 Dome Light Switch Panel                          |
| 96 Formation Lights  | 114 Caging Knob                          | 132 Lamp on Aileron Control                          |
| 97 Clock   | 115 Vacuum Pressure                      | 133 Cockpit Lights                                   |
| 98 De-Icer Valve   | 116 Fuel Selector Valve                  | 134 Running Lights                                   |
| 99 Spring Latch for Side Window                                      | 117 Manifold Pressure                    | 135 Oil Dilution Both Engines                        |
| 101 Air-Speed Tube Static Pressure Selector Valve (Alternate Source) | 118 Fuel Pressure                        | 136 Identification Light Keying Switch               |
| 102 Emergency Bomb Release   | 119 Oil Temperature                      | 137 Identification Light Top and Bottom              |
| 103 Pilot's Direction Indicator                                      | 120 Tachometer                           | 138 Bombardier Signal                                |
| 104 Altimeter  | 121 Cylinder Temperature                 | 139 Locking Controls, Propeller, and Mixture         |
| 105 Free Air Temperature   | 122 Hydraulic Pressure                   | 140 Locking Controls                                 |
| 106 Air Speed  | 123 Hydraulic Brake Pressure             | 141 Carburetor Air                                   |
| 107 Vacuum Adjustment Knob   | 124 Oxygen Regulator                     | 142 Extension Light and Switch                       |
| 108 Radio Compass  | 125 Oil Pressure                         | 143 Lamp on Aileron Control                          |
| 109 Turn and Bank Indicator  | 126 Passing Lights                       | 144 Fire Extinguisher Selector Valve and Pull Handle |
| 110 Turn Indicator   | 127 Battery Disconnect (Left)            |  |
|  | 128 Battery Disconnect (Right)           |  |

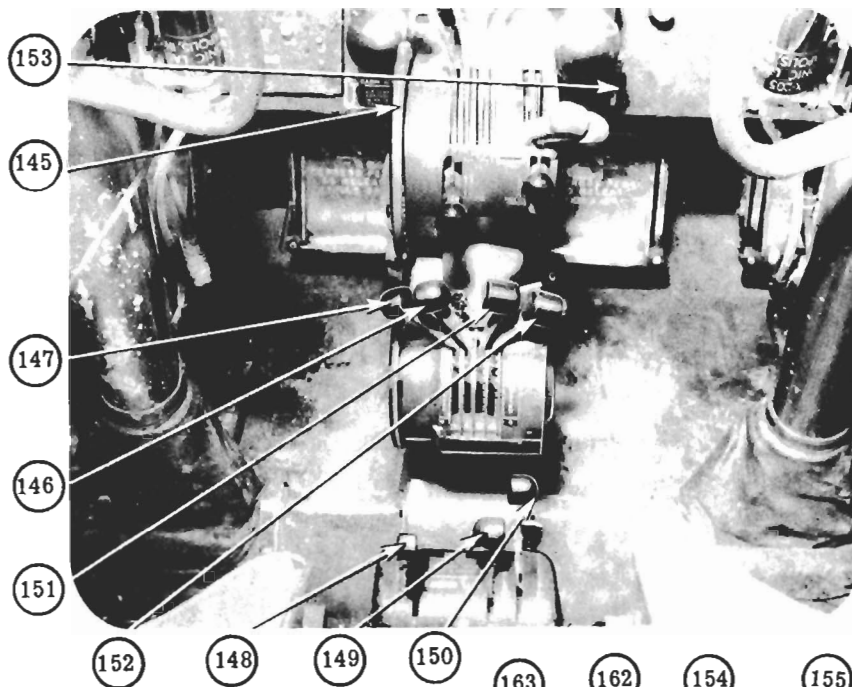
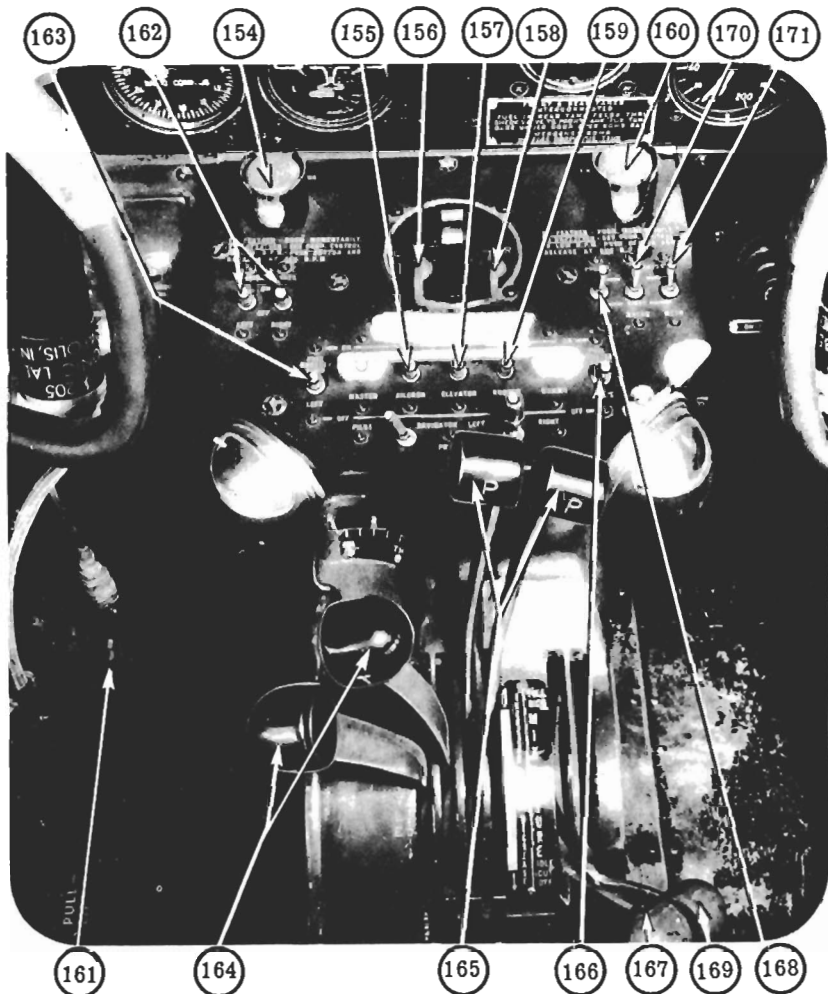


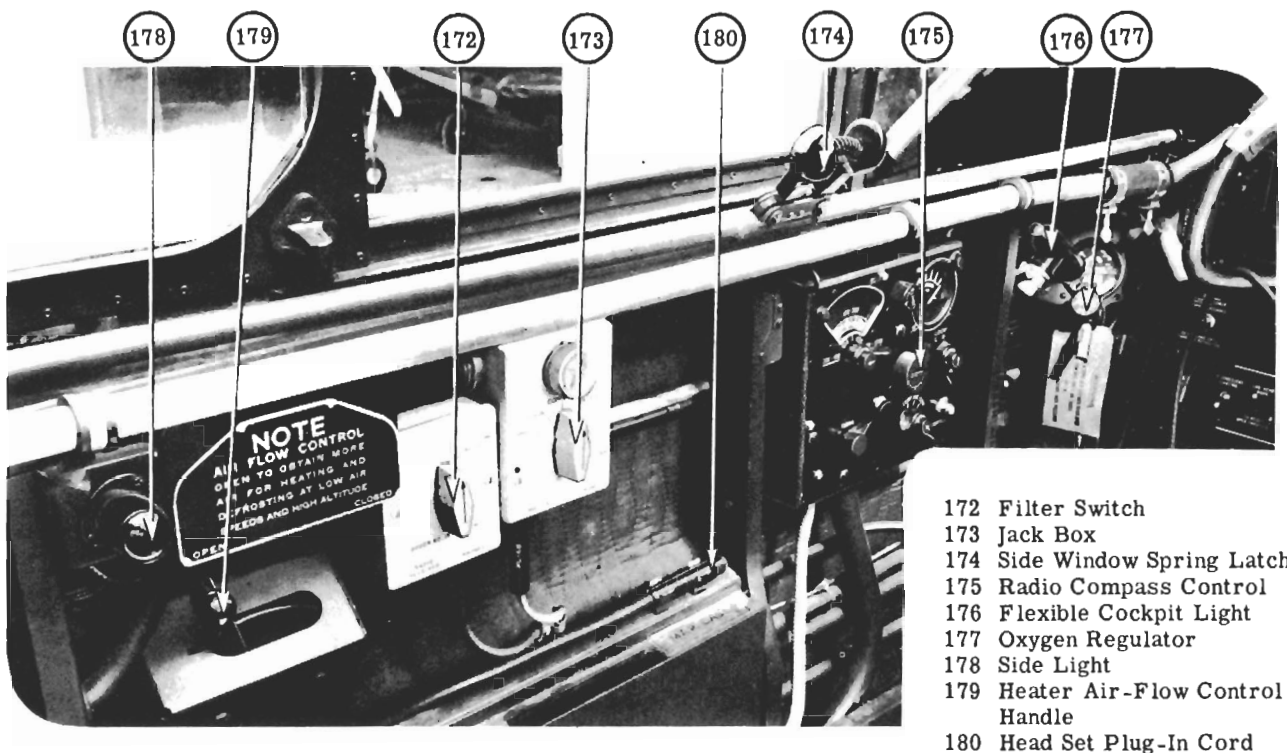
Figure 17 - Pilot's Control Pedestal

- 145 Rudder Trim Tab (Altitude)
- 146 Supercharger Control
- 147 Supercharger Control
- 148 Wing Flaps
- 149 Cowl Flaps
- 150 Cowl Flaps
- 151 Oil Cooler Shutters
- 152 Oil Cooler Shutters
- 153 Parking Brake

Figure 18 - Pilot's A.F.C.E. Control Panel

- 154 Propeller Feathering Knob
- 155 Aileron (A.F.C.E.)
- 156 Left Ignition Switch
- 157 Elevator (A.F.C.E.)
- 158 Right Ignition Switch
- 159 Rudder (A.F.C.E.)
- 160 Propeller Feathering Knob
- 161 Surface Control Lock Handle
- 162 Landing Lights
- 163 Fuel Booster Pump
- 164 Throttle
- 165 Propeller
- 166 Fuel Booster Pump
- 167 Mixture Control
- 168 Primer Switch
- 169 Mixture Control
- 170 Energizing Switch
- 171 Starter Switch

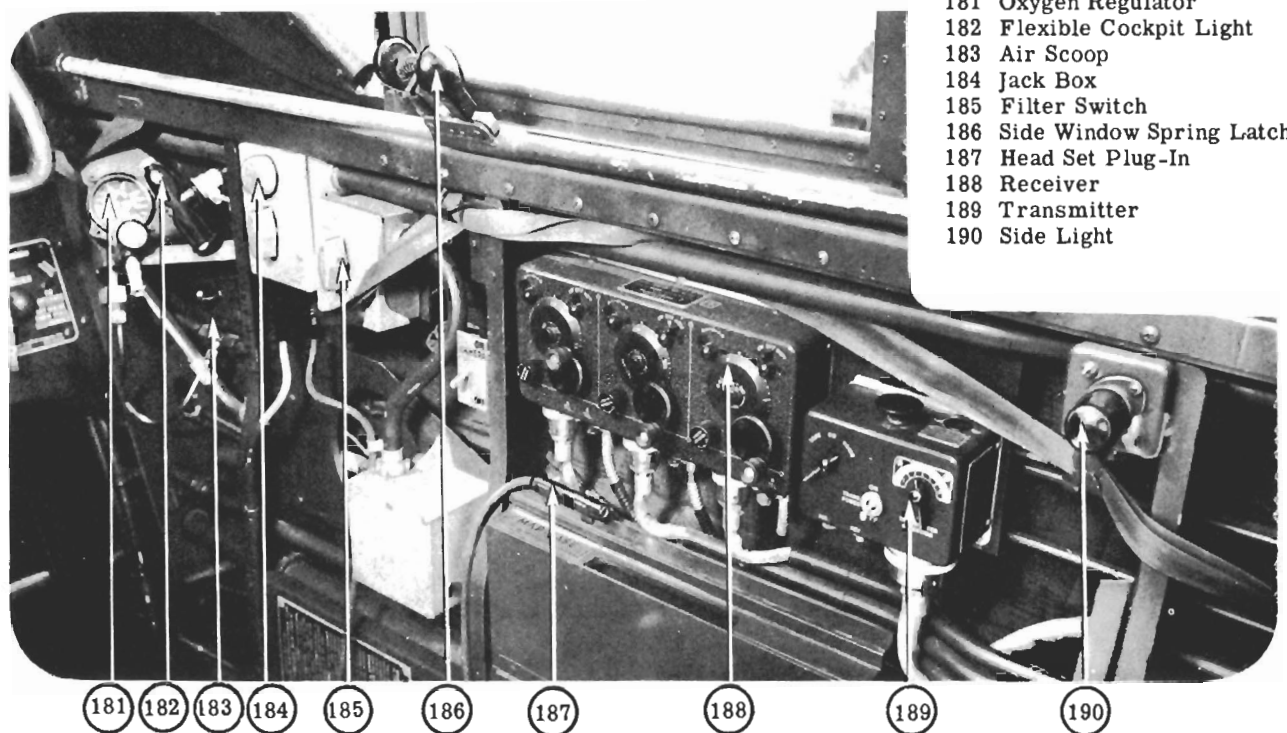




- 172 Filter Switch
- 173 Jack Box
- 174 Side Window Spring Latch
- 175 Radio Compass Control
- 176 Flexible Cockpit Light
- 177 Oxygen Regulator
- 178 Side Light
- 179 Heater Air-Flow Control Handle
- 180 Head Set Plug-In Cord

Figure 19 - Pilot's Compartment (Left Side)

Figure 20 - Pilot's Compartment (Right Side)



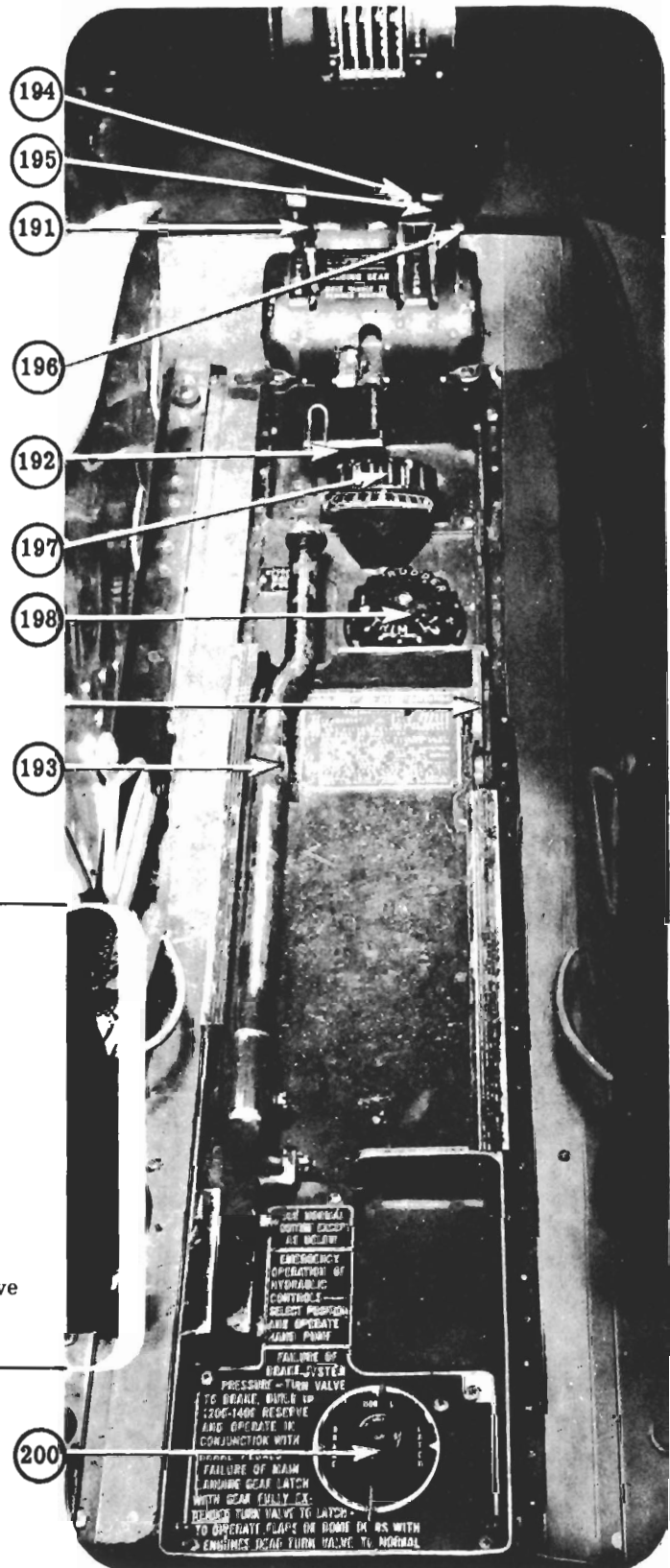
- 181 Oxygen Regulator
- 182 Flexible Cockpit Light
- 183 Air Scoop
- 184 Jack Box
- 185 Filter Switch
- 186 Side Window Spring Latch
- 187 Head Set Plug-In
- 188 Receiver
- 189 Transmitter
- 190 Side Light





Figure 21 - Floor Controls Between Pilot and Copilot

- ★ 191 Wing Flaps
- ★ 192 Landing Gear
- ★ 193 Hydraulic Hand Pump
- 194 Engine Cowl Flaps
- 195 Engine Cowl Flaps
- 196 Control Lock
- 197 Aileron Trim
- 198 Rudder Trim
- 199 Emergency Air Brake
- 200 Emergency Hydraulic Selector Valve



PilotCopilot3. STARTING ENGINE.

- a. Check with navigator to see that battery disconnect, generator-ignition safety, and active inverter switches are "ON."

b. Set booster pump switch (figure 18-166) to "ON" (fuel pressure 6 to 7 lb/sq in. (.4 to .5 kg/sq cm)).

c. Turn on engine primer switch (figure 18-168); prime 3 to 5 seconds if cold; 2 seconds if hot.

d. Set fire extinguisher switch (figure 16-144) to "ON."

- (1) If engine fails to start due to cold, instruct a crew member or a member of the ground crew to use hand crank. Then press engaging switch (figure 18-171) to "ON," followed by pressing energizing switch (figure 18-170) to "ON;" then hold both switches "ON."

e. Prime while engaging as required.

4. ENGINE WARM-UP.

a. As engine starts, check oil pressure gage (figure 16-125); if not 40 lb/sq in. (2.8 kg/sq cm) after 30 seconds, stop engine and investigate. Warm engine at 1200 rpm until oil temperature shows a definite increase and the oil pressure remains steady when throttle is opened.

b. Set booster pump switch (figure 18-166) "OFF" (fuel pressure 6 to 7 lb/sq in. (.4 to .5 kg/sq cm)).

c. Open oil cooler shutter controls (figure 17-151) to oil temperature of 40° degrees C (104 degrees F).

d. Check elevator trim tab control. (See figure 17-145.)

e. Check aileron trim tab control. (See figure 21-197.)

f. Check rudder trim tab control. (See figure 21-198.)

g. See that wing flap control handle (figure 17-148) is in "CLOSE" position.

h. Check each magneto at 1800-2000 rpm by momentarily turning each ignition switch off in turn; maximum manifold pressure 27 to 31.5 in. Hg (68.6 to 80 cm Hg)(maximum rpm drop 75). If drop is greater, run at same rpm for 15 seconds and recheck.

i. At 1600 rpm have navigator check voltmeter (figure 23-225) at 28 to 28.5 and the ammeter (figure 23-223) 40 to 60 maximum.

5. EMERGENCY TAKE-OFF.

- a. If the engines were properly diluted (figure 16-135) when previously stopped, no trouble should be experienced in maintaining oil pres-

Pilot

sure of 80 to 90 lb/sq in. (5.6 to 6.3 kg/sq cm). Then proceed with normal take-off.

6. ENGINE AND ACCESSORIES GROUND TEST.

- b. Check flight controls for free and proper movement, and watch control surfaces for correct response.
- c. Check de-icer control (figure 16-98) "OFF."
- d. Check with crew to see hatches are closed and that lower turret is retracted.
- e. Check with navigator on fuel level gages.
- f. Check suction (figure 16-115): 3.75 to 4.25 in. Hg (9.53 to 10.8 cm Hg).
- r. Check with navigator to see that emergency fuel shut-off valves (figure 23-227) are "ON."
- s. Check with navigator to verify heater switch (figure 22-212) "OFF."

7. PREFLIGHT CHECK.

- a. Check flight controls for free and proper movement, and watch control surfaces for correct response.
- b. Check for position of elevator, aileron and rudder trim tabs.
- c. Wing flaps (figure 17-148) 20 degrees down (control neutral).

Copilot

- a. See that automatic pilot or automatic flight control equipment (figure 16-114) is caged "OFF."
- g. Check hydraulic pressure (figure 16-122) at 800 to 1100 lb/sq in. (56.2 to 77.3 kg/sq cm).
- h. Check brake pressure (figure 16-123): 1000 to 1200 lb/sq in. (70.3 to 84.3 kg/sq cm).
- i. Fuel booster pumps (figure 18-163) "ON." Fuel pressure 6 to 7 lb/sq in. (.4 to .5/sq cm).
- j. Propeller controls (figure 18-165) at "INCREASE RPM" (locked snug).
- k. Mixture controls (figure 18-167) at "FULL RICH" (locked snug).
- l. Supercharger controls (figure 17-146) "LOW" (locked).
- m. Oil cooler shutters (figure 17-151) "OPEN."
- n. Carburetor air (figure 16-141) "NORMAL" or "ICING CONDITIONS" as required.
- o. Cowl flaps (figure 17-149) "OPEN" (control neutral).
- p. Emergency air brake (figure 21-199) safetied by wire in down position.
- q. Emergency hydraulic selector valve (figure 21-200) "NORMAL."
- t. Uncage gyro instruments. (See figure 16-114.)

PilotCopilot

- (1) For best obstacle clearance on short run set flaps 30 degrees down.

8. TAKE-OFF.

- a. Do not turn on heater during take-off.  
b. Propeller controls (figure 18-165) increase rpm (locked snug).

- c. Engine rpm 2600 maximum and manifold pressure (figure 16-117) 44 in. Hg (111.8 cm Hg). Maximum time 1 minute (lock throttle snug).  
d. Landing gear retracted only on definite signal from pilot.  
e. Fuel pressure (figure 16-118) 6 to 7 lb/sq in. (.4 to .5 kg/sq cm).  
f. Cylinder temperature (figure 16-121) 160 degrees C minimum to 260 degrees C maximum (320 degrees F minimum to 500 degrees F maximum for 5 minutes).  
g. Oil pressure (figure 16-125) 80 to 90 lb/sq in. (5.6 to 6.3 kg/sq cm).  
h. Oil temperature 40 degrees C (104 degrees F) minimum 95 degrees C (203 degrees F) maximum.

- i. Refer to "Take-off, Climb and Landing Chart."

9. ENGINE FAILURE DURING TAKE-OFF.

- a. Move mixture control (figure 18-169) to "IDLE CUT-OFF" and cut the ignition switch of dead engine.

- b. If bomb bay droppable tank is installed, release immediately if sufficient altitude has been attained to open and close bomb doors. (See figure 16-102.)

- c. Put nose of airplane down and make belly landing.

- d. Do not lower landing gear or nose wheel.  
e. If bombs are being carried do not release.

10. CLIMB.

- a. Landing gear (figure 21-192) "UP."  
b. Manifold pressure (figure 16-117) 38 in. Hg (96.5 cm Hg); maximum below 11,000 ft (3350 meters). 39 in. Hg (99.1 cm Hg); maximum above 11,000 ft (3350 meters).  
c. Engine rpm 2400 maximum.  
d. Fuel pressure (figure 16-118) 6 to 7 lb/sq in. (.4 to .5 kg/sq cm).  
e. Cylinder temperature (figure 16-121) 260 degrees C (500 degrees F) maximum for 15 minutes.  
f. Oil pressure (figure 16-125) 80 to 90 lb/sq in. (5.6 to 6.3 kg/sq cm).

PilotCopilot

- i. Carburetor air (figure 16-141) "NORMAL" or "ICING CONDITIONS" as required.
  - j. Supercharger: "LOW" below 11,000 ft (3350 meters); "HIGH" above 11,000 ft (3350 meters). Shift from low to high at 1400 to 2400 rpm.
  - k. Wing flaps (figure 17-148) "UP"; cowl flaps (figure 17-149) "OPEN" (controls neutral).
- g. Oil cooler shutters (figure 17-151) "OPEN." Oil temperatures 95 degrees C (203 degrees F) maximum. (See figure 16-119.)
  - h. Mixture (figure 18-167) "FULL RICH."

**11. FLIGHT OPERATION.**

**CAUTION:** Do not allow one fuel tank to run completely dry before switching to another tank.

- (5) Mixture fuel (figure 18-167) "RICH."
- (6) Supercharger "LOW" below 13,000 ft (4000 meters); "HIGH" above 13,000 ft (4000 meters). Shift from "LOW" to "HIGH" at 1400 to 2400 rpm.
- (8) Carburetor air "NORMAL" or "ICING CONDITIONS" as required.

**NOTE:** Consult Automatic Pilot Check-Off list if airplane is so equipped.

**12. ENGINE FAILURE DURING FLIGHT.**

The minimum controllable speed with one engine at rated power is 140 mph, indicated. If the speed drops below 140 mph, the application of

**a. Cruising.**

- (1) Engine rpm maximum and manifold pressure 31.5 in. Hg (80 cm Hg) maximum.
- (2) Fuel pressure 6 to 7 lb/sq in. (.4 to .5 kg/sq cm). Fuel booster pumps "ON" as required to maintain 6 to 7 lb/sq in. (.4 to .5 kg/sq cm) fuel pressure.
- (3) Oil pressure 80 to 90 lb/sq in. (5.6 to 6.3 kg/sq cm).
- (4) Check suction 3.75 to 4.25 in. Hg (9.53 to 10.8 cm Hg).
- (7) Adjust oil cooler shutters to obtain 60 degrees C to 85 degrees C (140 degrees F to 185 degrees F).
- (9) Wing flaps and landing gear "UP" (flap control "NEUTRAL").
- (10) Cowl flaps closed or open as required (control neutral). Cylinder temperature 205 degrees C (401 degrees F) maximum.
- (11) Check volts 28 to 28.5; Amperes 40 to 60 maximum.

PilotCopilot

full power on the single engine causes the airplane to yaw. Airplane should be dived at reduced power to attain proper speed. Adjust rudder trim tab to counteract loss of engine thrust and fly the airplane with the dead engine high.

13. EMERGENCY CREW EXITS. (See section X.)14. APPROACH, LANDING, AND CROSS-WIND LANDING.a. Landing.

- (2) Set de-icer control (figure 16-98) "OFF."
- (4) Verify that lower gun turret is retracted.
- (5) Check fuel levels with navigator.

- (1) Turn automatic pilot (figure 16-114) "OFF."
- (3) Cage gyro instruments. (Figure 16-114.)
- (6) Check hydraulic pressure (figure 16-122) at 800 to 1000 lb/sq in. (52.6 to 77.3 kg/sq cm).
- (7) Check brake pressure (figure 16-123) at 1000 to 1200 lb/sq in. (70.3 to 84.3 kg/sq cm).
- (8) Check fuel booster pumps (figure 18-166) both "ON."
- (9) Set propeller (figure 18-165) at 2100 rpm.
- (10) Set mixture controls (figure 18-169) "FULL RICH."
- (11) Lock supercharger control (figure 17-147) at "LOW."
- (12) Oil cooler shutters (figure 17-151) "OPEN."
- (13) Cowl flaps (figure 17-149) "CLOSED" (control neutral).
- (14) Set landing gear (figure 21-192) "DOWN" and lock. Air speed should be less than 170 mph (148 knots) when lowering landing gear. Check operation by indicator (figure 16-111) and warning horn.
- (15) Safety emergency brake control (figure 21-199) with pressure at 400 to 425 lb/sq in. (28.1 to 29.9 kg/sq cm).
- (17) Set wing flaps (figure 17-148) "DOWN" (control neutral). Do not exceed 170 mph (148 knots).

- (16) Check with navigator that heater control (figure 22-212) is "OFF."

**CAUTION:** If landing is not made, do not raise flaps until sufficient altitude and speed are obtained.

b. Emergency Operation of Landing Gear and Flaps.

- (1) Order navigator to lower nose gear.
- (2) At request of navigator, retard throttle momentarily to see that nose gear is locked

PilotCopilot

down, as evidenced by failure of warning horn to sound.

c. Lowering of Main Landing Gear.

- (1) Order radio operator to lower main landing gear.
- (2) Retard throttle momentarily to ascertain that the landing gear is locked down, as evidenced by the failure of warning horn to sound.

d. Emergency Operation of Flaps.

- (1) Order radio operator to lower wing flaps.
- (2) Move hydraulic flap control handle to the extreme position for the desired movement of the flaps.

e. Emergency Take-Off If Landing Is Not Completed.

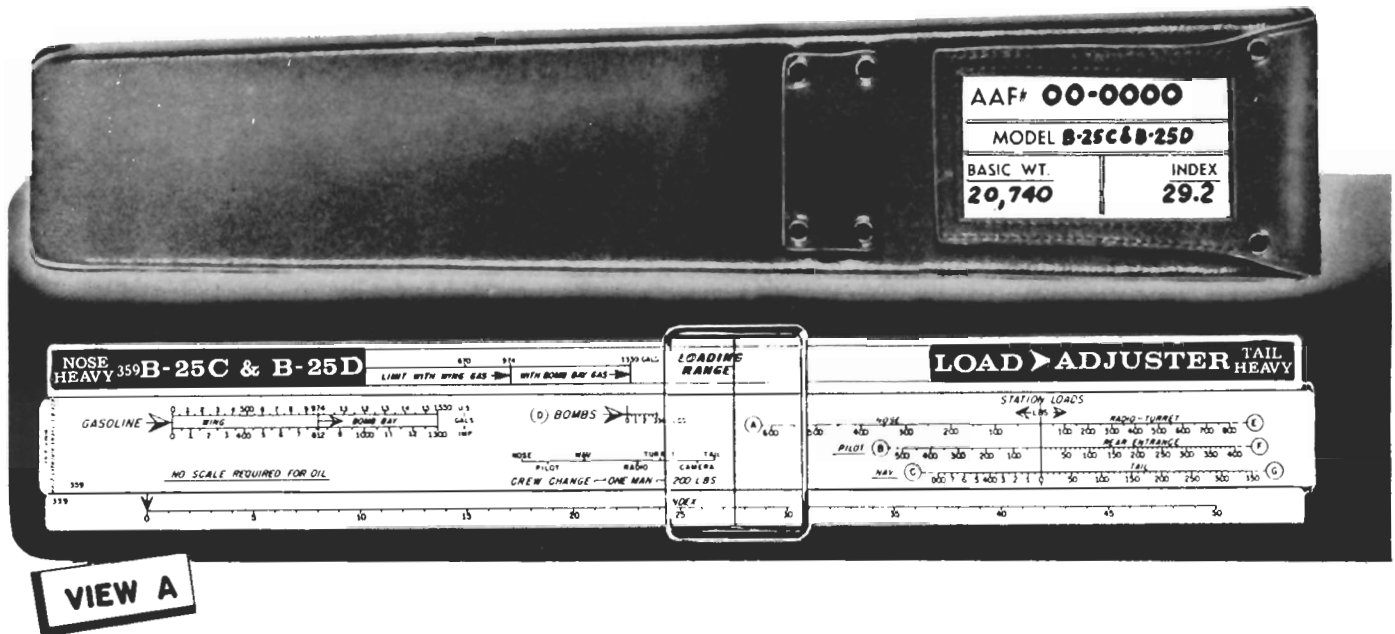
- (1) Full throttle.
- (2) Leave landing gear and wing flaps down until sufficient altitude and speed are obtained.

15. STOPPING OF ENGINES.

- a. Propeller at full "INCREASE RPM."
- b. If necessary use oil dilution system.
  - (1) Hold the oil dilution switch (figure 16-135) "ON" for approximately four minutes while engines are idling at 800 rpm.
  - (2) Stop engines conventionally keeping the dilution switch on until the engines stop turning.
- c. Idle at 600 to 800 rpm for one to three minutes until cylinder temperature is below 190 degrees C (374 degrees F).
- d. Run engines at 1500 to 1600 rpm for five seconds, then move mixture control to "IDLE CUT-OFF" and open throttle. Do not move mixture control from "IDLE CUT-OFF."
- e. After engine stops turn all switches "OFF."

16. BEFORE LEAVING PILOT'S COMPARTMENT.

- a. Fuel booster pumps "OFF."
- b. Propeller at full "INCREASE RPM."
- c. Wing flaps "UP."
- d. Cowl flaps "OPEN."
- e. Lock flying controls.
- f. Replace locks on hydraulic controls.
- g. If airplane is not to be serviced by a ground crew, lock all entrance hatches.



#### 17. Instructions for Use of Load Adjuster.

a. Airplane Loading. - Check and sign the weight and balance clearance prepared by the ground loading personnel. This may be rapidly and accurately accomplished by using a load adjuster (view A). The following instructions and sample loading problem are published as condensed instructions for the information and guidance of all personnel using a load adjuster to determine change in balance from the basic airplane to the loaded airplane as flown, and to insure that the weight distribution of all items loaded above and beyond the basic airplane weight and balance will not produce a weight and balance condition beyond permissible limits.

b. Application of Load Adjuster. - A load adjuster and carrying case for the models B-25C and B-25D airplanes will be found located on a mounting hook adjacent to the data case. Pick up the instrument and ascertain that the serial number for the airplane being loaded is identical with the serial number inscribed on the carrying case identification card (view A).

**CAUTION:** The airplane model designation stamped on every load adjuster indicates that the instrument may be used for balance calculations on any AAF airplane of that particular model. However, the index figure entered on the carrying case identification card is correct only for the specific airplane serial number printed directly above, and represents the balance moment of only that one individual basic airplane.

#### c. Operating Instructions.

(1) The following sample loading problem is itemized in detail, and complete instructions with supporting illustrations are published to furnish the Service with complete instructions on loading aircraft above and beyond the basic airplane (including personal items and all items commonly referred to as "expendable" items) are to be taken into consideration for each and every loading problem, and their balance moments must be added with the load adjuster on the compartment scale where they are to be located.





**NOSE HEAVY 359**

**B-25C & B-25D**

670 914 1329 CALS

LIGHT WITH WING GAS — WITH BOMB DAY GAS —

**LOADING RANGE**

**LOAD ADJUSTER TAIL HEAVY**

(1) SET INDICATOR TO BASIC INDEX. OBTAIN THIS FROM CARD OR FROM INDEX DETERMINATION SCALE ON BACK OF SLIDE.

(2) MOVE SLIDE UNTIL STARTING POINT VERTICAL LINE MARKED "O" OF ANY DESIRED SCALE IS UNDER THE INDICATOR HAIRLINE.

GASOLINE → 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

WING →

BOMB →

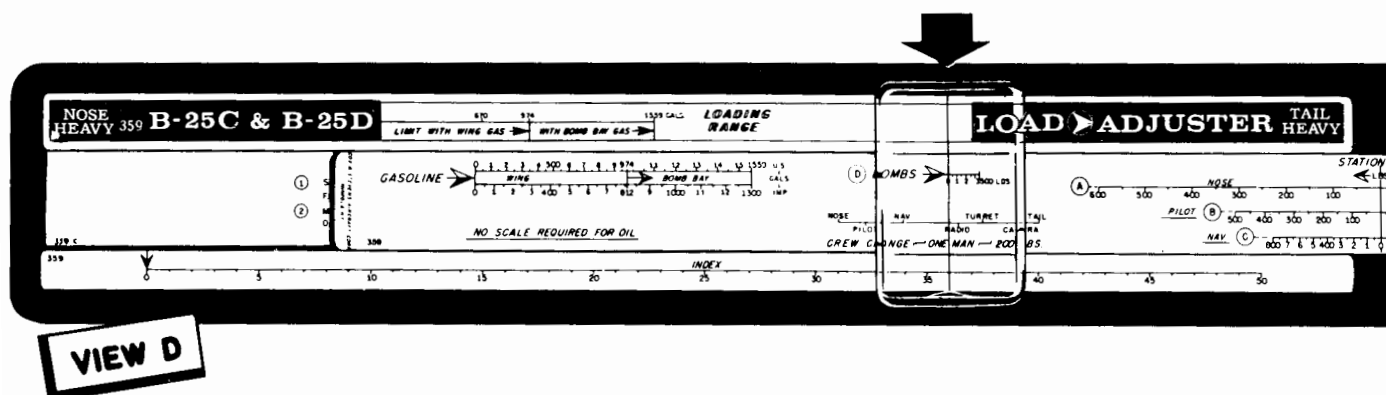
TAIL HEAVY →

NO SCALE REQUIRED FOR OIL

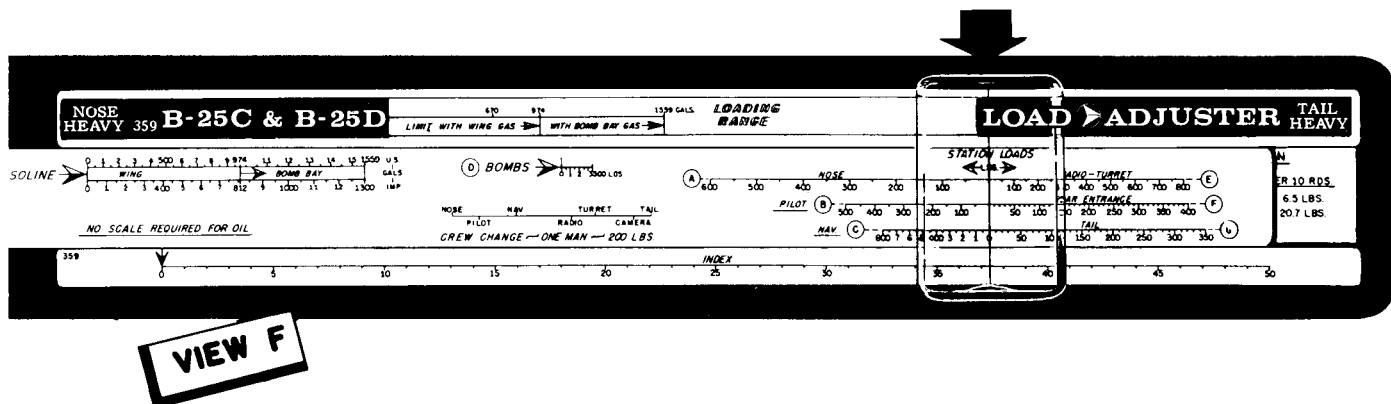
INDEX

VIEW C

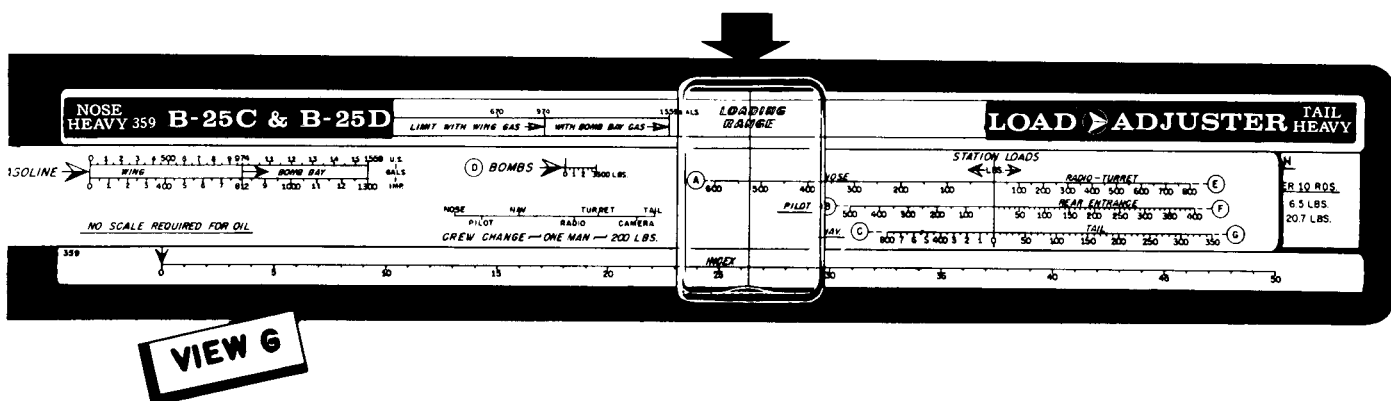
- (4) Set slide to the zero mark on the "BOMBS" scale as illustrated in view D.

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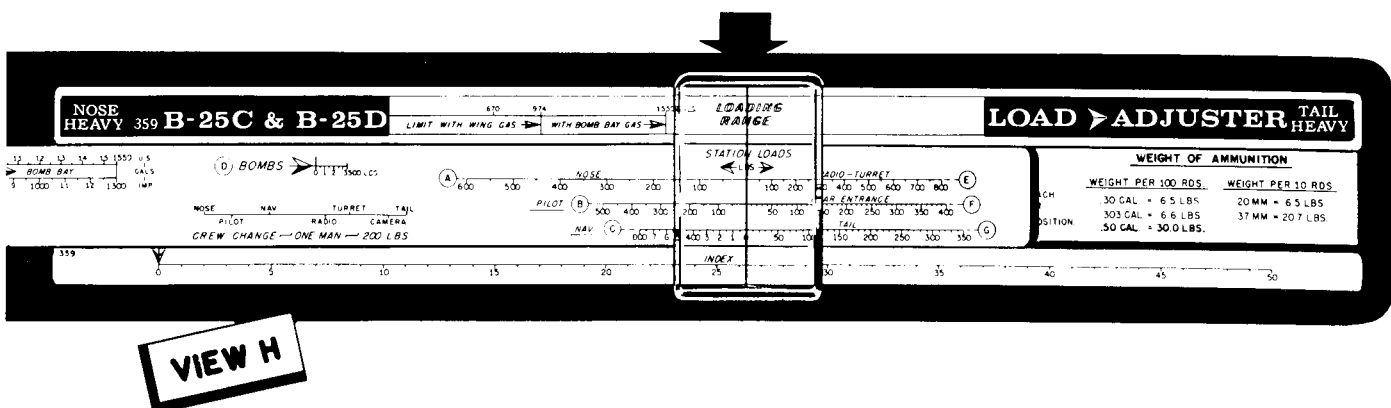
(5) Set slide to the compartment ("STATION LOADS") zero mark as illustrated in view F.



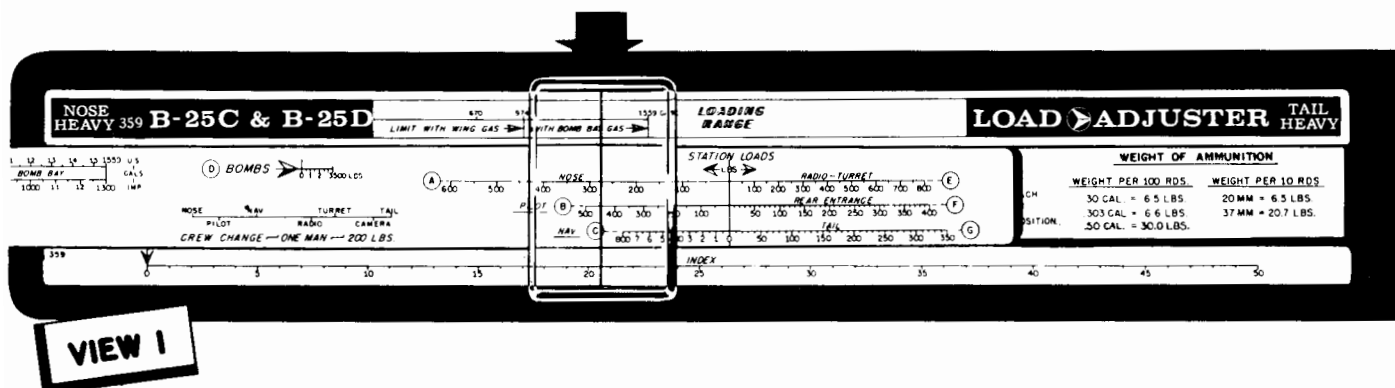
Move indicator until the hairline is over 525 on the "NOSE" scale. This adds the balance moment of the items that were loaded in that compartment and moves the index to 26.4 as illustrated in view G.



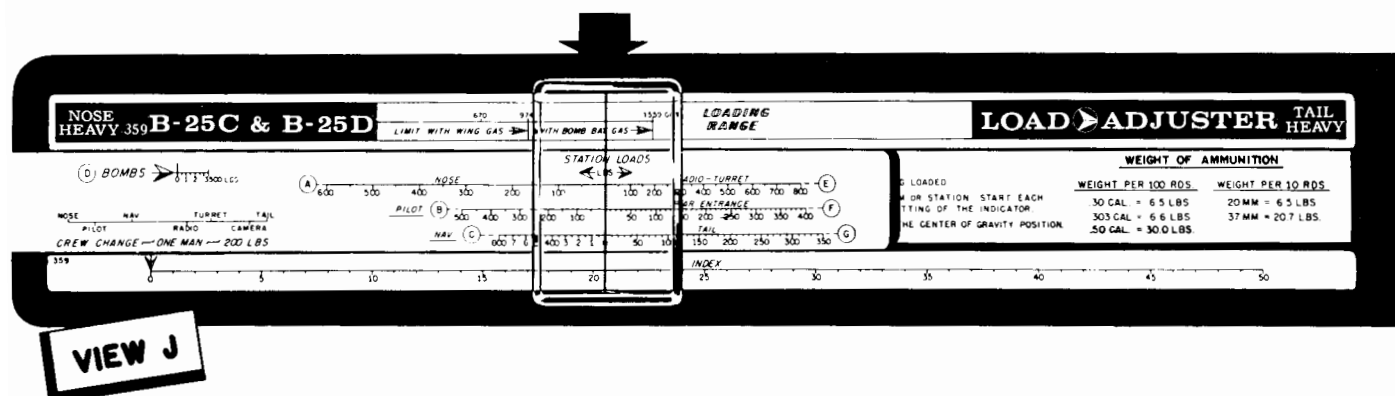
(6) Set slide to the compartment zero line as illustrated in view H.



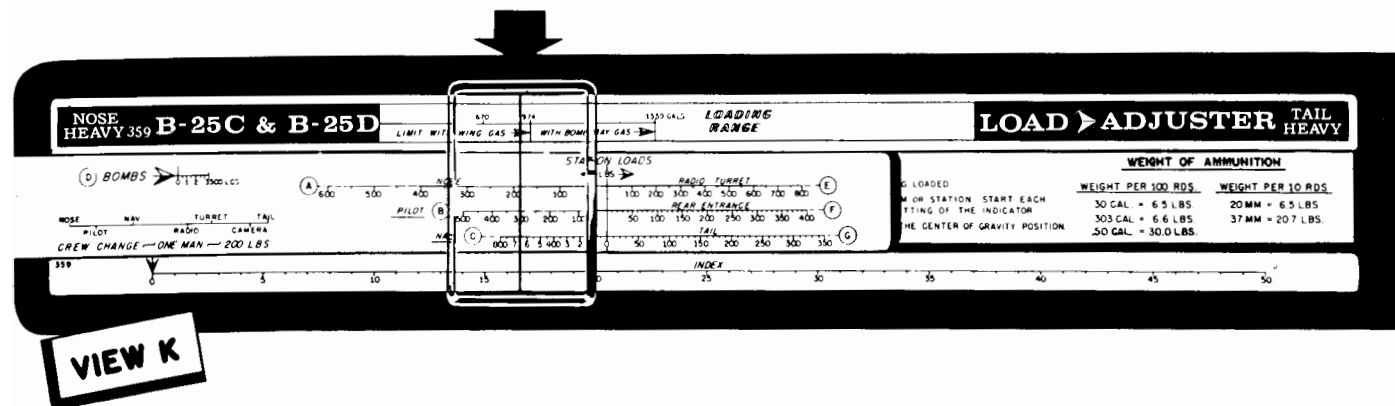
Move indicator until the hairline is over 450 on the "PILOT" scale. This adds the balance moment of the two pilots and their brief cases in the airplane and moves the index to 20.6 as illustrated in view I.



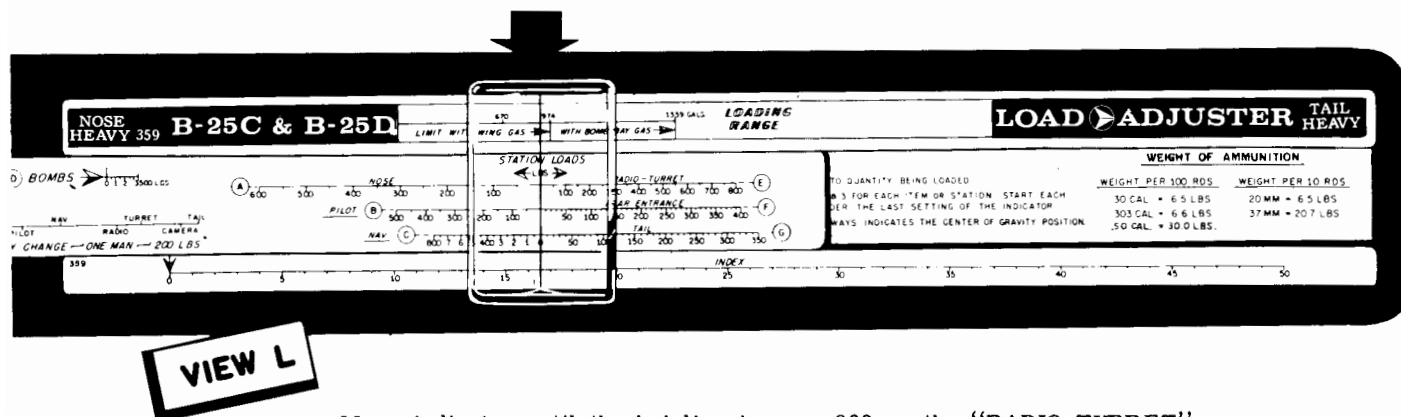
(7) Set slide to the compartment zero line as shown in view J.



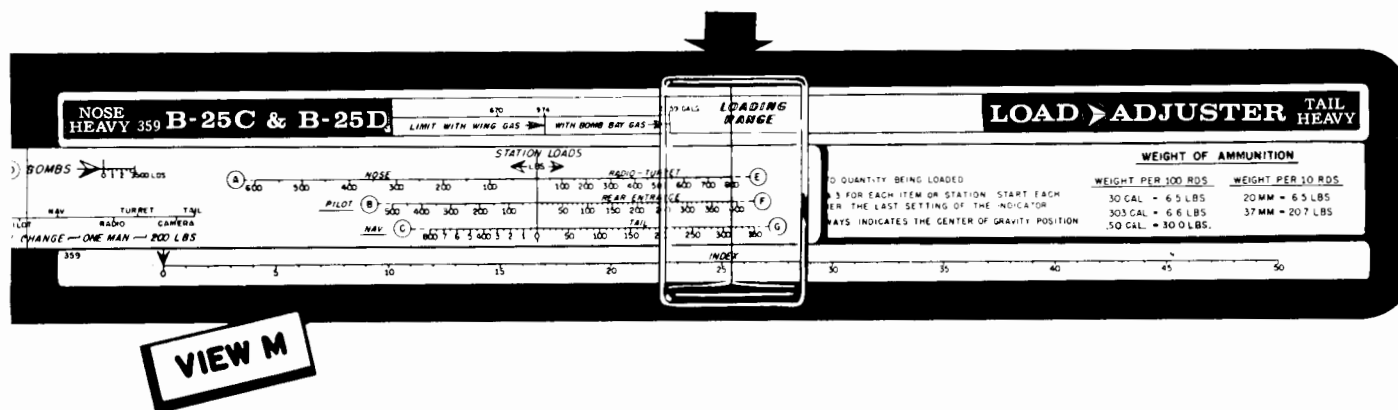
Move indicator until the hairline is over 650 on the "NAV." scale. This adds the balance moment of two men, 200 pounds of special equipment and 50 pounds of navigational and Handbook data as loaded in the airplane and moves the index to 16.6 as shown in view K.



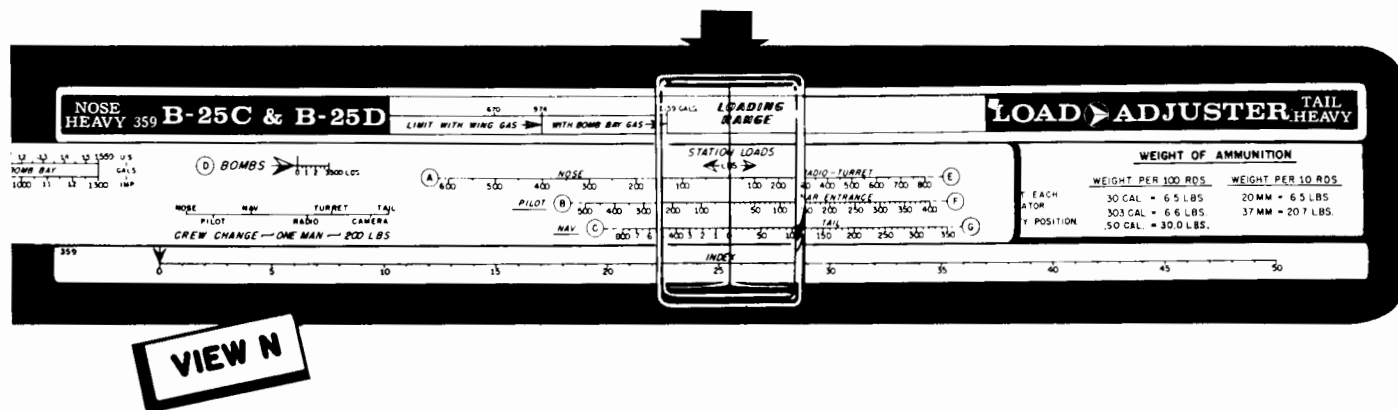
(8) Set slide to the compartment zero line as shown in view L.



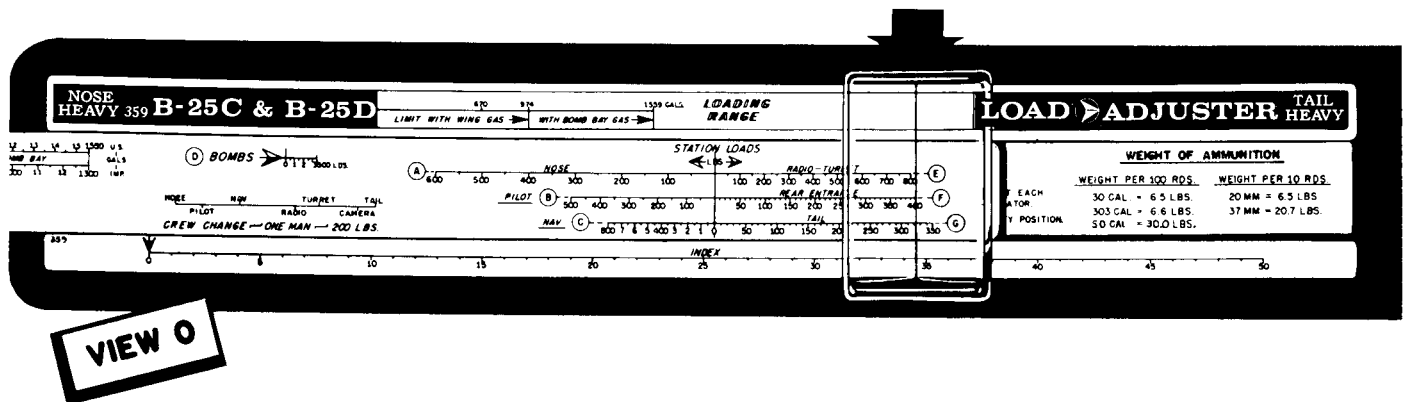
Move indicator until the hairline is over 800 on the "RADIO-TURRET" scale. This adds the balance moment of two men, special equipment and ammunition as loaded in this compartment and moves the index to 25.5 as shown in view M.



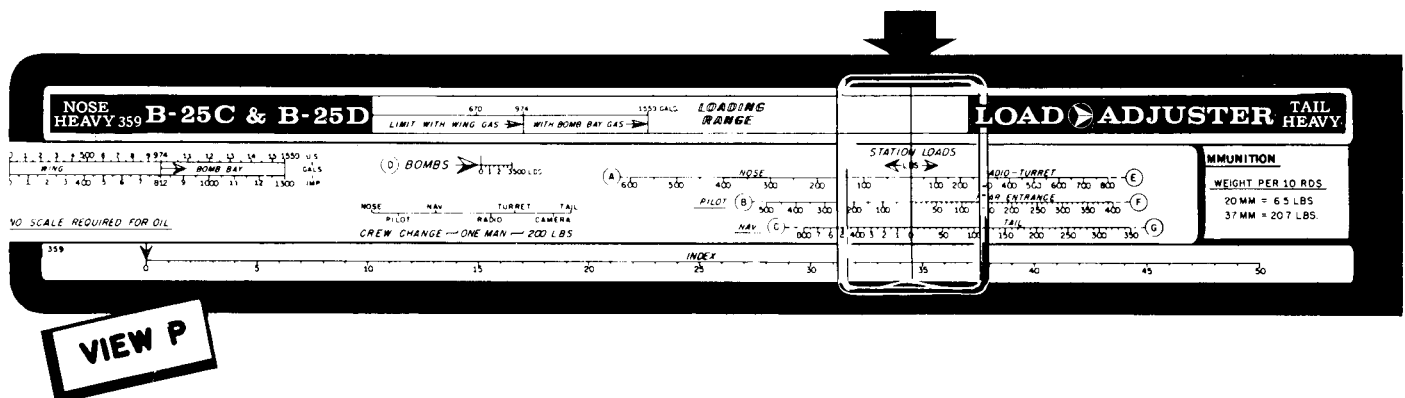
(9) Set slide to the compartment zero line as illustrated in view N.



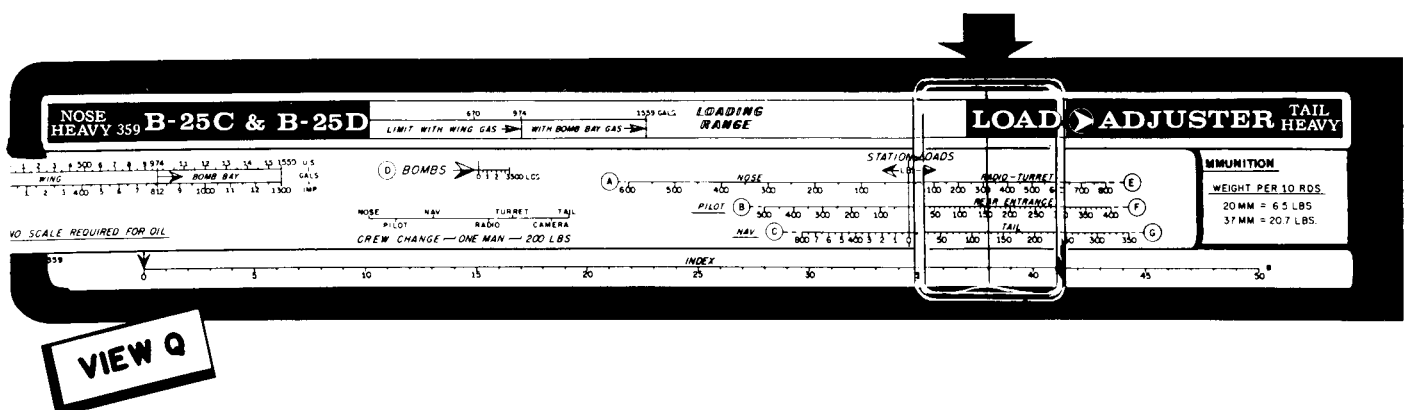
Move indicator until the hairline is over 400 on the "REAR ENTRANCE" scale. This adds the balance moment of photographic equipment and supplies, the photographer and brief cases as loaded in that compartment and moves the index to 34.5 as illustrated in view O.



(10) Set slide to the compartment zero line as shown in view P.



Move indicator until the hairline is over 125 on the "TAIL" compartment scale. This adds the balance moment of 125 pounds of equipment as loaded in the tail compartment and completes calculation of the balance moments of all items as initially loaded in the airplane. It has moved the airplane index to 38.0 as shown in view Q.

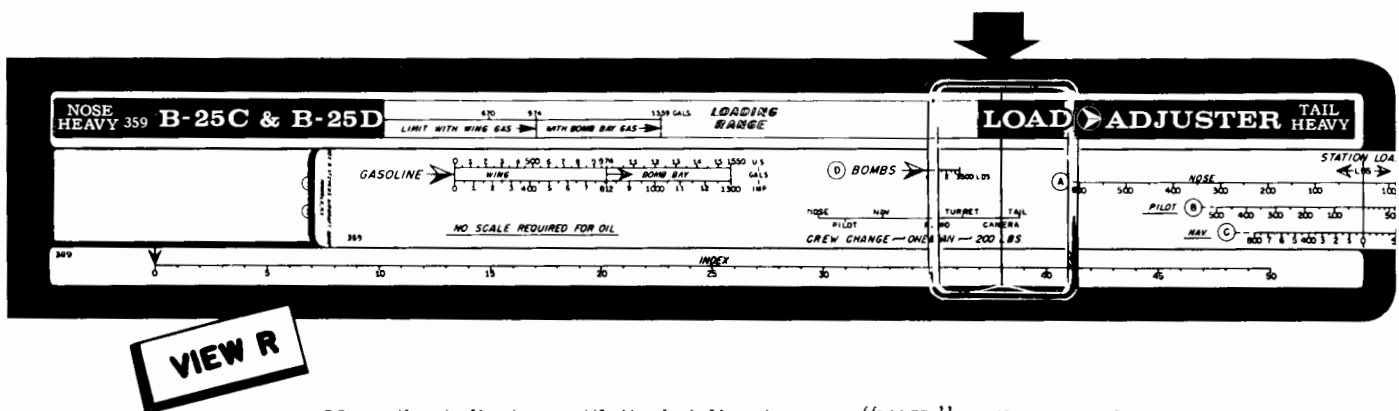


(11) Balance Correction.

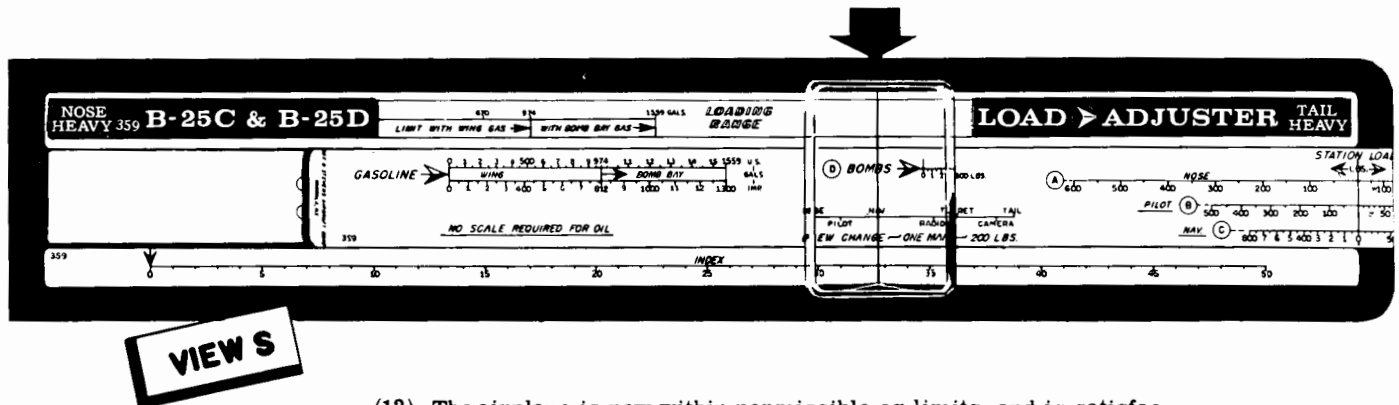
(a) Adding the weights of all items loaded (paragraph 1.c. of this section) shows the gross load of the airplane well within allowable limits, and, as far as weight alone is concerned, the airplane may be flown. However, the load adjuster indicator hairline is located in the red portion of the loading range which ABSOLUTELY PROHIBITS any attempt to fly the airplane because of a dangerous tail-heavy condition.

(b) This "out of balance" condition may be corrected by shifting some of the load or a member of the crew from an aft position to a forward position in the airplane, the amount of change required being predetermined by a "trim shift" of load on the load adjuster. In this sample case, shifting the photographer from the camera position in the rear entrance compartment forward to the navigator's compartment will bring the airplane balance well within cg limits.

(c) With the indicator hairline remaining on the last index (38.0), move the slide until "CAMERA" of the "CREW CHANGE-ONE MAN-200 LBS" scale is under the indicator hairline as shown in view R.



Move the indicator until its hairline is over "NAV." on the crew change scale. This changes the balance moment of one man (200 lb) from the camera position to the navigator's compartment, and moves the index to 32.7 as shown in view S.



(12) The airplane is now within permissible cg limits, and is satisfactory for flight. It is entirely permissible to shift miscellaneous cargo, baggage, or other items within the airplane to make the final balance fall within approved limits. The load adjusting instrument is exceedingly simple to operate, equally accurate, and the airplane should be loaded as it indicates.

**CAUTION:** Do NOT shift or dispose of any load without first pre-determining (by use of the load adjuster) that the balance will remain within limits after the change is made.

SECTION IIIFLIGHT OPERATION DATA1. Determining Gross Weight.

Secure gross weight from Form F, Weight & Balance Clearance.

2. Flight Planning.

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

a. If the flight plan calls for a continuous flight where the desired cruising power and air speed are reasonably constant after take-off and climb to 5000 feet, the fuel required and flight time may be computed as a "single section flight."

(1) Within the limits of the airplane, the fuel required and flying time for a given mission depend largely upon the speed desired. With all other factors remaining equal in an airplane, speed is obtained at a sacrifice of range, and range is obtained at a sacrifice of speed. The speed is usually determined after considering the urgency of the flight plotted against the range required. The time of take-off is adjusted so as to have the flight arrive at its destination at the predetermined time.

(2) Select the FLIGHT OPERATION INSTRUCTION CHART for the gross weight to be used at take-off. Locate the largest figure entered under "gph" (gallons per hour) in column I on the lower half of the chart. Multiply this figure by the number and/or fraction of hours desired for reserve fuel. Add the resulting figure to the number of gallons set forth in footnote No. 2, and subtract the total from the amount of fuel in the airplane prior to starting of engine. The figure obtained as a result of this computation will represent the amount of gasoline available and applicable for flight planning purposes on the RANGE IN AIR MILES section of the FLIGHT OPERATION INSTRUCTION CHART.

(3) Select a figure in the fuel column equal to, or the next entry less than, the available amount of fuel in the airplane, as determined in paragraph 2.a.(2) above. Move horizontally to the right or left and select a figure equal to, or the next entry greater than, the air miles (with no wind) to be flown. Operating values contained in the column number in which this figure appears, represent the highest cruising speed possible at the range desired; however, the airplane may be operated in accordance with values contained under OPERATING DATA in any column of a higher number, with the flight plan being completed at a sacrifice of speed but at an increase in fuel economy.

(4) Using the same column number selected by applications of instructions contained in paragraph 2.a.(3) above, determine the indicated air speed (in mph or knots, whichever is applicable to the calibration of instruments in the airplane) and gallons per hour listed at sea level in the lower section of the chart under the subtitle OPERATING DATA. Divide this IAS into the air miles to be flown and obtain the calculated flight duration in minutes, which can then be converted into hours and minutes and deducted from the desired arrival time at destination in order to obtain the take-off time (without consideration for wind). To allow for wind, use the above IAS as ground speed and calculate a new corrected ground speed with the aid of a flight calculator or by a navigator's triangle of velocities.

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

**CAUTION:** Ranges listed in column I under "Max. Cont. Power" are correct only at the altitude given in footnote 1, and the engine and airplane operating data listed under OPERATING DATA will give constant miles per gallon if operation is consistent with values set opposite the listed altitudes.

(6) The flight plan may be readily changed at any time enroute, and the chart will show the balance of range at various cruising powers by following the INSTRUCTIONS FOR USING CHART printed on each page.

(7) Multiple charts are provided to give accurate data for operation at different gross weights, different external loads, and/or different combinations of engine use, such as single engine operation. Extreme caution should be exercised to assure selection of the correct chart applicable to the specific operating condition.

b. If the original flight plan calls for a mission requiring changes in power, speed, gross load, or external load, in accordance with the titles shown at the top of each chart provided, the total flight should be broken down into a series of individual short flights, each computed as outlined in paragraph 2.b. in its entirety, and then added together to make up the total flight and its requirements.



MODEL (S)

B-25C

B-25D

FLIGHT OPERATION INSTRUCTION CHART

EXTERNAL LOAD ITEMS

NONE

SHEET 1 OF 8 SHEETS

POUNDS

34,000

30,000

GR. WT. TO

CONDITION

R.P.M.

M.P. (IN. HG.)

BLOWER POSITION

MIXTURE POSITION

DURATION IN MIN.

TAKE-OFF	2600	44.0	LOW	FULL	5
MILITARY POWER	2600	42.0	LOW	FULL	5
ENGINE (S)		41	HIGH	RICH	

R-2600-13

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

I (MAX. CONT. POWER)

RANGE IN AIR MILES

STATUTE

NAUTICAL

FUEL U.S. GALS. 2

1110

890

1020

950

870

800

730

760

700

630

660

580

510

570

510

440

440

360

290

380

320

250

II

RANGE IN AIR MILES

STATUTE

NAUTICAL

1870

1730

1600

1480

1350

1230

1280

1180

1070

1110

990

860

960

860

750

III

RANGE IN AIR MILES

STATUTE

NAUTICAL

2160

2000

1850

1710

1570

1420

1480

1360

1240

1280

1140

1000

1110

990

870

IV

RANGE IN AIR MILES

STATUTE

NAUTICAL

2460

2280

2100

1940

1780

1620

1690

1540

1400

1260

1120

980

840

700

560

V (MAX. RANGE)

RANGE IN AIR MILES

STATUTE

NAUTICAL

2750

2540

2350

2170

1990

1810

1630

1450

1270

1090

900

720

940

790

630

OPERATING DATA

R.P.M.

M.P. (IN. HG.)

T.A.S. (M.P.H.)

U.S. G. P. H.

2400

2400

2400

2400

F.T.

F.T.

39

F.T.

260

280

275

275

225

300

312

304

250

250

275

275

OPERATING DATA

R.P.M.

M.P. (IN. HG.)

T.A.S. (M.P.H.)

U.S. G. P. H.

2200

2100

2100

2100

28

32.5

29

30.5

147

195

210

215

215

230

220

186

179

191

183

179

OPERATING DATA

R.P.M.

M.P. (IN. HG.)

T.A.S. (M.P.H.)

U.S. G. P. H.

2100

2250

2100

2050

27.5

25.5

27.5

28.5

160

190

200

205

155

137

146

146

OPERATING DATA

R.P.M.

M.P. (IN. HG.)

T.A.S. (M.P.H.)

U.S. G. P. H.

2000

2000

2000

2000

29

28.5

28.5

29.0

182

170

182

182

142

133

125

125

OPERATING DATA

R.P.M.

M.P. (IN. HG.)

T.A.S. (M.P.H.)

U.S. G. P. H.

2050

2100

2100

2050

30.5

31.5

30.5

30.5

186

190

220

190

175

175

146

146

DENSITY

ALT. IN FEET

30000

25000

20000

15000

12000

9000

6000

3000

S. L.

OPERATING DATA

R.P.M.

M.P. (IN. HG.)

T.A.S. (M.P.H.)

U.S. G. P. H.

1850

1800

1700

1650

26

27

28

29

170

175

180

180

147

152

156

156

OPERATING DATA

R.P.M.

M.P. (IN. HG.)

T.A.S. (M.P.H.)

U.S. G. P. H.

1800

1700

1650

27

28

29

175

180

180

152

156

156

**MODEL (S)**  
**B-25C**  
**B-25D**

**FLIGHT OPERATION INSTRUCTION CHART**

SHEET 2 OF 8 SHEETS  
**EXTERNAL LOAD ITEMS**  
**NONE**

GR. WT. 30,000 TO 26,000 POUNDS

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

I (MAX. CONT. POWER)				II				III				IV				V (MAX. RANGE)				
RANGE IN AIR MILES		NAUTICAL		RANGE IN AIR MILES		NAUTICAL		RANGE IN AIR MILES		NAUTICAL		RANGE IN AIR MILES		NAUTICAL		RANGE IN AIR MILES		NAUTICAL		
STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	
760	660	940	1280	1110	1480	1280	1680	1460	1880	1630	783	1600	1400	1200	1040	860	690	520	340	170
640	550	800	1090	940	1260	1090	1430	1240	1600	1390	666	1400	1200	1040	860	690	520	340	170	
560	480	700	950	820	1100	950	1250	1080	1500	1210	633	1300	1100	940	770	610	460	300	140	
480	410	600	810	700	940	810	1070	920	1400	1100	600	1200	1000	800	650	500	350	200	100	
400	340	500	680	590	780	670	890	770	1300	1000	577	1100	900	700	560	410	260	130	60	
320	270	400	540	470	630	540	710	610	1200	900	533	1000	800	600	470	330	200	100	50	
240	200	300	400	340	470	400	530	460	1100	800	500	900	700	500	370	250	150	70	30	
160	130	200	270	230	310	270	350	300	1000	700	467	800	600	400	270	180	100	50	20	
80	60	100	130	110	150	130	170	140	900	600	433	700	500	300	200	130	70	30	10	

ENGINE IS R-2600-13

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

LEGEND

1 Range values of 14,000 ft. only

2 Allow 34 U.S. gals. 28 Imp. gals. for warm up, take-off to

from tanks in the following order:

Return fuel flows to tank

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

UNDERLINED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

BOLD NUMBERS: Use Auto-Rich

LIGHT ITALICS: Use Auto-Lean

WITH TWO SPEED BLOWER: Use high blower above heavy line only

IMP. G.P.H.: Imperial Gallons Per Hour

F.T.: Full Throttle

U.S. G.P.H.: U.S. Gallons Per Hour

IMP. G.P.H.: Imperial Gallons Per Hour

F.T.: Full Throttle

MODEL (S)										FLIGHT OPERATION INSTRUCTION CHART										SHEET 3 OF 8 SHEETS									
B-25C										EXTERNAL LOAD ITEMS										1 TORPEDO AND 8 WING BOMBS									
B-25D										GR. WT. 36,000 TO 32,000 POUNDS																			
CONDITION		R.P.M.	M.P.	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.																						
TAKE-OFF		2600	44.0	LOW	FULL	5																							
MILITARY POWER		2600	42	LOW	FULL	5																							
ENGINE (S)		R-2600-13																											

ALTERNATE CRUISING CONDITIONS										(NO RESERVE FUEL ALLOWANCE)									
I (MAX. CONT. POWER)		II		III		IV		V (MAX. RANGE)											
RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES											
STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL										
850	730	1190	1030	1390	1200	1580	1370	1770	1530										
800	690	1120	970	1300	1130	1480	1280	1670	1450										
740	640	1040	900	1200	1040	1370	1190	1540	1330										
680	590	950	820	1100	950	1260	1090	1410	1220										
620	530	860	740	1000	860	1140	990	1280	1110										
550	470	780	670	900	780	1030	890	1150	990										
490	420	690	600	800	690	910	790	1020	880										
430	370	600	520	700	600	800	690	900	780										

OPERATING DATA										OPERATING DATA										OPERATING DATA									
R.P.M.		T.A.S.		M.P.		I.A.S.		U.S.		R.P.M.		T.A.S.		M.P.		I.A.S.		U.S.		R.P.M.		T.A.S.		M.P.		I.A.S.		U.S.	
IN HG.		KNOTS		IN HG.		KNOTS		KNOTS		IN HG.		KNOTS		IN HG.		KNOTS		KNOTS		IN HG.		KNOTS		IN HG.		KNOTS		KNOTS	
ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.		ALT.	
IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET		IN FEET	
2400	30000	231	200	395	328	2100	32	150	130	235	2200	29	170	147	220	183	2100	28	160	139	190	158	2000	28	150	130	150	125	
2400	25000	39	227	197	365	2200	36.5	175	152	290	2200	30	175	152	215	179	2050	29	165	143	190	158	2000	28	155	134	145	121	
2400	20000	F.T.	234	203	330	2200	31.5	185	160	270	2100	30	175	152	215	179	2050	30	175	152	185	154	2000	29	165	143	145	121	
2400	15000	38	237	206	370	2150	32	190	165	260	2100	30.5	180	156	215	179	2050	30.5	180	165	180	150	2000	29.5	170	147	145	121	
2400	12000	38	230	199	355	2150	33	195	169	260	2100	31.5	185	160	215	179	2050	31	180	165	180	150	2000	29.5	170	147	145	121	
2400	9000	38	219	190	340	2150	34	195	169	255	2100	32	190	165	205	171	2050	32	180	165	175	146	2000	29.5	170	147	145	121	

LEGEND

RESTRICTED

[illegible]

**UNDERLINED FIGURES ARE PRELIMINARY; SUBJECT TO REVISION AFTER FLIGHT CHECK**

**MODEL (S)**  
**B-25 C**  
**B-25 D**

**FLIGHT OPERATION INSTRUCTION CHART**

**EXTERNAL LOAD ITEMS**  
**1 TORPEDO OR 8 WING BOMBS**

GR. WT. **36,000** TO **31,000** POUNDS

SHEET **5** OF **8** SHEETS

CONDITION	R.P.M.	M.P. (IN HG.)	BLOWER POSITION	MIXTURE	DURATION IN MIN.
TAKE-OFF	2600	44.0	LOW	FULL	5
MILITARY POWER	2600	42	LOW	FULL	5
ENGINE (S)			HIGH	RICH	
R-2600-13					

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS									
I (MAX. CONT. POWER)		II		III		IV		V (MAX. RANGE)	
RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES	
STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL
1100	950	1570	1360	1810	1570	2060	1780	2300	1990
1010	880	1450	1260	1670	1450	1890	1640	2120	1840
940	820	1350	1170	1550	1350	1760	1530	1960	1710
870	750	1240	1080	1430	1240	1620	1410	1810	1570
800	690	1140	990	1310	1140	1490	1290	1660	1440
720	630	1040	900	1190	1040	1350	1170	1510	1310
650	570	930	810	1070	930	1220	1060	1360	1180

OPERATING DATA																	
R.P.M.		T.A.S. (KNOTS)		I.A.S. (KNOTS)		M.P. (IN. HG.)		DENSITY ALT. (IN FEET)									
2400	2400	2400	2400	2400	2400	2400	2400	2400	2400								
F.T. 248	215	375/241	15000	165	143	240/200	2100	33	165	143	230/191	2050	32	160	139	210/175	15000
39	245	212	365/230	12000	185	160	290/241	2150	28.5	175	152	200	27.5	170	147	170	142
F.T. 252	220	330/258	9000	190	165	245/204	2050	29.5	180	156	200	2000	28.5	175	152	170	142
38	254	222	370/250	6000	195	169	240/200	2050	30	185	160	200	29	180	156	170	142
38	244	211	355/241	3000	200	173	230/191	2050	31	190	165	190	30	185	160	165	137
2400	233	202	340/229	S. L.	200	173	220/183	2050	31.5	195	169	180	30.5	185	160	155	129

OPERATING DATA									
R.P.M.		T.A.S. (KNOTS)		I.A.S. (KNOTS)		M.P. (IN. HG.)		DENSITY ALT. (IN FEET)	
1950	1950	1950	1950	1950	1950	1950	1950	1950	1950
27	155	134	135	112	1950	27.5	165	143	135
28.5	170	147	130	108	1950	28.5	170	147	130
29	175	152	130	108	1900	29	175	152	130

## LEGEND

1 Range values at **14,000** ft. only  
2 Allow **33** U. S. gal. **32** Imp. gal. for warm up, take-off to  
from tanks in the following order:  
Return fuel flow to tank

BOLD NUMBERS: Use Auto-Rich  
LIGHT ITALICS: Use Auto-Lean  
WITH TWO SPEED BLOWER: Use high  
blower above heavy line only

I.A.S.: Indicated Air Speed  
T.A.S.: True Air Speed  
M.P.: Manifold Pressure (In. Hg.)  
U.S.G.P.H.: U. S. Gallons Per Hour  
IMP.G.P.H.: Imperial Gallons Per Hour  
F.T.: Full Throttle

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

UNDERLINED FIGURES ARE PRELIMINARY. SUBJECT TO REVISION AFTER FLIGHT CHECK

**MODEL (S)**  
**B-25C**  
**B-25D**

**FLIGHT OPERATION INSTRUCTION CHART**

SHEET 6 OF 8 SHEETS  
**EXTERNAL LOAD ITEMS**  
**1 TORPEDO OR 8 WING BOMBS**

GR. WT. 31,000 TO 26,000 POUNDS

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS									
(NO RESERVE FUEL ALLOWANCE)									
I (MAX. CONT. POWER)		II		III		IV		V (MAX. RANGE)	
RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES	
STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL
620	530	1110	960	1270	1100	1430	1240	1600	1330
520	450	950	820	1080	940	1220	1060	1360	1180
460	400	830	720	950	820	1070	930	1190	1030
390	340	710	620	810	700	910	790	1020	880
330	280	590	510	680	590	760	660	850	740
260	230	470	410	540	470	610	530	680	590
200	170	350	310	410	350	460	400	510	440
130	110	240	200	270	230	300	260	340	300
60	50	110	100	130	110	150	130	170	140

OPERATING DATA		OPERATING DATA		OPERATING DATA		OPERATING DATA		OPERATING DATA	
R.P.M.	M.P. IN. HG.	R.P.M.	M.P. IN. HG.	R.P.M.	M.P. IN. HG.	R.P.M.	M.P. IN. HG.	R.P.M.	M.P. IN. HG.
2400	25.5	2100	27	2000	26.5	2000	26.5	2000	26.5
2400	26	2200	25.5	2150	25	2000	24	2000	24
2400	39	2150	28.5	2100	27.5	2000	26.5	2000	26.5
2400	257	2050	29.5	2000	28.5	2000	27	2000	27
2400	38	2050	30	2000	29	1950	27.5	1950	27.5
2400	38	2050	30.5	2000	29.5	1950	28.5	1950	28.5
2400	38	2050	31.5	2000	30	1900	29	1900	29

FUEL		FUEL		FUEL		FUEL		FUEL	
U.S. GALS.	IMP. GALS.	U.S. GALS.	IMP. GALS.	U.S. GALS.	IMP. GALS.	U.S. GALS.	IMP. GALS.	U.S. GALS.	IMP. GALS.
940	783	940	783	940	783	940	783	940	783
800	666	800	666	800	666	800	666	800	666
700	583	700	583	700	583	700	583	700	583
600	500	600	500	600	500	600	500	600	500
500	417	500	417	500	417	500	417	500	417
400	333	400	333	400	333	400	333	400	333
300	250	300	250	300	250	300	250	300	250
200	167	200	167	200	167	200	167	200	167
100	83	100	83	100	83	100	83	100	83

DENSITY		DENSITY		DENSITY		DENSITY		DENSITY	
ALT. IN FEET	IMP. G. P. H.	ALT. IN FEET	IMP. G. P. H.	ALT. IN FEET	IMP. G. P. H.	ALT. IN FEET	IMP. G. P. H.	ALT. IN FEET	IMP. G. P. H.
30000	0.00028	30000	0.00028	30000	0.00028	30000	0.00028	30000	0.00028
25000	0.00029	25000	0.00029	25000	0.00029	25000	0.00029	25000	0.00029
20000	0.00030	20000	0.00030	20000	0.00030	20000	0.00030	20000	0.00030
15000	0.00031	15000	0.00031	15000	0.00031	15000	0.00031	15000	0.00031
12000	0.00032	12000	0.00032	12000	0.00032	12000	0.00032	12000	0.00032
9000	0.00033	9000	0.00033	9000	0.00033	9000	0.00033	9000	0.00033
6000	0.00034	6000	0.00034	6000	0.00034	6000	0.00034	6000	0.00034
3000	0.00035	3000	0.00035	3000	0.00035	3000	0.00035	3000	0.00035
S. L.	0.00036	S. L.	0.00036	S. L.	0.00036	S. L.	0.00036	S. L.	0.00036

1 Range values at 14,000 ft. only  
2 Allow 34 U. S. gals. 28 Imp. gals. for warm up, take-off to from tank in the following order:  
Return fuel flows to tank

LEGEND  
1 Range values at 14,000 ft. only  
2 Allow 34 U. S. gals. 28 Imp. gals. for warm up, take-off to from tank in the following order:  
Return fuel flows to tank

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

UNDERLINED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

**INSTRUCTIONS FOR USING CHART:** Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. **NOTES:** (A) Avoid continuous cruising in Column I except in emergencies. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

## ALTERNATE CRUISING CONDITIONS

(NO RESERVE FUEL ALLOWANCE)

[illegible]

1 Range values at 6,000 ft. only  
2 Allow U. S. gals.            feet altitude

from tanks in the following order

Return fuel flows to tank

**BOLD NUMBERS:** Use Auto-Rich  
*LIGHT ITALICS:* Use Auto-Lean  
**TWO SPEED BLOWER:** Use high  
blower above heavy line only

I.A.S.: Indicated Air Speed  
T.A.S.: True Air Speed  
M.M.P.: Manifold Pressure (In. Hg.)  
U.S.G.P.H.: U. S. Gallons Per Hour  
I.M.P.G.P.H.: Imperial Gallons Per Hour  
T.: Full Throttle

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

**MODEL (S)**  
**B-25 C**  
**B-25 D**

**FLIGHT OPERATION INSTRUCTION CHART**  
(SINGLE ENGINE OPERATION)

SHEET 8 OF 8 SHEETS  
**EXTERNAL LOAD ITEMS**  
**NONE**

GR. WT. 26,000 TO 24,000 POUNDS

CONDITION		R.P.M.	M.P. (IN HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.
TAKE-OFF	2600	44.0	LOW	FULL	5	
MILITARY POWER	2600	42	LOW	FULL	5	
ENGINE (S)	R-2600-13 (1)	41	HIGH	RICH		

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. NOTES: (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), and True Airspeed are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

**ALTERNATE CRUISING CONDITIONS**

(NO WIND)

I (MAX. CONT. POWER)		II		III		IV		V (MAX. RANGE)	
RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES	
STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL
540	470	620	540	700	610	790	690	880	770
430	370	490	430	560	490	630	550	710	620
320	280	370	320	420	360	470	410	530	460
210	180	250	210	280	240	310	270	350	300
100	100	120	110	140	120	160	130	170	150

FUEL IMP. GALS. 2

DENSITY ALT. IN FEET

30000  
25000  
20000  
15000  
12000  
9000  
6000  
3000  
S. L.

OPERATING DATA

R.P.M. M.P. (IN HG.) I.A.S. (M.P.H.) U.S. (KNOTS) IMP. G. P. H.

2400 F. T. 205 178 165 137 9000  
2400 38 200 173 185 154 6000  
2400 38 195 169 175 146 3000  
2400 38 185 160 170 142 S. L.

1 Range values at 6,000 ft. only  
2 Allow U. S. gals. Imp. gals. for warm up, take-off to feet altitude and climb. Use fuel from tanks in the following order  
Return fuel flows to tank

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

BOLD NUMBERS: Use Auto-Rich  
LIGHT ITALICS: Use Auto-Lean  
WITH TWO SPEED BLOWER: Use high blower above heavy line only

I.A.S.: Indicated Air Speed  
T.A.S.: True Air Speed  
M.P.: Manifold Pressure (In. Hg.)  
U.S.G.P.H.: U. S. Gallons Per Hour  
IMP.G.P.H.: Imperial Gallons Per Hour  
F.T.: Full Throttle



RESTRICTED

AIRPLANE MODELS

B-25 C & B-25 D

WITH TORPEDO OR 8 WING BOMBS

TAKE-OFF, CLIMB & LANDING CHART

(SHEET 2 OF 3 SHEETS)

ENGINE MODELS

R-2600-13

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND (MPH)	HARD SURFACE RUNWAY			SOD-TURF RUNWAY			SOFT SURFACE RUNWAY									
		AT SEA LEVEL		AT 3,000 FT.	AT SEA LEVEL		AT 3,000 FT.	AT SEA LEVEL		AT 3,000 FT.	AT 6,000 FT.						
		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.						
36,000	0	4600	5700	5200	6400	6700	8100	5300	6300	7200	9200	8000	9300	10,500	11,500	13,000	
36,000	20	3200	4000	3400	4300	4500	5600	3500	4300	5000	5400	6600	6100	7,300	7,800	9,000	
36,000	40	2000	2700	2100	2800	2800	3700	2100	2900	2600	3400	4600	4000	5,000	5,100	6,100	
32,000	0	3300	4200	3700	4700	4700	5900	3700	4600	5000	5300	6600	6300	5900	6,800	8,200	9,500
32,000	20	2200	2900	2500	3300	3200	4200	2500	3200	3600	3400	4400	4300	4000	4,800	5,800	6,800
32,000	40	1400	2000	1600	2300	2000	2800	1700	2200	1800	2400	2900	2800	2700	3,300	3,900	4,700
28,000	0	2300	3000	2500	3300	3000	4000	2500	3300	2700	3500	4200	4200	3700	4,500	4,800	5,800
28,000	20	1600	2200	1700	2400	2100	2900	1700	2400	1800	2500	3000	2900	2500	3,100	3,300	4,200
28,000	40	1000	1500	1100	1600	1300	2000	1100	1600	1200	1800	2100	2000	1600	2,100	2,000	2,600

NOTE: INCREASE DISTANCE 10% FOR EACH 10°C (50°F) ABOVE 0°C (32°F)

CLIMB DATA

COMBAT MISSIONS USE		RPM & 38.0 IN. HG		RPM & 31.5 IN. HG		FERRY MISSIONS USE		RPM & 31.5 IN. HG	
GROSS WEIGHT (IN LBS.)	TYPE OF CLIMB	S.L. TO 3000	FT. ALT.	S.L. TO 3000	FT. ALT.	S.L. TO 3000	FT. ALT.	S.L. TO 3000	FT. ALT.
		BEST I.A.S.	TIME FROM S.L.	BEST I.A.S.	TIME FROM S.L.	BEST I.A.S.	TIME FROM S.L.	BEST I.A.S.	TIME FROM S.L.
36,000	COMBAT FERRY	145	1050 3:5	145	1020 5:5	145	830 9:0	145	650 13:0
32,000	COMBAT FERRY	145	7:0	145	4:30 14:0	145	4:30 21:0	145	180 31:0
28,000	COMBAT FERRY	150	1180 3:0	150	1170 5:0	150	960 8:0	150	790 11:0
		145	660 4:5	145	670 9:0	145	680 13:5	145	400 19:0
		155	1310 2:5	155	1300 4:5	155	1100 7:5	155	930 10:5
		145	940 3:5	145	960 6:5	145	980 9:5	145	680 13:5

NOTE: INCREASED ELAPSED CLIMBING TIME 10% FOR EACH 10°C (50°F) ABOVE 0°C (32°F) FREE AIR TEMPERATURE.

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 SEA LEVEL		AT 3,000 FT.	AT SEA LEVEL		AT 3,000 FT.	AT 6,000 FT.	
		GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	
34,000	120	3900	1900	4100	2100	2300	4400	9300	10,200	8200	11,100	8900
31,000	120	3600	1700	3800	1900	2100	4100	8700	9,400	7500	10,200	8200
25,000	110	3100	1400	3300	1500	3500	3800	7200	7,800	6000	8,400	6600

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  
NOTE: All distances are average, and subject to considerable variations because of differences in pilot technique, load, C.G., etc.  
RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

AIRPLANE MODELS

B-25 C & B-25 D

WITH TORPEDO AND 8 WING BOMBS

TAKE-OFF, CLIMB & LANDING CHART

(SHEET 3 OF 3 SHEETS)

ENGINE MODELS

R-2600-13

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND (MPH)	HARD SURFACE RUNWAY	SOD-TURF RUNWAY	SOFT SURFACE RUNWAY	
		AT SEA LEVEL	AT 3,000 FT.	AT 6,000 FT.	
		GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
36,000	0	4600	5200	6400	8100
36,000	20	3200	4000	4300	5600
36,000	40	2000	2700	2100	2800
32,000	0	3300	4200	4700	5900
32,000	20	2200	2900	3300	4200
32,000	40	1400	2000	1600	2300
28,000	0	2300	3000	3300	4000
28,000	20	1600	2200	2400	2900
28,000	40	1000	1500	1600	2000
NOTE: INCREASE DISTANCE 10% FOR EACH 10°C (50°F) ABOVE 0°C (32°F)					
		AT SEA LEVEL	AT 3,000 FT.	AT 6,000 FT.	
		GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
		8000	9000	9200	7600
		5300	6300	6000	7200
		3400	4000	3500	4600
		5500	6300	5300	6600
		4300	5000	3400	4400
		2300	2800	2100	2900
		3500	4200	3200	4200
		2300	2900	2100	3000
		1500	2000	1400	2100
ENGINE LIMITS FOR TAKE-OFF					
		2600	2600	2600	2600

CLIMB DATA

GROSS WEIGHT (IN LBS.)	TYPE OF CLIMB	2400	RPM & 38	IN. HG	RPM & 31.5	IN. HG
		COMBAT MISSIONS USE			FERRY MISSIONS USE	
		S.L. TO 3000	FT. ALT.	TIME FROM S.L.	S.L. TO 3000	FT. ALT.
		BEST I.A.S.	FT./MIN.	TIME FROM S.L.	BEST I.A.S.	FT./MIN.
36,000	COMBAT FERRY	145	760	4:0	145	550
		140	320	9:5	140	320
32,000	COMBAT FERRY	150	890	3:5	150	680
		140	540	5:5	140	560
28,000	COMBAT FERRY	155	1020	3:0	155	810
		140	830	4:0	140	860
NOTE: INCREASE ELAPSED CLIMBING TIME 10% FOR EACH 10°C (50°F) ABOVE 0°C (32°F) FREE AIR TEMPERATURE.						
		AT SEA LEVEL	AT 3,000 FT.	AT 6,000 FT.		BLOWER CHANGE
		GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	
		7400	10,200	8200	7400	11,000
		9,400	7500	10,200	8700	13,000
		7,800	6000	8,400	7200	11,000
		7,800	6000	8,400	7200	13,000

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.	
		TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN
34,000	120	3300	1900	2300	4200
31,000	120	3600	1700	2100	3900
25,000	110	3100	1400	1700	3600
NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.					
	BEST I.A.S. Approach	AT SEA LEVEL	AT 3,000 FT.	AT 6,000 FT.	
		TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN
		7400	10,200	8200	7400
		9,400	7500	10,200	8700
		7,800	6000	8,400	7200
		7,800	6000	8,400	7200

REMARKS

LEGEND

I.A.S.: Indicated Air Speed  
NOTE: All distances are average, and subject to considerable variations because of differences in pilot technique, load, C.G., etc.  
RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

## LEGEND

I. A. S.: Indicated Air Speed  
 NOTE: All distances are average, and subject to considerable variations because of differences in pilot technique, load, C.G., etc.  
 RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

AIRPLANE MODELS				SPECIFIC ENGINE				ENGINE MODELS						
B-25 C				B-25 D				R-2600-13						
B-25 D				R-2600-13				R-2600-13						
CONDITION	FUEL PRESSURE LB./SQ. IN.	OIL PRESSURE LB./SQ. IN.	OIL TEMP. °C	COOLANT TEMP. °C				MAX. PERMISSIBLE DIVING R.P.M.						
DESIRED	6-7	80-85		50-70				CONDITION	ALLOWABLE	OIL CONSUMPTION				
MAXIMUM	7	90		85				"MAX. CONTINUOUS"	46.6 IMP. PT./HR.	28	US. QT./HR.			
MINIMUM	6	75		95 (1.1 mb)				"ECONOMICAL MAX"	25 IMP. PT./HR.	15	US. QT./HR.			
IDLING	6-7	25						"MIN. SPECIFIC"	IMP. PT./HR.		US. QT./HR.			
SUPERCHARGER TYPE: TWO SPEED				FUEL OCTANE 100				OIL GRADE: (S) (W)						
OPERATING CONDITION	R.P.M.	MANIF. PRESS. (BOOST)	HORSE POWER	CRITICAL ALTITUDE (FEET)	USE LOW BLOWER BELOW	MIXTURE CONTROL POSITION	FUEL FLOW (GAL./HR./ENG.)	U.S.	IMP.	°C	°F	MAXIMUM CYL. TEMP.	MAXIMUM DURATION (MINUTES)	REMARKS
TAKE-OFF	2600	44.0	1700	SEA LEVEL	L ALWAYS FT. ALT.	FULL RICH	215	179	260	500		5		
EMERGENCY MAXIMUM	2600	42	1700	4,500	L 10,500	FULL RICH	215	179	260	500		5		
MAXIMUM CONTINUOUS	2400	38	1500	6,700	L 11,000	FULL RICH	180	150	218	420				
ECONOMICAL MAXIMUM	2100	31.5	1125	6,700	L 13,500	FULL RICH	115	96	205	400				
MINIMUM SPECIFIC CONSUMPTION	2100	31.5	1012	15,000	H FT. ALT.	FULL RICH	115	96	205	400				
MINIMUM		29.5	1005	6,700	L 15,500	CRUISING	90	75	205	400				
SPECIFIC CONSUMPTION		29.0	905	15,000	H FT. ALT.	LEAN	100	83	205	400				
MINIMUM CRUISING	2000	27.0	900	6,700	L 16,500	CRUISING	75	63	205	400				
CONDITIONS TO AVOID	1600	20.9	390	S.L.	L	CRUISING	31	26	205	400				Minimum Specific Fuel Flow
	1600	19.5	420	5,000	L	LEAN	33	27.5	205	400				
	1600	18.5	450	10,000	L		35	29	205	400				
	1600	18.0	490	15,000	L		37	31	205	400				

NOTE: CRITICAL ALTITUDE IS THAT AT WHICH MAXIMUM POWER IS OBTAINED WITH FULL THROTTLE UNDER CONDITIONS SHOWN.

## SECTION IV

### NAVIGATOR'S COMPARTMENT

#### 1. GENERAL DESCRIPTION.

The navigator's compartment is located just aft of the pilot and copilot's seats. There is no bulkhead separating this compartment from the pilot's compartment. All the instruments and equipment necessary for the successful navigation of the airplane in flight are located in this compartment. In addition to the conventional equipment, the emergency nose wheel operating crank, pawl control and uplatch release are located at the forward right side of the compartment. The emergency bomb bay door control is also located in this compartment. The relief tube for the use of the bombardier, pilot and copilot is in this compartment. The front entrance hatch (figure 48) to be used by the bombardier, pilot, copilot and navigator is provided.

#### 2. OPERATIONAL EQUIPMENT.

##### a. The Emergency Nose Wheel Control Operation.

(1) Ascertain from the pilot that the landing gear control handle (figure 21-192) is "DOWN."

(2) Pull nose gear emergency lock release (figure 25-238).

(3) Check with pilot or use drift meter to see that auxiliary gear is partially lowered before using lowering mechanism.

(4) Remove safety pin (figure 25-237) and turn pawl (figure 25-239) to "ON."

(5) Place crank (figure 25-241) on shaft and turn clockwise when facing until gear indicator registers (down and locked). If these instructions are violated the cables will break and the airplane will end in the repair shop.

**CAUTION:** Do not lower nose gear mechanically above an indicated air speed of 150 mph (130 knots). Do not return pawl to "OFF" until airplane is safely on the ground.

##### b. Emergency Bomb Bay Door Control (figure 22-204) Operation.

**NOTE:** Mechanical operation to be used only in the event of complete hydraulic pressure failure.

(1) Coordinate with the bombardier for correct position of his door operating and bomb release handle.

(2) Instruct bombardier to move bomb release handle (figure 35-314) to the doors "OPEN-RACK LOCK POSITION" or the "DOORS CLOSED" position as desired.

(3) Install bomb bay door operating crank on shaft in aft end of compartment. (Crank is stowed on lower right longeron opposite the crankshaft.) Install

the crank handle positioned downward. Turn crank clockwise to close doors and counterclockwise to open doors.

##### c. Fuel Transfer System Controls.

(1) To transfer fuel from fuel tanks on one side of airplane to forward wing fuel tanks on opposite side or to bomb bay droppable tank, or from the droppable tank to either of the forward wing fuel tanks, first connect the tanks desired by operating fuel transfer valves (figure 23-221). After setting the fuel transfer valves, move fuel flow direction switch (figure 23-229) in direction of desired flow and set transfer pump switch (figure 23-216) to "ON."

(2) The emergency fuel shut-off valves (figure 23-227) are located in the rear of the compartment.

d. Heating and Ventilating Control. - The air temperature control (figure 26-244) operates the heater and regulates its output.

e. Electrical Controls. - The generator main line switches (figure 23-223-226) and the generator voltage switch (figure 23-225) are to be turned to "OFF" in the event of a forced landing.

##### f. Navigator Controls.

(1) The radio compass control unit (figure 24-234) is located forward and below left window.

(2) The drift meter (figure 22-207) is located on right forward wall of compartment.

(3) Drift Meter Controls. - The electrically driven gyro must always be caged during take-off or landing, during turns when the incline is over 20 degrees from vertical when not in use, and before switching off the current. If the turn is started with the gyro uncaged, do not attempt to cage the gyro during the turn. Wait until the turn is completed and then cage the gyro. If the airplane inclines more than twenty degrees from the vertical in any direction during maneuvers, the gyro will strike its limit stops. This will cause the gyro to be moved from the vertical and will render all drift meter indications erroneous for several minutes after resuming level flight until the gyro has had time to erect itself. After an appreciable change of course, the gyro is apt to be slightly displaced from the vertical and a few minutes should be allowed for it to settle before taking observations.

##### (a) Starting Operations.

To start the electrically driven gyro of the drift meter turn on either of the battery disconnect switches and the gyro starting switch on the gyro housing.

(b) Allow the gyro to gain speed for at least 3 minutes.

(c) With the airplane in normal straight flight, uncage the gyro by pulling out the caging knob and moving it as far as it will go in the direction marked "UNCAGE." Make sure that caging knob snaps in place in the uncage position.

(d) Allow the gyro to run uncaged for at least ten minutes before attempting to take any readings.

(e) Turn the reticule light rheostat knob clockwise until the desired intensity of the grid lines is obtained.

g. Automatic Flight Controls. - A precessing switch is located below the right side window.

h. Oxygen System. - A type A-9A oxygen regulator (figure 22-205) is located on the right wall. To operate, attach hose to bayonet fitting and adjust regulator.

i. Interphone System.

(1) A jack box (figure 24-233) is located on the forward left wall. To operate, plug in ear phone cord and set switch to "CALL."

(2) An interphone amplifier is provided.

j. Fluorescent Lighting System.

(1) An inverter active and spare change over switch (figure 23-224) are located on the rear wall. If the active inverter fails, place the dual switches in the "SPARE" position.

NOTE: For normal operation, the switches will be kept in the "ACTIVE" position.

(2) A dome light switch (figure 27-247) and an extension light switch (figure 27-248) are provided and are operated conventionally.

k. Fire Extinguisher.

(1) One CO<sub>2</sub> fire extinguisher is located on the right side of the compartment.

(2) To operate, swing horn up, discharge close to base of fire and control with the trigger.

l. Additional Equipment.

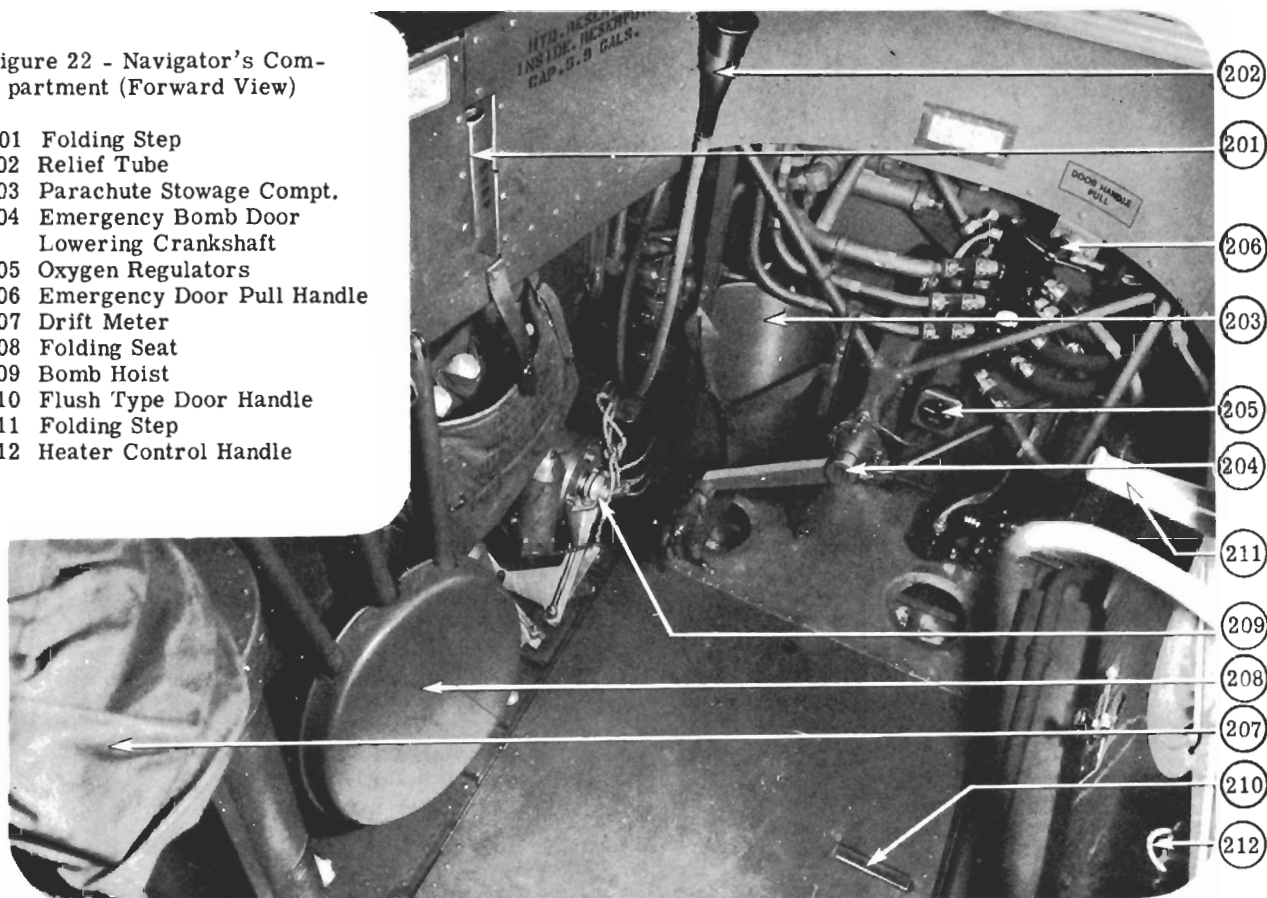
(1) An anti-icer supply tank valve is located beneath tank in rear of the compartment.

(2) An oil strainer is located in lower right rear corner of the compartment.

(3) A drinking water container and cup holder is located at the left side of the compartment.

Figure 22 - Navigator's Compartment (Forward View)

- 201 Folding Step
- 202 Relief Tube
- 203 Parachute Stowage Compt.
- 204 Emergency Bomb Door Lowering Crankshaft
- 205 Oxygen Regulators
- 206 Emergency Door Pull Handle
- 207 Drift Meter
- 208 Folding Seat
- 209 Bomb Hoist
- 210 Flush Type Door Handle
- 211 Folding Step
- 212 Heater Control Handle



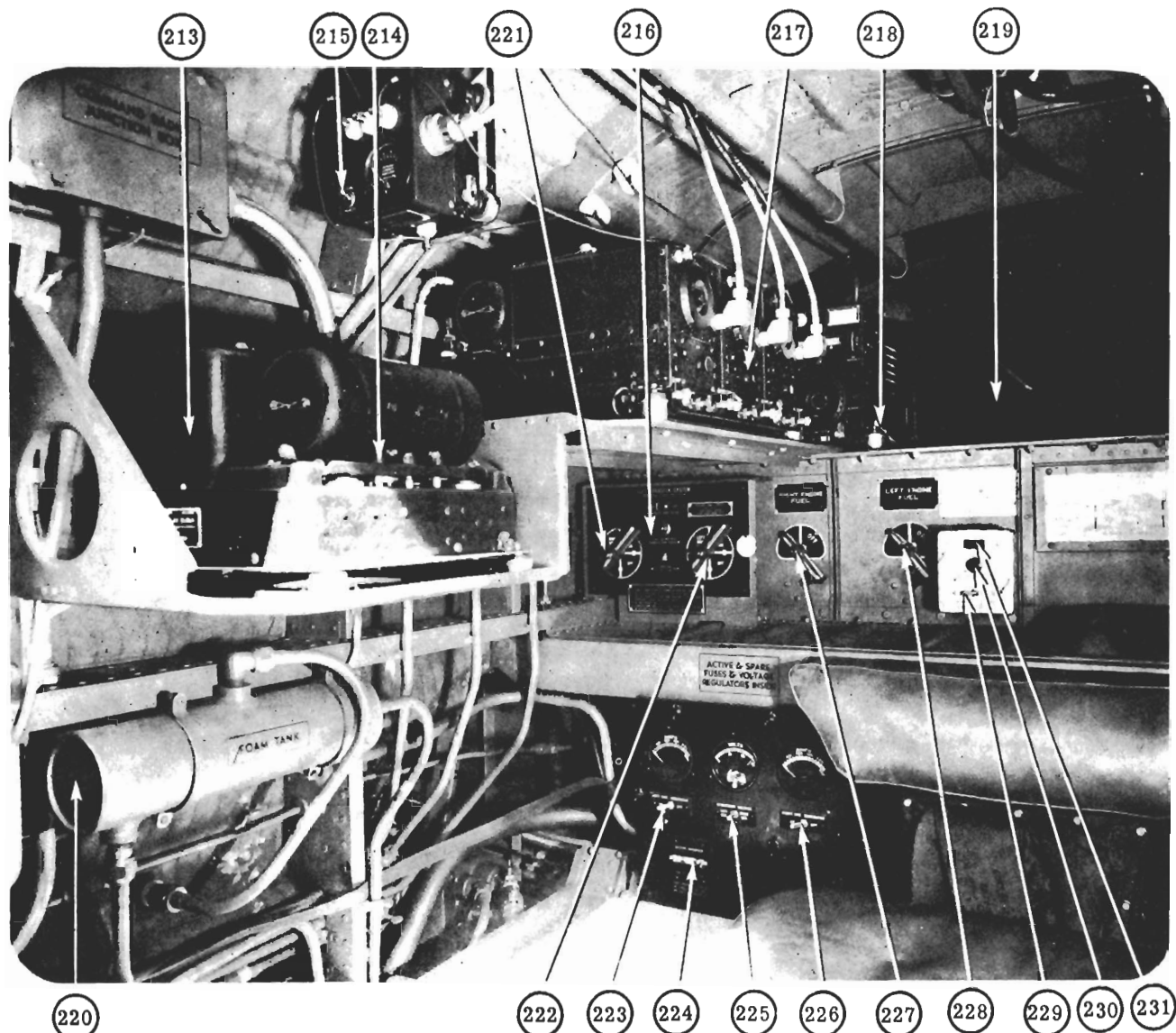


Figure 23 - Navigator's Compartment (Aft View)

- |   |  |
|---|--|
| 213 Command Set Modulator               | 223 Left Engine Generator Switch                       |
| 214 Dynamotor                           | 224 Active Inverter Switch                             |
| 215 Command Set Antenna Switching Relay | 225 Generator Voltage Switch                           |
| 216 Fuel Transfer Pump Switch           | 226 Right Engine Generator Switch                      |
| 217 Command Set Receiver                | 227 Emergency Fuel Shut-Off Valve                      |
| 218 Command Set Transmitter             | 228 Emergency Spring Catch on Emergency Shut-Off Valve |
| 219 Passageway Over Bomb Bay            | 229 Fuel Flow Direction Switch                         |
| 220 Hydraulic System Foam Tank          | 230 Transfer Pump Indicator Light                      |
| 221 Fuel Transfer Valve                 | 231 Emergency Fuel Transfer Pump Switch                |
| 222 Fuel Transfer Valve                 |  |



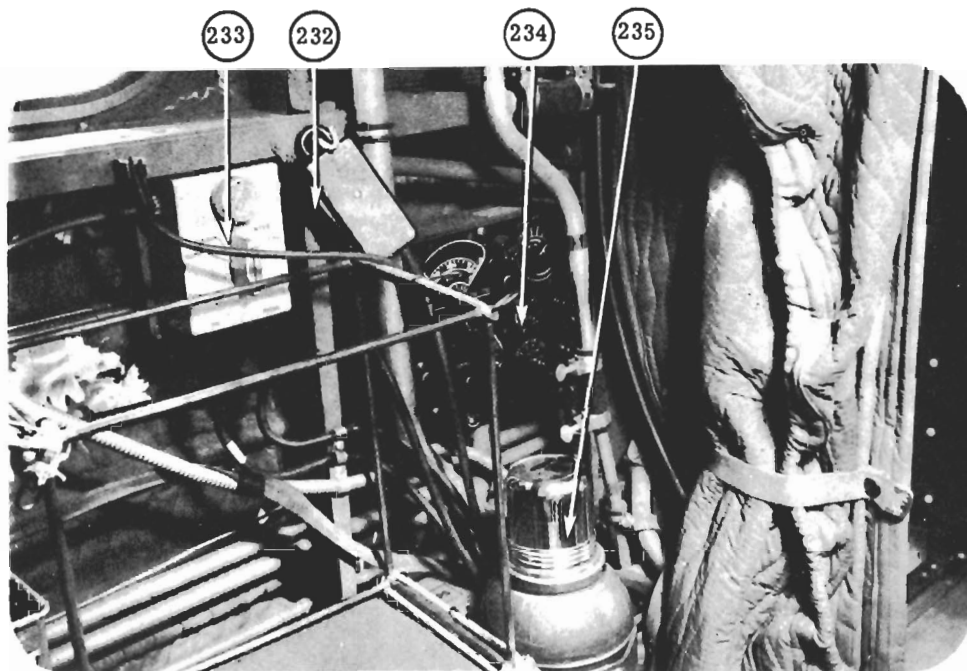


Figure 24 - Navigator's Compartment (Additional Equipment)

- 232 Push-To-Talk Switch  
 233 Jack Box  
 234 Radio Compass Control  
 235 Thermos Bottle

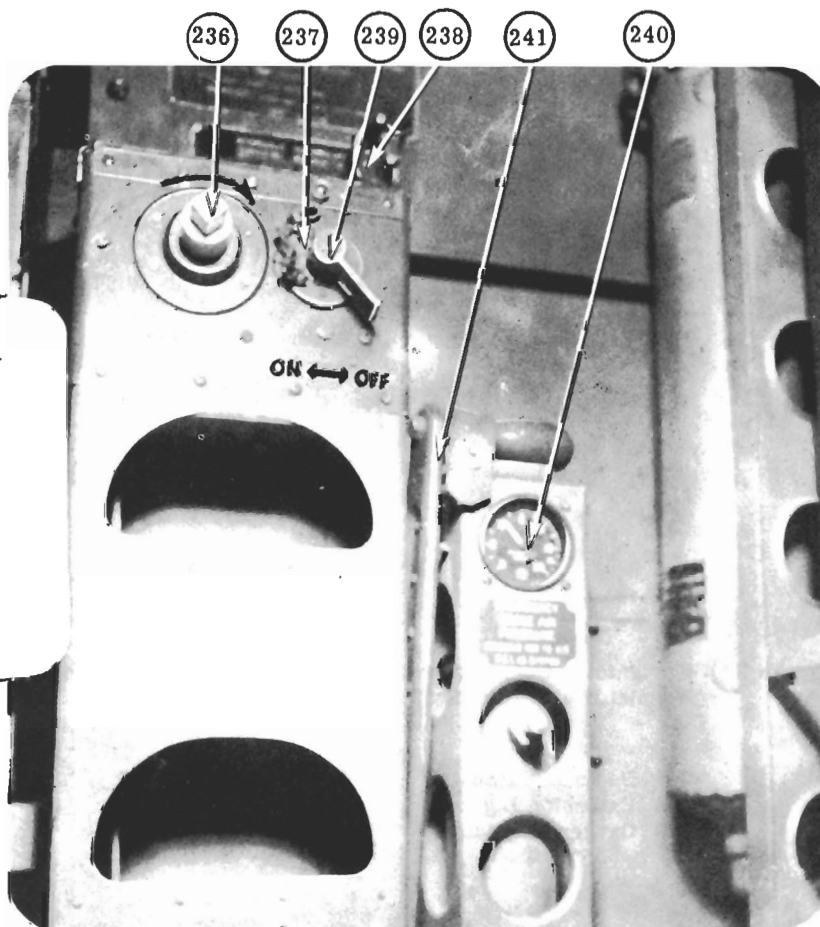


Figure 25 - Navigator's Compartment (Emergency Nose Wheel Controls)

- 236 Emergency Nose Gear Crankshaft  
 237 Safety Pin  
 238 Uplatch Release  
 239 Pawl Control  
 240 Emergency Air Brake Pressure Gage  
 241 Crank



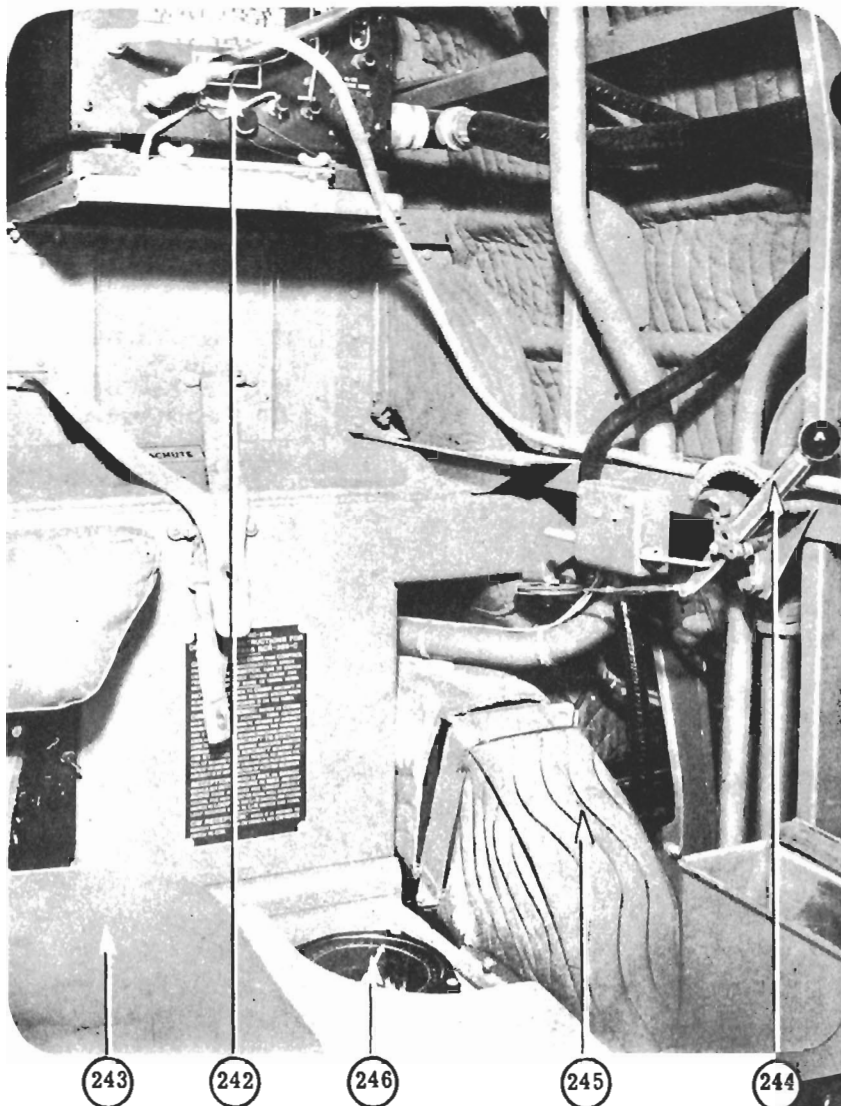


Figure 26 - Navigator's Compartment (Additional Equipment)

- 242 Radio Compass Receiver
- 243 Navigator's Seat
- 244 Cabin Heater Control
- 245 Warm Air Duct
- 246 Radio Compass Azimuth Indicator

Figure 27 - Navigator's Compartment (Oxygen Regulator and Light Switches)

- 247 Dome Light Switch
- 248 Extension Light
- 249 Oxygen Regulator

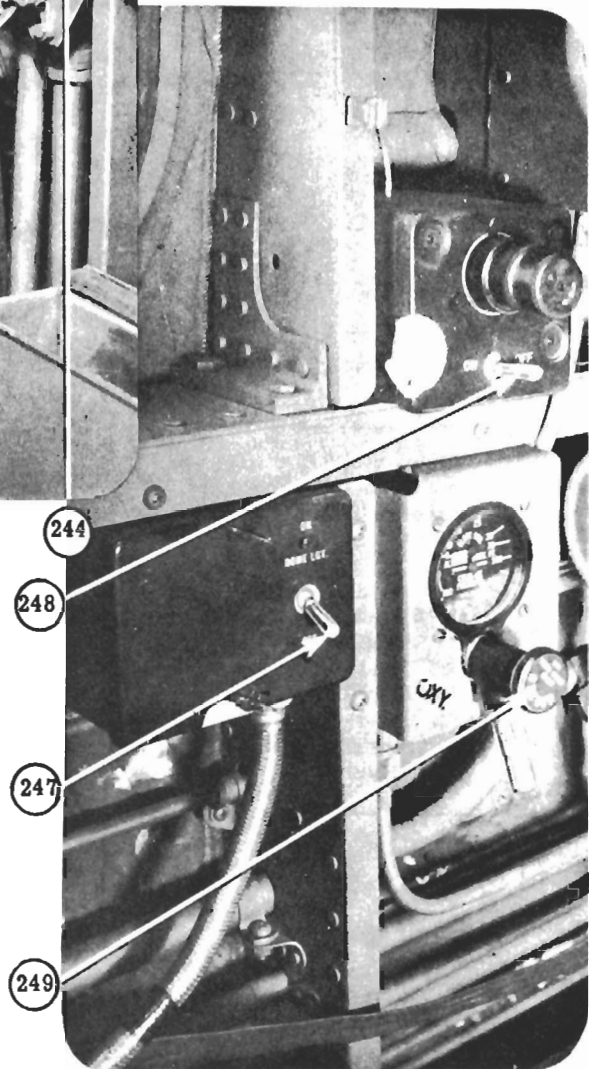
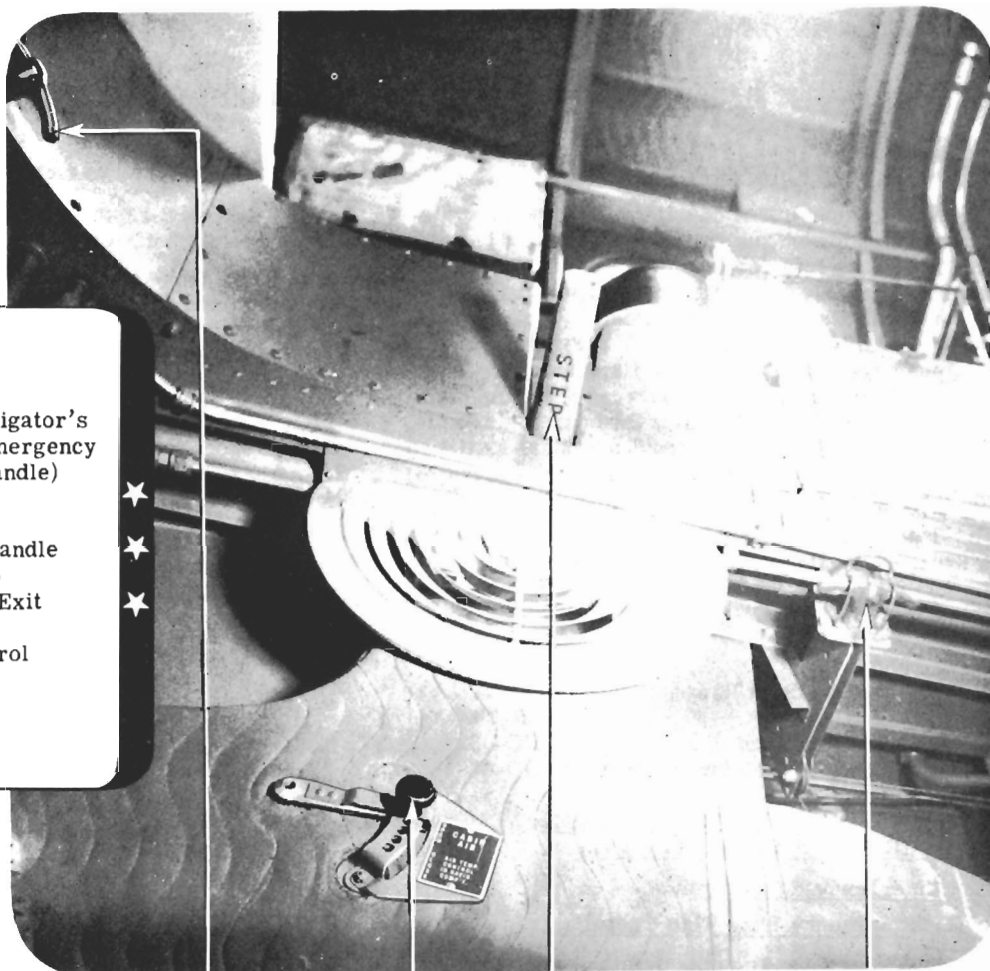


Figure 28 - Navigator's  
Compartment (Emergency  
Door-Pull Handle)

- 250 Door-Pull Handle
- 251 Folding Step
- 252 Emergency Exit  
Door Handle
- 253 Heater Control

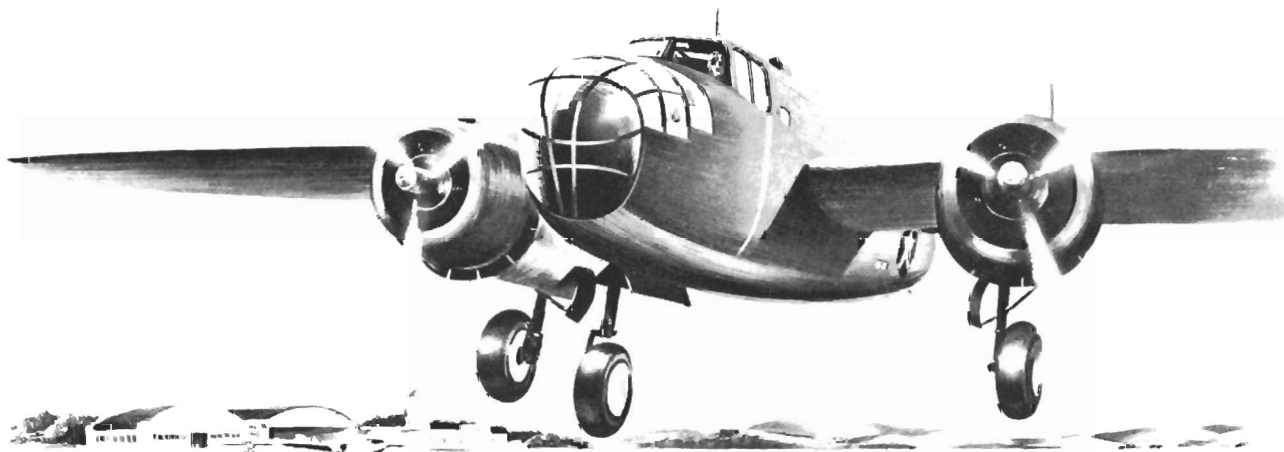


(250)

(253)

(251)

(252)



SECTION VRADIO OPERATOR AND LOWER GUN TURRET COMPARTMENT1. GENERAL DESCRIPTION.

a. The compartment containing the radio equipment and the lower gun turret is located aft of the bomb bay and is just forward of the upper gun turret. It contains not only the radio transmitter and receiving sets, but also the lower model "J" gun turret. Provisions are made in this compartment for the emergency operation of the wing flaps and main landing gear. It is equipped with a data case, folding table, and a relief tube located below the operator's table. The relief tube is used by crew members stationed aft of the bomb bay. A side escape hatch (figure 14) is on the right side of the compartment.

b. The radio equipment and the lower gun turret are usually operated by the same man.

c. The communication equipment consists of the following units:

Command Set	SCR-274-N
Liaison Set, Medium Range	SCR-287-A
Radio Compass	SCR-269-A
Interphone Equipment	RC-36
Marker Beacon Receiving Equipment	RC-43

2. OPERATIONAL EQUIPMENT - RADIO OPERATOR'S COMPARTMENT.a. Emergency Equipment.(1) Emergency Wing Flap Operation.

**NOTE:** Interphone communication between pilot and the radio operator is necessary.

**CAUTION:** Do not operate the emergency flap operating system (do not even install crank) unless there is a complete failure of the hydraulic pressure system.

(a) Ascertain from pilot that his hydraulic flap control handle is at the extreme position for the desired movement of the flaps.

(b) Open hinged cover (figure 29-264) and install crank (figure 29-265) on shaft of flap operating mechanism.

(c) Rotate crank clockwise to raise the flaps (approximately 27 complete turns are required in either direction). Rotate counterclockwise to lower the flaps.

(2) Emergency Operation of Main Landing Gear.

(a) Ascertain that pilot's hydraulic landing gear control handle is set at the "DOWN" position.

(b) Disengage lower gun turret operator's chest support (figure 33-296) by pulling adjustment pin, raising support and allowing lower section of adjustment rod to fall forward. Hinge upper section of

adjustment rod and lower chest support.

(c) Lower radio operator's table (figure 29-262) to useful position.

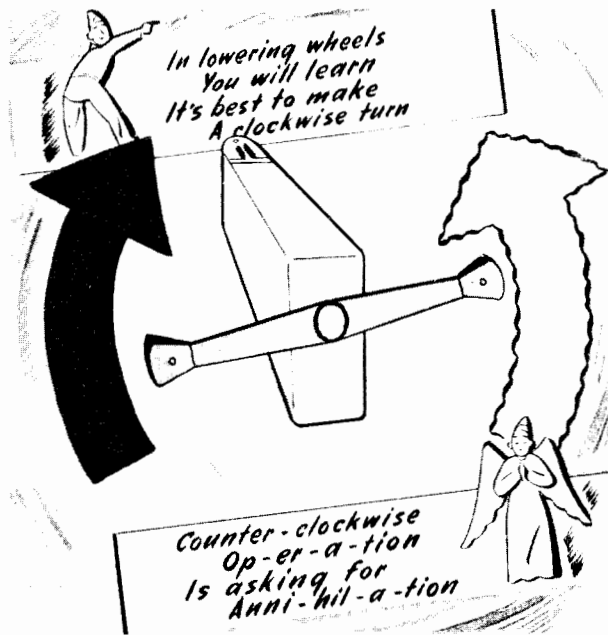
(d) Release main landing gear operating screw assembly (held to forward wall of the compartment by finger-type fastener), rotate assembly away from wall until it locks in a fore and aft position.

(e) Pull main landing gear emergency up-position lock pin release (figure 29-267), located to the right of the lowering screw. This control releases the main gear up-position lock pins only and allows the main gear to partially lower, due to its own weight.

(f) Turn lowering screw handle clockwise until advised by pilot that his indicator registers that the main gear is down and locked.

(g) Ask pilot to retard throttle momentarily to ascertain that the landing gear is locked down as evidenced by the failure of the warning horn to sound.

**WARNING:** Improper operation of main landing gear emergency lowering screw may break cables and prove dangerous and cause expensive repair.



**CAUTION:** After lowering gear in the above manner, do not turn lowering screw handle counterclockwise to return handle to its original position on the wall of the compartment until the airplane is safely landed.

(h) After airplane is landed, turn main landing gear emergency lowering screw handle counterclockwise, returning handle to its original position and stow assembly.

(3) Miscellaneous Emergency Equipment.

(a) The side escape hatch is located on the right wall of the compartment.

(b) A CO<sub>2</sub> fire extinguisher is clipped to the right side wall of the compartment just aft of the escape hatch.

b. Communications Equipment.

(1) Interphone Controls. - An interphone jackbox is located at the aft end of the radio operator's table. The selector control has five selective positions as follows:

(a) "COMP". - The audio output of the compass receiver only is heard.

(b) "LIAISON". - The output of the liaison receiver and the sidetone of the liaison transmitter are heard. The microphone push-to-talk switch operates the transmit receive relay located within the liaison transmitter. The microphone will modulate the liaison transmitter when the switch is closed and the transmitter is in "VOICE" position.

NOTE: From the "LIAISON" position, voice transmission is effective only at the pilot's, copilot's and radio operator's station.

(c) "INTER". - At this position, all jack boxes provide intercommunication between crew members. The microphone connects to the input of the interphone amplifier, and the headphones to the output of the amplifier. In this position the volume control is not effective.

(d) "CALL". - This is an emergency call position in which all of the positions in all boxes are placed in parallel across the output of the amplifier. In an emergency any crew member desiring to call a station which is in use, may do so by switching to the "CALL" position. This position is effective on all stations.

(2) Command Set.

(a) The command receivers and transmitters of the SCR-274-N set are independently controlled. There are three markings on the transmitter switch: "VOICE", "CW", and "TONE". With the switch at the "VOICE" position, the microphone from any jack box switched to "COMMAND" is operative and the voice is transmitted when the push-to-talk button at that station is pressed. With the switch at the "CW" position, a continuous wave or an unmodulated signal is transmitted. With the switch at the "TONE" position, a signal is transmitted which is practically 100 percent modulated at 1000 cycles. For long range communication through interference "CW" is most effective, "TONE" next and "VOICE" least effective.

(b) At both the "CW" and "TONE" positions, the microphone is inoperative by voice, and signalling

by code is accomplished by a key located on the top of the transmitter control box. An external or separate key may be used by plugging it into the jack marked "KEY". The push-to-talk button on the microphone may be used as a key for transmitting code when the control box switch is turned to the "CW" or "TONE" position. A microphone plugged into the jack marked "MIC" permits the operator to transmit voice over the command set only, instead of through the interphone system.

(3) Receiver. - The receiver control box is divided into three identical sections, each controlling the particular receiver to which it is electrically and mechanically connected. To receive a signal of specific frequency, use the section of the receiver control box which controls the particular receiver involved. The desired receiver is turned "ON" and "OFF" by a switch located in the upper right-hand corner of the control box section used. In addition to an "OFF" position, the switch has two selective positions marked "CW" and "MCW", each of which is an "ON" position and indicates the type of signal to be received.

(4) Liaison Set Transmitter.

(a) The "OFF"-"ON" switch of the liaison transmitter is located on the face of the transmitter case.

(b) With the transmitter turned "ON", the filament voltage, as indicated on the meter marked "FIL. VOLTAGE", must be within close limits of the line on the face of the meter at 10 volts. The "CW" and modulator filament voltages are checked individually by a switch adjacent to the "OFF"-"ON" switch. Each tuning unit contains tuned circuits to allow a transmitter output variable within the frequency limits specified on the tuning unit in use. A chart located on the face of each tuning unit indicates the dial settings for desired frequencies. It is possible with the monitor switch to tune the transmitter output frequency to match the frequency of any station coming in over the receiver. With the monitor switch at "MONITOR", the sidetone of the transmitter is automatically cut off and the receiver may be turned on with the "CW" switch and adjusted to a desired frequency as indicated on the dial, or to an incoming signal of a station which it is desired to contact. Then press the transmitter key and adjust the transmitter oscillator frequency dial until the transmitter frequency is heard in the receiver. This adjusts the transmitter and it will stand by ready for the break-in on the station to which it has been adjusted. With the monitor switch at "NORMAL" the receiver will be inoperative while the transmitter is operating.

(5) Liaison Receiver. - The liaison receiver is operated by a switch located on the front of the case and has three positions: "OFF", "MVC" and "AVC", the latter two designating manual volume control and automatic volume control, respectively. To tune in or search, turn the switch to "MVC" and upon obtaining the desired signal, change to "AVC." Operation

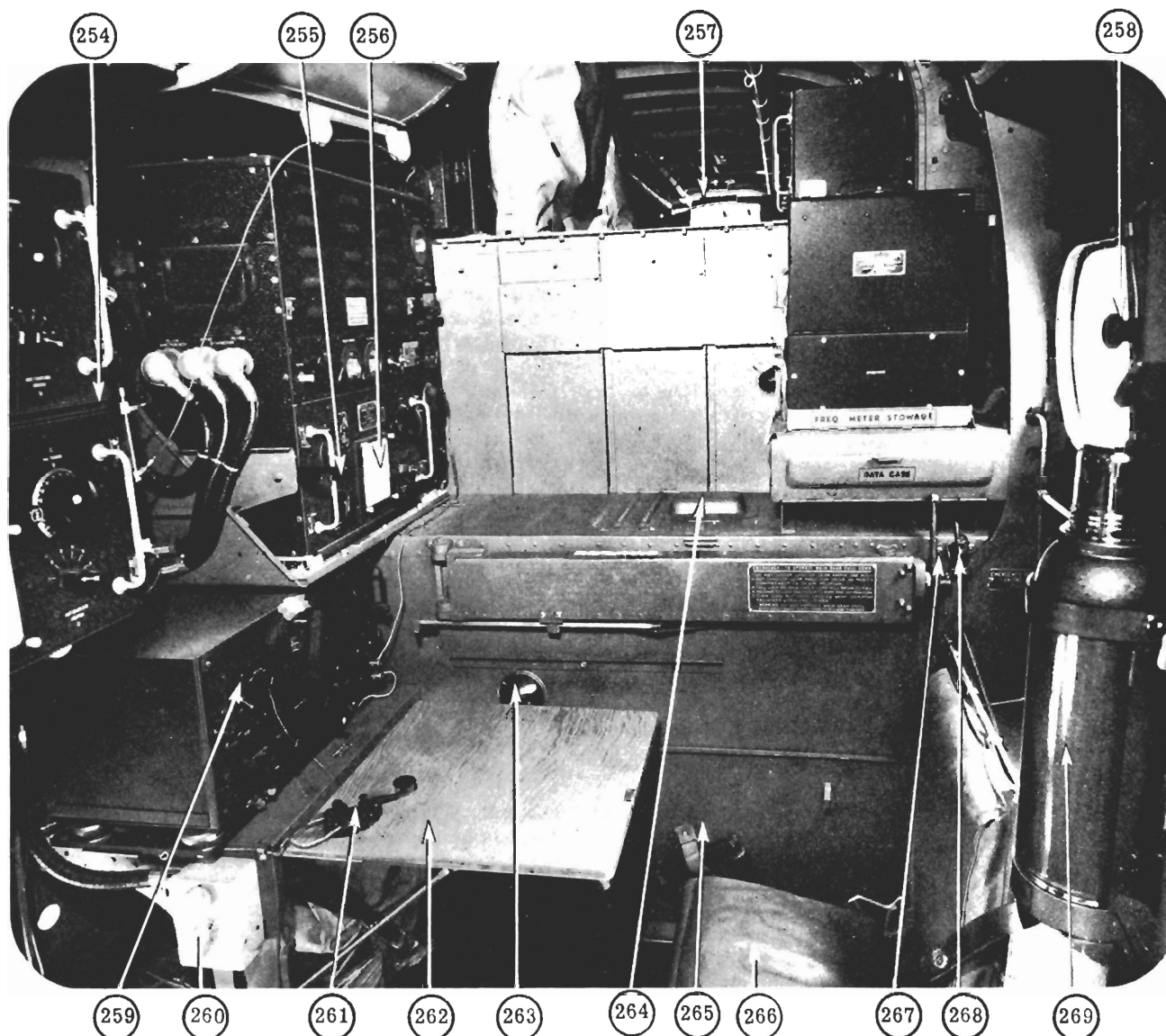


Figure 29 - Radio Operator's Compartment (Forward View)

- |  |  |
|--|--|
| 254 Replaceable Transmitter Tuning Units                       | 263 Ash Receiver   |
| 255 Hook for Holding Radio Operator's Table in Stowed Position | 264 Hinged Cover for Crankshaft for Emergency Flap Operation |
| 256 Transmitter  | 265 Crank for Emergency Flap Operation                       |
| 257 Passageway Over Bomb Bay                                   | 266 Radio Operator's Seat                                    |
| 258 Oxygen Regulator   | 267 Emergency Main Landing Gear Operating Screw              |
| 259 Receiver   | 268 Up Position Lock Release for Main Landing Gear           |
| 260 Jack Box   | 269 Thermos Bottle   |
| 261 Transmitting Key   |  |
| 262 Radio Operator's Table                                     |  |

of the "BAND SWITCH" knob located on the face of the receiver case controls the selection of the frequency band. Dial calibrations, corresponding to the band selected, are revealed by the dial mask.

**CAUTION:** Do not make any adjustments within the command or liaison transmitter while high voltage supply is on. Do not remove or replace any tubes within any of the equipment while the equipment is turned on. Do not remove covers from any of the dynamotors or replace any fuses while dynamotors are operating.

(6) Trailing Antenna Control. - A reel control box (figure 41-352) is located on a bracket on the left-hand side of the radio operator's compartment immediately aft of the liaison receiver. The control knob may be turned from its central "OFF" position, right to "OUT", or left to "IN", in order to extend or retract the weighted trailing antenna. A three-digit visible counter indicates the number of turns made by the antenna in extending and reversing during retraction.

**NOTE:** An amber signal light above the counter will warn of an unsatisfactory landing con-



*Turn power off when replacing tubes*

Figure 30 - Radio Operator's Compartment (Left Side)

- 270 Heater Control
- 271 Replaceable Transmitter Tuning Units
- 272 Replaceable Transmitter Tuning Units
- 273 Life Raft Stowage Compartment
- 274 Gun Sight Eye Cushion
- 275 Transmitter





dition if the trailing antenna is left in an extended position as the main landing gear starts to descend. Do not use the trailing antenna while on the ground.

(7) Radio Compass.

(a) The radio compass can be operated from either of the two control boxes, but not from both at the same time. The equipment is manually tuned from either remote control box, and electrical control is established at the desired control box by depressing the button marked "CONTROL" in the lower right-hand corner of the control box. When control is established at the desired remote control unit, a green indicating light will appear on the face of the unit.

(b) The radio compass performs the following functions:

1. Aural reception from the fixed antenna or from the rotatable loop. For signal reception during interference caused by precipitation, static or proximity of signals, the loop will prove superior.

2. Aural-null directional indication of an incoming signal with the loop only in use.

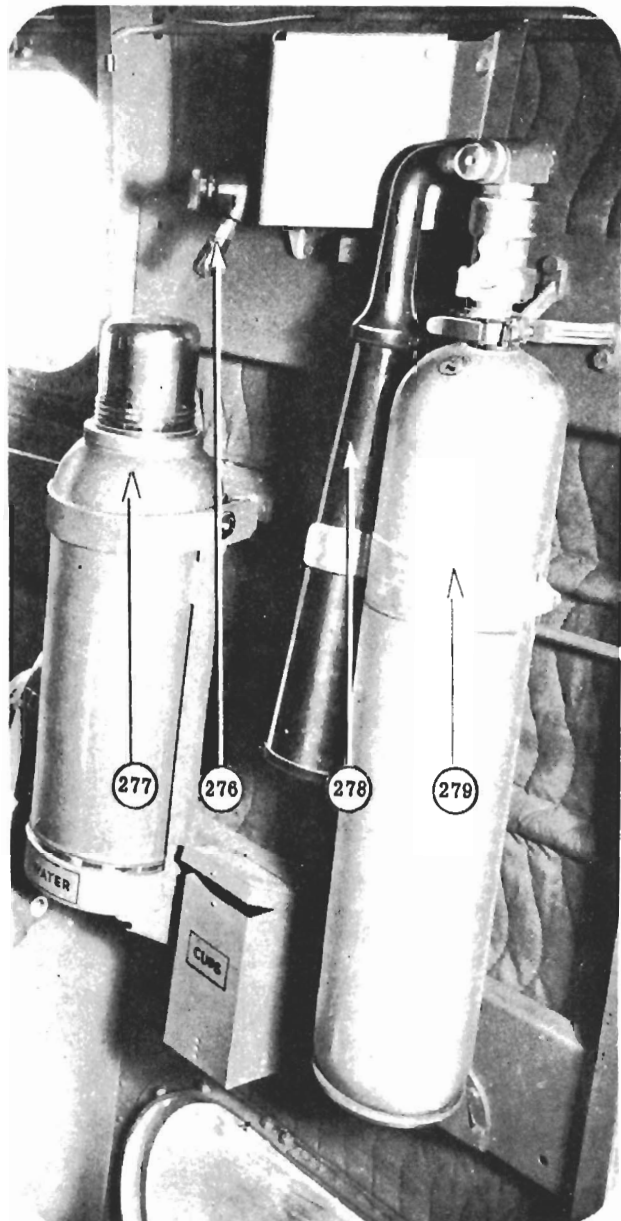
3. Visual uni-directional left-right indication of an incoming signal. The receiving unit is turned on or off by a switch on the face of the remote control box which in addition to having an "OFF" position marked thereon, has three other positions marked "COMP", "ANT", and "LOOP." With the switch turned to the position marked "COMP", both the rotatable loop and the fixed antenna are in use. In the "ANT" position, only the fixed antenna is in use and with the switch turned to "LOOP", only the rotatable loop is in use. Frequency band selection is accomplished by rotating the band switch handle to one of its three marked positions.

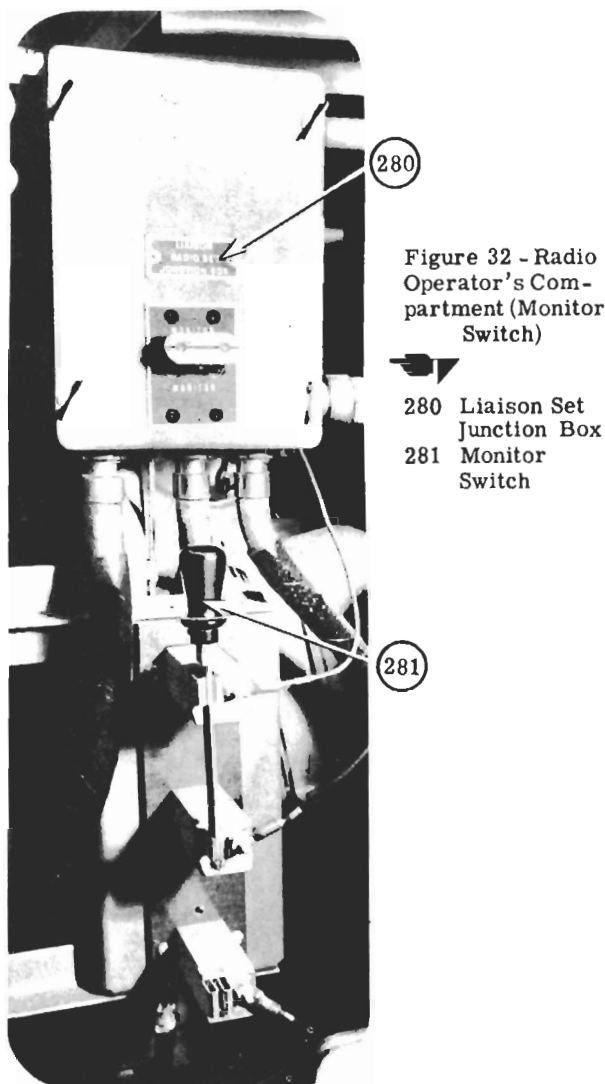
(8) Marker Beacon. - The operation of the marker beacon equipment is fully automatic. As the airplane passes over a fixed point from which a marker signal is being transmitted, the signal is picked up by the receiver, the output of which actuates a built-in relay. This relay in turn causes the indicator to flash on, thus indicating to the pilot that he has passed over a marker beacon.



Figure 31 - Radio Operator's Compartment (Oxygen Regulator and Fire Extinguisher)

- 276 Oxygen Regulator
- 277 Thermos Bottle
- 278 Horn of Fire Extinguisher
- 279 Fire Extinguisher (CO<sub>2</sub>)





matically engages and turret starts to rotate counterclockwise. Guns can be fired as soon as extended position is reached.

(2) Charging the Guns.

(a) To charge guns for combat or to remove faulty cartridge, depress control valve with knob rotated clockwise against stop (after depression, knob is automatically released at end of charging stroke, thereby positioning valve for next charging stroke).

(b) To charge guns and hold the bolt back in safety, depress control valve with knob rotated counterclockwise against stop. When ready to release for combat, rotate knob clockwise against the stop.

(3) Combat Operation.

(a) Lower the padded knee support well forward of turret.

(b) Adjust chest support as required by means of spring-loaded pin in chest support rod.

(c) To adjust focus of sight, pull up on knurled collar below sight cushion and rotate until desired focus is obtained. Then push collar down, engaging it in closest locking notch.

(d) Take kneeling position with right hand on control handle, left hand on steady grip and eye on sight eye cushion. (See figure 33-284.)

(e) Neutral position of control handle is halfway between vertical and horizontal rotation stops.

(f) To elevate the guns, rotate control handle vertically about its axis. The guns will move in same relative direction as handle, at a speed proportional to the degree of control handle rotation.

(g) To rotate turret in azimuth, rotate control handle horizontally about its vertical axis. Turret will move in same relative direction as handle, at a speed proportional to the degree of control handle rotation.

(h) Turn on windage indicator switch and rotate rheostat control to indicated air speed of aircraft determined from pilot. Microphone switch button is in the end of the steady grip.

(i) To fire guns, depress trigger firing switch in the control handle.

(j) Power is cut off by releasing grip on the control handle.

(4) Retraction to Stowed Position.

(a) Rotate turret slowly in clockwise direction with guns positioned approximately 12 degrees below horizontal. As guns approach aft position, firmly depress retraction lever, which will cause the turret to stop.

(b) Slowly raise guns in elevation, keeping control handle set for slow azimuth speed in clockwise direction, and retraction lever depressed. When guns

### 3. OPERATIONAL EQUIPMENT - LOWER GUN TURRET.

#### a. Gun Turret Operation.

**CAUTION:** Do not operate turret without adequate power supply. Damage to the turret or airplane may result if supply voltage at the turret is less than 20 volts.

##### (1) Extension to Combat Position.

(a) Firmly grasp control handle (figure 33-288) with right hand to depress master switch, but do not depress trigger switch.

(b) Turn control handle counterclockwise about vertical axis a few degrees for slow speed and maximum rotation for full speed.

**CAUTION:** As turret approaches extended position, use slow speed until indexing key auto-



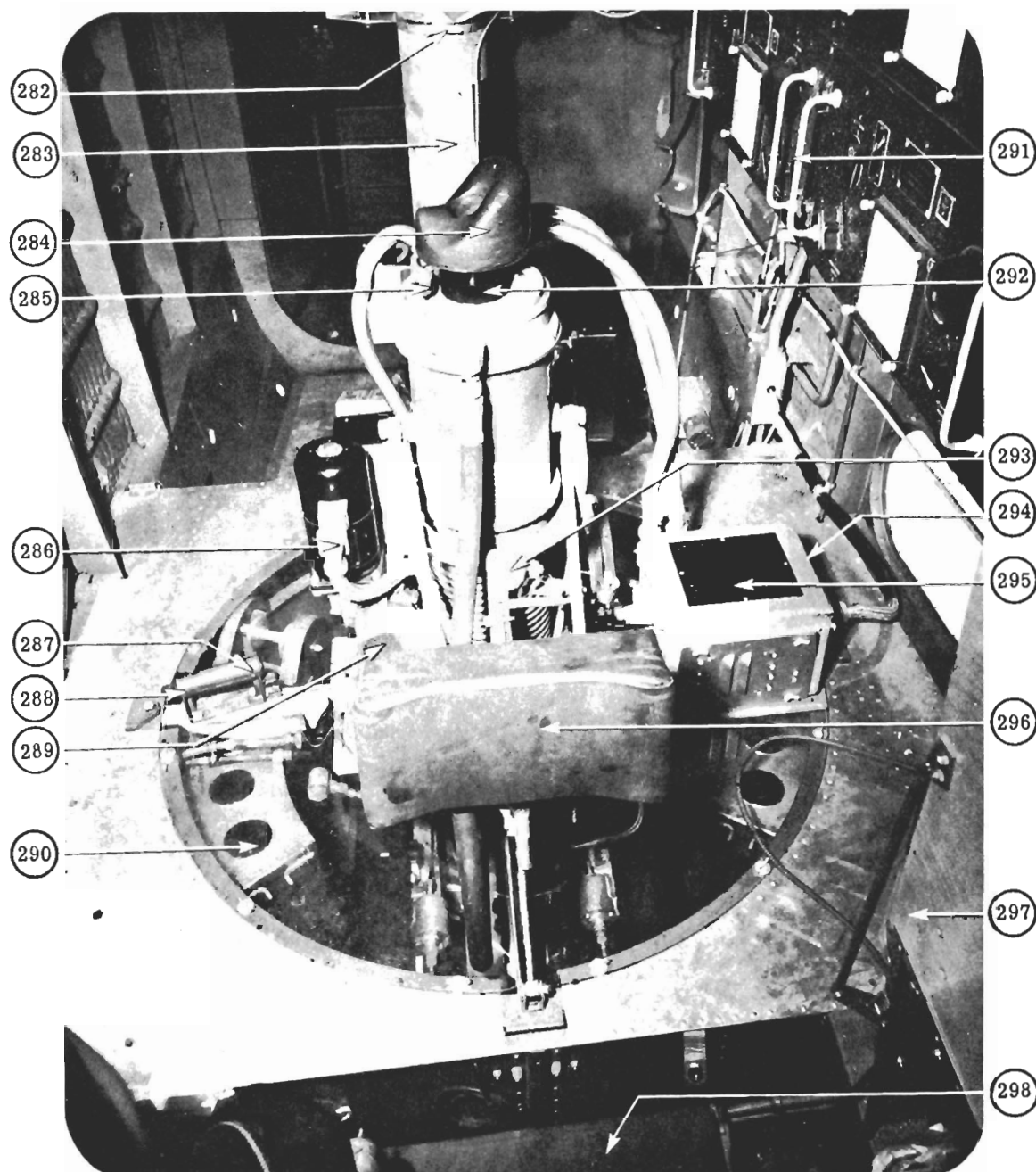


Figure 33 - Lower Gun Turret (Interior View)

- |  |   |                                     |
|--|---|-------------------------------------|
| 282 Foot Support Adjustment                        | 288 Steady Grip                                       | ret Control                         |
| 283 Upper Turret Shaft                             | 289 Manual Turret Control Shifter                     | 294 Turret Disconnect Switch        |
| 284 Gun Sight Eye Cushion                          | 290 Ammunition Box                                    | 295 Controller Box                  |
| 285 Retract Lever                                  | 291 Spare Insert Tuning Units for Liaison Transmitter | 296 Turret Operator's Chest Support |
| 286 Turret Rotation and Retraction Motor           | 292 Gun Sight Adjustment Collar                       | 297 Radio Operator's Table          |
| 287 Interphone Button - Inboard End of Steady Grip | 293 Crank Handle for Manual Turret Control            | 298 Turret Operator's Kneeling Pad  |

enter index zone (2 to 6 degrees below horizontal), turret will again turn clockwise, index and start retracting.

**CAUTION:** Control handle must be kept at slow speed until turret begins to retract.

(c) After turret has retracted approximately one inch, release retracting lever (figure 33-285) and continue retraction at any desired speed to stowed position.

b. Emergency Turret Operation.

**WARNING:** Firing restrictor cams, turret control cams and gun control cams which are used to electrically stop the gunfire, turret rotation, and the gun elevation at predetermined positions, are also disengaged when operating turret mechanically. Therefore, prior to attempting to fire guns while operating turret mechanically, mechanically rotating turret or moving guns in elevation, make sure guns will not fire on airplane or strike fuselage.

(1) Remove required transparent sections on turret deck.

(2) Engage handcrank (figure 33-293) in manual gun control shaft and rotate crank as required to position the guns approximately 2 to 6 degrees below horizontal.

(3) Engage handcrank in manual turret control shaft (figure 33-289) pull shaft forward to disengage clutch from reduction gear mechanism.

(4) Rotate turret until guns are slightly to left of aft position. Firmly depress retraction lever and rotate turret clockwise.

(5) When aft position is reached, turret will begin to retract. Hold retraction lever depressed until turret has retracted approximately one inch, and then release lever. Retract turret to stowed position.

**CAUTION:** Do not raise turret beyond the point where the aft turret support brace contacts the retract-position limit switch located below the aft leg of the spider, as damage to the turret will result.

(6) Replace sections of transparent fairing on turret deck.

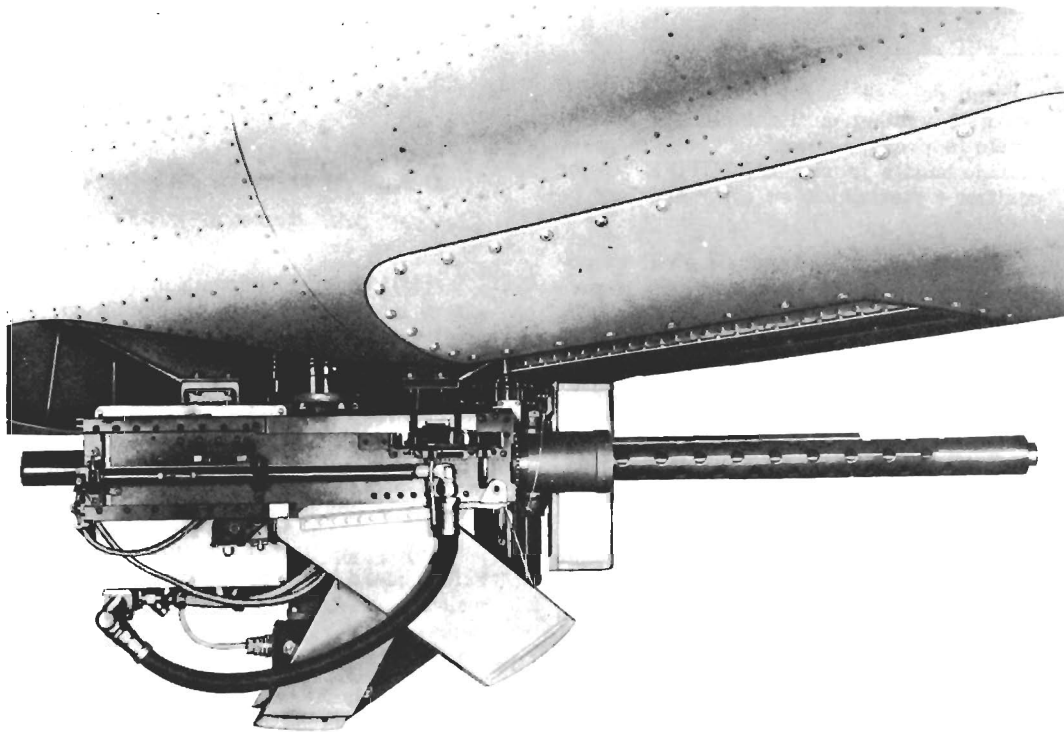


Figure 34 - Lower Gun Turret (Exterior View)

## SECTION VI

BOMBARDIER'S COMPARTMENT1. GENERAL DESCRIPTION.

The bombardier's compartment is located forward of and lower than the pilot's compartment. In the compartment, provision is made for the installation of the Norden M series, Estoppey D-8 or the British Mark IX bomb sights. The bomb controls provide for the "ARMED", "SAFE", "SELECTIVE", "TRAIN", "SALVO", and "EMERGENCY" releases. Ball and socket mounts (figure 36-322) for a .30 caliber machine gun are provided in the panels of the nose of this compartment. Stowage for the machine gun is by means of a socket and bracket at the right side of the compartment. Provision is also made for the installation of a type G-4 camera gun. In addition to the conventional equipment such as the interphone, ventilating and lighting systems this compartment has a side escape hatch (figure 14) to be used when the airplane is on the ground only. Armor plate on the seat and back of the bombardier's riding seat is the protection afforded in this compartment.

2. OPERATIONAL EQUIPMENT.a. Bomb-Controls Operation.

(1) The bomb release handle cannot be removed from one setting to another until the plunger knob at the top of handle is pressed down. In order to move the bomb release handle from "SELECTIVE" to the "SALVO" position a mechanical safety guard must be hinged upward.

(2) When not in use, bomb controls shall be positioned as follows: bomb bay door control (figure 35-314) at the "DOORS CLOSED" position with anti-salvo guard in place; selective-train switches on "SELECTIVE" and the momentary contact bomb release switch with mechanical safety guard in place. After releasing bombs the controls shall be returned to the above positions to prevent accidental release of the remaining bombs.

(3) Setting controls prior to releasing bombs.

(a) In electrical selective or train release, the bombs are automatically electrically armed. In emergency salvo release, the bombs are always released automatically in the safe condition.

(b) Set the train selective switches to the desired position.

(c) If electrical train release of the bombs is desired, set the desired spacing on bomb release interval control. Do not move control while motor is running.

(d) To open bomb bay doors, move bomb release handle to "DOORS OPEN-RACK LOCK" position.

**CAUTION:** Do not open or close bomb bay doors on the ground without first verifying that all personnel are clear.



*Be sure area under plane is clear before you open or close bomb doors!*

(e) When door position indicator light illuminates, move bomb release handle to "SELECTIVE" position, if electrical train or selective release is desired.

(f) To close bomb bay doors return bomb release handle to "DOORS CLOSED" position.

(4) Selective Release. - Hinge bomb release switch safety guard (figure 35-317) upward and press release switch once for each bomb to be released.

(5) Train Release. - Hinge bomb release switch safety guard upward, and press and hold down release switch until the desired number of bombs has been released.

(6) Salvo Release. - Hinge anti-salvo guard upward and move bomb release handle (figure 35-314) to the extreme forward, "SALVO" position.

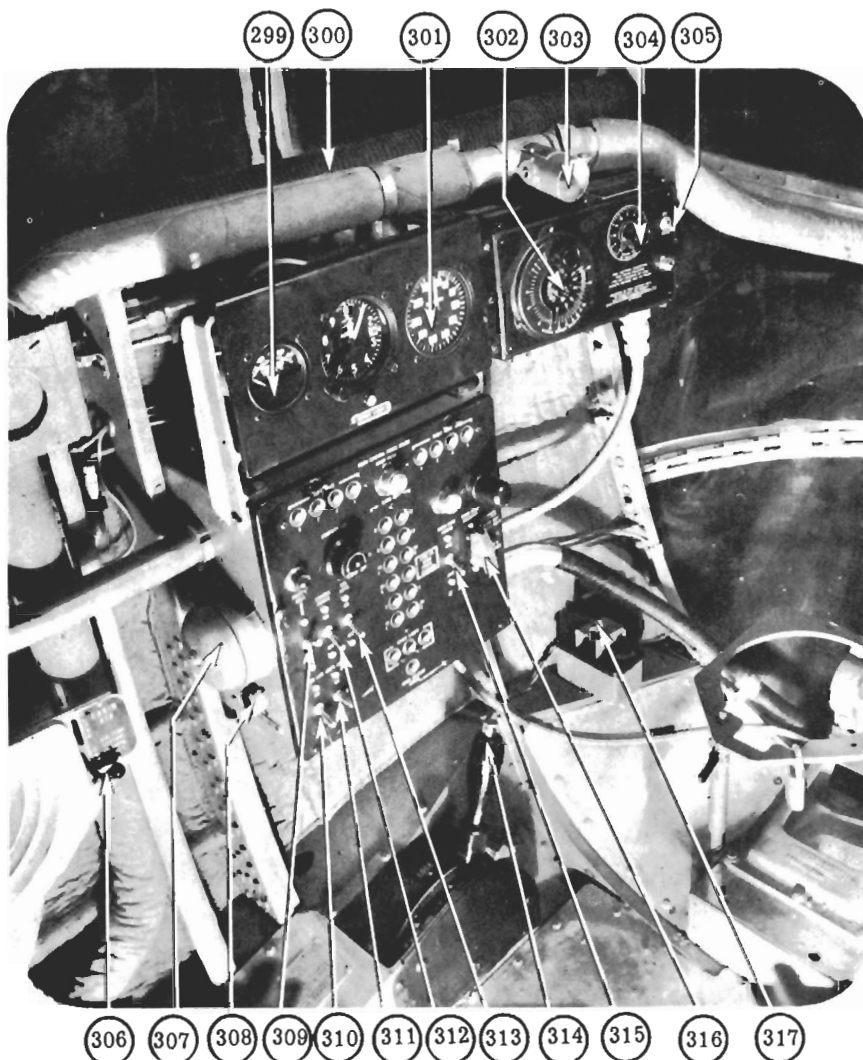
(7) Emergency Release by Pilot. - In the event the pilot has released the bombs or the droppable tank in an emergency, the bombardier performs the following operation.

(a) Move bomb release handle to the extreme forward end of the quadrant, past the "SALVO" po-

Figure 35 - Bombardier's Compartment (Left Side)



- 299 Free Air Temperature Gage
- 300 Bomb Sight Defroster Tube Stowed
- 301 Air-Speed Gage
- 302 Interval Control
- 303 Bomb Sight Defroster Tee
- 304 Interval Control
- 305 Selector Train Switch
- 306 Heater Control
- 307 Warning Kell
- 308 Warning Light
- 309 Pilot's Call Switch
- 310 Dome Light Switch
- 311 Cockpit Light Switch
- 312 Camera Power Switch
- 313 Identification Lights Switch
- 314 Bomb Release Handle
- 315 Salvo Switch
- 316 Bomb Rack Selector Switch
- 317 Bomb Release Switch



sition and then return handle to "DOORS CLOSED" position. This will cock the pilot's emergency release unit and close doors.

(b) The bombardier can also release the bombs or the bomb bay droppable tank in an emergency by using operation for "SALVO" release.

**CAUTION:** If the hydraulic system has failed, to release bombs from either the bombardier's or pilot's compartment, the bomb bay doors are to be cranked open from the navigator's compartment. However, the bombardier's door operating and bomb release handle must be positioned.

(8) Bombardier's Emergency Release. - Move bomb release handle (figure 35-314) to the extreme forward end of the quadrant, past the "SALVO" position and then return handle to the "SALVO" position. If handle was in "SALVO" return handle to the "SE-

LECTIVE" position and then forward past "SALVO" position in order to release bombs.

**b. Oxygen System.**

(1) Two type A-9A oxygen regulators are provided; one at bomb sight and one at riding seat.

(2) To operate, attach hose to bayonet fitting and adjust regulator.

**c. Interphone System.**

(1) A jack box (figure 37-336) is located at the right side of the compartment.

(2) To operate, plug in earphone cord and set switch to desired point. A throat microphone switch cord is also provided.

**d. Heating and Ventilating Equipment.**

(1) A controllable cold air scoop is provided on

the right side of the compartment.

(2) A valve equipped heat outlet (figure 36-324) is located on the left side of the compartment.

**CAUTION:** Do not open escape hatch during flight for ventilation.

e. Defrosting System.

(1) The bomb sight window receives heat whenever heater is on.

(2) A defroster tube (figure 35-303) for use on the bomb sight is provided. When not in use the tube may be stowed.

f. Automatic flight control equipment and pilot's call switch (figure 35-309) is located on bomb control panel.

g. Lighting System.

(1) A dome light switch (figure 35-310) is provided.

(2) An extension light switch (figure 36-319) is provided.

(3) Both of the above are operated conventionally.

h. Escape Hatch.

(1) A side escape hatch is located on the left side of the compartment.

(2) This hatch releases inboard.

**CAUTION:** This hatch is to be used when airplane is on the ground only and when motors are not running.

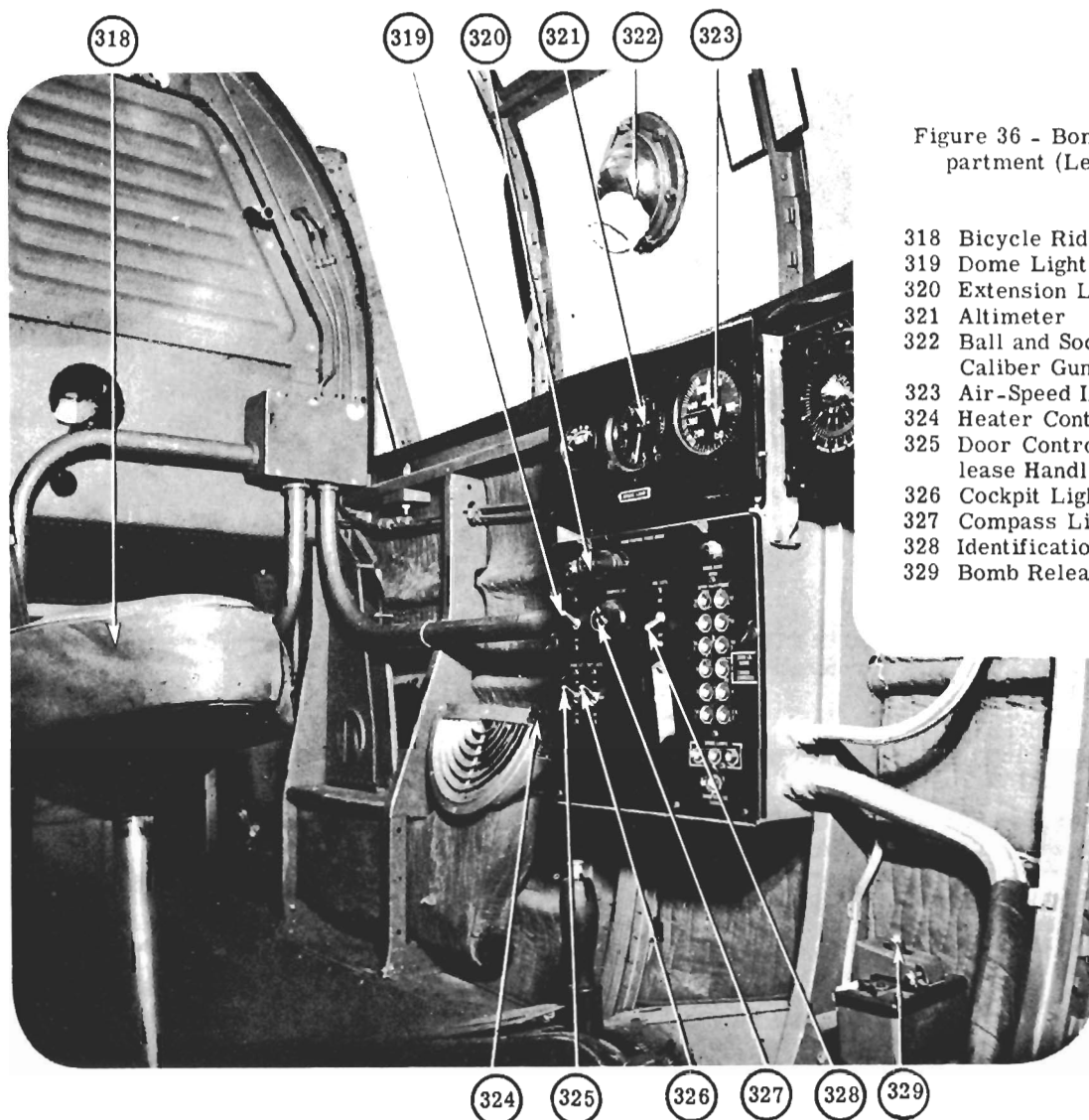


Figure 36 - Bombardier's Compartment (Left Rear View)

- 318 Bicycle Riding Seat
- 319 Dome Light Switch
- 320 Extension Light
- 321 Altimeter
- 322 Ball and Socket Mount for .30 Caliber Gun
- 323 Air-Speed Indicator
- 324 Heater Control
- 325 Door Control and Bomb Release Handle
- 326 Cockpit Light Switch
- 327 Compass Light
- 328 Identification Lights
- 329 Bomb Release Switch

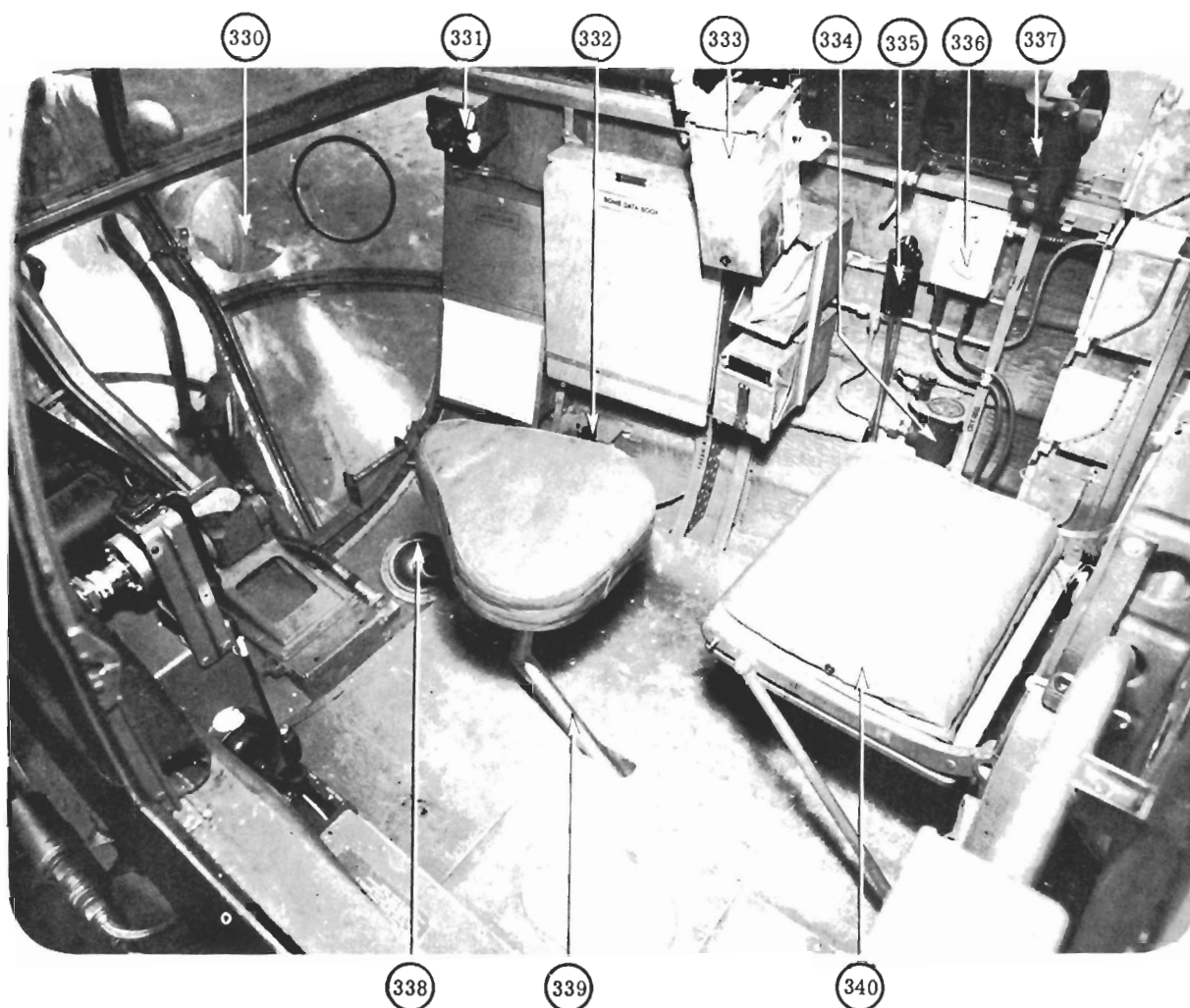


Figure 37 - Bombardier's Compartment (Right Side)

- |   |   |
|---|---|
| 330 Door for Cleaning Bomb Sight Window | 335 Push-To-Talk Switch                               |
| 331 Light Switch                        | 336 Jack Box  |
| 332 Oxygen Regulator                    | 337 .30 Caliber Machine Gun                           |
| 333 Ammunition Box                      | 338 Ball and Socket Mount for .30 Caliber Machine Gun |
| 334 Oxygen Regulator                    | 339 Bomb Sight Seat                                   |
| 340 Riding Seat                         |   |



## SECTION VII

## UPPER GUN TURRET COMPARTMENT

## 1. GENERAL DESCRIPTION.

a. The upper gun turret is located just forward of the armor plate bulkhead which separates the radio compartment from the photographer's and tail observer's compartment. It is equipped with oxygen and interphone controls.

b. This gun turret is an upper model "L" type and is provided with two (.50 caliber) model M-2 fixed machine guns equipped with hydraulically operated gun chargers and electric trigger motor solenoids. If the guns are elevated sufficiently to clear the fuselage, the turret may be rotated continuously (360 degrees) in azimuth. The guns swing from horizontal to straight up. The guns cannot be fired manually in the event of electrical failure. Provisions are made for 440 rounds of ammunition per gun.

## 2. OPERATIONAL EQUIPMENT.

**CAUTION:** Do not operate turret without adequate power supply. Damage to the turret or airplane may result if the supply voltage at the turret is less than 20 volts.

## a. Normal Operation of Turret.

(1) Before entering turret, turn on the disconnect switch (figure 40-349) located on the brush box at the forward side of the turret.

(2) Enter turret by pushing the riding seat to one side, and extend foot rests. (Do not step on the azimuth motor, compensator or brush box.)

**CAUTION:** Do not touch the main power switch on back of master control handle.

(3) Adjust foot rests and lock in place with the hand screw located at aft side of support attaching bracket. Adjust seat by sliding bracket on the center column.

(4) To charge the guns or remove faulty cartridge, depress gun charger button until chargers have moved gun bolts to rear position. Releasing the switch charges guns.

**NOTE:** Do not hold charger button depressed over 30 seconds.

(5) Rotate the sight cushion (figure 38) for individual focus.

## b. Combat Operation.

(1) Move the master control handle (figure 39-346) to the neutral position and grip the control handle with the right hand to depress the main power switch on the back of the handle.

**CAUTION:** Do not depress the trigger switch on the front of control handle as the guns fire

as soon as the main power switch is depressed.

(2) The swing of the guns in elevation follows the swing of the control handle up or down, the speed being proportional to the degree of the handle movement from neutral. The guns swing from horizontal to straight up.

(3) To rotate the turret in azimuth, rotate the control handle about its vertical axis. The turret will turn in the same relative direction as the handle at a speed proportional to the degree of the control handle rotation from its neutral position.

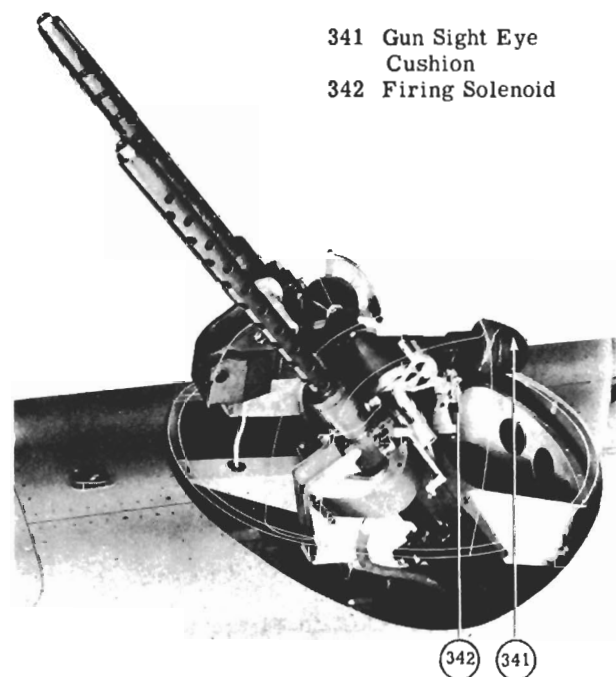


Figure 38 - Upper Gun Turret (Exterior View)

**NOTE:** The turret may be rotated continuously in azimuth (360 degrees) providing the guns are raised enough to clear the fuselage.

(4) To fire the guns, depress the trigger switch on the front control handle.

(5) Sight and train guns on the target by means of the master control handle. The intersection of the sight cross hairs indicates the point on which the guns are trained. (For sights without cross hairs use the dot in the center of reference circle.)

(6) Turn off the disconnect switch when the turret is not in use.

**CAUTION:** The electrical firing restrictor controls are disengaged when operating the turret mechanically. Make sure guns will not fire on airplane or strike fuselage. ----->

**c. Emergency Operation.**

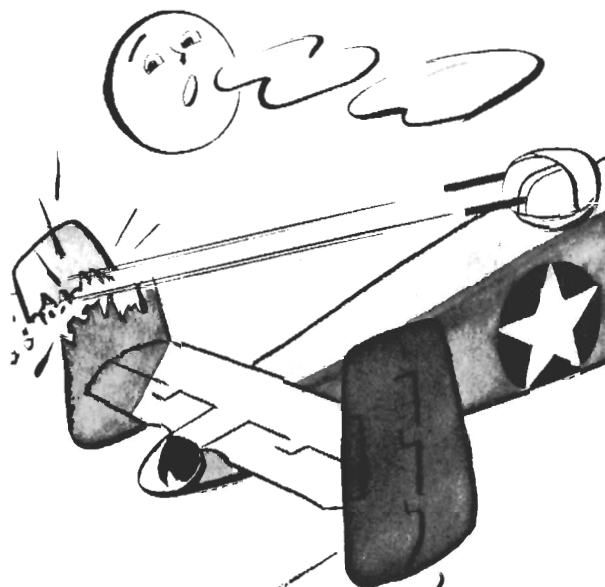
**NOTE:** The crank stowed on the lower turret shall also be used for manual control of the upper turret. A crank extension shaft is provided and must be used for the upper gun turret control only.

(1) Engage the hand crank with the extension shaft in upper end of gun elevation motor shaft (figure 38-342) and rotate crank as required to position guns so that they will clear fuselage when turret is rotated to aft position.

(2) Engage the hand crank with the end of the shifter shaft and pull the shaft out one-half inch (1.27 cm) by means of the crank in order to disengage the shaft from the reduction gear mechanism. Rotate the turret so that guns are in their aft position.

**d. Interphone Control.** - The interphone jack box (figure 39-349) is located on the left wall of the airplane next to the turret. Operation is conventional.

**e. Oxygen Control.** - The oxygen regulator (figure 39-350) is next to the interphone jack box on the left wall. Operation is conventional.



*Careless mechanical operation of turret gun will result in damage to plane!*

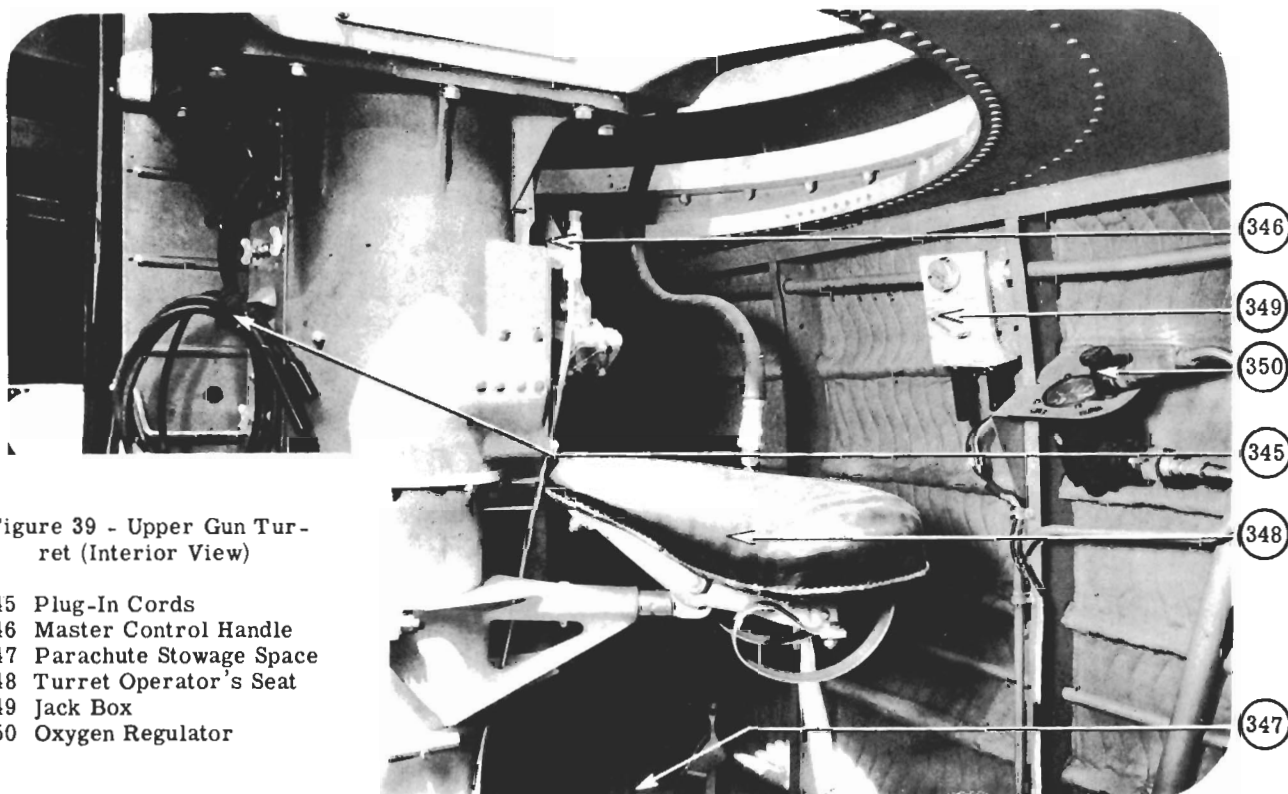


Figure 39 - Upper Gun Turret (Interior View)

- 345 Plug-In Cords
- 346 Master Control Handle
- 347 Parachute Stowage Space
- 348 Turret Operator's Seat
- 349 Jack Box
- 350 Oxygen Regulator



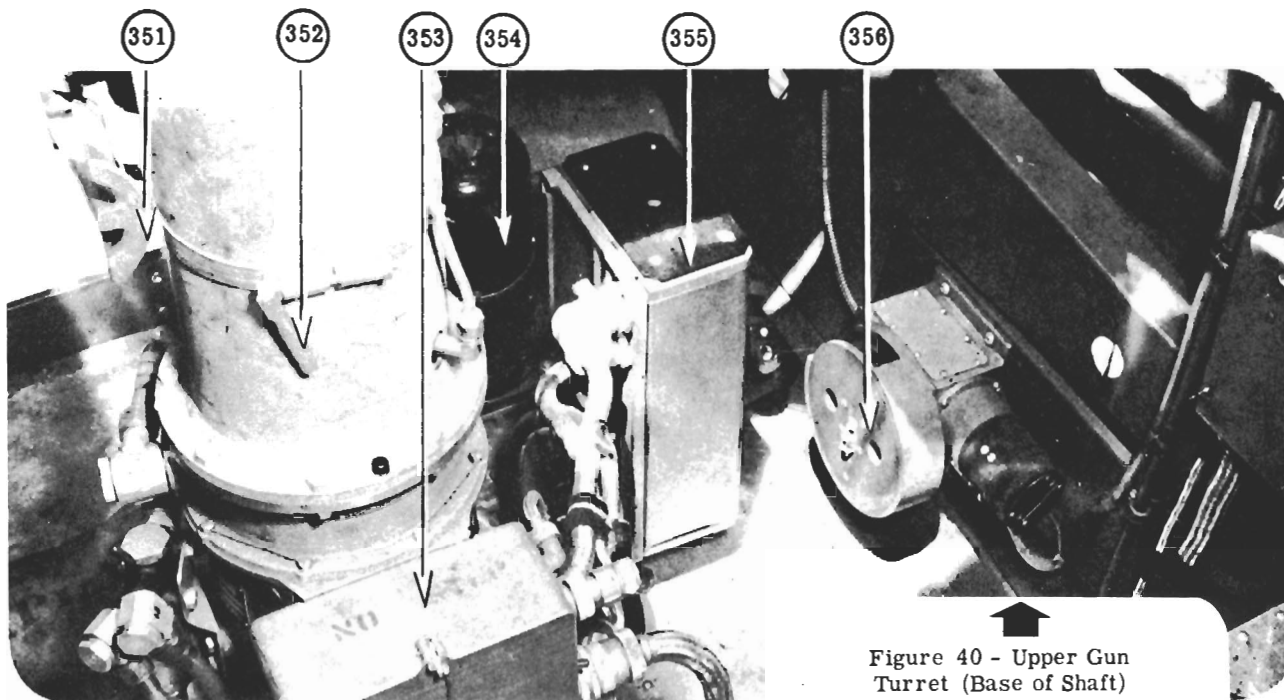


Figure 40 - Upper Gun  
Turret (Base of Shaft)

- 351 Folding Foot Rest
- 352 Foot Rest Adjustment
- 353 Brush Box
- 354 Turret Rotation and  
Retraction Motor
- 355 Compensator Box
- 356 Electrically Operated  
Trailing Reel Antenna

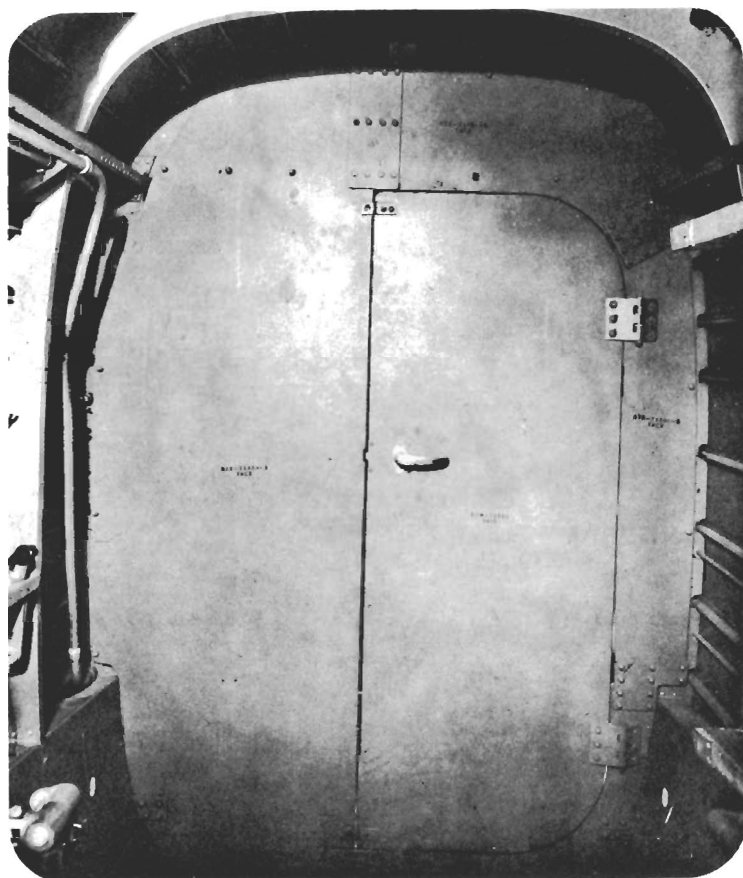


Figure 41 - Armor Plate Bulkhead



Armor Plate Door Immediately Aft of  
the Upper Gun Turret

## SECTION VIII

BOMB BAY1. GENERAL DESCRIPTION.

a. The bomb bay is located between the navigator's and radio operator's compartments. The bomb bay may be used as a receptacle for bombs, for carrying the droppable fuel tank, or for the installation of the tow target equipment.

b. A passageway (figure 14) over the bomb bay is provided for the movement of the crew from station to station. A manhole in the passageway permits entering and leaving of bomb bay.

2. OPERATIONAL EQUIPMENT.a. Bomb Bay Droppable Fuel Tank.

(1) The capacity of this tank is 585 U. S. gallons (488 Imperial gallons).

(2) This tank may be released in an emergency by either the pilot or bombardier.

b. Tow Target Equipment. - Emergency operation necessitates the following:

(1) Cut windlass cable.

(2) Escape through hatch in floor, then through bomb bay doors.

(3) If bomb bay doors are accidentally closed, exit is made through manhole in roof of bomb bay and then through one of the other hatches.

NOTE: An attachable parachute should be placed in the bomb bay whenever the tow target operator is at his station.

CAUTION: The bomb bay doors shall be open whenever tow target operator is in bomb bay, except during take-off or landing. Wire cutters must be carried by tow target operator at all times.

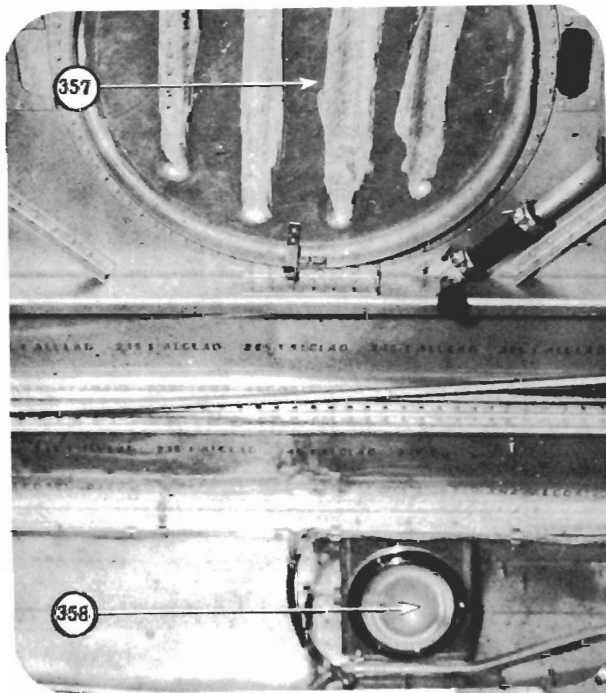


Figure 42 - Bomb Bay (Hatch to Passageway over Bomb Bay)

357 Hatch to Passageway Over Bomb Bay  
358 Dome Light

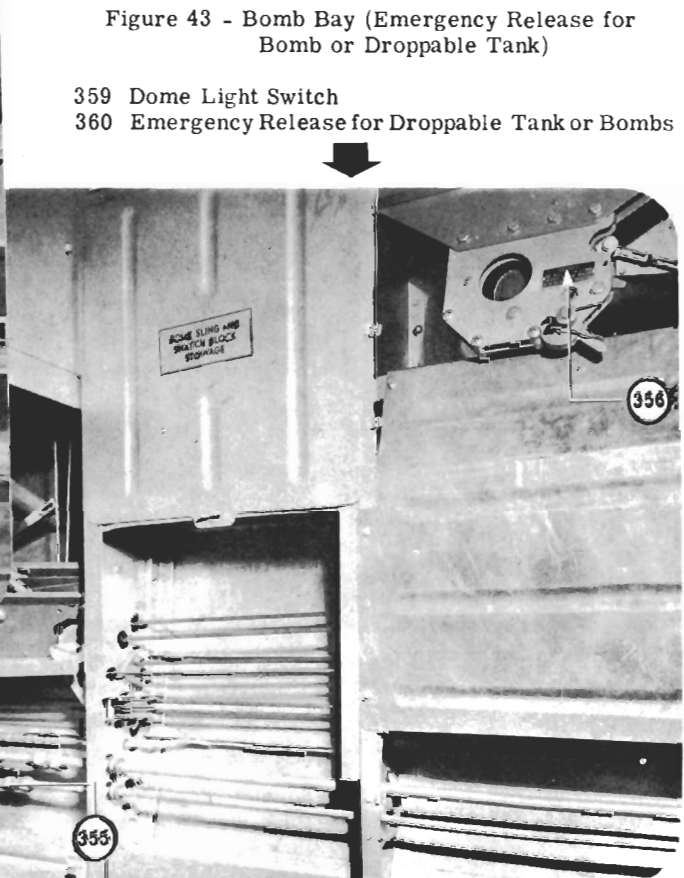


Figure 43 - Bomb Bay (Emergency Release for Bomb or Droppable Tank)

359 Dome Light Switch  
360 Emergency Release for Droppable Tank or Bombs

SECTION IXPHOTOGRAPHER'S COMPARTMENT  
(Including Tail Observer's Station)1. GENERAL DESCRIPTION.

The photographer's compartment (figure 44) is located near the tail of the airplane just aft of the armor plated bulkhead at the rear of the upper gun turret, and forward of the tail observer's station. The tail observer's station is in the center of the empennage and the portion which extends beyond the elevators is enclosed with plexiglass. It affords a range of vision rearward of 180 degrees in azimuth and 180 degrees in elevation. No oxygen outlet is provided at the tail observer's station. A chemical toilet is located between the two compartments. One window on each side of the fuselage just aft of the camera equipment can be used for escape hatches on the ground only.

2. OPERATIONAL EQUIPMENT.a. Photographic Equipment.

(1) Provision is made in the photographer's compartment for mounting a type K-7C, type K-3B or a type T-3A camera. A vacuum valve and camera power junction box (figure 44-363) in which are a signal light and an intervalometer (figure 44-360) and camera power sockets are provided. The camera is mounted on spring-loaded support tubes and may be raised to uncover the camera opening which has a removable cover. The cover can be stowed at the right side of the camera operator's seat. Windows are provided on each side of the fuselage for taking oblique photographs. These windows hinge inboard from the top and are held open by hooks.

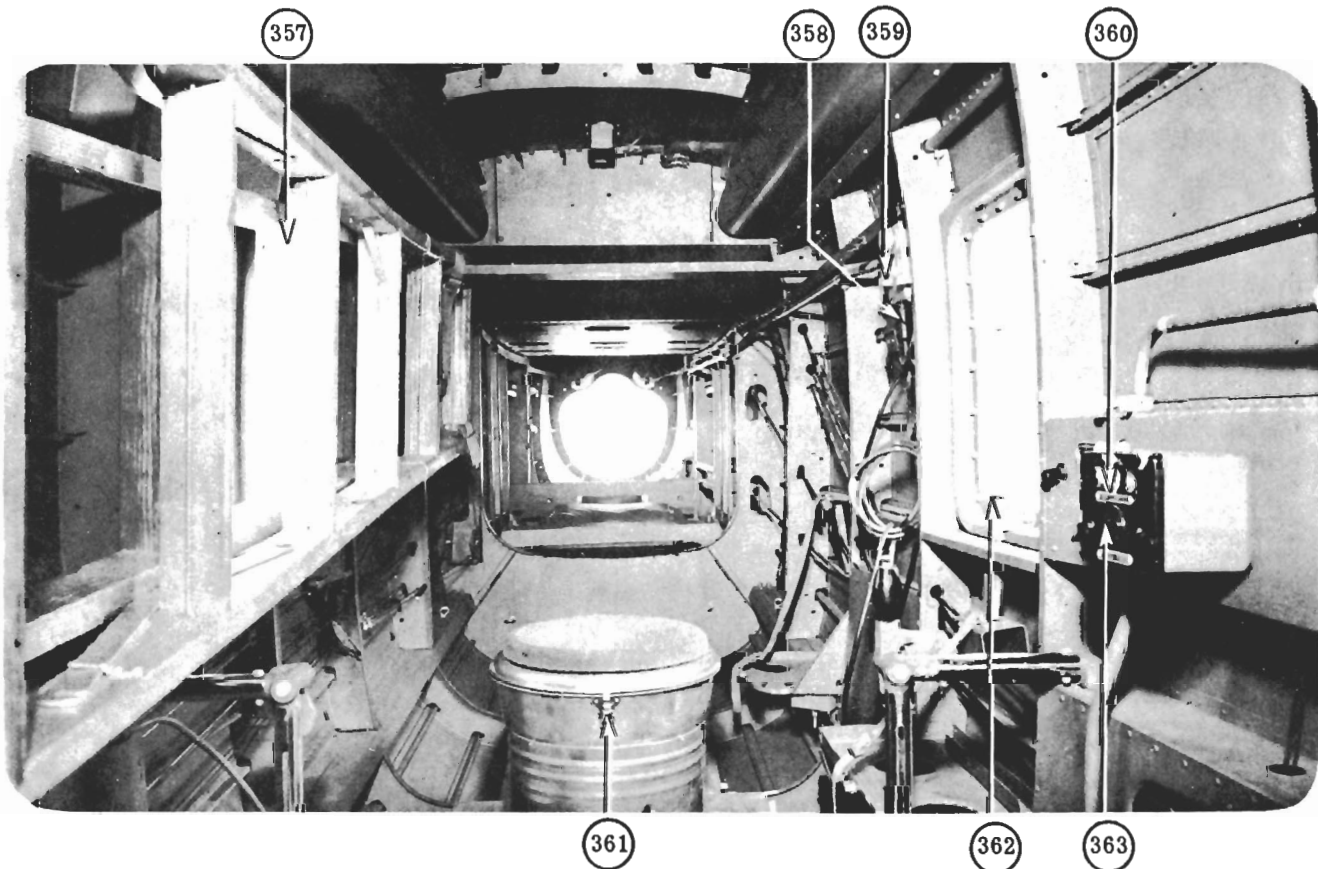


Figure 44 - Photographer's Compartment (Rear View)

- |                               |                       |
|-------------------------------|-----------------------|
| 357 Service Stepladder        | 360 Intervalometer    |
| 358 Push-To-Talk Switch       | 361 Chemical Toilet   |
| 359 Jack Box                  | 362 Side Window Latch |
| 363 Camera Power Junction Box |                       |

**CAUTION:** When windows are closed, stow the hooks to prevent injury to crew members.

(2) A camera rest is secured to either window sill with fasteners.

(3) The chemical toilet (figure 44-361) is used as the camera operator's seat. No safety belt is provided for this seat.

b. Interphone Control. - A jack box (figure 44-359) is located on the left wall aft of the escape hatch. Operation is conventional.

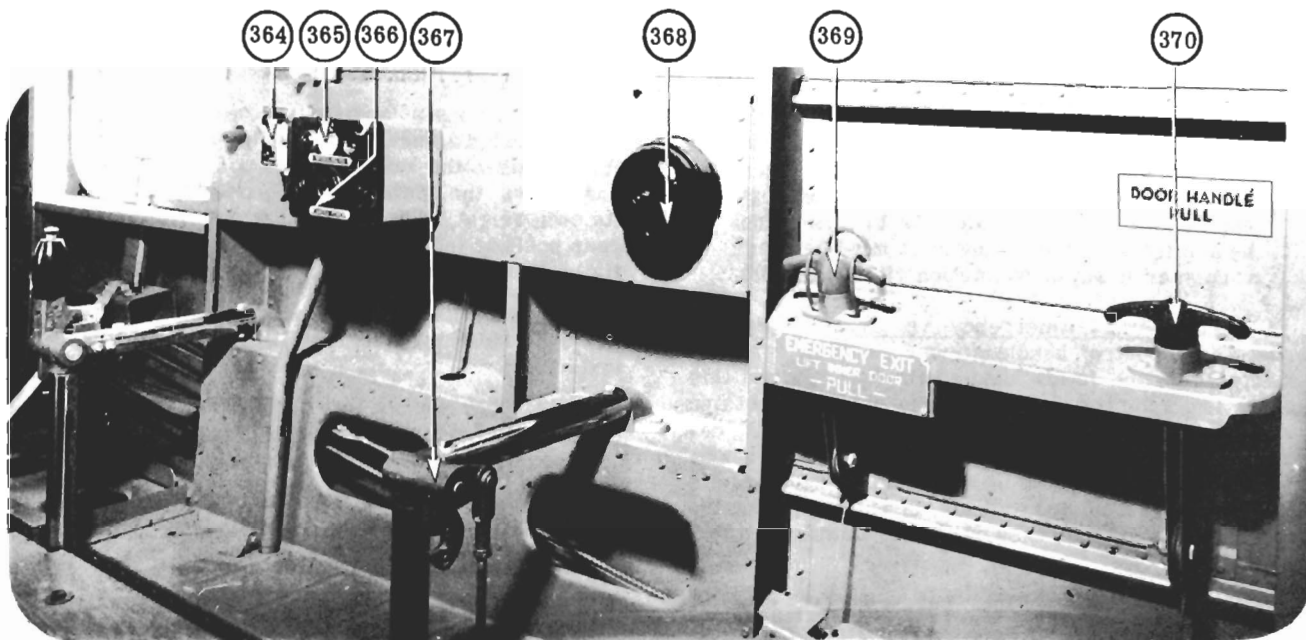
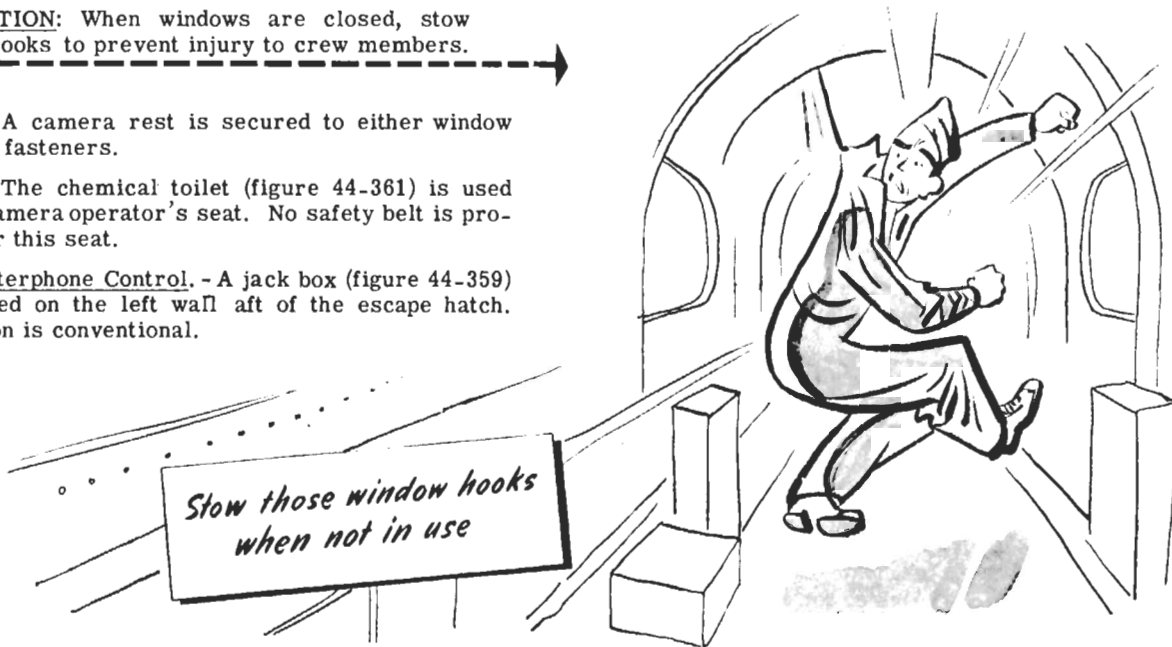


Figure 45 - Photographer's Compartment (Right Side)

- |                                   |                              |
|-----------------------------------|------------------------------|
| 364 Camera Vacuum Selector Switch | 367 Camera Mount             |
| 365 Intervalometer                | 368 Alarm Bell               |
| 366 Camera Power                  | 369 Emergency Exit Door Pull |
|                                   | 370 Door Pull Handle         |

**CAUTION:** When windows are closed, stow the hooks to prevent injury to crew members.

(2) A camera rest is secured to either window sill with fasteners.

(3) The chemical toilet (figure 44-361) is used as the camera operator's seat. No safety belt is provided for this seat.

b. Interphone Control. - A jack box (figure 44-359) is located on the left wall aft of the escape hatch. Operation is conventional.

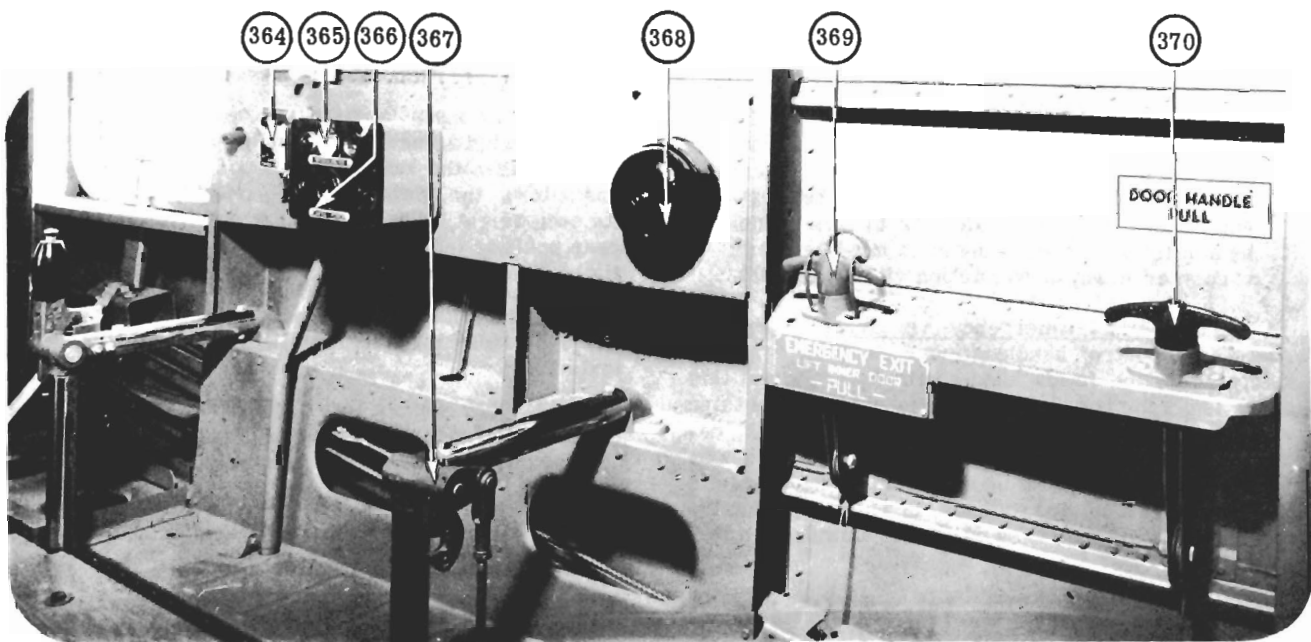
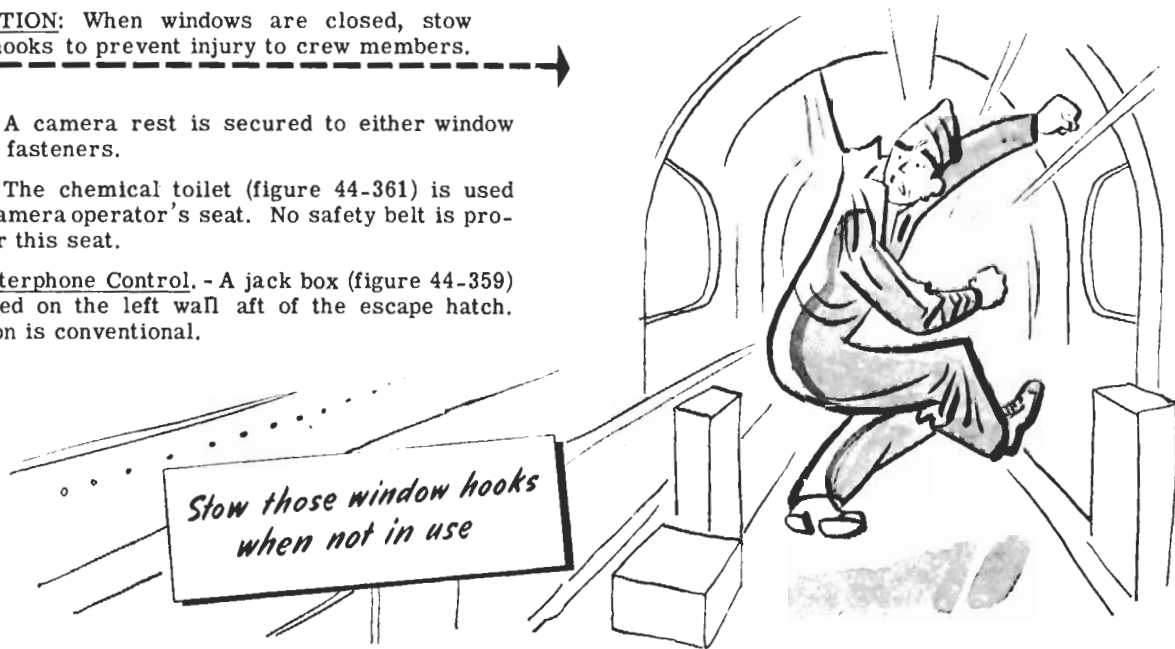


Figure 45 - Photographer's Compartment (Right Side)

- |                                   |                              |
|-----------------------------------|------------------------------|
| 364 Camera Vacuum Selector Switch | 367 Camera Mount             |
| 365 Intervalometer                | 368 Alarm Bell               |
| 366 Camera Power                  | 369 Emergency Exit Door Pull |
|                                   | 370 Door Pull Handle         |

SECTION XEMERGENCY OPERATIONS AND INSTRUCTIONS1. EMERGENCY OPERATION IN CASE OF  
HYDRAULIC SYSTEM FAILURE

a. Emergency Hydraulic Brake Operation. - If there is less than 800 lb/sq in. (56.2 kg/sq cm) pressure indicated.

(1) Turn emergency hydraulic selector valve (figure 21-200) to "BRAKE."

(2) Operate hydraulic hand-pump until pressure gages show 800 lb/sq in. (56.2 kg/sq cm) and not more than 1450 lb/sq in. (102 kg/sq cm).

**CAUTION:** While applying brakes after landing, operate hand-pump continuously to maintain as much pressure as possible in the brake system accumulator as the accumulator pressure alone is not adequate for the amount of brake application required for a normal landing.

(3) If a pressure of 600 lb/sq in. (42.2 kg/sq cm) cannot be built up prior to landing, a field with at least one mile of runway is needed to land the airplane safely.

b. Emergency Air Brake Control.

**CAUTION:** Use air pressure brake system as a last resort only. When it is known that the emergency air pressure brake system may have to be used during landing, the longest runway available shall be sought and the shortest landing possible made. As brakes cannot be applied selectively, the pilot must be ready to counteract any uneven action with the throttle.

(1) To Apply Emergency Air Brake. - Pull up sharply on control handle (figure 21-193), breaking safety wire, and lower handle halfway. Repeat this operation, applying brakes by very quick, successive upward pulls of the handle from the intermediate position until the desired amount of brake action is obtained. Spring action aids in lowering the handle to halfway (intermediate) position, in which position the air pressure to the brakes will be maintained.

(2) To Release the Emergency Air Brakes. - It is only necessary to push handle fully down to its normal position.

(3) The air brake may be reapplied but the pilot should depend on only one application.

**CAUTION:** After a landing during which the air brakes were used, taxiing should be accomplished with extreme care, as very little, if any, brake pressure will be available.

**CAUTION:** After using emergency air brake system, hydraulic brake system must be bled.

c. Main Landing Gear Emergency Mechanical Operation.

**NOTE:** The screw jack for lowering the main gear is very powerful, and if the handle continues to be turned after the gear is down and locked, damage to the cable results. Contact between the pilot and the radio operator by the interphone system is imperative. It is also important not to return the lowering screw handle to its original position until the airplane is safely landed.

(1) Move hydraulic landing gear control handle (figure 21-192) in pilot's compartment to "DOWN" position.

(2) Pull pin and fold down adjustment rod of lower turret operator's chest support.

(3) Lower radio operator's table to useful position.

(4) Release main landing gear operating screw assembly (figure 29-267) (held to forward wall of radio compartment with finger type fastener) and rotate assembly away from wall until it locks in a fore and aft position.

(5) Pull main landing gear up-position latch release, located adjacent to lowering screw. This control releases the main gear up-position latches only, and allows the main gear to partially lower due to its own weight. Check visually or on pilot's landing gear position indicator that both main gears are partially lowered before using the lowering mechanism.

(6) Turn lowering screw lever clockwise (figure 47) until indicators register the main gear is down and locked.

**CAUTION:** Do not lower main landing gear by the emergency mechanical lowering system above 150mph (130 knots) indicated air speed.

**NOTE:** The main gear cannot be raised mechanically.

d. Nose Wheel Emergency Mechanical Operation.

(1) Ascertain that the landing gear control handle (figure 21-192) in pilot's compartment is in the "DOWN" position.

(2) Pull nose gear emergency lock release (figure 25-238) located on top of mechanism. This releases the nose gear and allows it to lower partially due to its own weight. Check on pilot's gear indicator or by means of the drift meter, to see that auxiliary gear is partially lowered.

(3) Remove safety pin and turn pawl (figure 25-239) to "ON."

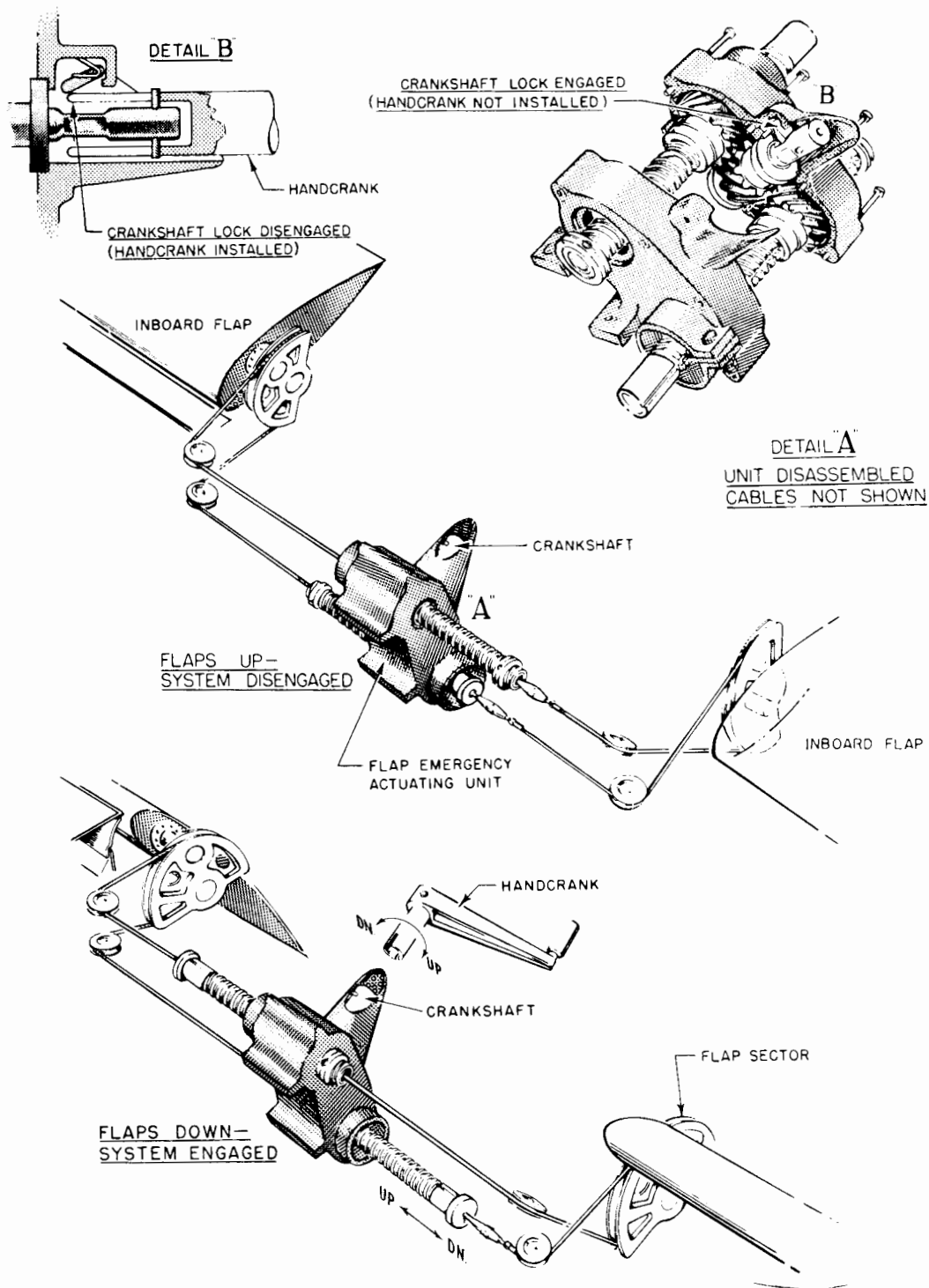


Figure 46 - Wing Flap Emergency Operating System Diagram



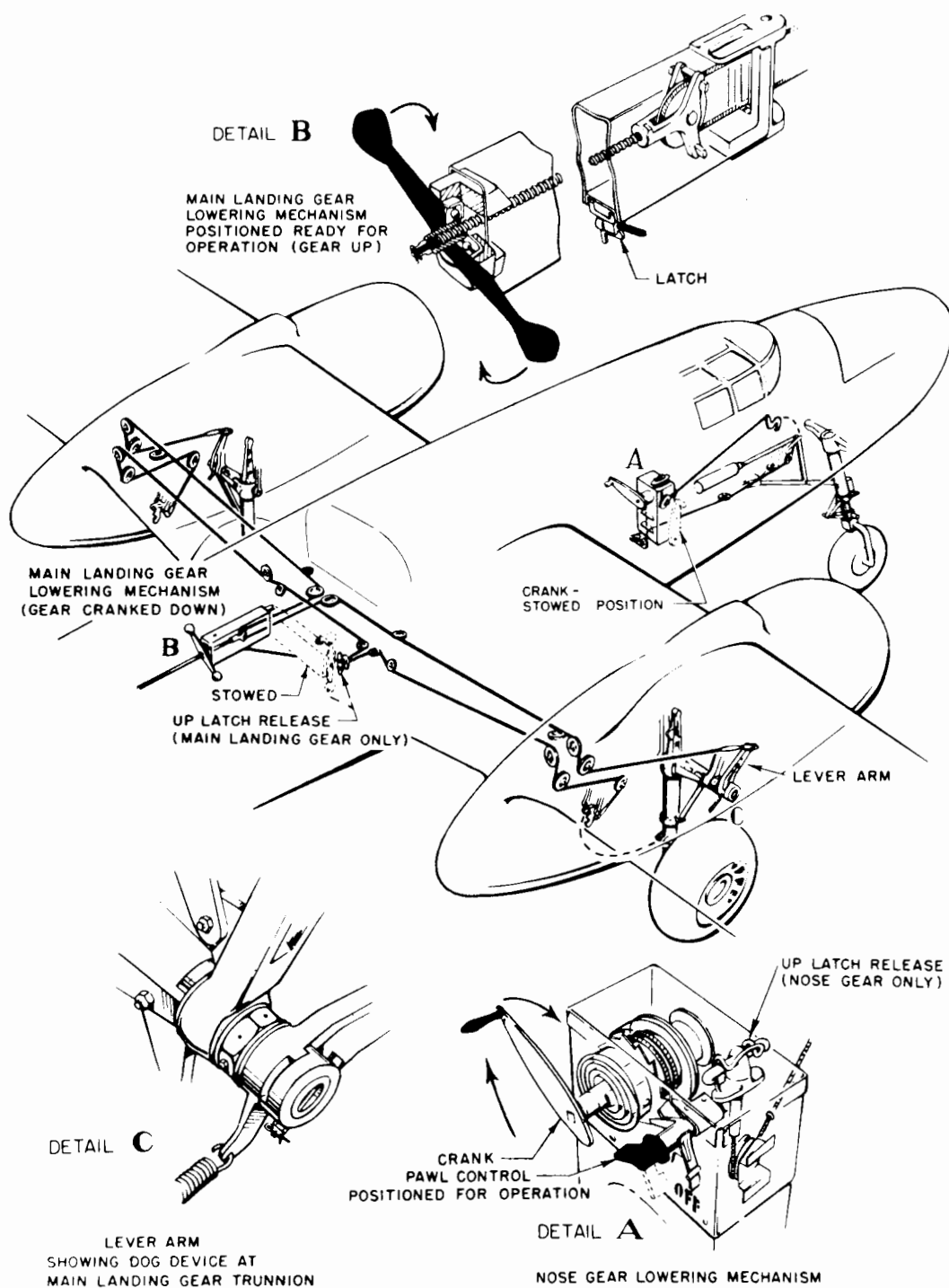


Figure 47 - Landing Gear Emergency Lowering Systems



- (4) Place crank (figure 25-241) on shaft and turn clockwise until gear indicator registers "DOWN" and "LOCKED."



*For emergency nose wheel operation:-  
Turn handle clockwise*

**CAUTION:** Do not lower nose gear by means of the mechanical lowering system, above an indicated air speed of 150 mph (130 knots). Do not return pawl to "OFF" until airplane is safely on the ground.

e. Emergency Hydraulic Operation of Main Landing Gear Down-Position Latches.

**NOTE:** Whenever the main landing gear down-position lockpins fail to engage automatically, regardless of the method used to lower the main gear, the following operations should be performed.

- (1) With gear fully extended (check position indicator) turn emergency hydraulic selector valve (figure 21-200) to "LATCH."

- (2) Operate hydraulic hand-pump until position indicator registers main landing gear lockpins are in place.

**NOTE:** Main landing gear must be fully down, prior to using hand-pump.

**CAUTION:** Once the lockpins have been pumped into the latched position, they cannot be retracted. It is impossible to get the gear into the fully down position if the latches have been pumped to the latched position prematurely.

**NOTE:** If the nose wheel position indicator shows the nose landing gear fully extended but warning flag shows the down-position lock is not engaged, it is safe to land if the pawl of the nose wheel emergency lowering crank is "ON" and the gear has been pulled down as far as possible. Before landing under these conditions, send all available personnel into the tail section of the airplane.

f. After Landing. - Before operating the landing gear hydraulically, again it is absolutely essential to perform the following:

- (1) Turn nose gear emergency lowering mechanism pawl control to "OFF" position and stow crank on side of drum housing. To turn pawl control "OFF" relieve tension on pawl by exerting pressure on crank handle.

- (2) Turn main landing gear emergency lowering screw handle counterclockwise to return handle to its original position and stow assembly with fastener provided.

g. Bomb Bay Door Emergency Mechanical Operation. - To be used only in the event of complete hydraulic pressure failure.

- (1) Move bomb release handle to the "DOORS OPEN-RACK LOCK" or the "DOORS CLOSED" position as desired.

- (2) Install bomb bay door operating crank on shaft in aft end of navigator's compartment. (Crank is stowed on lower right longeron opposite the crank-shaft.) The crank shall be installed with the crank positioned downward. Turn crank clockwise to close doors and counterclockwise to open doors. The crank has an automatic clutch mechanism which enables it to be operated in either direction and helps to hold the doors in the position to which they are operated.

**NOTE:** After closing the bomb bay doors by means of the crank, thread strap secured to crank handle through tie-down loop on floor below crank and tighten securely.

h. Wing Flap Emergency Mechanical Operation.

**CAUTION:** Do not attempt to operate the emergency flap operating system (do not even install crank) unless there is hydraulic system pressure failure, as the hydraulic and mechanical systems oppose each other.

- (1) Coordination through interphone communication between pilot and radio compartment is necessary.

- (2) Reduce speed of airplane to 150 mph (130 knots) before operating flaps by means of emergency system. Do not fly at a speed over 150 mph after flaps are mechanically lowered.

- (3) Move pilot's hydraulic flap control handle to the extreme "DOWN" position.

- (4) Open hinged cover located on shelf at forward

end of radio operator's compartment, and install crank (stowed on wall below hinged cover) on shaft of flap operating mechanism.

(5) Rotate the crank clockwise to lower flaps. (Approximately 27 full turns of the crank are required to lower flaps.)

(6) To lock the flaps in any desired position, remove the hand crank.

(7) To disengage the mechanical flap operating mechanism, it is necessary to rotate the crank counterclockwise against its stop and stow the crank. Inadvertent engagement of the mechanical system is prevented by a lock which acts upon the removal of the hand crank. This lock also serves as guarantee against engagement of the mechanical system while the hydraulic system is in operation, if the crank has been turned counterclockwise as far as it will go.

**CAUTION:** The emergency mechanical flap operating system must be returned to its full "UP" position, by turning the crank counterclockwise against its stop, after which the crank must be removed and stowed before the wing flaps are operated hydraulically again. Otherwise damage to the cable system will result.

(8) Prior to lowering the wing flaps mechanically, it is necessary to be sure that the pilot's hydraulic flap control handle is moved to the extreme "DOWN" position. Approximately one minute in flight is required to lower the flaps mechanically.

i. Hydraulic Operation of Wing Flaps with Engine Stopped.

(1) Move wing flap control handle (figure 21-191) to the extreme position for the desired movement. Normally, there will be enough pressure in the accumulator (800 to 1100 lb/sq in., 56.2 to 77.3 kg/sq cm) to complete one full movement of the flaps. Further movement of the flaps should be accomplished as follows.

(2) Turn emergency hydraulic selector valve to "NORMAL."

(3) Operate hydraulic hand-pump until the desired position of the flap is reached, after which flap control handle shall be returned to "NEUTRAL."

**NOTE:** To lower wing flaps, by the emergency mechanical lowering system, while on the ground all pressure must be bled from the hydraulic system. This may be done by operating the engine cowl flaps until gage registers zero.

2. EMERGENCY EXIT DURING FLIGHT.

a. Pilot, copilot, bombardier and navigator use front entrance hatch located in the floor of navigator's compartment.

(1) Raise inner door by pulling lever (figure 22-210) and secure door with catch.

(2) Disengage safety guard on emergency release handle (figure 28-252) and pull handle

b. All crew members stationed aft of the navigator's compartment should use rear entrance hatch aft of upper turret bulkhead.

(1) Raise inner door by pulling lever (figure 45-370) and secure door with catch.

(2) Disengage safety guard on emergency release handle (figure 45-369) and pull handle.

(3) The escape hatch located at the right side of the lower turret releases inboard.

c. The following procedure is to be carried out by the tow target operator.

(1) Cut windlass cable if trailing.

**NOTE:** Wire cutters must be carried by tow target operator at all times. Bomb bay doors must be kept open while operator is in bomb bay, except during landing or take-off. If possible, cut or retract trailing antenna before using floor hatches.

(2) Escape through hatch in floor aft of seat, then through bomb bay doors.

(3) If bomb bay doors are accidentally closed, make exit through manhole in roof of bomb bay and then through one of the other hatches.

**CAUTION:** To use bombardier's side escape hatch, pilot's escape hatch, or pilot's side windows as a means of escape during flight, propellers must be feathered and the airplane must be under control.

3. EMERGENCY EXIT ON GROUND.

In addition to the above exits of escape are the following ground exits:

a. Bombardier's enclosure escape hatch located on the left side of the compartment. This hatch releases inboard.

b. Pilot's enclosure escape hatch is located above pilot's and copilot's seats. The hatch releases outboard.

c. Pilot's compartment side windows slide aft on tracks. To operate, squeeze handles located forward of windows near the instrument panel.

d. The side windows in the photographer's compartment which hinge at the top may be opened from within the airplane and used as exits.

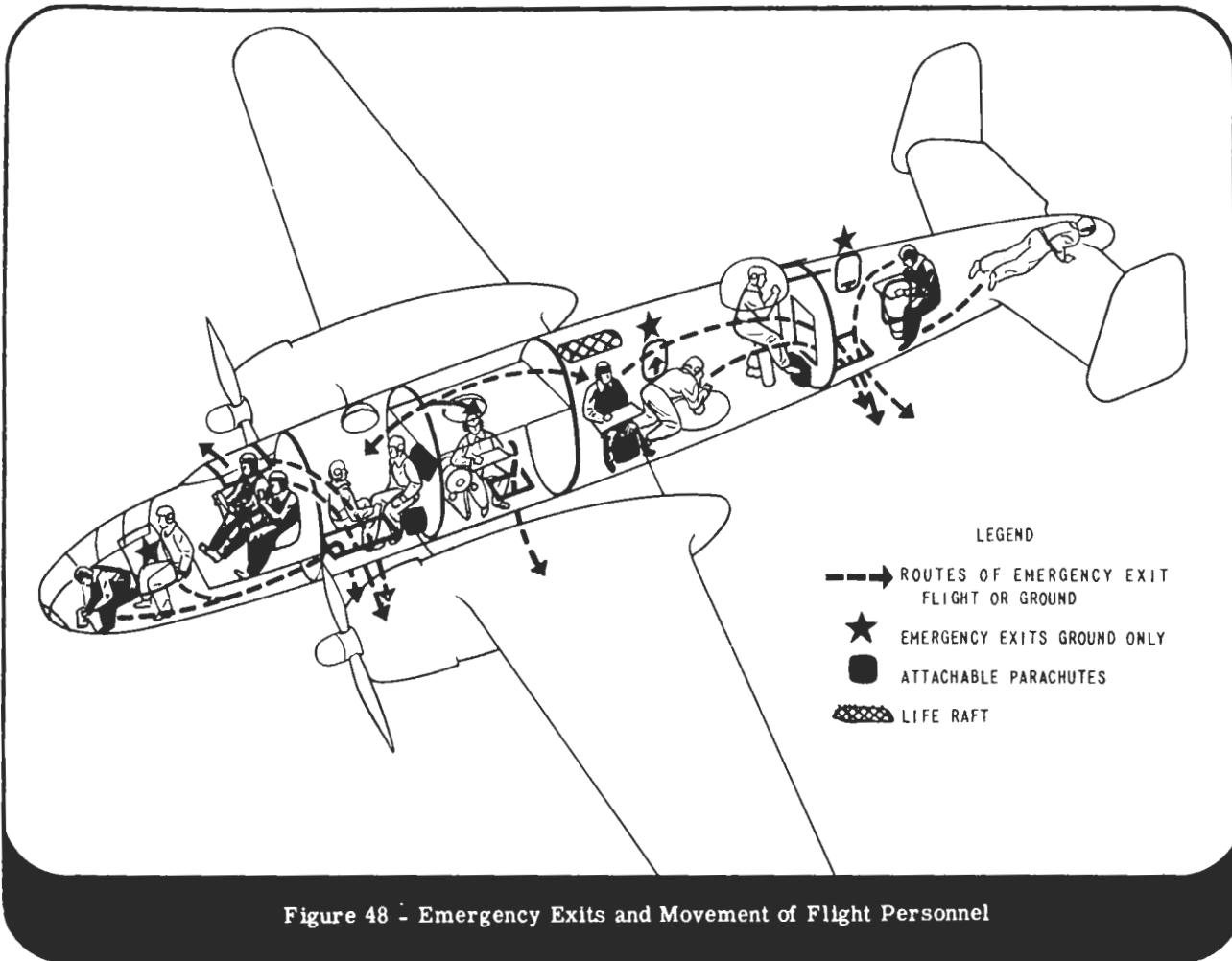


Figure 48 - Emergency Exits and Movement of Flight Personnel

#### 4. MISCELLANEOUS EMERGENCY NOTES.

##### a. Interphone.

- (1) Set jack box dial control to "CALL."
- (2) All stations, even those already in use, will be placed in parallel across the amplifier.

##### b. Emergency Fuel Shut-off Valves.

- (1) Valves (figure 23-227) are located in right-hand rear corner of navigator's compartment.
- (2) To operate: depress spring-loaded catch (figure 23-228) and twist control handles to "OFF."

##### c. Emergency Release of Bombs or Droppable Fuel Tank.

- (1) All bombs may be released simultaneously and in "SAFE" condition by operating pilot's emergency release (figure 16-102) or bombardier's release control. (See figure 35-314.)
- (2) To operate bombardier's release control.

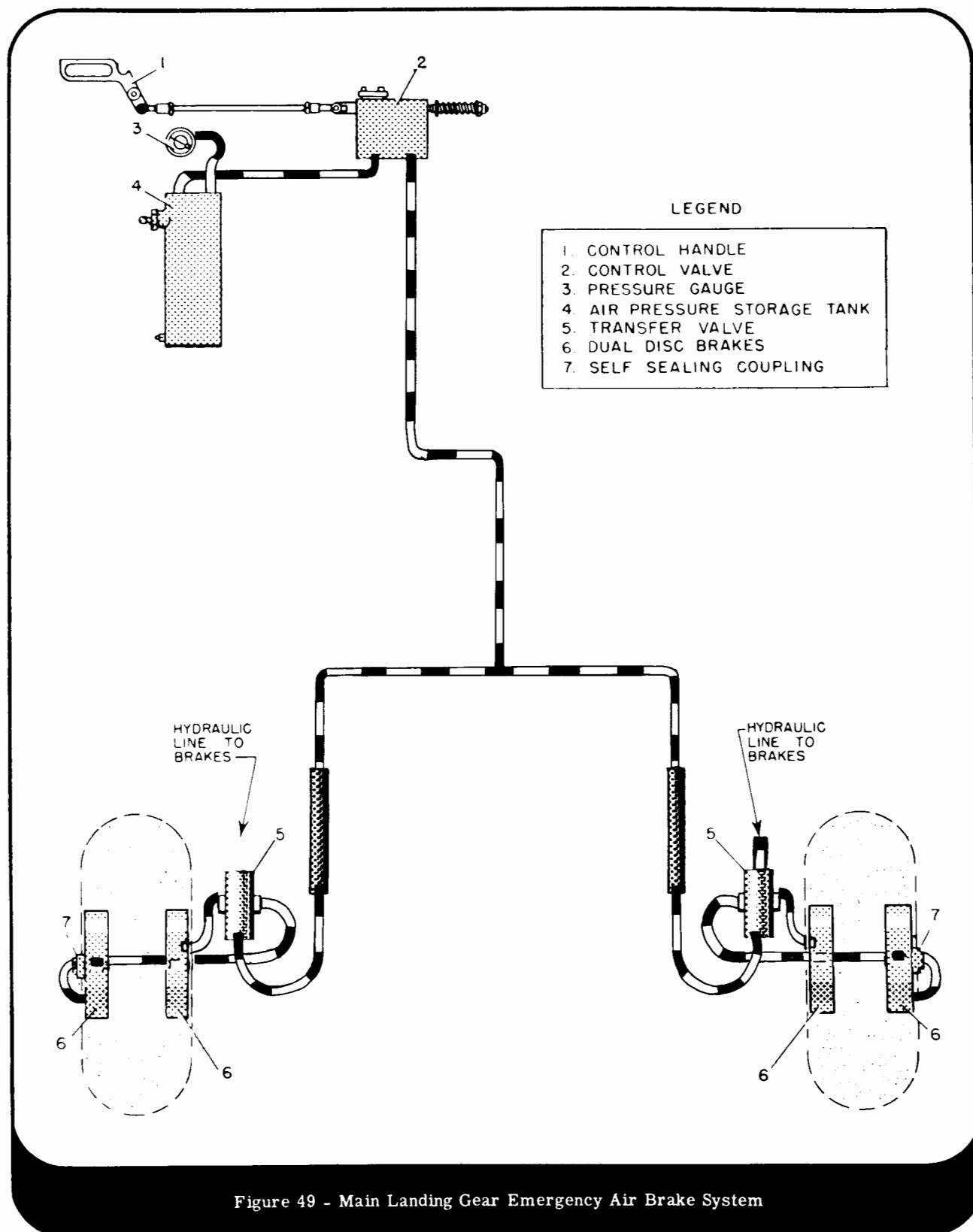
(a) Hinge the anti-salvo guard upward and move the bomb release handle to the extreme forward "SALVO" position.

(b) In case of hydraulic system failure, crank bomb bay doors open mechanically by the following procedure:

1. Ascertain that bombardier's door-operating and bomb release handle is at the "DOORS OPEN-RACK LOCK" or "DOORS CLOSED" position.

2. Install bomb bay door operating crank on shaft (figure 22-204) in aft end of navigator's compartment. Crank is stowed on lower right longeron opposite the crank shaft. The crank shall be installed with the crank positioned downward. Turn crank clockwise to close doors and counterclockwise to open doors. The crank incorporates an automatic clutch mechanism which enables it to be operated in either direction and helps to hold the doors in the desired position.

**WARNING:** After closing the bomb bay doors



by means of the crank, thread the strap secured to crank handle through tie-down loop on floor below crank and tighten securely. This is necessary as the brake action of the crank clutch mechanism is insufficient to hold doors closed.

(3) If emergency bomb release has been sprung, or if the bombardier's control handle has been placed in "SALVO" the bombs or bomb bay droppable tank will release automatically when doors reach full open position.

**NOTE:** If the automatic release is not desired, before cranking doors open, recock pilot's emergency release by moving bomb release control forward past the "SALVO" position and then back to "DOORS OPEN" position.

d. Alarm Bells. - Three emergency warning bells are located, one each in the bombardier's radio operator's, and photographer's compartment. The control switch is located on the pilot's switch panel.

e. Fire Extinguishers.

(1) The engine fire extinguisher control (figure 16-144) is located below the instrument panel forward of the copilot. To operate, set valve to "RIGHT ENGINE" or "LEFT ENGINE" and then pull handle.

(2) A carbon dioxide fire extinguisher is located at the right side of the navigator's compartment and on the right side of the radio operator's compartment. To remove a fire extinguisher from its bracket, push up on retainer strap handle. To operate:

- (a) Swing horn up.
- (b) Discharge close to base of fire.
- (c) Control with trigger.



*Watch how you handle a CO<sub>2</sub> extinguisher. Look out for frostbite!*

**CAUTION:** White discharge is dry ice. Avoid frost bite. Do not permit extended contact with skin.

(3) One carbon tetrachloride fire extinguisher is mounted on the inner side of the "RED" door hinged on the lower outboard side of each engine nacelle.

**WARNING:** Do not use carbon tetrachloride fire extinguisher in an enclosed space since the gas formed by this chemical is phosgene which acts as an anesthetic and may result in fatal poisoning.

f. Life Raft Release. - A type A-2 life raft is stowed in the upper left side of the fuselage in the radio operator's compartment.

(1) To operate from within airplane pull control (figure 30-273) in radio operator's compartment.

(2) To operate when outside airplane pull control located on left upper side of fuselage above the trailing edge of wing.

## 5. FORCED DESCENT OF LAND PLANES AT SEA (DITCHING).

a. General. - The following notes have been prepared by the British for the general guidance of all members of airplane crews in the event of a forced landing at sea, which is called "Ditching". These general notes do not specifically apply to this type of airplane. The life raft referred to in paragraph 4.f. is called a "Dinghy" in the following text. American airplanes at present have no provision for dumping fuel except by releasing the bomb bay droppable tank.

### b. Preparation for Ditching.

(1) If doubt exists in the pilot's mind whether he can reach the coast, preparation for ditching must begin, particularly as to radio procedure.

(2) If height cannot be maintained above 1000 feet the crew should move to their stations in order that the pilot can readjust trim, and lower his flaps without the crew moving about the airplane.

(3) The pilot's command to prepare for ditching is "Dinghy, dinghy, prepare for ditching" which must only be given by the pilot. The command will be acknowledged by the entire crew on the interphone system with the answer "Navigator ditching" or "Bombardier ditching," whichever is appropriate. The crew should also have a prearranged call light ditching signal and the letter "D" repeated three times is appropriate. The pilot will normally warn the wireless operator in this manner and the member of the crew nearest the wireless operator should also give him verbal warning. The preparation for ditching is thus begun on a coordinated basis and the pilot is assured that his crew are aware of the situation, and if they have practiced the drill, that they know what to do and do it.

(4) The pilot's duty is to coordinate the work of his crew, but each crew member should act on the pilot's command "Dinghy, dinghy, prepare for ditching"

without further orders being necessary, other than the pilot's final command to the wireless operator to move to his ditching station and the final warning of the impending impact.

c. The Navigator.

(1) The navigator should have a constant knowledge of the wind speed, direction, drift and the fixed position of the airplane. He should always know the fuel consumption in relation to his estimated time of arrival.

(2) At the pilot's command the navigator will:

(a) Calculate his position.

(b) Advise the wireless operator of the drift position, with the course, height, and speed maintained.

(c) Receive fixes and bearings from wireless operator.

(d) Calculate estimated position of ditching and advise wireless operator.

(e) Inform pilot of surface wind speed and direction.

(f) Make out air and dinghy release pigeon messages.

(g) Destroy secret papers and place charts (with latest position marked thereon) in satchel.

d. Wireless Operator. - On the pilot's command "Dinghy, dinghy, prepare for ditching" the wireless operator will:

(1) If on "GROUP" frequency make the first signal on that frequency and then change over to the allotted MFDF section.

(2) Turn IFF to emergency.

(3) According to the situation use one of the three priority calls:

(a) S.O.S. I am in immediate need of assistance. May Day (by radio telephone).

(b) I may require assistance.

(c) I may be forced to land without further signal.

(4) Give a time and position to the signal. It is better to make one of the appropriate distress signals, than to remain silent. A distress call can always be cancelled when no longer applicable and in fact, this must be done.

(a) Transmit course, height and ground speed maintained.

(b) Advise navigator of fixes or bearings.

(c) Get estimated position of ditching from navigator.

(d) Transmit estimated position of ditching.

(e) Clamp down key on pilot's command and move to ditching station.

(f) Destroy secret papers.

(g) Where possible use the trailing antenna as an altimeter.

e. It is the Personal Responsibility of the Pilot:

(1) To be sure that the bomb doors are opened, the bombs and containers jettisoned and the doors closed again. It takes time to open and close doors and if there is any doubt that there is sufficient time to accomplish this, it is better to keep the doors closed; in this case it is essential for the pilot to check the bomb controls at "SAFE."

(2) To determine whether or not to jettison fuel, the crew member who has been detailed in the previous drill opens the cocks on the pilot's order. After the fuel is jettisoned it is imperative that the cocks be closed again to retain the buoyancy of the tanks. Fuel cockstake time to open and close and fuel can seldom be jettisoned faster than 100 gallons per minute. If the airplane is equipped with a full droppable tank, drop it, but if empty retain to aid flotation.

(3) Make sure that the crew member detailed in the drill assists him to secure his sutton harness.

(4) To release pilot's upper escape hatch.

(5) Check that landing gear and nose gear is "UP."

(6) Lower flaps as required.

(7) To order the wireless operator to his ditching station, since it is important that he remain at the set as long as possible.

(8) To warn the crew when ditching is imminent.

(9) To switch on the landing lights and upper identification lights (if this doesn't cause reflections which upset vision). It is important to remember that although the surface may be seen in the beam of the landing lights, judgment of height may not be correct.

f. Preparation of the Airplane to Make it as Seaworthy as Possible.

(1) Not only does jettisoning the fuel lighten the airplane and so reduce the speed at which the airplane may be ditched, but also the empty fuel tanks are a considerable contribution to flotation.

(2) The security of all lower and side hatches must be checked. Side escape hatches may have to be used in ditching but only upper escape hatches can be regarded as ideal, since they must be opened before ditching. This is necessary because the hatches may become jammed on impact and also because it is essential for the crew to be free to leave the airplane without delay after ditching.

(3) The bombs should be jettisoned to lighten the airplane to assist in reducing the air speed at impact and this loss of extra weight will contribute considerably to flotation. If there is any danger of the bomb doors being open when the airplane hits the water, it is better to keep the bombs on board in "SAFE" position. Thirty seconds must be allowed for the opening

and closing of the bomb doors. All loose equipment should also be jettisoned for similar reasons.

**NOTE:** Be sure that when equipment is jettisoned it does not hit the empennage or carry away the IFF antenna.

(4) All bulkhead doors must be closed to hinder the flow of water, from bow to stern.

(5) Close all camera hatches and flare chutes.

**g. Preparation by the Crew to Insure Safety On and After Impact.**

(1) All the actions to make the airplane seaworthy also come into this category.

(2) It is vitally important that the crew should be braced against the impact. There are two ideal ditching stations:

(a) In a sitting position back and head braced against a solid structure such as at the rear of a spar, an armored door or an armored bulkhead. If the head comes above a spar being used as a ditching station, it is very important that the head should be clasped in the hands to avoid it being forced back and injured. In this position the body can withstand forces which are far greater than those expected in ditching with the exception of forces expected when the airplane dives straight in.

(b) The second but less satisfactory ditching station is to lie on the floor with the head to the rear and the feet braced against a solid structure. It is necessary to have the knees bent to avoid injury as far as possible, but the limiting factor of this ditching station is the liability of the legs to fracture.

(3) Straps are not normally required at ditching stations unless there is a lack of suitable positions in the airplane in which case the crew member may have to remain in his seat. Loss of life may occur due to failure to get clear of the airplane so that straps must not be used unless virtually necessary.

(4) It is vitally necessary that the pilot be secured by sutton harness and it is considered that the embarrassment caused by having harness done up during ditching is far less serious than the consequence of not being secured.

(5) The rear step formed by the end of the bomb bay should not be used as a ditching station, since a great rush of water is expected here, owing to the almost certain collapse of the bomb bay doors and consequently the step will be liable to burst inward.

(6) All forward and amidship upper hatches should be opened before ditching to facilitate the rapid egress of the crew and also to insure that the hatches do not become jammed on impact due to being left closed. It should, however, be borne in mind that open hatches cause drag and therefore, if the airplane is being flown at reduced power these upper hatches should not be opened until at least 1000 feet is reached.

(7) In night ditching, all bright internal lights should be put out and only the amber lights used. This will accustom the eyes to the external darkness.

(8) All lights should be left on after ditching to facilitate search, in the event of the airplane floating for a period.

(9) Life jackets must be worn at all times with the leg straps secured. Where there are small upper ditching hatches, jackets should not be inflated until immediately after leaving the hatch. On airplanes with large upper hatches the jacket may be inflated before the ditching takes place. In most cases it is safe to inflate the jacket with one or two breaths before ditching.

(10) Parachute harnesses should be removed before ditching in all cases where practicable, except where the single seater dinghy is attached to the parachute harness.

(11) Helmets should be retained for the sake of protection of the head against cold when in the dinghy. The leads should be tucked firmly within the life jacket below the V of the neck, at the top tie.

(12) The latest airplane sea rescue equipment is usually stowed in either the dinghy stowage or conveniently near the ditching hatches and it should not be removed from these stowages before ditching to avoid it being flung forward on impact and becoming lost in the surge of water. That equipment which is carried free must be held firmly during ditching.

**h. Wind Speed and Direction and Surface Conditions in Relation to Ditching.**

(1) At least an elementary understanding of sea conditions must be gained to obtain full advantage from the notes on handling, which follow this section.

(2) With a calm type of sea, there may be little or no wind, so that it is essential to ditch with the lowest indicated air speed possible. Such a sea is deceptive with regard to judgment of height, particularly if the surface is glassy. If there are ripples upon the surface judgment of height is improved.

(3) Waves always move with the wind except close inshore and in fast flowing estuaries. Waves are the direct result of the wind which creates them and maintains them.

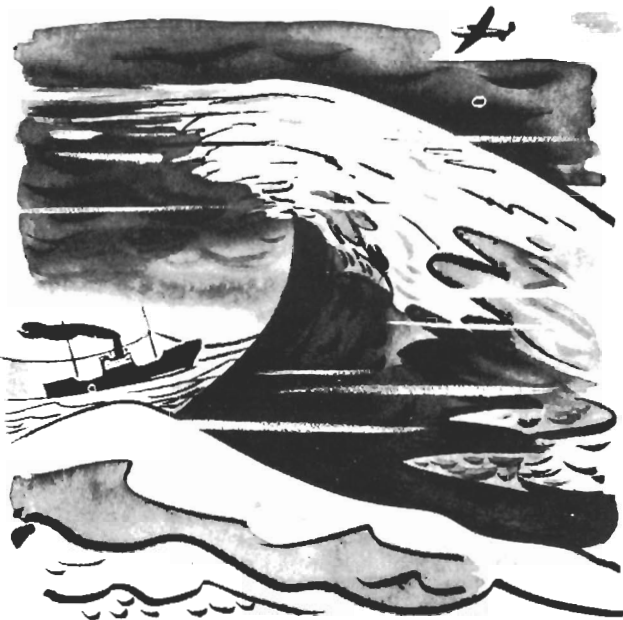
(4) "Swell" is an undulating movement of the surface caused by past or distant disturbance by action of the wind. It does not necessarily move with the wind and it has no breaking crests. If the wind is blowing across the swell a cross-sea is created with the waves (which are moving downwind) running on the swell. In these conditions the pilot must choose that direction along the swell which will make the approach as near into the wind as possible.

**i. Ditching Characteristics.** - If the airplane alights tail down in a three pointer attitude (as it should) there will be a primary slight impact as the rear of the airplane strikes. This will be followed by a severe



impact with violent deceleration in most cases. If the alighting has been made too fast a bounce will occur, providing the fuselage is sufficiently strong. As the airplane comes to rest the nose will bury, but if the alighting has been carried out correctly, the effect of the nose burying will be minimized and the structure may not collapse. Bomber airplanes may usually be expected to float for a minimum period of one minute.

j. Characteristics in a Short, Moderate or Calm Sea. - If the airplane bounces, the control column should be held back. In the average short sea the tail should touch the crest of a wave and as soon as it does the nose should be kept up as much as possible. This should cause the forebody to touch down approximately under the center of gravity on the next wave.



*The sea's not as calm as it appears  
from up there*

**WARNING:** The open sea always appears from the air to be much more calm than is the case.

k. Wind, Speed, and Direction.

(1) In the absence of any fixed mark (land, light-ship, etc.) or floating object not under way, the pilot can only judge motion relative to the motion of the waves.

(2) Waves, as distinct from swell, move downwind and the line of the wind can be taken to be at right angles to the lines of the wave crests; but doubt may exist as to which way the wind blows along the line.

(3) If there is sufficient wind, waves break and they break downwind. This can readily be observed from a low height. If the airplane is flown at right

angles to the breaking waves the direction of drift will be apparent.

(4) If there is enough wind to blow the spray off the wave crests, the direction in which the spray moves is reliable.

(5) Wind direction may be obtained by dropping a smoke float. The smoke from ships is also a useful guide. Smoke naturally drifts with the wind and if this drift could be observed the direction would be indicated. But do not make the mistake of supposing that the wind direction is along the trail of the smoke. This trail is resultant of the wind speed and direction and the ship's forward motion. Therefore the wind direction is somewhere between the forward path of the ship and the smoke trail. Only when the wind is blowing in a similar direction to the forward motion of the ship will the smoke be a reliable indication of direction. It will be from astern.

(6) If low enough it is possible to calculate the direction of the wind by observing the sails of surface craft. A reasonable indication of speed can also be gained by observing the set of the sails.

(7) Where the surface is not broken up, it is possible to watch gusts rippling the surface in great sweeps, which indicate the wind direction.

l. Drill During the Final Approach.

(1) The pilot should keep his wireless operator at the set as long as possible and only allow him a safe margin of time to take up his ditching station.

(2) The crew on their part must see to it that the wireless operator's ditching station is not occupied and is clear of obstacles.

(3) The pilot will warn the wireless operator to move to his ditching station by call light and / or interphone; or by shouting.

(4) The wireless operator for his part can be fairly certain that the order will come when he feels the flaps finally being lowered.

(5) The wireless operator will immediately clamp down the key and move to the ditching station at the pilot's command, fully realizing that he has been left at the set only as long as it is safe, thus if he does not move quickly he may be caught standing up at impact. This is very dangerous.

(6) The pilot will maintain intercommunication with the crew up until the last moment and warn them of the impending impact. It is not reasonable to expect the crew to remain braced for long periods. If they are not in communication with the pilot the temptation to get up and see how things are progressing may end in their being caught away from their ditching station with consequent injury. A casualty in ditching is a grave handicap to the rest of the crew, who may scarcely be able to save themselves.

m. Drill During Ditching.

The crew must not relax or release them-



selves in their ditching stations until the airplane has come to rest. The first impact of the tail can be mistaken for the shock against which they are on guard, but it will be followed by a greater shock as the nose strikes the water after a correct three pointer tail down ditching.

**NOTE:** Serious casualties have occurred in crews who have not taken up proper ditching stations or where they have relaxed before the final impact. Also, some crews have thought that they knew better ditching stations than those laid down in the official drill; this also has resulted in casualties. It is pointed out that these drills are the result of the experience of a great many previous ditchings and are drawn up accordingly.

**n. Handling of Landplanes in Ditchings.**

(1) **Use of Flaps.** - The flaps should be lowered to reduce the speed at which the airplane can approach and touch down. It is better to use a medium setting and not to lower them fully because little, if any, further reduction of speed is obtainable by so doing, while the rate of descent is increased and the airplane approaches more nose down. A steep nose down descent is dangerous if the sea is met sooner than expected, and also more height is required for flattening out from such an attitude.

**NOTE:** The maximum flap deflection for the B-25C and B-25D airplanes is 45 degrees.

(2) **Approach Speed.** - Assuming that symmetrical power is not available the normal glide approach speed should be used. This will insure control and some margin of speed after flattening out to allow the pilot to choose the best point for ditching on the swell.

(3) **Touch Down.** - Apart from choosing the best point at which to ditch, the pilot should hold off until he loses all excess speed above the stall and so strikes the sea at the normal three point landing attitude (slow landing attitudes for tricycles). The best point for ditching is towards an oncoming swell top.

(4) **Direction of Approach in a Swell.** - In a steep swell the pilot should ditch along the top of the swell. He should ditch up wind in a long ocean swell; however, if ditching along the swell would involve alighting with a very strong cross-wind, the airplane should be ditched into the wind. In ditching across the swell, the airplane should be put down on an upslope towards the top.

(5) **Ditching Across Wind Along a Swell.** - As the sea is approached drift should be taken off by side-slipping and the airplane ditched on the upslope of the swell.

(6) **Use of Engines.** - If one engine is available a little power should be used to flatten the approach; but the engine should not be used to such an extent that the airplane cannot be turned against it right down to the stall, with a margin of rudder power in hand. On no account should the engine be opened up during

the final stages of ditching. The power that can be used will depend on the characteristics of the airplane.

**o. Retention of Fuel for Ditching.** - The value of power in ditching is so great that the pilot should always ditch before the fuel is quite exhausted, when it is certain that shore cannot be reached.

**p. Altimeter.** - The aneroid altimeter is quite unreliable as an indicator of close approach to the sea. The trailing antenna can be used, the wireless operator signalling the pilot when the current drops as the weight hits the sea. An alternative method is to engage the antenna with an insulated hook held in the hand, when the impact of the weight on the sea will be felt. This drill can only be carried out where a suitable ditching station is adjacent to the wireless operator.

**q. Drill After the Airplane Has Come to Rest.**

**NOTE:** There are two critical periods in ditching:

(1) The actual handling of the airplane on the water. This is the sole responsibility of the pilot.

(2) The abandonment of the airplane in an orderly manner after ditching in the very shortest possible time. This cannot be done well in a training fuselage in a hangar without much practice. Far less can it be expected to carry out an efficient drill in the dark after a shock in a fuselage rapidly filling with water unless the drill is perfect. Practice makes perfect. A large number of crews have saved themselves thus and been rescued by surface craft.

(a) The crew must not release themselves until the airplane comes to rest.

(b) Most multi-engine airplanes now have an automatic release for the dinghy, but do not depend solely upon this because the mechanism may have been damaged. Operate the manual release of the dinghy as soon as the airplane comes to rest but not before. The manual release should not be pulled before or during ditching to avoid inadvertent release as a result of the impact. If this mistake is made the dinghy will break out while there is still way on and it may thus drift out of reach.

(c) As soon as the airplane comes to rest, rise from the ditching stations and collect the equipment detailed in the drill. Leave by the hatch assigned in the drill and in the correct order, carrying that equipment allocated to each crew member. When the dinghy radio is carried remember that it and the means of erecting the aerial (mast or kits) are the most vital pieces of equipment required in the dinghy to assist rescue; the pigeons are next in importance and the food last but not least.

(d) On emerging inflate the life jacket if not already done. Do not be surprised to find that waves may be breaking over the airplane. If they are large it is possible to be swept off. If the airplane has a life line attached to the inside of the hatch, make use of it, otherwise hold on to the outside of the hatch and

await a favorable moment to board the dinghy, but by doing so take care not to block the escape hatch or to hinder the tempo of the drill to any great extent.

(e) In airplanes equipped with blow-out dinghies one man is detailed to assist the dinghy from the stowage and it is his duty to see that the necessary cordage does not entangle during inflation. He should also assist the dinghy into the water in order to hasten the boarding.

(f) If the dinghy should inflate inverted an effort should be made to right it from the wing if the airplane is not sinking too rapidly; otherwise one (and only one) of the crew should jump into the sea and right it. There are two methods of righting the dinghy:

1. If there are handling patches on the bottom of the dinghy grasp them with both hands. Then haul on these patches with the knees on the buoyancy chamber. Now while still hauling on the handling patches lean back and prepare to become submerged for a moment. Even the largest dinghy will turn over.

2. In the absence of handling patches place the toe of the foot on the bottom of the ladder, grasp the two nearest stabilizing pockets. Lean back and haul on the pockets while pressing with the foot on the ladder.

(g) Do not jump on the inverted dinghy, as doing so expels the air trapped beneath it and makes righting more difficult.

(h) If there is a painter which attaches the dinghy to the airplane, it is made light in order that it will break if the airplane sinks while the dinghy is still attached. There is a floating knife attached to the dinghy near the point where the painter is made fast. This knife is to be used to cut the dinghy free.

#### r. Boarding the Dinghy.

(1) If the ditching has been made into the wind the dinghy should float towards the empennage and the boarding would not be difficult.

(2) If a cross-wind ditching has been made, the airplane will tend to swing into the wind. If the dinghy is on the up wind side of the airplane, there is danger of its becoming wedged beneath the wing as the airplane rolls and swings into the wind. On the other hand, if the dinghy is on the down wind side there is a danger of its getting beneath the fuselage or empennage, which may be thrashing up and down as the airplane weather cocks into the wind. Look out for jagged edges which may puncture the dinghy.

(3) Do not jump into the dinghy; by so doing it may become damaged and the whole crew endangered.

(4) If boarding from the sea, use the rope ladder, or the tail line if provided. When using the ladder grasp the ratlines (which run across the dinghy) with one hand and the bottom rung of the ladder with the other pushing it down into the water as far as it will go to assist in inserting the foot. Then grasp the ratline with both hands and pull, at the same time pressing downward with the foot.



*I told Matoffsky NOT to jump!*

(5) One man already in the dinghy can be of great assistance to those in the water.

(6) To avoid the consequences of exposure it is important not to get wetter than absolutely necessary. Wet clothing must not be taken off; it is far warmer with wet clothes on than off. In hot weather this may not apply so far as cold is concerned, but the body should be covered against the sun.

(7) On every main dinghy there is a heaving line which may be used for aiding crews to reach the dinghy.

(8) All the above actions concerning the boarding of the dinghy are comparatively simple if the life jacket is fully inflated. If this jacket has been partly inflated by mouth it is important to see that the mouth valve is closed before using the CO<sub>2</sub> bottle. A non-swimmer can feel quite confident in a fully inflated jacket providing the leg straps are secure.

#### s. Aboard the Dinghy.

(1) Once aboard it is the duty of the man detailed in the drill to check whether there are any leaks and stop them up with the repair material provided. Another member of the crew is also detailed to connect up the inflating bellows and inflate until the dinghy is rigid. If any of the crew are in the water inflation of the dinghy will greatly assist in boarding.

(2) Once every one is aboard, the pilot should call the roll and give the order to cast off, then the crew should paddle away from the airplane. If the airplane floats, keep nearby to increase the chance of being spotted. But do not remain made fast to the airplane if there is any chance of the dinghy being punctured or in rough weather where the dinghy is likely to be damaged by the rise and fall of the airplane.

(3) The dinghy cover should next be rigged with the assistance of the whole crew.

(4) Once the dinghy cover is rigged, bailing should start to clear out most of the water.