PILOT'S HANDBOOK

FOR THE

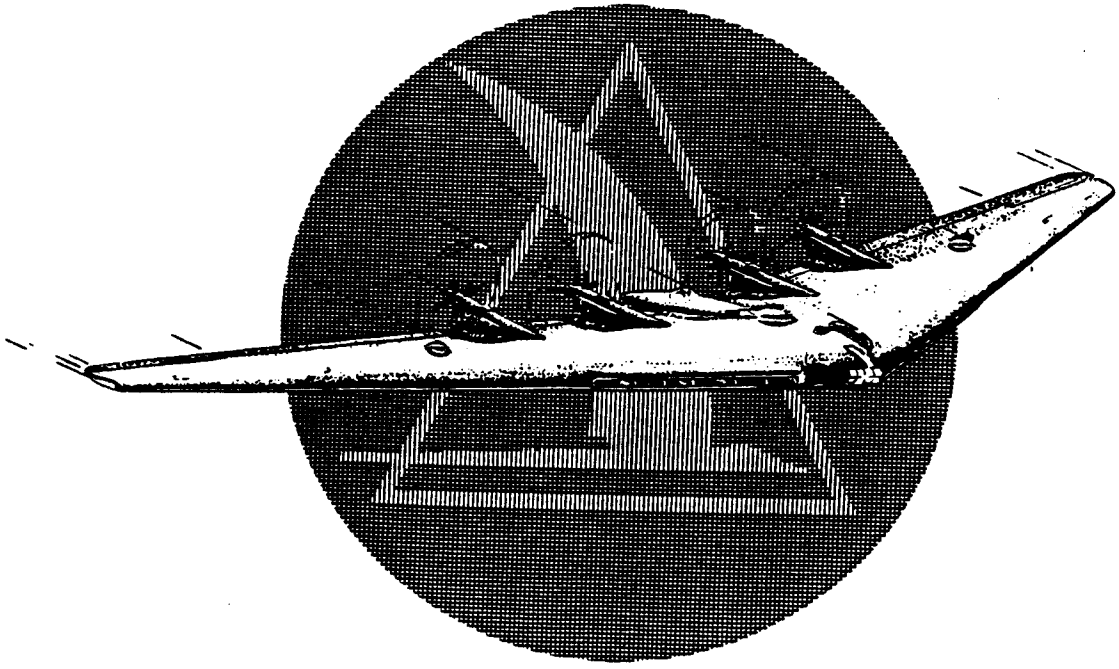
XB-35

HEAVY BOMBARDMENT AIRPLANE

Serial Number AAF 42-13603
(Northrop Number 1484)

NOTE

This handbook is classified as Confidential because of information contained in Appendix I.



Prepared by

NORTHROP AIRCRAFT, INC.

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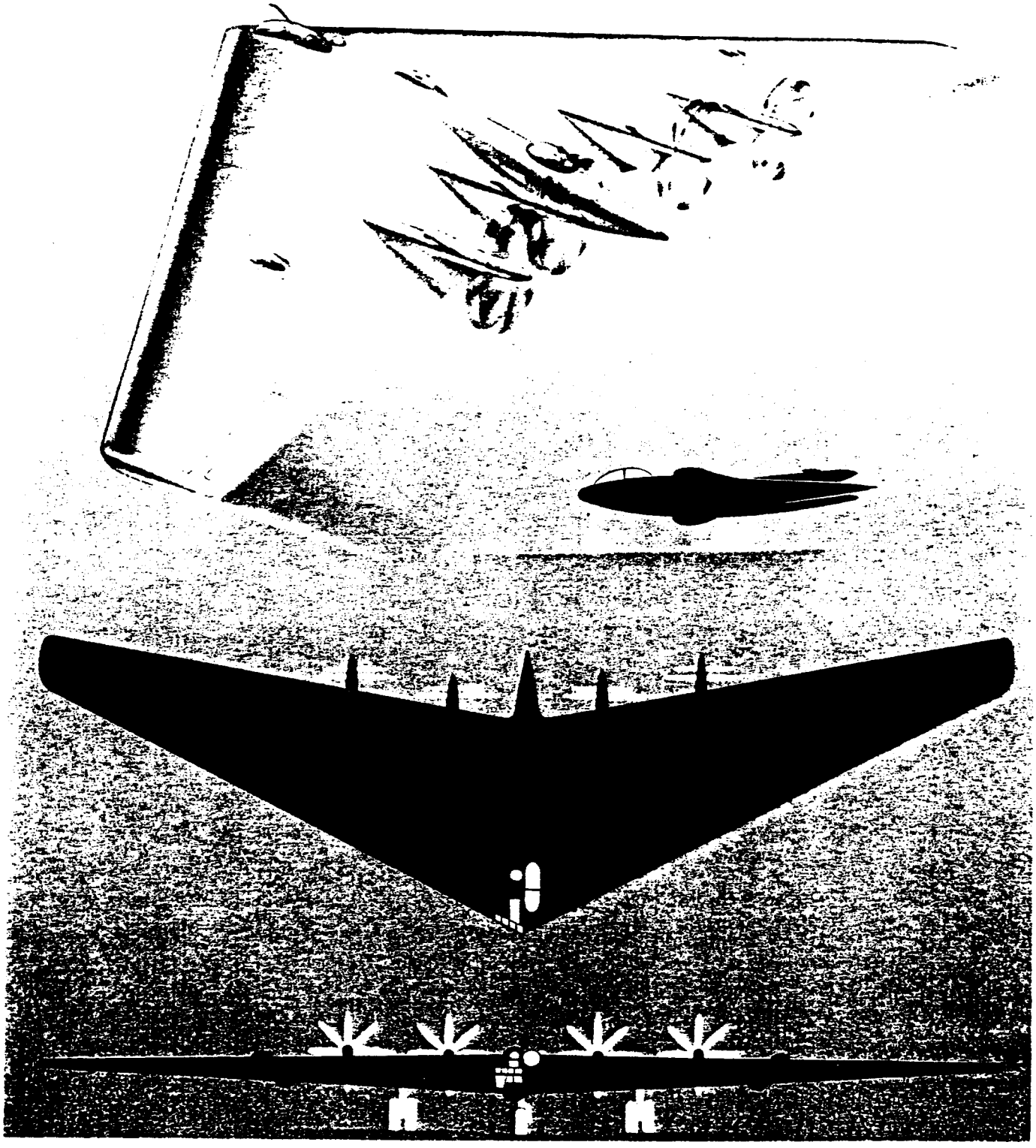
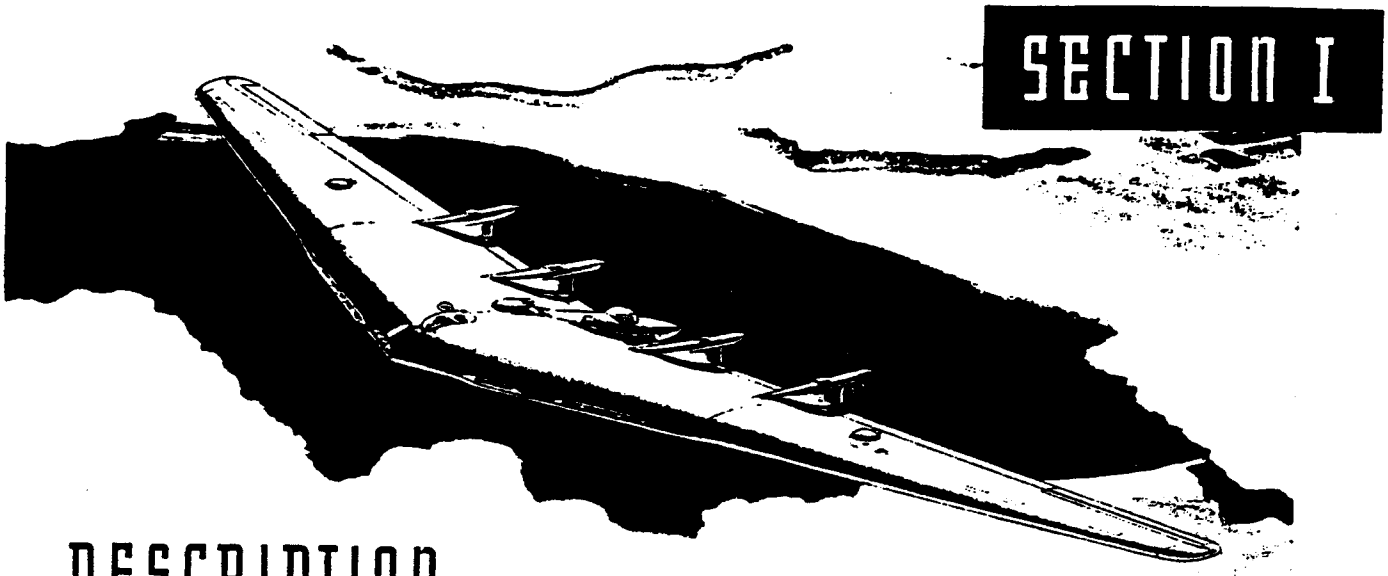


Figure 1. XB-35 Airplane



SECTION I

DESCRIPTION

1. GENERAL.- The Northrop XB-35 heavy bombardment airplane, serial number AAF42-13603, is a flying wing of the pusher type, powered by four R-4360 turbosupercharged engines; each driving an eight-bladed, dual rotating, reversible pitch propeller. It has a wing span of 172 feet, an overall length of 52 feet, and an overall height of 20 feet. The weight empty is approximately 84,000 pounds and the maximum gross weight is approximately 140,000 pounds. This airplane has not been equipped with armament but dummy fairings have been installed to simulate gun turrets and sighting stations. Eight bomb bays are incorporated in the wings. The crew nacelle is located at the center of the wing and provisions have been made to accomodate a crew of six; pilot, copilot, flight engineer, navigator, radio operator, and bombardier. (See figure 2.)

2. FLIGHT CONTROLS.- Conventional control wheels and columns are provided for the pilot and copilot. The rudder pedals are somewhat unconventional in operation inasmuch as they operate independently of one another. Due to the elevons and rudders being power operated, only friction loads are placed on the control systems, therefore, mechanical loads have been imposed on the control systems to lend "feel" to elevon and rudder operation. A control force bellows is connected to the pilot's control column, and spring assemblies are attached to the control wheel mechanisms and to the copilot's rudder pedals to add "feel" to these controls. The spring assemblies, attached to the rudder pedals, are used to preload the pedals and are also connected to the rudder trim control for rudder trim. See figure 3. for identification of the control surfaces.

3. ELEVONS. (See figure 3.)- These surfaces are normally actuated by hydraulic pressure, but, in case of a hydraulic failure they may be operated electrically. The elevons function as both elevators and ailerons. Fore and aft movement of the column moves both elevons together as a conventional elevator and turning the control wheel moves the elevons in opposite directions, in a manner similar to conventional ailerons. Operation of the control column and wheel may be made individually or in combination as illustrated in figure 4. Simultaneous movement of the control column and wheel produces a combined elevator and aileron action.

4. ELEVON EMERGENCY CONTROLS.- Either one of two switches, one on the pilot's control wheel and one on the pedestal (see 1, figure 7.) between the pilot and copilot, will engage the emergency electrical control system. The swit on the pilot's control wheel is used for a mon entary check of the system or for quick engagement during flight. The "ON" position of the pedestal switch will engage the system for continued use. When the system is engaged, the normal hydraulic pressure is by-passed. The emergency system is operated from power produced by the A.P. units, and in the event of a failure of both A.P. units, the emergency system will automatically switch over to the airplane battery where it will operate for approximately 30 minutes before complete failure. Should this system be engaged while in flight it must be left "ON," no attempt should be made to return to the normal system. The emergency system has sufficient power to completely control the airplane at airspeeds below 200 mph (IAS).

5. EMERGENCY ELEVON LOAD LIMIT LIGHTS.- Two load limit lights are installed on the pilot's pedestal. These lights indicate that the emergency system has reached its load limit and the airplane should be retrimmed to relieve the loads imposed.

6. RUDDERS. (See figure 4.)- A hydraulically-actuated, double split-flap type rudder is attached to each trim flap. The rudders move with the trim flaps when the trim flaps are used to trim the airplane but they operate independently of the flaps for directional con-

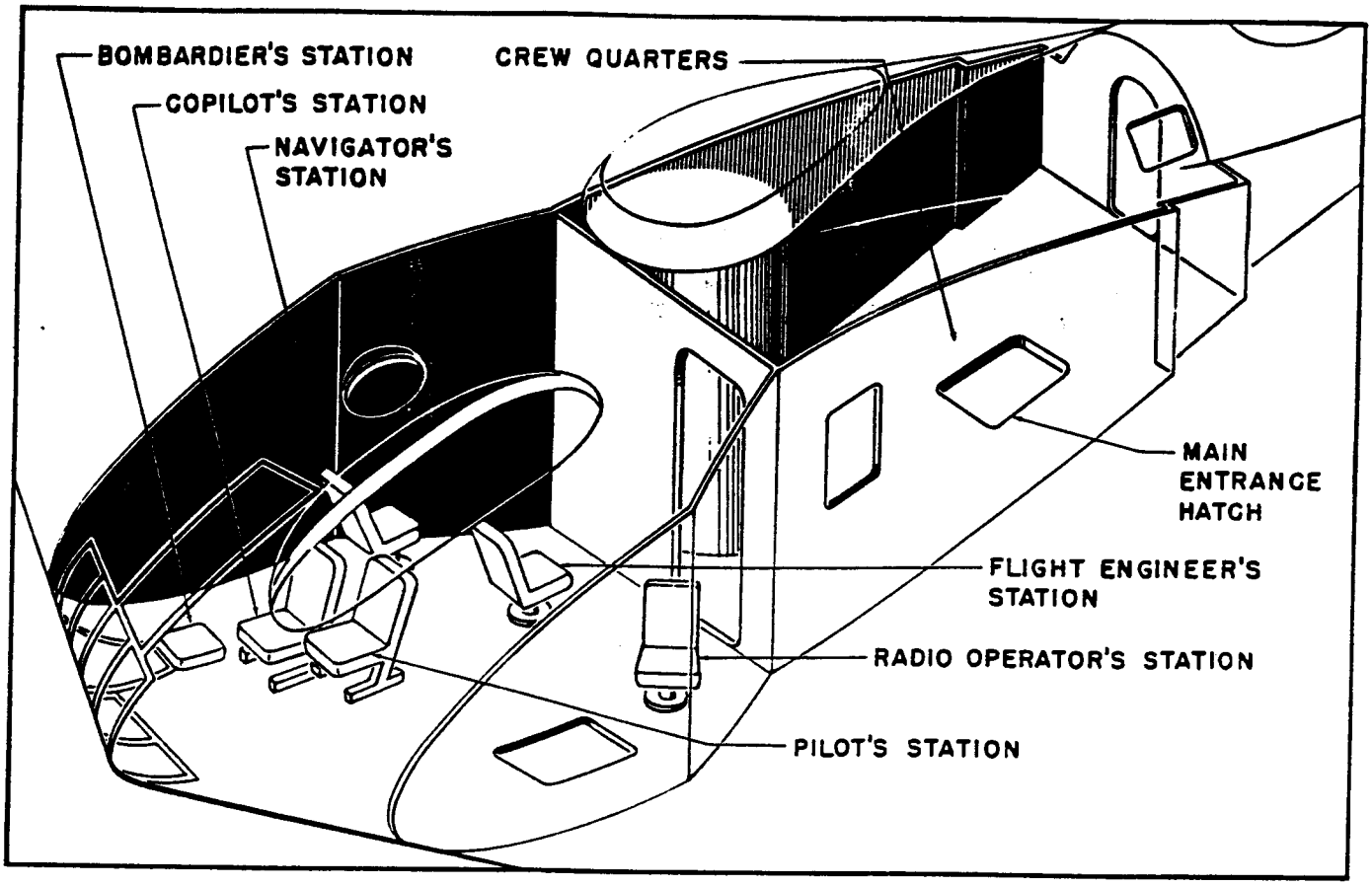


Figure 2. Crew Stations

trol of the airplane. Pressure on one rudder pedal causes its corresponding rudder to open, its surfaces deflecting above and below the trim flap surface. The rudder pedals are not interconnected, therefore, simultaneous movement of the pedals will open both rudders, and they will also operate when the pedals are used to apply the brakes.

7. RUDDER TRIM CONTROL.- A rudder trim control knob is located on the pedestal to the right of the pilot. (See 25, figure 6.) Movement of the knob to the left or right, moves the corresponding rudder pedal out of the neutral position so that the rudder operated by that pedal is opened the amount selected to maintain the flight attitude of the airplane. The rudder trim control must be kept in the neutral position for landing and take-off. The reason for keeping the trim control in neutral, particularly for landing, is that it moves one of the rudder pedals out of neutral so that if a brake control switch were actuated, hydraulic pressure would be released to the brake controlled by that pedal.

8. TRIM FLAPS. (See figure 3.)- The trim flaps are used for either aileron or elevator trim. The trim flaps are electrically actuated and controlled by an eight-position switch located on the pedestal between the pilot and copilot. (See figure 5.) Two trim flap position indicators are installed on the pedestal immediately forward of the control switch. One indicator shows the amount of aileron trim and the other the amount of elevator trim being used.

9. LANDING FLAPS. (See figure 3.)- Electrically operated landing flaps are used on this airplane. A control switch is located on the pedestal within reach of either the pilot or copilot. The switch has "UP," "OFF," and "DOWN" positions. By moving the switch to the "OFF" position the landing flaps may be held in any desired position. The landing flaps are used for landing only. They lower the stall speed only slightly, but they will appreciable steepen the glide path of the airplane and decrease the angle of attack, thus allowing improved visibility. The landing flaps may be lowered to 50°, however, they should not be lowered over 30° on this airplane.

10. LANDING FLAP EMERGENCY CONTROL.- Normally two electric motors drive the landing flaps and either motor is capable of operating the flaps in an emergency. The two motors operate through a differential gear assembly, and should one motor fail, it is necessary for the motor brake to be applied on the inoperative motor before the other motor can drive the flaps. To set the motor brake on the inoperative motor its electric power must be cut. This is accomplished by the use of switches that are located on the flap power unit. The flap power unit is installed in the top of the crew nacelle aft of the rear spar bulkhead. A reset handle

is also located on the power unit which is used to re-engage the power unit in case an electrical limit switch fails and the mechanical stop is engaged. A red light on the power unit indicates overtravel of the flaps, in which event, the motors must be reversed and then engaged using the reset handle.

11. WING SLOT DOORS. (See figure 3.)- An upper and lower door control the flow of air through the slot in each outer wing. The doors are electrically controlled and hydraulically actuated. A three-position switch, located on the control pedestal, allows the pilot manual or automatic control of the doors. (See 17, figure 7). Automatic control of the doors is accomplished through the use of pressure switches which measure the air pressures on the upper and lower wing surfaces, opening or closing the doors at pre-determined lift coefficients. Since it is desirable to have the slot doors open during take-off and landing, a landing gear operated switch has been installed which opens the doors when the landing gear is down. Indicator lights for the "DOORS OPEN" position are located on the instrument panel. In case of an electrical or hydraulic failure, the doors will assume the full open position. If one set of doors should be held open or closed due to a mechanical failure, the pilot may place the doors in the other wing in the same position by placing the control switch in the "OPEN" or "CLOSED" position as necessary.

12. AUTOMATIC PILOT.- Provisions have been made for the installation of an all-electric autopilot and formation stick, however, this equipment has not been installed in the airplane.

13. LANDING GEAR.- The tricycle landing gear and the landing gear fairing doors are actuated by electric motors. Dual wheels, each equipped with a disc brake, are used on each main gear and a single steerable wheel is used on the nose gear. Normal retraction time for the landing gear is approximately 57 seconds and the normal extension time is approximately 55 seconds.

14. LANDING GEAR NORMAL CONTROLS. (See 22, figure 6.)- The landing gear control handle, located on the pedestal, is safetied in the "DOWN" position by an automatic device whenever the airplane is resting on the landing gear. In addition to the "DOWN" position safety, a "trigger" lock, attached to the side of the control handle, must be raised before the handle can be moved.

15. LANDING GEAR EMERGENCY CONTROLS.- An emergency mechanical system is provided to lower the landing gear in the event of an electrical failure. The emergency release control is located on the side of the turret structure adjacent to the passageway into the forward cabin. (See figure 8.) The emergency system unlocks the landing gear fairing doors, releases the uplocks, and disengages the clutches of the landing gear actuators which allows the gears to fall of their own weight to a point where air-oil bungees will force them into the down-locks.

16. LANDING GEAR INDICATOR LIGHTS. (See Figure 9.)- Indicator lights, situated on the pilot's and copilot's instrument panel, indicate the up and locked, down and locked, or the unsafe condition of the gears. The red light is on when the gears are moving, or not in the locks. The green light is on when the gears are down and locked. Both lights are off when the gear is up and locked.

17. LANDING GEAR WARNING HORNS.- Two warning horns are installed in the cabin which operate when the throttles are retarded below cruising rpm and all three gears are not down and locked. Provision is made for turning off the horns by pressing the button located on the switch assembly that is installed just aft of the pilot's throttles. To re-engage the warning horns, the throttles must all be advanced above the cruising position.

18. NOSE WHEEL STEERING CONTROLS. - The nose wheel is free swiveling or it may be steered through an arc of 98 degrees. Nose wheel steering is accomplished by squeezing the trigger on the parking brake handle and then turning the handle to the left or right.

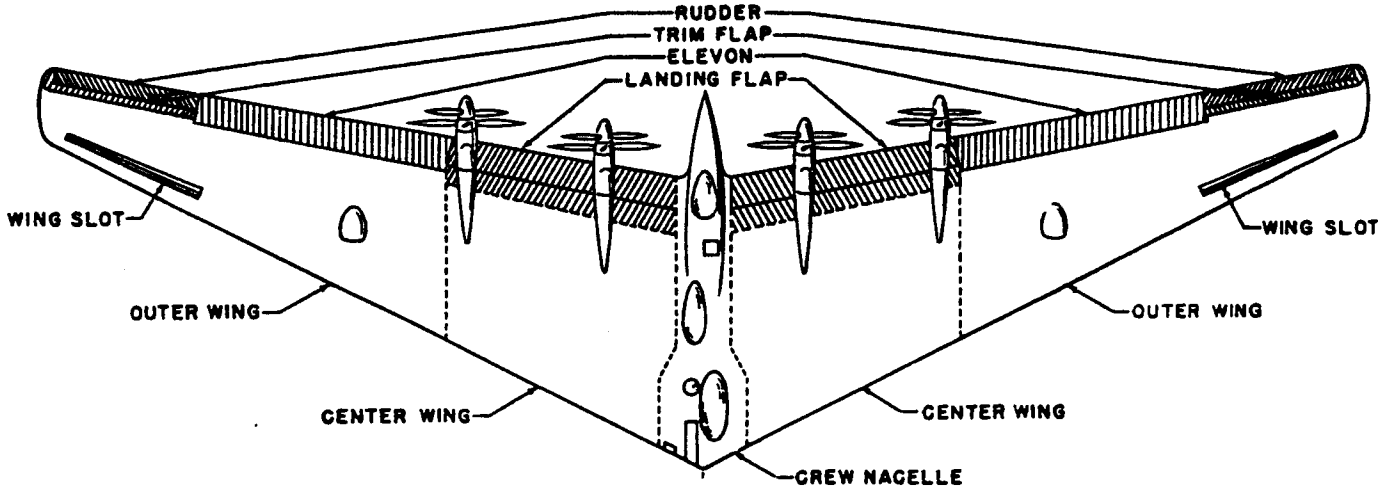


Figure 3. Airplane Plan View

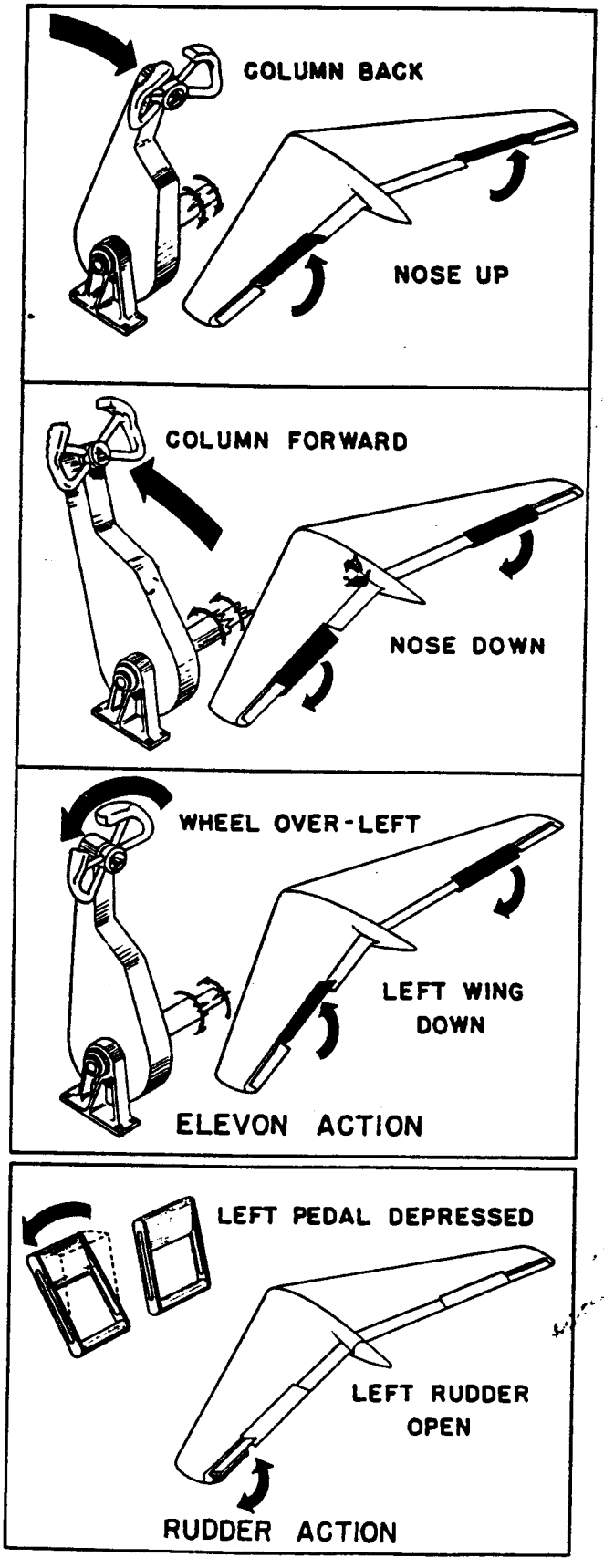


Figure 4. Elevator and Rudder Action

Initial movement of the trigger actuates a switch which releases hydraulic pressure to the steering unit on the nose gear, and at the same time, this switch allows the pilot to operate the brakes. Final movement of the trigger releases the handle when it is pulled out for the parking brakes. (See 5, figure 6.)

19. BRAKE CONTROLS. (See figure 10.)- Power brake valves, connected to the rudder pedal torque tubes, are operated by normal movement of the rudder pedals. A solenoid valve in the pressure line leading to the brake valves prevents the application of the brakes when the rudders are operated. Three switches, any one of which operates the solenoid, are provided; one switch is actuated by the trigger on the parking brake and steering control handle, and one on the rim of each control wheel. To secure braking action, one of the three switches must be pressed and held while the rudder pedals are depressed. The rudders are operated each time the brakes are applied.

20. EMERGENCY BRAKE CONTROLS.- An emergency air brake system is incorporated in the airplane. (See figure 10.) The air brake control levers are located overhead between the pilot and copilot. (See figure 11.) Differential and metered pressure is obtained with the use of the two levers. Metered pressure proportions braking action to the movement of the two control levers. The air storage bottle contains sufficient air for four complete actuations of the brakes.

21. PARKING BRAKE CONTROL. (See 5, figure 6.) The brakes are set for parking by pulling the NOSE STEERING-PARKING BRAKE control handle out. The parking brakes may be released by squeezing the trigger on the control handle and then allowing the handle to move to its full forward position. When the hydraulic system is up to its normal operating pressure it is sufficient to hold the brakes for approximately 12 hours.

22. HYDRAULIC SYSTEMS.- Two separate and independent hydraulic systems are used on this airplane. One hydraulic system is used to operate the primary flight surfaces and the other system is used to operate the steerable nose wheel and the main gear brakes. There are no manual controls for either system, operation is entirely automatic.

23. HYDRAULIC POWER BOOST SYSTEM. (See figure 12.)- The hydraulic power boost system is used to operate the elevons, rudders, and wing slot doors. It is comprised of four complete systems, interconnected in such a manner that the flight control surfaces can be operated to control the airplane even with three engines dead. Four hydraulic pressure gages, one for each of the four systems, are located to the engineer's left below the instrument panel. Operating pressure of this system is 2000 psi.

24. HYDRAULIC NOSE WHEEL STEERING AND BRAKE SYSTEM. (See figure 10.)- Two electric motor-driven hydraulic pumps supply 3000 psi hydraulic pressure for the operation of the nose wheel steering unit and the brakes. An accum-

ulator pressure gage is visible from the bombardier's station, the gage being located in front of the pilot's and copilot's instrument panel. A hydraulic pressure gage for this system is located below the engineer's instrument panel. This system operates only when the landing gear is extended.

25. ELECTRICAL SYSTEMS. (See figures 13 and 14.)- The primary electric power used on this airplane is 208v a-c, 3 phase, 400 cycles. 28v d-c current is used to operate relay controls, instruments, and some control motors. The airplane is equipped with two auxiliary power units, hereafter referred to as A.P.U. which supply a-c power, and two motor-generators furnish d-c current. An A.P.U. control panel is located at the engineer's station. (See figure 15.)

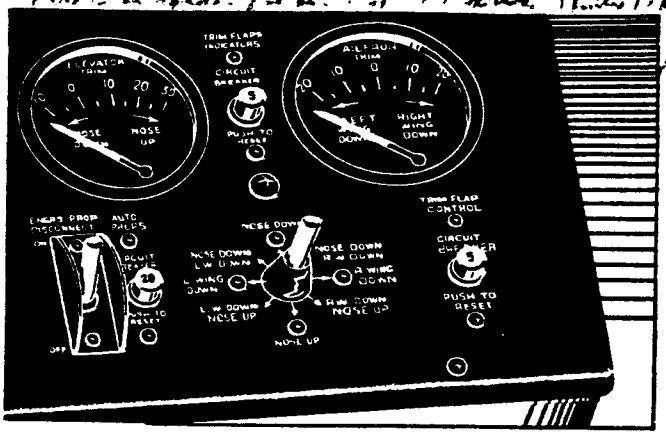


Figure 5. Trim Flap Controls

26. AUXILLARY POWER UNITS.- One A.P.U. is installed in number 3 bomb bay and one in number 6 bomb bay. The controls are located on the A.P.U. control panel, as shown in figure 15. Conventional starting, priming, and magneto switches are provided for the units, and two green ignition lights are located adjacent to the magneto switches which indicate that the magnetos are in proper operating order when the magneto switches are closed. A dual type engine tachometer is located at the center of the control panel.

27. A.P.U. FREQUENCY AND VOLTMETER SWITCH AND VOLTAGE SWITCHES. (See figure 15.)- The frequency and voltmeter switch, having a center position of off and extremes of "RH" and "LH," is used to select the A.P.U. desired for a frequency and voltage output reading. When this switch is held to one extreme the current frequency and voltage for that A.P.U. is shown on the CYCLE and AC VOLT indicators. Current frequency can then be adjusted by regulating the SPEED CONTROL switch until the correct frequency is indicated on the CYCLE indicator and the voltage may be adjusted by observing the AC VOLT indicator and regulating the VOLTAGE switch.

28. A.P.U. SPEED CONTROL SWITCHES. (See figure 15.)- Engine speeds of the A.P.U.'s are controlled by the SPEED CONTROL switches. The switches are spring-loaded to the center positions and must be held to "IDLE SPEED" or "FULL SPEED" positions to change engine speeds. When the desired engine speed is reached the switches are then released and the engines will maintain the selected speed. Indicator lights next to each switch indicate the idle or full speed operation of the units Each control circuit is protected by a fuse that is located next to the control switch.

29. A.P.U. LOW OIL TEMPERATURE INDICATOR LIGHT. (See figure 15.)- A red indicator ligh is located next to each SPEED CONTROL switch. The light indicates low oil temperature and the unit must be operated in "IDLE SPEED" unt the light goes out.

30. A.P.U. PARALLELING LIGHTS AND PARALLELIN SWITCHES. (See figure 15.)- The paralleling lights indicate when slip frequency occurs fo the purpose of paralleling the two units. The two paralleling switches engage the units in parallel operation. The switch located betwe the EXCITER FIELD switches is placed on "PARA for the operation of both units and on "NON PARALLEL" for single operation.

31. A.P.U. RELEASE SWITCHES. (See figure 15.) An A.P.Unit may be removed from the "line" by moving the appropriate release switch to the "RELEASE" position, and the switch between the EXCITER FIELD switches to "NON PARALLEL" position.

32. A.P.U. EXTERNAL POWER RELAY SWITCH. (See figure 15.)- This switch is used to actuate a relay which connects ground power into the airplane circuit. The switch is normally kept in the "OFF" position.

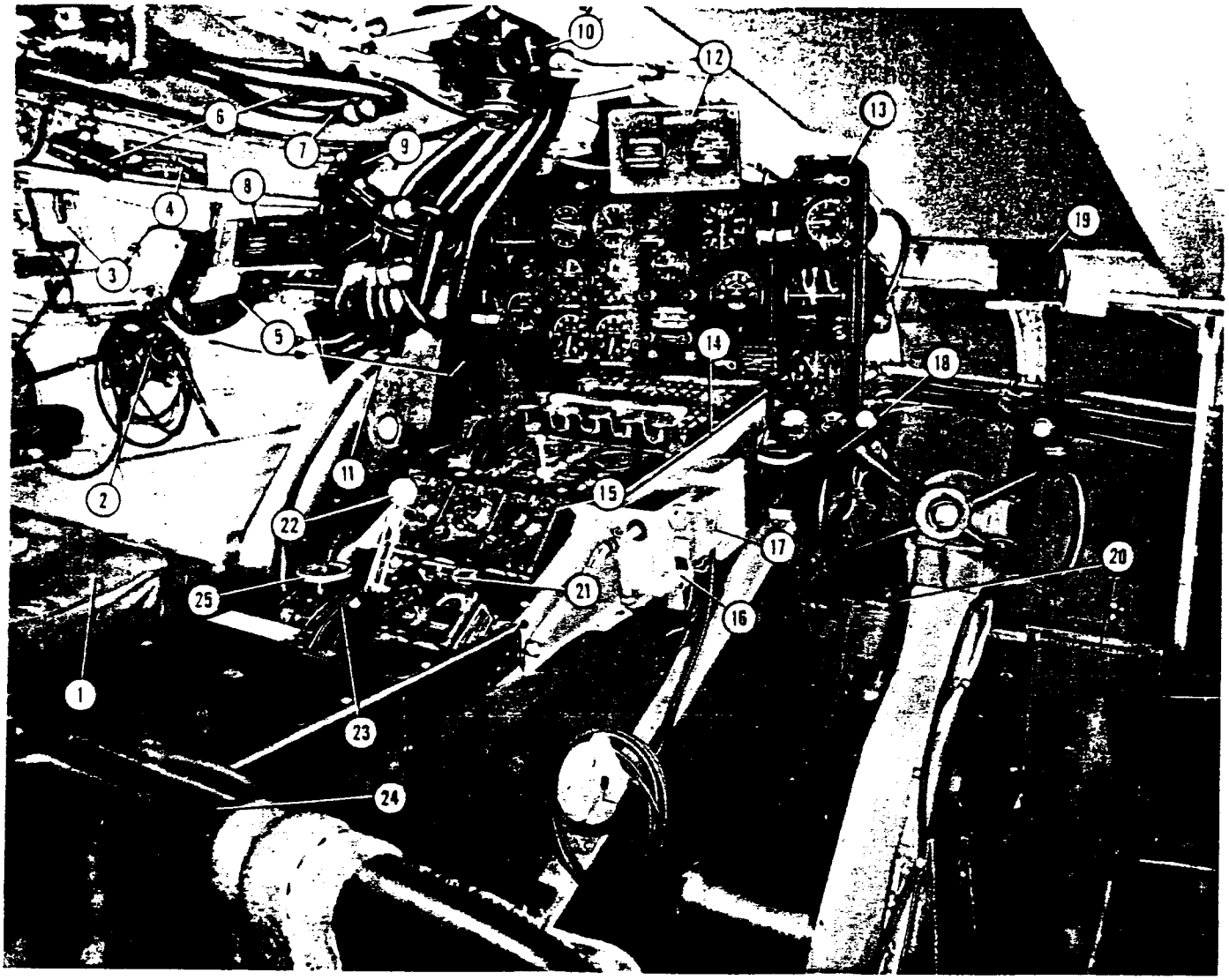
33. A.P.U. RING BUS EXTERNAL POWER CIRCUIT BREAKER. (See figure 15.)- This circuit breaker protects the d-c circuit for the external power relay circuit. The circuit breaker is normally "ON" and in the event of an overload of the circuit the breaker will turn off. It can be reset by moving the toggle to the "ON" position.

34. A.P.U. RING BUS RELAY SWITCHES. (See figure 15.)- These switches turn on the ring bus relays which distribute power to the entire 3 phase a-c system. The switches are normally left in the "ON" positions.

35. A.P.U. AC AMPERE INDICATOR. (See figure 15.)- An a-c ampere indicator is provided for each unit to indicate the amperes being used.

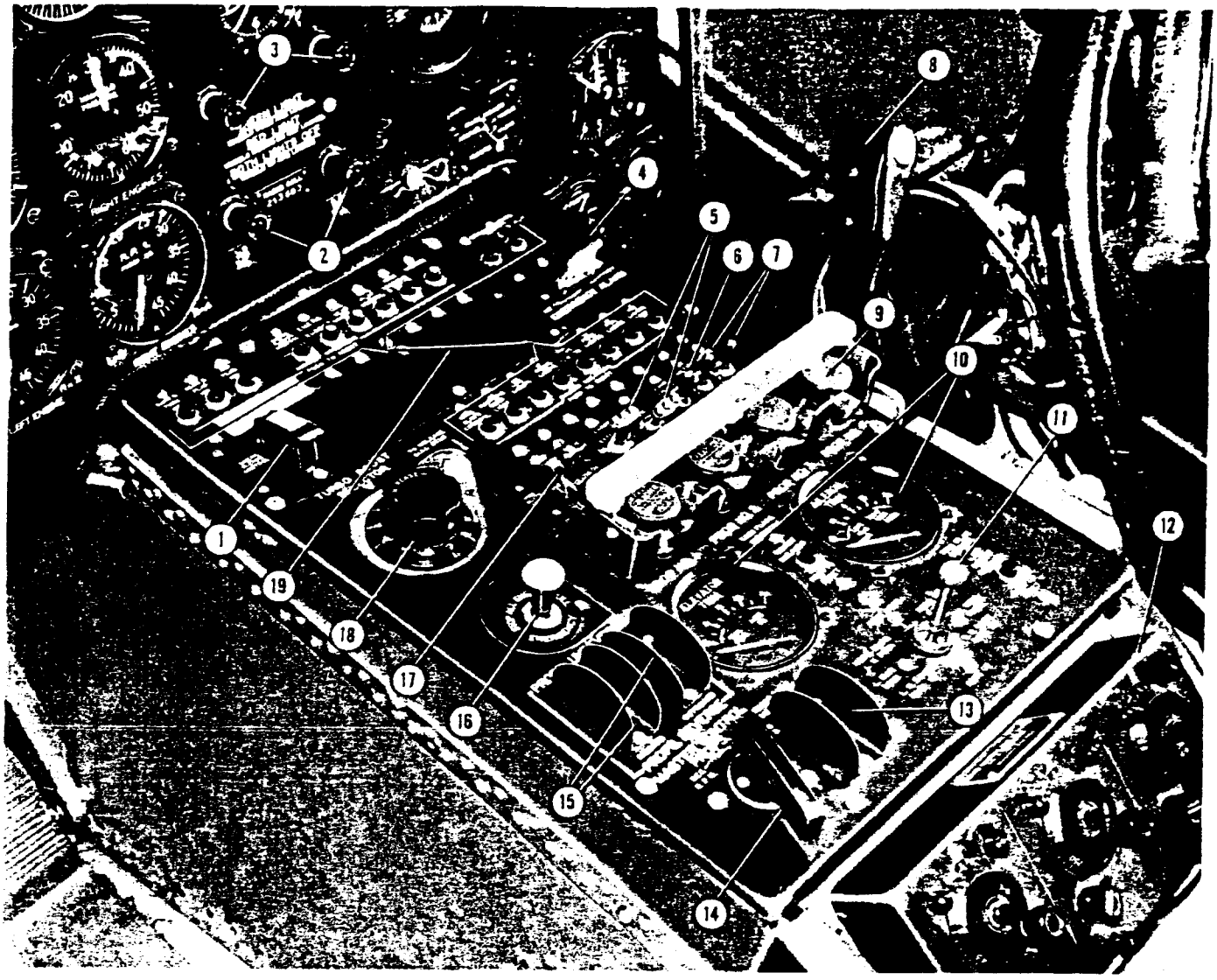
36. A.P.U. KW OR KVAR INDICATORS. (See figure 15.)- These indicators show the kilovolt amperes being used. Each power unit is rated at 36.5 KVAR.

37. MOTOR GENERATORS.- Power for all direct current uses is supplied by two motor-generator converter units. The units may be operated either singularly or in parallel by the use of the two separate control switches located on the A.P.U. control panel (See figure 15.). A d-c ampere indicator is situated above each switch. A voltage regulator incorporated in each unit automatically regulates voltages.



1. PILOT'S SEAT
2. PILOT'S OXYGEN REGULATOR
3. PILOT'S FILTER SWITCH BOX
4. NOSE WHEEL STEERING AND BRAKE INSTRUCTIONS
5. NOSE WHEEL STEERING AND BRAKE CONTROL HANDLE
6. PILOT'S INSTRUMENT LIGHTS
7. EMERGENCY AIR BRAKE LEVERS
8. PILOT'S OXYGEN INSTRUMENTS
9. PILOT'S CONTROL COLUMN
10. CO-PILOT'S OXYGEN REGULATOR
11. THROTTLES
12. CO-PILOT'S OXYGEN INSTRUMENTS
13. PILOT'S INSTRUMENT PANEL
14. PILOT'S CONTROL PEDESTAL SWITCH PANEL
15. COMMAND RADIO CONTROLS
16. CO-PILOT'S RADIO JACK BOX
17. CO-PILOT'S FILTER SWITCH BOX
18. CO-PILOT'S CONTROL COLUMN
19. MAGNETIC COMPASS
20. CO-PILOT'S RUDDER PEDALS
21. RECOGNITION LIGHT KEYING SWITCHES
22. LANDING GEAR CONTROL
23. LANDING FLAP CONTROL SWITCH
24. CO-PILOT'S SEAT
25. RUDDER TRIM CONTROL

Figure 6. Pilots' Station



1. EMERGENCY ELEVON CONTROL SWITCH
2. WING SLOT DOOR INDICATOR LIGHTS
3. LANDING GEAR INDICATOR LIGHTS
4. EMERGENCY ALARM BELL SWITCH
5. LANDING LIGHT CONTROL SWITCHES
6. FORMATION LIGHT SWITCH (not in use)
7. POSITION LIGHT SWITCHES
8. CO-PILOT'S CONTROL COLUMN
9. PROPELLER FEATHERING CONTROL BUTTONS
10. TRIM FLAP POSITION INDICATORS
11. TRIM FLAP CONTROL SWITCH
12. COMMAND RADIO RECEIVER CONTROLS
13. ENGINEER'S PROPELLER DISCONNECT SWITCH
14. PILOT'S MASTER PROPELLER CONTROL
15. PROPELLER REVERSING SWITCHES
16. EMERGENCY BATTERY AND IGNITION SHUT-OFF
17. WING SLOT DOOR CONTROL SWITCH
18. PILOT'S TURBO CONTROL
19. "PUSH" TYPE CIRCUIT BREAKERS

Figure 7. Pilots' Control Pedestal Switch Panel

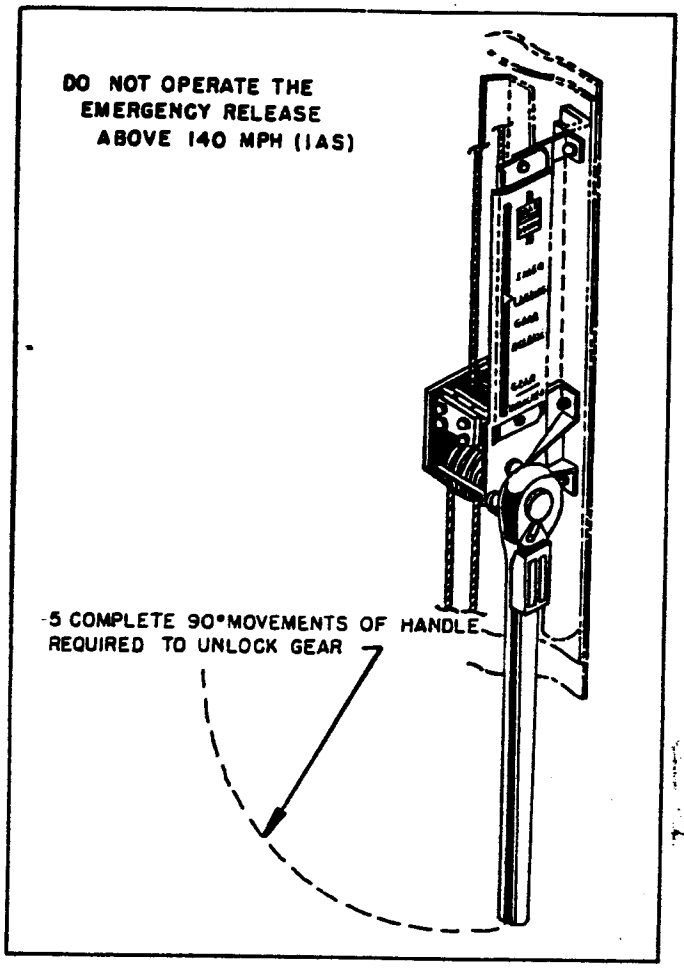


Figure 8. Emergency Landing Gear Control

38. EXTERNAL POWER RECEPTACLES.- A-c and d-c external power receptacles are located in the lower wing skin, immediately forward of number four bomb bay. A hinged cover, secured by two fasteners, protects the receptacles.

39. BATTERY.- A 24 volt, 17 ampere hour storage battery is located in the nose wheel well. In normal operation the battery is connected to the d-c power system which permits the motor-generators to charge the battery, or if the motor-generators are not operating, the battery will supply current for limited operation of d-c equipment. The battery control switch is located on the engineer's upper electrical panel. The switch should be "ON" during operation of the airplane but must be turned "OFF" when the airplane or its equipment is not in use.

40. CIRCUIT BREAKERS AND LIMITERS.- Switch and reset type circuit breakers are located on the pilot's control pedestal (See 19, figure 7.) and switch type circuit breakers are identified on the engineer's control panels. Limiters (fuses) are installed in a-c and some d-c circuits. Limiters accessible in flight are located as follows: A-c limiters- aft side of the rear spar bulkhead, a-c and d-c limiters- in back of engineer's instrument panel, d-c limiters- on cabin wall to bombardier's right, and a-c limiters- in nose of airplane forward of the co-pilot.

41. LIGHTS.

a. CABIN DOME LIGHTS. - Three dome lights are located in the forward cabin and two in the aft cabin. An "ON-OFF" switch is provided on each light panel.

b. FLOURESCENT INSTRUMENT LIGHTS.- There are two of these lights for the pilot, one for the co-pilot, one for the navigator, and four for the engineer. A knob on the back of each light has "OFF-DIM-BRIGHT" positions.

c. FLOURESCENT MAP LIGHTS. - There are three of these lights in the airplane; one for the pilot, co-pilot, and navigator. A knob is located on the side of each light for focusing and an "ON-OFF" dimming rheostat is on the top of each light.

d. EXTENSION TROUBLE LAMPS.- One trouble lamp is provided for the engineer, one for the radio operator and one for the co-pilot. An "ON-OFF" switch is located on the light panel. The end of each light may be adjusted for spot or focussed light.

e. LANDING LIGHTS.- Two retractable landing lights are installed in the lower surface of the wing. The lights are controlled by two switches on the pilot's pedestal. One switch controls the extension and retraction of both lights and the other their illumination.

f. POSITION LIGHTS.- Two three-position switches operate the position lights. One switch controls the wing lights and the other the tail light.

g. RECOGNITION AND FORMATION LIGHT SWITCHES.- These switches have been installed on the pilot's pedestal but are inoperative.

42. PITOT TUBE AND CONTROL BELLOWS HEATING.- Both pitot tube heads and the control bellows for the flight controls, see paragraph 2, are heated electrically. A single switch on the engineer's lower electrical panel controls the heaters. (See figure 16.)

43. WING ANTI-ICING.- A single switch on the engineer's lower electrical panel controls the anti-icing of both outer wings. When the switch is turned "ON" a portion of the hot air that has passed through the outboard engines heat exchangers is diverted through the leading edge of the outer wings. Openings in the lower wing skin of each outer wing provide for the discharge of the air after it has passed through the leading edge of the wings.

44. MAIN FUEL SYSTEM. (See figure 19.)- An independent fuel system is provided for each engine, however, the four main fuel tanks and engines are connected to a common manifold line. The manifold line permits the operation of any engine with fuel from any tank. Cross-feed valves installed in the manifold line control the flow of fuel across the airplane.

a. TANK CAPACITIES:

Left Outboard	1239 US	(1031.68 Imp.)	gallons.
Left Inboard	1201 US	(1000.04 Imp.)	gallons.
Right Inboard	1321 US	(1099.96 Imp.)	gallons.
Right Outboard	1239 US	(1031.68 Imp.)	gallons.
TOTAL	5000 US	(4163.36 Imp.)	gallons.

i. FUEL LEVEL INDICATORS.- Two dual indicating type fuel level indicators are located on the engineer's instrument panel. One indicator is used for both outboard fuel tanks and the other indicator is used for both inboard tanks. (See figure 18.)

b. FUEL TRAPPAGE:

	Degree of Dive	Degree of Climb	Degree of LH Bank	Degree of RH Bank	Fuel Gal. Trapped
Each outboard fuel tank.	20				404
	15				306
	10				208
		20			17
		15			12
		10			3½
			20		192
				20	13½
Each inboard fuel tank.	20				145
	15				93
	10				16
		20			14
		15			9
		10			4½
			20		110
				20	7

c. FUEL VAPOR RETURN.- Each carburetor returns vapor to its main fuel tank at a maximum rate of 10 gallons per hour.

d. MAIN ENGINE VALVES.- Fuel is directed to the engines through a series of motor-controlled valves which are operated by the MAIN ENGINE VALVE switches. (See figure 16.) The "TANK #__ ONLY" position connects an engine to its main tank only. "TANK AND MANIFOLD" position connects the tank and its engine to the manifold line. "MANIFOLD ONLY" position of a switch connects its respective engine to the manifold and shuts off its main tank.

e. MAIN TANK PUMP SWITCHES.- These switches located on the engineer's lower electrical panel (See figure 16) have "ON" and "OFF" positions to control the single speed tank pumps.

f. AUXILIARY AND AUXILIARY BOMB BAY TANK SWITCHES.- These switches are inoperative on this airplane.

g. CROSS FEED VALVE SWITCH. (See figure 16.)- This switch, having "OPEN" and "CLOSE" positions, controls valves in the manifold line. When the switch is in the "OPEN" position, fuel is allowed to flow through the manifold line, so that an engine or engines may be operated with fuel supplied by a tank on the opposite side of the airplane.

h. FUEL FLOW INDICATOR.- Two fuel flow indicators of the dual indicating type are located on the engineer's instrument panel. (See figure 18.)

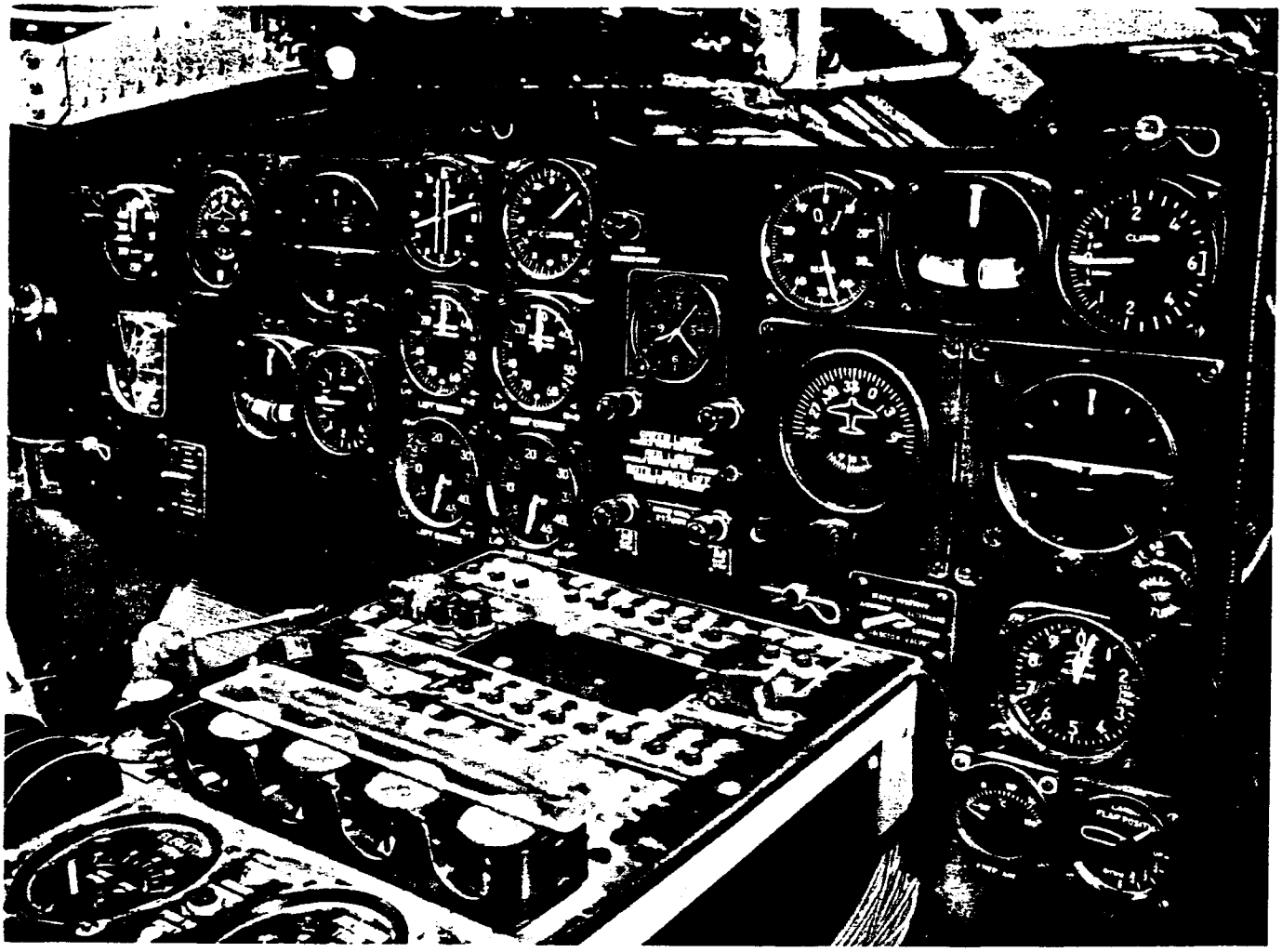
j. EMERGENCY FUEL SHUT-OFF CONTROLS. (See figure 20.)- Emergency shut-off controls are located overhead between the engineer and radio operator. Four handles, one for each engine, are operated by pulling them down as far as possible. The handles operate manual control valves and the valves are open when the handles are up. Oil shut-off controls are located adjacent to the fuel handles and when they are pulled, the fuel controls are also actuated.

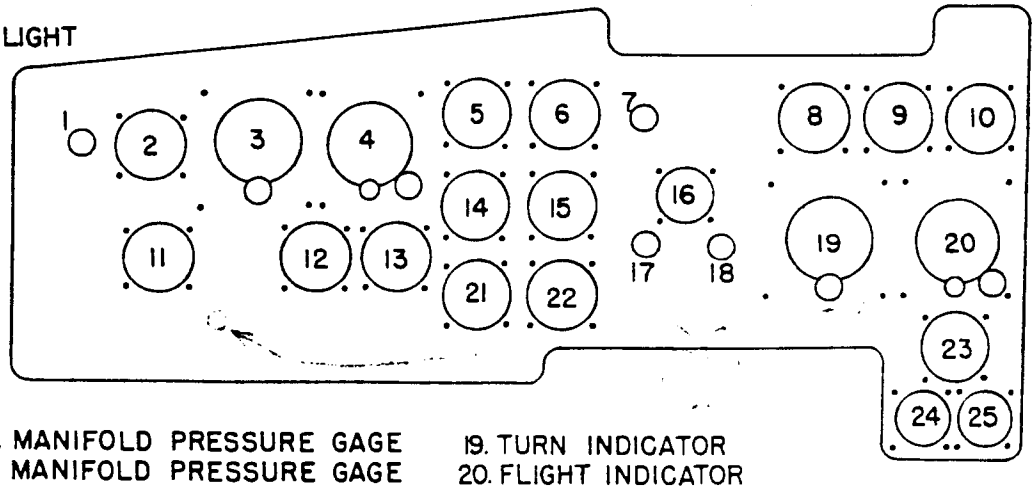
45. A.P.U. FUEL SYSTEM. (See figure 21.)- Each A.P.U. is supplied with fuel from a 42.5 US gallon fuel tank. Both tanks are installed in No. 5 bomb bay. A primer switch for each power unit is provided on the A.P.U. control panel. There are no quantity gages but a dip stick is located in the top of each fuel tank for checking fuel level when the airplane is on the ground.

46. ENGINE AND TURBO OIL SYSTEM.- An independent oil system is provided for each engine and its two turbosuperchargers. (See figure 22.) Oil may be transferred between the two tanks on the same side of the airplane.

a. TRANSFER SWITCHES.- Two oil transfer switches are located on the engineer's lower electrical control panel. (See figure 16.) One switch is for the two left-hand tanks and the other for the right-hand tanks. One position of a switch transfers oil in one direction and in the other position the direction of transfer is reversed.

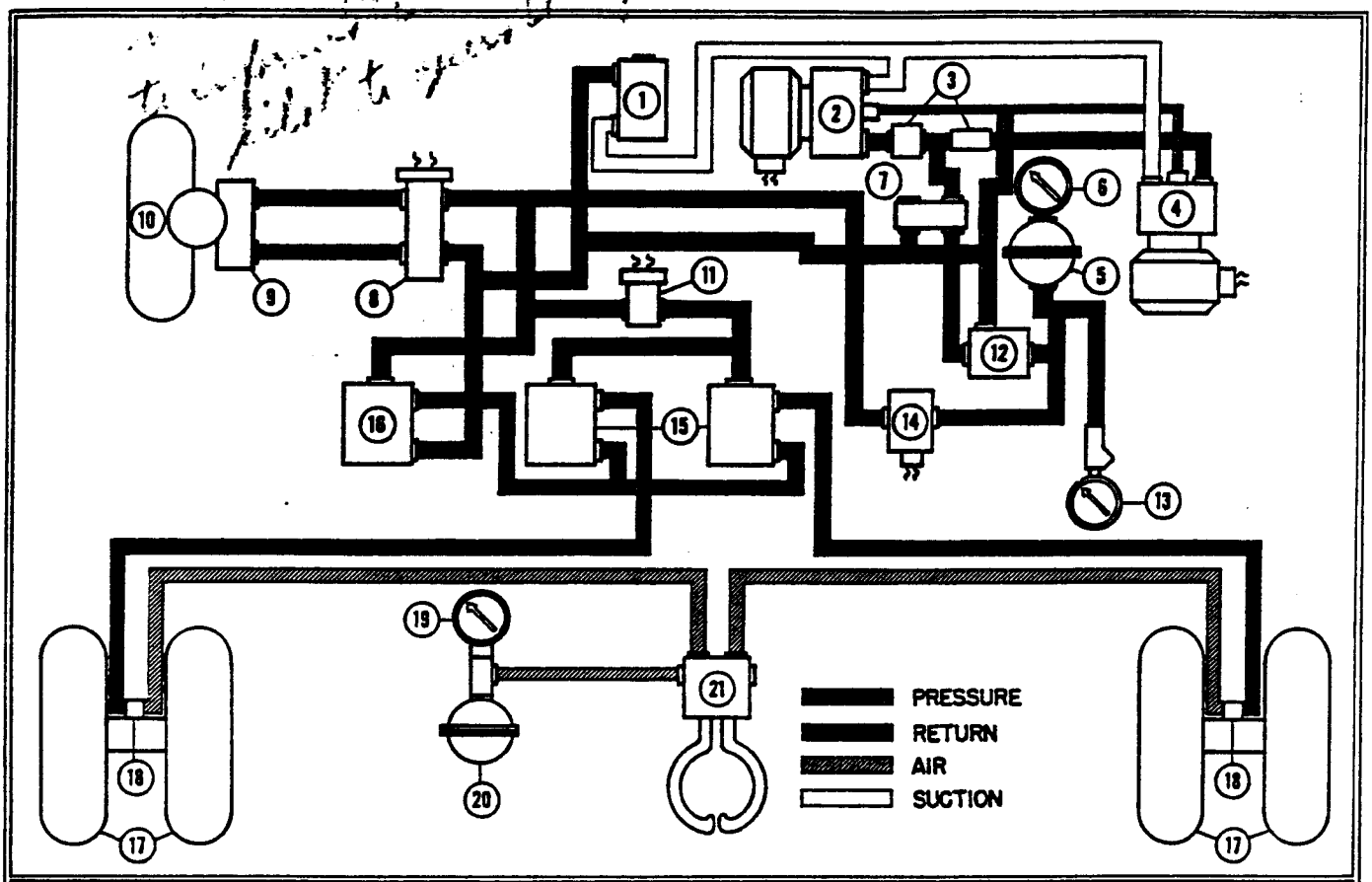
b. OIL TEMPERATURE REGULATION.- Oil temperatures are automatically regulated. There are no manual controls.





1. BOMB RELEASE SIGNAL LIGHT
2. AIRSPEED INDICATOR
3. TURN INDICATOR
4. FLIGHT INDICATOR
5. REMOTE COMPASS INDICATOR
6. RADIO COMPASS INDICATOR
7. MARKER BEACON
8. AIRSPEED INDICATOR
9. BANK AND TURN INDICATOR
10. RATE OF CLIMB INDICATOR
11. ALTIMETER
12. BANK AND TURN INDICATOR
13. RATE OF CLIMB INDICATOR
14. MANIFOLD PRESSURE GAGE
15. MANIFOLD PRESSURE GAGE
16. CLOCK
17. GREEN LDG. GR. POSITION LOCKED DOWN
18. RED LDG. GR. POSITION RELEASED BUT NOT LOCKED
19. TURN INDICATOR
20. FLIGHT INDICATOR
21. TACHOMETER
22. TACHOMETER
23. ALTIMETER
24. FLAP POSITION INDICATOR
25. THERMOMETER

Figure 9. Pilots' Instrument Panel



1. RESERVOIR	11. BRAKES SOLENOID VALVE	12. PRESSURE REGULATOR
2. AUXILIARY HYDRAULIC PUMP AND MOTOR		13. ENGINEER'S SYSTEM PRESSURE GAGE
3. CHECK VALVES		14. PRESSURE SWITCH
4. HYDRAULIC PUMP AND MOTOR		15. BRAKE VALVE
5. ACCUMULATOR		16. HAND BRAKE AND PARK BRAKE VALVE
6. ACCUMULATOR PRECHARGE GAGE		17. MAIN LANDING GEAR
7. RELIEF VALVE		18. SHUTTLE VALVE
8. NOSE STEERING SOLENOID SELECTOR VALVE		19. EMERGENCY AIR BOTTLE GAGE
9. STEERING DAMP UNIT		20. EMERGENCY BRAKE AIR BOTTLE
10. NOSE WHEEL		21. EMERGENCY AIR BRAKE CONTROL VALVE

Figure 10. Nose Wheel Steering and Brake System

c. OIL EMERGENCY SHUT-OFF CONTROLS.- Oil emergency shut-off control handles are located adjacent to the emergency fuel shut-off handles in the top of the cabin between the engineer and radio operator. When these handles are pulled down, they also actuate the fuel shut-off handles. (See figure 20.)

47. PROPELLER GEAR BOX OIL SYSTEM.- Each propeller gear box is provided with an independent oil system. (See figure 23,) Oil temperature control switches are located on the engineer's lower electrical control panel, however, these switches are inoperative on this airplane. The propeller gear box oil cooler shutters have been secured in the open position to prevent malfunction of the controls until further study has been made of the controls.

48. POWER PLANT AND CONTROLS.

a. GENERAL.- The XB-35 airplane is powered by four radial 28-cylinder, Pratt and Whitney Wasp Major Engines, models R-4360-17 and -21. Each engine is coupled to a remote gear box assembly by an extension drive shaft. An eight-bladed, dual rotating, reversible pitch, full feathering, Hamilton Standard Super Hydromatic propeller is mounted on a dual shaft extending from each gear box.

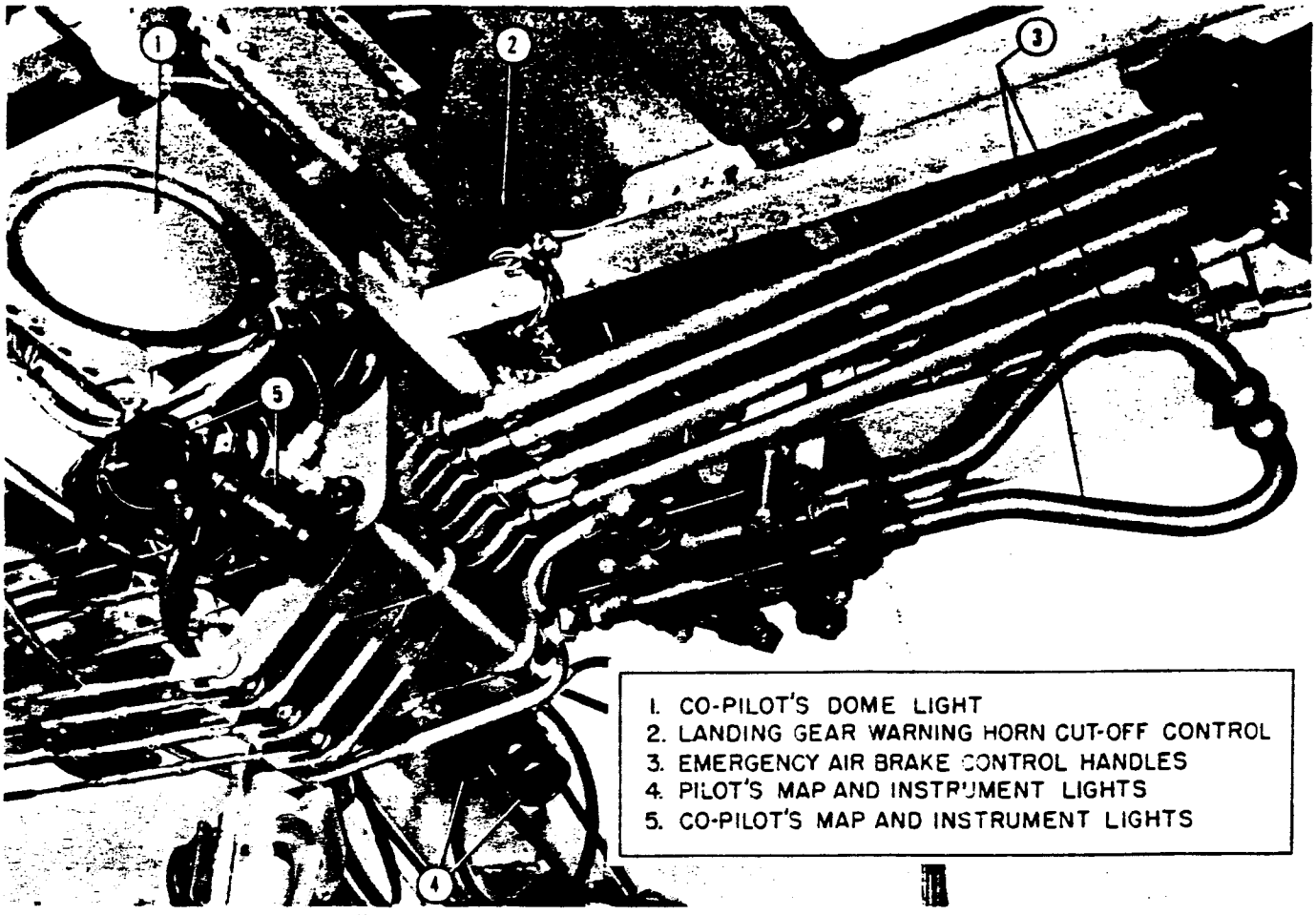


Figure 11. Emergency Brake Controls

b. THROTTLE CONTROLS. (See 11, figure 6 and 12, figure 24.)- One set of throttle controls is suspended from the top of the cabin between the pilot and co-pilot and another set is mounted in a quadrant on the engineer's table. Both sets of controls are mechanically interconnected so that either the pilots or the engineer can control throttle settings.

c. THROTTLE BRAKE.- A throttle brake is located at the left side of the engineer's throttle quadrant. Moving the control in one direction or the other increases or decreases the friction on the throttle levers.

d. MIXTURE CONTROLS.- One set of mixture controls is provided. The controls are mounted in the quadrant with the throttle levers on the engineer's table.

e. PROPELLER CONTROLS. (See figures 18 and 25.)- A master propeller control, engineer's disconnect switch, feathering controls, and pitch reversing switches are located on the pilot's pedestal. The pilot can control the rpm settings of all four propellers with the master control. The master propeller control must be moved to the "INC.RPM" or "DEC. RPM" position until the desired rpm is reached. The engineer is provided with individual controls for each propeller consisting of; a propeller pitch control switch, pitch limit light, and a pitch indicator. The engineer's propeller pitch switches have momentary positions for decrease and increase rpm and on positions for constant speed and locked pitch.

f. TURBOSUPERCHARGER CONTROLS. (See 8 figure 24 and figure 26.)- The pilot and engineer are furnished with dial-type turbo boost selector controls which are mechanically interconnected. In this manner all turbos are synchronized to a single dial setting which may be selected by either the pilot or engineer. The turbo boost control box is located under the engineer's table and individual boost adjustments may be made by means of the four knobs on the face of the box. (See 9, figure 24.)

g. ENGINE TURBO SELECTOR SWITCHES.- These four switches are located on the engineer's upper control panel. (See figure 17.) In the "PARALLEL" position all turbos operate and in the "SINGLE" position one of each pair of turbos is rendered inoperative. The "SINGLE" position is used to correct turbo pulsation or collapse. Normally the switches are kept in the "PARALLEL" position.

h. CARBURETOR AIR CONTROL SWITCH.- A single three-position switch, see figure 16, is used

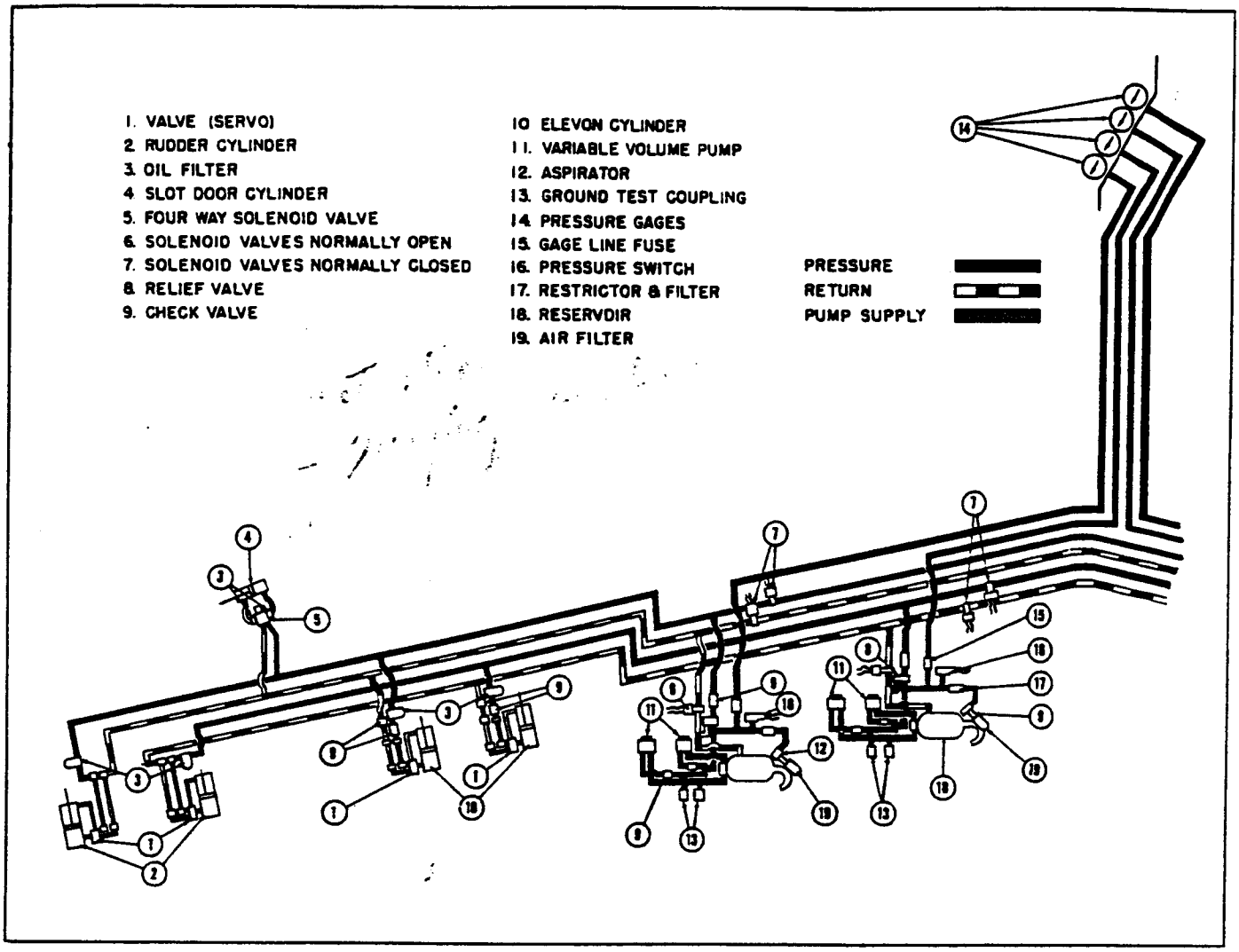


Figure 12. Hydraulic Power Boost System

to select "FILTERED," "NORMAL" (ram), or "PRE-HEAT" air for all engines.

i. ENGINE FAN SWITCHES.- The engine fan switches, figure 16, have two momentary positions, "WARMER" and "COOLER." The center position is off. Two dual indicating fan speed tachometers are located on the engineer's instrument panel. (See figure 18.) Holding a switch to the "WARMER" or "COOLER" position decreases or increases the fan speed respectively. Approximately 6 seconds are required to change the fan speed from one extreme to the other.

j. CYLINDER HEAD TEMPERATURE CONTROL SWITCHES.- These switches, figure 16, control the opening and closing of cooling flaps installed in the trailing edge of the wing. The switches have three positions including an "AUTOMATIC" position. The "AUTOMATIC" position is not used. Cylinder head temperatures must be manually controlled by holding the switches to the "WARMER" or "COOLER" position momentarily and then returning them to the center (off) position. The length of time for holding a switch to make a temperature change depends on the amount of change necessary. Operating time from one extreme to the other is approximately 34 seconds.

k. ENGINE TEMPERATURE SWITCHES.- These switches were installed for use with the automatic position of the CYLINDER HEAD TEMPERATURE switches. They are inoperative on this switches. They are inoperative on this airplane.

l. INTERCOOLER TEMPERATURE CONTROL SWITCHES. These two switches, one controlling the intercooler temperature for the two left engines and the other the two right engines, are located on the engineer's lower control panel. (See figure 16.) The switches have an "AUTOMATIC" position, momentary "OPEN" and "CLOSE" positions, and a center off position. Intercooler temperature is manually controlled by holding a switch to the "OPEN" or "CLOSE" position for an estimated length of time according to the amount of temperature change desired and then returning the switch to the center position. Operating time from one extreme to the other is approximately 38 seconds.

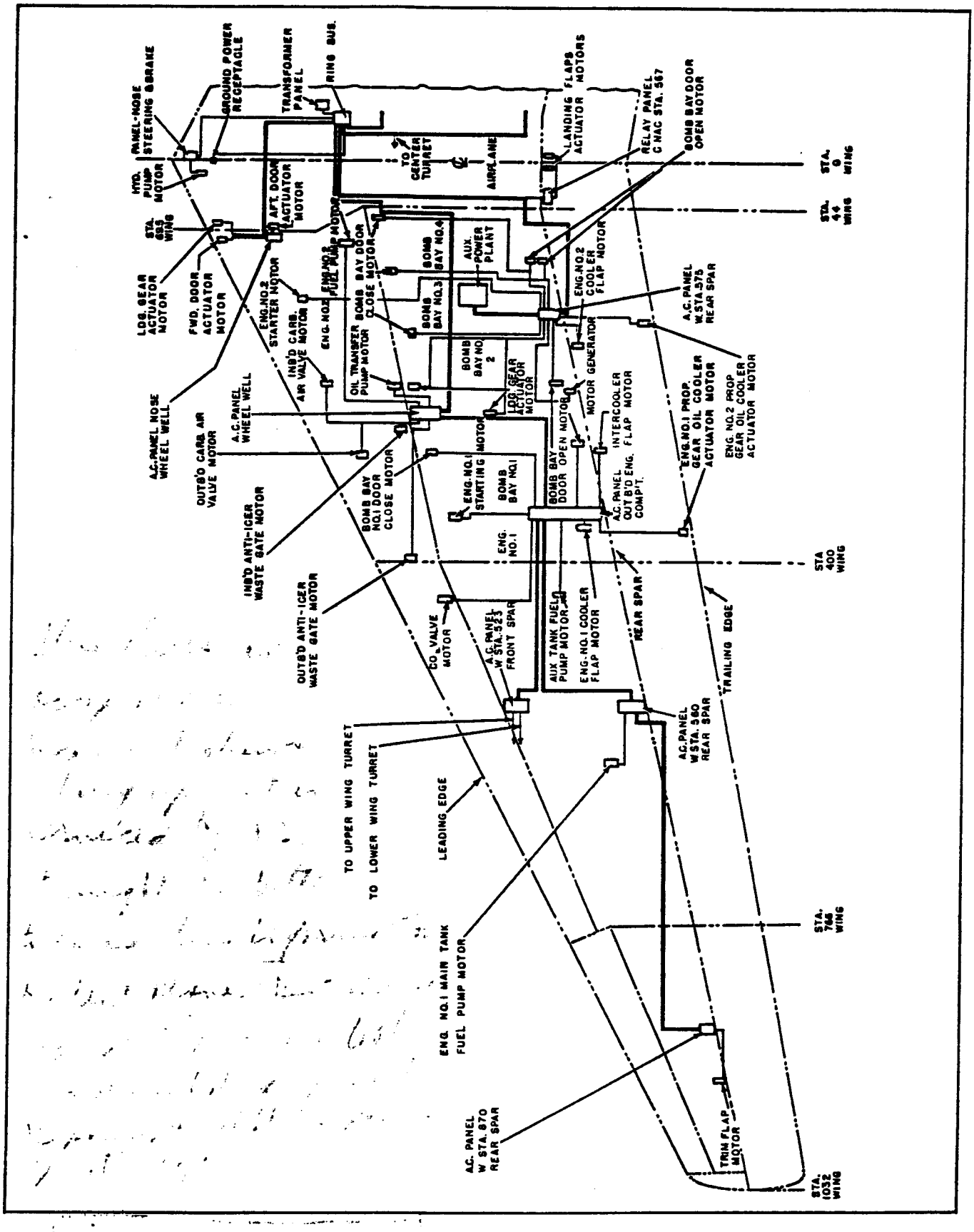


Figure 13. AC Power Distribution

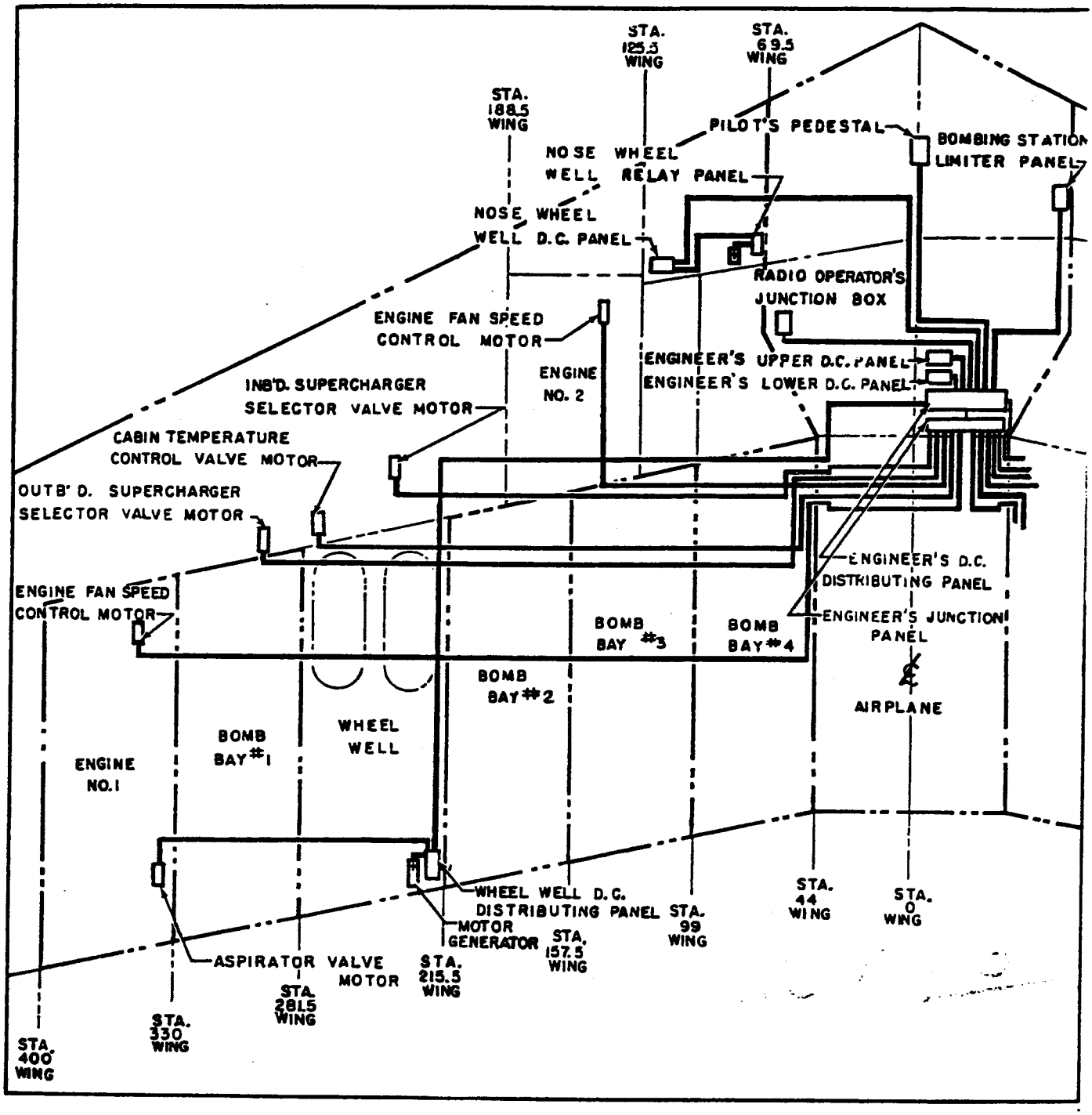


Figure 14. DC Power Distribution

m. HEAT EXCHANGER WASTE GATE MOTOR SWITCHES. (See figure 17.)- These switches are used to control the temperatures of the exhaust gases to the turbosuperchargers. Normally for ground operations the switches are held to the "OPEN" position to open the waste gates and in flight they are placed on "AUTOMATIC." Manual control is accomplished by holding the switches to the "OPEN" or "CLOSE" position momentarily and then returning the switches to the center (off) position. The center position being off, the waste gates will remain in the position that they were in when the switches were turned off. Operating time from one extreme to the other is approximately 10 seconds.

n. OIL DILUTION SWITCHES.- These switches, figure 17, have two positions; "OFF" and momentary "ON." In the "ON" position diluted oil is diverted into the oil tank hoppers rather than throughout the oil tanks. In the "OFF" position engine oil is automatically diverted directly to the hopper as required by the oil temperature.

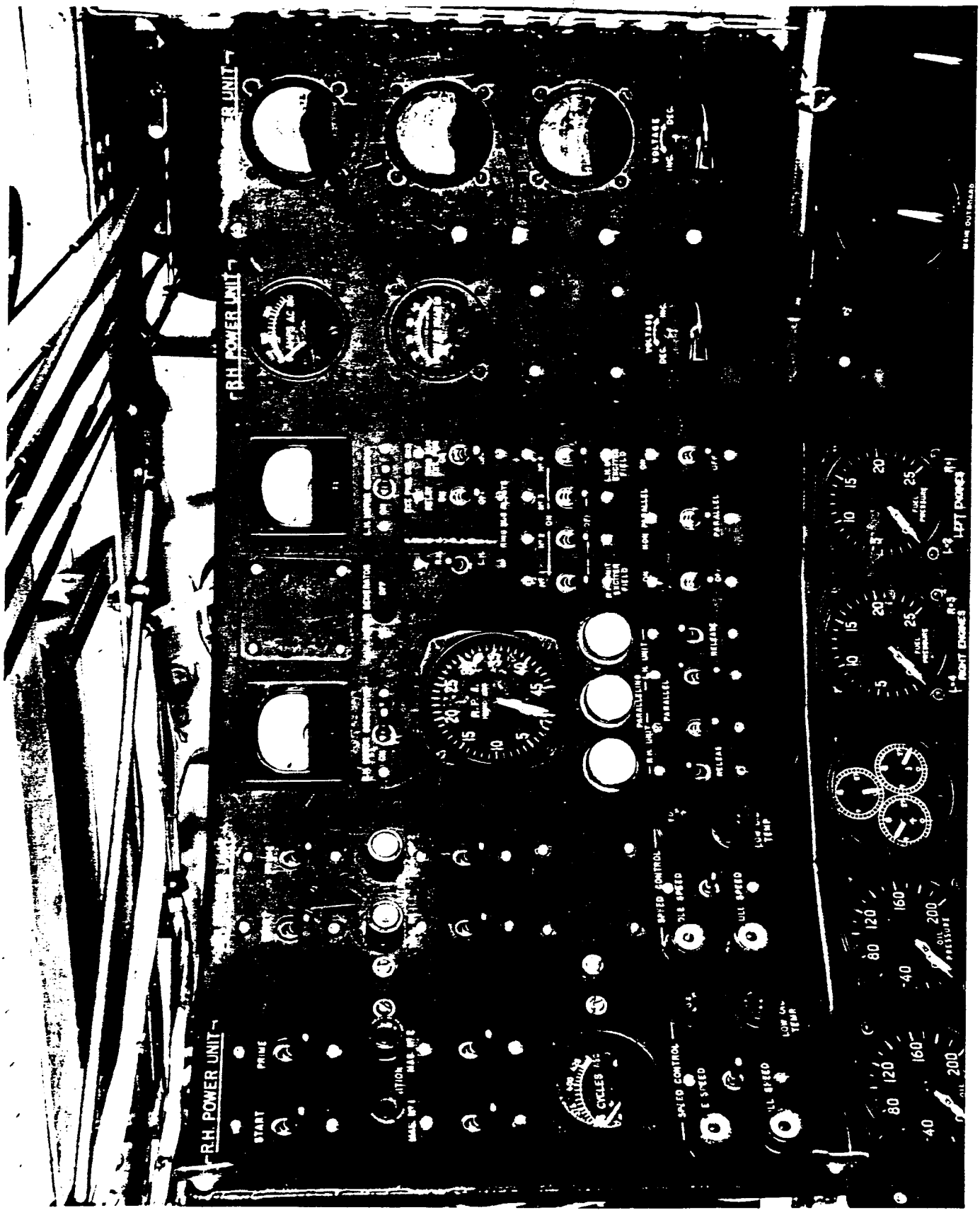


Figure 15. Engineer's A.P.U. Control Panel

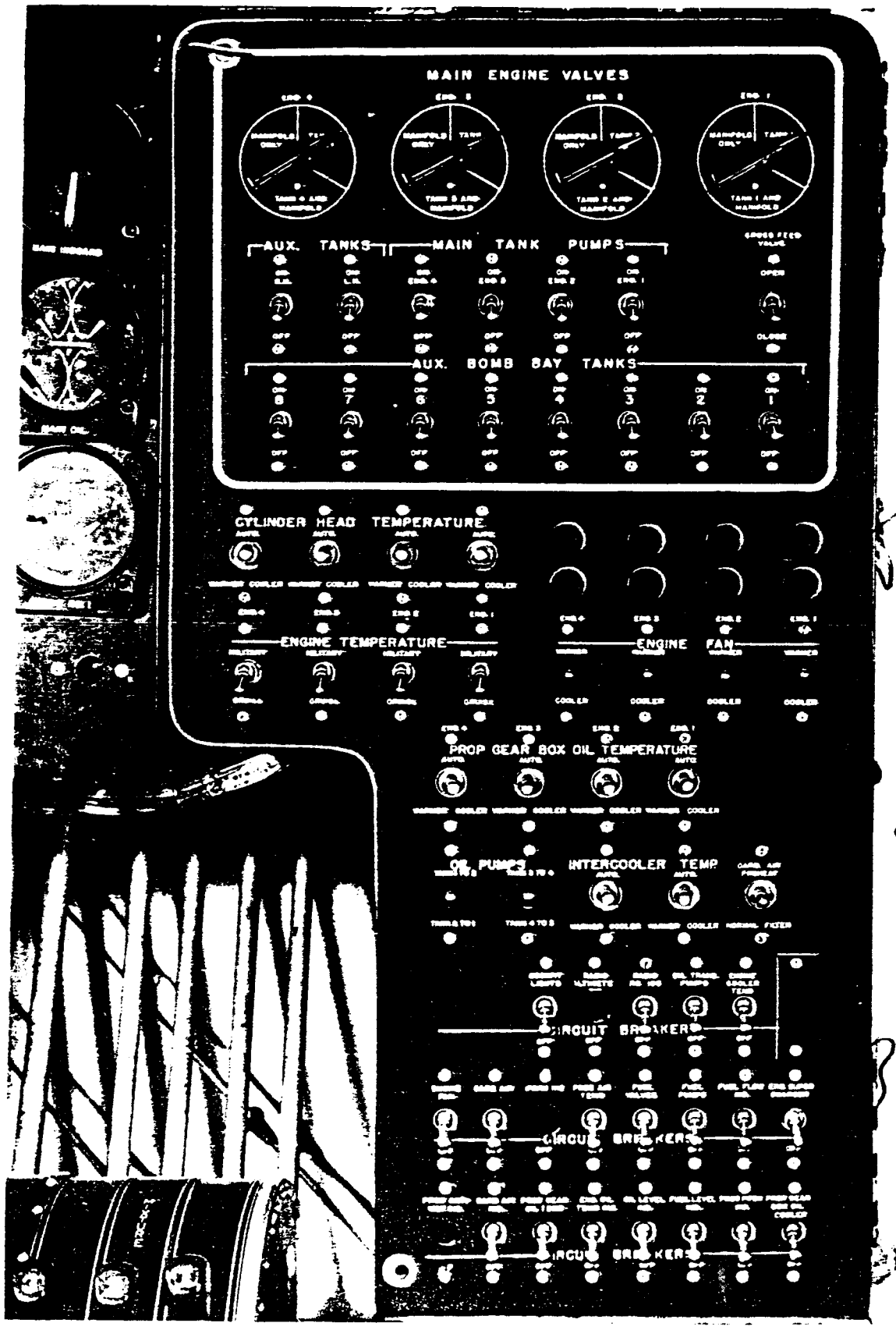


Figure 16. Engineer's Lower Electrical Control Panel

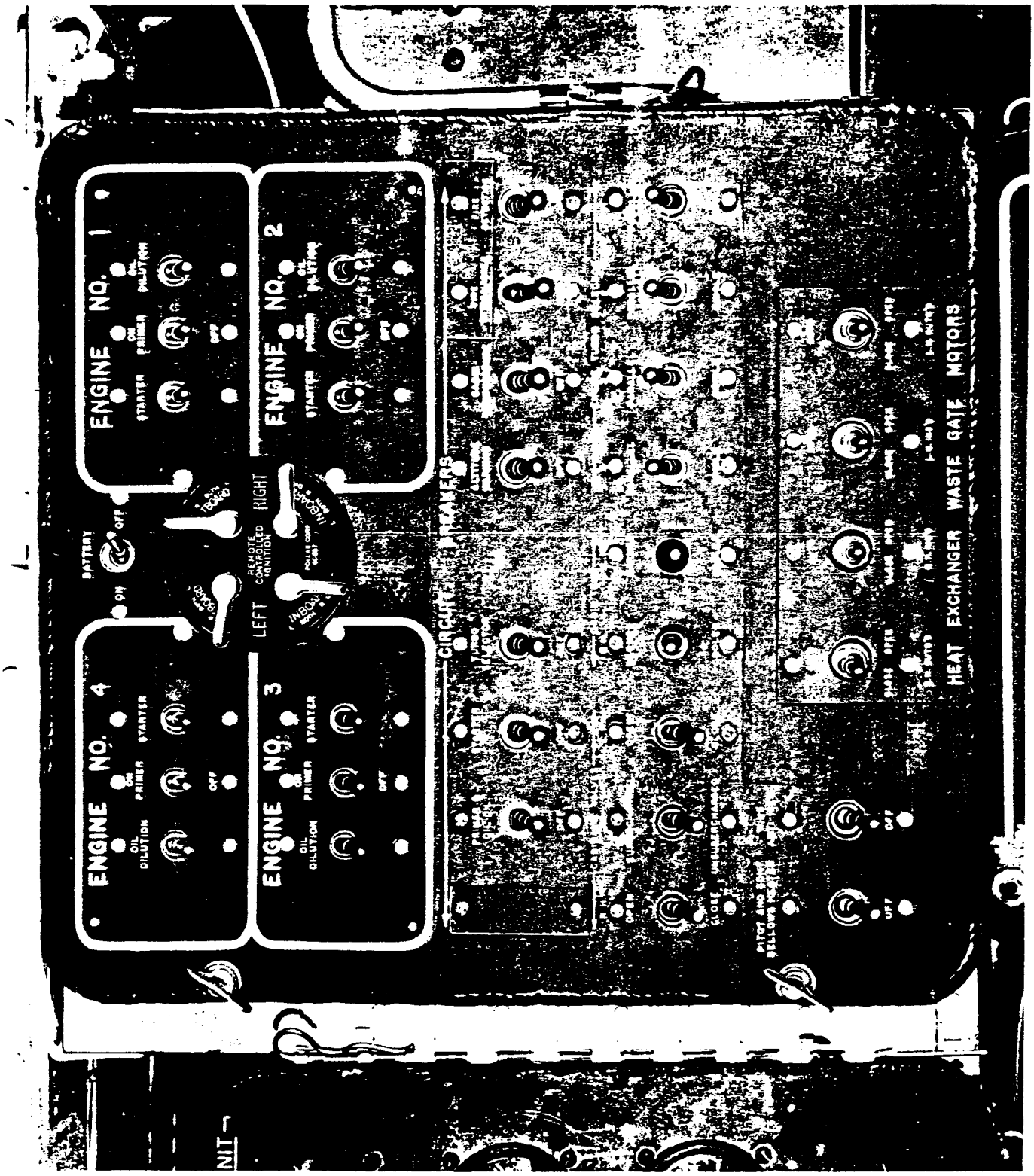


Figure 17. Engineer's Upper Electrical Control Panel

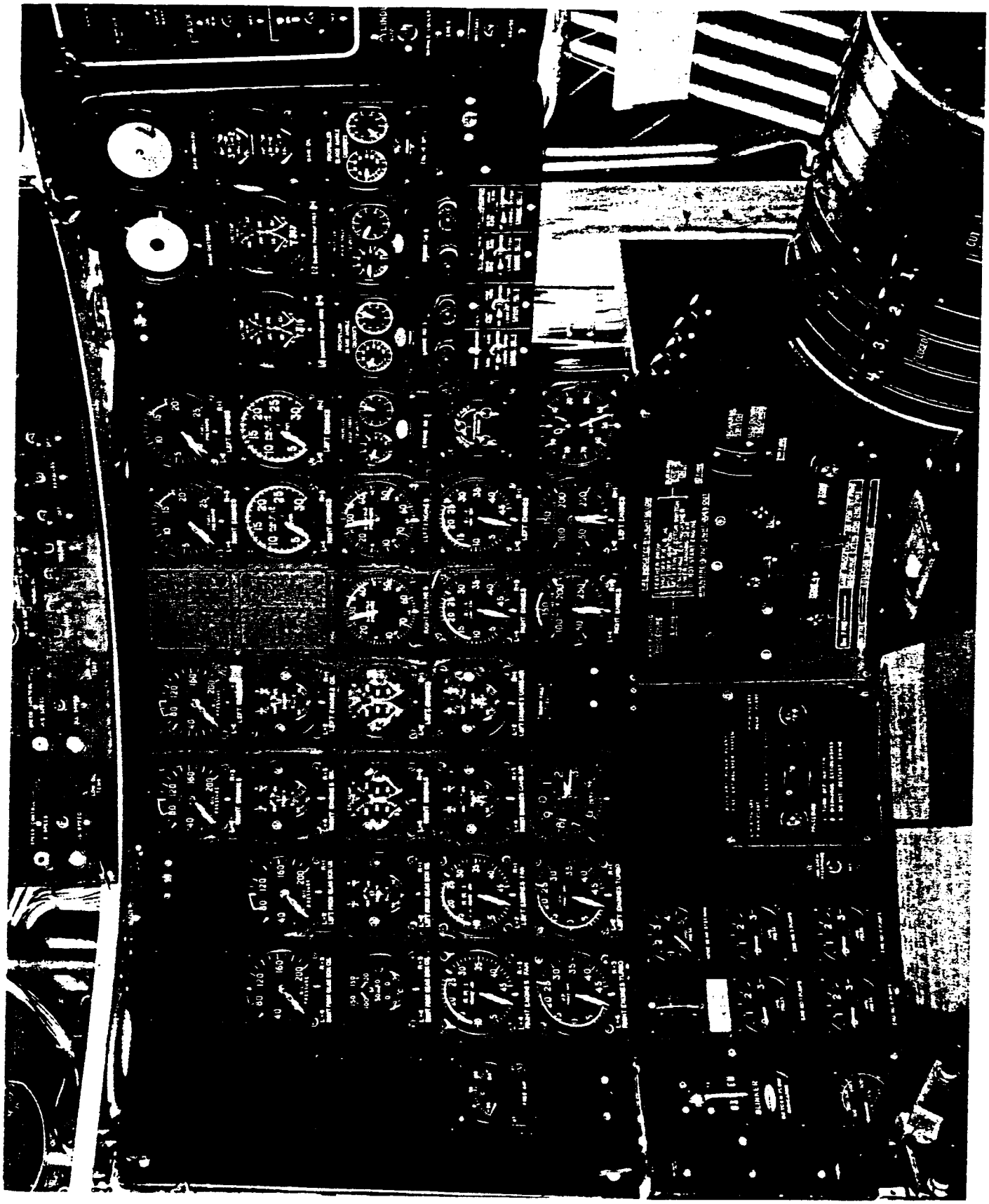


Figure 18. Engineer's Instrument Panel

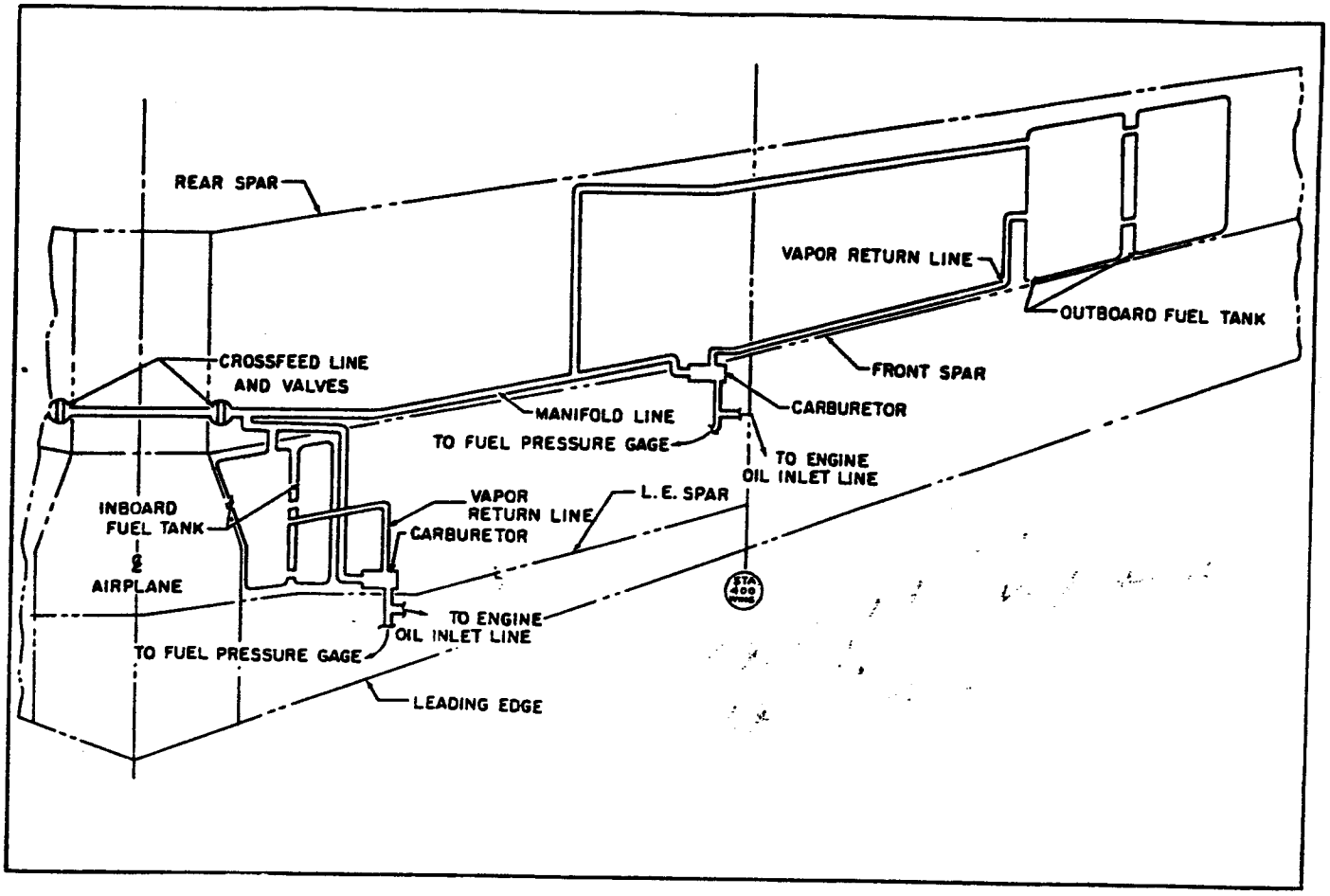


Figure 19. Main Fuel System

o. PRIMER SWITCHES.- A primer switch, spring loaded to the "OFF" position, is provided for each engine. (See figure 17.)

p. IGNITION SWITCHES.- Individual ignition switches with provisions for checking both the left and right hand magnetos of each engine are located on the engineer's upper control panel. (See figure 17.) An emergency switch is installed on the pilot's pedestal that will cut the ignition for all four engines when it is pulled out. (See figure 7.)

q. STARTER SWITCHES.- Switches for direct cranking starters are located on the engineer's upper control panel, figure 17. The switches are spring loaded to the "OFF" position.

49. ENGINE SECTION FIRE EXTINGUISHER SYSTEM. (See figure 27.)- A "two shot" carbon dioxide fire extinguisher system is provided for the control of fires occuring in the engine sections, including the areas around the turbosuperchargers and the propeller gear boxes. The fire control panel (See 13, figure 24) is located immediately below the engineer's instrument panel. Four indicator lights, a fire zone selector switch, and a double throw discharge switch are located on the panel. A fire will illuminate a respective indicator light to which the selector switch must be turned to before using the discharge switch. For a first fire the discharge switch must be held up for six seconds and should a second fire occur the switch must then be held in the opposite direction. The discharge may be directed to either the same zone as where a first fire occurred or it can be directed to another zone.

50. BLOWER THROAT FIRE EXTINGUISHER.- A special fitting is provided in the airplane, among the stowed items, to replace the conventional nozzle on a 50# Co_2 fire extinguisher bottle. The ground crew must attach this fitting to an extinguisher, ready for use before starting the engines. The fitting attaches to connections (two in each main gear wheel well) which lead directly to the blower section of each engine. A sudden rise in temperature, shown by the blower throat temperature indicators, figure 18, indicates a fire. The Co_2 charge may be released directly to the affected blower section by the ground crew.

51. AUXILIARY POWER UNIT FIRE EXTINGUISHER SYSTEM.- A carbon dioxide fire extinguishing system is provided for each A.P.U. A double-throw switch and two detector lights are installed on a panel beneath the engineer's instrument panel. (See 14, figure 24.) Holding the discharge switch in the direction of the lighted lamp will release a Co_2 charge to the affected unit.

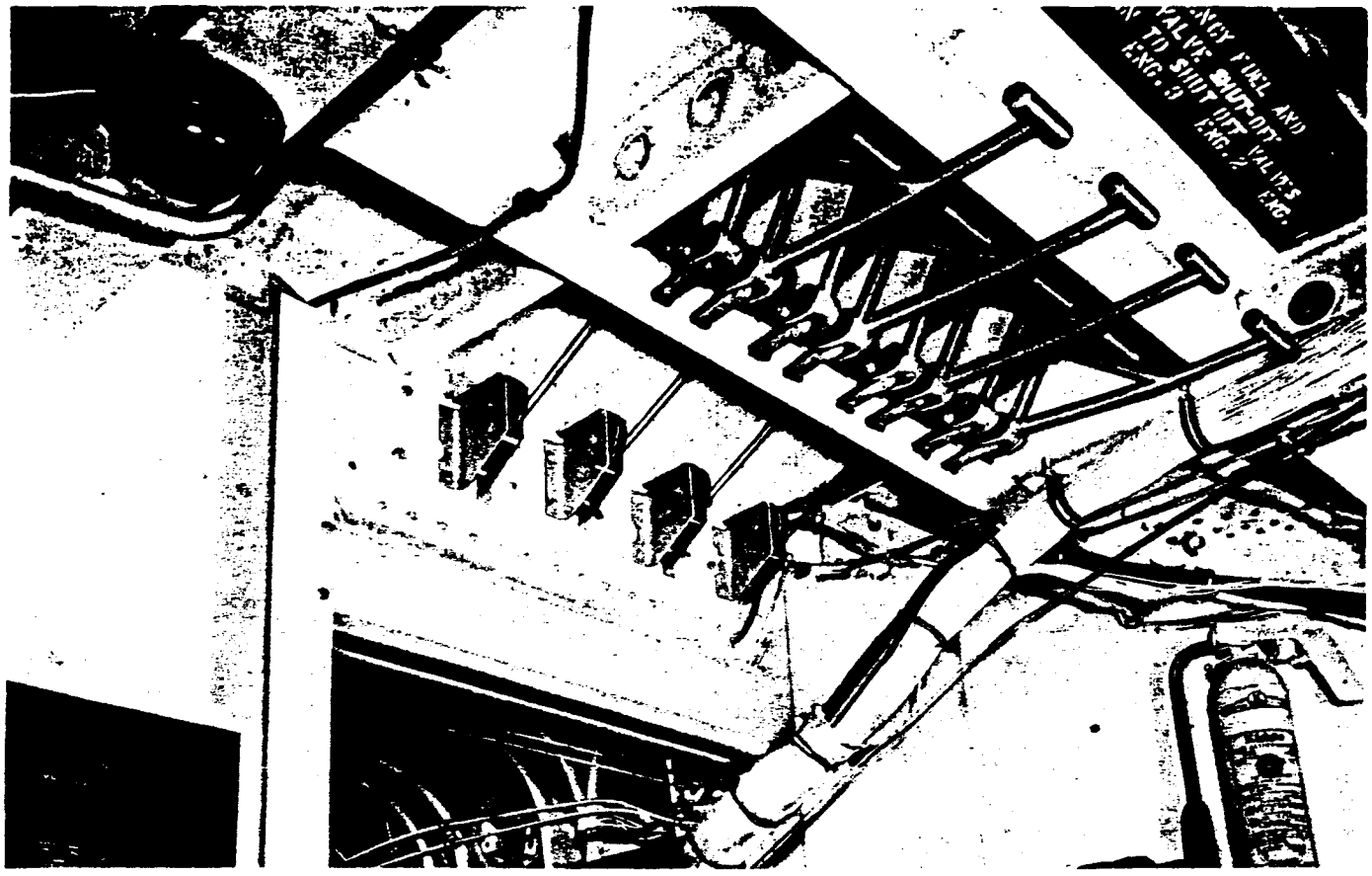


Figure 20. Emergency Fuel and Oil Shut-Off Controls

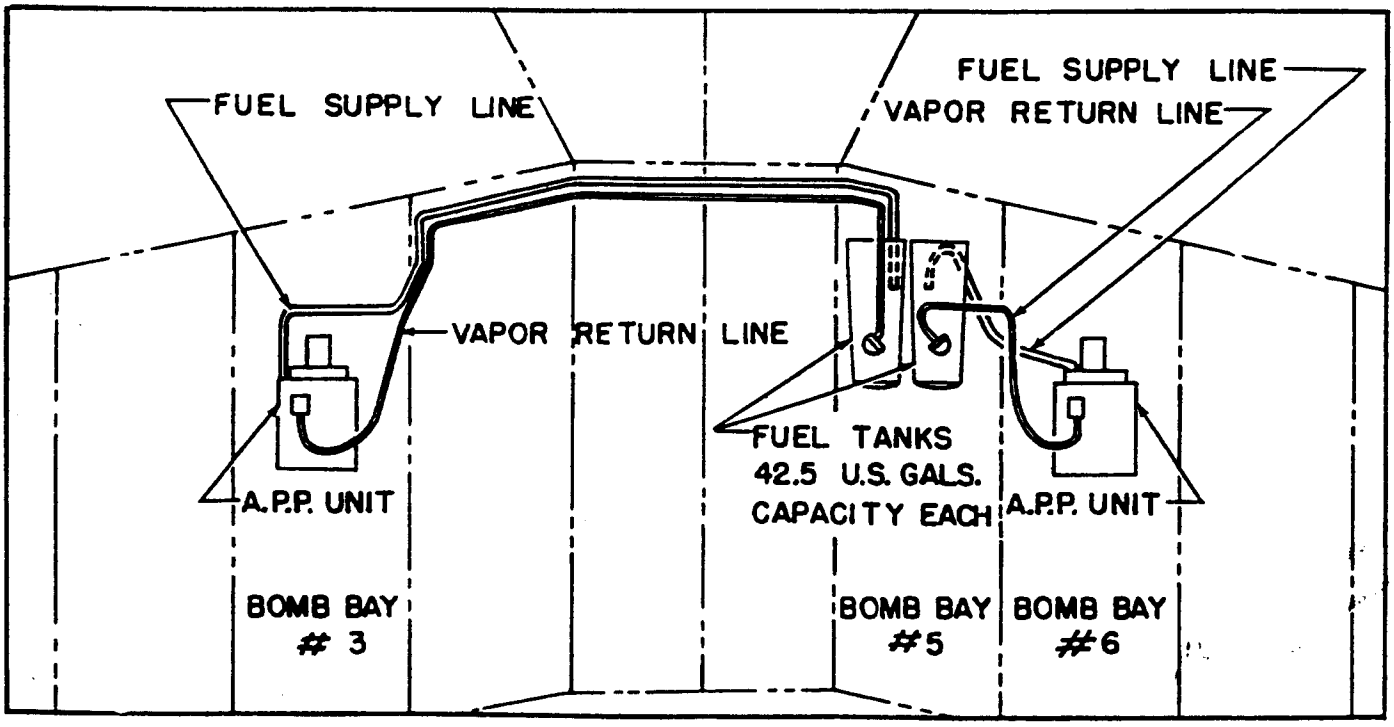


Figure 21. A.P.U. Fuel System

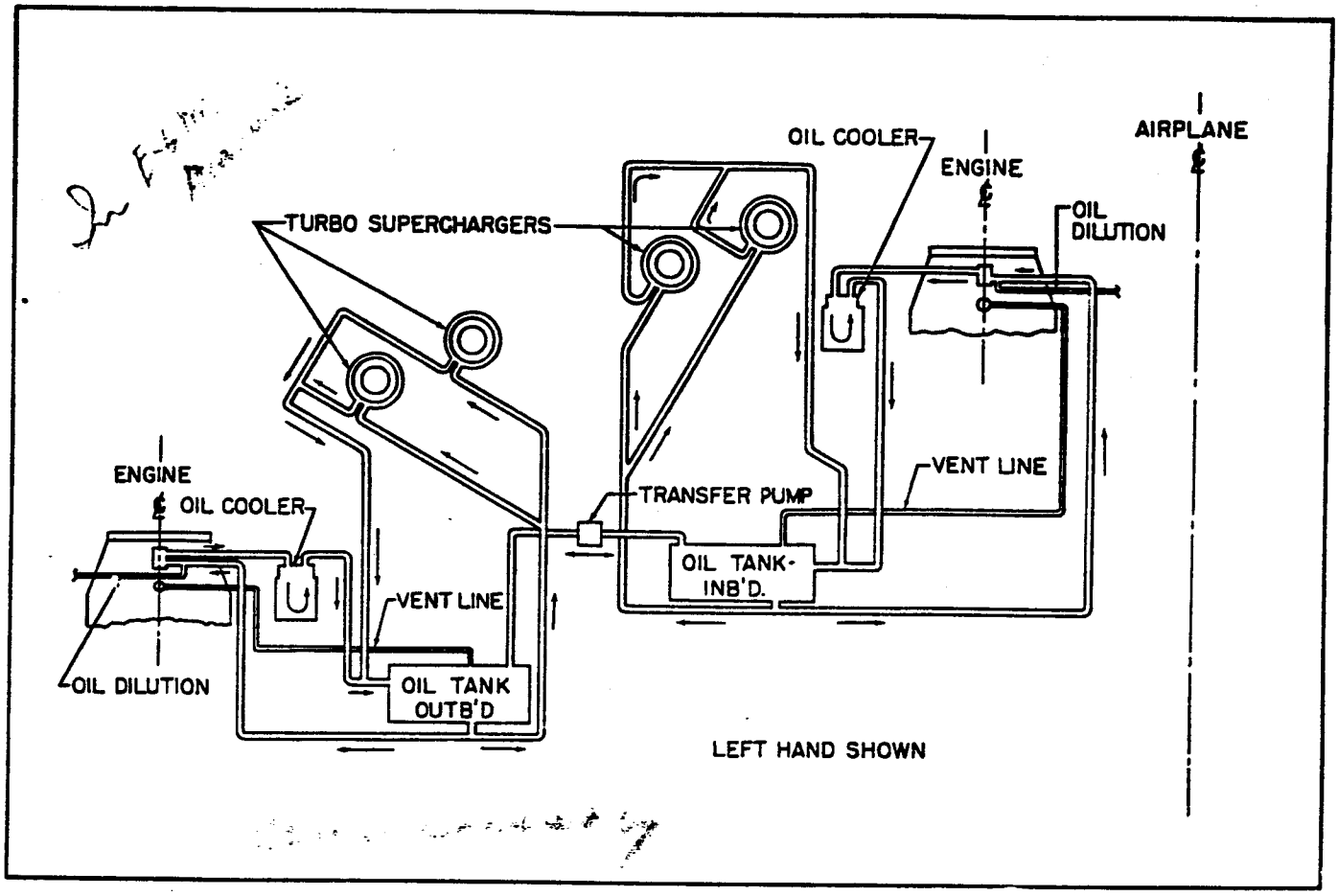


Figure 22. Engine Oil System

52. HAND FIRE EXTINGUISHERS.- A hand-operated carbon dioxide fire extinguisher is clipped to the cabin wall at the radio operator's station. (See Section IV, figure 2.) A second extinguisher is located on the aft side of the turret structure in the aft cabin.

53. CRASH AXES.- One crash ax is located at the radio operator's station, see Section IV, figure 2, and another is clipped to the aft side of the turret structure in the aft cabin.

54. FIRST AID KITS.- A first aid kit is attached to the cabin wall at the radio operator's station. (See Section IV, figure 2.)

55. ALARM BELLS.- There are three alarm bells; one at the engineer's station, one at the navigator's station, and one in the aft cabin. The alarm bell operating switch is located on the pedestal adjacent to the co-pilot. (See 4, figure 7.)

56. ESCAPE HATCHES. (See Section IV, figure 1.)

a. ASTRO DOME.- The astro dome at the navigator's station may be used as a ground escape hatch.

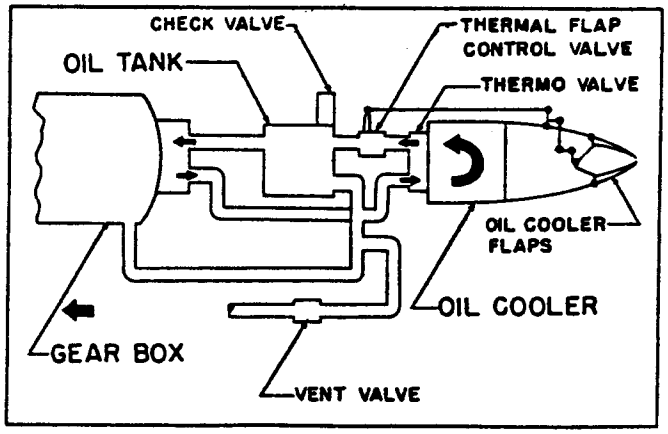
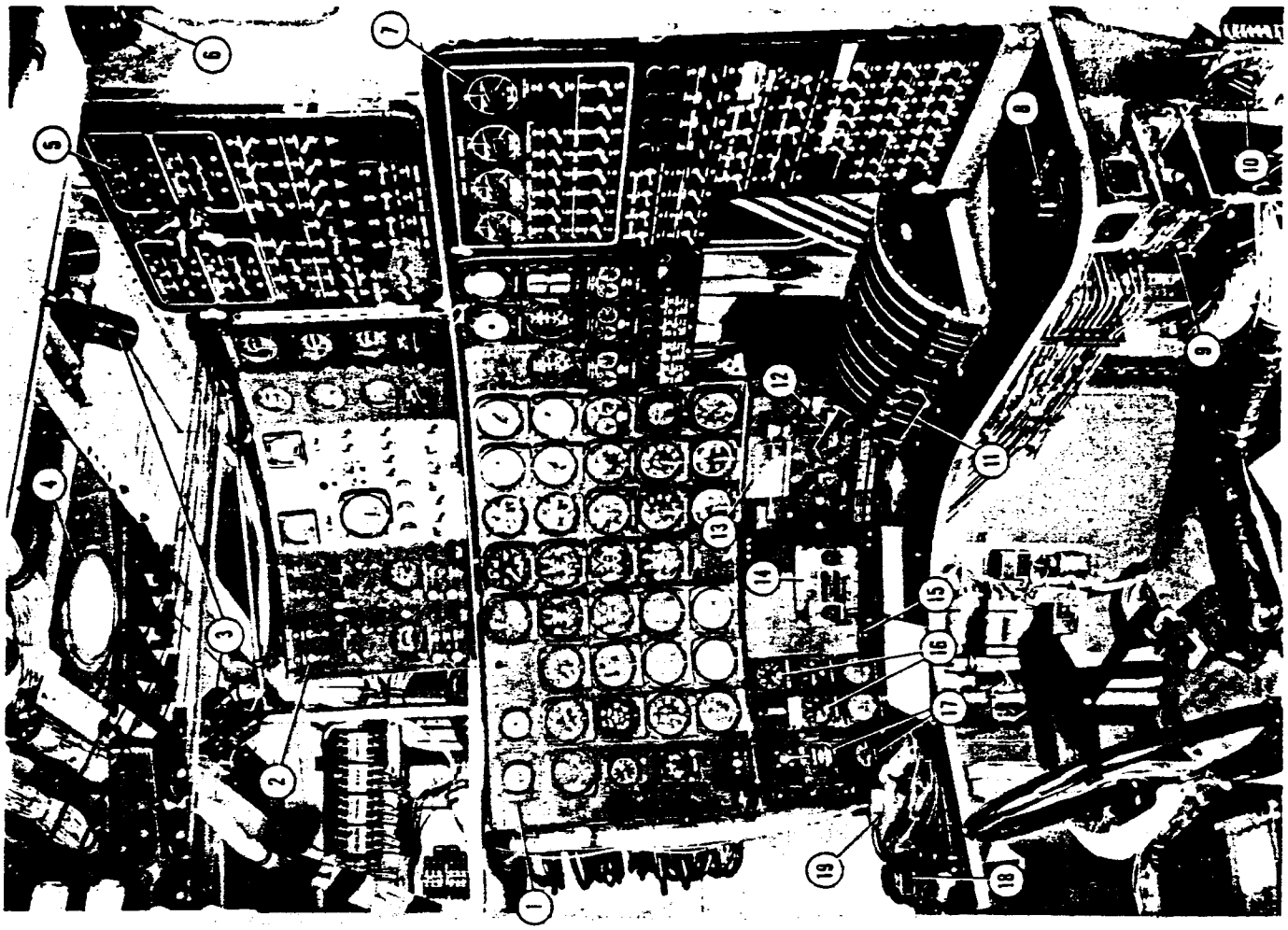


Figure 23. Propeller Gear Box Oil System

b. MAIN ENTRANCE HATCH.- The main entrance hatch may be released to provide escape during flight.

c. UPPER ESCAPE HATCH.- The upper escape hatch, in the aft cabin, may be released for ground escape. Steps are provided on the bulkhead below the hatch. This hatch is also used for access to the top of the airplane for servicing.



1. INSTRUMENT PANEL
2. A. P. U. CONTROL PANEL
3. INSTRUMENT LIGHTS
4. DOME LIGHT
5. UPPER ELECTRICAL CONTROL PANEL
6. EMERGENCY ALARM BELL
7. LOWER ELECTRICAL CONTROL PANEL
8. TURBO BOOST SELECTOR DIAL
9. INDIVIDUAL TURBO BOOST ADJUSTMENT KNOBS
10. SUIT HEATER CONTROL BOX
11. MIXTURE CONTROLS
12. THROTTLES
13. ENGINE SECTION FIRE EXTINGUISHER CONTROL PANEL
14. A.P.U. FIRE EXTINGUISHER CONTROL PANEL
15. GROUND CREW INTERPHONE SWITCH
16. HYDRAULIC PRESSURE GAGES
17. OXYGEN INSTRUMENTS
18. OXYGEN REGULATOR
19. RADIO JACK BOX

Figure 24. Engineer's Station

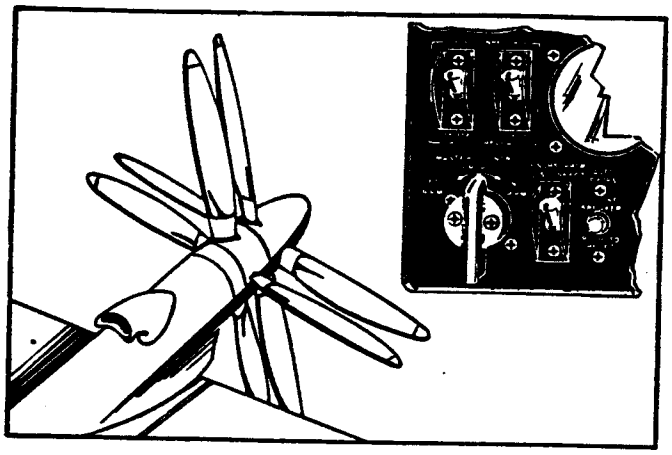


Figure 25. Pilot's Propeller Controls

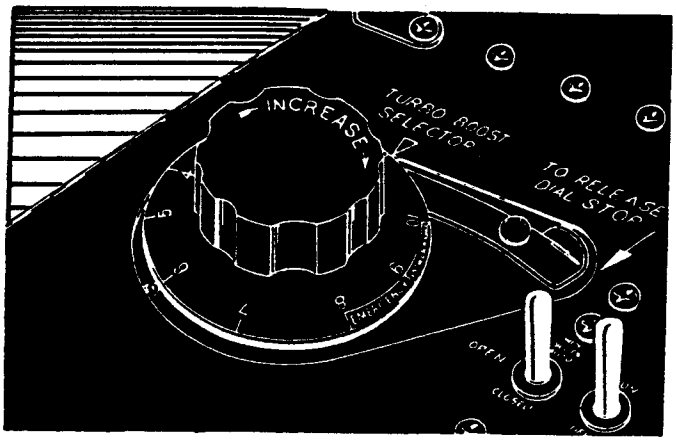


Figure 26. Pilot's Turbo Control

d. BOMB BAY ESCAPE HATCH.- An escape natch is provided in the cabin wall opposite the turret which leads into bomb bay No. 4.

e. BOMB BAY NO. 4 EMERGENCY OPENING CONTROLS.- Two salvo or emergency switches are located, one on each side of the escape hatch into the bomb bay. Another emergency salvo switch is located at the pilot's station. The bomb bay may also be opened with the normal controls at the bombardier's station. (See Section IV, paragraph 5.)

f. LOWER FORWARD ESCAPE HATCH.- An escape hatch is located in the floor immediately behind the pilot. A conventional handle is provided on the hatch that must be raised and turned to release the hatch.

57. SEATS.

a. PILOT'S SEAT.- A lever on the right side of the pilot's seat provides for the up and down movement of the seat. A lever on the left side of the seat has two positions: The forward position of the lever allows the seat to be turned to the left for access. The aft position allows forward and aft movement of the seat.

b. CO-PILOT'S SEAT.- A lever on the right side of the seat allows up and down adjustments and the lever on the left side permits fore and aft movement of the seat.

c. NAVIGATOR'S, ENGINEER'S, AND RADIO OPERATOR'S SEAT.- These three seats have only a lever on the right side which permits rotation. The seats will lock into four positions 90° apart.

58. DATA CASES.- One data case is located to the left of the pilot near the floor and another is attached to the structure opposite the co-pilot's seat. A flight report holder is located between the pilot and co-pilot.

PILOT'S NOTES

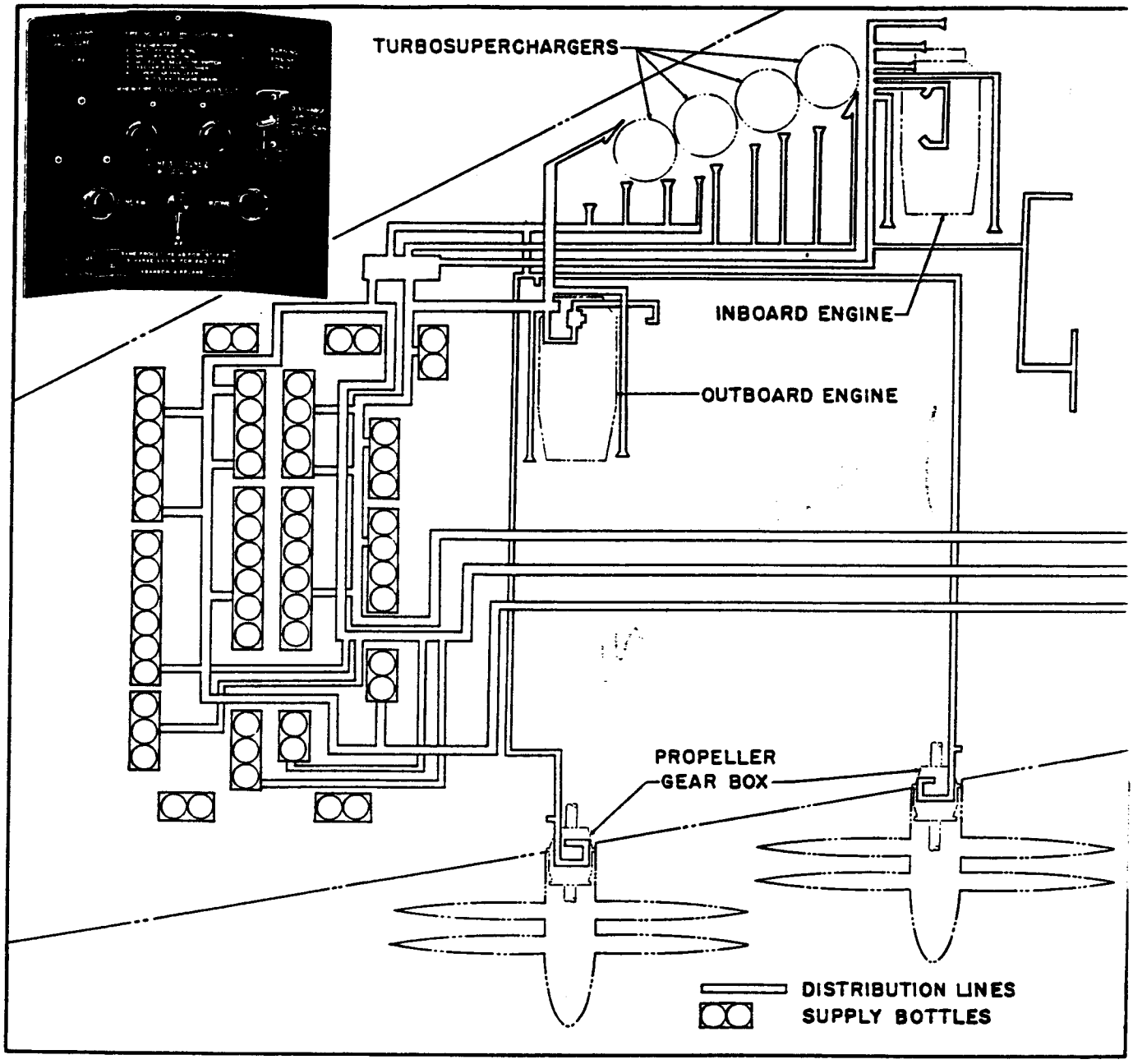
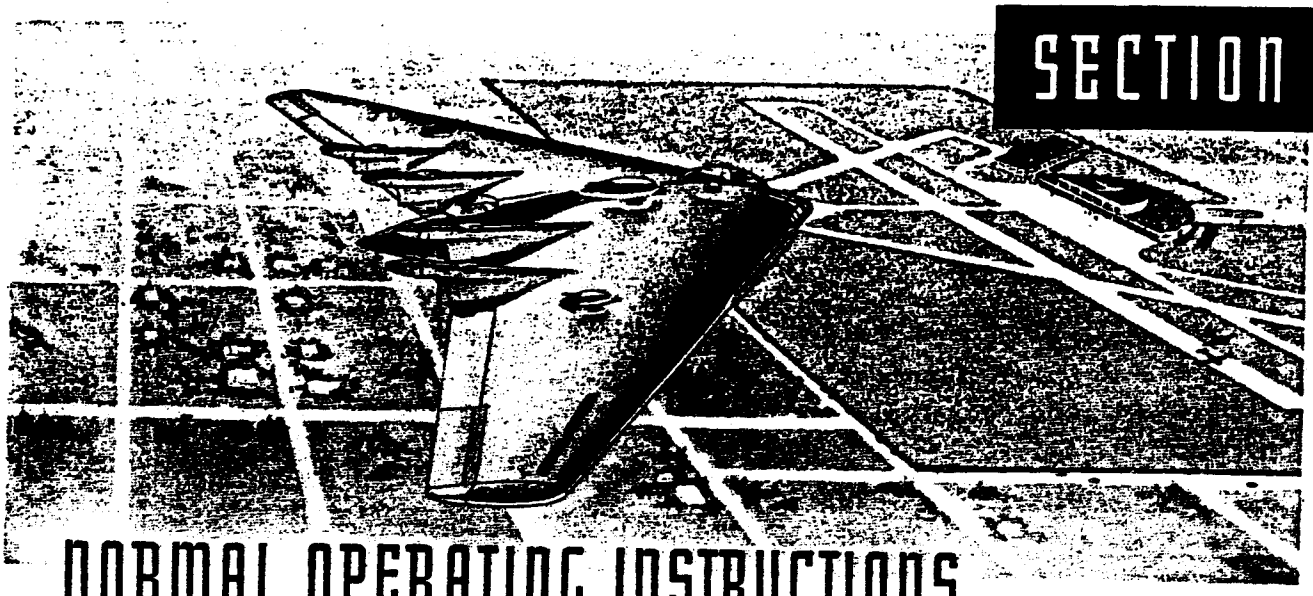


Figure 27. Engine Section Fire Extinguisher System

PILOT'S NOTES

PILOT'S NOTES

SECTION II



NORMAL OPERATING INSTRUCTIONS

1. BEFORE ENTERING THE AIRPLANE.

a. RESTRICTIONS.- These limitations and restrictions are subject to change, and latest service directives and orders must be consulted.

(1) ALTITUDE.- Flights above 15,000 feet are not recommended and are restricted to 20,000 feet. This restriction is necessary because of auxiliary power unit limitations.

(2) PROHIBITED MANEUVERS.- Dives, loops, spins, slips, rolls, and Immelman turns.

(3) MAXIMUM ALLOWABLE DIVE AIRSPEEDS.-

Altitude	IAS
0 to 10,000 feet	360
10,000 to 20,000 feet	345
20,000 feet	325

(4) LANDING FLAPS.- Do not lower the landing flaps above 160 mph or over 30° at any time. Full down flaps as indicated on the landing flap indicator is 50°. Do not lower flaps much over one-half of the indicator range.

(5) LANDING GEAR.- Do not lower the landing gear above 175 mph.

b. LOAD CONDITIONS.- Determine the gross weight and balance of the airplane. Complete weight and balance charts locating the center of gravity under various load conditions are supplied with the airplane.

c. CHECK LIST.

Pilot	Copilot	Engineer
(1) See that the airplane is headed into the wind.	(1) Check all seams for apparent fluid leaks	(1) See that the engine sections have been inspected.
(2) Check the condition of the tires and shock struts. See that the wheels are chocked.	(2) See that the wings are free of ice, snow, frost, oil or heavy accumulations of dust.	(2) Check for servicing-fuel tanks, oil tanks, hydraulic reservoirs, landing gear bungees, and nose gear steering and brake accumulator.
(3) See that ground crew personnel are stationed at the nose gear with earphones and microphones plugged in.	(3) Check control surfaces for damaged skin or fabric.	(3) See that all dust covers have been removed.
		(4) See that the ground crew has an extinguisher with a special nozzle connected to No. 1 engine blower section connection. (See paragraph 50, Section I.)

d. ENTRANCE TO THE AIRPLANE. (See figure 1.)- The main entrance hatch is located in the bottom center of the crew nacelle. Turn the handle at the center of the door to the right and lower the door, then place the ladder against the door.

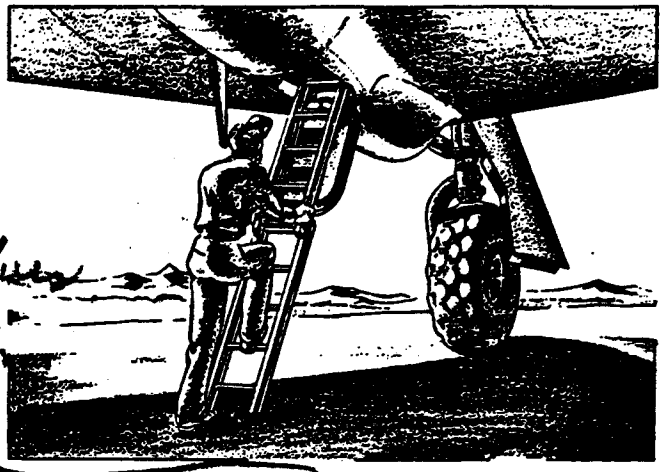


Figure 1. Entrance

PILOT'S NOTES

Do not start figure numbers over again for each section. This should have been Fig 28

2. ON ENTERING THE AIRPLANE.

a. STANDARD CHECK.

Pilot	Copilot	Engineer
(1) Parking brake- Set.	(1) Visually check the upper escape hatch on entering airplane.	(1) Ignition switches- "OFF."
	(2) Circuit breakers- On. (See Section I, figure 7.)	(2) Circuit breakers- "ON." (See Section I, figures 16 and 17.)
		(3) Battery switch- "ON." (See Section I, figure 17.)
(4) Interphone- Check.	(4) Interphone- Check. Shouldn't this be "off" if external power is used?	(4) Interphone- Check.
		(5) GROUND CREW INTERPHONE switch- "ON." (See Section I, figure 24.)
(6) Instruct ground crew to close entrance hatch and check lower escape hatch.		(6) External power (if used)- Notify ground crew.
		(7) Mixture controls- "IDLE CUT-OFF."
(8) Instruments- Check condition.	(8) Instruments- Check condition.	(8) Instruments- Check condition.
	(9) Alarm bell- Test. (See Section I, figure 7.)	(9) Fuel and Oil- Check quantity gages.
(10) Landing gear indicator lights- Green lights ON. (See Section I, figure 9.)	(10) STATIC PRESSURE SELECTOR VALVE- "AIR-SPEED TUBE." (See Section I, figure 9.)	(10) Emergency fuel and oil shut-off controls- On. (See Section I, figure 20.)
	Will this give a reading without AC power?	(11) MAIN ENGINE VALVES- "TANK ONLY." (See Section I, figure 16.)
		(12) MAIN TANK PUMPS- "OFF." (See Section I, figure 16.)
		(13) CROSS FEED VALVE- "CLOSE." (See Section I, figure 16.)

(Continued next page)

(14) Command radio- Check with tower.

(15) Radio compass- Check.

(16) ENGINEER'S PROPELLER DISCONNECT switch- "ON." (See Section I, figure 25.)

(17) Notify Engineer- "Ready to start A.P.U.'s."

(14) Landing Flap indicator- Flaps up.

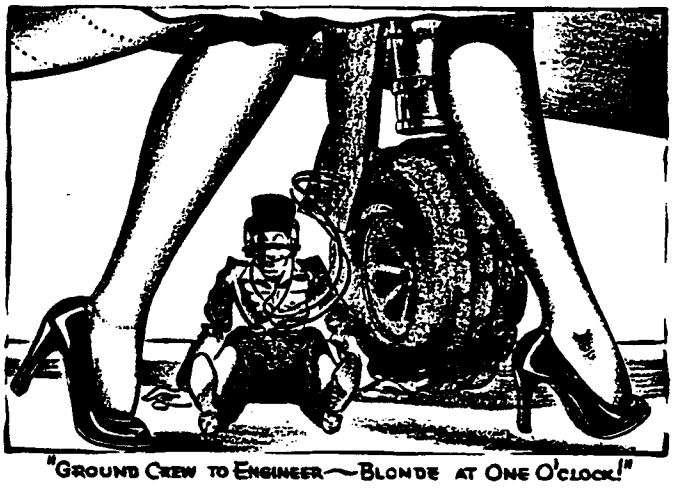
(14) CABIN AIR VALVE switches- "CLOSED" and "UNSUPERCHARGED." (See Section I, figure 17.)

(15) PITOT AND CONTROL BELLOWS HEATER- "OFF." (See Section I, figure 17.)

(16) WING ANTI-ICER switch- "OFF." (See Section I, figure 17.)

(18) Acknowledge pilot when ready.

PILOT'S NOTES



"GROUND CREW TO ENGINEER—BLONDE AT ONE O'CLOCK!"

PILOT'S NOTES

3. STARTING AUXILIARY POWER UNITS. (Engineer) (See Section I, figure 15.)

a. FIRE CONTROL.- Observe indicator lights on fire control panel during starting procedure. (See Section I, figure 24.)

b. EXCITER FIELD SWITCH.- "OFF."

c. SPEED CONTROL SWITCH.- Hold to "IDLE" position until white indicator light comes on, then release.

d. MAGNETO SWITCHES.- Both "ON."

e. IGNITION LIGHTS (Green).- Both on.

f. START SWITCH.- Hold to "START." Observe tachometer for start of unit. If unit does not start after cranking for several seconds, prime.

g. PRIME SWITCH.- Hold to "PRIME" momentarily if necessary.

h. AFTER START.- Allow unit to operate at idle speed until the red light (low oil temperature) goes out.

i. SPEED CONTROL SWITCH.- Hold to "FULL SPEED" position until white indicator light comes on.

j. EXCITER FIELD SWITCH.- "ON," after white light comes on.

CAUTION

Do not throw the exciter field into the alternator circuit at speeds much lower than 2500 rpm, as an additional load will be placed on the alternator field causing it to overheat.

k. SPEED CONTROL SWITCH.- Adjust unit speed to approximately 2160 rpm.

l. FREQUENCY AND VOLTMETER SWITCH.- Hold to the required position and take a reading of the CYCLE and AC VOLT indicators.

m. FREQUENCY.- Adjust unit speed until 400 cycles are maintained as shown on the CYCLE indicator.

n. VOLTAGE.- Adjust the VOLTAGE switch until a terminal voltage of 208v is shown on the AC VOLT indicator. (See l. preceding.)

o. PARALLEL-NON-PARALLEL SWITCH.- "NON-PARALLEL."

p. Start the second auxiliary power unit in the foregoing manner.

4. PARALLELING A.P.U's. (See figure 15.)

a. PARALLELING SWITCH.- Close the paralleling switch of either unit to place that unit on the line.

b. SPEED CONTROL AND VOLTAGE SWITCHES.- Adjust the frequency of the unit that is on the line by means of the SPEED CONTROL switch to 400 cycles. The proper frequency will occur at a tachometer reading of approximately 2160 rpm. Adjust the voltage to 208v with the voltage switch.

c. PARALLEL-NON-PARALLEL SWITCHES.- Move both switches to the "PARALLEL" position.

d. SPEED CONTROL AND VOLTAGE SWITCHES.- Adjust these switches for proper frequency and voltage readings for the other unit to be brought into operation.

e. PARALLELING SWITCH.- Close the parallel switch for the incoming unit when the synchronizing lamps are dark. ?

5. FUEL SYSTEM MANAGEMENT. (See figure 2.)

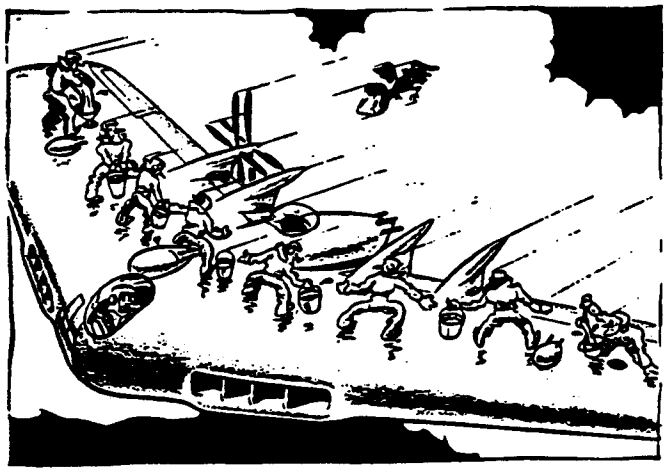
a. CONTROLS.- See Section I, figures 16 and 18.

NOTE

Switches, identified as AUX. TANKS and AUX. BOMB BAY TANKS are not used on this airplane.

b. FUEL SELECTION. (See figure 2.)

(1) TAKE-OFF AND CLIMB.- "TANK AND MANIFOLD."



"Know your fuel system."

(2) NORMAL FLIGHT.- "TANK ONLY."

(3) LANDING.- "TANK AND MANIFOLD."

PILOT'S NOTES

don't use "close" or "open" for electrical switches but "on" or "off"

6. OIL SYSTEM MANAGEMENT. (See figure 3.)- Oil may be transferred between the two engine oil tanks on the same side of the airplane. To transfer oil, hold the OIL PUMP switch to the desired position. (See Section I, figure 16.) Observe the quantity gages on the engineer's instrument panel. (See Section I, figure 18.)

7. STARTING ENGINES. (Engineer)

a. FIRE PRECAUTIONS.- Check with ground crew.

b. FIRE EXTINGUISHER SELECTOR SWITCH.- Set to zone in which engine is to be started.

c. STARTING ORDER.- 1, 2, 3, 4.

d. PREPARATION. why not 3, 4, 2, 1

(1) IGNITION.- "OFF."

(2) ENGINES.- "Inch" each engine through two revolutions with the starter. Engage and disengage the starter so that the engine is turned only a few degrees at a time.

(3) ENGINE TURBO SELECTOR SWITCHES.- "PARALLEL."

(4) MAIN ENGINE VALVE SWITCHES.- "TANK ONLY."

(5) MAIN TANK PUMP SWITCHES.- "OFF."

(6) CROSS FEED VALVE SWITCH.- "CLOSE."

(7) CYLINDER HEAD TEMPERATURE SWITCHES.- "COOLER."

(8) ENGINE PAN SWITCHES.- "COOLER."

(9) INTERCOOLER TEMPERATURE SWITCHES.- "COOLER."

(10) CARBURETOR AIR SWITCH.- "NORMAL."

(11) PROPELLER SWITCHES.- "INC. RPM."

(12) TURBO BOOST SELECTOR DIAL.- "0."

(13) MIXTURE CONTROLS.- "IDLE CUT-OFF."

NOTE

All controls with "AUTOMATIC" position must be regulated manually during ground operation to assure proper cooling.

(14) PRIMING.- Cold engine, two seconds. Warm engine, no prime. Turn MAIN TANK PUMP "ON" and hold PRIME switch "ON" required time.

IMPORTANT

The MAIN TANK PUMPS are to be "ON" for priming and at the moment of starting only.

e. STARTING.

(1) MIXTURE CONTROL.- "IDLE CUT-OFF" until engine is firing on prime.

CAUTION

It is possible to have an excessive collection of fuel in the intake pipes resulting from moving the MIXTURE CONTROL from the "IDLE CUT-OFF" position too soon or for too long a period. This fuel can remain in the intake pipes until a critical engine speed is reached at which time all collected fuel will be drawn into the engine. The amount can be sufficient to "hydraulic" the engine.

(2) THROTTLE.- Cracked.

(3) MAIN TANK PUMP.- "ON."

(4) IGNITION.- On "BOTH."

(5) STARTER SWITCH.- "ON."

(6) MIXTURE CONTROL.- "AUTO RICH" as soon as engine fires.

(7) THROTTLE.- Adjust 700-1000 rpm.

(8) OIL PRESSURE.- Observe rise.

CAUTION

If the oil pressure does not register 50 psi almost at once, stop the engine and investigate.

(9) If the engine fires but does not continue to run, proceed as follows:

(a) MIXTURE CONTROL.- "IDLE CUT-OFF" immediately.

(b) Continue cranking; start may be effected as over-rich mixture is leaned out.

(c) If the engine does not start within a reasonable length of time, stop cranking and repeat the procedure beginning with the priming.

NOTE

Overloading of a warm engine may be indicated by a discharge of fuel from the drain on the underside of the wing, however, this does not necessarily indicate overloading of a cold engine. In either case, if overloading is suspected, turn the ignition switch "OFF," move the mixture control to "IDLE CUT-OFF," and open the throttle. After fuel has ceased to flow from the drain, crank the engine through 12 revolutions.

f. INSTRUCTIONS IN CASE OF FIRE.

(1) TURBO FIRE.- Increase throttle setting momentarily.

(2) BLOWER SECTION FIRE.- Notify ground crew over interphone. (See Section I, paragraph 50.)

(3) ENGINE SECTION FIRE.- See Section III, paragraph 2.

PILOT'S NOTES

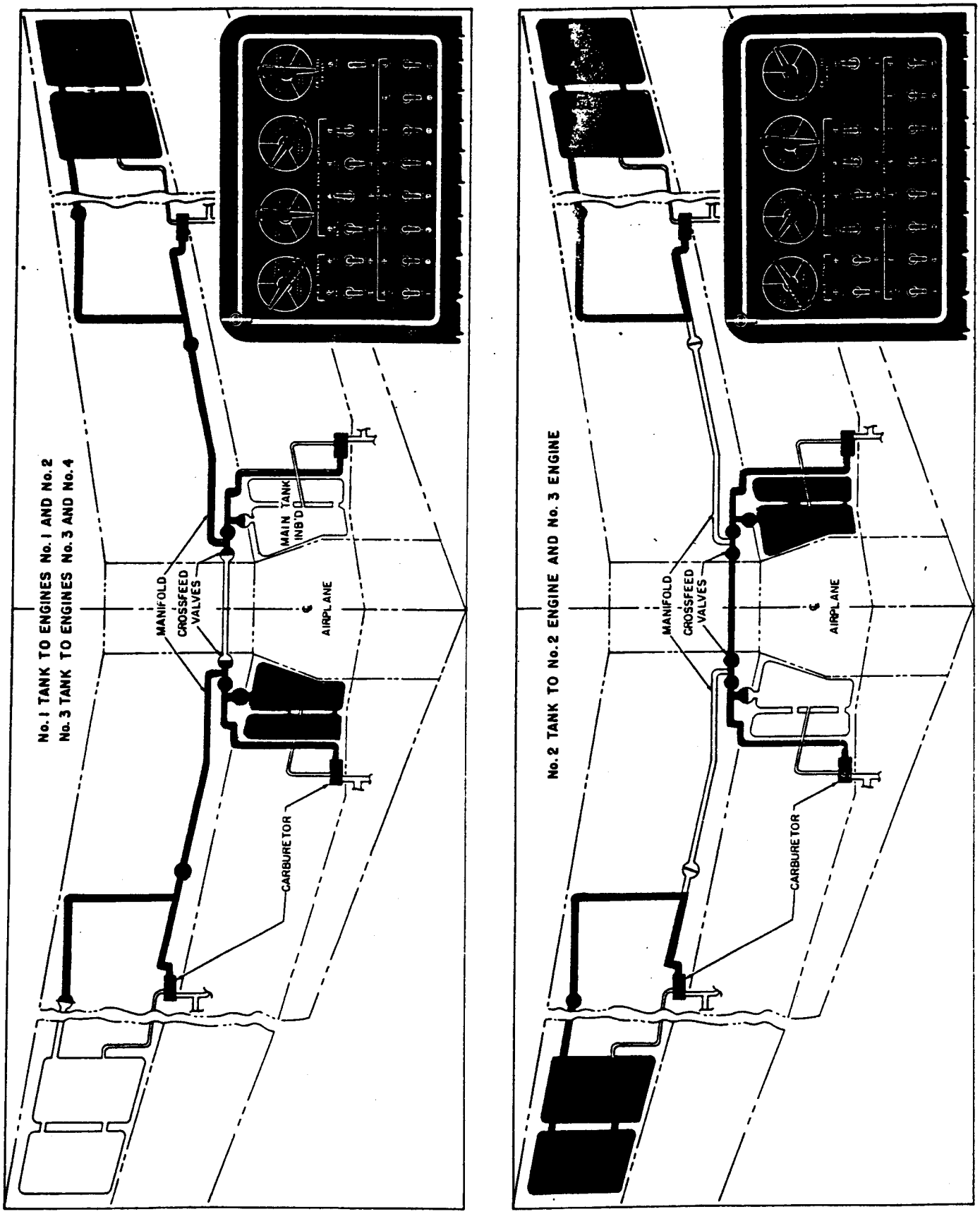


Figure 2. Fuel System Management (Sheet 1 of 2 Sheets)

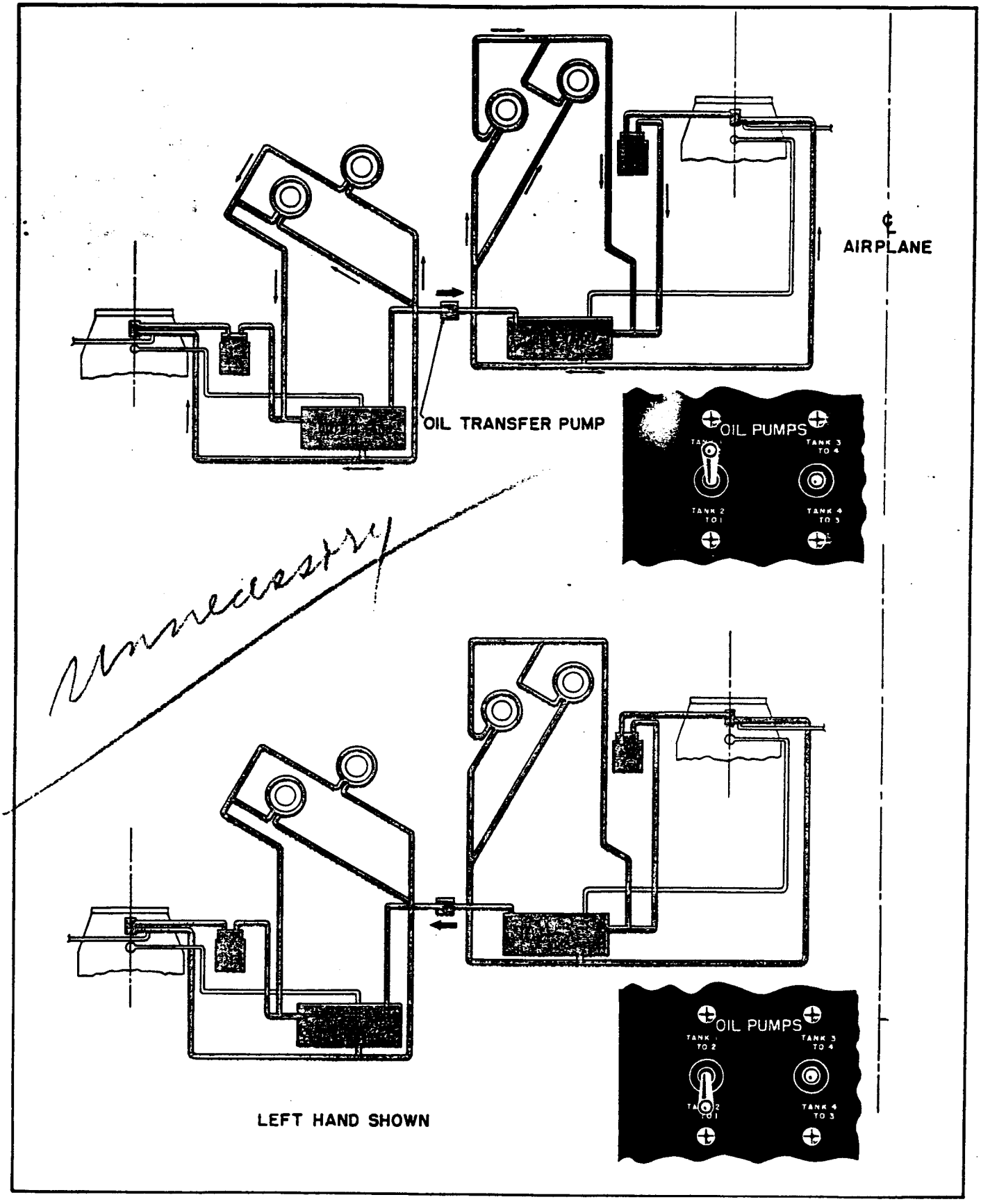


Figure 3. Oil System Management

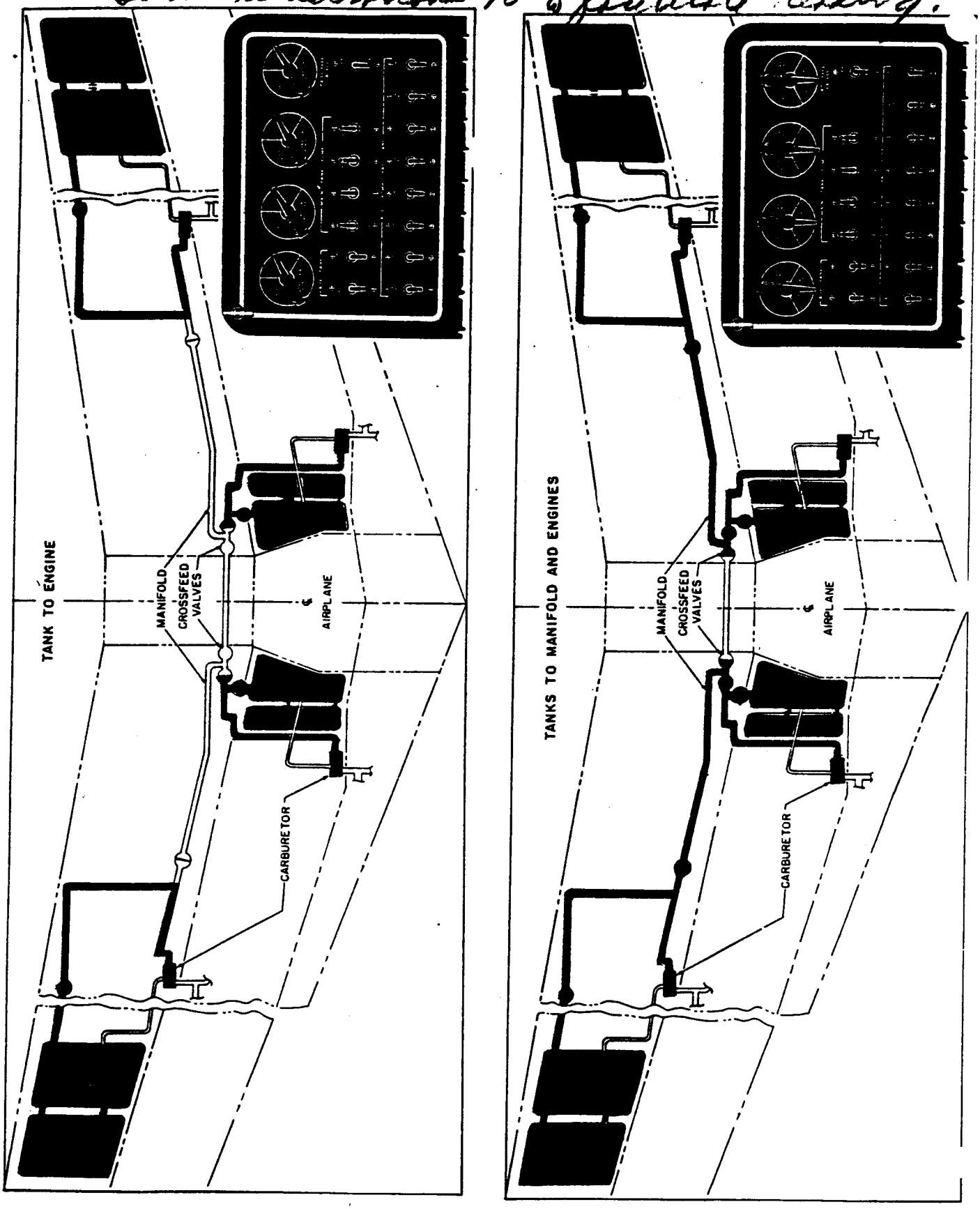


Figure 2. Fuel System Management (Sheet 2 of 2 Sheets)

(Continued from preceding page)

f. Check each propeller in turn as follows:

(1) Minimum engine oil inlet temperature- 40° C. Oil pressure- 80-100 psi.

(2) THROTTLE- 2000 rpm.

(3) PROP. PITCH- Hold limit switch to "DECR. RPM" until limit light comes on.

(4) PROP. PITCH- Hold limit switch to "INCR. RPM" until limit light comes on.

(5) Notify pilot- "Ready to check propeller reversing."

g. Acknowledge engineer. Then check propeller reversing as follows:

(1) Operate both inboard engines at 1500 rpm and 22 in. Hg.

(2) Advise engineer to check inboard propeller pitch indicators.

(3) Move the INBOARD switch to "PROPS. REVERSE" position. (See Section I, figure 25.)

(4) Return the INBOARD switch to "PROPS. UNREVERSE."

(5) Retard the throttles for the inboard engines to idle rpm.

(6) Repeat procedures (1) through (5) for the outboard propellers.

g. Check propeller reversing as shown by the propeller pitch indicators, upon notification.

h. Advise engineer- "Check magnetos."

i. Make a magneto check for each engine in turn as follows:

CAUTION

Do not check the magnetos with the turbos on.

(1) Advance the throttle to 2000 rpm and 30 in. Hg.

(2) PROPELLER PITCH- Place the limit switch on "LOCKED PITCH."

(Continued next page)

8. ENGINE WARM-UP.

Pilot	Copilot	Engineer
a. Order ground crew to check operation of flight controls. Operate each surface through a complete cycle.		a. Set controls as follows: (1) THROTTLES- 1000 rpm. (2) TURBO BOOST- Dial "0." (3) CARBURETOR AIR- "NORMAL." (4) INTERCOOLER TEMPERATURE- "COOLER." (5) ENGINE FAN SPEED- "COOLER." (6) CYLINDER HEAD TEMPERATURE- "COOLER." (7) PROPELLER GEAR BOX OIL TEMPERATURE (if in use)- "COOLER."
b. Engage EMERGENCY ELEVON SWITCH and check operation of elevons. (See Section I, Paragraph 4.)		b. HYDRAULIC BOOST PRESSURES- Check gages for 2000 psi. c. HYDRAULIC STEERING AND BRAKE PRESSURE- Check gage for 3000 psi.
d. Notify Engineer- OK for run-up.		d. Acknowledge and advise pilot.

9. ENGINE GROUND TEST.

Pilot	Copilot	Engineer
a. Airplane headed into wind.	a. WING SLOTS switch- "OPEN."	
b. Brakes- Set.	b. Wing slot indicator lights- On.	b. Turbo Boost- Dial "0."
c. ENGINEER'S PROP. DISCONNECT switch- "ON."		
		d. PROP. PITCH LIMIT switches- Hold to "INCR. RPM." Check limit light, On.
		e. Ignition safety check for each engine in turn as follows: (1) THROTTLE- 1000 rpm. (2) IGNITION SWITCH- "LEFT" then "BOTH." Check for slight rpm drop. (3) IGNITION SWITCH- "RIGHT" then "BOTH." Check for slight rpm drop. (4) IGNITION SWITCH- Turn to "OFF" just long enough to determine that ignition is grounded. Return to "BOTH."

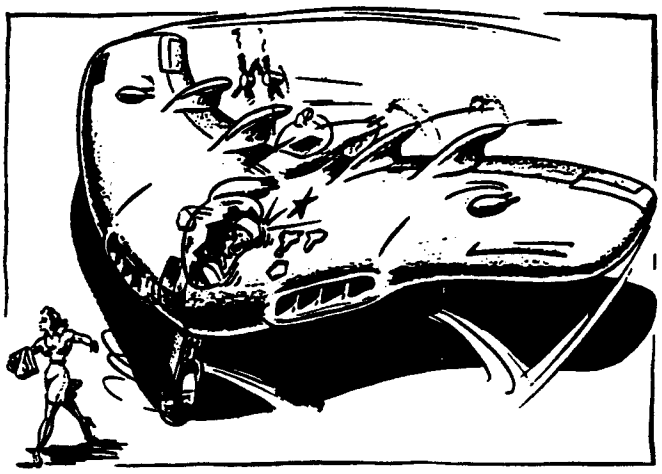
Too much detail — drop at 1000 rpm" is enough

(Continued next page)

(2) Turn the airplane gently with the nose wheel. It is not necessary to use the brakes to make a turn.

(3) If the airplane gains excessive speed while taxiing, bring it almost to a stop by pulling the parking brake handle out. Use of the parking brake meters pressure evenly to both brakes so that the airplane may more readily be stopped in a straight line.

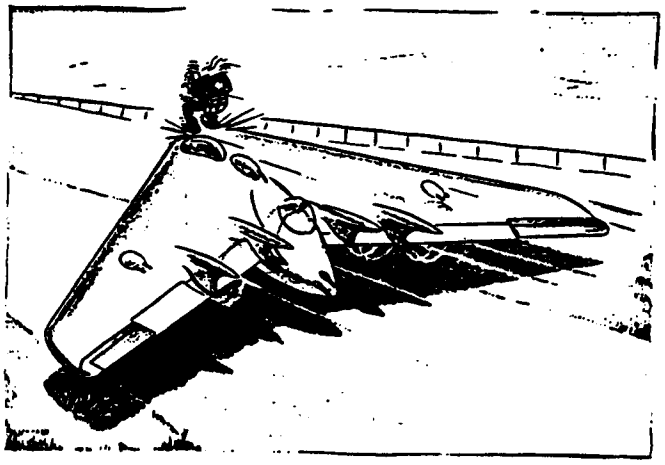
d. TAXIING IN A CROSS-WIND.- This airplane does not have vertical surfaces, therefore, it taxis easily in a cross-wind. Use the steerable nose wheel and hold the up-wind wing down.



"Turn airplane gently."

11. BEFORE TAKE-OFF.

Pilot	Copilot	Engineer
a. Call engineer for full power check.		
	b. Slot door lights- On.	b. TURBO BOOST- Dial "8."
	c. Landing flap indicator- Flaps up.	c. Advance throttles one at a time, full open, to check manifold pressure and rpm. Engine tachometers should read 2700 rpm and the manifold pressure should be 51 in. Hg.
		d. After check, return throttles to 1000 rpm and leave the turbo boost on "8" for take-off.
		e. Check fuel pressure for each engine- 17 psi.
		f. MAIN ENGINE VALVES- "TANK AND MANIFOLD."
		g. Hold cylinder head temperature to a minimum before take-off.
		h. Notify pilot, "Check complete and OK."



Do not be alarmed at the nose-high attitude on take-off.

12. TAKE-OFF.

a. NORMAL TAKE-OFF.

(1) Roll onto the runway from the engine run-up point without stopping. "Walk" the throttles forward as rapidly as possible while maintaining directional control with the steerable nose wheel until rudder control is gained. Directional control is maintained first with the nose wheel, then with the rudders. Do not use the brakes except in an emergency.

NOTE

It is not necessary to hold pressure on the control column because hydraulic pressure will hold the elevons in position.

(Continued from preceding page)

(3) Check the magnetos, calling out to the pilo' "Right, both, left, both. Normal magneto drop is 60 to 80 rpm. Maximum 100 rpm.

(4) If rpm drop is excessive, run the engine up to full power, then return to 2000 at 30 in. Hg. and recheck the magnetos.

CAUTION

Do not use "AUTO-LEAN" mixture to assist in burning off fouled plugs.

j. After checking magnetos, increase propeller rpm until the limit light comes on. Then place the propeller limit switch on "CONSTANT SPEED."

k. See that all instruments are within limits and notify pilot, "Ready to taxi."

10. TAXIING INSTRUCTIONS.

a. PRIOR TO TAXIING.

Pilot	Copilot	Engineer
(1) Notify ground crew to remove the wheel chocks and stand clear.		
(2) Receive OK from ground crew. Allow time for ground crew to disconnect from interphone.		
(3) Rudder trim- Neutral.		
(4) Check with crew members.		(4) Turn "OFF" the ground crew interphone switch. (See Section I, figure 24.)

b. PRECAUTIONS.

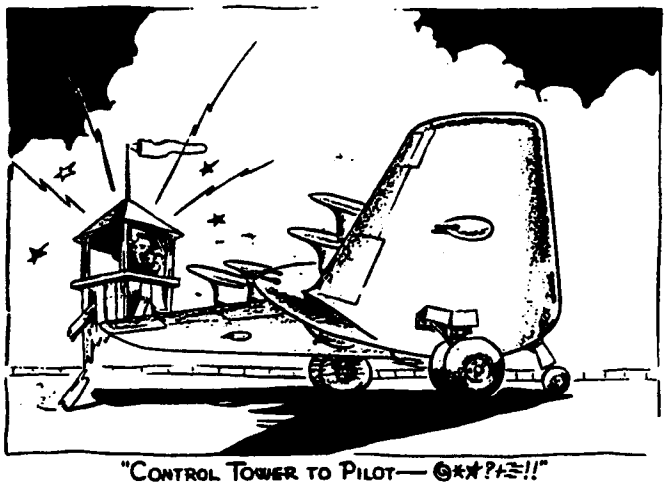
(1) Do not engage a brake switch while the rudder pedals are depressed.

(2) Avoid sudden turns.

(3) Don't taxi fast.

c. USE OF NOSE WHEEL STEERING BRAKES.

(1) Squeezing the trigger switch on the parking brake handle and then turning the handle to one side or the other causes the nose wheel to follow the same proportional movement of the handle. When this switch is held, it also allows either pilot to apply the brakes without the necessity of holding the switch on either control wheel.



"CONTROL TOWER TO PILOT— @**?+=!!"

"Watch your wing tips."

13. CLIMB.

a. TEMPERATURES.- The engineer should not allow the cylinder head temperatures to exceed 232°C or the carburetor air temperature to exceed 38°C. The maximum oil-inlet temperature during a climb is 98°C.

b. NORMAL CLIMB.- Normal climbs are made with rated power settings. If the cylinder head temperatures run high, and it is not possible for the engineer to lower them by holding the control switches in the "COOLER" positions, increase the airspeed.

c. OBSTACLE CLIMB.- Clearing obstacles on the climb-out after take-off should be made at approximately 20 mph IAS above the take-off speed to avoid control difficulties. Raise the gear as soon as possible and keep a constant check of cylinder head and oil temperatures.

14. DURING FLIGHT.

a. See the Flight Operation Instruction Charts and Power Plant Chart, Appendix I, for airplane performance due to changes in gross weight and engine operating data.

b. CHANGING POWER CONDITIONS IN FLIGHT.- Operation is conventional.

c. CHARACTERISTICS OF WING SLOT DOORS.- As the wing slot doors close, the airplane will nose down abruptly then will return to the original trim condition.

d. PROPELLER OPERATION.

PILOT'S NOTES

(1) FEATHERING.

Pilot	Copilot	Engineer
(a) Notify engineer- "Feathering No.____ propeller."		
(b) Close throttle of affected engine.		
(c) Press propeller feathering button. Do not hold button down. It will pop out when propeller is fully feathered.		
		(d) Mixture control- "IDLE CUT-OFF."
		(e) EMERGENCY FUEL AND OIL SHUT-OFF CONTROL- "OFF."
		(f) MAIN TANK PUMP- "OFF."
		(g) CYLINDER HEAD TEMPERATURE SWITCH- Hold to "WARMER" position to close cooling flap.
		(h) IGNITION- "OFF" when propeller stops turning.

(Continued next page)

(2) During the take-off, the copilot should call airspeeds to the pilot so that the pilot may devote all of his attention to the runway.

(3) When the pilot releases the throttles to take over the control column, the copilot will hold the throttles to prevent creeping and to make minor throttle adjustments.

(4) Take-off speed varies with the gross weight of the airplane. Do not attempt to take-off with less than 51 in. Hg. and 2700 rpm.

(5) When flying speed is gained, apply gentle back pressure to the control column. Do not be alarmed by the apparent excessive nose-high attitude of the airplane as it leaves the ground.

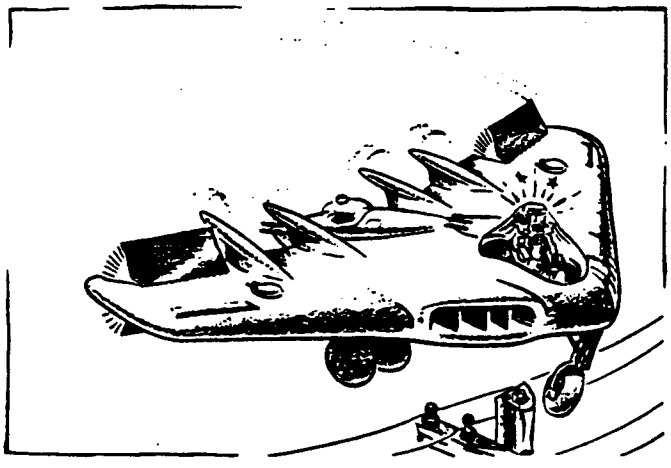
(6) As soon as the airplane is airborne, the pilot will pull the parking brake handle out momentarily to brake the wheels and then signal the copilot to raise the landing gear.

WARNING

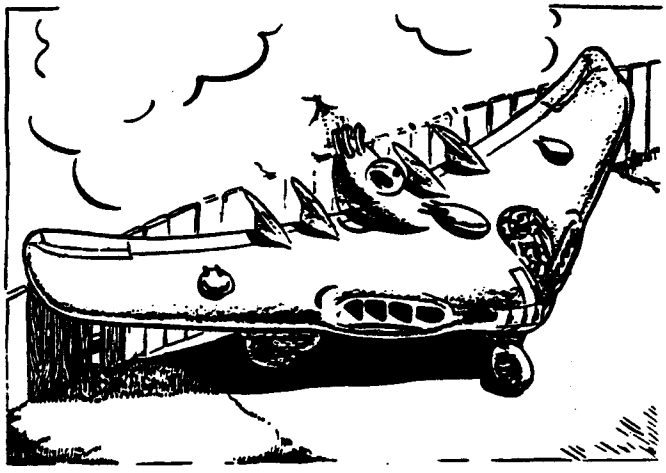
Do not attempt to brake the wheels by using the rudder pedals. Using the rudder pedals will operate the rudders as well as the brakes. Be sure that the parking brake is released after using.

(7) As soon as a safe altitude and airspeed have been reached and all obstacles cleared, reduce the manifold pressure slowly. Then reduce to rated power for the climb. Always reduce manifold pressure first, then the rpm.

(8) Place the SLOT DOORS control switch on "AUTOMATIC."



"Don't use rudder pedals to brake wheels on take-off."



"Minimum run take-off."

b. MINIMUM RUN TAKE-OFF.

(1) Start the take-off as close to the end of the runway as possible.

(2) Run the engines to full take-off manifold pressure, 51 in. Hg. against the brakes.

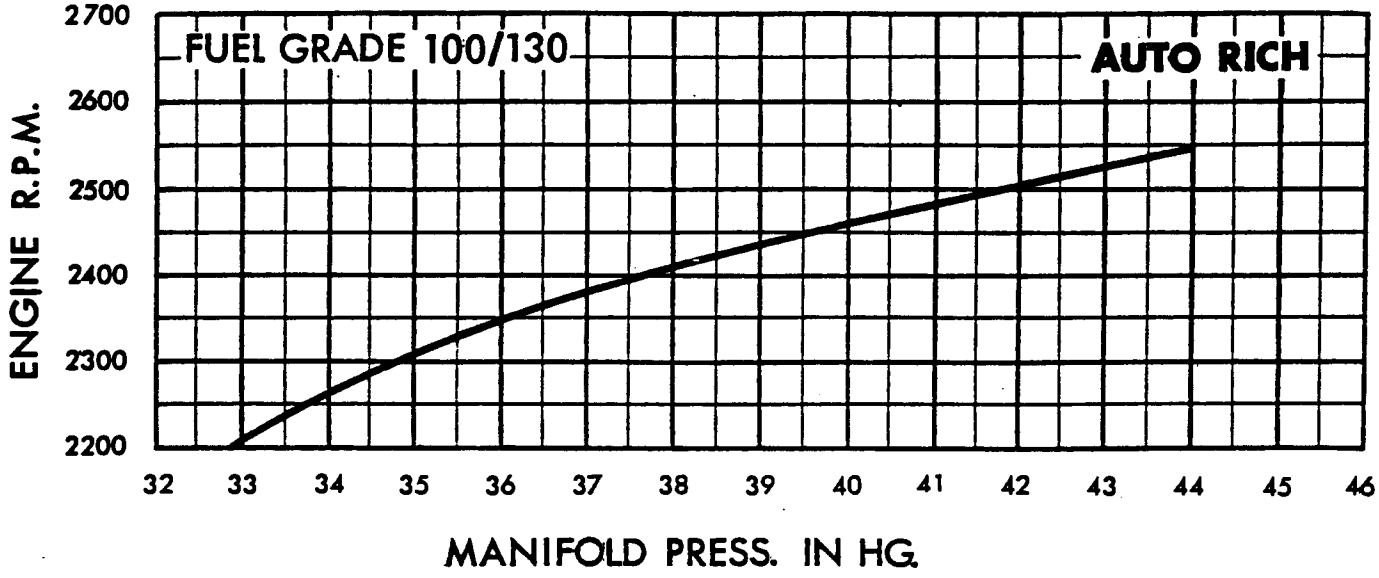
(3) Be sure that the nose wheel is centered, then release the brakes and start the run, holding the nose wheel on the ground while picking up speed.

(4) Pull the nose wheel up and take-off as soon as flying speed is attained.

(5) Retract the landing gear and level off to pick up airspeed before climbing.

c. ENGINE FAILURE DURING TAKE-OFF.- See Section III, paragraph 3. a.

PILOT'S NOTES



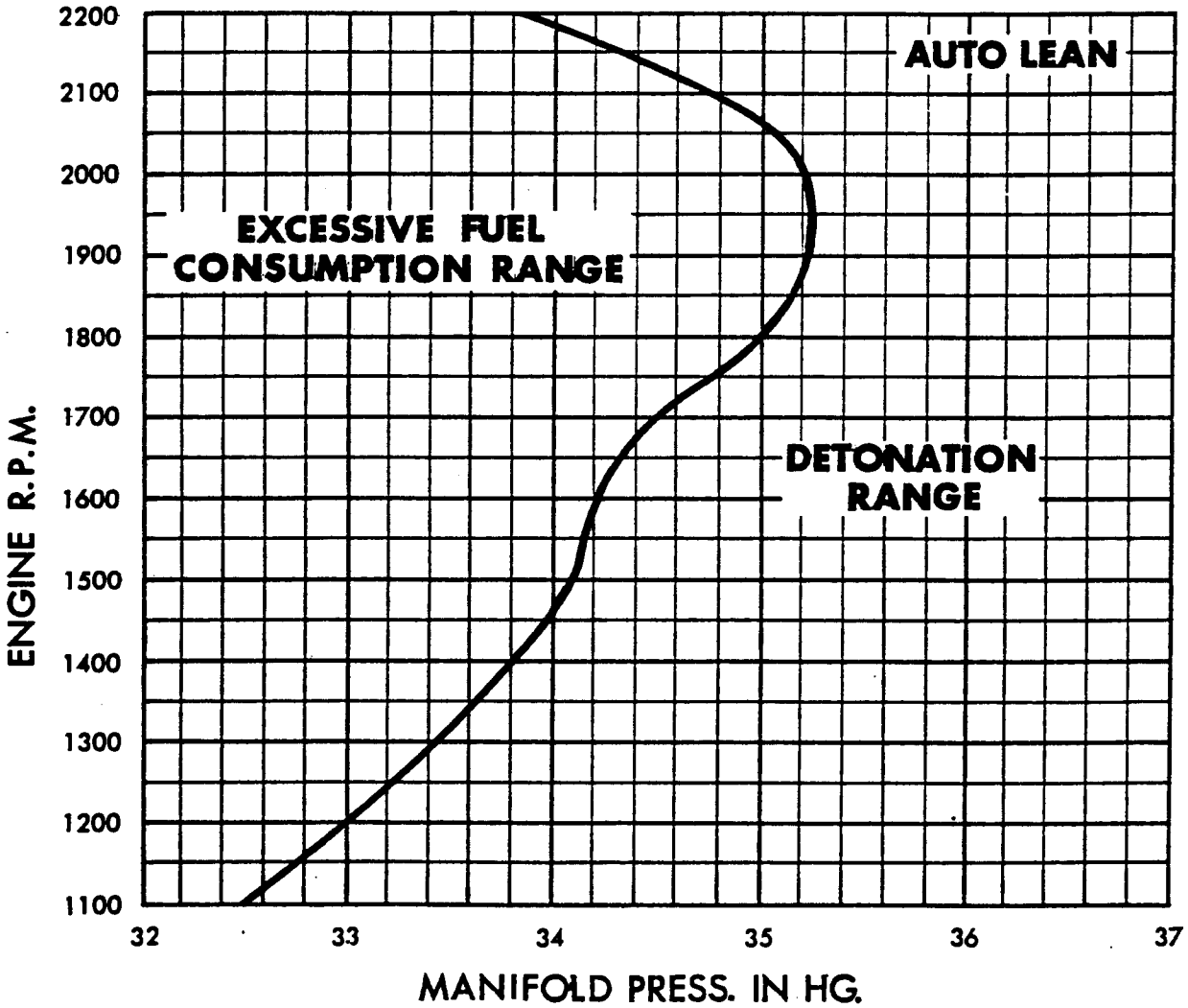


Figure 4. Optimum Engine Operating Range

(Continued from preceding page)

(2) UNFEATHERING.

Pilot	Copilot	Engineer
(a) Check with engineer before unfeathering.		
(b) Hold the feathering button out until the tachometer indicates that the propeller is windmilling. Then release button.		(b) CYLINDER HEAD TEMPERATURE SWITCH- Hold to "COOLER" position to open cooling flap.
		(c) EMERGENCY FUEL AND OIL SHUT-OFF CONTROL- "ON."
		(d) When the propeller moves from the feathered range and begins to windmill, hold the PROPELLER PITCH LIMIT SWITCH to "DECR. RPM" until the limit light comes on.
		(e) MIXTURE CONTROL- "IDLE CUT-OFF."
		(f) THROTTLE- Open to starting position.
		(g) IGNITION- On "BOTH."
		(h) MAIN TANK PUMP- "ON."
		(i) When propeller reaches at least 600 rpm and not more than 1000 rpm, move MIXTURE CONTROL to "AUTO RICH."
		(j) Warm the oil to 40° C at 1000 rpm.
		(k) Establish proper cylinder head temperature, then advance the rpm and throttle.

e. FLIGHT CONTROLS.- The hydraulic boost system, controlling the rudders, elevons, and wing slot doors, has been designed for maximum operation of the control surfaces at engine speeds of 1800 rpm. Engine speeds much below this or an inoperative engine will lower the hydraulic fluid volume, resulting in somewhat slower control surface response. At low IAS lateral and longitudinal control is adequate, but directional control may be difficult. To correct for yaw at low IAS use differential power on the outboard engines in conjunction with the rudders.

f. TURBOSUPERCHARGER CHARACTERISTICS.- Two phenomena occur with turbine operation, which may cause those unfamiliar with them some concern:

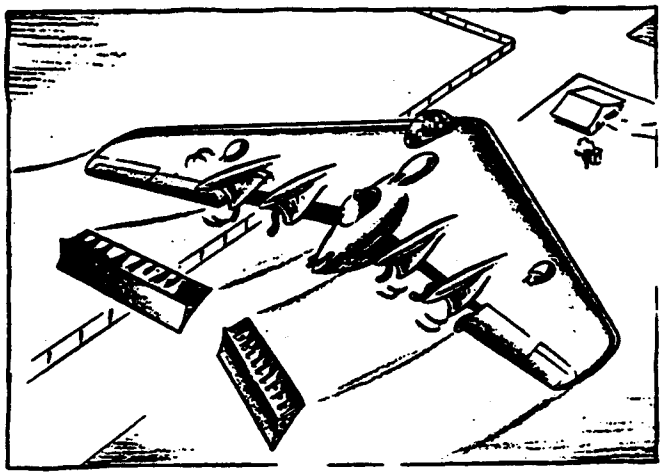
(1) One is turbine collapse. This may occur at intermediate altitudes when power is decreased by reducing engine speed while holding a relatively high manifold pressure. If the wastegate is nearly closed, a point may be reached where there is an insufficient quantity of exhaust gas to maintain the turbine speed required to hold the manifold pressure. This results in reduced turbine speed with a reduction in manifold pressure, which further reduces engine power so that a slow "collapse" of the power system occurs. This phenomenon may be recognized by a gradual lowering of the manifold pressure with no change in throttle setting. In order to prevent complete collapse and stopping of the engine, the engine speed should be increased and the ENGINE TURBO SELECTOR switches placed on "SINGLE." If necessary, further reduction of manifold pressure may be made by decreasing the setting of the TURBO BOOST SELECTOR dial.

(2) Pulsation is the second phenomenon. It is more likely to occur than "collapse," and is a characteristic of highly supercharged engine installations, operating at high altitudes. It is caused by the stalling of the compressor-impeller and diffuser blades. It occurs when power is reduced while holding a relatively high manifold pressure, thereby creating a condition where the engine cannot use all the air the

). NIGHT FLYING.

a. TAKE-OFF.- Take-off in a normal manner and immediately afterwards hold the airplane level to build up airspeed, then resume climbing at rated powers.

b. LANDING APPROACH.- Make the landing approach with the turbo dial set on "8." It is also recommended that the landing gear not be fully lowered until the airplane is lined up with the runway. In this manner the airplane will be more easily controlled if the necessity of a go-around arises.



"Don't lower landing flaps above 160 mph IAS."

20. LANDING APPROACH. (See figure 6.)

a. ENGINE AND FLIGHT CONTROL SETTINGS.

Pilot	Copilot	Engineer
(1) Rudder trim- Neutral.	(1) WING SLOT DOORS- "OPEN."	(1) MAIN ENGINE VALVES- "TANK AND MANIFOLD."
		(2) MIXTURE CONTROL- "AUTO RICH."
(3) At 175 mph IAS signal copilot to extend the gear. Extend the gear at a point in the traffic pattern that will place the gear in the down and locked position when opposite the center of the runway on the down-wind leg. Approximately 50 seconds are required for full extension of the gear at 175 mph.		(3) TURBO BOOST SELECTOR- Dial "8."
	(4) Lower the gear on the pilot's signal and inform him when it is down and locked.	(4) PROPELLER AND LIMIT SWITCHES- "CONSTANT SPEED."
(5) Continue the approach at 160 mph and signal the copilot to lower the landing flaps one-half (15°) on th base leg.		
	(6) On the pilot's signal lower the flaps one-half. Return the control switch to the "OFF" position.	(6) STEERING AND BRAKE HYDRAULIC PRESSURE- 3000 psi.
(7) On the final approach, signal the copilot to lower the landing flaps to 30°. As the flaps are being lowered, retrim the airplane to a nose-up condition as necessary. Nose-up trim depends upon the gross weight and center of gravity of the airplane.		
	(8) Lower the landing flaps to 30°. Return the switch to the "OFF" position.	

(Continued next page)

supercharger attempts to pump. Pulsation can be identified by violent fluctuations of the manifold pressure and intermittent misfiring. It is not harmful to the engine, but if the manifold pressure reaches too low a value, the engine may quit. The remedy is the same as for turbine collapse- increase the rpm and operate on "SINGLE" turbo.

(3) Since it is generally more economical to operate at reduced power by operating at the lowest possible rpm and the highest allowable manifold pressure, it is important, where economy is desired, to operate as close to the pulsation limits (where they are limiting factors) as possible. Figure 4 is a curve of the approximate rpm vs. altitude where pulsation or collapse may occur.

PILOT'S NOTES

15. STALLS.

a. STALLING SPEEDS.- Stall speeds vary depending on the gross weight and C.G. of the airplane. (See figure 5.) A stall with a rearward center of gravity is more violent with a tendency for the airplane to drop off into a spin. An airspeed of at least 15 mph IAS above the stall speed should be maintained at all times.

b. STALL WARNING.- No stall warning is felt in the form of control force reversal. This is due to the fact that the elevons are power operated. A stall may be defined as that point where the gyro-horizon indicates an uncontrolled sharp drop of the nose or a rapid drop of one wing. (See paragraph 14. c., this section.)

c. RECOVERY.- The airplane has a tendency to spin from a stall with uneven power settings or a rearward center of gravity. Recovery from a stall is made by dropping the nose and using rudder and elevon control to prevent roll.

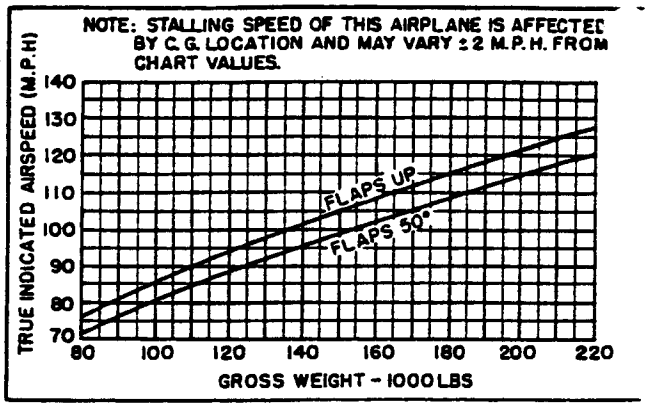


Figure 5. Stall Speed Chart

16. SPINS.- Intentional spins are prohibited in this airplane.

a. SPIN CHARACTERISTICS.- There is no tendency for the airplane to spin inadvertently in either the cruising or landing attitude. A roll from a stall may develop into a spin, particularly with a rearward center of gravity. A spin will be very steep with some oscillation and the airplane will lose approximately 1800 feet per turn.

b. RECOVERY.- Recovery from a spin may be affected in approximately 2½ turns by moving the control column forward and reversing the wheel, leaving the rudder with the spin.

NOTE

Rudder reversal retards recovery. The rudder should be left with the spin.

17. ACROBATICS.- Acrobatics are prohibited in the XB-35 airplane.

18. DIVING.- The pilot's airspeed indicator and altimeter are placarded with the maximum airspeeds vs. altitude. Engine rpm is limited to 3060 for 30 seconds. Avoid abrupt pullouts at high speeds.

PILOT'S NOTES

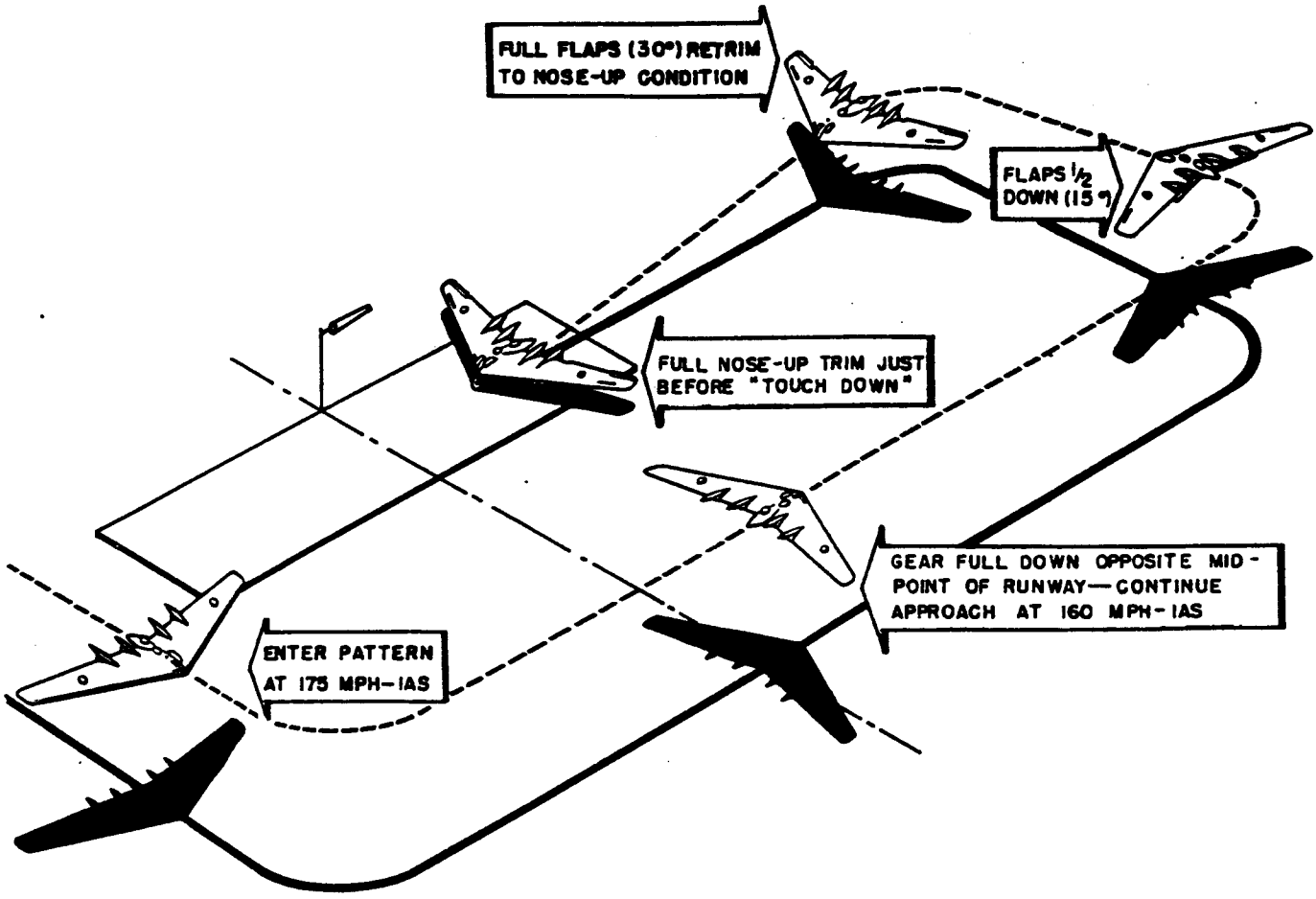


Figure 6. Traffic Pattern

b. CROSS-WIND LANDING.- Cross-wind landings may be made safely with this airplane. The lack of vertical surfaces reduces drift to a minimum. Make a fairly long approach, keeping the up-wind wing down while lining up with the runway. Just before the touchdown, level the airplane by applying a little power to the outboard engine on the up-wind side. Hold the up-wind wing down during the landing roll.

c. TAKE-OFF IF LANDING IS NOT COMPLETED.

(1) Apply power, raise the landing flaps immediately, and retrim the airplane.

NOTE

The airplane will be trimmed nose high for landing, so it must be retrimmed as power is applied.

(2) Move the propeller control to full "INCR. RPM."

(3) Raise the landing gear as soon as is apparent that the runway will not be touched.

(4) Do not attempt to climb until the flaps are up and a safe flying speed is reached.

22. STOPPING THE ENGINES.

a. NORMAL STOPS.

(1) Hold the CYLINDER HEAD TEMPERATURE switch to the "COOLER" position to open the air exit flaps.

(2) If the cylinder head temperatures are high, operate the engines at 800-1000 rpm allowing them to cool to 177°C.

(3) Before the shut-down, run the turbos up to at least 3000 rpm for two minutes. This is to clear out oil accumulations.

(4) Advance the throttles to 1200 rpm and run each engine for at least 30 seconds at this speed.

(5) Move the mixture control to "IDLE CUT-OFF." Be sure to leave the control in this position.

(6) Close the throttles.

(7) Stop the auxiliary power units by operating them at "IDLE SPEED" for 30 seconds, then cutting the ignition switches.

(Continued from preceding page)

(9) Set propeller rpm to 2300 on base leg. After turning from base leg to the final approach at 160 mph gradually reduce airspeed until 120 mph is indicated "over the fence."

PILOT'S NOTES

21. LANDING.

a. NORMAL

Pilot	Copilot	Engineer
(1) As the landing roll is started, reverse the propellers. Then as the propeller blade angle passes dead center, open the throttles to 2550 rpm. As speed decreases, maintain 2550 rpm by retarding the throttles.		
NOTE As the propellers are reversed, hold the control column forward to keep the nose wheel on the ground.		
(2) At 60 mph IAS apply the parking brakes.		
(3) Unreverse the propellers at approximately 1500 rpm.	(3) Raise the landing flaps.	

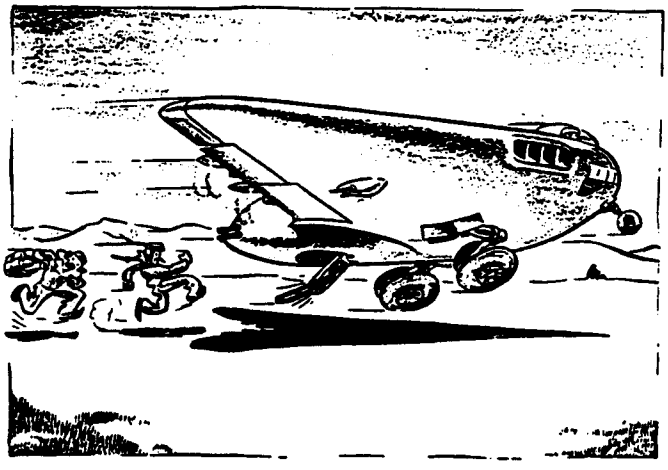
PILOT'S NOTES

b. COLD WEATHER STOPS.- Until cold weather data has been compiled from tests, use oil dilution according to experience. Use oil dilution at the time the engines are run up to 1200 rpm before moving the mixture control to "IDLE CUT-OFF."

23. BEFORE LEAVING THE AIRPLANE.

Pilot	Copilot	Engineer
(a) Set parking brakes.	(a) Radios- Off.	(a) BATTERY SWITCH- "OFF."
CAUTION Do not set the brakes if they are hot.		
(b) See that the wheels are chocked.		(b) Report any malfunctions to crew chief.

PILOT'S NOTES



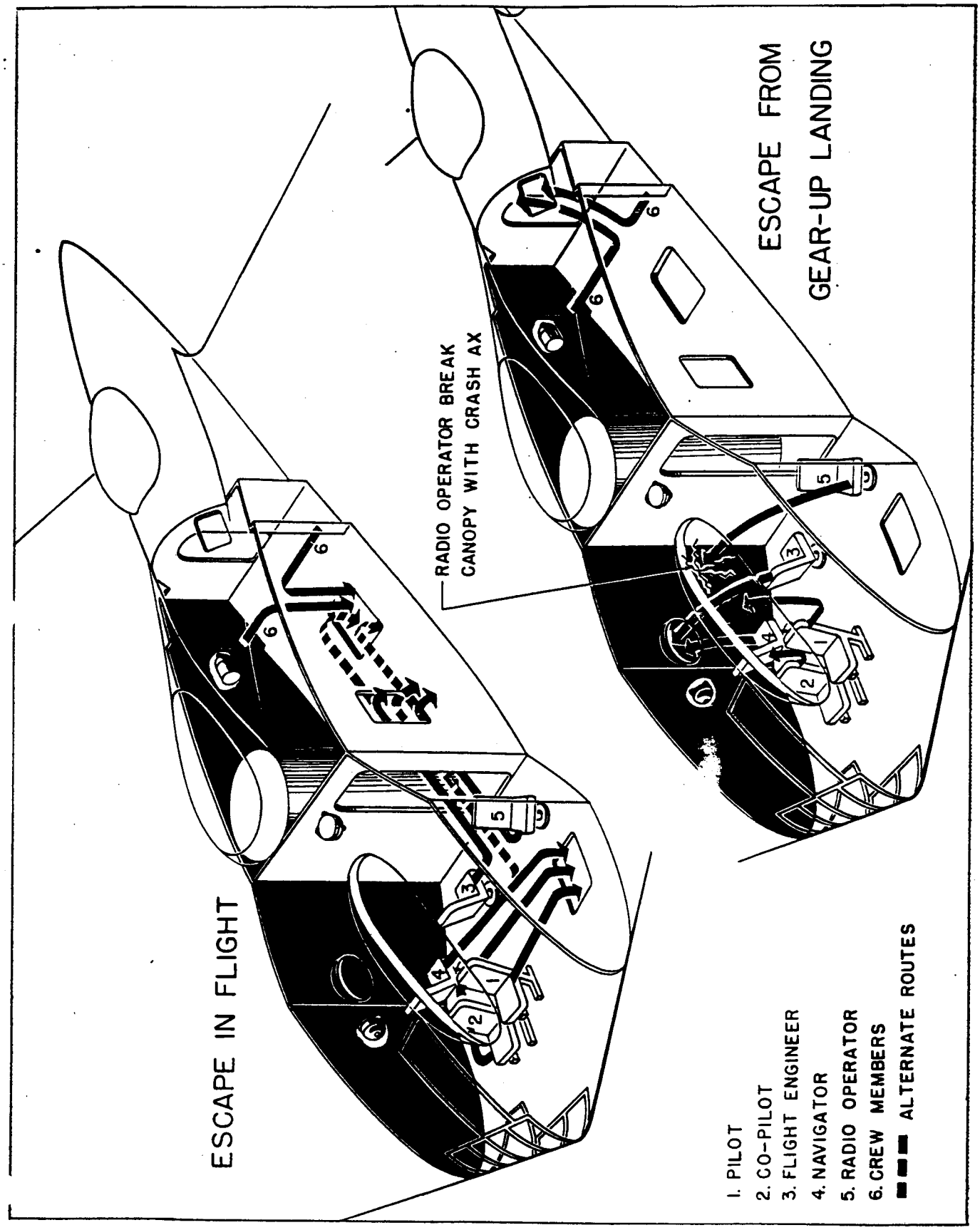


Figure 1. Emergency Crew Exits

SECTION III

EMERGENCY OPERATING INSTRUCTIONS

1. EMERGENCY ESCAPE. (See figure 1.)

a. GENERAL.- The escape hatches are plainly stenciled with instructions for releasing.

b. DURING FLIGHT.- Exit should never be made from the top of the airplane during flight. The pusher type propellers would be difficult to avoid.

Pilot	Copilot	Crew Members
(1) Have copilot give bailout preparation signal.		
	(2) Three short rings on alarm bell.	
		(3) Prepare for bailout.
(4) Assign a member of the crew to open No. 4 bomb bay door and escape hatch.		
(5) Notify the radio operator to open the hatch just forward of his station.		(5) Appointed crew member- Trip the switch at the forward edge of the bomb bay escape hatch. Allow 10 seconds, then open the hatch.
		(6) Radio operator- Release the hatch as directed.
(7) If it is necessary to abandon the airplane, have the copilot turn "ON" the alarm bell switch and instruct crew to bailout.		
	(8) Turn "ON" the alarm bell switch.	
		(9) Upon the bailout signa (continuous ringing of bell) bailout as instructed by the pilot.

c. AUXILIARY POWER UNIT FIRE. (Engineer)- If an A.P.U. fire detector light should indicate a fire, proceed as follows:

(1) Notify the Pilot.

(2) Move the PARALLEL-NON-PARALLEL switch to the NON-PARALLEL position. This switch is on the A.P.U. Control Panel.

(3) IGNITION.- "OFF" for the affected unit.

(4) DISCHARGE SWITCH.- Hold switch in direction of lighted lamp for six seconds.

(5) Do not restart the affected unit.

d. WING FIRE.- In the event of a wing fire beyond the reach of the engine section fire extinguisher system, see Section I, figure 27, attempt to put the fire out by sideslipping the airplane.

e. CABIN FIRE.- If a fire occurs in the cabin, turn the CABIN AIR VALVE switches to "CLOSED" and the CABIN TEMPERATURE switches "OFF." Use a hand operated fire extinguisher immediately.

3. ENGINE FAILURE.

a. ON TAKE-OFF.

(1) BEFORE LEAVING THE GROUND.- In the event of an engine failure during the take-off run, don't take-off unless sufficient flying speed has been reached so that all obstacles can be cleared. If flying speed has not reached or obstacles cannot be cleared, reverse the propellers and apply maximum brakes without skidding the tires.

NOTE

The landing gear cannot be retracted as long as the weight of the airplane is on the gear.

(2) AFTER LEAVING THE GROUND.- If an engine should fail on the take-off, retract the gear as soon as the airplane is airborne. Balance eccentric thrust with the rudders, momentarily, then allow the airplane to yaw up to 10°, while reducing rudder deflection. This procedure will give minimum drag. Level off to pick up airspeed and feather the propeller of the affected engine. (See Section II, paragraph 14. d.)

b. DURING FLIGHT.- Refer to the Flight Operating Instruction Charts in Appendix I. At high gross weights, trim the airplane as conditions require and increase the power on the remaining engines to increase the airspeed.

4. EMERGENCY ELEVON OPERATION.- If for any reason the elevons should fail to respond to normal control, check the hydraulic pressure of the power boost system. Engage the emergency electrical system by turning "ON" the switch located on the pilot's pedestal. (See Section I, figure 7, Item 1.)

5. EMERGENCY BOMB SALVO.- Bombs may be released in salvo from the bombardier's control panel or by tripping the switch at either the pilot's station or at the aft side of the escape hatch which opens into number 4 bomb bay. At any time a salvo switch is operated, an indicator light on the bombardier's panel and one next to each salvo switch will light. Another switch and light is located at the forward side of the escape hatch which will open number 4 bomb bay door and salvo bombs in that bay only.

6. EMERGENCY LANDING FLAP OPERATION.- Failure of the landing flaps to operate can be from two causes: first, the flaps may have overrun the electrical limit and second, one actuating motor may have failed. In either case, operation is as follows:

a. FLAP OVERRUN.- Ascertain the direction of overtravel and then place the control switch in the opposite direction. Reset the flap power unit by pulling the reset handle. Instructions are marked on the flap power unit.

b. ACTUATING MOTOR FAILURE.- Ascertain which actuating motor is faulty and turn "OFF" the individual switch for that motor. The two individual switches are located on the flap power unit and instructions for use are marked on the power unit.

7. EMERGENCY LANDING GEAR OPERATION.- To lower the landing gear, turn the ratchet stop, see Section I, figure 8, to "DOWN" and operate the handle through five complete 90° movements. Observe the landing gear indicator lights on the instrument panel to see that the gear engages the down locks. Do not operate the emergency release above 140 mph IAS.

8. EMERGENCY BRAKE OPERATION.- If the nose wheel steering and brake hydraulic system should fail, the emergency air brake can be used to stop the airplane by pulling down on the control handles. (See Section I, figure 11.)

9. LANDING WITH THE WHEELS RETRACTED.

a. If the airplane is carrying bombs, drop them in a "safe" condition over an unpopulated area.

b. Prepare the crew for a crash landing.

c. Have the astro dome and the upper escape hatch opened.

d. Notify the radio operator to be ready with the crash ax should it be necessary to break the canopy for exit after landing.

e. Have all oxygen regulators turned to "100% OXYGEN" to release oxygen.

f. If practicable, circle the landing field to use up excess fuel.

g. Hold power on until the airplane has reached landing attitude just above stalling speed with the landing flaps down.

c. ON THE GROUND.- If time and conditions do not permit the use of the astro dome and upper escape hatch for exit, the crash ax at the radio operator's station may be used to break the pilot's canopy.

2. FIRE.

a. BLOWER SECTION FIRE.- A fire in a blower section during the starting procedure may be extinguished by having the ground crew release Co_2 to the affected blower section.

b. ENGINE SECTION FIRE.

Pilot	Copilot	Engineer
		(1) Notify the pilot.
(2) Have the necessary emergency exits opened in case it becomes necessary to abandon the airplane.		
(3) Feather propeller of affected engine.	(3) Lower the landing gear.	(3) Close the EMERGENCY FUEL AND OIL SHUT-OFF VALVES.
		(4) CYLINDER HEAD TEMP. SWITCH- Hold to "WARMER."
		(5) MIXTURE CONTROL- "IDLE CUT-OFF."
		(6) THROTTLE- Closed.
		(7) IGNITION- "OFF."
		(8) Fire extinguisher selector switch- Set to zone indicated by lighted lamp.
		(9) DISCHARGE SWITCH- Hold to "1st FIRE" for six seconds.
		(10) When the fire is out, the light will go out. If the light should remain on, hold DISCHARGE SWITCH to "2nd FIRE" for 6 seconds.
		NOTE
		The "2nd FIRE" position of the DISCHARGE SWITCH may be used for the same zone or it may be directed to another zone.
		(11) Do not start the engine in the affected zone again.
		WARNING
		If a third fire occurs, abandon the airplane.

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h. Alert the crew and at the moment preceding the "touch down" have the engineer cut the ignitions for the A.P.U's, and at the same time pull the EMERGENCY STOP ALL ENGINES switch. (See Section I, figure 7, Item 16.)

i. After the airplane has come to rest, leave it immediately. Make sure all crew members are out then get a safe distance away from the airplane.

10. LANDING IN WATER (DITCHING).- Information on ditching procedures has not been compiled at the time of this publication.

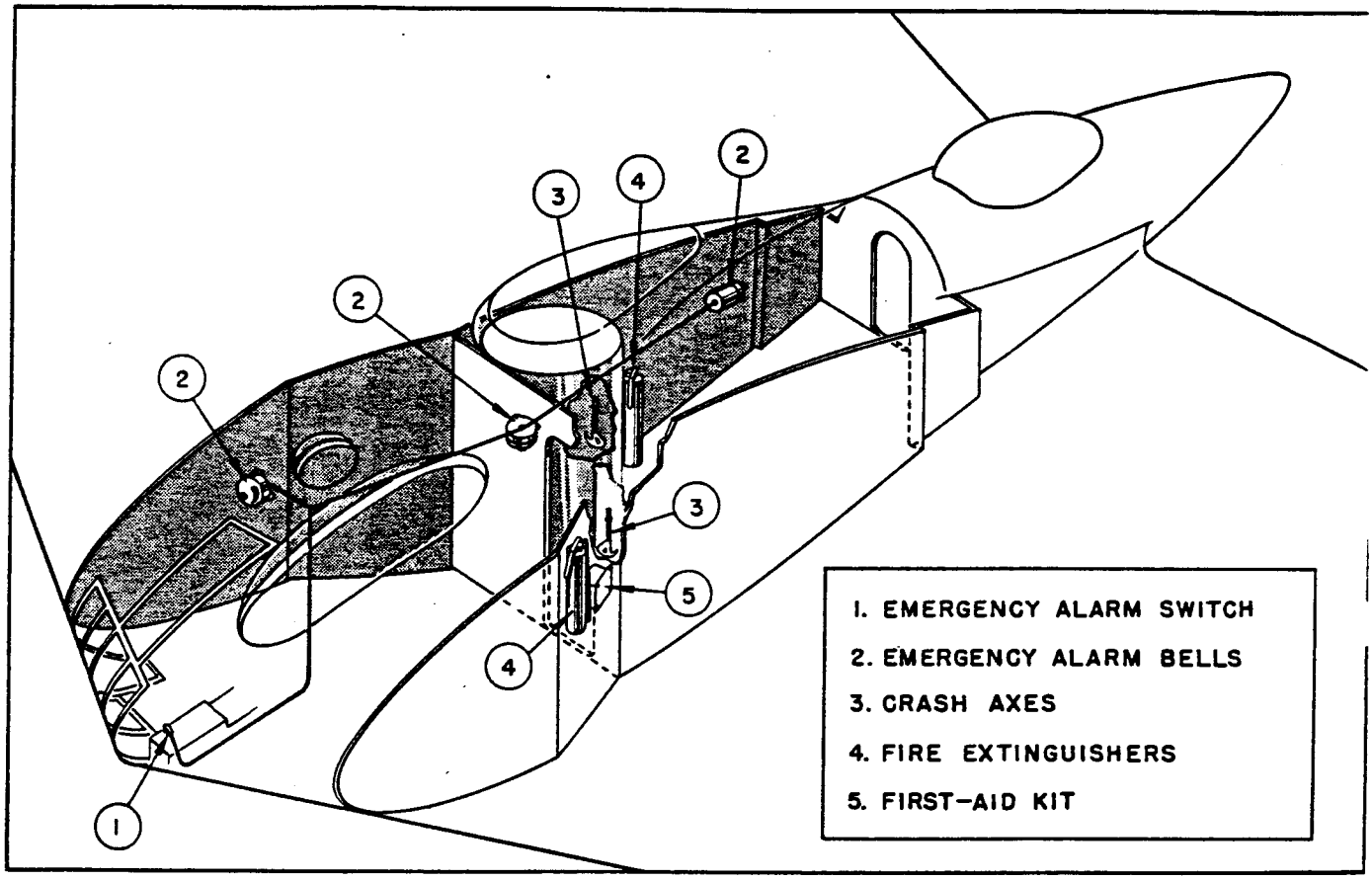


Figure 2. Crash Axes, Fire Extinguishers and First Aid Kits

PILOT'S NOTES

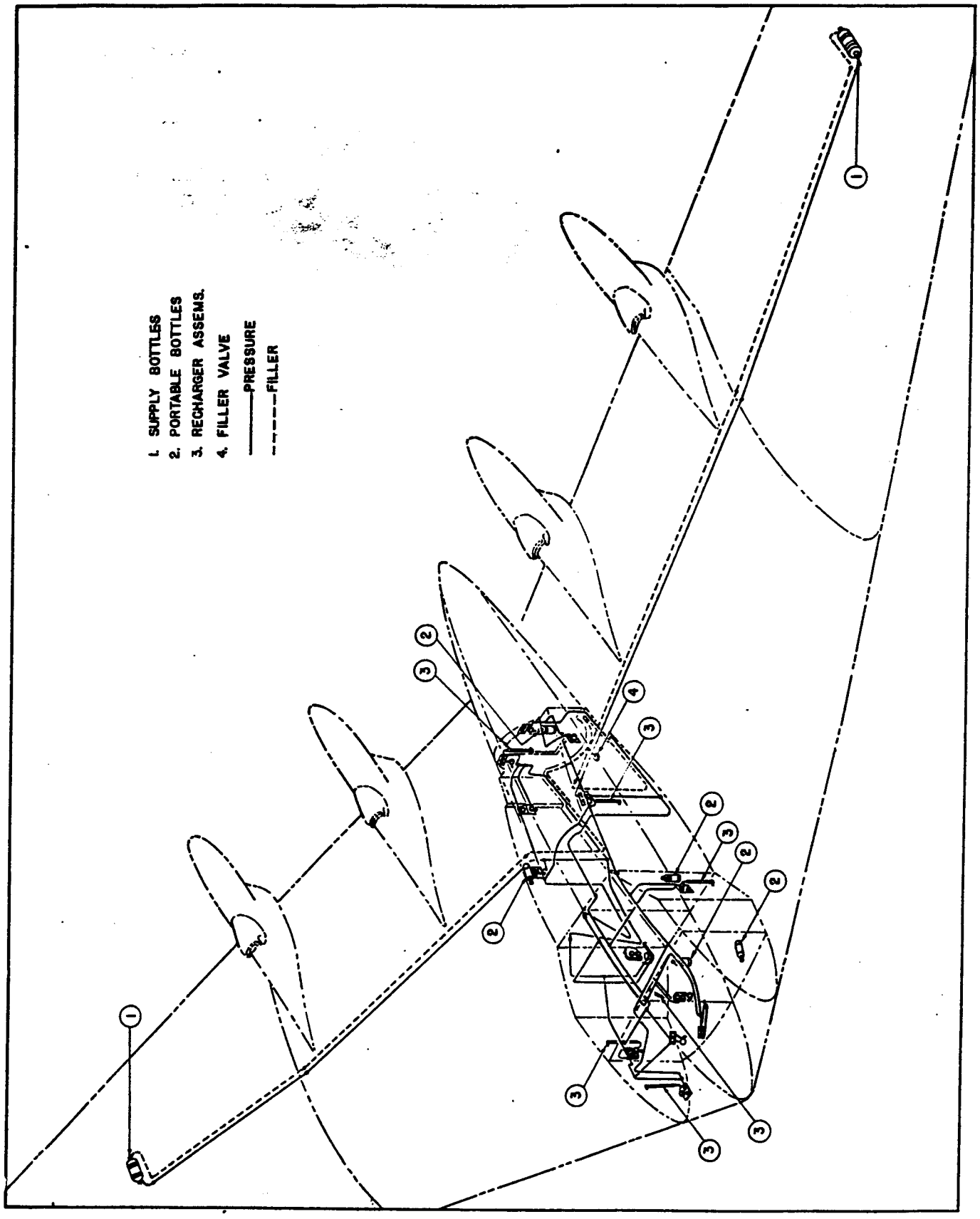
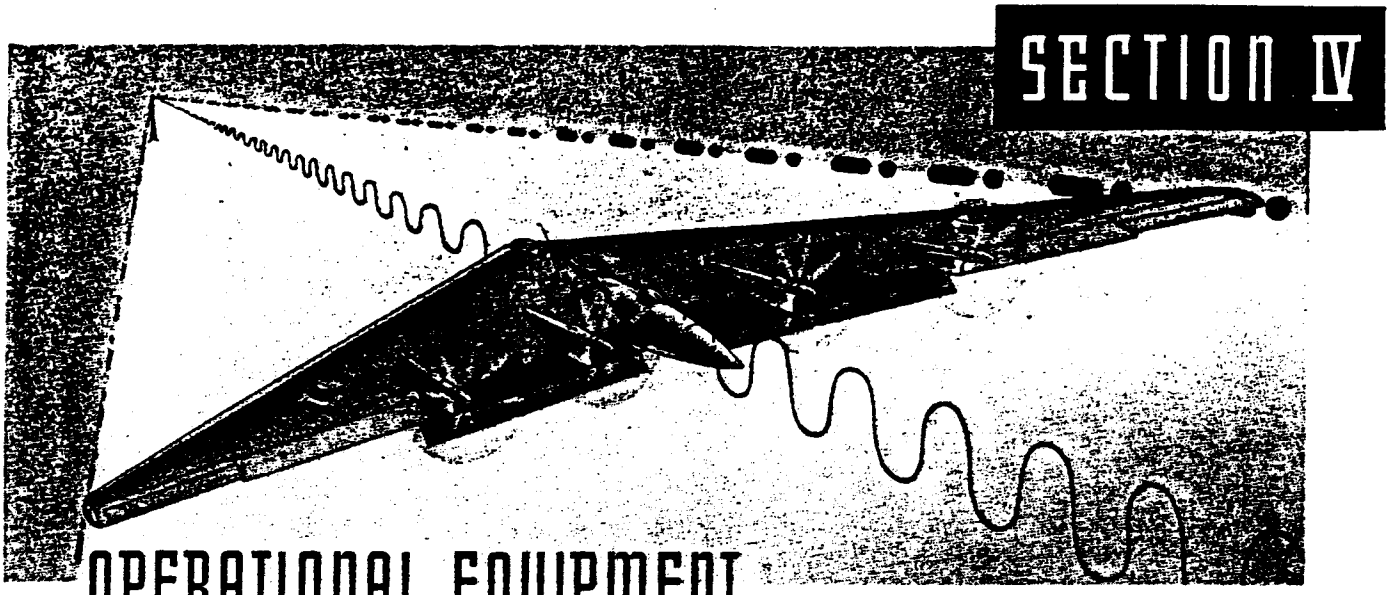


Figure 1. Oxygen System



SECTION IV

OPERATIONAL EQUIPMENT

1. OXYGEN SYSTEM.

a. GENERAL.- The airplane is equipped with a low pressure, demand-type, oxygen system, operating at a maximum working pressure of 425 psi. Thirteen oxygen regulators, flow indicators, and pressure gages are provided for crew members. In addition to the normal system, there are four portable oxygen bottles and six recharger hose assemblies in the airplane. (See figure 1.)

b. USE OF OXYGEN (UNPRESSURIZED CREW NACELLE).

(1) Use oxygen above 10,000 feet.

(2) At night use oxygen from the ground up, with auto-mix "ON."

(3) Above 10,000 feet, use portable oxygen bottles when moving about the airplane.

c. CHARGING PORTABLE OXYGEN BOTTLES.

(1) Remove the recharge hose assembly from its stowage clip. Hold the hose and move the lever to the right to remove the plug from the end.

(2) Slip the hose end over the filler neck on the portable bottle and allow the bottle to fill to system pressure.

(3) Remove the hose assembly from the bottle, replace the plug and stow the hose.

2. RADIO EQUIPMENT. (See figure 2, Radio Utility Chart.)

a. GENERAL.- The radio equipment installed in this airplane consists of the following sets: AN/AIC-2 interphone, SCR-274N command set, AN/ARN-7 radio compass, RC-193 marker beacon set, T-30 and T-17 microphones, and HS-33 headsets. Ten BC-1366 jack boxes are installed in the airplane, one at each crew station in the forward cabin and four in the aft cabin. Headset and microphone plugs are attached to each main gear strut for use of ground crew observers during ground operations. The pilot and copilot each have a filter switch box plugged into the headset circuit between an adapter and the jack box. (See figure 3.)

b. JACK BOXES.- The following positions are marked on the jack boxes:

(1) "COMMAND."- This position controls radio set SCR-274N for transmission and reception with ground stations or other aircraft.

(2) "COMP."- In the compass position, radio set AN/ARC-7 is used for listening to ground stations for navigational purposes.

(3) "INTER."- The interphone position is discussed in paragraph c. following.

(4) "CALL."- This position is spring-loaded momentary selection for connecting the pilot and crew members, regardless of the switch positions on the other jack boxes.

c. INTERPHONE.- An interphone amplifier is mounted on a shelf just forward of the radio operator's table. An "ON-OFF" switch and a GAIN CONTROL are installed on the face of the amplifier. Gain control settings are stenciled on the top of the amplifier.

RADIO UTILITY CHART

RADIO	USE	TYPE	PILOT	COPILOT	BOMBARDIER	NAVIGATOR	ENGINEER	4 CREW STATIONS	RADIO OPERATOR	LANDING GEAR
1. Interphone	Inter-airplane telephone communications - Reception of radio compass audible signals - Transmission and reception thru command radio equipment.	AN/AIC-2	LTFAS	LTFAS	LT	LT	LT	LT	LT	LT#S'
2. Command Radio	Short range, two way, voice or code, communication.	SCR-274-N	LTFSOKAAJ	LTFSOKAAJ	LTAJP	LTAJP	LTAJP	LTAJP	LTAJP	LT#S'P
3. Radio Compass	Reception of voice and code signals, bearings, and homing.	AN/ARN-7	LVSOAAJF	LVFSOAAJ	LAJ	LVFSOAAJ	LAJ	LAJ	LAJ	L#S'
4. Marker Beacon Radio	Reception of location marker signals on navigation beam.	RC-193A	V Sr	V Sr		Sr				

CODE

F- Filter Voice and Code
K- Send Code by Key
P- Send Code by Microphone (Press to Talk) Switch
L Listen (Jack Box Connection)
V Visual Reception
L' Listen (Jack Connection)
O Operate, Select Band, Tune, Complete Control
S Switch On or Off
S' Switch Control Engineer's Panel
T Talk
A Adjust Output Volume or Radio
AJ Adjust Volume With Jack Box Volume Control Knob
No Jack Box - Phone and Microphone Jacks Only

Figure 2. Radio Utility Chart

(1) OPERATION.

(a) TO LISTEN:- Place the jack box selector switch on the "INTER" position.

(b) TO TALK:- (Selector on "INTER.") The pilot and copilot press the microphone switch on their respective control wheels and other crew members actuate their "PRESS-TO-TALK" hand switches.

3. PILOTS' STATION.

a. COMMAND RADIO SCR-274N.- The command set is comprised of two transmitters and three receivers. A remote radio receiver control box and a transmitter control are situated on the pedestal between the pilot and copilot. (See figure 4.)

(1) OPERATION OF RECEIVERS.

(a) To turn on a receiver, place the "CW-OFF-MCW" switch on either "CW" or "MCW."

(b) Place the jack box switch on "COMMAND."

(c) Place the "A-B" switch on "A" for reception with one receiver.

(d) Adjust the tuning dial and the "INCREASE OUTPUT" knob for best reception.

(e) To turn a receiver off, move the "CW-OFF-MCW" switch to the "OFF" position.

(2) OPERATION OF TRANSMITTERS.

(a) To start a transmitter, turn the "TRANS. POWER" switch to the "ON" position. Allow a 15 second warm-up period before transmitting.

(b) Set the "TRANSMITTER SELECTION" switch to the desired transmitting frequency, indicated on the write-in plate.

(c) Set the emission switch to "TONE," "CW," or "VOICE" as required.

(d) If on "VOICE," hold the control wheel MICROPHONE switch, then speak clearly and distinctly.

(e) To turn the transmitter off, move the "TRANS. POWER" switch to the "OFF" position.

b. RADIO COMPASS AN/ARN-7.- The radio compass is used in navigation to take bearings on two or more radio stations to establish a fix, to home on (fly directly toward) any radio station, or simply to listen to any radio station in the frequency. Two radio compass control boxes are located in the airplane; one at the aft end of the pedestal between the pilot and copilot and the other is located on the cabin wall at the navigator's station. A radio compass indicator is located on the pilots' instrument panel and a master indicator is provided for the navigator. (See figure 7.) Two antennae are used with the radio compass; a loop antenna and a "sense" antenna, both of which are located on the underside of the crew nacelle.

(1) OPERATION OF THE RADIO COMPASS.

(a) Turn the jack box selector switch to "COMP." or plug the headset directly into the radio compass control box. The latter method disconnects the radio compass from the interphone system.

(b) To start the radio compass, turn the function switch to either "COMP." "ANT," or "LOOP." Then push the "CONTROL" button to operate the green light indicating control from that station.

(c) The function switch positions are used as follows:

1. "COMP."- This position is used for automatic direction finding. When the desired station is tuned in, the loop turns toward it automatically. The indicator pointer always points toward the radio station. For instance if the pointer is to the right of zero, the station is to the right of the heading of the aircraft. The A-N signal will also be heard in the earphones.

2. "ANT."- The antenna position is used to listen to signals from the non-directional "sense" antenna, such as radio range or standard broadcast signals. For best reception of these signals, set the interphone volume control to full "INCREASE OUTPUT" and adjust the volume of the signal with the "AUDIO" control on the radio compass control box.

3. "LOOP."- Direction bearings are obtained on the compass indicator at this position. Place the "CW-VOICE" switch on "CW" and use the "LOOP L-R" switch to rotate the loop for minimum headset volume and read the bearing indicated as shown by the tail end of the pointer.

NOTE

Bearings on "LOOP" and "ANT." are subject to 180 degrees ambiguity.

c. MARKER BEACON SET RC-193.- The marker beacon radio receiver is connected to the radio compass control box so that any time the radio compass is in operation, the marker beacon will be on. A marker beacon indicator light is located on the pilots' instrument panel.

d. INTERPHONE.- An interphone jack box, adapter, and filter switch box is located to the left of both pilots. Refer to paragraph 2. c. preceding.

e. OXYGEN.- An oxygen regulator is located on the cabin wall to the left of the pilot. The copilot's regulator is mounted on the side of the control pedestal. See paragraph 1.

f. SUIT HEATER CONTROL.- A suit heater control box, see 3, figure 5, is located to the left of the pilot on the cabin wall. The copilot's control box is secured to the airplane structure in back of his seat.

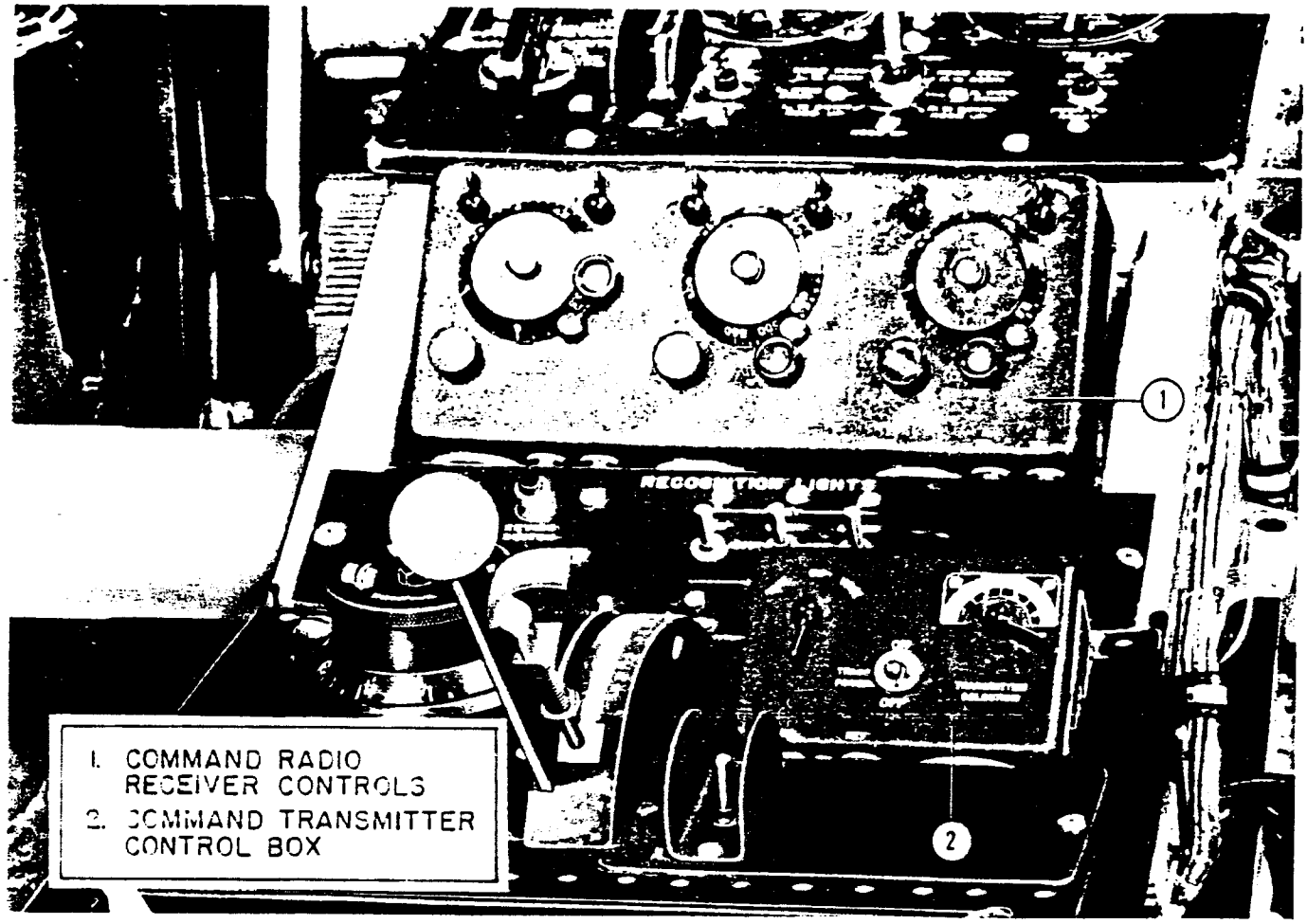


Figure 4. SCR-274N Radio Controls

c. INTERPHONE.- The interphone jack box is situated to the navigator's left. Refer to paragraph 2, c. in this section.

d. OXYGEN.- The navigator's oxygen controls are mounted on the cabin wall to the left of the radio compass control box. (See figure 7.) A recharger hose assembly for filling the portable oxygen bottles is installed adjacent to the oxygen regulator. Refer to paragraph 1. c. in this section for instructions regarding the use of the recharger assembly.

e. SUIT HEATER CONTROL.- A suit heater control box is installed on the cabin wall just forward of the oxygen controls.

6. RADIO OPERATOR'S STATION.

a. INTERPHONE.- The radio operator's interphone jack box is located on the cabin wall above the table. The interphone amplifier is mounted on the lower radio shelf, forward of the radio operator's position. (See figure 9.)

b. OXYGEN CONTROLS.- Oxygen controls are located to the left of the radio operator. Refer to paragraph 1, in this section.

c. SUIT HEATER CONTROL.- The radio operator's suit heater control box is mounted under the left side of his table.

7. BOMBARDIER'S STATION. (See figure 10.)

a. BOMBING CONTROLS.

(1) GENERAL.- The bomb release system is all-electric. The control panel is to the bombardier's right and a bomb release switch, on a flexible cord, extends from the aft side of the panel. The BOMBARDIER'S POWER SUPPLY switch is located at the lower left corner of the panel. (See figure 11.) While on the ground, this switch should be kept in the "OFF" position.

WARNING

Before entering a bomb bay, be sure that the BOMB BAY DOOR MASTER and the BOMBARDIER'S POWER SUPPLY switches are both "OFF."

The bomb bay doors are opened by turning the BOMBARDIER'S POWER SUPPLY switch "ON" and the desired BOMB BAY DOOR SELECTOR switches to the "OPEN" position. Then, by turning the [illegible] switch "ON," the selected doors will open.

4. ENGINEER'S STATION. (See Section 1, figure 24.)

a. CABIN HEAT AND VENTILATION.

(1) GENERAL.- Air that has been heated while passing through each inboard engine exhaust heat exchanger is ducted to a cabin heat exchanger in each wing. This heated air is passed through or around the cabin heat exchanger and is then dumped overboard through a waste gate in the lower skin of each wing. Cabin air, either supercharged (from the intercoolers) or unsupercharged (ram), is passed through the cabin heat exchangers. Here the air is heated or allowed to remain at its initial temperature before being discharged into the crew nacelle. This system has been designed so that the supercharged air could be used for cabin pressurization, however, this airplane is not equipped with a sealed crew nacelle so it cannot be pressurized. (See figure 6.)

(2) CONTROLS. (See figure 6.)- Cabin air temperature is controlled by motor-operated valves which regulate the amount of hot air passed through the cabin heat exchangers. The valve for each heat exchanger is controlled by a switch marked CABIN TEMP. Two switches, identified as CABIN AIR VALVES RH-LH, open or close valves in the cabin air discharge ducts. The switch marked "SUPERCHARGED-UNSUPERCHARGED," selects supercharged air from the intercoolers or rammed air from scoops in the leading edge of the wings.

(3) OPERATION.- Move the two CABIN AIR VALVE switches to the "OPEN" positions and place the third switch on either "SUPERCHARGED" or "UNSUPERCHARGED." Regulate the temperature of the cabin by momentarily holding the CABIN TEMP. switches to the "WARMER" or "COOLER" position.

b. WING ANTI-ICING.- See Section I, paragraph 43.

c. INTERPHONE.- An interphone jack box is located on the table to the left of the engineer. A GROUND CREW INTERPHONE switch is situated on the panel next to the fire extinguisher controls. This switch is used to connect the ground crew observers, at the nose gear, into the interphone system during ground operation.

d. OXYGEN.- The oxygen regulator is located on the table to the left of the engineer. (See paragraph 1, this section.)

e. SUIT HEATER CONTROL.- A suit heater control box is installed under the right hand edge of the engineer's table.

5. NAVIGATOR'S STATION. (See figures 7 and 8.)

a. RADIO COMPASS.- The navigator may take control of the radio compass by turning the function switch to either "COMP," "ANT," or "LOOP," and then pressing the CONTROL switch. See paragraph 3. b. in this section.

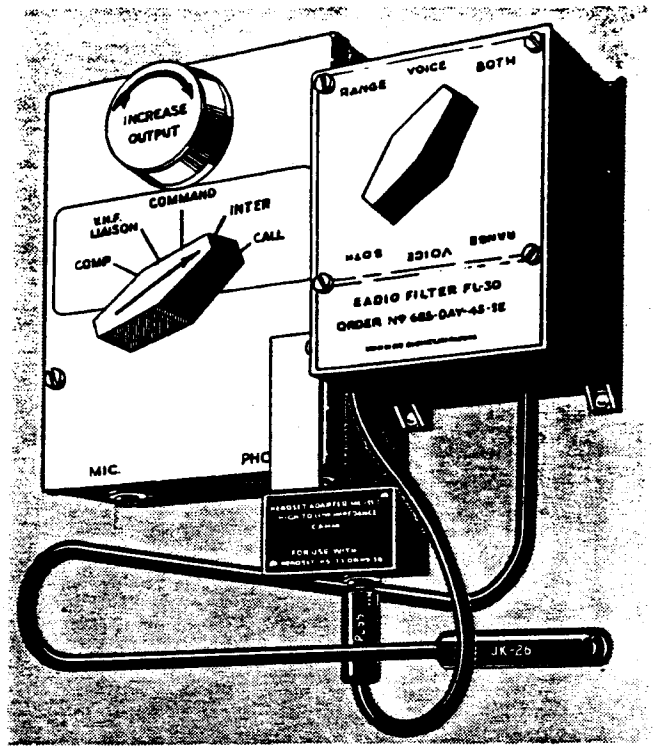


Figure 3. Jack Box, Filter, and Adapter

b. GYRO FLUX GATE COMPASS.

(1) GENERAL.- The master compass indicator is located on the navigator's instrument panel, see 1, figure 8, and a repeater indicator is situated on the pilots' instrument panel. The amplifier is located on the floor under the navigator's table.

(2) OPERATION.

(a) To start the gyro compass, turn "ON" both the dc and ac switches. (See figure 8.) Check to see that the amplifier switch is "ON."

(b) Allow ten minutes after starting the gyro before caging or uncaging.

(c) Erect the gyro by moving the toggle switch, figure 8, first to the "CAGE" position and then, after waiting a few seconds, to the "UNCAGED" position.

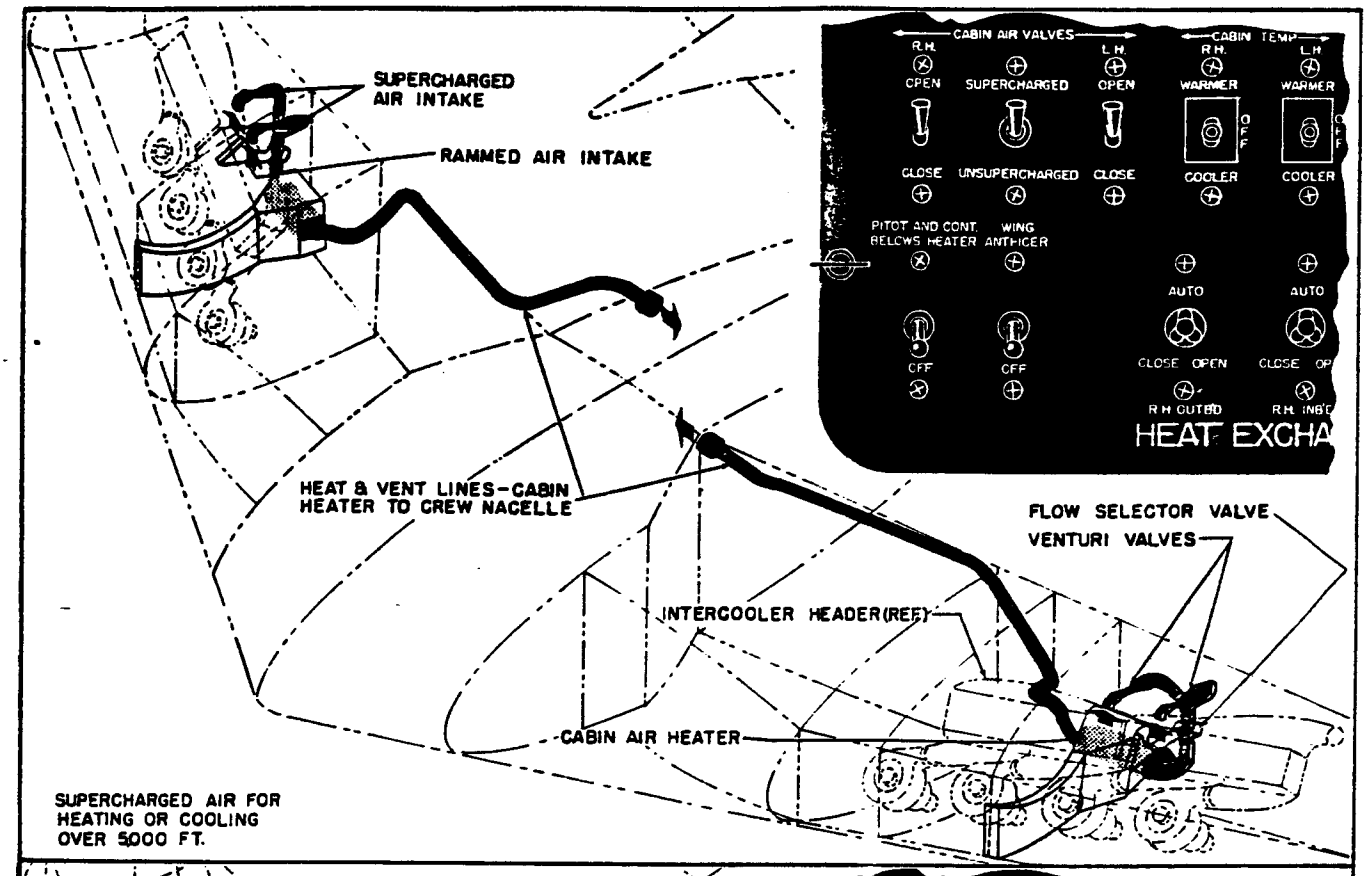
NOTE

Keep the toggle switch in the "UNCAGED" position at all times except when running the caging cycle.

(d) Correct for magnetic variation, if necessary.

(e) Check to see that the gain control on the amplifier is properly set.

(f) To stop the gyro, turn the ac and dc switches "OFF."



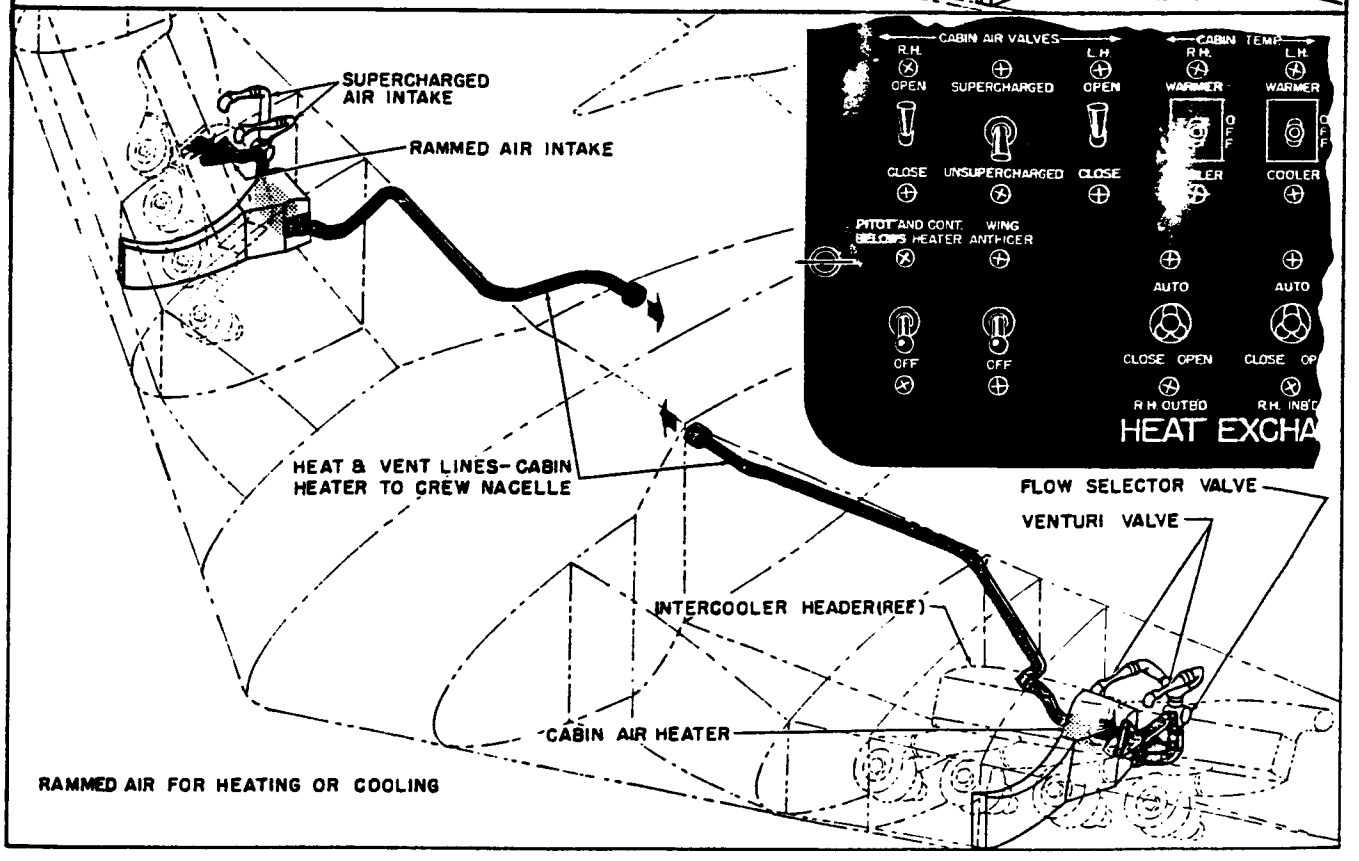


Figure 6. Heat, Vent, and Cabin Supercharging System

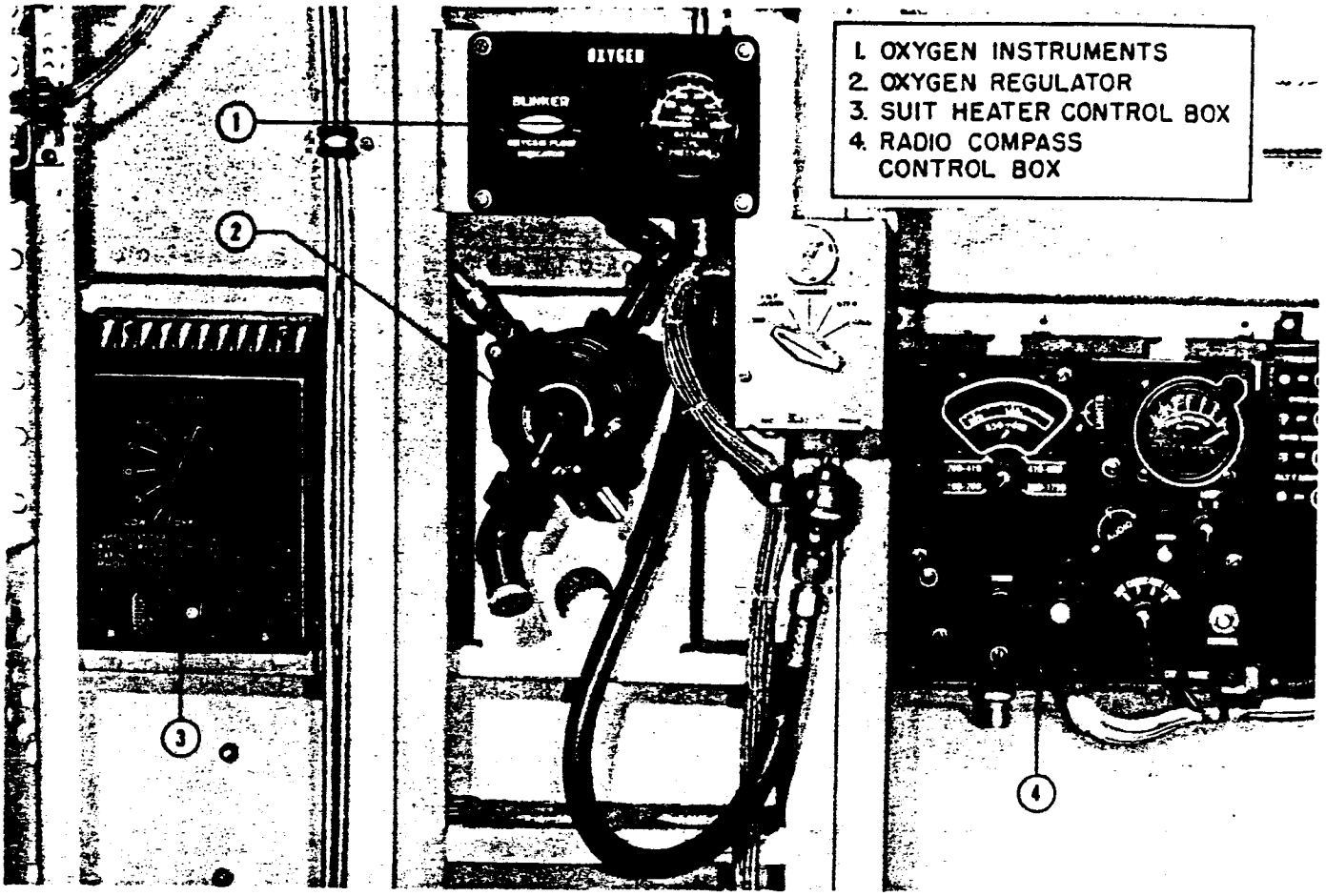


Figure 5. Radio Compass Controls, Suit Heater Control, and Oxygen Instruments

PILOT'S NOTES

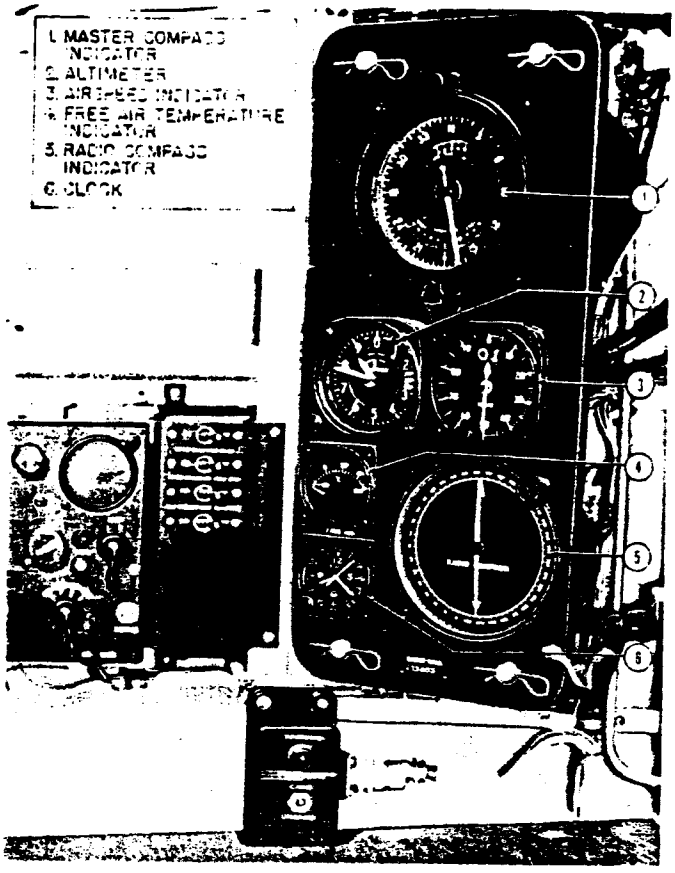


Figure 8. Navigator's Instrument Panel

(i) If bombs are to be released in train, hold the release switch on until the train is completed. For selective release, press and release the switch for each bomb dropped.

NOTE

Train release may be stopped by releasing the bomb switch.

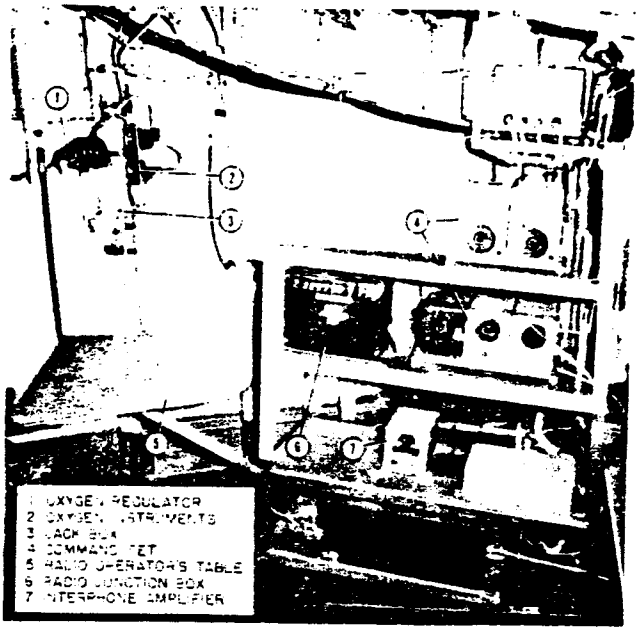
(j) Close the bomb bay doors by placing the BOMB BAY DOOR SELECTOR switches to "CLOSE" and moving the BOMB BAY DOOR MASTER switch to "ON."

b. INTERPHONE.- The bombardier's interphone jack box is located on the floor under the bomb control panel. (See 3, figure 10.) Refer to paragraph 2. c. preceding.

c. OXYGEN.- The oxygen regulator and gages are on the floor adjacent to the interphone jack box. (See 2, figure 10.)

d. SUIT HEATER CONTROL.- A suit heater control box is mounted on the cabin wall to the bombardier's right. (See 4, figure 10.)

View Looking Outboard



View Looking Aft

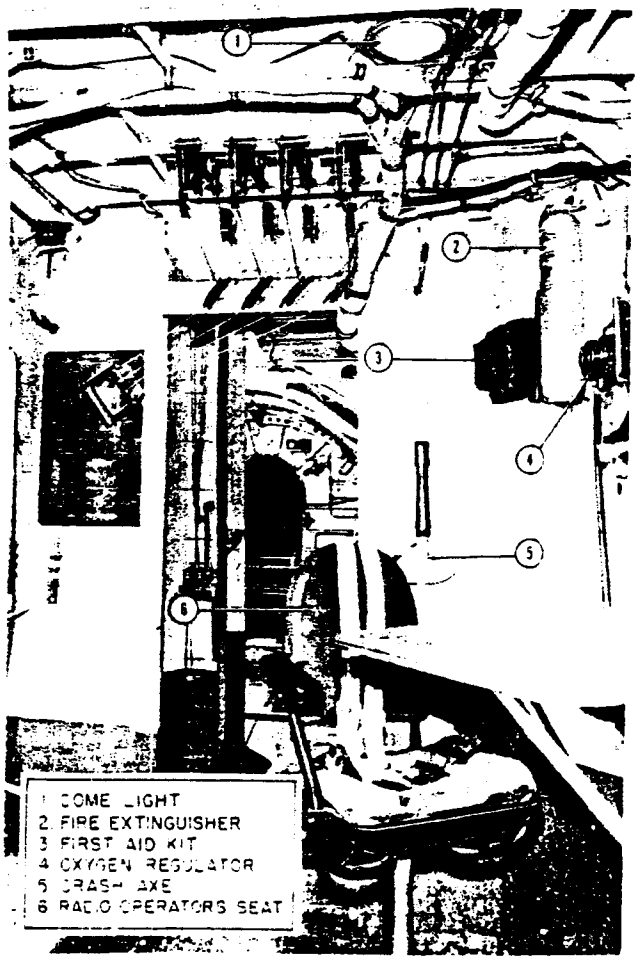


Figure 9. Radio Operator's Station

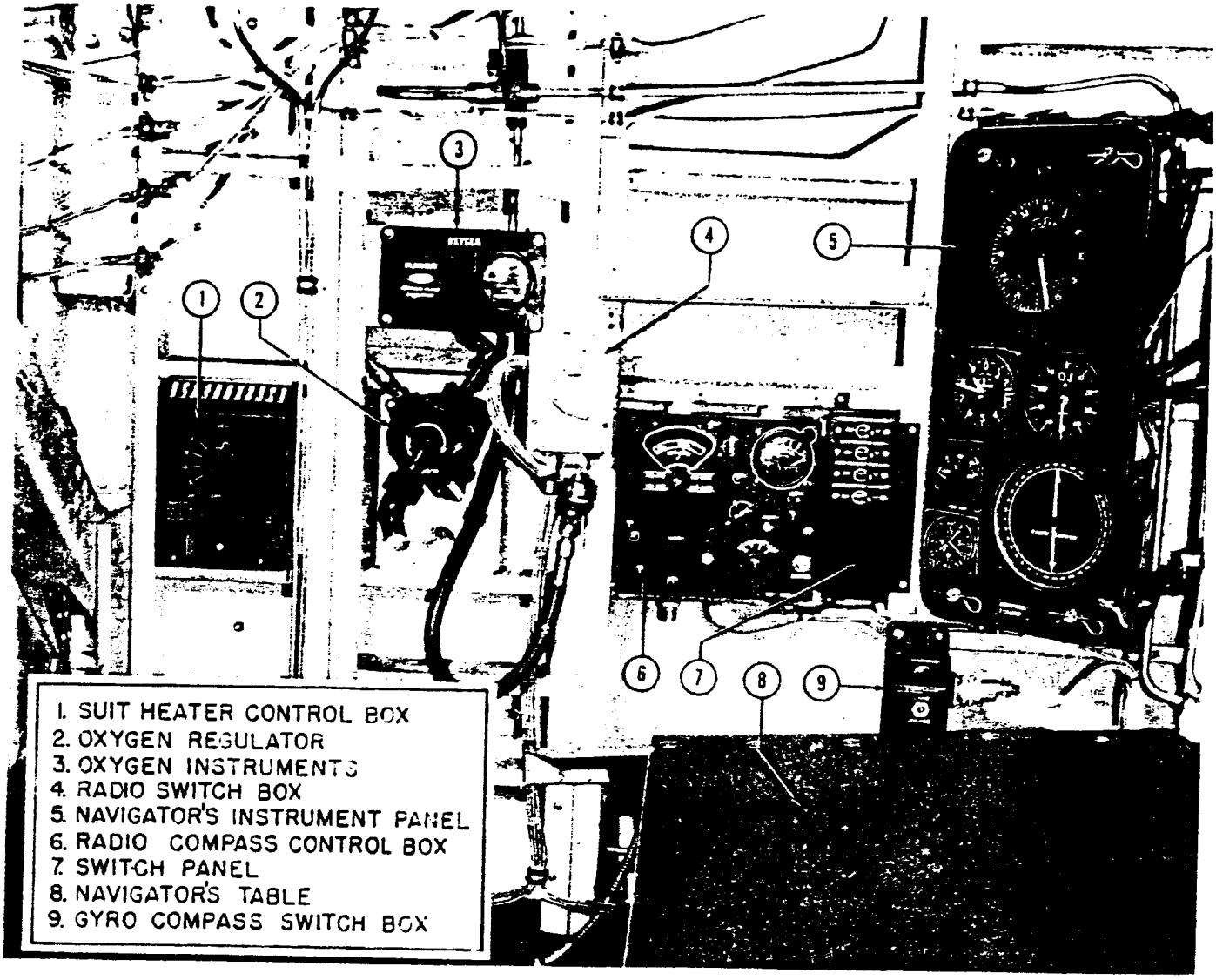


Figure 7. Navigator's Station

(2) OPERATION OF THE BOMB RELEASE SYSTEM. (See figure 11.)

(a) Turn the BOMBARDIER'S POWER SUPPLY switch "ON."

(b) Place the BOMB BAY SELECTOR switches in the "ON" position.

(c) Move the corresponding BOMB BAY DOOR SELECTOR switches to the "OPEN" position.

NOTE

These switches must be operated in pairs according to the firing order. The firing order is marked on the panel immediately above the indicator lights.

(d) Test the indicator lights by moving the INDICATOR LIGHTS switch from "NORMAL" to "TEST." All indicator lamps should light.

(e) Set the intervalometer dial to "SEL" or "TRAIN." If set for "TRAIN" release, adjust the dials as desired.

(f) To open the selected bomb bay doors, move the BOMB BAY DOOR MASTER switch to the "ON" position.

(g) If nose arming is desired, move the ARMING switch that is located to the right of the intervalometer to "ARM." The indicator lamp next to the switch will light for the armed position.

(h) To check the loaded bomb stations, hold the INDICATOR LIGHT SWITCH "ON."

NOTE

Do not hold the INDICATOR LIGHT switch "ON" during bomb release.

PILOT'S NOTES

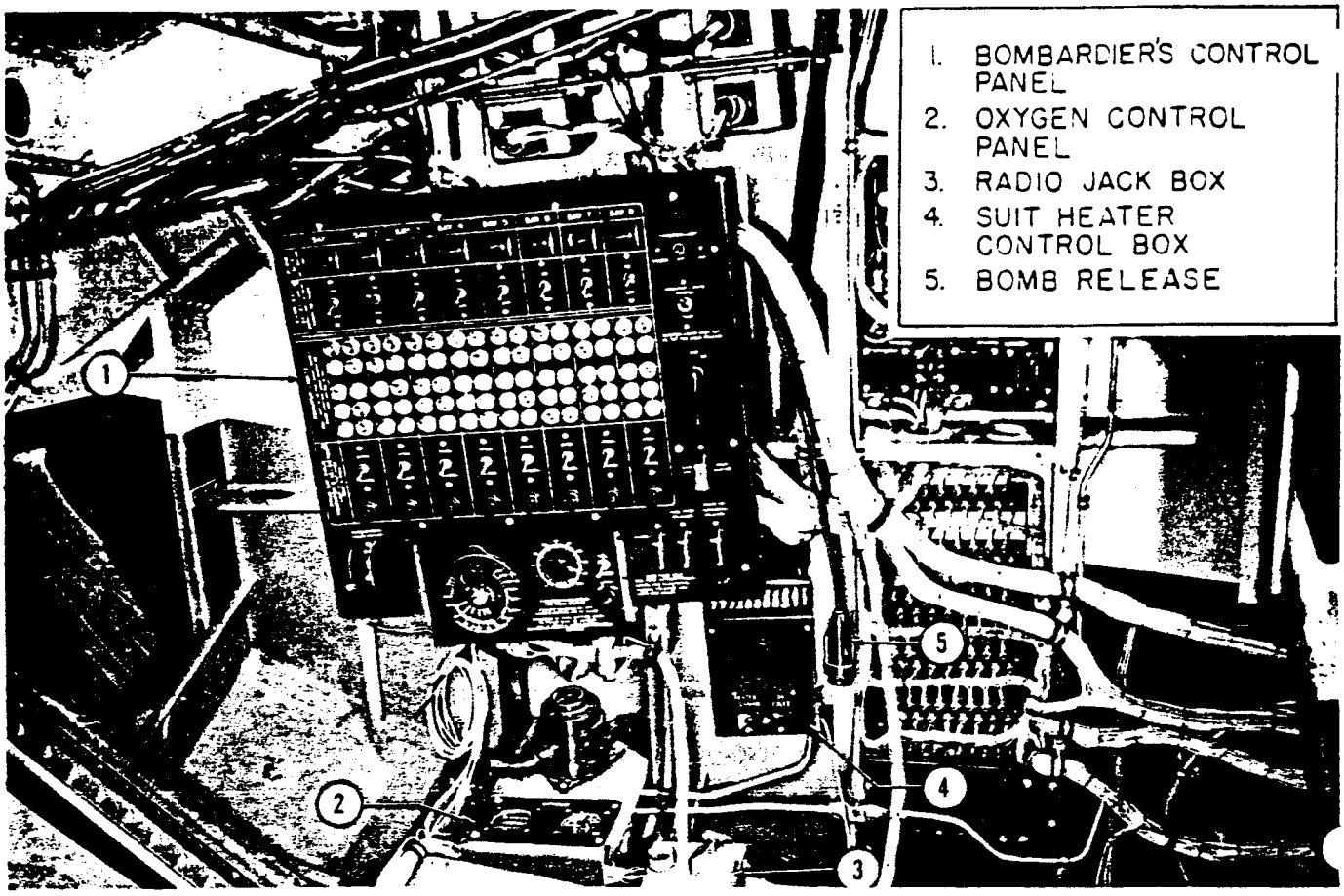


Figure 10. Bombardier's Station

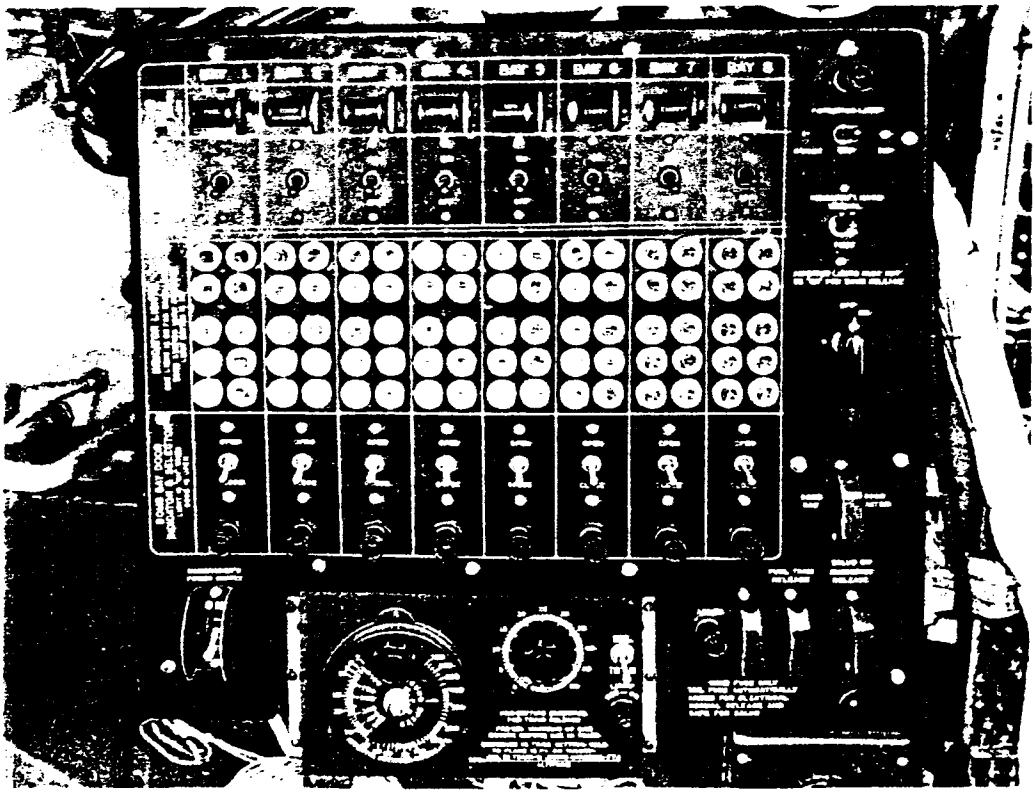


Figure 11. Bombardier's Control Panel

e. CRUISING.

(1) CARBURETOR ICING.- When the carburetor air temperature is between -10°C to +10°C in an atmosphere of high humidity or free moisture, carburetor icing is likely to occur. Under such atmospheric conditions, a carburetor air temperature of between 10°C and 38°C should be maintained. Use carburetor preheat for two minutes every half-hour during flight if carburetor icing is suspected.

(2) WING ANTI-ICING.- Use outer wing anti-icing at any time icing conditions are present.

(3) CONTROL BELLOWS HEATER AND PITOT TUBE HEATERS.- Keep the control switch for these heaters "ON" at any time icing conditions are present. (See Section I, figure 17.)

f. APPROACH AND LANDING.

(1) LANDING FLAPS.- Use full flaps (30°) when landing on ice- or snow-covered runways.

(2) CARBURETOR AIR.- Always land with carburetor air on "PREHEAT."

(3) PROPELLERS.- To reduce the landing roll and use of brakes, reverse the pitch of all propellers immediately after starting the landing roll.

(4) ENGINE COOLING.- Avoid rapid engine cooling when letting down.

g. BEFORE LEAVING THE AIRPLANE.

(1) PARKING.- Park the airplane on canvas or pine boughs to prevent the tires from freezing to the ground.

(2) PARKING BRAKES.- Do not set the parking brakes. Use wheel chocks.

(3) MOORING.- In cold climates where high winds are frequent, the airplane, if parked outside, must be properly moored.

(4) COVERS.- If the airplane is to be parked where ice and snow may accumulate on the wings, cover the upper surfaces. See that the fabric cover is installed over the electrical equipment in the nose wheel well.

PILOT'S NOTES

EXTREME WEATHER OPERATIONS

1. ARCTIC OPERATION.

a. BEFORE ENTERING THE AIRPLANE.

(1) TIRES AND BRAKES.- Move the airplane enough to be sure that the tires are not frozen to the ground. If the tires are frozen, thaw them out. If the airplane moves but the wheels slide, the brakes are frozen. Thaw the brakes with a hot air blast.

(2) LANDING GEAR.- Check all microswitches to see that they are free of ice.

(3) PROPELLERS.- Remove any accumulations of snow or ice from the propellers.

(4) DRAINS.- Check the fuel and oil sump drains. If fuel and oil does not flow freely from the drains, thaw them out. Then drain a sufficient quantity of fuel or oil to insure removal of any accumulation of water.

(5) VENTS.- See that all vents are free of ice.

(6) OIL.- If the oil has been removed from the airplane, heat it to approximately 70°C before putting it back into the oil system.

b. ON ENTERING THE AIRPLANE.

(1) INSTRUMENTS.- If necessary, apply heat to the instruments which operate independently of the engines.

(2) WINDOWS.- If frost has formed on the inside of the windows, warm them with blast heaters and wipe off the frost as it melts.

STARTING THE ENGINES.

(1) PREHEATING THE ENGINES AND A.P. UNITS.

(a) If the outside air temperature is below -18°C (0°F), apply preheat to the engines before attempting to start them.

(b) Apply hot air from blast heaters along the leading edge of each wing so that the hot air will be directed through each engine cooling fan. Direct hot air through the intake scoops of the auxiliary power units.

(2) CARBURETOR PREHEAT.- After the A.P. Units have been started, apply heat to each engine carburetor air intake from the leading edge of the wing while the engines are being "inched" through, prior to starting.

(3) PRIMING.- Adequate priming varies from two seconds with an air temperature of 5°C (40°F) to more than 10 seconds depending on the temperature.

d. WARM-UP.- Follow the normal warm-up procedure, except when extremely cold temperatures make it necessary to dilute the oil further in an emergency. Use carburetor air "PREHEAT" during warm-up when outside air temperatures are -20°C (-4°F), or below. Use "PREHEAT" also on the ground when conditions are conducive to the formation of carburetor ice. Be sure to turn the CARBURETOR AIR switch to "NORMAL" before take-off. If left on "PREHEAT," it over-heats the engines, causes loss of power, and will probably produce detonation.

POWER PLANT CHART

AIRCRAFT MODEL(S): XB-35

PROPELLER(S): HAMILTON STANDARD SUPER HYDROMATIC

CARBURETOR: PR-1CO-B1 or PR-100-B2

ENGINE MODEL(S): R-4360-17, -21

GAUGE READING	FUEL PRESS.	OIL PRESS.	OIL TEMP. °C	COOLANT TEMP.	CARB. AIR TEMP.	OIL[4] CONS.
DESIRED MAXIMUM	17PSI 19	80-85 100	60-75 85*		38°C	
MINIMUM IDLING	16 9	80 25	40			

*98°C For Climb

MAXIMUM PERMISSABLE DIVING RPM: 3060/30 Sec.
MINIMUM RECOMMENDED CRUISE RPM: 1150
MAXIMUM RECOMMENDED TURBO RPM: 22,500

OIL GRADE: (S) 1120 (W) 1120
FUEL GRADE: 100/130

WAR EMERGENCY (COMBAT EMERGENCY)			MILITARY POWER (NON-COMBAT EMERGENCY)			OPERATING CONDITION			NORMAL RATED (MAXIMUM CONTINUOUS)			MAXIMUM CRUISE (NORMAL OPERATION)		
MINUTES			5 MINUTES			TIME LIMIT			UNLIMITED			UNLIMITED		
No War Emergency Rating As Yet			232°C			MAX. CYL. HD. TEMP.			232°C			218°C		
			A.R. 2700			MIXTURE R. P. M.			A.R. 2550			A.L. 2230		
MANIF. PRESS.	SUPER-CHARGER	FUEL[2] Gal/Min	MANIF. PRESS.	SUPER-CHARGER	FUEL[2] Gal/Min	STD. TEMP. °C	PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH[3]	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH[3]
			51		6.1	-55.0	40,000 FT.	-67.0	FF		348	33.5		146
			51		6.1	-55.0	38,000 FT.	-67.0	FF		348	33.5		146
			51		6.1	-55.0	36,000 FT.	-67.0	FF		348	33.5		146
			51		6.1	-52.4	34,000 FT.	-62.3	FF		348	33.5		146
			51		6.1	-48.4	32,000 FT.	-55.1	FF		348	33.5		146
			51		6.1	-48.4	30,000 FT.	-48.0	FF		348	33.5		146
			51		6.1	-40.5	28,000 FT.	-40.9	FF		348	33.5		146
			51		6.1	-36.5	26,000 FT.	-33.7	FF		348	33.5		146
			51		6.1	-32.5	24,000 FT.	-26.5	FF		348	33.5		146
			51		6.1	-28.6	22,000 FT.	-19.4	FF		348	33.5		146
			51		6.1	-24.6	20,000 FT.	-12.3	FF		348	33.5		146
			51		6.1	-20.7	18,000 FT.	- 5.2	FF		348	33.5		146
			51		6.1	-16.7	16,000 FT.	2.0	FF		348	33.5		146
			51		6.1	-12.7	14,000 FT.	9.1	FF		348	33.5		146
			51		6.1	- 8.8	12,000 FT.	16.2	FF		348	33.5		146
			51		6.1	- 4.8	10,000 FT.	23.4	FF		348	33.5		146
			51		6.1	- 0.8	8,000 FT.	30.5	FF		348	33.5		146
			51		6.1	3.1	6,000 FT.	37.6	FF		348	33.5		146
			51		6.1	7.1	4,000 FT.	44.7	FF		348	33.5		146
			51		6.1	11.0	2,000 FT.	51.8	FF		348	33.5		146
			51		6.1	15.0	SEA LEVEL	59.0	FF		348	33.5		146

GENERAL NOTES

[1] OIL CONSUMPTION: MAXIMUM U.S. QUART PER HOUR PER ENGINE.
[2] Gal/Min: APPROXIMATE U.S. GALLON PER MINUTE PER ENGINE
[3] GPH: APPROXIMATE U.S. GALLON PER HOUR PER ENGINE.
F.T.: MEANS FULL THROTTLE OPERATION.
VALUES ARE FOR LEVEL FLIGHT WITH RAM.

FOR COMPLETE CRUISING DATA SEE APPENDIX II
NOTE: TO DETERMINE CONSUMPTION IN BRITISH IMPERIAL UNITS, MULTIPLY BY 10 THEN DIVIDE BY 12. RED FIGURES ARE PRELIMINARY SUBJECT TO REVISION AFTER FLIGHT CHECK.

TAKE-OFF CONDITIONS:	CONDITIONS TO AVOID:
2700 RPM, 51" HG., Auto Rich	Item (2) Under "Special Notes."

SPECIAL NOTES

1. Flight above 15,000 feet is not recommended due to auxiliary power plant limitations.
2. The following RPM-MP, combinations cause detonation in auto lean:

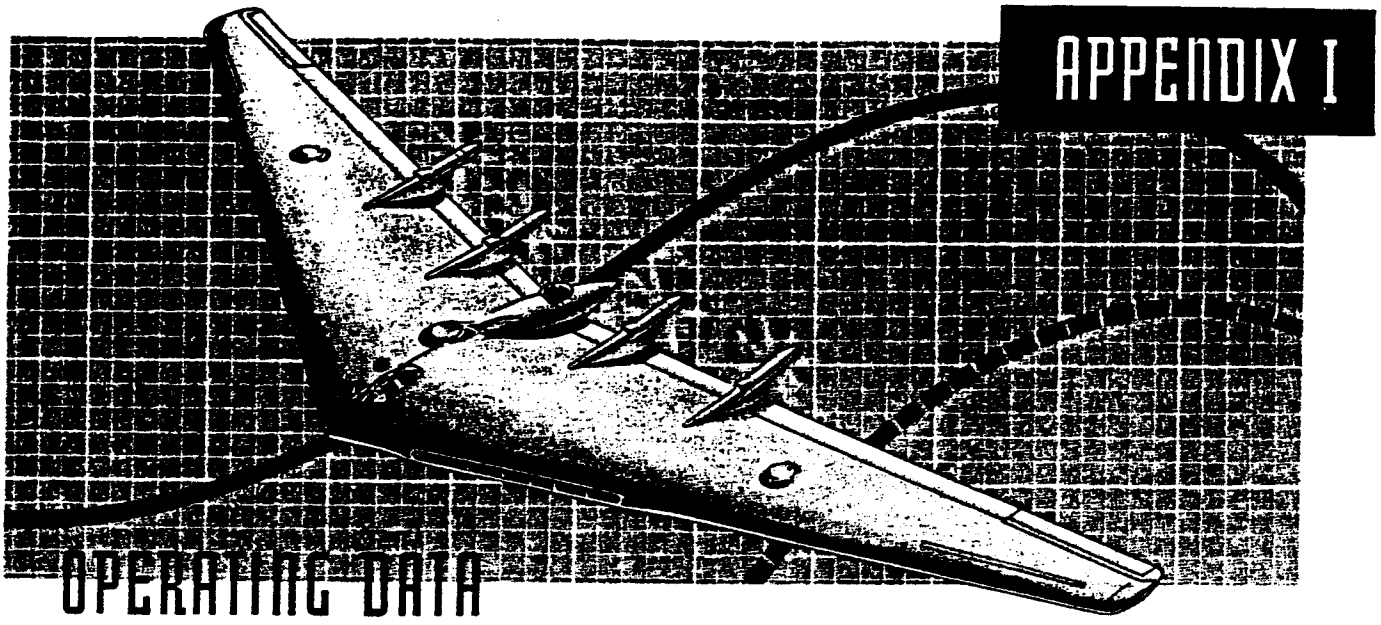
   2000 RPM-MP above 35.2" Hg.
   2100 RPM-MP above 34.7" Hg.
   2230 RPM-MP above 33.5" Hg.

DATA AS OF 4-18-46 BASED ON Estimate

AAFMC-526 4-1-45

WP-3-31-44-10M

Figure 2. Power Plant Chart



AIRSPEED INSTALLATION
CORRECTION TABLE

I.A.S.	CORRECTION

FLAPS RETRACTED

INFORMATION NOT AVAILABLE

FLAPS & GEAR EXTENDED

Figure 1. Airspeed Installation
Correction Table

AIRCRAFT MODEL(S)
XB-35

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
(2) R-4360-17
(2) R-4360-21

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
160,000	0	0	4090	6910	3140	7360	5080	7840	4480	7300	4980	7780	5550	8280	5850	8680	6510	9240	7250	9840
	20	17	3050	5860	2440	6320	3790	6890	3340	6190	3710	6680	4140	7160	4360	7360	4860	7920	5400	8520
	40	35	2370	4810	1820	5260	2950	5740	2590	5090	2890	5560	3220	6060	3390	6040	3770	6600	4200	7200
130,000	0	0	2380	4100	2620	4330	2890	4560	2530	4250	2780	4490	4060	4730	3030	4750	3330	5020	3680	5280
	20	17	1720	3410	1900	3640	2100	3880	1840	3540	2010	3780	2220	4010	2190	3950	2410	4230	2670	4480
	40	35	1310	2730	1450	2950	1600	3190	1400	2820	1530	3060	1690	3290	1670	3150	1840	3430	2030	3680
100,000	0	0	1250	2040	1380	2140	1510	2250	1300	2090	1430	2190	1560	2300	1480	2260	1620	2380	1784	2500
	20	17	870	1650	960	1750	1050	1860	900	1690	990	1790	1090	1900	1020	1830	1130	1940	1240	2060
	40	35	650	1250	710	1350	780	1460	660	1290	730	1390	800	1500	760	1390	830	1500	910	1630

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

DATA AS OF 2-12-46 BASED ON: Calculated Data

OPTIMUM TAKE-OFF WITH 2700 RPM, 51 IN.HG. & 0° DEG. FLAP IS 75% OF CHART VALUES

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL				AT 5000 FEET					AT 10,000 FEET					AT 15,000 FEET					AT 25,000 FEET					AT 35,000 FEET				
	BEST I.A.S.		RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS			MPH	KTS		TIME MIN.	FUEL USED Gal	MPH	KTS		TIME MIN.	FUEL USED Gal	MPH	KTS		TIME MIN.	FUEL USED Gal	MPH	KTS		TIME MIN.	FUEL USED Gal	MPH	KTS		TIME MIN.	FUEL USED Gal
160,000	176		830	200	174		795	6	324	172		760	12.5	452	169		712	19.5	588	167		555	35	896	166		292	58	1355
130,000	170		1246	200	168		1230	4	281	165		1208	8	363	163		1170	12.5	447	159		1025	21.5	627	158		764	32.5	847
100,000	165		1785	200	162		1780	3	256	160		1760	5.5	312	157		1735	8.5	370	154		1611	14.5	489	151		1295	21	624

POWER PLANT SETTINGS: (DETAILS ON FIG. SECTION III): 2550 RPM & 44 IN. HG. AUTO RICH

DATA AS OF 2-12-46 BASED ON: Calculated Data

FUEL USED (U.S.GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
160,000	137		127		2010	3630	2220	3920	2410	4190	2160	3680	2390	4090	2580	4360	3210	4840	2440	4140	3640	5620
100,000	110		100		1260	2560	1380	2730	1510	2910	1310	2610	1440	2790	1570	2970	1760	3060	1930	3280	2110	3510

DATA AS OF 2-12-46 BASED ON: Calculated Data 30° Flaps

OPTIMUM LANDING IS 75% OF CHART VALUES

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

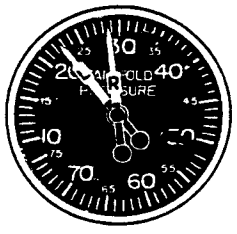
LEGEND

I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure 4. Take-Off, Climb, and Landing Chart

■ MAX. MILITARY RATED POWER 24,750
■ OPERATING RANGE 1,000-22,500

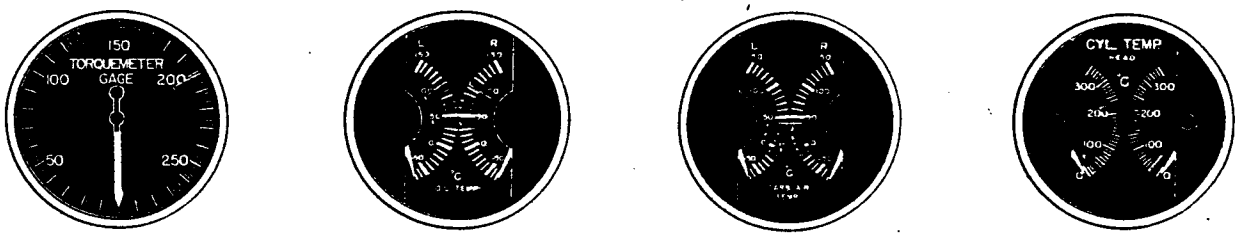
■ MAX. TAKE OFF R.P.M. 2700
■ AUTO RICH OPER. 2200-2550 R.P.M. (REQUIRED)
■ AUTO LEAN OPER. 1150-2200 R.P.M.(PERMITTED)



■ MAX. TAKE OFF PRESS. 51.0 IN. HG.
■ AUTO RICH OPER. 35.2-44 IN. HG.
■ AUTO LEAN OPER. 32.8-35.2 IN. HG

■ MAX. SAFE PRESS. 19 P.S.I.
■ OPERATING RANGE 16-18 P.S.I.
■ MIN. SAFE PRES. 16 P.S.I.

■ MAX. SAFE PRESS. 100
■ OPERATING RANGE 60-100
■ MIN. SAFE PRESS. 60

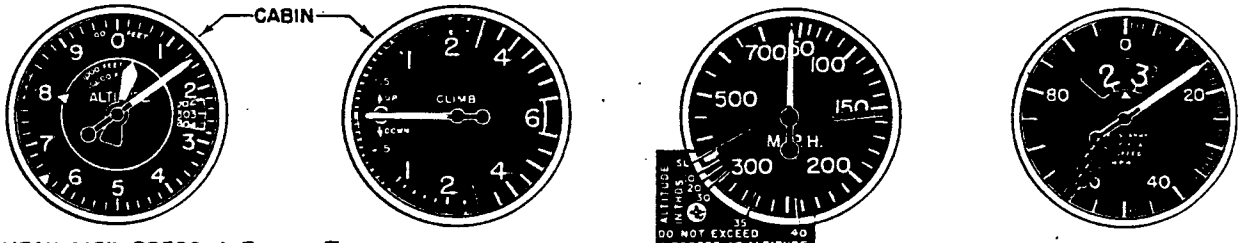


■ MAX. TAKE OFF TORQUE 202
■ AUTO RICH OPER. 150-178
■ AUTO LEAN OPER. 130-150

■ MAX. INDICATED OIL TEMP. 98° C.
■ OPERATING RANGE OIL TEMP. 60°-75° C.
■ MIN. FOR T.O. AND FLIGHT 40° C.

■ MAX. ALLOWABLE +38° C.
■ DESIRABLE +18° - +38° C.
■ POSSIBLE ICING -10° - +18° C.
■ MIN. 18° C.

■ MAX. TAKE OFF TEMP. 232° C.
■ AUTO RICH OPER. 218°-232° C.
■ AUTO LEAN OPER. 150°-218° C.
■ MIN. SAFE TEMP. 25° C.



■ MEAN CABIN PRESS. ALT.
8000 FT. ±300 FT.

■ MAX. RATE CABIN PRESS.
CHANGE ± 300 FT./MIN.
■ OPERATING RANGE
0-300 FT./MIN.

■ 360 M.P.H. I.A.S. MAX.
■ 160 M.P.H. I.A.S. MAX.
FLAPS DOWN

Figure 3. Instrument Limitation Markings

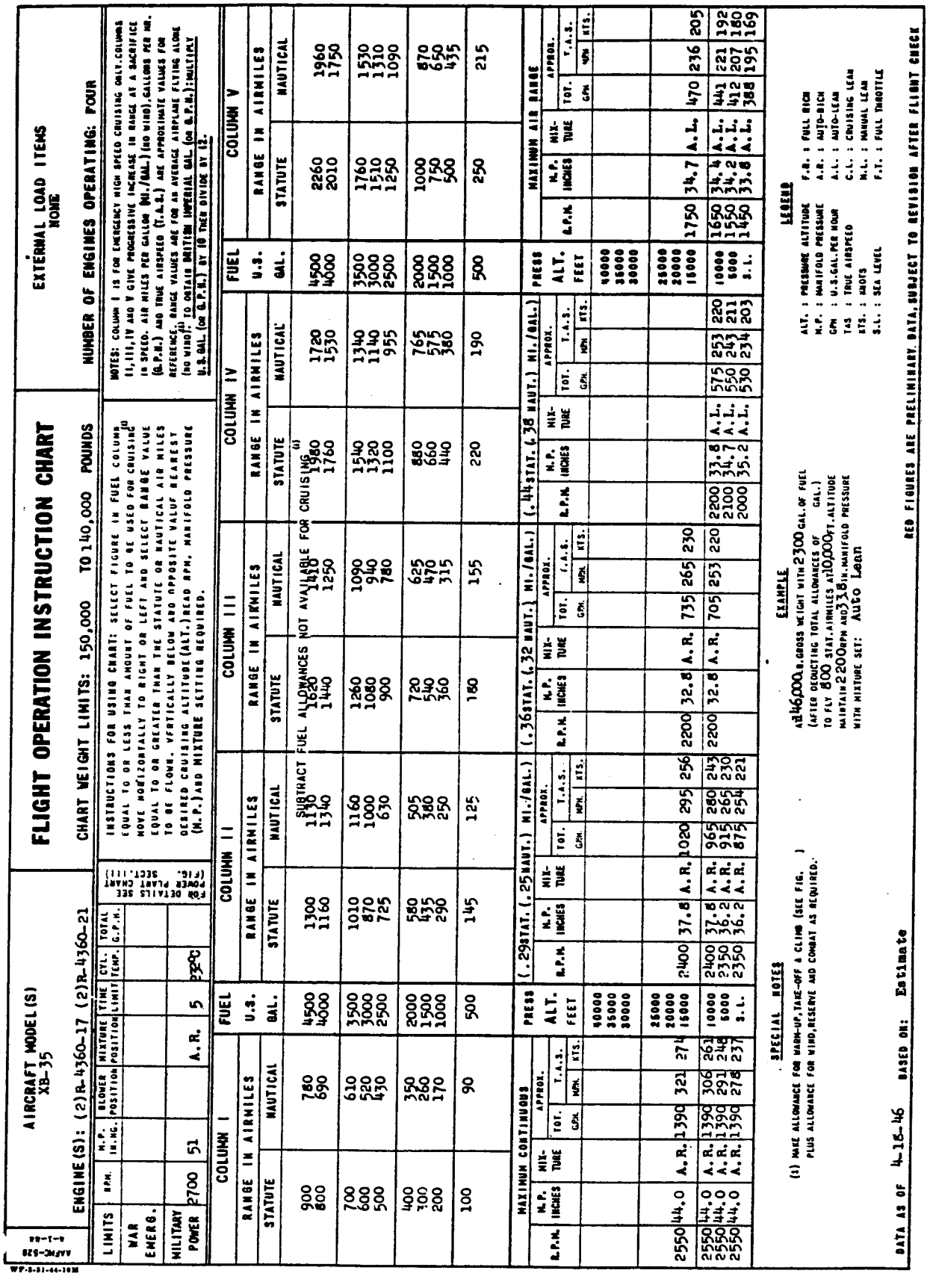


Figure 5. Flight Operation Instruction Chart (Sheet 2 of 6 Sheets)

AAFMC-528 8-1-45

AIRCRAFT MODEL(S) XB-35

ENGINE(S): (2)R-4360-17 (2)R-4360-21

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 160,000 TO 150,000 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	51		A.R.	5	232°C	

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[2] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
890	770	4500	1210	1050	1570	1360	1890	1640	4500	2090	1820
790	690	4000	1080	940	1400	1210	1680	1460	4000	1860	1610
690	600	3500	940	820	1220	1060	1470	1270	3500	1620	1410
590	510	3000	810	700	1050	910	1260	1090	3000	1390	1210
490	420	2500	670	580	870	750	1050	910	2500	1160	1010
390	340	2000	540	470	700	610	840	730	2000	930	810
300	260	1500	400	350	520	450	630	550	1500	700	610
200	170	1000	270	230	350	300	420	360	1000	465	400
100	90	500	130	110	170	150	210	180	500	230	200

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(.27 STAT. (.23 NAUT.) MI./GAL.)						(.35 STAT. (.30 NAUT.) MI./GAL.)						(.42 STAT. (.36 NAUT.) MI./GAL.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
2550	44.0	A.R.	1390	318	276	20000	2450	39.8	A.R.	1095	296	257	2200	32.8	A.R.	720	252	219							20000						
						15000																			15000	1900	35.2	A.L.	510	237	206
2550	44.0	A.R.	1390	301	261	10000	2400	37.8	A.R.	1030	279	242	2200	32.8	A.R.	700	244	212	2200	33.9	A.L.	580	244	212	10000	1800	35	A.L.	489	227	197
2550	44.0	A.R.	1390	288	250	5000	2400	37.8	A.R.	980	265	230	2200	32.8	A.R.	680	237	206	2150	34.3	A.L.	565	237	206	5000	1700	34.5	A.L.	459	213	185
2550	44.0	A.R.	1390	275	239	S.L.	2350	36.3	A.R.	935	253	219							2050	35.2	A.L.	550	230	200	S.L.	1600	34.2	A.L.	430	200	174

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

(2) Flight above 15,000 ft. is not recommended due to auxiliary power plant altitude limitations

EXAMPLE

AT LB. GROSS WEIGHT WITH GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF GAL.) TO FLY STAT. AIRMILES AT FT. ALTITUDE MAINTAIN RPM AND IN. MANIFOLD PRESSURE WITH MIXTURE SET:

LEGEND

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

AS OF 4-18-46 BASED ON: Estimate

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

Figure 5. Flight Operation Instruction Chart (Sheet 1 of 6 Sheets)

AAFRC-528 4-1-46

AIRCRAFT MODEL(S)
XB-35

ENGINE(S): (2) R-4360-17 (2)R-4360-21

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 130,000 TO 120,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. (IN.HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER							

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (M./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1]. TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
910	790	4500	1390	1210	1840	1620	2250	1980	4500	2660	2310
810	700	4000	1240	1080	1640	1440	2000	1760	4000	2360	2050
710	620	3500	1080	940	1430	1260	1750	1540	3500	2070	1800
610	530	3000	930	810	1230	1080	1500	1320	3000	1770	1540
510	440	2500	775	675	1020	900	1250	1100	2500	1480	1290
410	360	2000	620	540	820	720	1000	880	2000	1180	1030
300	260	1500	465	405	610	540	750	660	1500	890	770
200	170	1000	310	270	410	360	500	440	1000	590	510
100	90	500	155	135	200	180	250	220	500	290	250

MAXIMUM CONTINUOUS						PRESS	(.31 STAT. (.27 NAUT.) MI./GAL.)						(.41 STAT. (.36 NAUT.) MI./GAL.)						(.50 STAT. (.44 NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE				
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
2550	44.0	A.R.	1390	328	285	20000																			20000						
						15000	2350	36.2	A.R.	955	296	257							2050	35.0	A.L.	560	279	242	15000	1550	34.2	A.L.	402	238	207
2550	44.0	A.R.	1390	311	271	10000	2350	36.2	A.R.	810	283	246							1900	35.2	A.L.	520	259	225	10000	1450	34.0	A.L.	372	220	141
2550	44.0	A.R.	1390	296	257	5000	2300	34.7	A.R.	855	265	230							1800	35.0	A.L.	490	244	212	5000	1350	33.6	A.L.	342	202	175
2550	44.0	A.R.	1390	282	245	S.L.	2300	34.7	A.R.	820	254	220	2200	33.8	A.L.	595	244	121	1700	34.5	A.L.	460	229	199	S.L.	1300	33.4	A.L.	321	190	165

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT LB. GROSS WEIGHT WITH GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF GAL.)
TO FLY STAT. AIRMILES AT FT. ALTITUDE
MAINTAIN RPM AND IN. MANIFOLD PRESSURE
WITH MIXTURE SET:

LEGEND

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

DATA AS OF 4-18-46 BASED ON: Estimate

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

Figure 5. Flight Operation Instruction Chart (Sheet 4 of 6 Sheets)

AAFRC-528 6-1-45

AIRCRAFT MODEL(S)
XB-35

ENGINE(S): (2)R-4360-17 (2)R-4360-21

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 140,000 TO 130,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER							

FOR DETAILS SEE POWER PLANT CHART SECT. III (FIG.)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[2]. TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
910	790	4500	1350	1170	1750	1520	2120	1840	4500	2460	2140
810	700	4000	1200	1040	1560	1350	1880	1630	4000	2190	1900
710	620	3500	1050	910	1350	1170	1650	1430	3500	1920	1670
600	520	3000	900	780	1170	1020	1410	1230	3000	1640	1420
500	430	2500	750	650	975	845	1120	970	2500	1370	1190
400	350	2000	600	520	780	680	940	820	2000	1090	945
300	260	1500	450	390	585	510	705	615	1500	820	710
200	170	1000	300	260	390	340	470	410	1000	550	480
100	85	500	150	130	195	170	235	205	500	270	235

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(.30 STAT. (.26 NAUT.) MI./GAL.)						(.39 STAT. .34 NAUT.) MI./GAL.)						(.47 STAT. (.41 NAUT.) MI./GAL.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
2550	44.0	A.R.	1390	324	281	20000	2400	37.8	A.R.	1000	300	261	2200	32.8	A.R.	695	271	235	2200	33.8	A.L.	575	271	235	20000	1650	34.4	A.L.	432	236	206
2550	44.0	A.R.	1390	308	267	10000	2350	36.2	A.R.	930	279	243							2050	35.0	A.L.	555	260	226	10000	1550	34.2	A.L.	402	221	192
2550	44.0	A.R.	1390	294	255	5000	2300	34.7	A.R.	875	263	228							1950	35.2	A.L.	525	246	214	5000	1450	34.0	A.L.	377	207	180
2550	44.0	A.R.	1390	280	243	S.L.	2300	34.7	A.R.	835	251	218							1800	35.0	A.L.	490	230	200	S.L.	1350	33.6	A.L.	348	191	166

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT LB. GROSS WEIGHT WITH GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF GAL.)
TO FLY STAT. AIRMILES AT FT. ALTITUDE
MAINTAIN RPM AND IN. MANIFOLD PRESSURE
WITH MIXTURE SET:

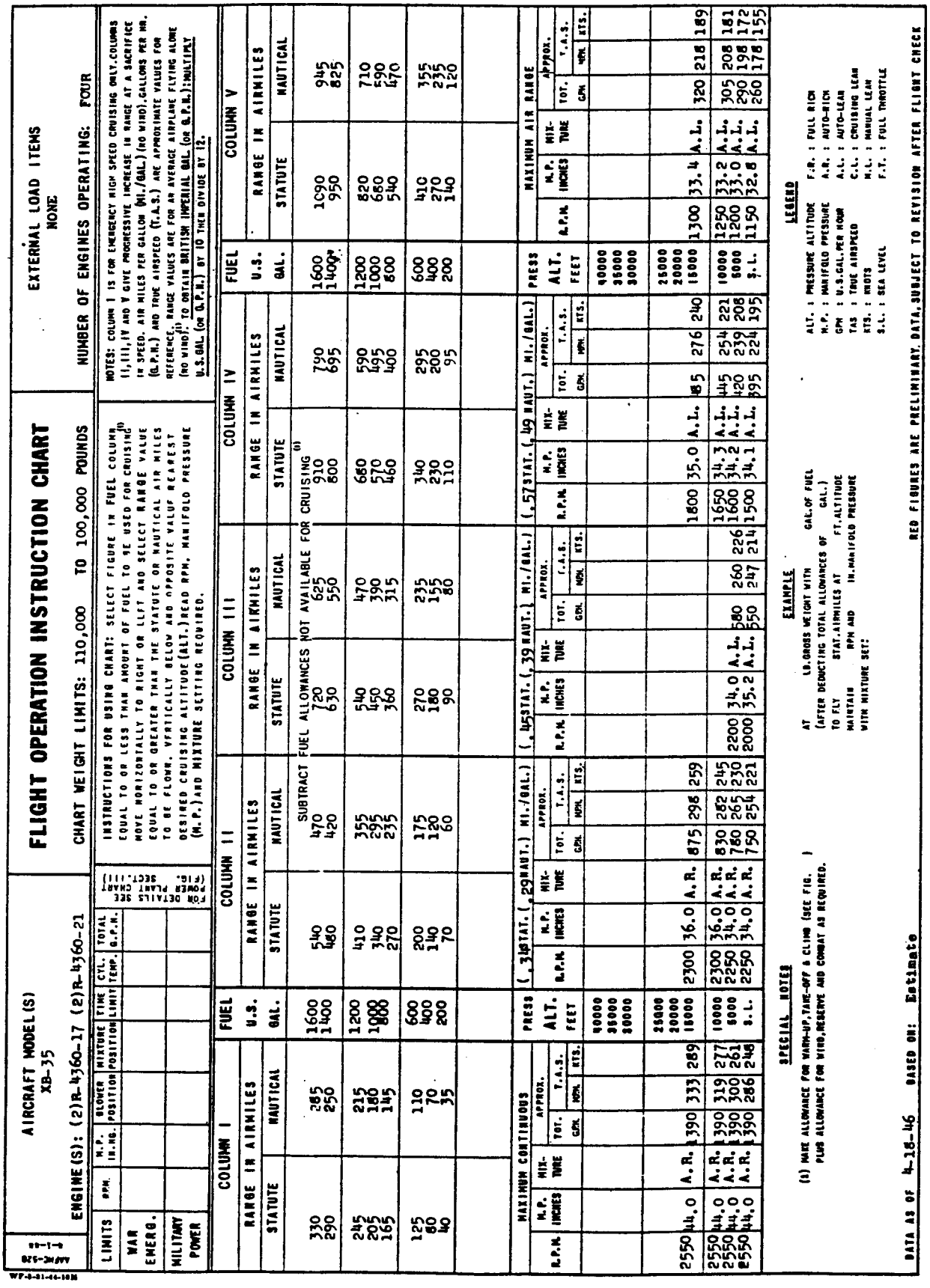
LEGEND

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

AS OF 4-18-46 BASED ON: Estimate

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

Figure 5. Flight Operation Instruction Chart (Sheet 3 of 6 Sheets)



AIRCRAFT MODEL(S): XB-35
ENGINE(S): (2)R-4360-17 (2)R-4360-21

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 110,000 TO 100,000 POUNDS

EXTERNAL LOAD ITEMS: NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN. HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER							

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[10] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE[11] RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[11] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S.GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II							COLUMN III							COLUMN IV							COLUMN V						
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES							RANGE IN AIRMILES							RANGE IN AIRMILES							RANGE IN AIRMILES						
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	PRESS ALT. FEET	STATUTE	NAUTICAL	MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	PRESS ALT. FEET	STATUTE	NAUTICAL	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	PRESS ALT. FEET
			SUBTRACT FUEL ALLOWANCES FOR CRUISING[10]							NOT AVAILABLE FOR CRUISING[10]																				
330	285	1600	540	470	2550	44.0	A.R.	390	333	289	25000	470	410	2300	36.0	A.R.	875	298	259	25000	625	540	2200	34.0	A.L.	580	260	226	25000	910	795	1650	34.3	A.L.	445	254	221	25000	945	825	2550	44.0	A.R.	390	319	277	20000
290	250	1400	480	420	2550	44.0	A.R.	390	300	261	20000	630	550	2250	34.0	A.R.	760	265	230	20000	720	630	2000	35.2	A.L.	550	247	214	20000	800	695	1600	34.2	A.L.	420	239	208	20000	825	720	2550	44.0	A.R.	390	286	248	20000
245	215	1200	410	355	2550	44.0	A.R.	390	319	277	10000	540	470	2300	36.0	A.R.	830	282	245	10000	680	590	2200	34.0	A.L.	580	260	226	10000	1090	950	1650	34.3	A.L.	445	305	208	10000	1090	950	2550	44.0	A.R.	390	319	277	10000
205	180	1000	340	295	2550	44.0	A.R.	390	300	261	8000	450	390	2250	34.0	A.R.	760	265	230	8000	570	495	1600	34.2	A.L.	550	247	214	8000	950	825	1600	34.2	A.L.	420	290	198	8000	950	825	2550	44.0	A.R.	390	300	261	8000
165	145	800	270	235	2550	44.0	A.R.	390	286	248	S.L.	360	315	2250	34.0	A.R.	750	254	221	S.L.	460	400	1500	34.1	A.L.	525	224	195	S.L.	760	660	1500	34.1	A.L.	395	260	178	S.L.	760	660	2550	44.0	A.R.	390	286	248	S.L.
125	110	600	200	175							25000	270	235							25000	340	295							25000	600	520							25000	355	310							25000
80	70	400	140	120							20000	180	155							20000	230	200							20000	400	345							20000	235	205							20000
40	35	200	70	60							15000	90	80							15000	110	95							15000	200	175							15000	120	105							15000

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT LB. GROSS WEIGHT WITH GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF GAL.) TO FLY STAT. AIRMILES AT FT. ALTITUDE MAINTAIN RPM AND IN. MANIFOLD PRESSURE WITH MIXTURE SET:

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL

F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 4-15-46 BASED ON: Estimate

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

Figure 5. Flight Operation Instruction Chart (Sheet 6 of 6 Sheets)

AAFAC-528 6-1-44

AIRCRAFT MODEL(S)
XB-35

ENGINE(S): (2)R-4360-17 (2)R-4360-21

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 120,000 TO 110,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: FOUR

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER							

FOR DETAILS SEE POWER PLANT CHART (FIG. ____, SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[2] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I						FUEL	COLUMN II						COLUMN III						COLUMN IV						FUEL	COLUMN V					
RANGE IN AIRMILES						U.S.	RANGE IN AIRMILES						RANGE IN AIRMILES						RANGE IN AIRMILES						U.S.	RANGE IN AIRMILES					
STATUTE			NAUTICAL			GAL.	STATUTE			NAUTICAL			STATUTE			NAUTICAL			STATUTE			NAUTICAL			GAL.	STATUTE			NAUTICAL		
MAXIMUM CONTINUOUS						PRESS ALT. FEET	(.33 STAT. (.28 NAUT.) MI./GAL.)						(.44 STAT. (.38 NAUT.) MI./GAL.)						(.54 STAT. (.47 NAUT.) MI./GAL.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000 35000 30000																			40000 35000 30000						
2550	44.0	A.R.	1390	330	286	25000 20000 15000	2350	36.2	A.R.	910	301	261							1900	35.2	A.L.	510	276	240	25000 20000 15000	1450	34.0	A.L.	375	236	205
2550	44.0	A.R.	1390	316	274	10000	2300	34.7	A.R.	840	278	241							1750	34.7	A.L.	475	255	221	10000	1350	33.6	A.L.	340	215	187
2550	44.0	A.R.	1390	298	259	5000	2300	34.7	A.R.	810	267	232	2100	34.7	A.L.	560	247	214	1700	34.5	A.L.	445	241	209	5000	1300	33.4	A.L.	318	201	174
2550	44.0	A.R.	1390	284	247	S.L.	2250	33.7	A.R.	765	252	219							1600	34.2	A.L.	420	228	198	S.L.	1200	33.0	A.L.	290	184	160
610			530			3000	990			860			1320			1150			1620			1410			3000	1900			1650		
550			480			2700	890			770			1190			1030			1460			1270			2700	1710			1480		
490			430			2400	790			690			1060			920			1300			1130			2400	1520			1320		
430			370			2100	690			600			920			800			1130			980			2100	1330			1150		
370			320			1800	590			510			790			685			970			840			1800	1140			990		
310			270			1500	490			425			660			575			810			705			1500	950			825		
250			220			1200	400			350			530			460			650			565			1200	760			660		
180			160			900	300			260			400			350			490			420			900	570			495		
120			100			600	200			175			260			225			320			280			600	380			330		
60			50			300	100			85			130			115			160			140			300	190			165		

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. ____) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT ____ LB. GROSS WEIGHT WITH ____ GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF ____ GAL.) TO FLY ____ STAT. AIRMILES AT ____ FT. ALTITUDE MAINTAIN ____ RPM AND ____ IN. MANIFOLD PRESSURE WITH MIXTURE SET:

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
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C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 4-18-46 BASED ON: Estimate

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

Figure 5. Flight Operation Instruction Chart (Sheet 5 of 6 Sheets)