

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 COMPARTMENT1. 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.

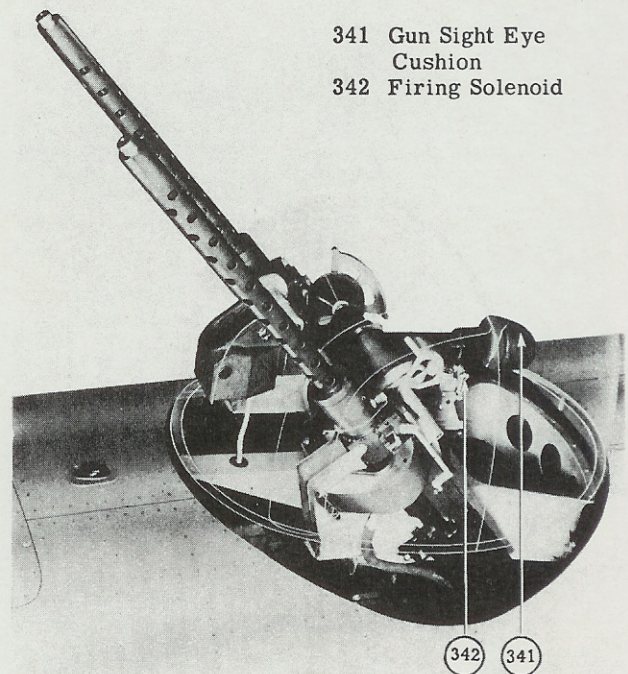


Figure 38 - Upper Gun Turret (Exterior View)

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.

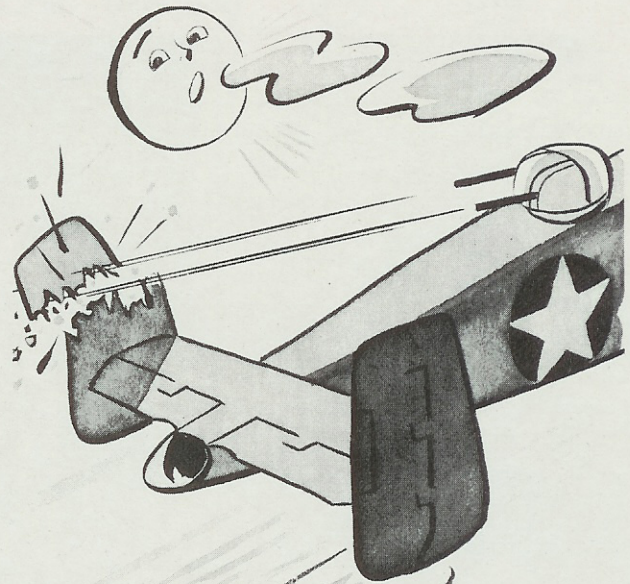
NOTE: The crank stowed on the lower turret shall also be used for manual control of the upper turret. A crank extension shaft is provided and must be used for the upper gun turret control only.

(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!

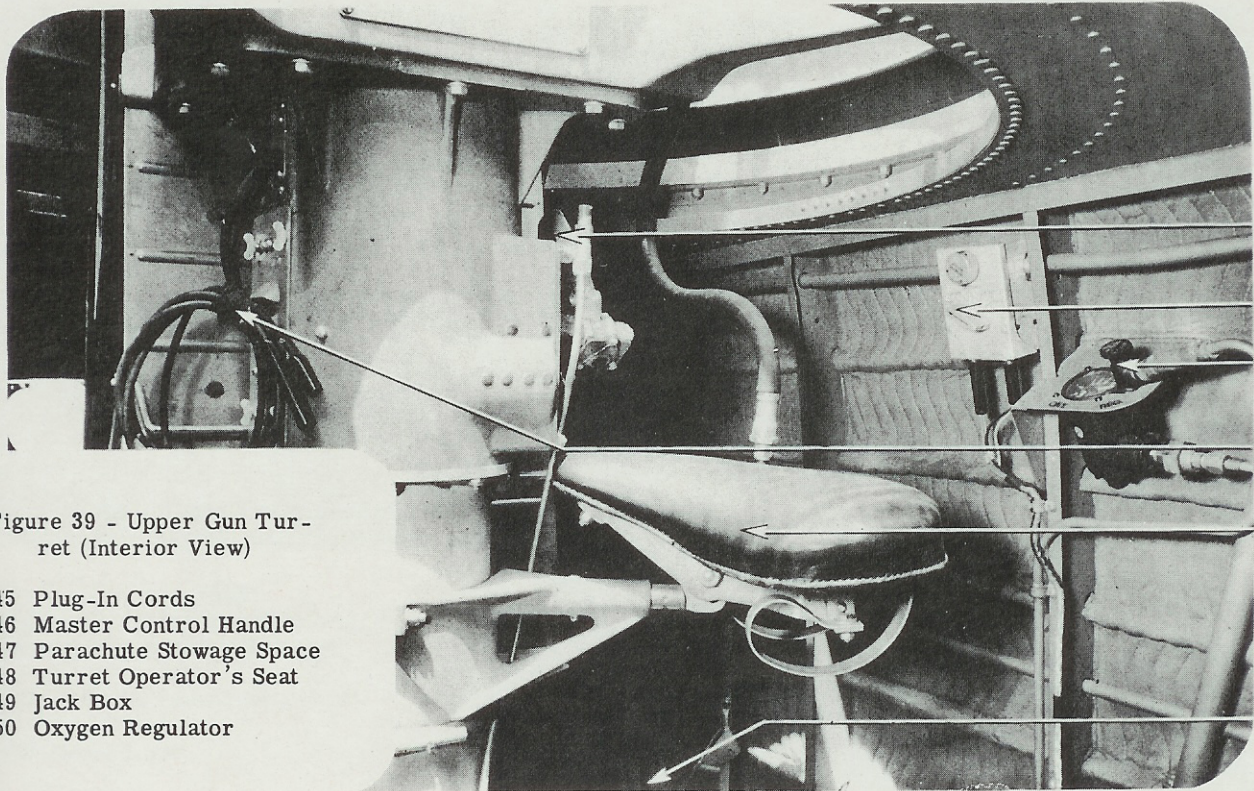


Figure 39 - Upper Gun Turret (Interior View)

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

- 346
- 349
- 350
- 345
- 348
- 347

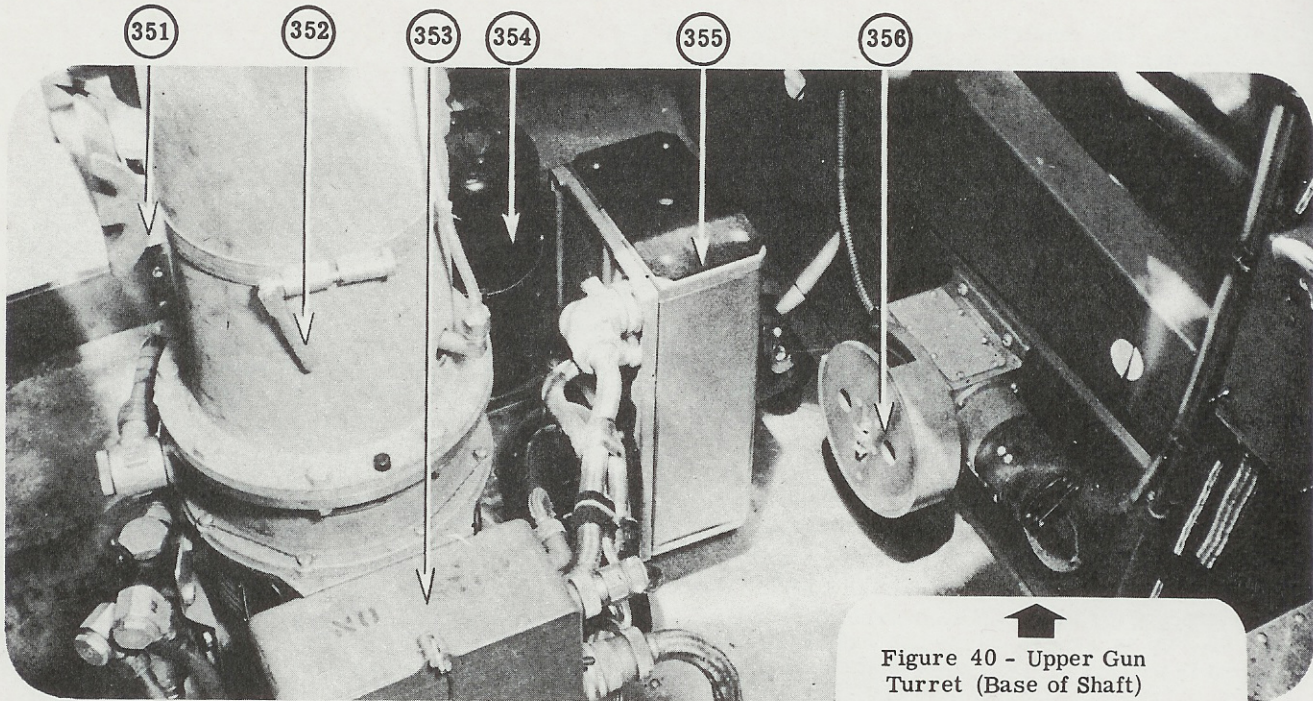


Figure 40 - Upper Gun Turret (Base of Shaft)

- 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

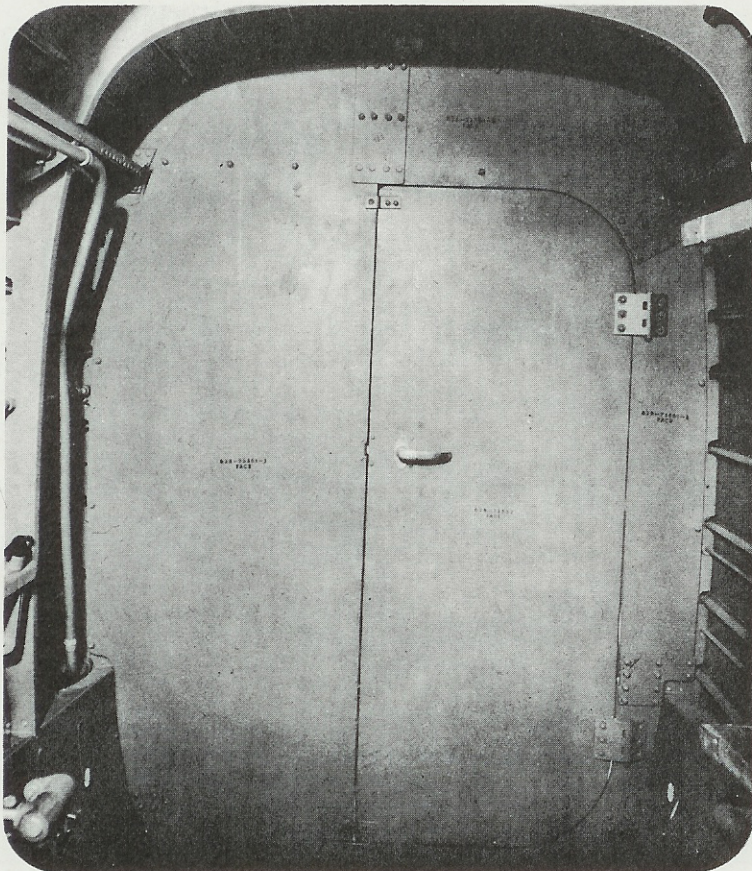


Figure 41 - Armor Plate Bulkhead



Armor Plate Door Immediately Aft of the Upper Gun Turret

SECTION VIII

BOMB BAY

1. 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.

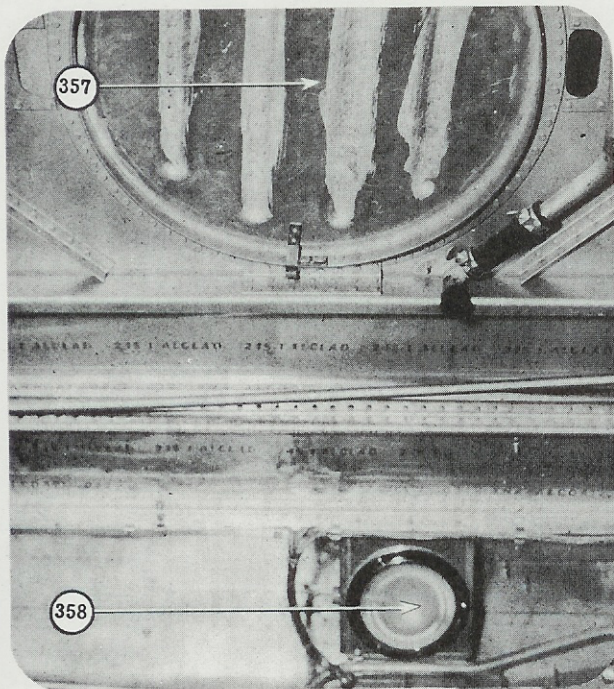
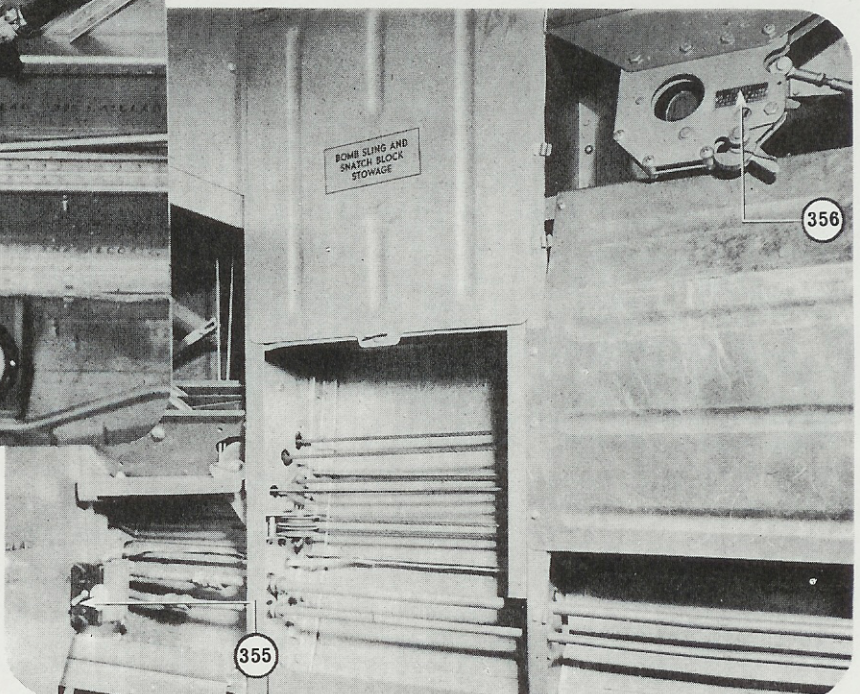


Figure 42 - Bomb Bay (Hatch to Passageway over Bomb Bay)

- 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 IX

PHOTOGRAPHER'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.

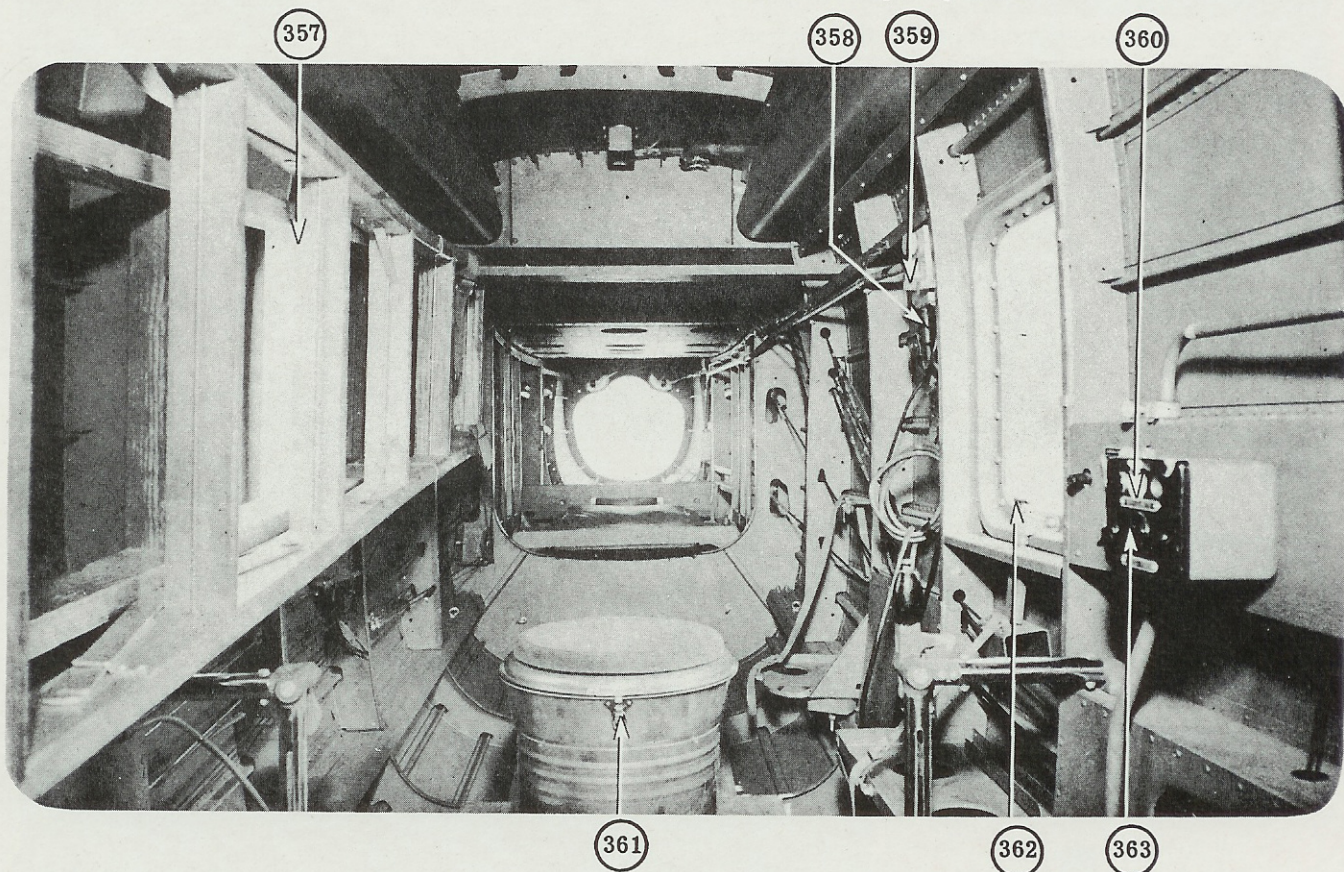


Figure 44 - Photographer's Compartment (Rear View)

- | | |
|-------------------------------|-----------------------|
| 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.

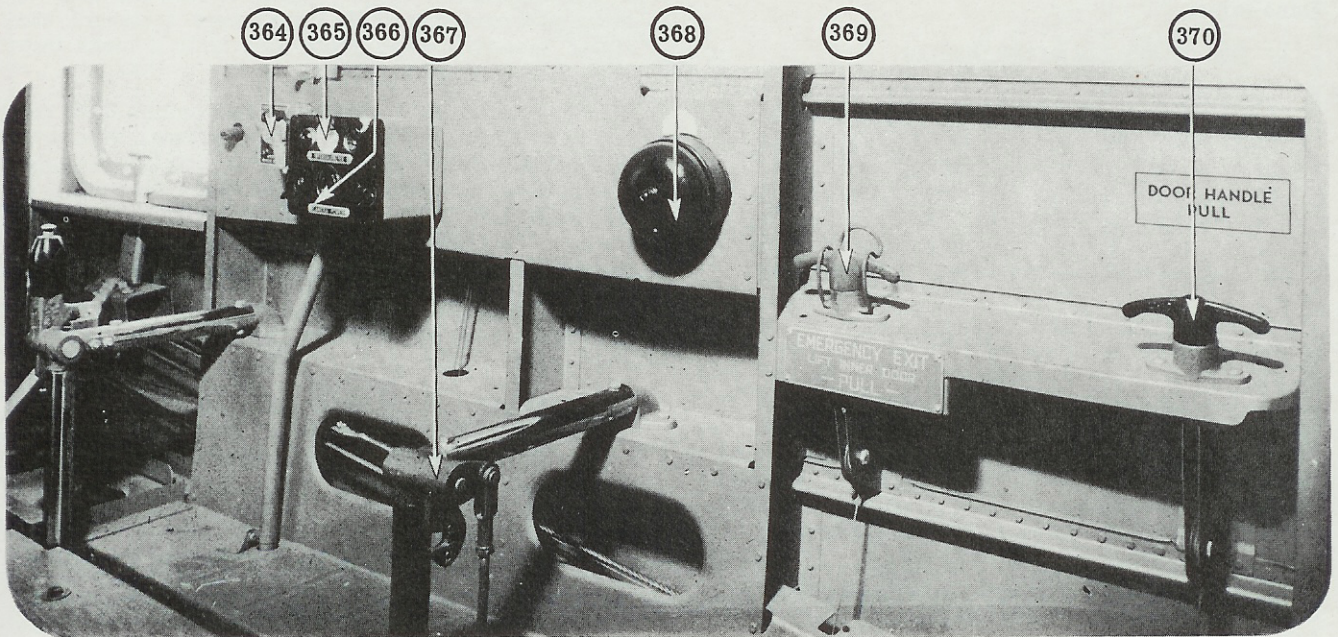
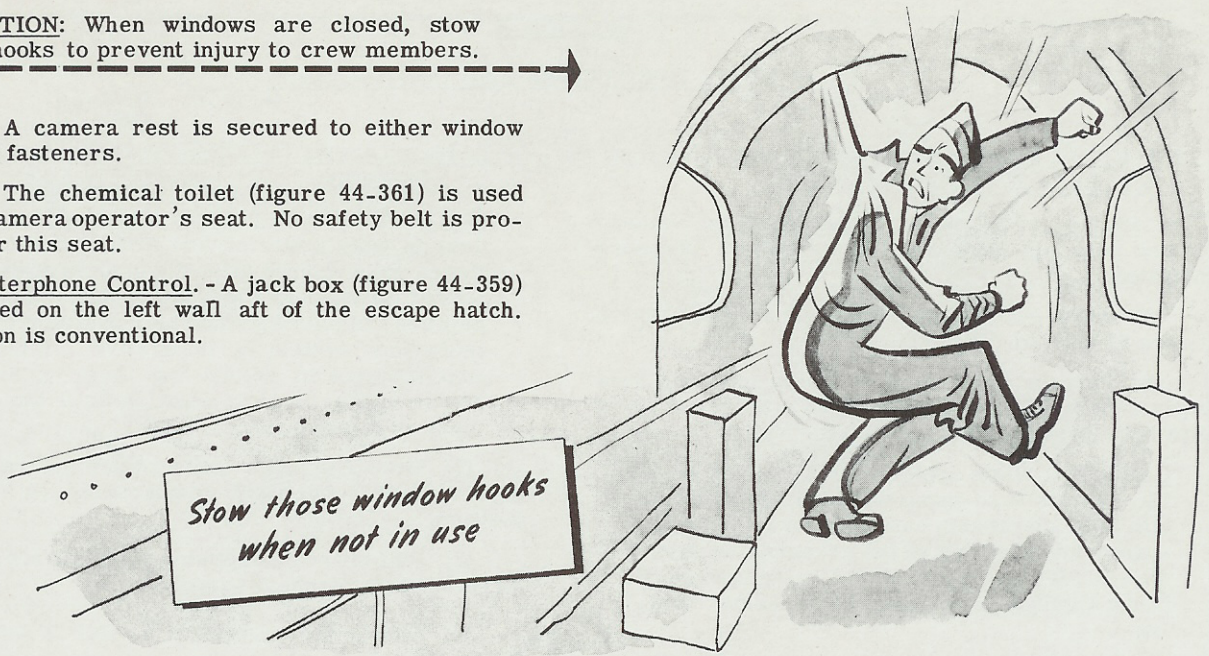


Figure 45 - Photographer's Compartment (Right Side)

- | | |
|-----------------------------------|------------------------------|
| 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 |

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."

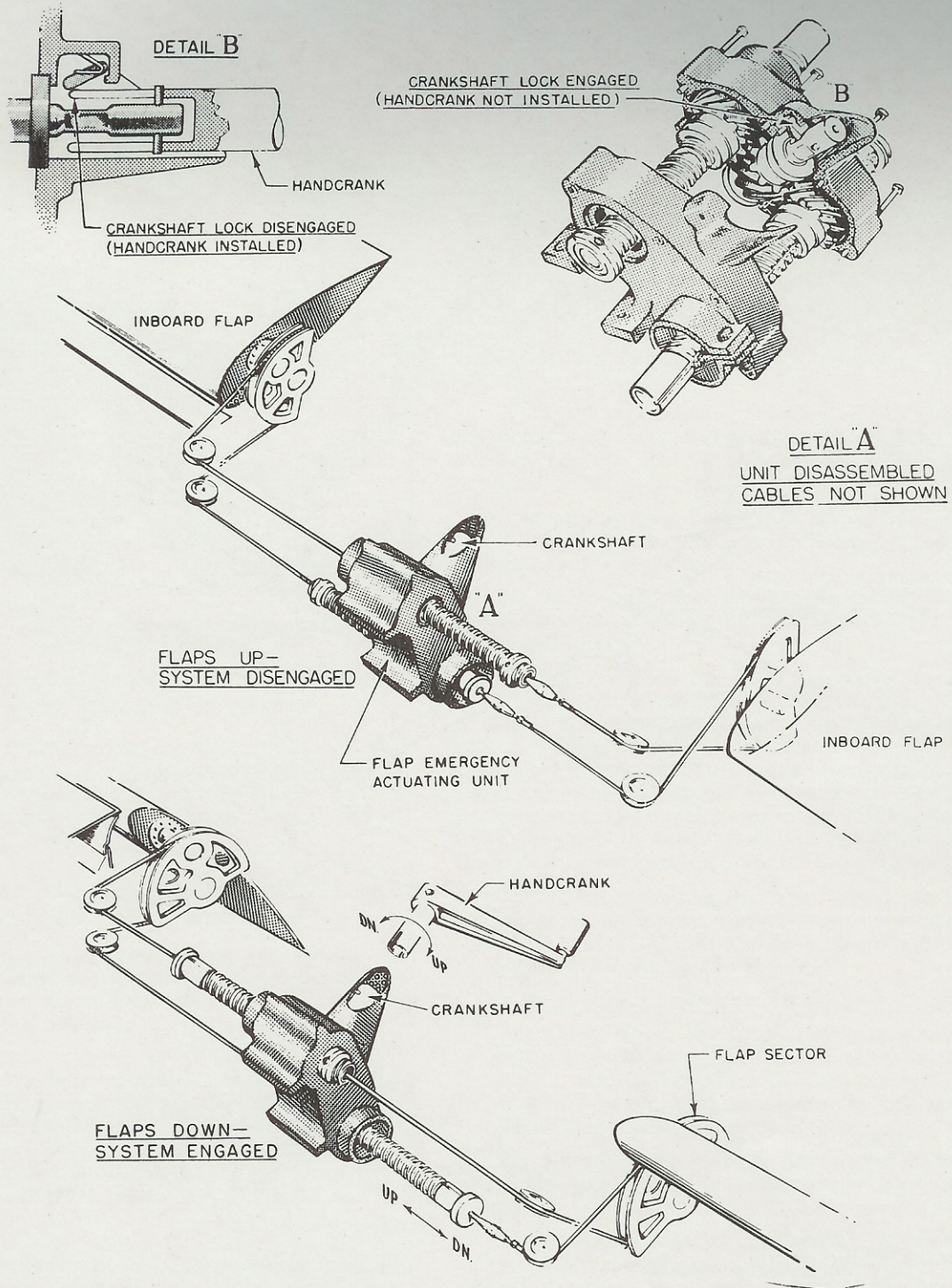


Figure 46 - Wing Flap Emergency Operating System Diagram

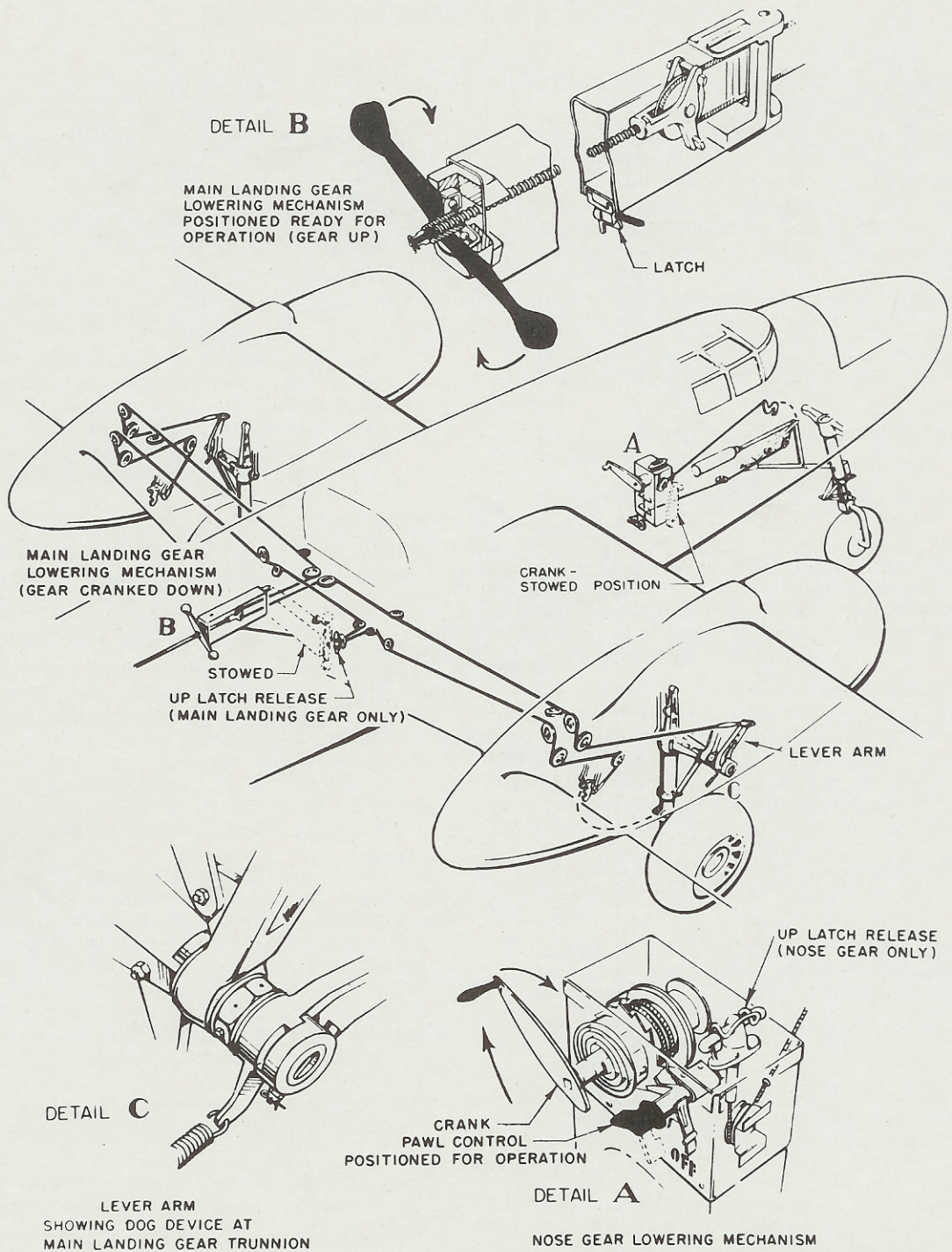
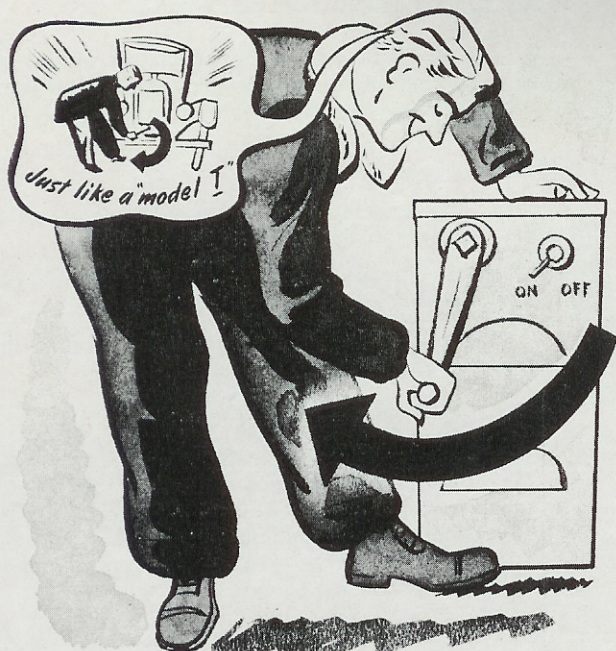


Figure 47 - Landing Gear Emergency Lowering Systems

(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.

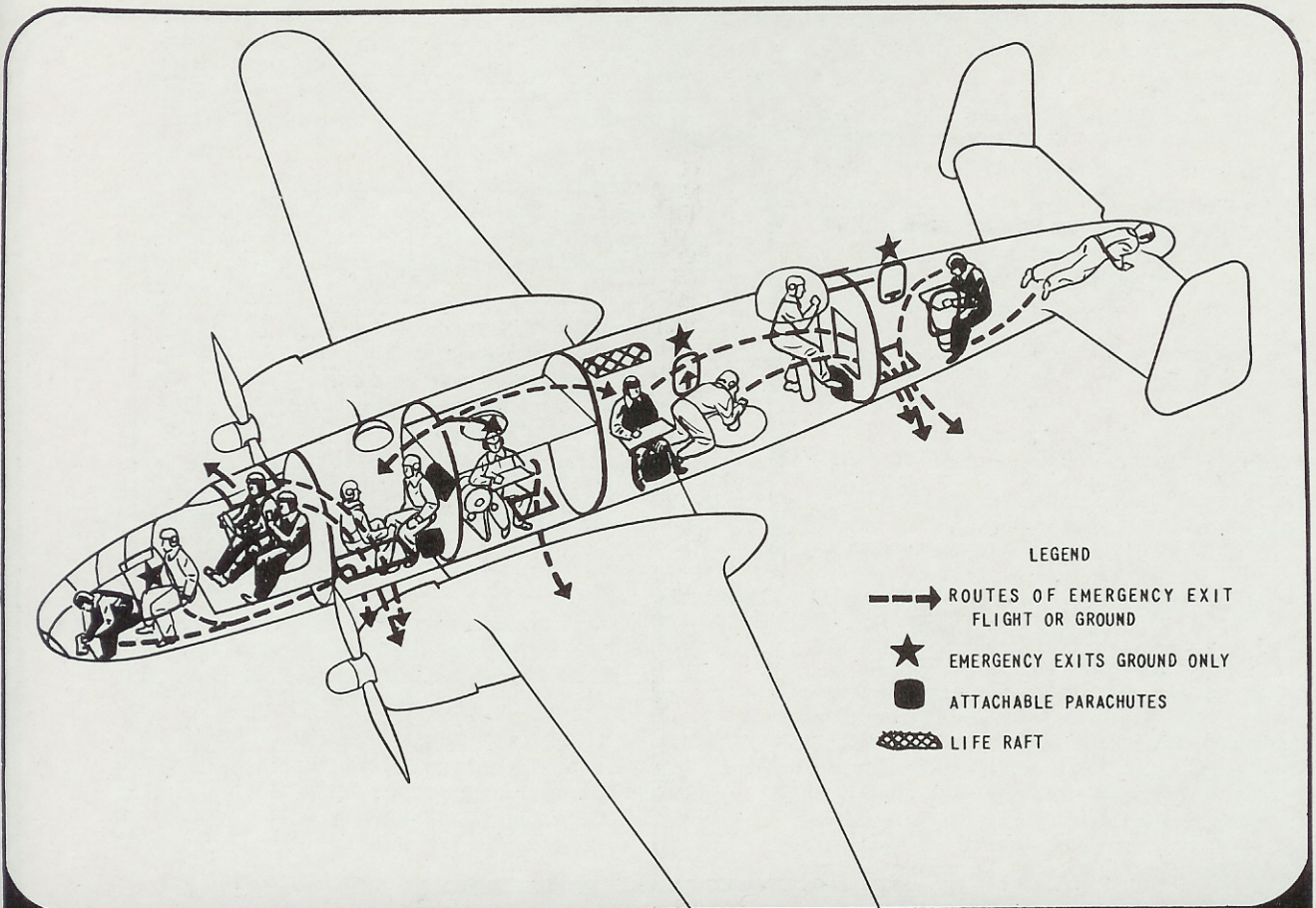


Figure 48 - Emergency Exits and Movement of Flight Personnel

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

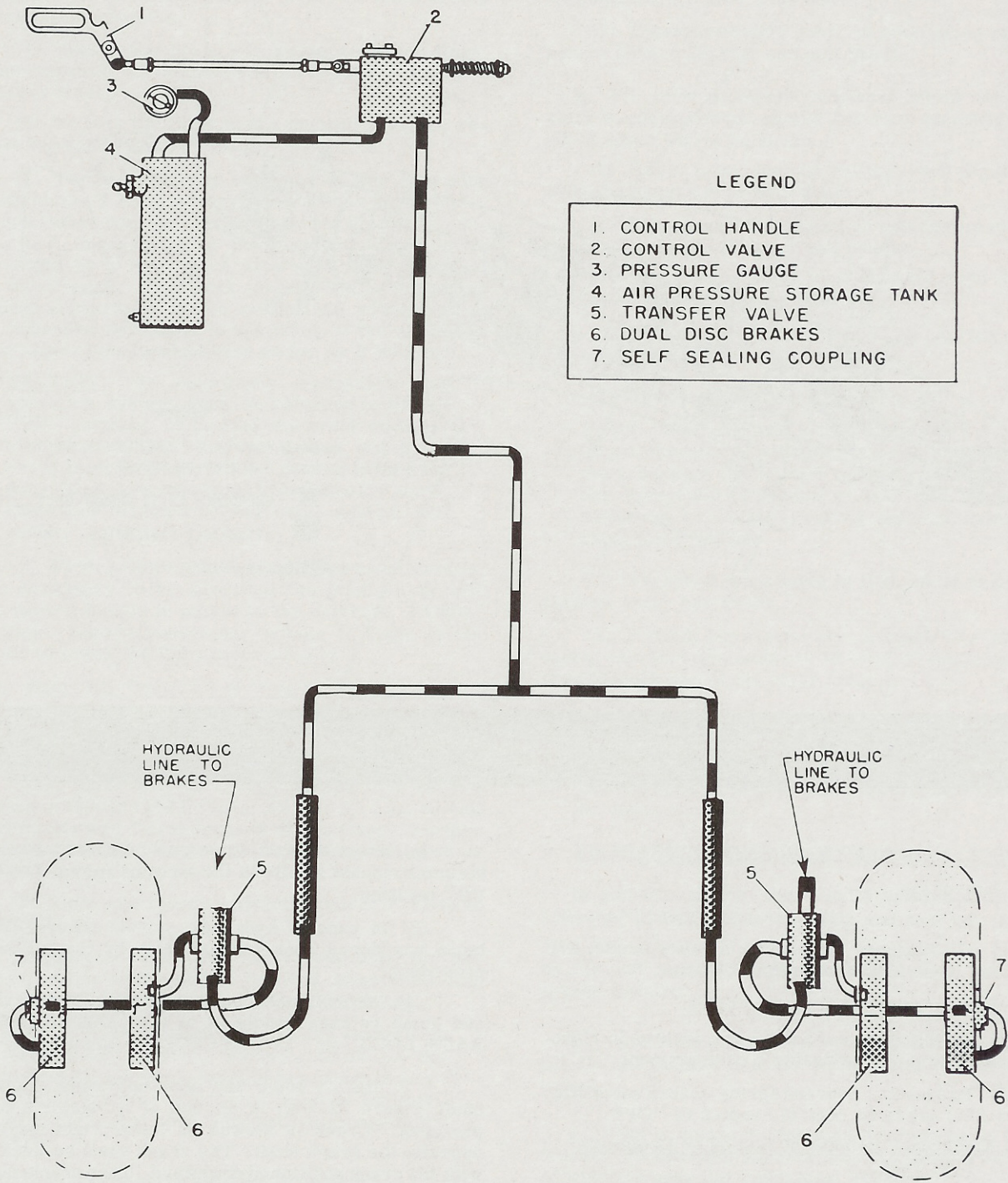


Figure 49 - Main Landing Gear Emergency Air Brake System

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 CO₂ 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 embarassment 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, lightship, 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 CO₂ 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.