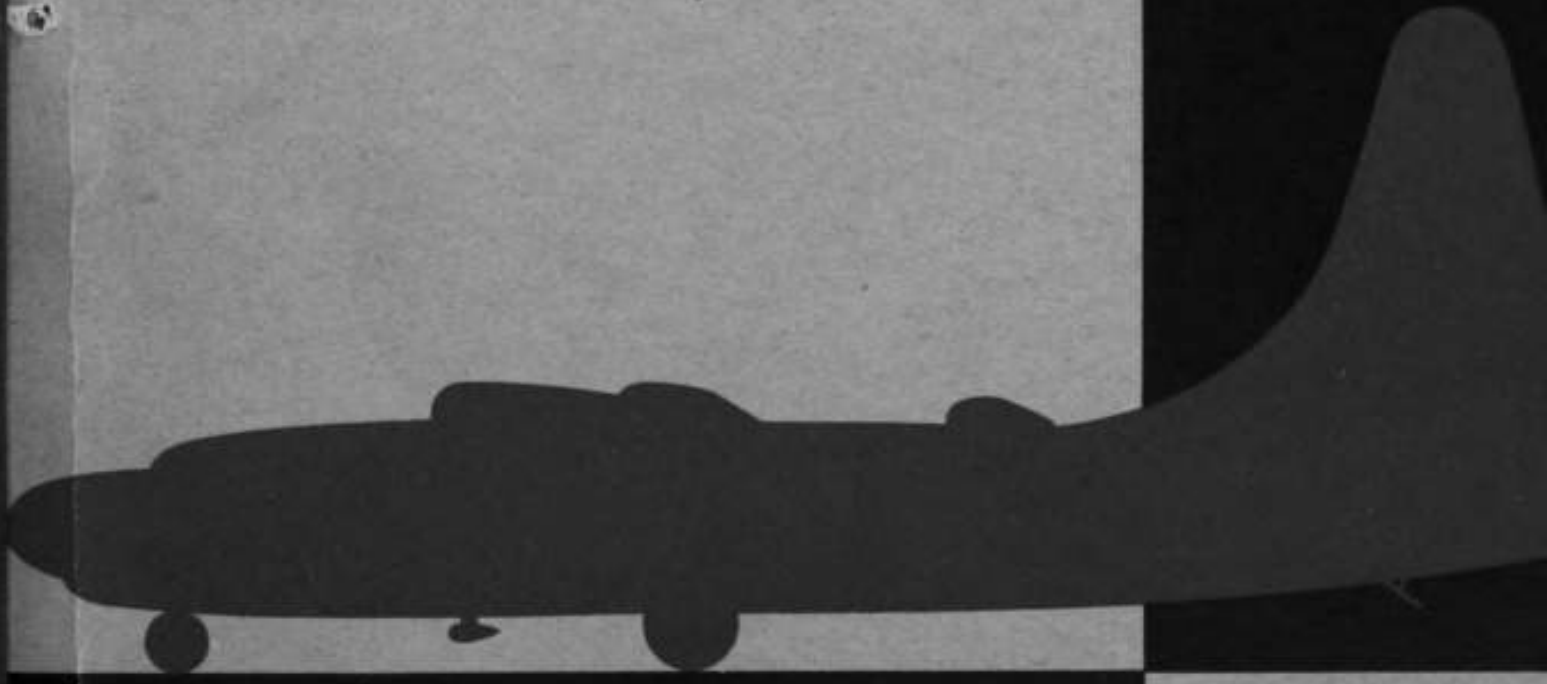
AAF MANUAL 51-126-7

AIRPLANE COMMANDER

TRAINING MANUAL

FOR THE B-32

DOMINATOR



HEADQUARTERS ARMY AIR FORCES

AIRPLANE COMMANDER TRAINING MANUAL FOR THE DOMINATOR

Hq. Army Air Forces
Washington 25, D. C., 15 July 1945

The use and authentication of this manual are governed by the provisions of AAF Regulation 50-17.

By command of General ARNOLD:

HEADQUARTERS ARMY AIR FORCES — OFFICIAL — WAR DEPARTMENT

Ira C. Eaker
Lieutenant General, United States Army
Deputy Commander, Army Air Forces

Additional copies of this manual should be requested from: Hq. AAF, Office of Flying Safety, Safety Education Division, Winston-Salem 1, North Carolina

INITIAL DISTRIBUTION: HEADQUARTERS AAF • AAF TRAINING COMMAND

Con. P. Curran Printing Co., St. Louis - 7-16, -45 - 3M

Introduction

This manual is the text for your training as a B-32 pilot and airplane commander.

The Air Forces' most experienced training and supervisory personnel have collaborated to make it a complete exposition of what your pilot duties are, how each duty will be performed, and why it must be performed in the manner prescribed.

The techniques and procedures described in this book are standard and mandatory. In this respect the manual serves the dual purpose of a training checklist and a working handbook. Use it to make sure that you learn everything described herein. Use it to study and review the essential facts concerning everything taught. Such additional self-study and review will not only advance your training, but will alleviate the burden of your already overburdened instructors.

This training manual does not replace the Technical Orders for the airplane, which will always be your primary source of information concerning the B-32 so long as you fly it. This is essentially the textbook of the B-32. Used properly, it will enable you to utilize the pertinent Technical Orders to even greater advantage.

COMMANDING GENERAL, ARMY AIR FORCES

Contents

The first edition of this manual is necessarily general in scope. Specific procedures outlined are designed primarily for transition training. More advanced flying technique for the B-32 will be described in subsequent editions.

The B-32 Dominator

The B-32's Past

The history of your B-32 Dominator starts in 1940, when the Army accepted Boeing, Martin and Consolidated Vultee designs for VHB aircraft. Martin designs were not completed, but the end results of those Boeing and Convair plans are the present B-29 and B-32 airplanes. Between the first 32 design and the airplane you're flying today, however, is a long succession of changes.

The originally planned XB-32 was an airplane with several similarities to the present Superfortress. It had pressurization and remotely controlled turrets. It also had a double tail, wing guns and cannon, and other features which it doesn't have today. The Army decided not to put all its eggs in one basket, but to have at first only one airplane with the new features of the 29, and to duplicate its purpose in another model of more conventional design.

So Consolidated re-designed the B-32, and in the process practically started over again and built a new airplane, the changes putting the B-32 program behind the B-29. The XB version first flew Labor Day, 1942, in San Diego. The B type first flew late in 1944. The B-32 you are flying today is still a brand new airplane, and it is still undergoing changes to make it a better airplane.

The B-32's Future

You won't find here any predictions about the future of the Dominator. That story can't

be truthfully set down anywhere, yet. But when it is, it will be written by you. You and all the others who fly the B-32, service it, and maintain it, will sky-write its record in the combat theater when the chips are down. No matter how good the airplane is to begin with or how well it performs in transition, the way you handle it can build up or tear down its reputation. Now is the time to add every bit you can to your knowledge of the B-32, to get the most out of its potentialities. For this airplane has potentialities. It is stable and maneuverable. It's a surprisingly easy airplane to fly, and it has plenty of power, speed, range, and load capacity.

In the final analysis, however, it will be up to you to find out and to demonstrate how good an airplane this Dominator is.

About This Training Manual

The first part of this manual concerns inspections, checks, and flying procedures. The sequence of subjects in the procedures section is chronological, following the order in which you consider them in actual operations. The last part of the manual presents brief and condensed reference summaries of systems and equipment on the airplane. Emergency procedures, or emergency operations of equipment, are taken up under the subject to which they refer. For example, emergency landing flight procedures, like landing with engines out or gear up, follow the normal landing amplified checklist. Emergency operation of hydraulic units is treated at the end of the hydraulic system section, electrical system emergencies at the end of the electrical system section, etc.

The Airplane Commander

Teamwork makes a good bomber crew. As the airplane commander you are responsible for achieving and maintaining teamwork. The proficiency of each crew member as part of the team is your responsibility as much as is your ability to fly the B-32. To operate as a fighting unit at top efficiency you must know your own job and know your crew.

Knowing your own job means knowing all you can find out about your airplane and developing the highest possible skill in operating it.

Knowing your crew means knowing the duties and responsibilities of each man, his qualifications for those duties, and the manner in which he performs them. Your copilot and aerial engineer, with whom you start your B-32 training, are the nucleus of your team. Begin your career as airplane commander by showing as much interest in their training as you can and continue this policy with the rest of the crew when they join you later. Take a genuine interest in your men: learn something about their experiences, their families, their plans and ideas. Help them with their personal problems as well as their training progress.

As commanding officer of your small aerial army you must maintain crew discipline. Your personal interest in your men and your companionship with them can assure good discipline rather than detracting from it if you handle it right. Be friendly and understanding but be firm. Demonstrate that you know your job by the way you perform your duties. Be uncompromising in your insistence on the proper performance of crew duties before everything else. Make fair decisions after due consideration of all the facts, but make them in such a way as to impress upon your crew that your decisions are made to stick.

ENFORCE THESE RULES ON EVERY FLIGHT

Smoking

1. No smoking during ground operation.
2. No smoking during and immediately after takeoff.
3. No smoking during fuel transfer operations.
4. No smoking at any time any occupant detects fumes.
5. No smoking in bomb bay or fuselage section at any time they contain auxiliary fuel.

Parachutes

1. See that each person aboard has a parachute on every flight and that there is one extra parachute aboard for every four persons. As a minimum, carry two extra parachutes, one in the forward and one in the aft compartment.
2. Insist that all persons aboard wear parachute harness at all times from takeoff to landing.

Propellers

1. Allow no person to walk near propellers at any time, whether or not propellers are turning.
2. See that no person leaves the airplane when propellers are turning unless you personally ordered him to do so.

Oxygen Masks

1. See that oxygen masks are carried on all day flights of four hours or more in which altitude may exceed 8,000 feet; on all flights in which altitude may exceed 10,000 feet; and on all combat and tactical night flights.
2. Have all persons start use of oxygen at 8,000 to 10,000 feet on all day flights where altitude at any time will exceed 10,000 feet.
3. Have all persons use oxygen from the ground up on all combat and tactical flights at night and all training flights at night during which altitude may exceed 10,000 feet.

Training

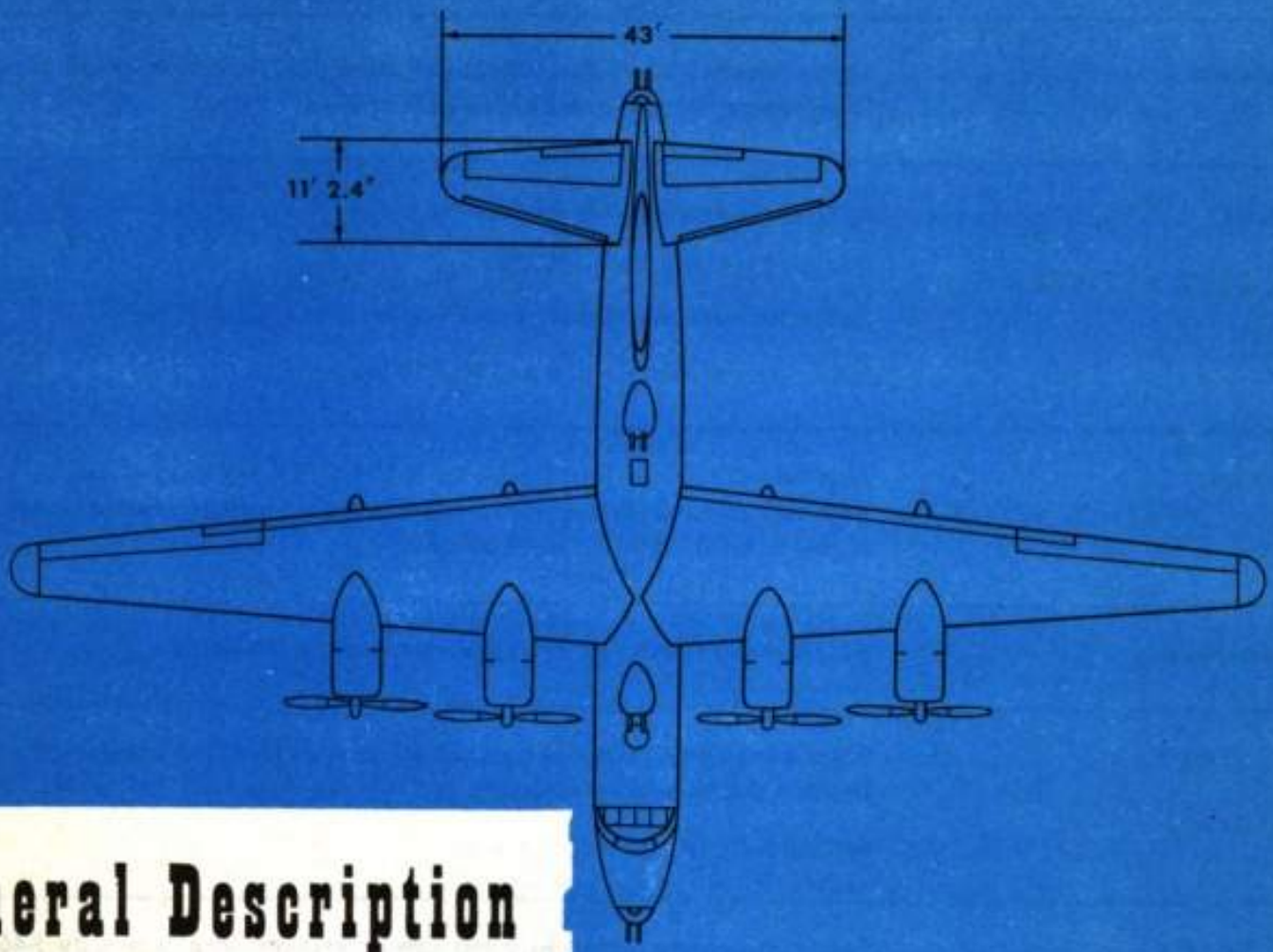
1. Tell your crew the purpose of each mission and what you expect each to accomplish.
2. Keep the crew busy throughout the flight. Get position reports from the navigator; send them out through the radio operator. Put the engineer to work on the cruise control and maximum range charts and require him to keep a record of engine performance. Give them a workout. Encourage them to use their skill. Let them sleep in their bunks—not in a B-32. A team is an active outfit. Make the most of every practice mission.
3. Practice all emergency procedures at least once a week: bailout, ditching, and fire drill.

Inspections

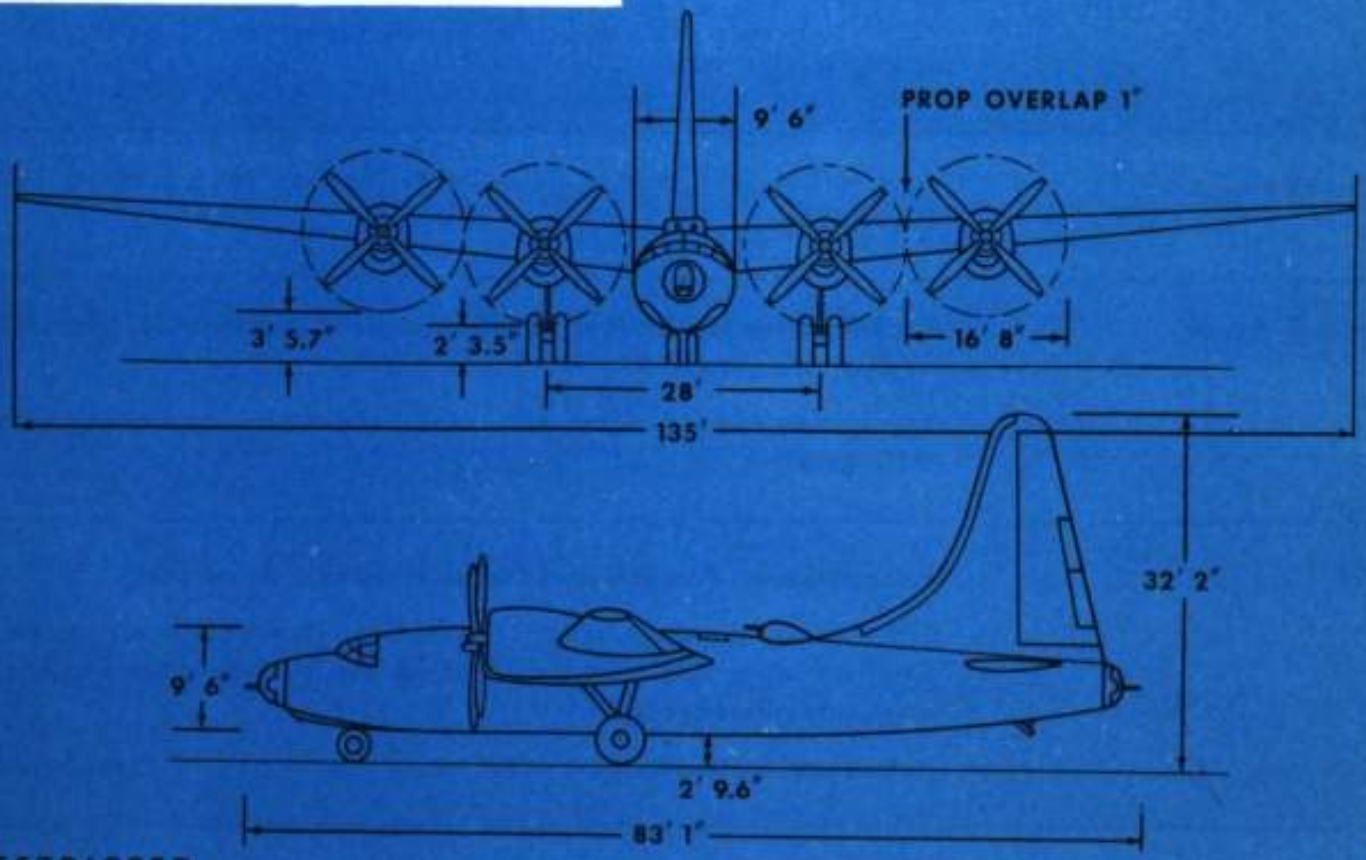
1. Check your airplane with reference to the particular mission you are undertaking. **Check everything.**
2. Check your crew and passengers for equipment, preparedness, and understanding of all duties in transition training. Make your preflight crew and passenger check in accordance with CFTC Memorandum 50-2-4.

Interphone

1. Keep the interphone chattering. Ask for immediate reports of aircraft, trains, and ships just as you would expect them in combat—with proper identification.
2. Require interphone reports every 15 minutes from all crew members when on oxygen.



General Description



Airplane	Consolidated Vultee Aircraft Corporation B-32, all metal, high wing, long range, heavy bombardment airplane
Weight	Empty—Approximately 61,000 lbs Design gross weight—100,000 lbs Recommended maximum gross for takeoff—100,800 lbs Maximum allowable gross—123,250 lbs
Engines	Four 18-cylinder Wright Cyclones, R-3350-23A, air-cooled, each with two exhaust-driven turbo-superchargers having electronic regulator control, 2200 hp at 2800 rpm
Propellers	Four-bladed Curtiss electric, reverse pitch on inboards
Cowl Flaps	Eight per engine, electrically controlled and electrically operated by flexible shafts and screw jacks Settings—0° to 20°
Fuel Tanks	Four self-sealing tanks in wing center section, total capacity 5460 U. S. gallons Four removable self-sealing bomb bay tanks, total capacity 3000 U. S. gallons
Oil Tanks	Four self-sealing tanks in wing center section, total capacity 306 U. S. gallons
Landing Gear	Tricycle, three sets of dual wheels, completely retractable, operated by hydraulic power Retractable tailskid, fitted with air-oil shock strut, operating with main gear
Wing	Full cantilever, internally-braced, stressed-skin Davis wing Permanently attached center section, two removable outer panels, and two wing tips, to which leading and trailing edge sections, flaps, and ailerons attach Hot air anti-icers in leading edge

Wing Flaps

Two Alclad-covered Fowler flaps in wing center section on each side of fuselage, spanning center section from fuselage to aileron

Hydraulically-operated and electrically-controlled

Outboard flaps mechanically interconnected and inboard flaps mechanically interconnected

Empennage

Full cantilever stabilizer with fabric-covered elevators, dual trim tabs

Single dorsal and vertical fin, with fabric-covered rudder and two rudder tabs

Rudder and elevator noses reinforced with Alclad skin, statically and dynamically balanced

De-icer boots on first 200 airplanes, hot air anti-icers on subsequent airplanes

Armament

Ten .50 caliber M-2 machine guns, mounted two each in five locally-controlled turrets

Nose, tail, and lower are electric-hydraulic ball turrets, lower turret hydraulically retractable; upper turrets electrically operated; all turrets heated

Total rounds ammunition—5800

NOTE: Transition airplanes have turrets removed, and 700 lbs of ballast in tail section of fuselage.

Bomb Load

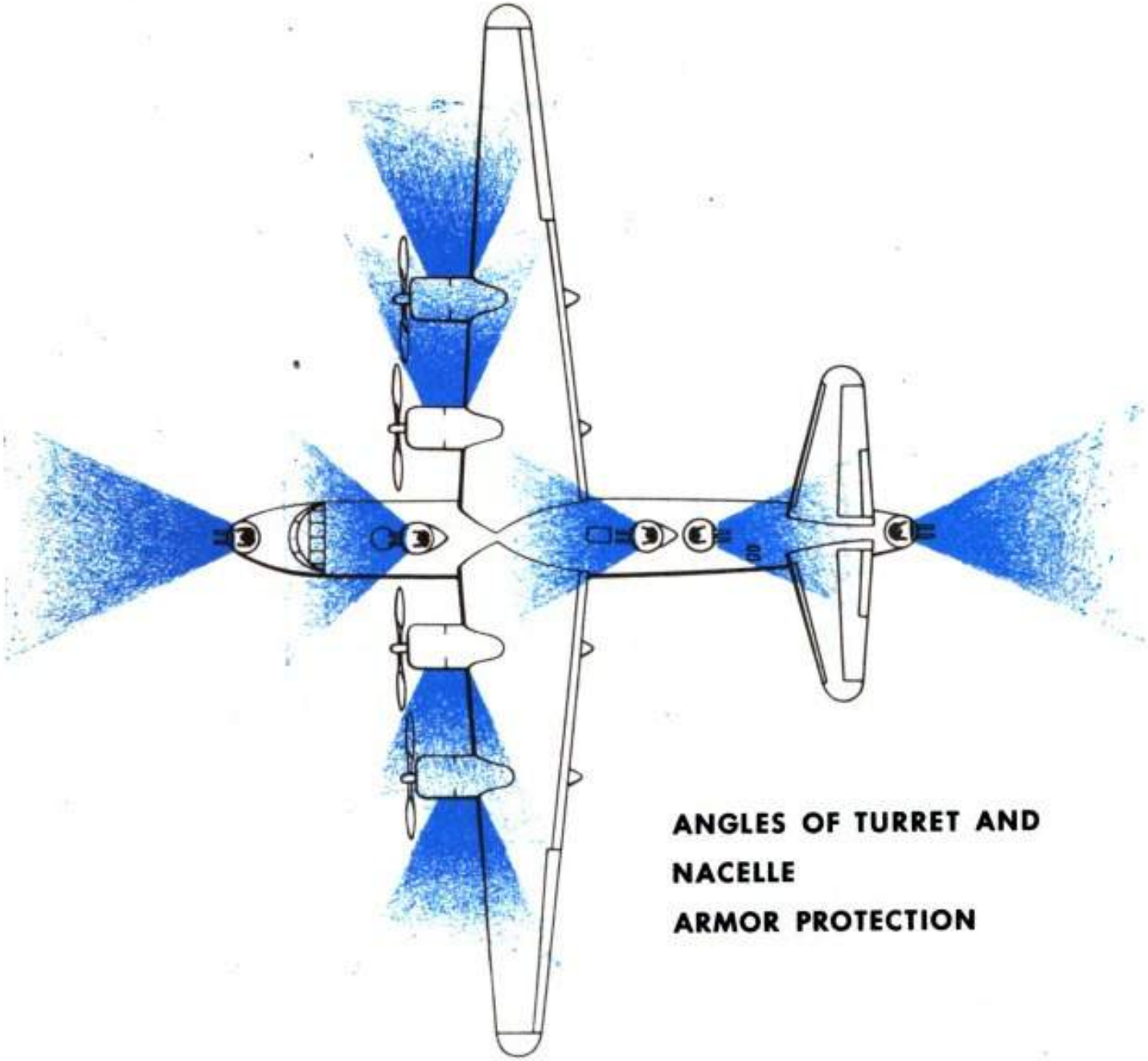
Carried in two bomb bays, providing total of 48 stations maximum at one time

Possible loads:

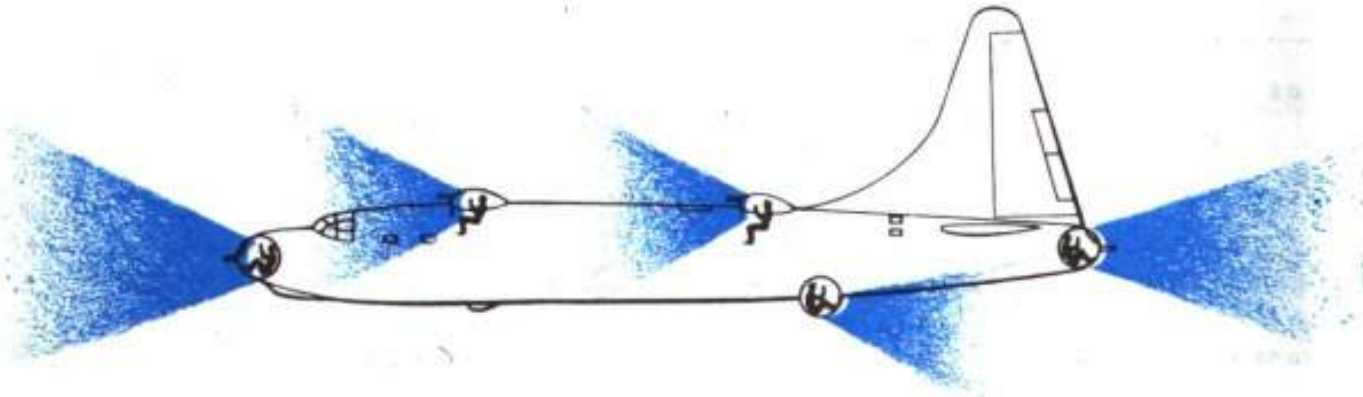
40 500 lb bombs	8 2000 lb bombs
12 1000 lb bombs	4 4000 lb bombs
8 1600 lb bombs	

Areas

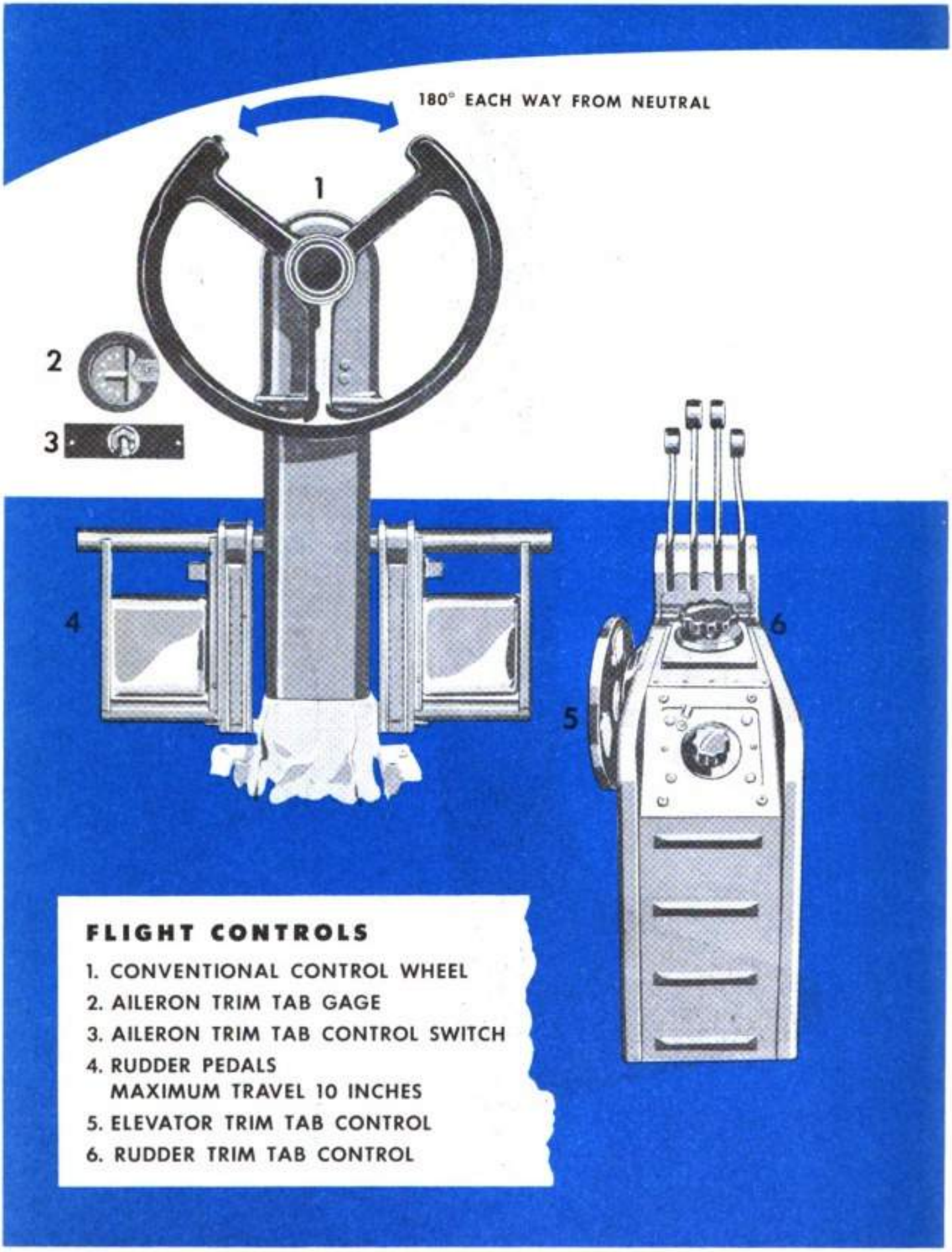
Total wing, including ailerons	1532.52 sq. ft.
Wing, flaps extended	1544.94 sq. ft.
Flaps, total each set	128.25 sq. ft.
Ailerons, each, including tab	50.65 sq. ft.
Aileron tabs, each	2.3 sq. ft.
Horizontal stabilizer, including elevators	333 sq. ft.
Elevators, each, including tab	56.08 sq. ft.
Elevator tabs, each	4.65 sq. ft.
Vertical stabilizer, including rudder	267.8 sq. ft.
Rudder, including tabs	107.3 sq. ft.
Rudder tabs, each	5.8 sq. ft.



ANGLES OF TURRET AND NACELLE ARMOR PROTECTION



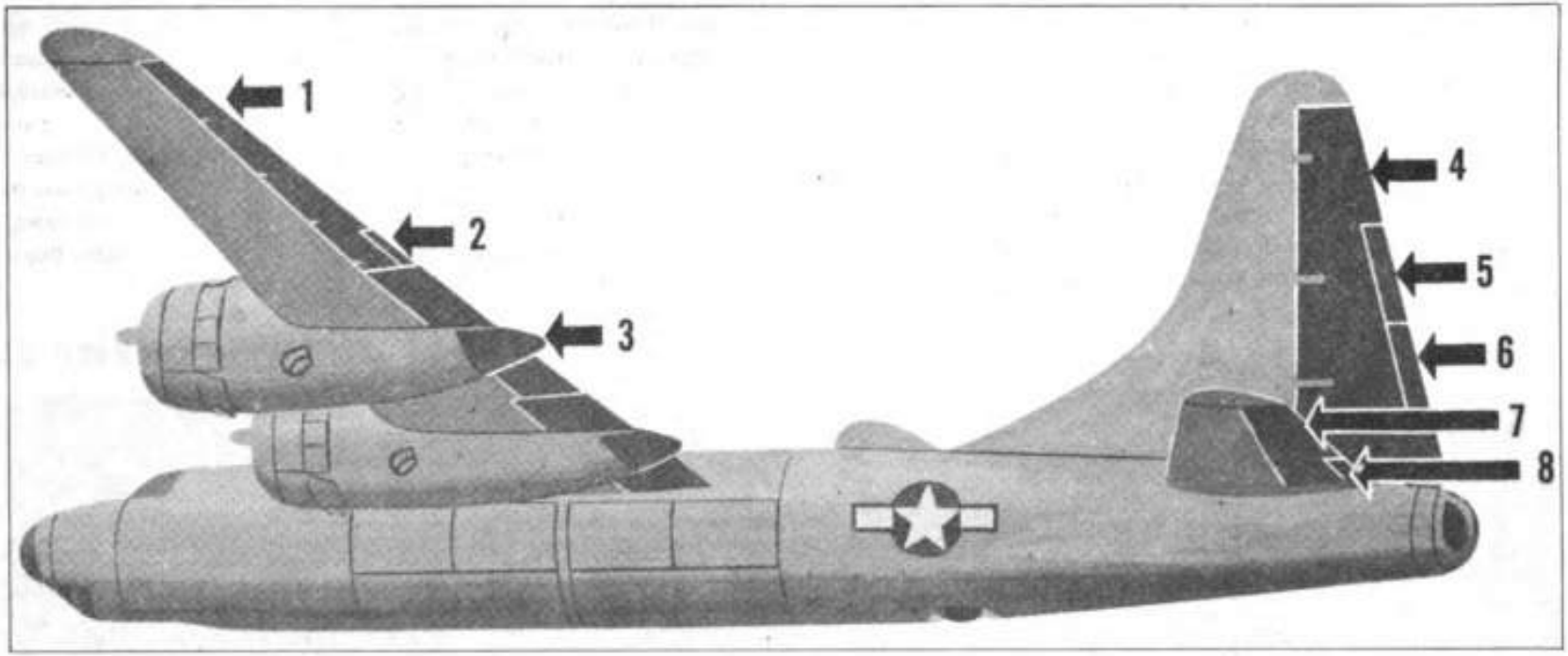
ANGLES OF FIRE



FLIGHT CONTROLS

1. CONVENTIONAL CONTROL WHEEL
2. AILERON TRIM TAB GAGE
3. AILERON TRIM TAB CONTROL SWITCH
4. RUDDER PEDALS
   MAXIMUM TRAVEL 10 INCHES
5. ELEVATOR TRIM TAB CONTROL
6. RUDDER TRIM TAB CONTROL

CONTROL SURFACE MOVEMENTS



1. AILERONS • 20° UP AND DOWN
2. AILERON TRIM TABS • MANUAL TRIM DEFLECTION 10° UP AND DOWN
   SERVO DEFLECTION 20° UP AND DOWN
3. FLAPS • 40° (TOTAL)
4. RUDDER • 20° LEFT AND RIGHT
5. RUDDER TRIM TAB • SERVO DEFLECTION 8° LEFT AND RIGHT
6. RUDDER TRIM TAB • MANUAL TRIM DEFLECTION 10° LEFT AND RIGHT
7. ELEVATOR • 25° UP • 15° DOWN
8. ELEVATOR TRIM TAB • 10° UP • 14° DOWN

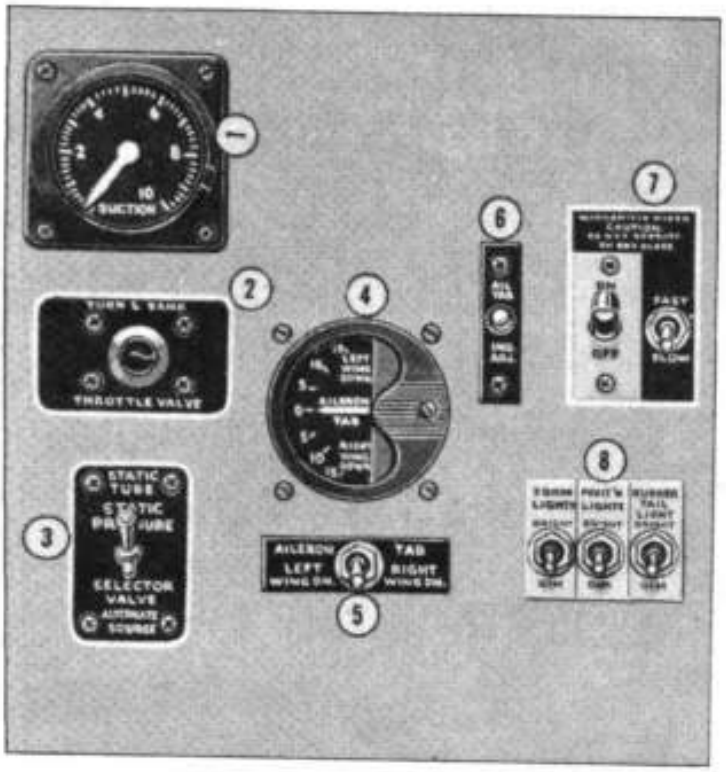
Note

Aileron trim tabs are operated and controlled electrically by a motor housed in each aileron. Tab balance (servo) deflection is mechanically produced by the control linkage, in order to take some load off the controls.

RESTRICTED

MAIN INSTRUMENT PANEL

1. PDI
2. Ball turret warning light
3. Radio marker beacon
4. Bomb doors warning light
5. Bomb release warning light
6. Bomb salvo switch
7. Salvo switch warning light
8. Airspeed indicator
9. Directional gyro
10. Flight indicator
11. Altimeter
12. Turn and bank indicator
13. Rate of climb indicator
14. Radio compass
15. Flux gate compass repeater
16. Both inverters out warning light
17. Manifold pressure gages
18. Tachometers
19. C-1 autopilot panel
20. Alarm bell switch
21. Flaps switch
22. Ignition switches
23. Flap position indicator
24. Oil temperature gages
25. Cylinder head temperature gages
26. Main oil pressure gages
27. Landing gear switch
28. Landing gear down-lock light
29. Master tachometer
30. Proportional synchro-control knob
31. Propeller control panel
32. Oil cooler exit flap switches
33. Airspeed indicator
34. Altimeter
35. Main hydraulic pressure gage
36. Intercooler switches
37. Directional gyro
38. Flight indicator
39. Nose oil pressure gages
40. Carburetor temperature gages
41. Cowl flap switches
42. Brake pressure warning light
43. Hydraulic pump over-ride switch
44. Brake hydraulic pressure gages

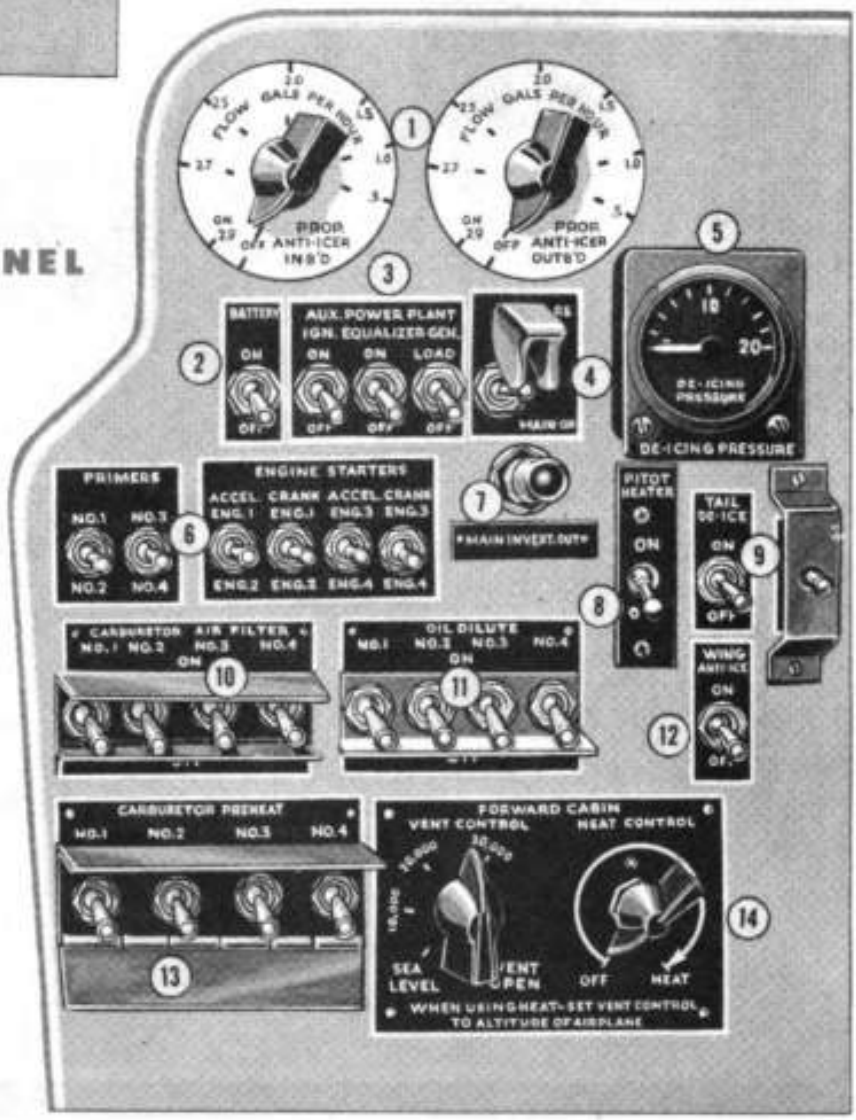


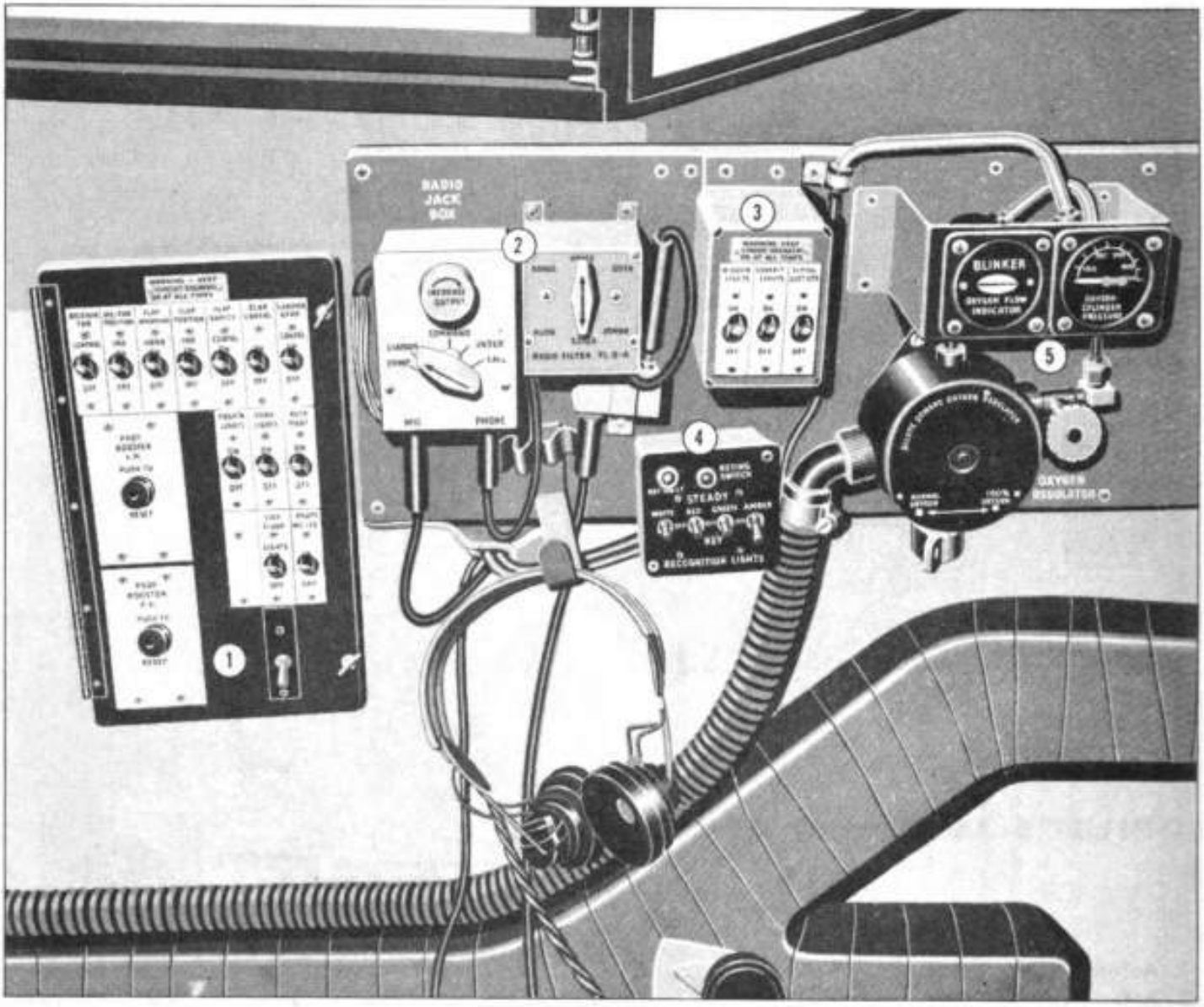
AIRPLANE COMMANDER'S AUXILIARY PANEL

1. Suction gage
2. Turn and bank needle valve
3. Static pressure selector valve
4. Aileron tab indicator
5. Aileron tab switch
6. Aileron tab indicator adjustment
7. Windshield wiper circuit breaker and switch
8. Formation, position, and tail lights switches

COPILOT'S AUXILIARY PANEL

1. Anti-icer flow controls
2. Battery switch
3. APP switches
4. Inverter switch
5. De-icer pressure gage
6. Engine priming and starting switches
7. Main inverter out warning light
8. Pitot heater switch
9. Tail de-icer switch
10. Carburetor air filter switches
11. Oil dilution switches
12. Wing anti-icer switch
13. Carburetor pre-heat switches
14. Forward cabin ventilating and heat controls



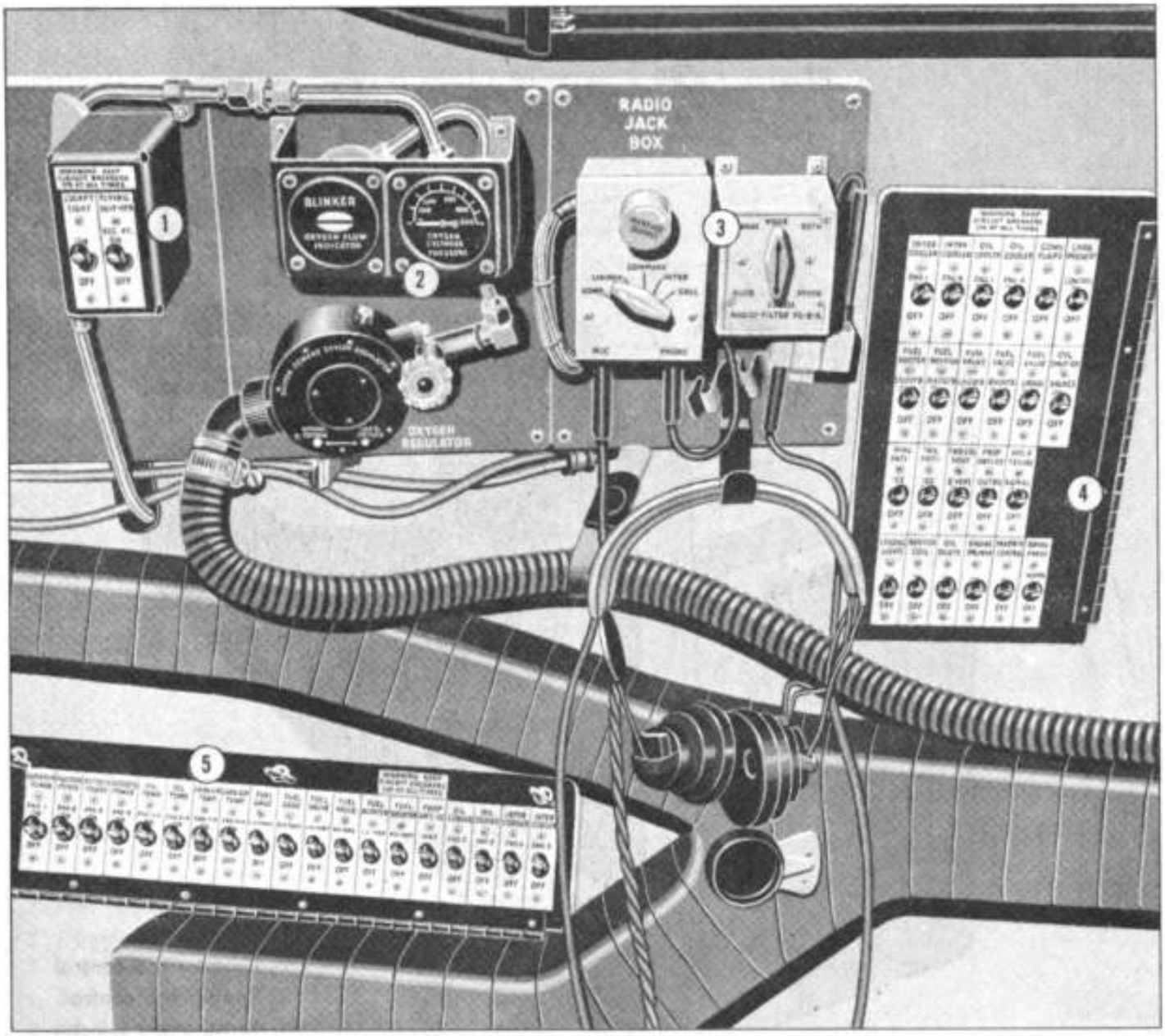


AIRPLANE COMMANDER'S CIRCUIT BREAKER PANEL

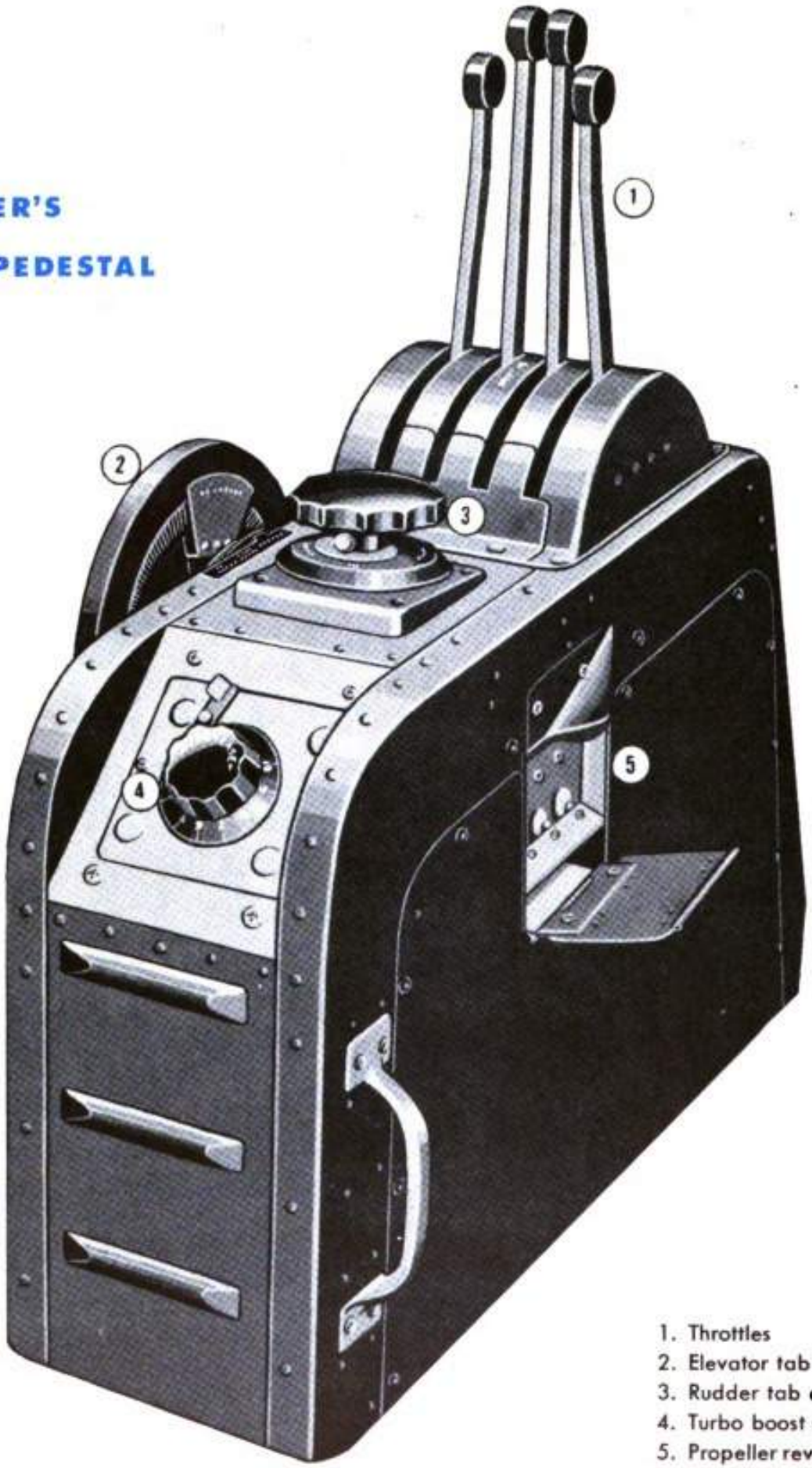
1. Circuit breakers
2. Radio jack box and filter
3. Circuit breakers
4. Recognition light control panel
5. Oxygen panel

COPILOT'S CIRCUIT BREAKER PANEL

1. Circuit breakers
2. Oxygen panel
3. Radio jack box and filter
4. Circuit breakers
5. Circuit breakers

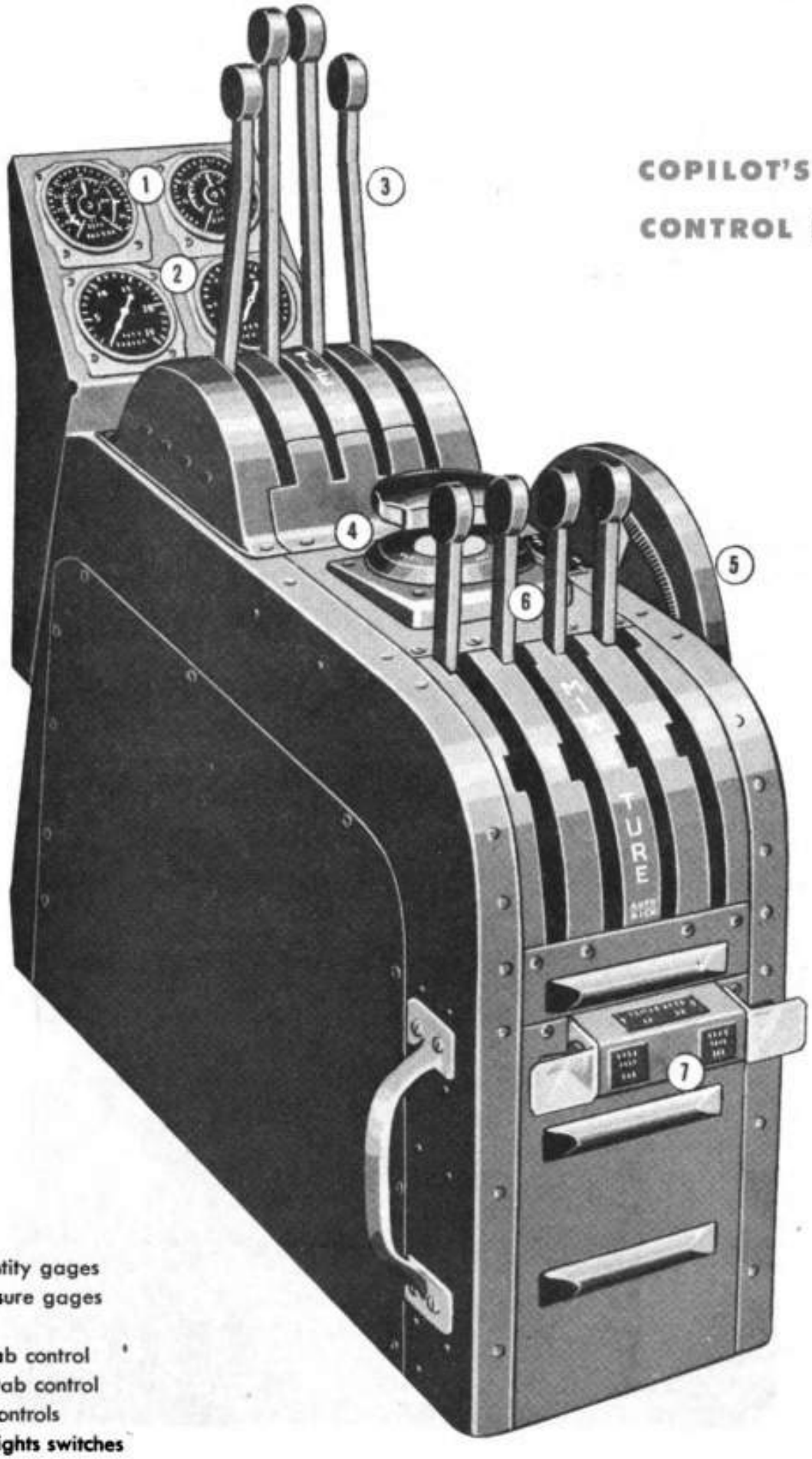


AIRPLANE COMMANDER'S CONTROL PEDESTAL

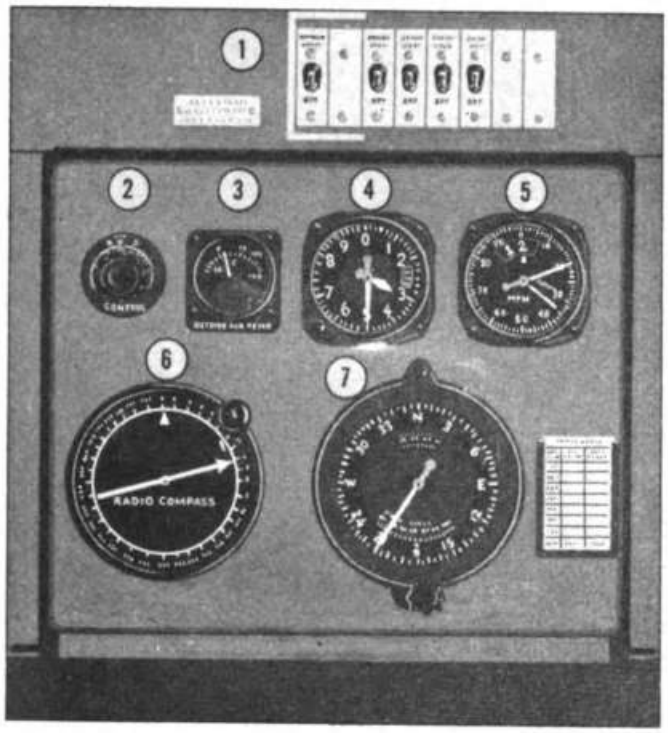


1. Throttles
2. Elevator tab **control**
3. Rudder tab **control**
4. Turbo boost **selector**
5. Propeller **reverse switches**

COPILOT'S CONTROL PEDESTAL



1. **Fuel quantity** gages
2. **Fuel pressure** gages
3. **Throttles**
4. **Rudder tab** control
5. **Elevator tab** control
6. **Mixture** controls
7. **Landing lights switches**

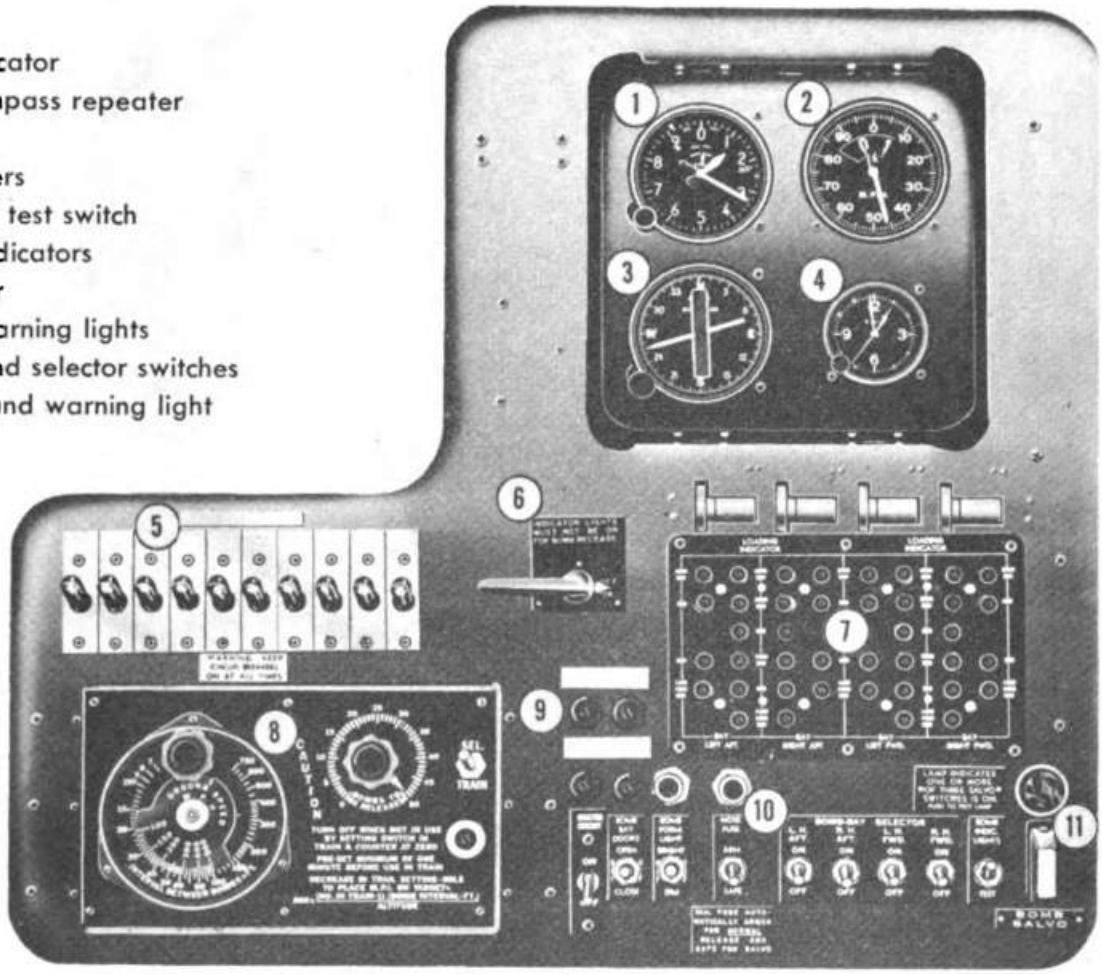


NAVIGATOR'S PANEL

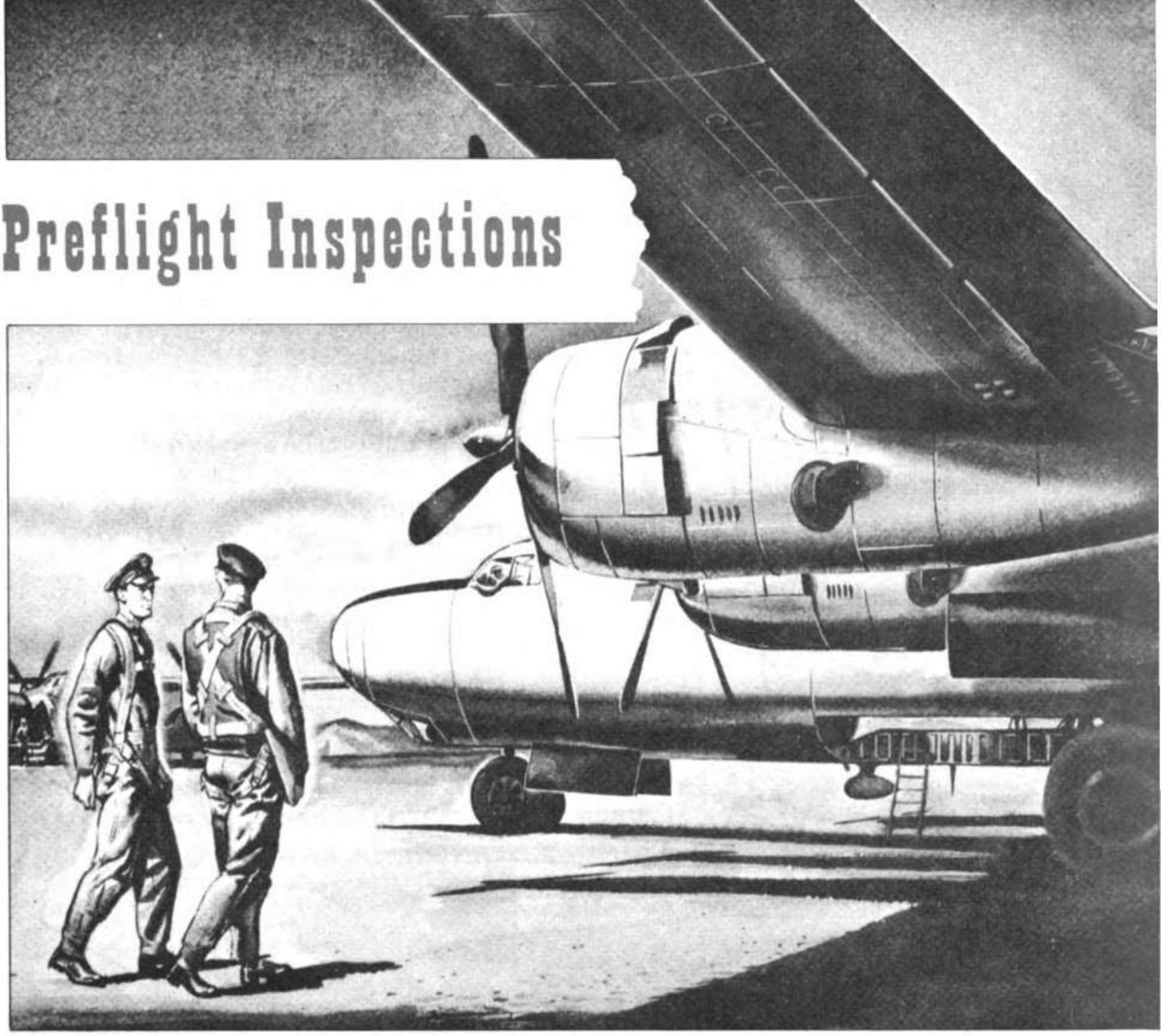
1. Circuit breakers
2. Autopilot turn control knob
3. Free air temperature
4. Altimeter
5. Airspeed indicator
6. Radio compass indicator
7. Master flux gate indicator

BOMBARDIER'S PANEL

1. Altimeter
2. Airspeed indicator
3. Flux gate compass repeater
4. Clock
5. Circuit breakers
6. Indicator light test switch
7. Bomb load indicators
8. Intervalometer
9. Bomb door warning lights
10. Door, light, and selector switches
11. Salvo switch and warning light

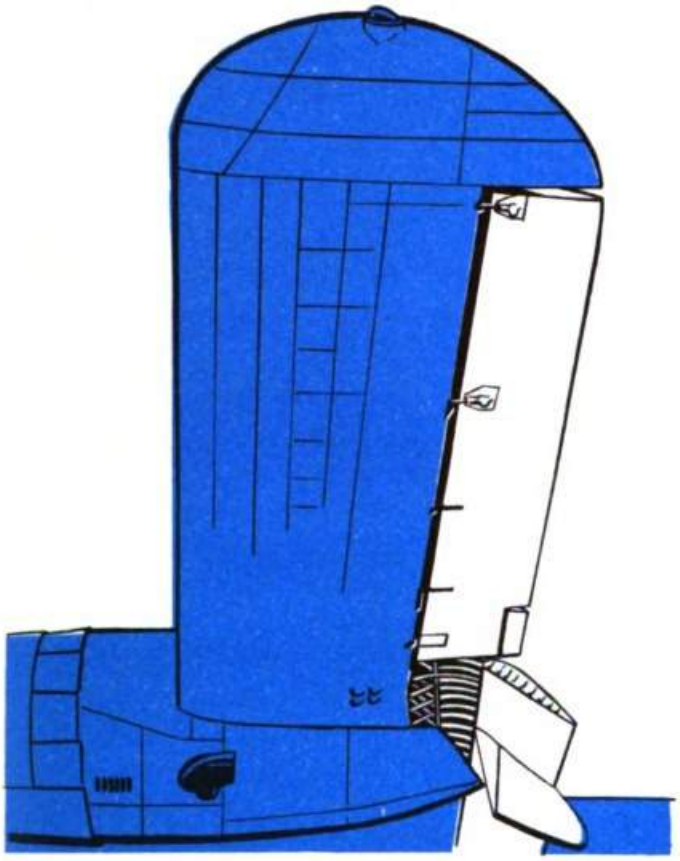


Preflight Inspections



It is your responsibility as airplane commander to know before each flight that your airplane is in proper flying condition. Transition training procedure requires you to perform the accompanying airplane commander's preflight inspection, signing the inspection checklist form before takeoff. Continue to make this inspection before all flights throughout your career as a B-32 airplane commander. For speed and efficiency, always make the inspection the same way, following the route shown in the diagram.

AIRPLANE COMMANDER'S PREFLIGHT INSPECTION

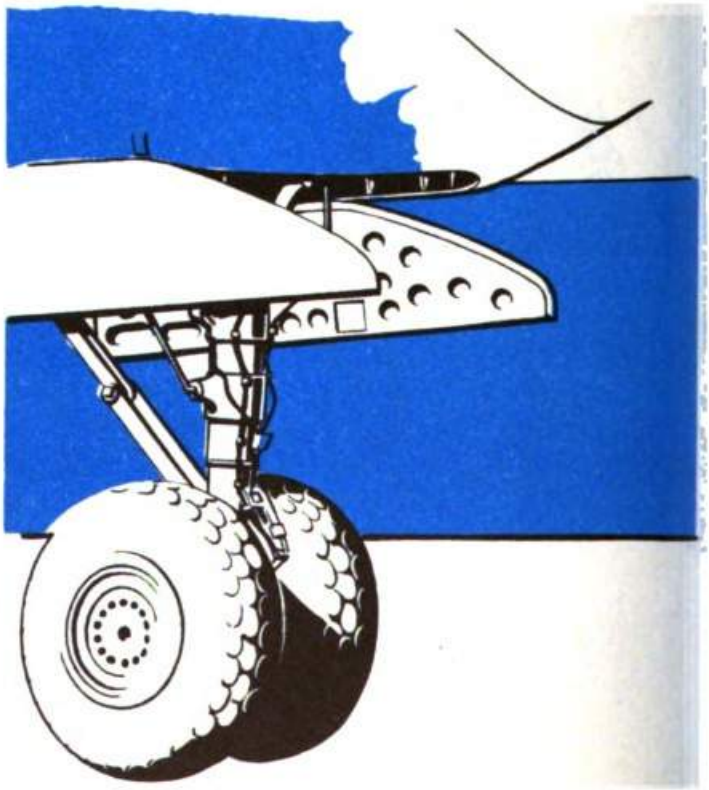


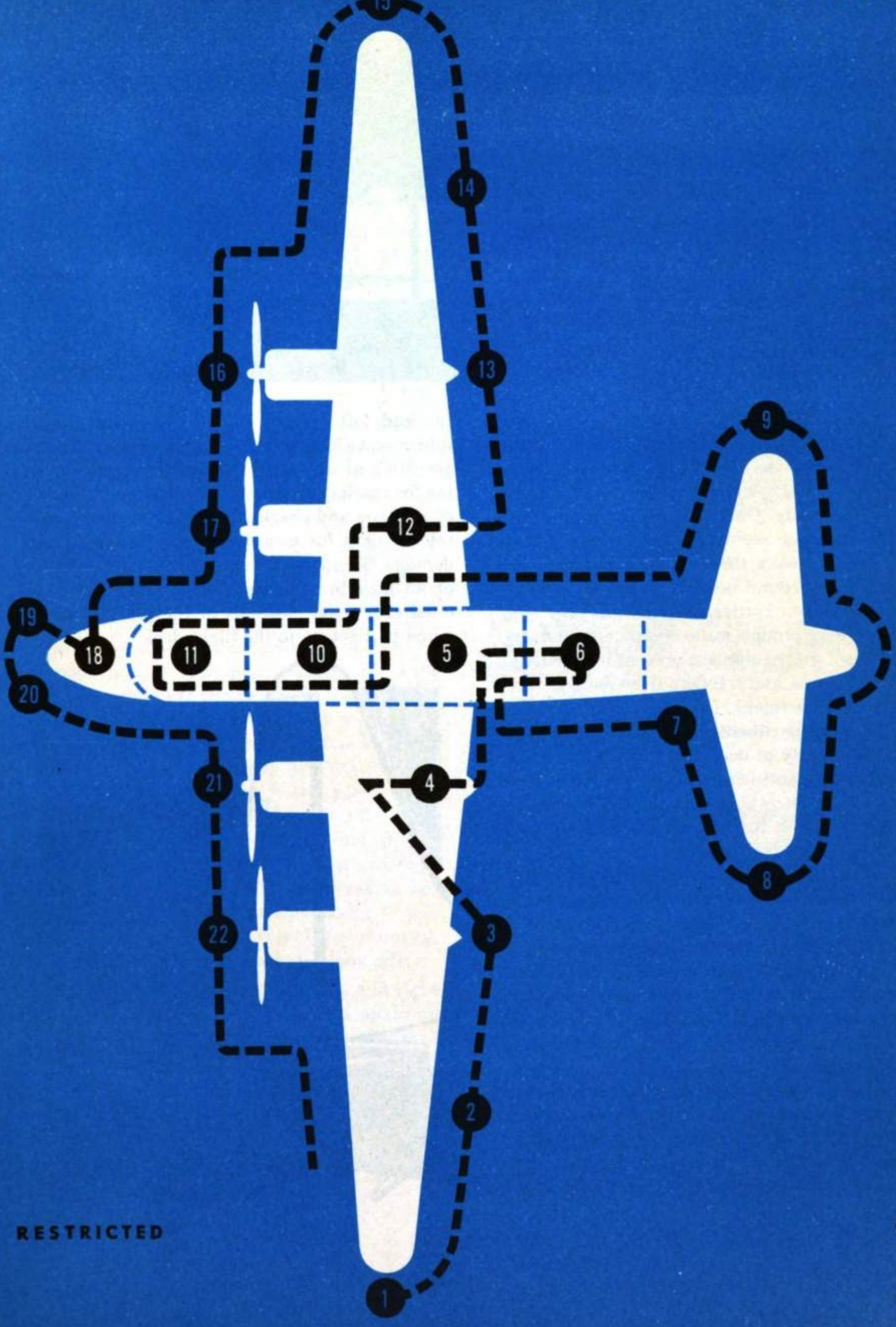
1. **Left wing tip:** Check leading edge of wing tip for condition, and wing tip skin for cleanliness, freedom from wrinkles, missing rivets, damage. Check running light to see that it is clean and undamaged. Walk around to aft side of wing tip.

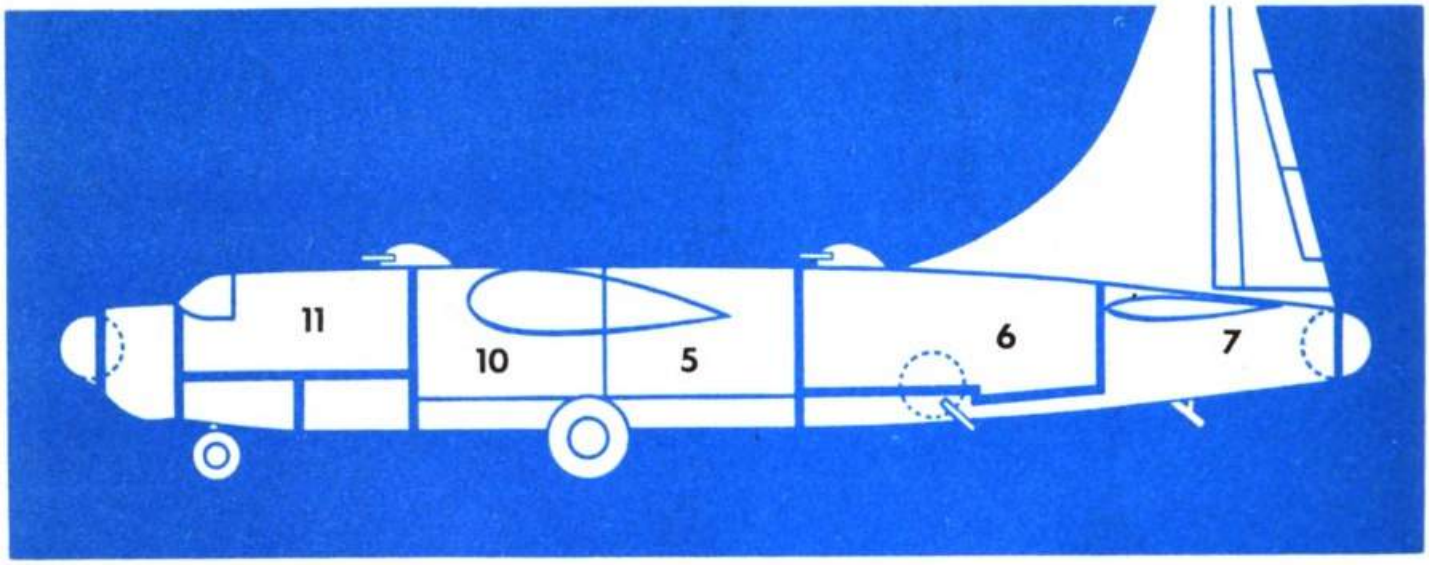
2. **Left aileron:** Check condition of aileron fabric and aileron hinges. Check condition of aileron tab.

3. **No. 1 nacelle and left outboard flap:** Check nacelle for loose fasteners, evidence of oil leaks. Use a flashlight to look up into primary heat exchanger dump flap and make sure that Y valve is open, so that primary heated air dumps overboard. Check flaps for condition, flap hinges, and visible cables and pulleys for fraying. Check condition of wing between No. 1 and No. 2 nacelles. Check stress plates for security. Check fuel cell area for leaks, particularly around selector valve area.

4. **Left main gear, No. 2 nacelle, and left inboard flap:** Check oleo strut for proper inflation (2-11/16″ clearance). Check gear accumulator pressure (normal–350 to 450 lbs). Check tire inflation, using gage if practicable (normal pressure up to 100,000 lbs gross load–77 psi). Check tires for condition and slippage and brakes for evidence of hydraulic leaks. Inspect all hydraulic lines in wheel well for security and evidence of leaks. Look for signs of fuel leaks in well, and check fuel draincocks to be sure they are safetied. Check liquidometer gage for fuel quantity. Check down locks for security and see that ground locks are removed. Check shock strut down lock assembly and latch release lever for clearances–approximately ⅛″ each. Check No. 2 nacelle and inboard flap as you did No. 1 nacelle and outboard flap. Check fuel cell area for leaks. Enter rear bomb bay.




1
2
3
4
5
6
7
8
9
10
11
12
13
14
16
17
18
19
20
21
22



5. **Rear bomb bay:** Check flap cables and pulleys for fraying and for proper tension. Check for hydraulic leaks around flap motors. Check condition of flaps, looking out along spar from top of bomb bay. Check all electrical and hydraulic lines for security. Check for evidence of hydraulic leaks throughout bomb bay, including area around bomb door motors. Check CO_2 and oxygen bottles, hand crank, gear box, prop anti-icer pumps, radio equipment, and any other necessary equipment present for security, proper stowage, and freedom from damage. Enter rear compartment.

6. **Rear compartment:** Check for proper stowage and security of equipment, including extra hydraulic and anti-icing fluid if present, covers for nacelles, turrets, and windshields. Check lower turret for full retraction and security. Check presence and accessibility of parachutes, and inspect each pack for general condition of pack, elastics, ripcord pins and seal. Look at inspection record card on each pack to be sure pack has been inspected and re-packed at proper time. Check scanning blisters for cleanliness. Check tail section for security of ballast in training ships, and for proper stowage and security of any other equipment carried there. Exit through bomb bay, left side.

7. **Aft fuselage section:** Check left side of rear fuselage for general condition. Check tailskid air-oil shock strut for proper pressure (550 to 650 psi). Proceed aft to left side of tail.

8. **Left side of empennage:** Check left elevator and left side of rudder for condition of fabric and skin, of hinges, and of tabs. Check condition of tail de-icer boots, if present, looking for cracks and damage. Walk around to rear of airplane and check running lights and bomb release light for cleanliness and freedom from damage. Stand back from tail and note position of all elevator, rudder, and aileron tabs, and cross-check the positions of the tab indicators when you get up to the flight deck.

9. **Right side of empennage:** Repeat the foregoing checks on the right side of the rudder and the right elevator. Walk forward, checking condition of the right aft fuselage section. Note top turret for proper position. Then enter forward bomb bay.

10. **Forward bomb bay:** Inspect fuel selector valves and hose connections for security, and look carefully for signs of fuel leaks. Check liquidometer gages for fuel quantity. Check main and brake hydraulic reservoirs for correct fluid levels. Check brake accumulators, main hydraulic selector valve, and all hydraulic lines and connections for security and for leaks. Check all electric and fuel lines for security. Look for leaks in fuel cell areas. Check fuel draincocks for safetying. Inspect visible control cables for proper tension and for signs of fraying. Check recognition lights for cleanliness and freedom from damage, and lower antennas for security. Enter flight compartment.

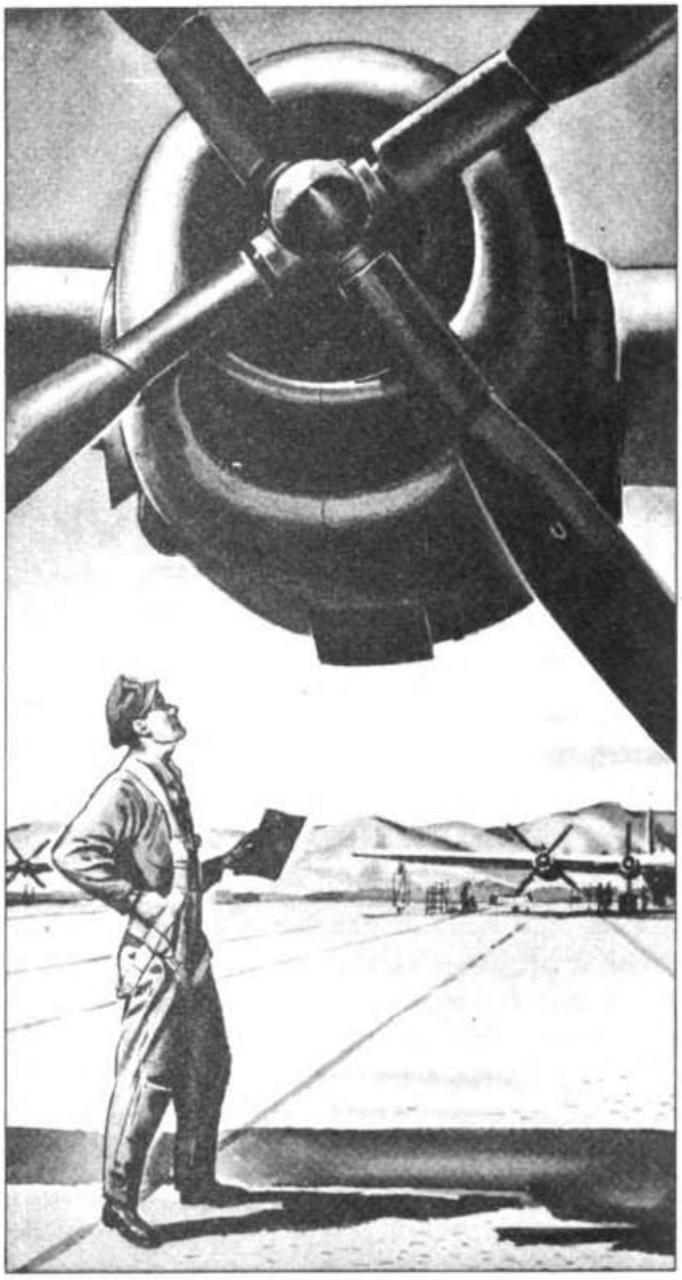
11. **Flight compartment:** Check emergency hydraulic reservoir for correct fluid level. Check whole compartment for security and proper stowage of equipment. Check parachutes for presence and accessibility and repeat the inspection of each pack which you made on those in the rear compartment. Check positions of tab indicators to see that they agree with the positions of the tab surfaces. Check ignition and battery switches for OFF position so that you can safely check the props when you go out again. Check Forms 1, 1A, and F (loading). Check for availability and proper stowage of maps and radio aid charts. Check spare light bulb and turbo fuse boxes to see that necessary bulbs and fuses are there. Check forward upper turret, if present, for security. Exit through forward bomb bay, right side.

12. **Right main gear, No. 3 nacelle, and right inboard flap:** Repeat the checks you made on the left gear, No. 2 nacelle, and the left inboard flap.

13. **No. 4 nacelle and right outboard flap:** Repeat the checks you made on No. 1 nacelle and left outboard flap.

14. **Right aileron:** Repeat the checks you made on the left aileron.

15. **Right wing tip:** Repeat the checks you made on the left wing tip.



16. **No. 4 propeller and engine:** Inspect nose section for oil leaks, or foreign matter wedged into scoops or between cylinders. Check engine for general cleanliness. Check propeller for cleanliness, for nicks and abrasions, and for security of mounting. Look for anti-icer fluid leaks, and visually check the security of the anti-icing slinger ring.

17. **No. 3 propeller and engine:** Repeat the checks you made on No. 4 propeller and engine. Then enter nosewheel well.

18. **Nose gear assembly:** Check nose gear tires for condition, proper inflation (45 to 50 psi), and slippage. See that wheels are in line with centerline of airplane. Check the oleo strut for proper inflation (3⅛" clearance). Check down locks for security. Check hydraulic lines, pistons, and connections for leaks. Check for buckling of skin at suspension points, indicating beginning of structural failure from excessive torque loads. Exit nosewheel well to right side.

19. **Right nose section:** Check general condition of right side of nose section. Check landing light for full retraction and for cleanliness. Rub cover of static pressure source to drain condensation. See that pitot cover is removed. Walk around to front and check nose turret for proper position. If your airplane has no nose turret, check the passing light for cleanliness and freedom from damage.

20. **Left nose section:** Repeat the checks you made on the right nose section.

21. **No. 2 propeller and engine:** Repeat the checks you made on No. 4 propeller and engine.

22. **No. 1 propeller and engine:** Repeat the checks you made on No. 4 propeller and engine. Then assemble crew for inspection.

AERIAL ENGINEER'S PREFLIGHT INSPECTION

Check over the following preflight inspection, performed by your aerial engineer, so that you are aware of what is done to your airplane before flight. This is a sample inspection as performed in transition training operations. Check your student aerial engineer periodically to be sure that he knows these inspection duties and can perform them efficiently.

1. Remove pitot cover.

2. Enter flight deck; check all switches on bombardier's panel for OFF position.

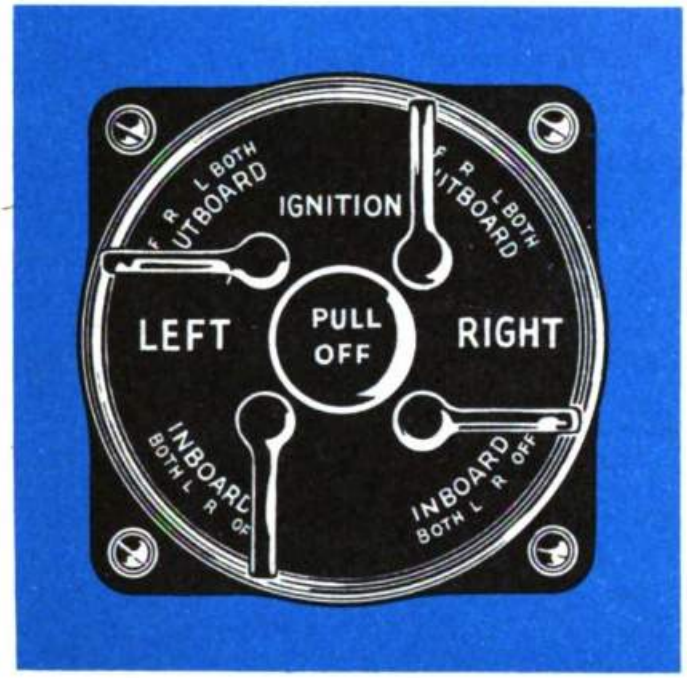
3. Check Forms 1 and 1A and parachutes, if aboard.

4. Set generator voltmeter to APP, all generator switches to OFF position.

5. Turn electric hydraulic pump control to OFF position. Check circuit breaker for ON position.

6. Check fire extinguisher.

7. Check oxygen pressures and masks, if aboard—six gages: bombardier's, airplane commander's, pilot's, navigator's, radio operator's, and forward settee gage.



8. Check ignition switches for OFF position.

9. Check all propeller switches for normal positions.

10. Check all electrical units for OFF positions, landing gear and flap switches for neutral.

11. Check engine controls.

12. Check propellers clear, and turn battery on.

13. Start APP; idle with APP generator switch in LOAD position.

Note: If external power source is available, use it instead of APP for ground operation.

14. Check controls for freedom of movement and position, with assistance of another man checking outside.

15. Set tabs for right wing down, right rudder, and nose down.

16. Lock controls.

17. Set APP throttle to RUN position and check output.

18. Check cowl flaps and leave open.

19. Check propeller master motor and control knob, leaving control at 2800 rpm.

20. Check propeller anti-icers.

21. Check instrument panel lights, landing lights, recognition lights, formation, passing, and running lights.

22. Open and close intercooler flaps manually. Then open or close flaps manually, depending on temperature, and set to AUTOMATIC position to check automatic operation.

23. Open and close oil cooler flaps manually. Then open or close manually, depending on temperature, and set to AUTOMATIC position to check automatic operation.

24. Turn fuel selector valves to TANK TO ENGINE position, and drain valve to CROSSFEED.

25. Turn fuel selector valve circuit breakers to OFF position.

26. Turn No. 1 booster pump to LOW position, and move mixture control out of IDLE CUT-OFF momentarily until you note a rise in pressure, then return mixture control to IDLE CUT-OFF. Turn off booster pump. Repeat this procedure on Nos. 2, 3, and 4 engines.

Note: This procedure checks the operation of the lock pins in the selector valves when the current is cut, thus insuring flow to the engine in event of solenoid failure. Avoid leaving mixture control out of IDLE CUT-OFF any longer than absolutely necessary because that procedure may produce liquid lock in the lower cylinders.

27. Turn fuel selector valve circuit breakers to ON position.

28. Check all other circuit breakers for ON position.

29. Set parking brakes and check accumulator pressure drop.

30. Check main and spare inverters, leaving switch in MAIN ON position.

31. Check AC voltage.

32. Check fluid level in emergency reservoir.

33. Turn hydraulic pump control switch to ON position and check brake pressure.

34. Lower inboard and outboard flaps with emergency hydraulic system.

35. Open bomb bay doors with emergency hydraulic system.

36. Return all selector switches to OFF and switchover valve to BRAKE SYSTEM ON.

37. Check brake over-ride switch; check all electrical switches for OFF position.

38. Turn pitot heat to ON position for 10 seconds; then to OFF.

39. Turn APP and battery switches to OFF position.

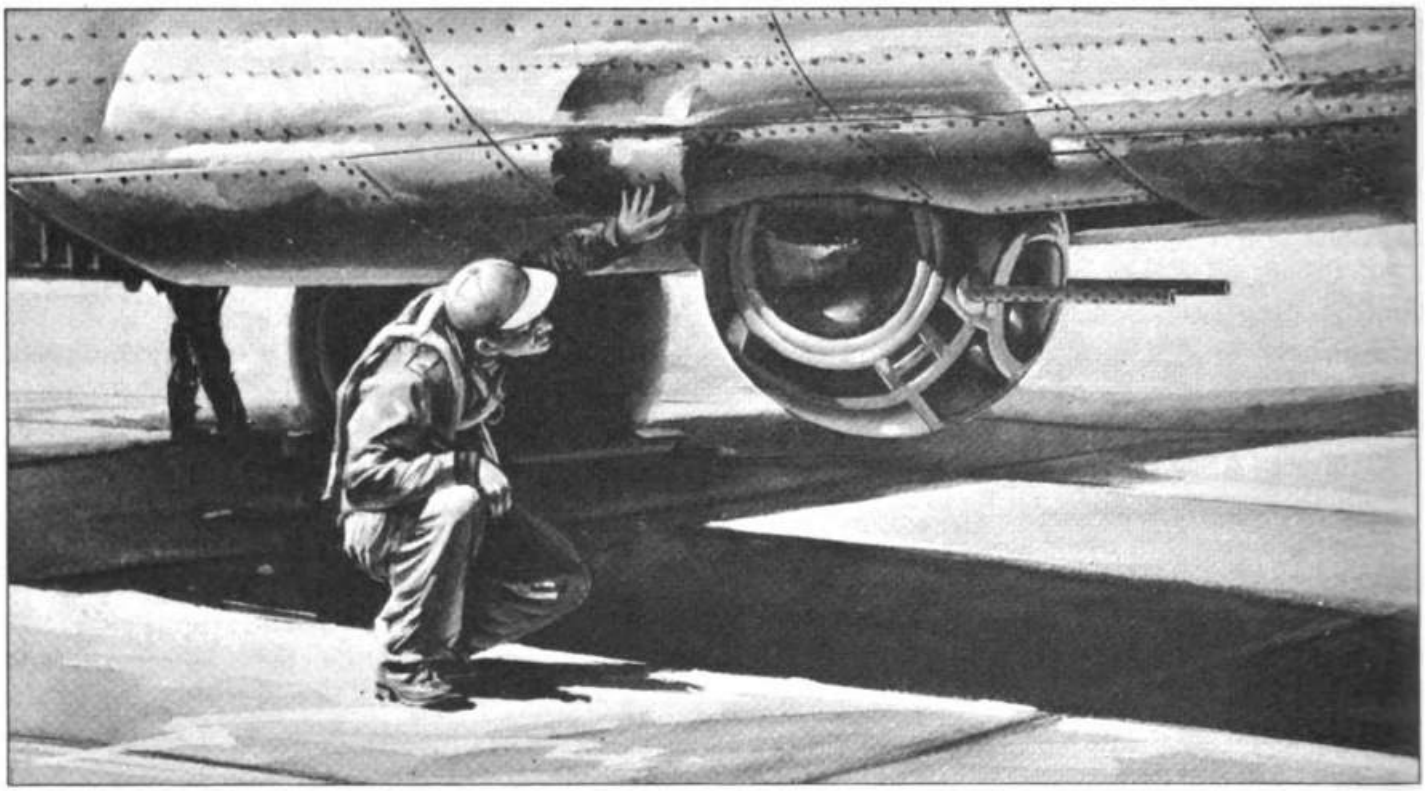
40. Turn electric hydraulic pump control switch to OFF position.

Exit Through Bomb Bays and Check

1. Lower exterior of airplane.
2. Pitot mast for heat.
3. Control access plates.
4. Nosewheels, tires, strut, for inflation and condition.
5. Nosewheel well and mechanism.
6. Circuit breakers under flight deck, station 3.0.
7. Turbo amplifiers, spare, and battery.
8. Main wheel well and mechanism, including accumulator in wheel well.
9. Main wheels, tires, struts, gear mechanism, for condition and inflation.
10. Outboard fuel tank level indicator.
11. Brake bleeder valve.
12. Chocks in place for quick removal.
13. Cables, pulleys, and turnbuckle safetying, under the flaps.
14. Engine cowlings, Nos. 1 and 2 (or 3 and 4) engines.
15. Exhaust bolts, through flap opening.
16. Condition of aileron fabric.
17. Tabs, for right wing down.
18. Fuel cell vents and access plates.
19. Flaps, upper surface, for rubbing.
20. Oil cooler air exit and flap for position.
21. Engine and cabin air intakes.
22. Fuselage and empennage, including rupture discs for CO_2 bottles.
23. Tailskid and shock strut inflation.
24. De-icer boots, if installed.
25. Control surface fabric on empennage.
26. Tabs, for right rudder and nose down.
27. Other side of airplane: repeat inspection.

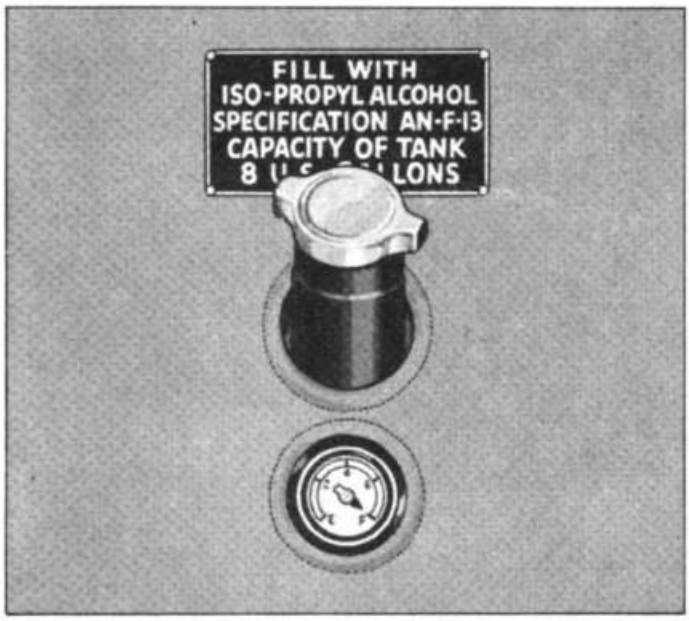
Enter Bomb Bays and Check

1. Forward compartment: APP controls and unit, brake valves, hydraulic units and lines.



2. Fluid level in main and brake reservoirs.
3. Accumulators.
4. Control cables, pulleys, turnbuckles, tension regulators, and attachments.
5. Hydraulic units: selector valve, hydraulic pump, pressure switch, etc., and selector valve relay circuit breaker for ON position.
6. Inboard fuel tanks fluid level indicators, fuel lines, and fuel valves in bomb bays.
7. Access plates under center section.
8. Flap cables, drums, and motors.
9. Aileron control locks, autopilot servo unit, and CO_2 bottles.
10. Propeller anti-icer tank for leaks.

Enter Aft Cabin and Check



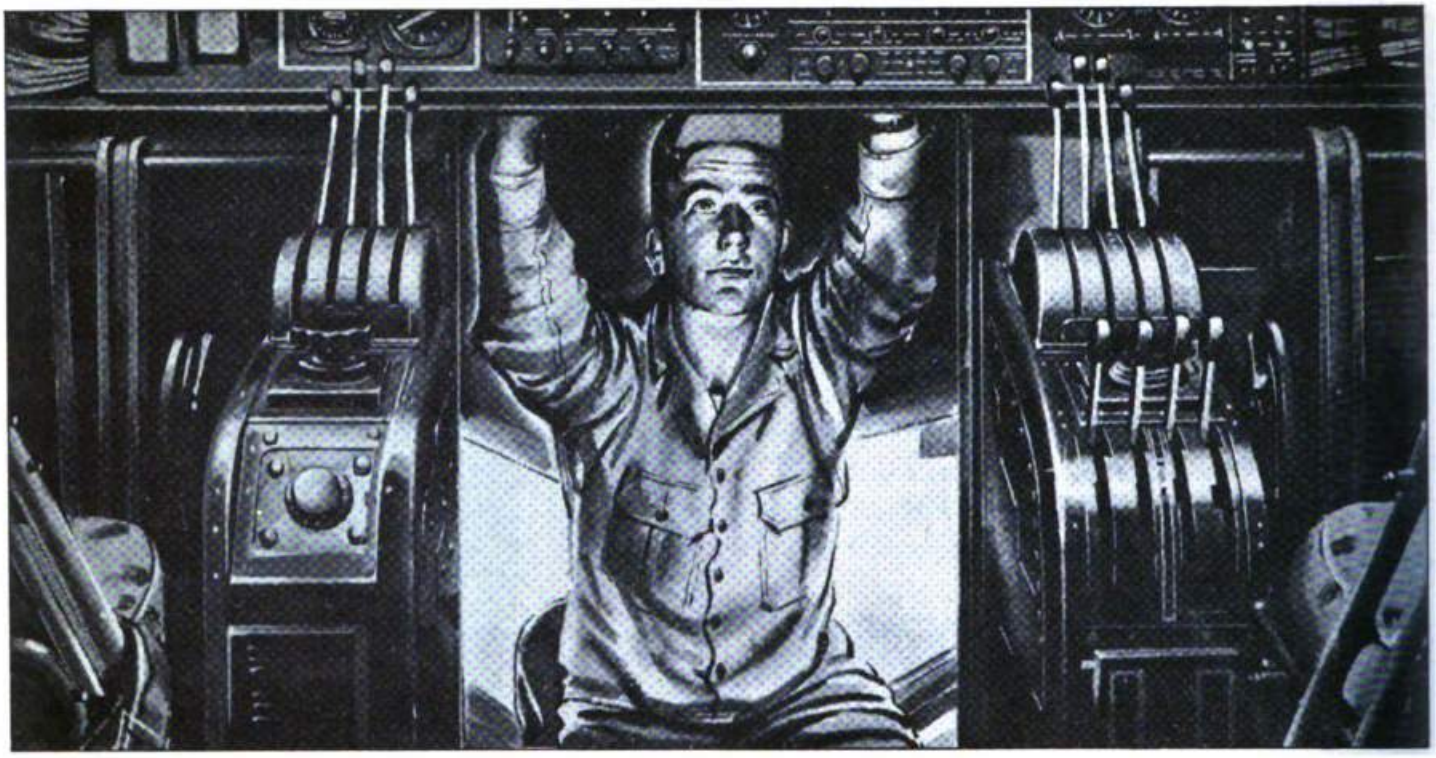
1. Anti-icer fluid level and reservoir filler cap.
2. Oxygen pressure and masks, if aboard.
3. Fire extinguisher.
4. Turrets locked.
5. Hatches closed.

Enter Tail Compartment and Check

1. Empennage attachment bolts.
2. Control cables, pulleys, control locks, and attachments.
3. All loose equipment for proper stowage.
4. Tail turret locked.
5. Return to cockpit and set tab controls to neutral. Turn battery on to set aileron tab; off after operation.

Climb on Top of Airplane and Check

1. Aileron fabric.
2. Aileron tabs for neutral.
3. Fuel and oil quantity and proper installation of caps.
4. Engine cowling and fasteners.
5. Engine exhaust bolts through cowl flap opening.
6. Carburetor, for leaks, with mixture control on and booster pump on HIGH.
7. Antennas for security.
8. Intercooler flaps for proper position.
9. De-icer boots, if installed, and tabs on empennage for neutral.
10. Turrets.
11. Life rafts.
12. Clean windshields.

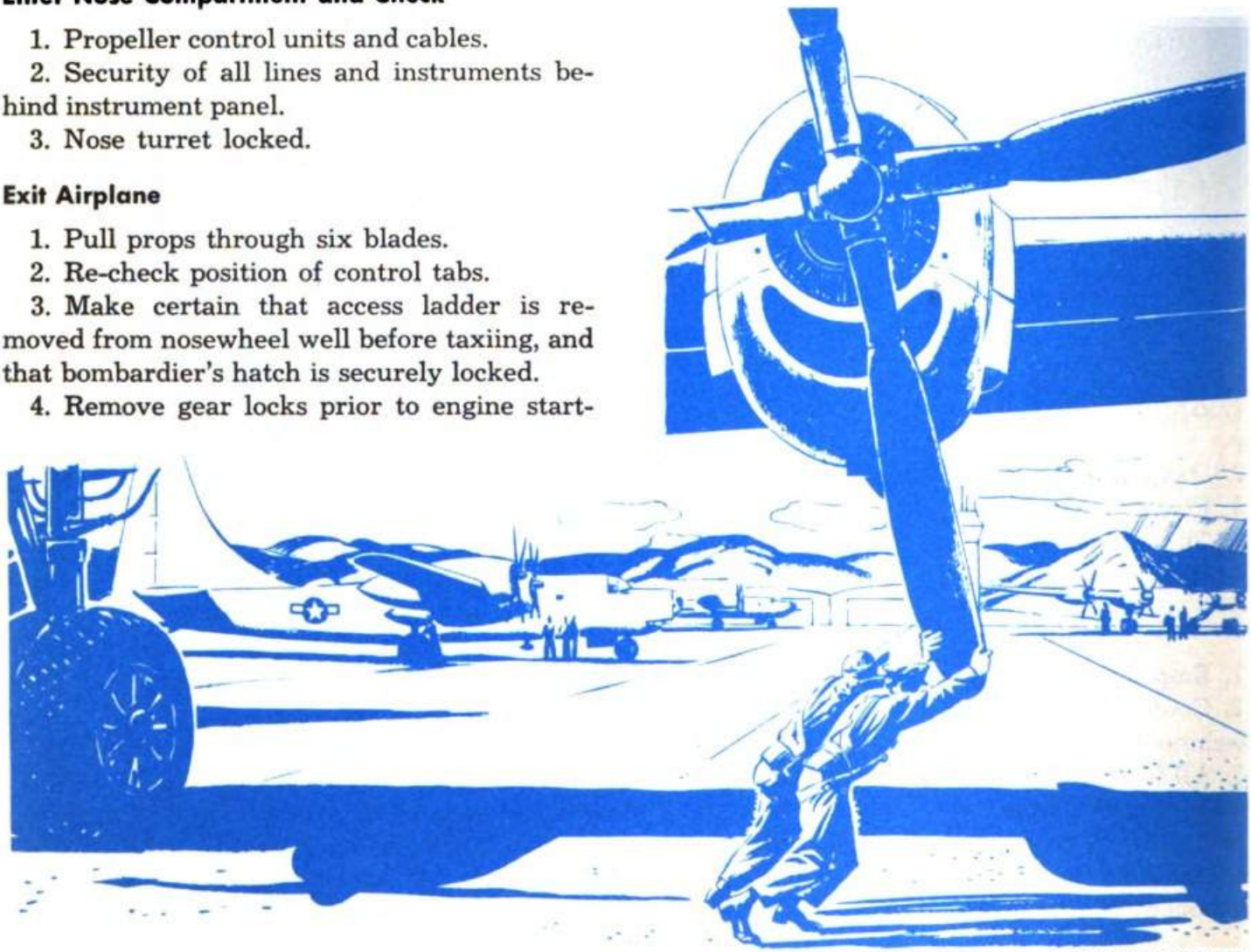


Enter Nose Compartment and Check

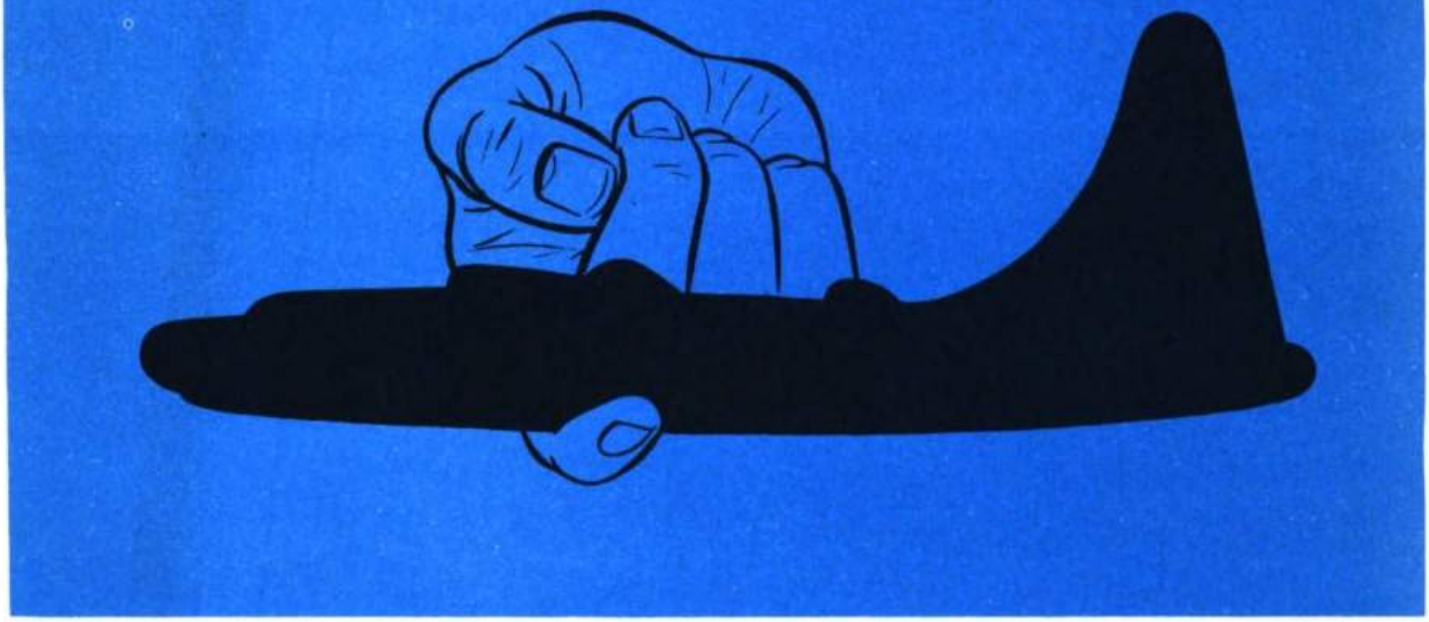
1. Propeller control units and cables.
2. Security of all lines and instruments behind instrument panel.
3. Nose turret locked.

Exit Airplane

1. Pull props through six blades.
2. Re-check position of control tabs.
3. Make certain that access ladder is removed from nosewheel well before taxiing, and that bombardier's hatch is securely locked.
4. Remove gear locks prior to engine start-



Weight and Balance



Weight and balance is as important in the B-32 as it is in any large airplane. Proper loading permits getting the most out of this high performance ship, while improper loading cuts down on the efficiency of the airplane and may even cause a crash.

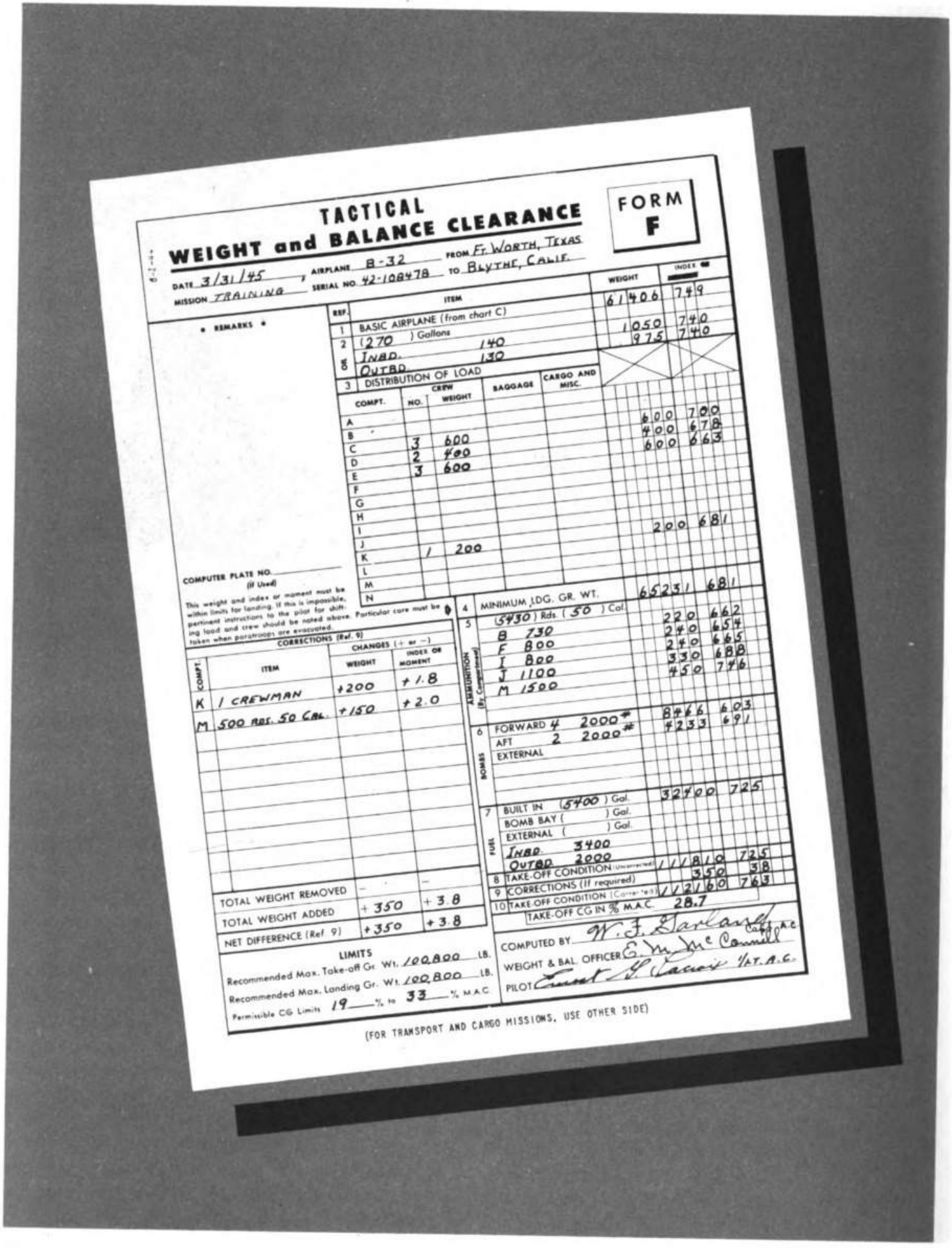
The routine of transition training often causes pilots to slight weight and balance precautions. In your daily flights with lightly loaded B-32's, without armament, weight distribution is of less importance and you tend to overlook it. But while you are in transition, form the habit of making out the loading list carefully and submitting it regularly so that later you automatically think of proper loading and the Form F as your first inspection.

You should know how to use a load adjuster and how to make out a Form F. Remember that the tactical Air Force you join expects you to know weight and balance. Read and understand the weight and balance information in T. O. AN 01-1B-40. Examine your copilot and flight engineer on their knowledge of weight and balance.

Check the basic weight of your B-32 carefully. Remember that yours is a new airplane which may have undergone modification affecting the basic weight. Be sure the basic weight you are using applies to your airplane.

For best operation the center of gravity must be well within the allowable range of limits, as near 25% MAC as possible. If it is not within limits, you have difficulty getting on the step, and have to use excessive trim, slowing your airspeed and increasing your fuel consumption.

The forward CG limit of the B-32 is 19% MAC, and the aft limit is 33% MAC. All loads in all compartments of the airplane not part of the basic airplane must be calculated with the load adjuster. For practice and to be sure you understand the procedure, follow through the sample Form F computation in this section.



TACTICAL
WEIGHT and BALANCE CLEARANCE

FORM F

DATE 3/31/45 , AIRPLANE B-32 FROM FT. WORTH, TEXAS
MISSION TRAINING SERIAL NO. 42-108478 TO BLYTHE, CALIF.

REF.	ITEM	WEIGHT	INDEX
1	BASIC AIRPLANE (from chart C)	61406	749
2	(270) Gallons	1050	740
3	INBD. 140	975	740
	OUTBD. 130		

3 DISTRIBUTION OF LOAD

COMPT.	CREW NO.	CREW WEIGHT	BAGGAGE	CARGO AND MISC.		
A						
B						
C	3	600			600	700
D	2	400			400	678
E	3	600			600	663
F						
G						
H						
I					200	681
J						
K	1	200				
L						
M						
N						

* REMARKS *

COMPUTER PLATE NO. (If Used)

This weight and index or moment must be within limits for landing. If this is impossible, pertinent instructions to the pilot for shifting load and crew should be noted above. Particular care must be taken when paratroops are evacuated.

CORRECTIONS (Ref. 9)

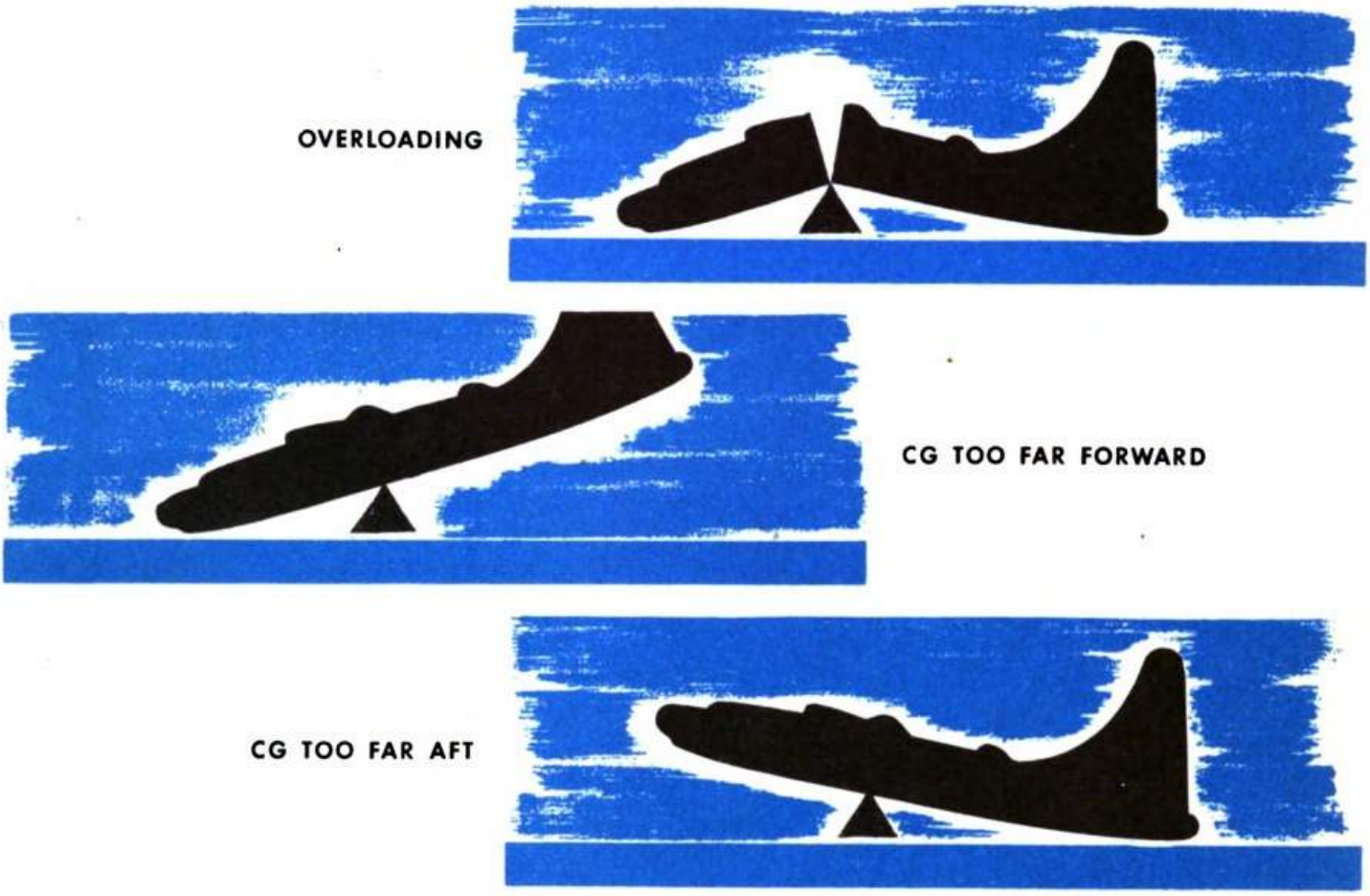
COMPT.	ITEM	CHANGES (+ or −) WEIGHT	INDEX OR MOMENT
K	1 CREWMAN	+200	+1.8
M	500 RDS. 50 CAL.	+150	+2.0
	TOTAL WEIGHT REMOVED	−	−
	TOTAL WEIGHT ADDED	+350	+3.8
	NET DIFFERENCE (Ref 9)	+350	+3.8

4	MINIMUM LDG. GR. WT.	65231	681	
5 AMMUNITION (By Compartment)	(5430) Rds. (50) Cal.		220	662
	B 730		240	654
	F 800		240	665
	I 800		330	688
	J 1100		450	746
	M 1500			
6 BOMBS	FORWARD 4 2000#		8466	603
	AFT 2 2000#		4233	691
	EXTERNAL			
7 FUEL	BUILT IN (5400) Gal.		32400	725
	BOMB BAY ( ) Gal.			
	EXTERNAL ( ) Gal.			
	INBD. 3400			
	OUTBD. 2000			
8	TAKE-OFF CONDITION (Uncorrected)	111810		725
9	CORRECTIONS (If required)	350		38
10	TAKE-OFF CONDITION (Corrected)	112160		763
	TAKE-OFF CG IN % M.A.C.	28.7		

LIMITS
Recommended Max. Take-off Gr. Wt. 100,800 LB.
Recommended Max. Landing Gr. Wt. 100,800 LB.
Permissible CG Limits 19 % to 33 % M.A.C.

COMPUTED BY W. J. Garland Capt. A.C.
WEIGHT & BAL. OFFICER E. M. McConnell
PILOT Grant G. Lacroix 1/LT. A.C.

(FOR TRANSPORT AND CARGO MISSIONS, USE OTHER SIDE)



EFFECTS OF IMPROPER LOADING

Overloading

1. Causes a higher stalling speed.
2. Results in lowering of airplane structural safety factors.
3. Reduces maneuverability.
4. Increases takeoff run.
5. Lowers angle and rate of climb.
6. Decreases ceiling.
7. Increases fuel consumption for given speed (decrease in miles per gallon).
8. Decreases range.
9. Lowers tire factors.

CG Too Far Forward

1. Produces oscillating tendency with resultant strain on pilot during instrument flying.
2. May cause critical condition during flap operation.
3. Increases difficulty in getting nose up during landing.
4. Overstresses nose gear.
5. Results in dangerous condition if tail structure is damaged or surface is shot away.

CG Too Far Aft

1. Creates unstable condition.
2. Increases stall tendency.
3. Increases pilot strain in instrument flying.
4. Results in dangerous condition if tail structure is damaged or surface is shot away.
5. May result in a stall before recovery is possible from a sudden up or down gust. In this situation the elevator is trimmed to keep the nose down. Each bump throws the nose up. In case of a severe bump there is little elevator travel left to bring the nose down, making recovery difficult.

Abbreviated Checklists

You already know the value of the checklist. On the B-32 it is even more important than it was on your B-24 or B-17. The B-32 is bigger with more equipment and more procedures to remember, and you must use the checklist correctly to fly the airplane safely.

In transition training the second student airplane commander, stationed on the flight deck behind you, reads off the checklist items. With a combat crew your copilot reads them. Be sure that each item is read clearly, audibly, and completely. The man reading the checklist should index each item with his thumb to be sure he overlooks nothing. Have the crew member who performs the prescribed duty repeat the item in its entirety as soon as the action is complete. For example, the copilot reads "Gear switch—NEUTRAL" and the engineer checks the switch, then repeats "Gear switch—NEUTRAL."

Only by following this procedure faithfully can you be sure that the instruction is understood, that the action is completed, and that nothing is overlooked. Don't let the man reading the checklist proceed to the next item until the prescribed crew member has repeated the instructions, indicating that the action has been done.

All checklists for the airplane are included in this section in their abbreviated forms, convenient for reference and study. The amplifications of these checklists, describing each action in detail, are taken up in subsequent sections of this manual, in the order you deal with them in normal operations.

BEFORE STARTING

ENGINES

1. Crew inspection–COMPLETED.
2. Forms 1 and 1A and loading–CHECKED.
3. Flight controls–CHECKED.
4. Pitot covers–REMOVED.
5. Wheel chocks–IN PLACE.
6. Electrical units–OFF.

Radios	Carburetor heat
Booster pumps	Oil coolers
Autopilot	Intercoolers
Prop master motor	Lights
Pitot heater	Windshield wipers
Inverter	Hydraulic pump
Anti-icer	

7. Gear switch–NEUTRAL.
8. Battery–ON.
9. APP–IDLE.
10. Gyros–UNCAGED.
11. Turbos–OFF.
12. Mixture controls–IDLE CUT-OFF.
13. APP–RUN, LOAD, VOLTAGE CHECKED.
14. Inverter–SPARE ON, CHECKED.
15. Cowl flaps–OPEN.
16. Intercoolers–AUTOMATIC.
17. Oil coolers–AUTOMATIC.
18. Carburetor air filters–AS REQUIRED.
19. Propeller controls:
    Ready switch–SAFE.
    Selector switches–AUTOMATIC.
    Master motor switch–ON.
    Master tach–2800 RPM.
    Reverse switches–NORMAL.
20. All circuit breakers–ON.
21. Electric hydraulic pump–ON.
22. Parking brakes–ON.
23. Fuel valves–TANK TO ENGINE.
24. Booster pumps–LOW.

STARTING ENGINES

1. Fire guard–POSTED.
2. Master ignition–ON.
3. Start engines–3, 4, 2, 1.
4. Fuel and oil pressures–CHECKED.
5. Remove wheel chocks.
6. No. 1 and No. 4 engine generators–ON.
7. APP equalizer–ON.
8. Inverter–MAIN ON, CHECKED.
9. Flight indicators and suction–CHECKED.
10. Booster pumps–OFF.
11. Interphone and alarm bell–CHECKED.
12. Exercise flaps–CHECKED.

BEFORE TAXIING

1. All instruments–CHECKED.
2. Radio, altimeter, time–CHECKED.
3. Wheel chocks–REMOVED.

BEFORE TAKEOFF

***Items with asterisk for subsequent takeoffs.**

*1. Mixture controls–AUTO RICH.
2. Propeller controls–CHECKED.
   Reverse
   *Automatic
*3. Master tachometer–2800 RPM.
*4. Magnetos and turbos–CHECKED.
*5. Gyros–SET AND UNCAGED.
*6. Wing flaps–AS REQUIRED.
*7. Trim tabs–SET.
*8. Flight controls–CHECKED FREE.
*9. Doors and hatches–CLOSED.
*10. Cylinder head temperatures–CHECKED.
*11. Booster pumps–HIGH.
*12. Turbos–SET TO 8.
*13. Cowl flaps–AS REQUIRED.
*14. Generators–CHECKED AND ON.
*15. Interphone–CHECKED.

AFTER TAKEOFF

***Items with asterisk for subsequent takeoffs and running takeoffs.**

*1. Brakes–APPLIED.
*2. Gear–UP.
*3. Power reduction–42", 2400 RPM.
*4. Wing flaps–UP.
*5. Power reduction–AS REQUIRED.
*6. Cylinder head temperatures–CHECKED.
*7. APP–AS REQUIRED.
*8. Booster pumps–OFF.

BEFORE LANDING

***Items with asterisk for subsequent landings and running takeoffs.**

1. APP idle, load, and equalizer–ON.
2. Radio call and altimeter–CHECKED.
*3. Crew positions–CHECKED.
*4. Electric hydraulic pump–ON.
*5. Fuel valves–TANK TO ENGINE.
*6. Booster pumps–HIGH.
7. Autopilot–OFF.
*8. Brake pressure–CHECKED.
*9. Mixture controls–AUTO RICH.
*10. APP throttle–RUN.
*11. Wing flaps–10°.
*12. Gear–DOWN.
*13. Master tachometer–2300 RPM.
*14. Gear check–DOWN AND LOCKED.
*15. Cowl flaps–AS REQUIRED.

FINAL APPROACH

***Items with asterisk for subsequent landings and running takeoffs.**

*1. Turbos–SET.
*2. Master tachometer–2400 RPM.
*3. Flaps–40°.

AFTER LANDING

1. Ready and reverse–ON GROUND ONLY.
2. Reverse switches–NORMAL AND SAFE.
3. Cowl flaps–OPEN.
4. Booster pumps–OFF.
5. Turbos–OFF.
6. Master tachometer–2800 RPM.
7. Wing flaps–UP.
8. No. 2 and No. 3 generators–OFF.
9. Bomb doors–OPEN (airplane commander's option).

SECURING AIRPLANE

1. Parking brakes–ON.
2. Master ignition–CHECKED (700 rpm).
3. No. 1 and No. 4 engine generators–OFF.
4. Mixture controls–IDLE CUT-OFF.
5. Ignition switches–OFF.
6. Fuel valves–OFF.
7. Electrical units–OFF.
8. Flight controls–LOCKED.
9. Wheel chocks–IN PLACE; brakes–OFF.
10. Load, equalizer, and battery–OFF.
11. APP–IDLE, THEN OFF.

SCANNERS' CHECKLIST

Be sure that your scanners know how and when to perform all the following duties:

1. Participate in crew inspection.

2. Check flight controls on signal from pilots.

3. Post fire guards for starting engines.

4. Pull wheel chocks after engines are started.

5. Take positions in rear compartment and stand by on interphone.

6. Check interphone with pilot before taxiing.

7. Check flaps for 20° positions before takeoff.

8. Call airplane commander after takeoff when gear is up, flaps are up, and if engines show smoking or torching.

9. Call airplane commander every 15 minutes to report condition of engines.

10. Call airplane commander on landings, reporting main gear and tailskid down and flap positions.

11. Check flaps on running takeoffs for 20° positions.

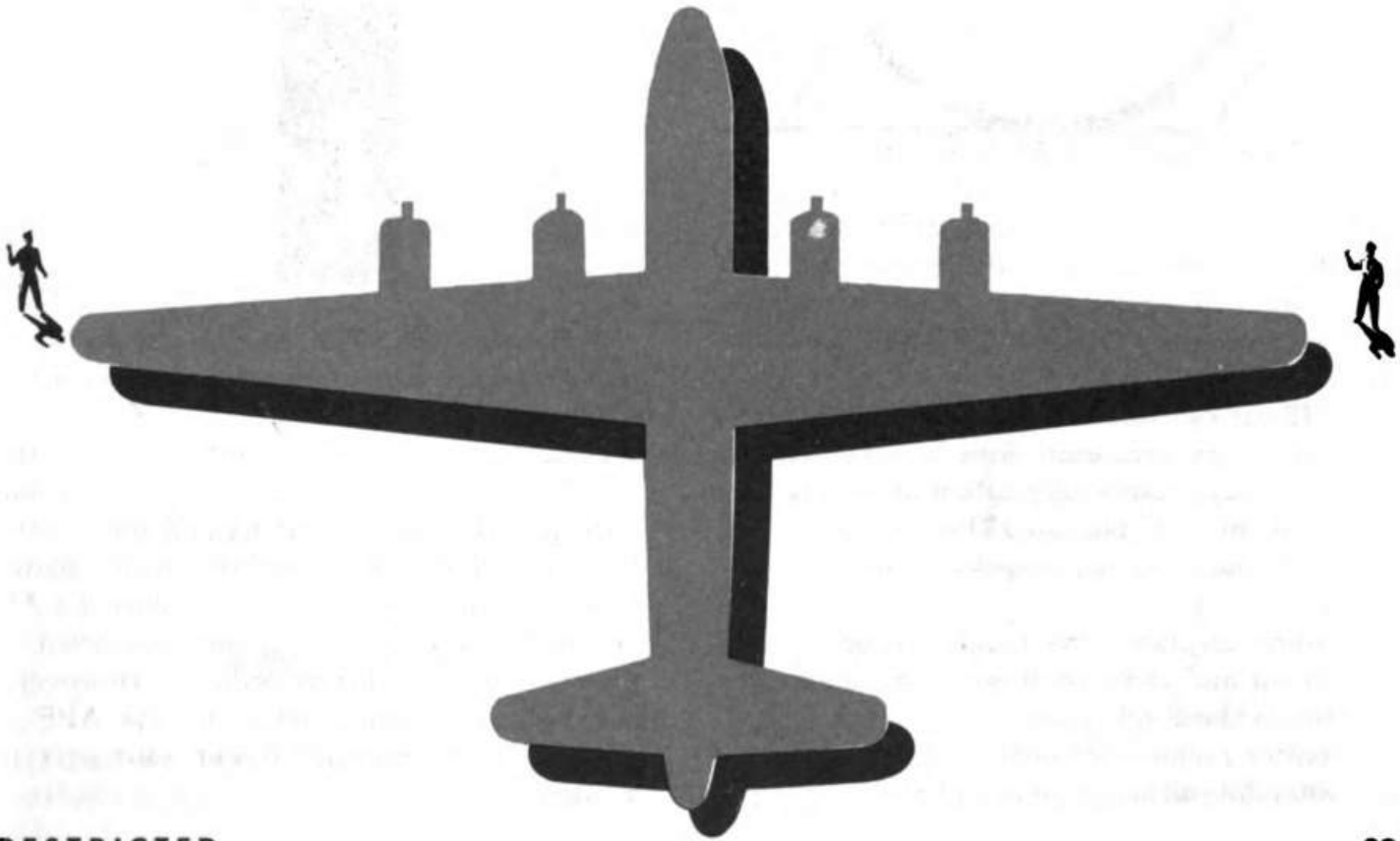
Before Starting Engines

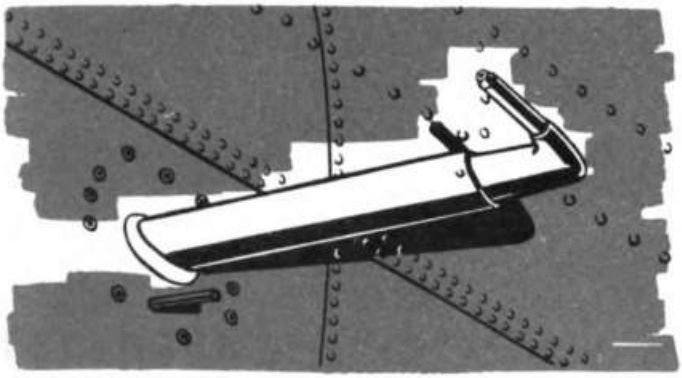
AMPLIFIED CHECKLIST

1. **Crew inspection—COMPLETED.** The airplane commander's reply to this item indicates that he has inspected the crew (in accordance with CFTC Memorandum 50-2-4 for transition training) and that his own and the aerial engineer's preflight inspections have been made and airplane and crew found ready for flight.

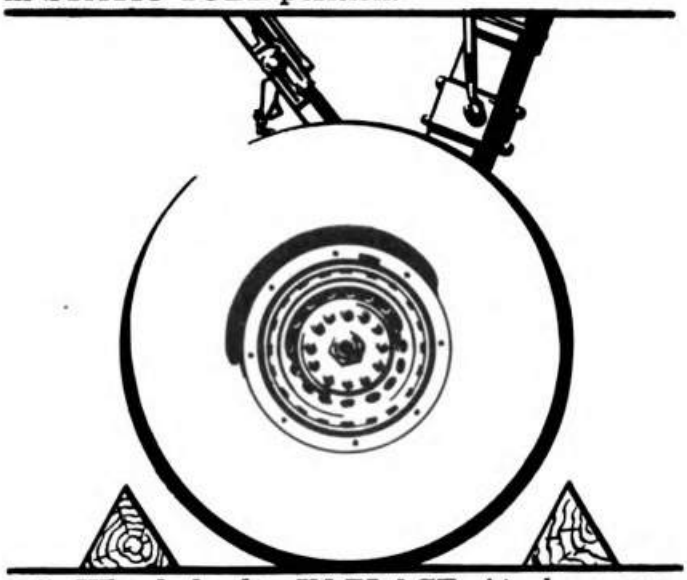
2. **Forms 1 and 1A and loading—CHECKED.** The airplane commander's reply indicates that he has checked Forms 1 and 1A and the loading list or Form F to see that they are satisfactory and that any defects found in preflight inspections are properly entered on Form 1A.

3. **Flight controls — CHECKED.** Airplane commander and copilot check operation of flight controls, with the assistance of the two scanners, one stationed at the right wing tip and one at the left wing tip. As the airplane commander exercises each control surface, the scanners call out the positions of the surfaces to airplane commander and copilot. At the same time both airplane commander and copilot check cockpit controls for free movement to extreme positions: 180° each way wheel turn, 10″ rudder pedal travel, full fore and aft column travel.





4. **Pitot covers—REMOVED.** The airplane commander looks out to see that the pitot cover is off the left mast and the copilot does the same for the right mast. Airplane commander checks static pressure selector switch to see that it is in STATIC TUBE position.



5. **Wheel chocks—IN PLACE.** Airplane commander and copilot look back from their respective windows to see that wheel chocks are in place in front and behind the main gear, out a few inches from the tire. Airplane commander and copilot report "IN PLACE LEFT," and "IN PLACE RIGHT."

6. **Electrical units—OFF.** The copilot calls out the units, and each crew member checks the switches nearest his position to be sure that they are in OFF position. These switches and the crew member who checks each are as follows:

Radios—airplane commander checks command set and radio compass; designated crew members check other sets

Booster pumps—engineer

Autopilot—airplane commander

Prop master motor—engineer

Pitot heater—copilot

Inverter—copilot

Anti-icer—copilot

Carburetor heat—copilot

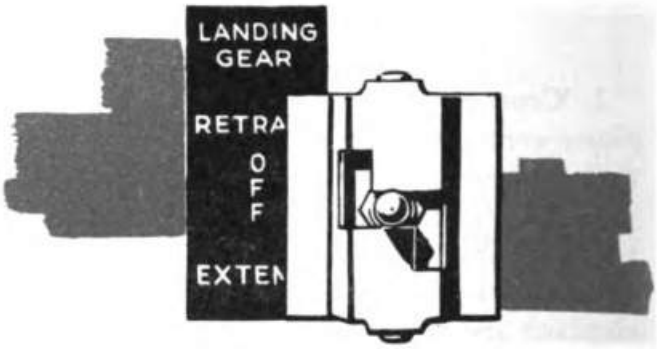
Oil coolers—engineer

Intercoolers—engineer

All lights—all crew members

Windshield wipers—airplane commander and bombardier

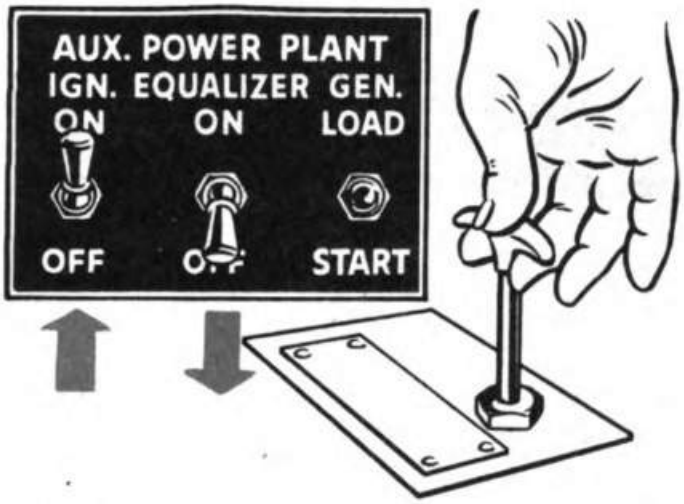
Hydraulic pump—engineer



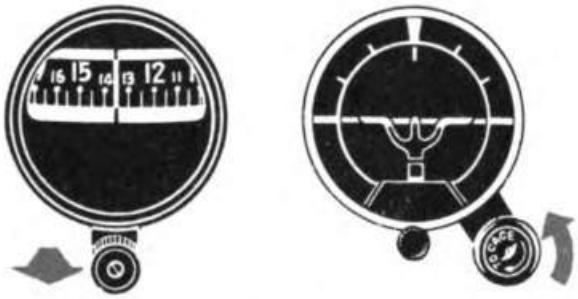
7. **Gear switch—NEUTRAL.** Engineer checks to see that the landing gear switch is in NEUTRAL position, and that the guard is set so that the switch cannot be inadvertently moved to UP position.

8. **Battery—ON.** The copilot checks to see that props are clear, then turns battery switch to ON position.

Note: Recommended procedure for the B-32 is to use an external power source for ground operation during inspections and for starting. If you follow that procedure, leave battery switch off at this point. You can start the APP now and let it idle until engines are started, adjusting your checklist accordingly. However, it has been standard practice to use APP for starting when external power source is not available.

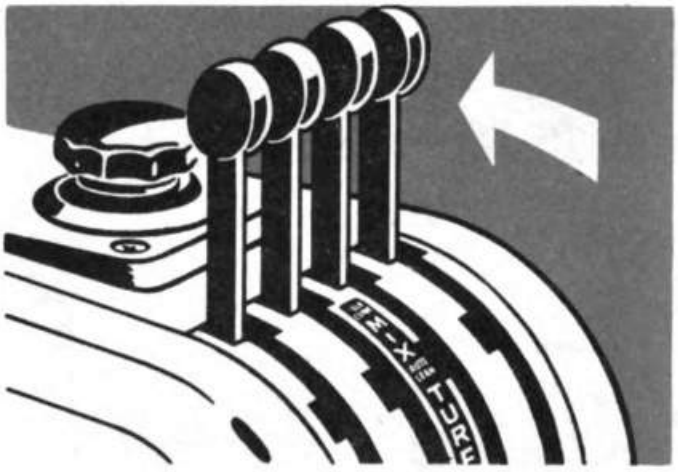


9. **APP–IDLE.** The copilot turns the APP ignition switch to ON position and opens the APP throttle, located on the floor at the right of his seat, to IDLE position. He holds the APP generator switch in START position until the APP starts. Pumping the throttle briefly chokes the engine when necessary in cold weather. He leaves the generator switch in neutral position to let the APP warm up for a few minutes because the application of load too soon may shear the generator drive shaft.



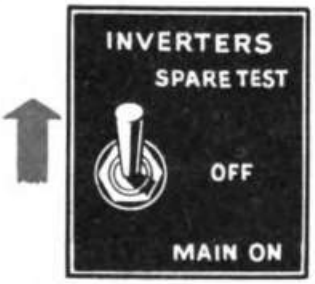
10. **Gyros–UNCAGED.** Airplane commander and copilot check to see that all flight instruments are uncaged, reporting "UNCAGED LEFT" and "UNCAGED RIGHT."

11. **Turbos–OFF.** Engineer checks to see that turbo regulator control knob is set to 0.



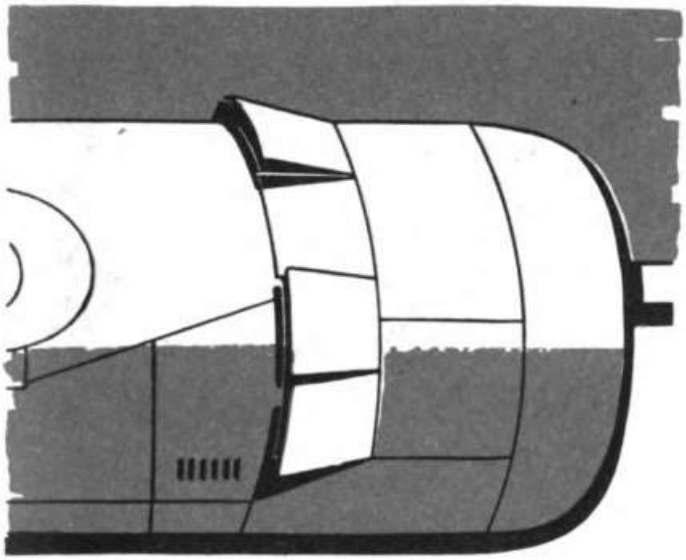
12. **Mixture controls–IDLE CUT-OFF.** Engineer checks to see that mixture controls are in IDLE CUT-OFF position.

13. **APP – RUN, LOAD, VOLTAGE CHECKED.** At this point the APP normally has had time to warm up and the copilot pulls the throttle up to RUN position, then turns the APP generator switch to LOAD. In cold weather it may be necessary to allow more time for the APP to warm up. Engineer checks the APP voltage at the generator panel.

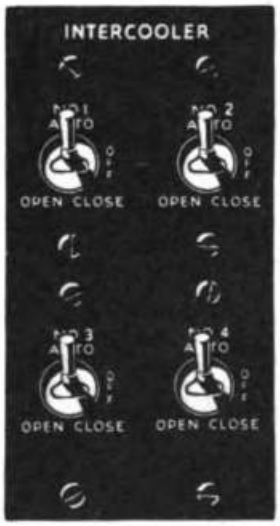


14. **Inverter–SPARE ON, CHECKED.** Copilot turns the inverter switch to SPARE TEST position. You turn the inverter on before starting in order to insure the proper position of the waste gates. You use spare, rather than main, inverter at this point because under the low power output of APP or external power source the automatic changeover relay might kick over to the spare inverter. Copilot checks the warning light on the main panel which indicates that both inverters are out. If this light is on, the spare inverter is out.

15. **Cowl flaps–OPEN.** Airplane commander and copilot check from their respective windows to see that cowl flaps are open, reporting "OPEN LEFT" and "OPEN RIGHT." Never



close cowl flaps on the ground to speed engine warm-up; uneven engine cooling and burning of the ignition harness might result.

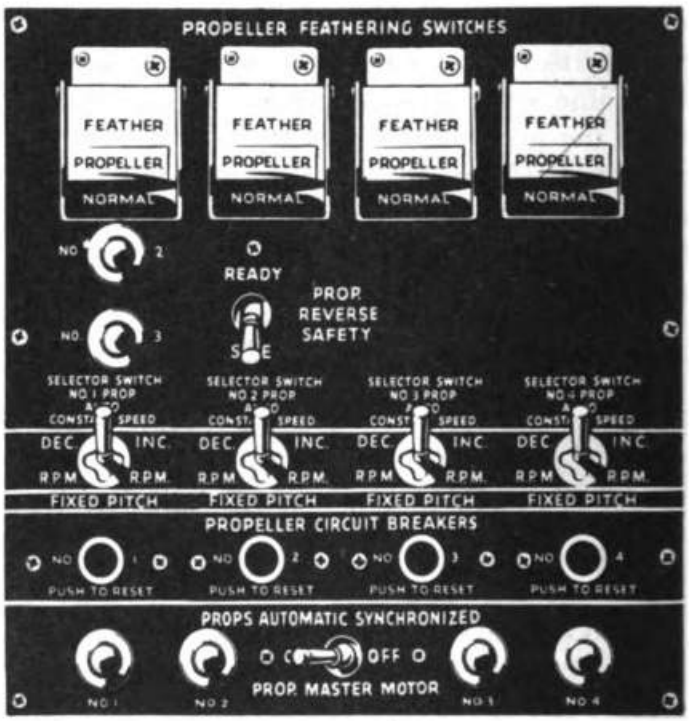


16. **Intercoolers – AUTOMATIC.** Engineer sets intercooler control switches to AUTOMATIC position.

Note: Normal operation of intercoolers and oil coolers is in AUTOMATIC position (items 16 and 17). However, keep careful watch on carburetor, cylinder head, and oil temperatures. If the automatic system fails, or if temperatures run high and you suspect malfunctioning of the automatic system, operate the intercoolers and oil coolers with the switches in MANUAL. Return switches to AUTOMATIC position as soon as practicable after takeoff, unless the automatic system has failed.

17. **Oil coolers – AUTOMATIC.** Engineer puts the oil cooler control switches in AUTOMATIC position.

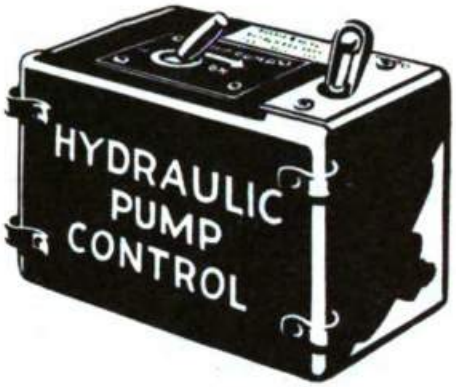
18. **Carburetor air filters–AS REQUIRED.** When ground conditions warrant, carburetor air filters are used at the direction of the airplane commander. Normally you don't need carburetor air filters except for operation in dust conditions. Copilot reports "NOT REQUIRED" or "ON," as the case may be.



19. **Propeller controls:**
Ready switch–SAFE
Selector switches–AUTOMATIC
Master motor switch–ON
Master tach–2800 RPM
Reverse switches–NORMAL

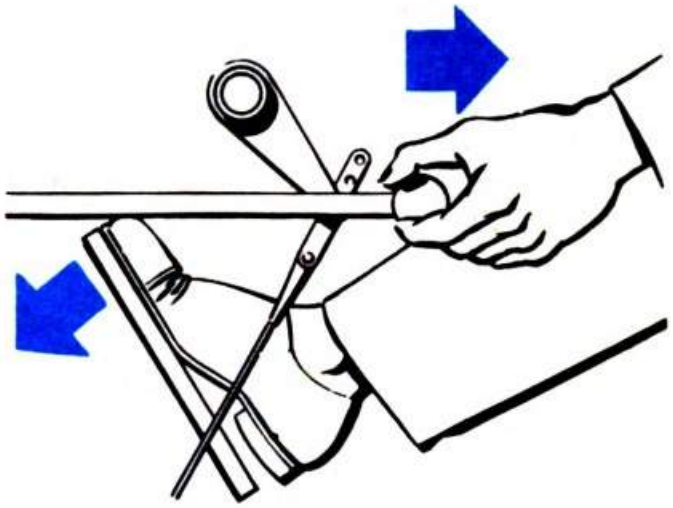
The engineer checks or sets each item at desired position.

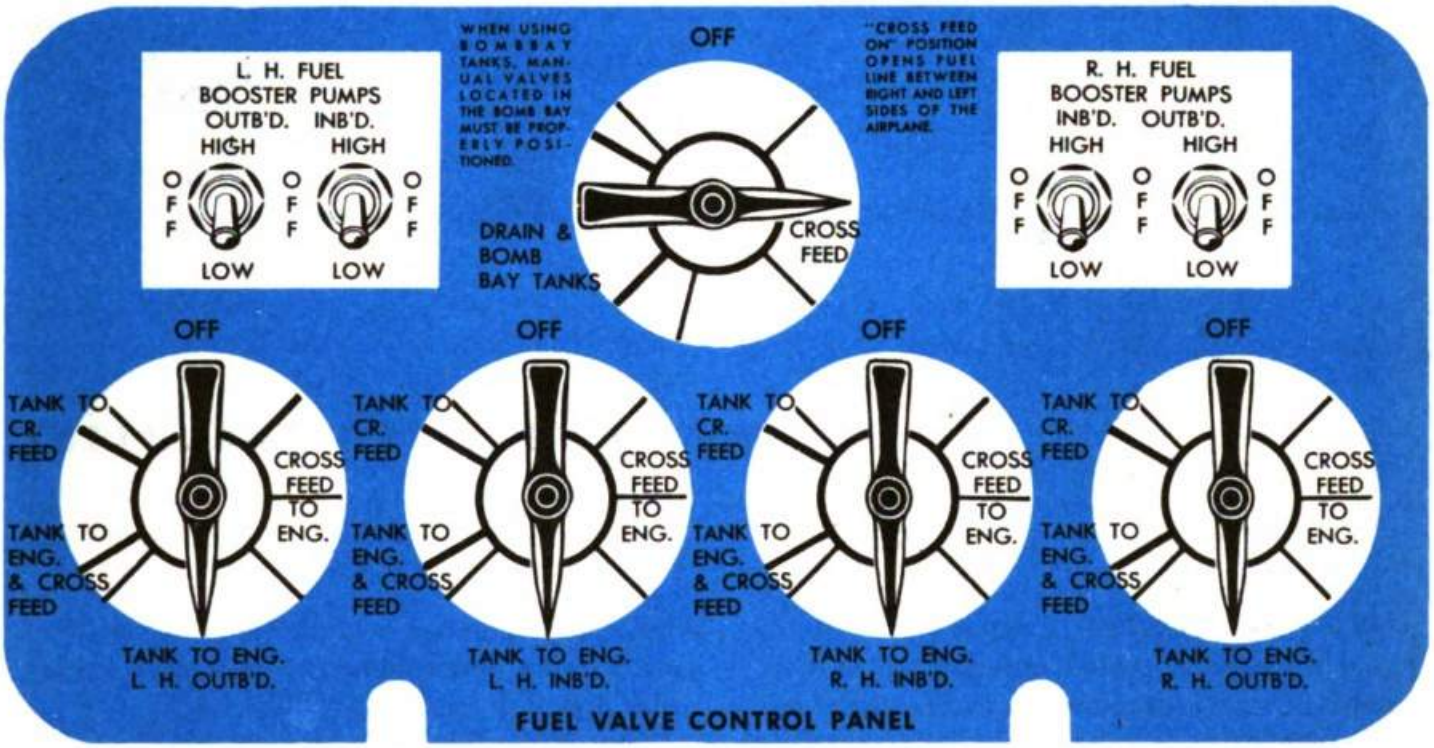
20. **All circuit breakers–ON.** Each crew member checks all circuit breakers at his station to see that they are in ON position and reports to the copilot.



21. **Electric hydraulic pump—ON.** Engineer turns the electric hydraulic pump control switch at station 4.0 to ON position, re-checking the pump circuit breaker for ON position.

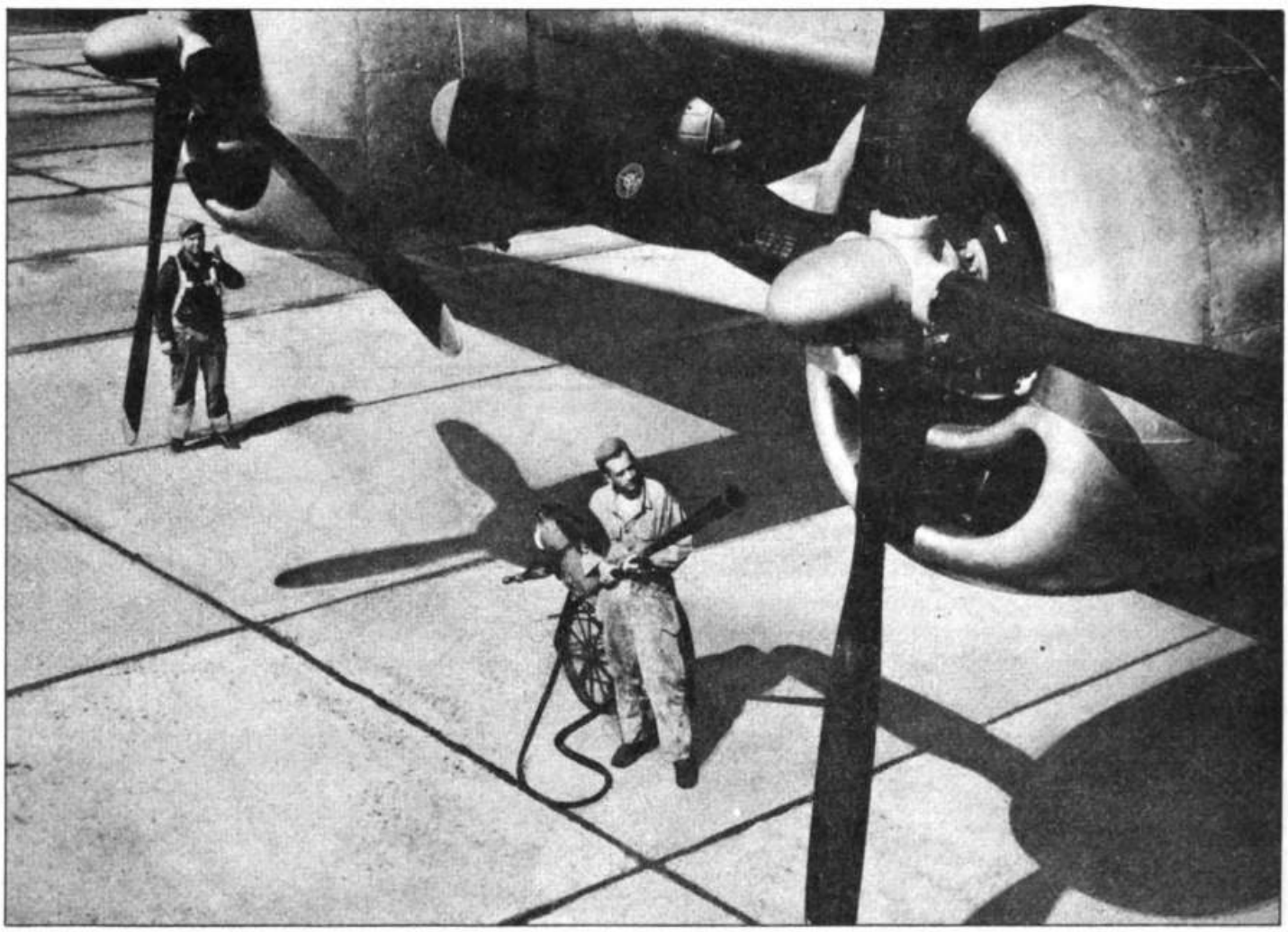
22. **Parking brakes—ON.** Copilot checks brake pressure gages for a minimum pressure of 850 psi. Airplane commander then depresses the brake pedals fully, pulls out on the two lock levers, and releases pedals. During this operation, copilot should watch the pressure gages for a drop in pressure. If the pressure drops below 850 psi, the electric pump should cut in to bring the pressure up.





23. **Fuel valves—TANK TO ENGINE.** Engineer turns all tank selector valves to TANK TO ENGINE position, and drain valve to CROSS-FEED position.

24. **Booster pumps—LOW.** Engineer turns all four booster pump switches to LOW position.



Starting Engines

☛ AMPLIFIED CHECKLIST

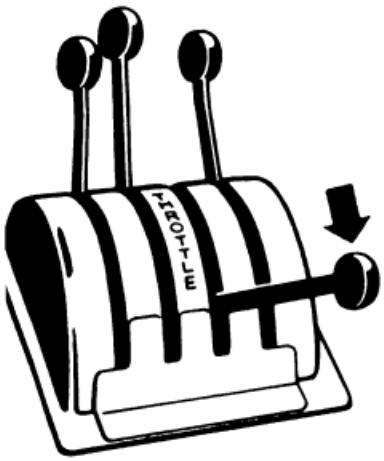
1. **Fire guard—POSTED.** Copilot looks out to see that scanner is posted at wing tip and a ground crewman is standing by as fire guard at No. 3 engine.

2. **Master ignition—ON, CALL CLEAR.** Engineer turns the master ignition switch to ON position. Copilot checks to be sure that nobody is near prop, calls "CLEAR" and hand signals fire guard that he is about to start No. 3 engine.

3. **Start engines 3, 4, 2, 1.** Airplane commander sets throttle and reports "READY ON ...," indicating that he is ready for the copilot and engineer to start the designated engine. Copilot and engineer start engines in the order 3, 4, 2, 1.

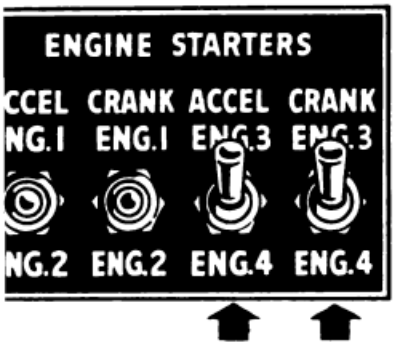
Note: When No. 3 engine is running, and before No. 2 is started, check vacuum gage to see that No. 3 vacuum pump is operating. Have engineer retract flaps to check operation of the hydraulic pump on No. 3 engine. After the flight similarly check operation of the No. 2 vacuum pump and hydraulic pump after stopping No. 3 engine and before stopping No. 2 engine.

NORMAL ENGINE STARTING PROCEDURE



NOTE: See also Engines section for additional tips and precautions on starting. See Cold Weather Operations for low temperature starting.

1. Airplane commander retards throttle to the approximate 1000-1200 rpm position. The throttle controls the amount of air delivered to the engines during starting procedure. If it is too far open, the mixture is too lean for starting; if it is not far enough open, the mixture is too rich. In cold weather and at higher altitude bases it is better to keep the throttle near the lower limit of the 1000-1200 range.

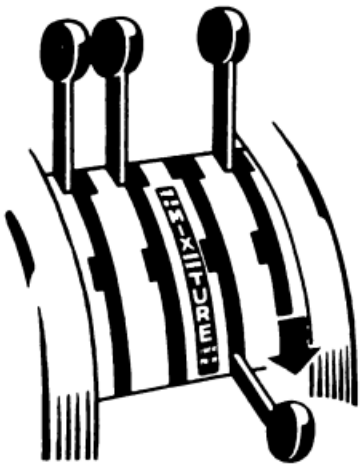


2. The copilot reports "ACCELERATING No. . . .," and holds the accelerating switch to the desired position for 10 to 12 seconds. Excessive acceleration overspeeds and burns out your starter, and under-acceleration does not turn the engine over fast enough for starting. On accelerating No. 3 and No. 4, copilot has the engineer check APP voltage at the voltmeter, to see that the APP voltage returns to normal before he starts cranking.

3. Copilot then reports "CRANKING No. . . .," and holds the crank switch to the desired engine, continuing to hold the accelerating switch in position.

4. After the props go through approximately two revolutions, the copilot holds the primer switch to the desired engine and the engineer turns the ignition switch to BOTH position.

Note: If the engine does not fire, don't crank for longer than a minute. Let the starter motor cool between starting attempts. Don't operate the primer when the engines are not turning over.



5. After the engine fires, run on prime alone until you get at least 800 rpm and it is certain that the engine is going to continue to run.

6. At the direction of the copilot, the engineer moves the mixture control to AUTO RICH. If the engine stops, the engineer must return the mixture to IDLE CUT-OFF, otherwise excess fuel goes to the blower section, increasing the possibility of an engine induction fire or of a liquid lock developing on the next starting attempt.

Note: The AUTO RICH and AUTO LEAN positions deliver the same amount of fuel when the engine is operating below 1200 rpm since only the idling system delivers fuel at engine speeds below 1200 rpm.

10 SECONDS

MAIN

7. As soon as the engine is running, engineer and copilot check oil pressures for rise. If the main oil pressure does not show 40 psi in 10 seconds or the nose oil pressure does not show 45 psi in 30 seconds, move the mixture control back to IDLE CUT-OFF immediately and investigate the trouble. Lubrication is extremely important during starting of high performance engines. Don't overspeed the engines; except for momentary advancing of throttle to 1500 rpm for clearing out engines, 1200 rpm is the top limit until the oil temperature reaches 55°C., or in emergencies until you note a 10° rise in oil temperature.

30 SECONDS

NOSE

8. After the engine is running smoothly with the mixture control in AUTO RICH and the copilot has completed the oil pressure checks, he reports "No. ... IN; OIL PRESSURE CHECKED," indicating that he is ready to start the next engine at the airplane commander's direction.

Caution **Beware of trick techniques for starting engines.**

They may cover up faulty engine operation.

Stick to these proved procedures.

---

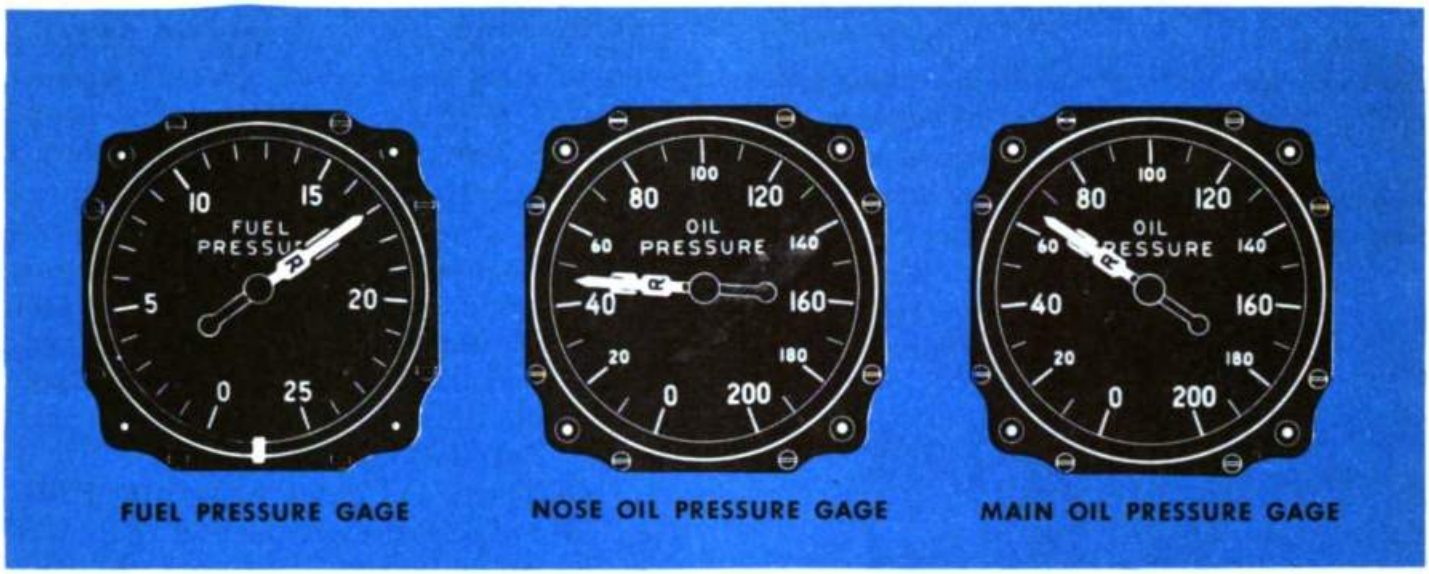
4. **Fuel and oil pressures—CHECKED.** Engineer checks fuel pressure for an operating range of 16 to 18 psi and oil pressure for ranges of 45 to 50 psi nose pressure and 60 to 70 psi main pressure, with the rpm between 1000 and 1200. If pressure indications are other than normal, he reports the gage reading instead of reporting CHECKED.

If oil temperature is low, oil pressure may be higher than normal; in this situation continue the warm-up. In an operational emergency, if you have a steady oil pressure indication **after a rise of at least 10°** in oil temperature, you can consider that satisfactory for takeoff. In general practice if oil temperature is only slightly low but has indicated a rise of at least 10°, it is safe to utilize taxiing as part of the warm-up period. **However, do not attempt engine run-up or takeoff until gages indicate operating limits.**

If oil temperature is higher than 85°, check to see that the oil cooler doors have opened in AUTO settings. If they have not, open them with the manual switch and leave the switch in neutral position. In hot weather you may get slightly high oil temperatures because of the lack of ram cooling. You can consider these temperatures safe if they don't exceed 95° for continuous operation or 105° for short periods. You can help keep temperatures down by heading the airplane into the wind for ground operation, holding ground operation time to a minimum, and decreasing power.

If high oil temperatures occur in cold weather, close the oil cooler flaps with the manual switch and watch the oil temperature carefully. Congealed oil in the cooler may be causing the oil to by-pass the cooler.

Cross-check oil temperature and oil cooler flaps frequently during starting and warm-up as a check on the automatic operation of the



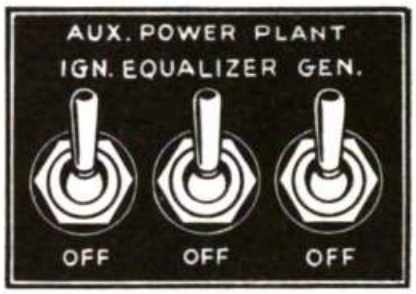
FUEL PRESSURE GAGE NOSE OIL PRESSURE GAGE MAIN OIL PRESSURE GAGE

oil temperature control. The oil temperature should rise steadily with the flaps closed until it reaches 85°. Then it should remain constant with the flaps opening and closing to control the temperature as necessary. Normally on the ground in all but extremely cold weather the flaps stay full open, or nearly so, after warm-up.

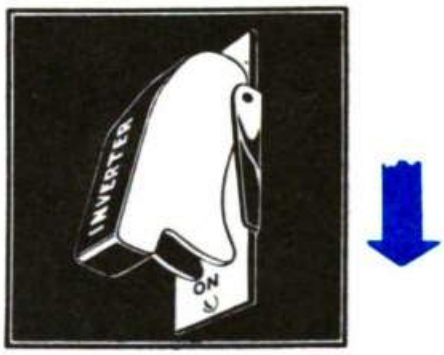
5. **Remove wheel chocks.** Copilot and airplane commander signal scanners or other designated crew members to remove wheel chocks.

6. **No. 1 and No. 4 engine generators—ON.** Engineer turns on the outboard generators and checks their voltage output at the generator panel. Only the outboard generators are used at this point because they have the 2-speed drive which gives full output as low as 800 rpm.

Note: After starting No. 4 engine, you can turn on No. 4 generator, if desirable, to provide generator current for starting No. 2 and No. 1 engine.



7. **APP equalizer—ON.** The copilot turns the APP equalizer switch to ON position, which connects the APP generator in parallel with the engine-driven generators and equalizes the loads.

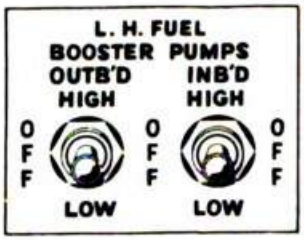


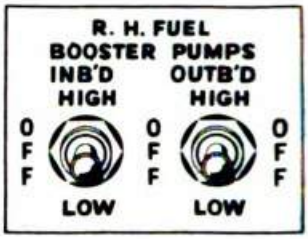
8. **Inverter—MAIN ON, CHECKED.** Engineer checks both 26-volt and 115-volt output of the spare inverter on the AC voltmeter at the generator panel. Copilot then returns switch to neutral, waits 3 to 5 seconds to prevent arcing of relay points, then turns it to MAIN ON position. Engineer checks 26-volt and 115-volt output of main inverter. Then copilot checks both

push-to-test inverter warning lights to be sure they are working.

Note: Leave inverter switch in MAIN ON position after check. In flight, never turn inverters off or change inverters by use of manual switch except in emergencies when automatic changeover relay fails.

9. **Flight indicators and suction—CHECKED.** Airplane commander and copilot check to see that their gyros are working, and the airplane commander checks the suction gage on his auxiliary panel for a range of 5 to 5½" Hg. They report "CHECKED LEFT" and "CHECKED RIGHT."

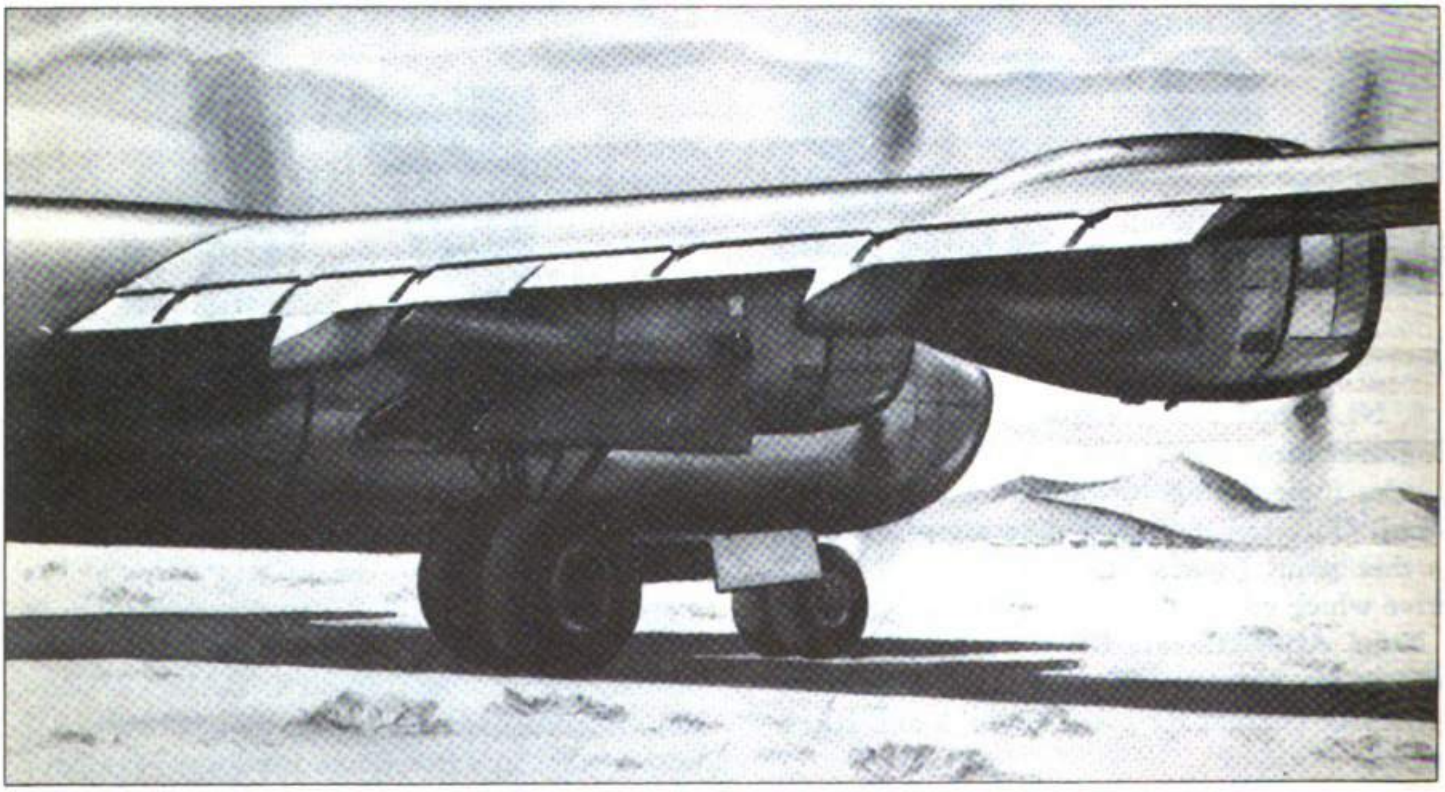


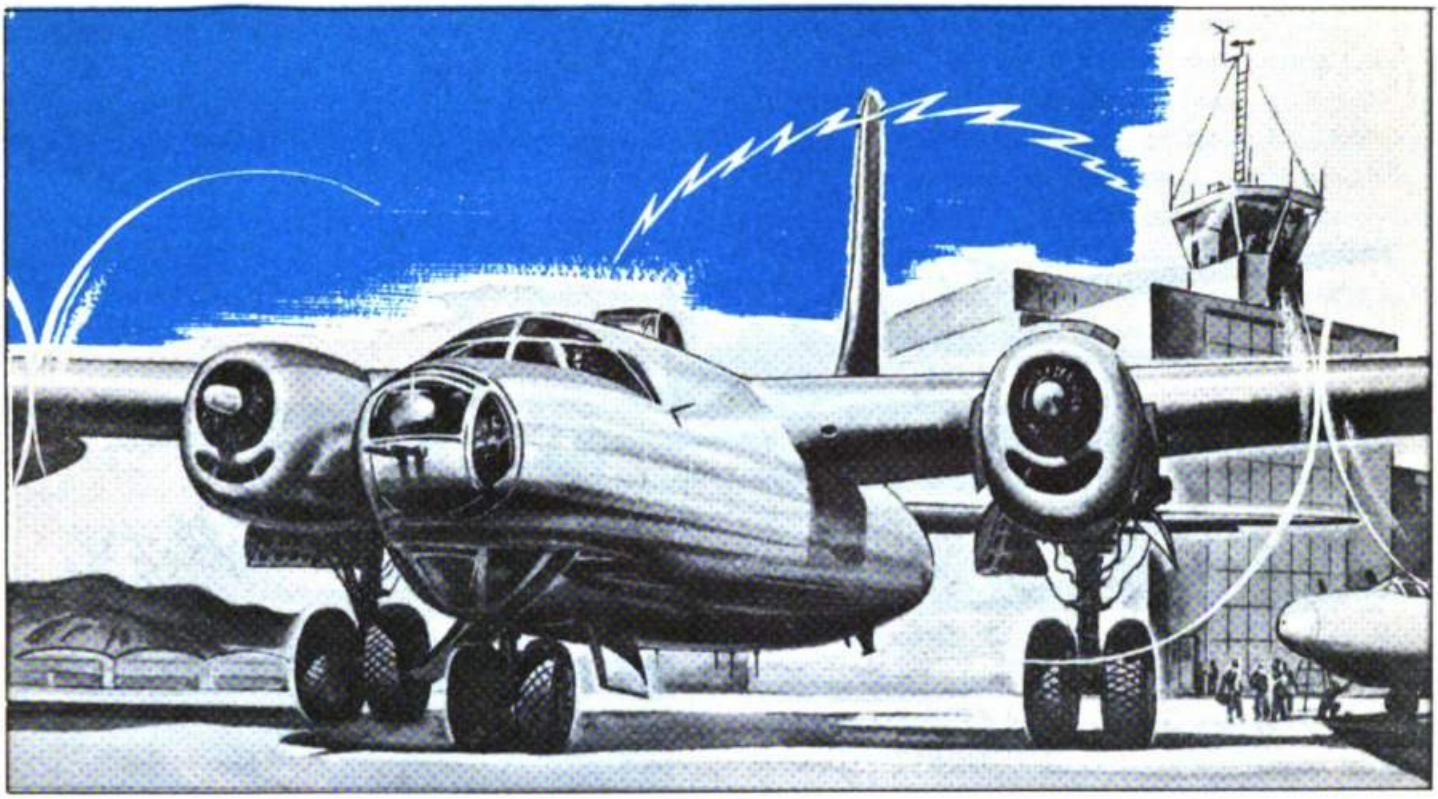


10. **Booster pumps—OFF.** Engineer turns all booster pumps to OFF position and checks fuel pressure for engine-driven pump operation. Minimum fuel pressure on the ground at idling speeds should be at least 15 psi with the engine-driven pumps alone operating.

11. **Interphone and alarm bell—CHECKED.** The copilot checks the operation of the interphone by calling all stations, during which he gets a report on the engines from the scanners. He checks the operation of the alarm bell by giving a certain number of rings and having the scanners in the aft compartment report what they heard. He also has scanners stand by to check and report on flap operation during exercising of flaps.

12. **Exercise flaps — CHECKED.** Engineer operates the flaps through one complete cycle, checking the operation of the main hydraulic system by noting the rise of pressure on the open center hydraulic gage.





Before Taxiing

☛ AMPLIFIED CHECKLIST

1. **All instruments—CHECKED.**

a. Airplane commander sets throttles to 1000 rpm.

b. Copilot re-checks brake hydraulic pressures for 850 to 1030 psi.

c. Engineer re-checks oil pressures and temperature. See Item 4, **Starting Engines, Amplified Checklist.**

d. Engineer re-checks cylinder head temperature for a maximum of 260°. CHT should be well below maximum before taxiing unless the weather is extremely hot; otherwise something is wrong.

e. Engineer re-checks fuel pressures. With the booster pumps in OFF position, at engine idling speeds, the fuel pressure may not come up to operating range of 16 to 18 psi.

f. Engineer re-checks master tachometer for a setting of 2800 rpm.

g. Engineer re-checks the landing gear switch for neutral position and for guard in place to prevent accidental tripping of switch to UP position.

2. **Radio, altimeter, time—CHECKED.** While copilot and engineer are checking instruments, airplane commander calls the tower for taxiing instructions, radio, altimeter, and time check, setting his instruments accordingly.

3. **Wheel chocks—REMOVED.** Airplane commander and copilot look out their windows to see that chocks are pulled, reporting "REMOVED LEFT" and "REMOVED RIGHT." Airplane commander releases parking brakes and you're ready to roll.

TAXIING TIPS

In general the same technique and precautions for taxiing any large tricycle gear airplane apply to taxiing your B-32.

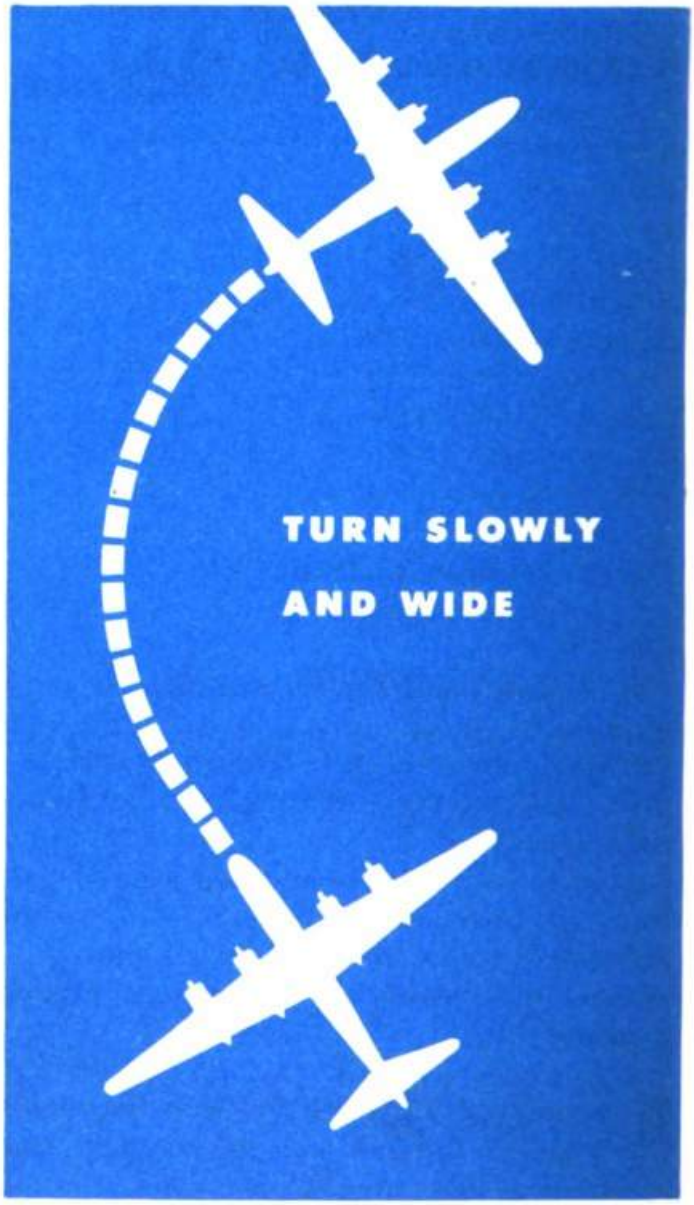
1. Always establish radio contact with tower before leaving the line. You take up a lot of room, and it is imperative that tower know where you are in order to handle ground traffic safely.

2. Keep looking around to both sides and to front. Post a crew member in astro glass hatch to watch traffic. Have all crew members at take-off stations and on interphone, with those who are in suitable positions helping to watch traffic, particularly scanners at scanning blisters.

3. At strange bases make sure before you taxi that taxiways and runways you plan to use are strong enough to hold up your airplane if you have any doubt about it.

4. Turn slowly and wide. Your airplane must be moving before you try to turn. Your two nosewheels are on one axle so that they rotate together. This design eliminates shimmying without incorporation of a shimmy damper unit, but causes some slippage when you make turns. Short turns result in excessive tire wear, and a short turn from dead stop might even cause buckling of nose section. If nose is turned before you start out, let airplane roll for a short distance in direction of nosewheel before attempting to straighten it out.

5. Except for demonstration purposes in



transition training, taxi with controls locked. Even slight cross wind on large side surfaces of your airplane makes it difficult to keep it straight, and in high wind it is absolutely necessary to lock controls to hold airplane, in training or any other operations. It is important, however, for student pilots to taxi with controls unlocked when it is safe to do so in order to appreciate the force exerted by the wind on control surfaces.

6. Taxi slowly. It is easy to build up excessive speed in this airplane, particularly when taxiing long distances downwind. It may be impossible to use sufficient rpm to prevent fouling of plugs and still maintain reasonably slow taxi speed. In that case cut inboard engines.

7. Use brakes sparingly. Excessive overheating and possible brake expander tube failure results from use of brakes for long periods. Don't ride brakes continuously to slow speed; apply them intermittently. Don't use throttle against brake on same side. When you apply brakes you may notice a slight delay in taking hold with a grabbing action just as airplane comes to stop, possibly turning nose gear out of line. These are normal characteristics for this expander tube. Eliminate the difficulty by pumping brakes briefly when you first apply them until they feel solid; then use them lightly. Release brakes just before airplane comes to a shuddering halt and let it roll to a stop.

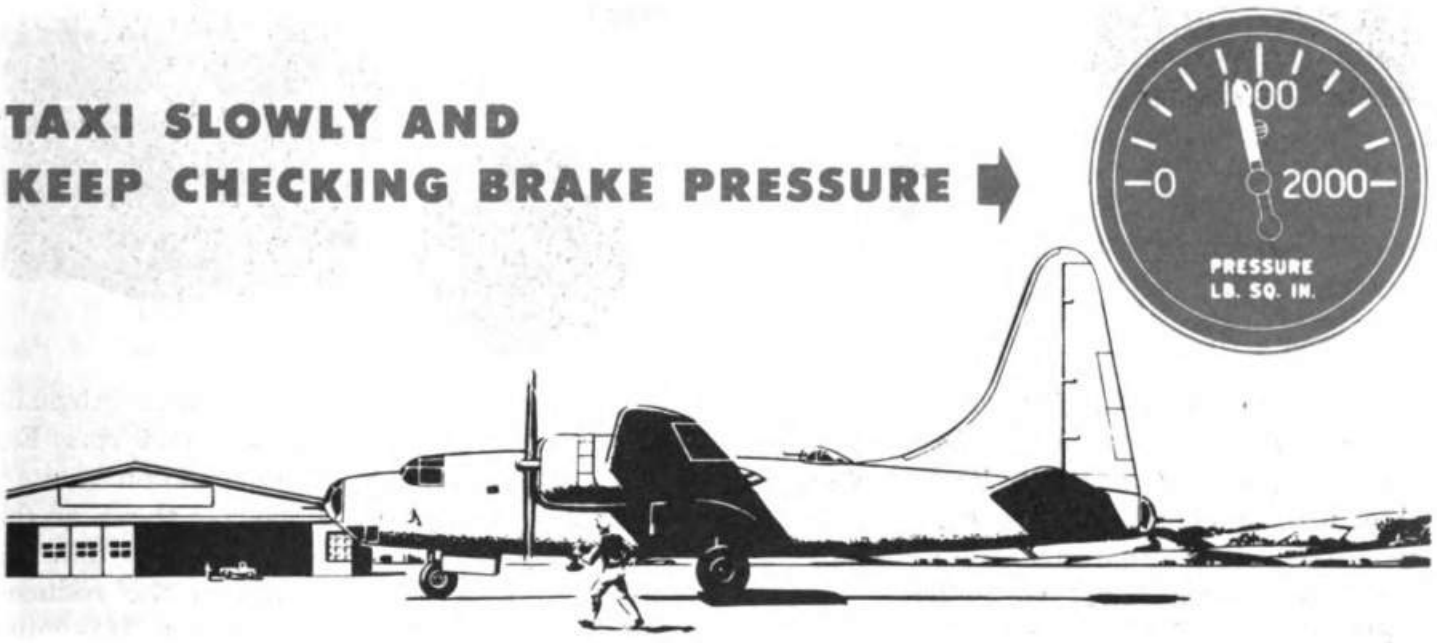
8. **Keep checking brake pressure continually.** If you see brake pressure continue to drop below 850 psi, indicating that electric pump is failing to cut in, immediately operate brake override switch until pressure returns to 1030 psi. If brake warning light comes on, indicating that pressure is down to approximately 600 psi, stop airplane immediately if possible with remaining pressure and have it towed back to line. At 600 psi you have only about two complete brake applications left.

9. APP must always be in operation while you are taxiing. Engine-driven generators alone may not be putting out sufficient juice to operate electric hydraulic pump, particularly for emergency stops. Keep checking electrical output.

10. Maintain sufficient rpm to keep engines clear. Advance rpm when stopped for clearance to cross runways and, if necessary, stop on taxiway and run up engines momentarily.

11. Always operate with mixtures controls in AUTO RICH. Watch cylinder head temperatures in hot weather during extended ground operation. If CHT's get too high it is better to shut down engines before they reach maximum limit of 260°C. and save fuel and engines.

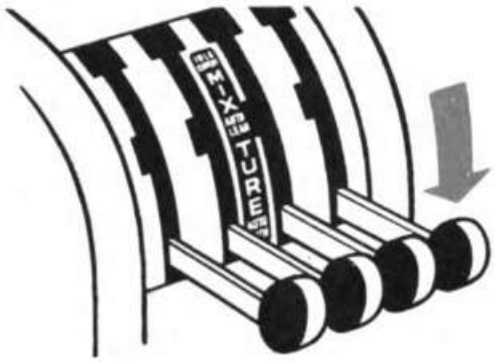
12. Always stop with nosewheels in line with centerline of airplane to minimize nosewheel side loads at re-start of taxiing and during engine run-up.



Before Takeoff

AMPLIFIED CHECKLIST

*Items with asterisk for subsequent takeoffs.



*1. **Mixture controls—AUTO RICH.** Engineer re-checks mixture controls to see that they are in AUTO RICH position.

2. **Propeller controls—CHECKED.**

a. Reverse prop control check: Airplane commander sets throttles for 1000 rpm. Engineer turns reverse safety switch to READY position; then turns reverse switch to REVERSE position. Check to see that green prop tel-lights go out as engineer trips reverse switches and that amber reverse tel-lights come on as props reach reverse pitch position. With experience you can tell by sound of your engines when props have reached full reverse pitch. It normally takes only 3 or 4 seconds for props to reverse completely. Engineer should also check for momentary rpm rise as props go through flat pitch. Engineer immediately returns reverse switch to NORMAL and safety switch to SAFE position. There is a possibility of stalling your engines at low power settings while props are in reverse. Remember that you can return prop pitch to normal before props complete the reverse cycle, if necessary. Merely return reverse switch to NORMAL and ready switch to SAFE.

DROP 300 RPM

*b. Automatic prop control check: Airplane commander sets all throttles at 1500 rpm. Engineer rotates prop synch-control knob counterclockwise until a drop of 300 rpm shows on the engine tachometer and checks to see that engine speed remains constant at the reduced speed without hunting or surging. Maximum

allowable difference between master tachometer and engine tachometers is plus or minus 50 rpm. Use the engine tachs as the reference in case of variance. Airplane commander also observes instruments as a double check. The engineer rotates the knob full clockwise until master tach indicates 2800 rpm and checks to see that engine tachs show the original 1500 rpm.

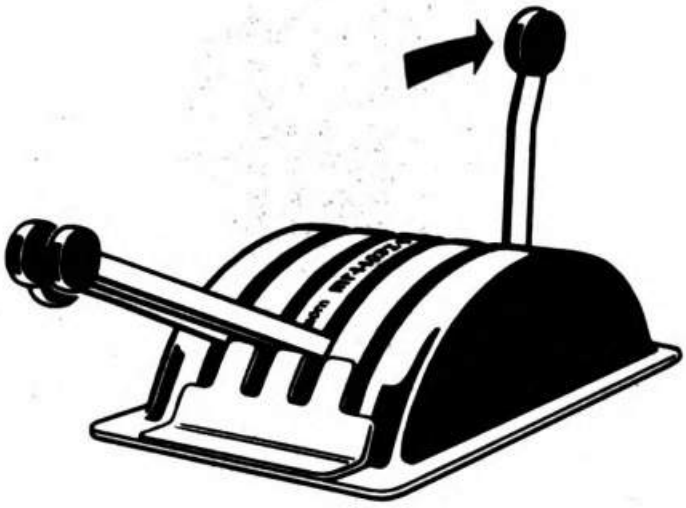
Note: The foregoing procedure tests the automatic synchronization of propellers, operation of the propeller pitch change motor, and the increase-decrease control circuits. Feather control operation is tested once a day in the preflight.

***3. Master tachometer—2800 RPM.** Engineer re-checks master tachometer for a setting of 2800 rpm.

***4. Magnetos and turbos—CHECKED**

a. Airplane commander checks magnetos and full throttle power setting by advancing throttle to 2200 rpm and having engineer check individual magnetos on that engine. Then airplane commander advances throttle to full open position and notes amount of power available with throttle alone. He retards throttle to idling position of 1000 rpm and advances next engine. Normal sequence is to work from right to left across the airplane, starting with No. 4, then No. 3, No. 2 and No. 1.

b. After full throttle check on No. 1 engine, airplane commander turns the TBS dial to position 8 (normal takeoff position), and checks manifold pressure again to see that desired takeoff power is available. Leaving TBS at 8, airplane commander reduces No. 1 throttle to



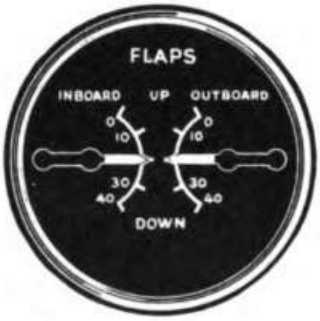
idling, 1000 rpm, and proceeds to check the other engines in sequence 2, 3 and 4. Keep all throttle movements slow to avoid sudden surg-

ing of power. After turbo check on No. 4 engine the airplane commander turns TBS dial to 0 position until immediately before takeoff.

c. When the wind is strong and the airplane is not parked directly into wind, it is advisable to advance opposite throttle to 2000 rpm while you make the full throttle check on an outboard engine. Watch cylinder head temperatures carefully. Keep the time of full throttle operation to a minimum on the ground in order not to overheat engines.

***5. Gyros—SET AND UNCAGED.** Airplane commander and copilot set and uncage their gyro instruments.

***6. Wing flaps — AS REQUIRED.** For light loads engineer puts down 20° flaps, observing



the flap indicator. Copilot calls the scanners on interphone and each scanner checks flaps positions through his scanning blister and reports settings to the copilot.

*7. **Trim tabs—SET.** Airplane commander sees that trim tab controls are set for takeoff.

*8. **Flight controls—CHECKED FREE.** Airplane commander moves all flight controls through their full range.

*9. **Doors and hatches—CLOSED.** Crew members check closing and securing of all doors and hatches and report to the copilot. Airplane commander and copilot close their windows; engineer checks nose compartment entrance hatch, astro hatch, and nosewheel hatch. Scanners secure the aft cabin hatches. Be sure bomb bay doors are closed.

Note: Check the following items immediately before takeoff.

*10. **Cylinder head temperatures—CHECKED.** Engineer re-checks head temperatures for a range of 50°C to 260°C.

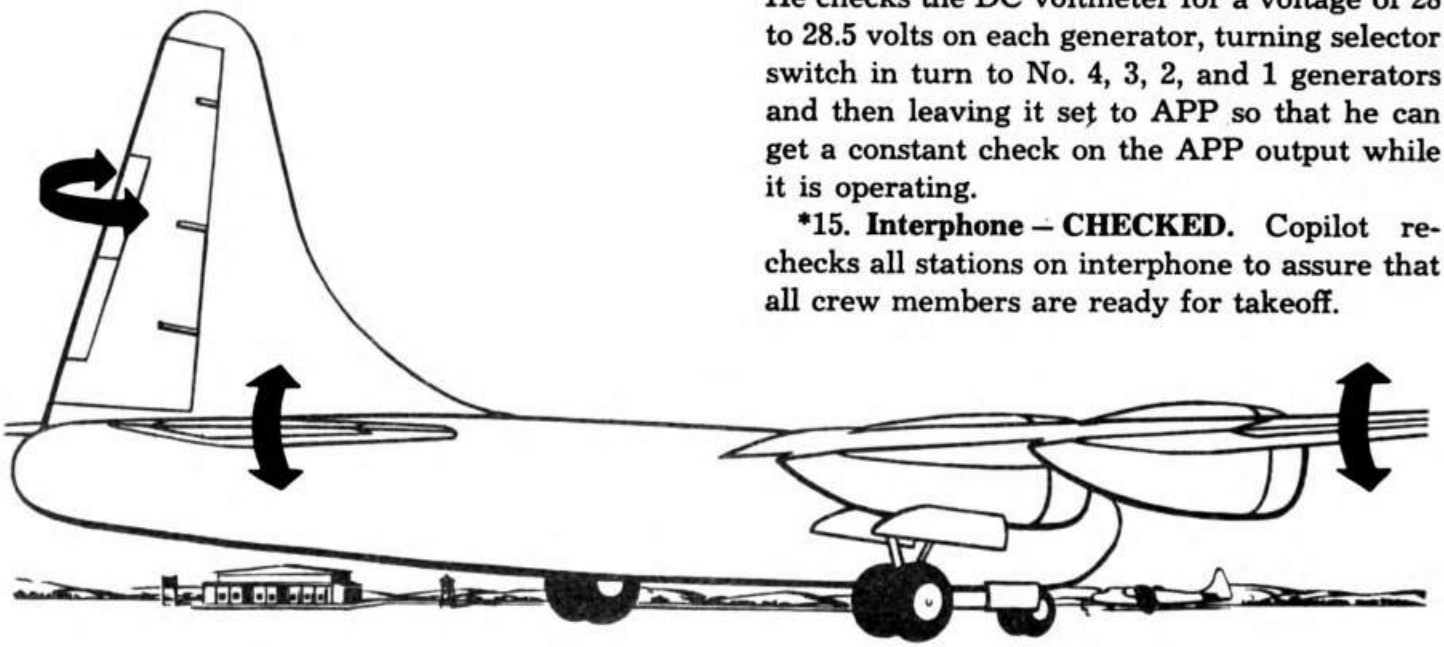
*11. **Booster pumps—HIGH.** Engineer turns all booster pumps to high position.

*12 **Turbos—SET TO 8.** Airplane commander rotates TBS knob to setting of 8.

*13. **Cowl flaps—AS REQUIRED.** Airplane commander directs copilot to close cowl flaps to trail setting. Copilot reports setting when he completes the action.

*14. **Generators—CHECKED AND ON.** Engineer turns No. 2 and No. 3 generators on, rechecking No. 1 and No. 4 to be sure they are on. The engineer should make the voltage check with the engine turning up 1800 rpm. He checks the ammeter to see that all generators are putting out and that the load is evenly distributed among them. Then he turns the AC voltmeter selector switch to the 26-volt position to see that the voltage is normal and to the 115-volt position to check for a range of 100 to 120 volts. He checks the DC voltmeter for a voltage of 28 to 28.5 volts on each generator, turning selector switch in turn to No. 4, 3, 2, and 1 generators and then leaving it set to APP so that he can get a constant check on the APP output while it is operating.

*15. **Interphone – CHECKED.** Copilot rechecks all stations on interphone to assure that all crew members are ready for takeoff.



Normal Takeoff

Your B-32 has no surprises in store for you in takeoff, unless it may be the fact that you find it easier to handle than you expected. Otherwise the takeoff technique is about the same as that for any large tricycle gear airplane. The large tail on your airplane makes directional control easier than on other airplanes of this type, and rapid acceleration gives you a comparatively short takeoff run.

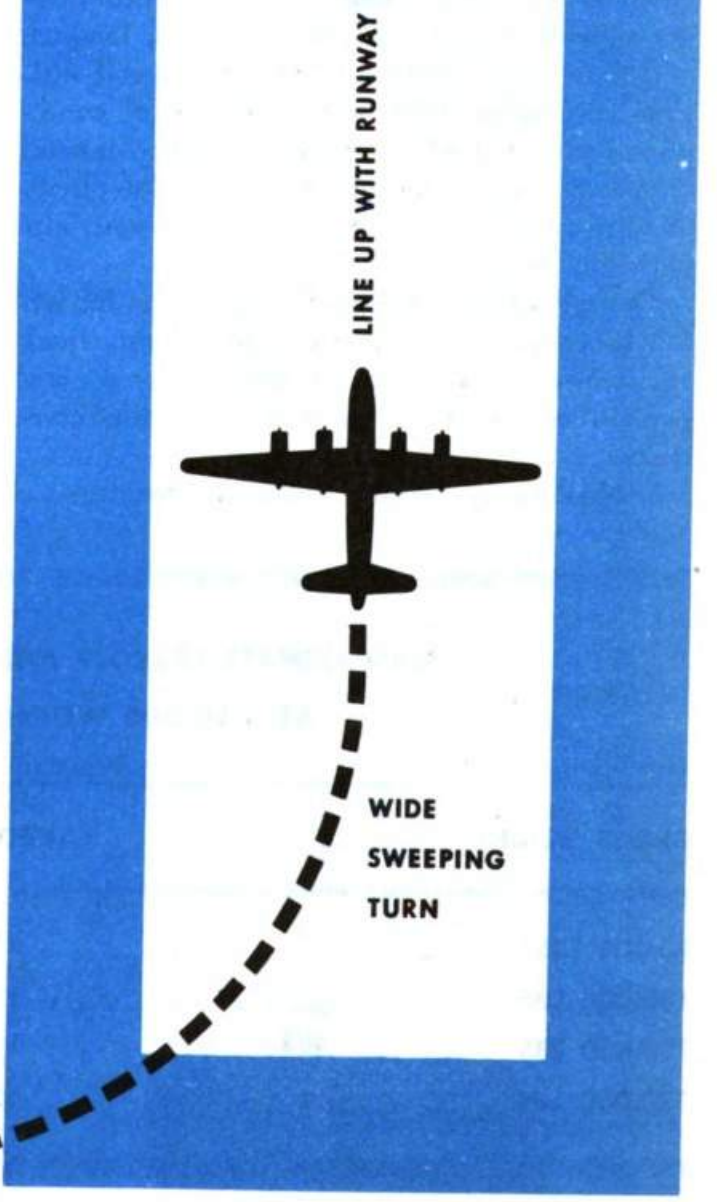
The following paragraphs include some general tips on takeoff technique:

1. Obtain tower clearance before takeoff and also make sure to look for yourself for any traffic the tower might have missed.

2. Line up with runway. Use wide sweeping turn to get onto runway and use up as little runway as possible in lining up.

3. Keep a continuous check on instruments during takeoff, with the help of your copilot and engineer.

4. Release brake. Normally you can advance all throttles evenly, with smooth and steady action. If you need directional control in early part of takeoff run, walk throttles forward, holding airplane straight by leading with throt-



tles. Don't throttle back or use brakes to maintain direction unless you lose control as a result of poor technique or an emergency.

5. Have copilot follow through on throttles and make certain that they are full forward. Throttles are of ratchet type and do not creep.

Note: Takeoff settings are 49 inches manifold pressure and 2800 rpm. When you first open throttles fully, engine tachometers may indicate slight overspeed. However, the automatic synchronizers should immediately reduce this overspeed to normal. Don't allow overspeed of more than 2880 rpm.

6. Have your engineer help you watch manifold pressure and rpm throughout takeoff and warn you if they exceed limits.

7. Use rudder control as soon as you get it.

8. As your speed increases to approximately 70 to 80 mph, ease back on control column to get takeoff attitude. Field conditions, loading, and experience dictate what this takeoff attitude should be. With any given set of conditions, you can control length of run and takeoff airspeed by your attitude. Normally, use plenty of runway and a safe airspeed and fly your airplane off runway.

The takeoff and stalling speeds in the following table are only approximate. Flight check and feel out your own airplane to get a comparison of its takeoff and stalling characteristics.

9. Maximum cylinder head temperature is 260°C for 5 minutes during takeoff. If your head temperatures ran high during ground operations or you note them rising abnormally on takeoff, use a longer ground run and get an airspeed of 200 mph or more as soon as possible after takeoff.

10. Don't be overanxious to gain altitude immediately after takeoff. Get enough initially to clear obstructions; brake and retract your wheels; and allow airspeed to build up to 160 mph before retracting flaps and to 180 mph before establishing climb.

Crosswind Takeoffs

You can handle a crosswind takeoff with no particular difficulty in your B-32. Proper leading with the upwind throttles and rudder pressure hold the airplane straight on the runway, and the inherent directional stability of tricycle landing gear helps to keep it straight and prevent any tendency to weathercock.

It is good practice in crosswinds to fly the airplane off the runway at airspeeds 5 to 10 mph higher than you use normally, particularly in takeoffs from a rough surface. This prevents the possibility of bouncing off the ground and then dropping back, putting a side load on the gear. It also enables you to establish a crab safely, in order to hold your takeoff ground track immediately after leaving the ground. Establish your crab by coordinated use of controls.

APPROXIMATE TAKEOFF AND POWER-ON STALLING SPEEDS AT VARIOUS WEIGHTS WITH 20° OF FLAPS

GROSS WEIGHT	TAKEOFF IAS	STALLING SPEED IAS
90,000 LBS	118	95
100,000 LBS	123	100
110,000 LBS	129	105
120,000 LBS	133	110

Touch-and-go Takeoffs

Use the following procedure for touch-and-go (running takeoffs):

1. Bring airplane in for normal 2-point landing.

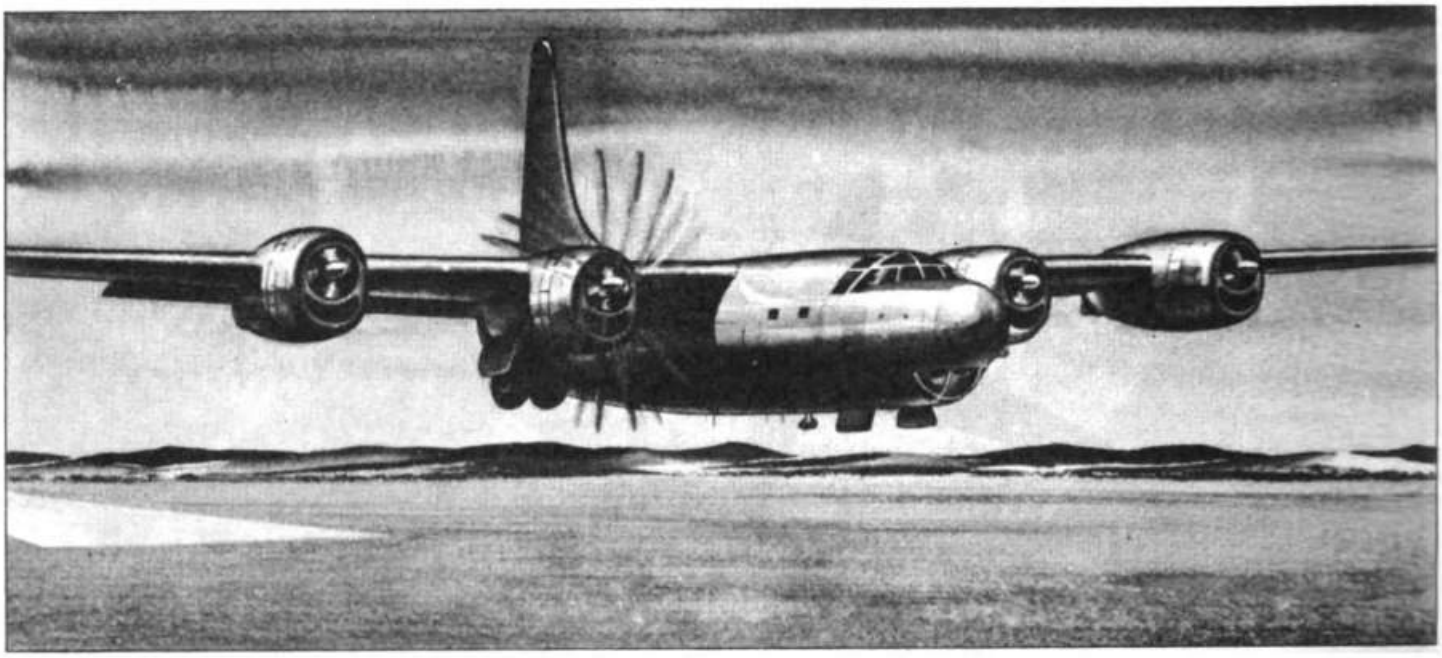
2. At your direction after airplane is definitely on ground, engineer raises flaps to 20°, sets trim tabs for takeoff, re-checks master tach for 2400 rpm setting and TBS knob for desired setting and then notifies you that airplane is ready for takeoff. Scanners check flaps for 20° and notify copilot over interphone.

Note: You don't have to use full takeoff power and rpm for touch-and-go takeoffs. Your airplane is already rolling at approximately half takeoff speed. Turbo setting should be enough so that when you advance throttles you get approximately 43″ manifold pressure and 2400 rpm. If you don't get these settings with full throttle, turn TBS knob up until you do get them. If full throttle gives you higher settings than these, leave the higher power on until you are retracting your wheels.

3. You don't have to use throttle for directional control during touch-and-go since your airspeed is high enough to give you good rudder control throughout the ground roll.

4. Apply throttles slowly and smoothly. There is always a tendency to over-accelerate in a touch-and-go takeoff, so take special care not to apply power too fast. Remember that you are already going much faster than normally, and it doesn't take much more to get you into the air.

5. Fly the airplane off the runway and when airborne proceed as you do for normal takeoffs.



EMERGENCY TAKEOFFS

Engine Failure on Takeoff

Note: See also general tips on procedures for engine failures, under **Engines** section.

The large rudder and generally good flight characteristics of the B-32 make it an easier airplane to handle than other 4-engine bombers under conditions imposed by engine failures on takeoff. Particularly in the light B-32's you fly in transition training, even losing two engines on the same side on takeoff is not a dangerously critical condition if you use proper technique. As gross loads increase on the airplane, loss of an engine becomes more critical. However, although flight-tested information is scanty as yet, the tests which have been run indicate that the B-32's characteristics under engine failure conditions at heavier loads will probably still be better than those of other airplanes of this type.

Follow this procedure if an engine fails on takeoff.

1. If you are still on ground and have enough runway, stop. Use brakes and reverse props if possible.

2. If airborne get directional control first with rudder and aileron. Don't let the dead engine wing drop. Correct with trim tabs. With two engines out on one side don't use more than approximately 7° rudder tab if possible to avoid the chance of blanketing out your rudder and causing tail stall.

3. Maintain airspeed, nosing down to pick up speed if necessary and possible.

4. While you are taking care of control, have engineer get gear up immediately.

5. Have engineer bring up flaps to between 5° and 8°. Leave this setting while you go around until you lower flaps again for landing.

6. Reduce power as soon as you have everything under control and can safely do so.

7. Don't make a turn until you have a safe airspeed and then turn away from the dead engine if practicable. If conditions necessitate turning into the dead engine, be sure to maintain airspeed and trim in the turn.

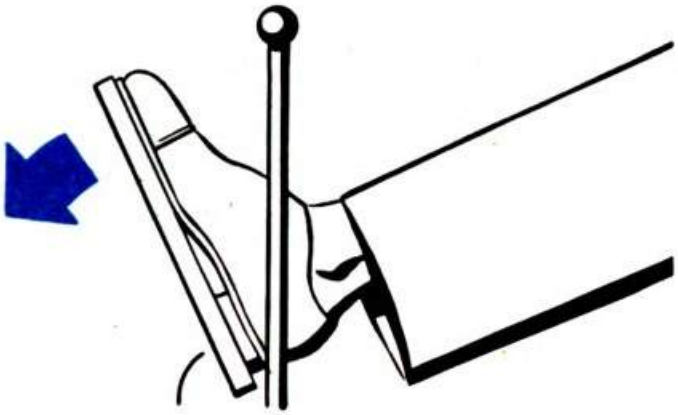
Runaway Props and Turbos

See emergency procedures under **Propellers** and **Turbo-superchargers** sections, respectively, for instructions on handling these conditions.

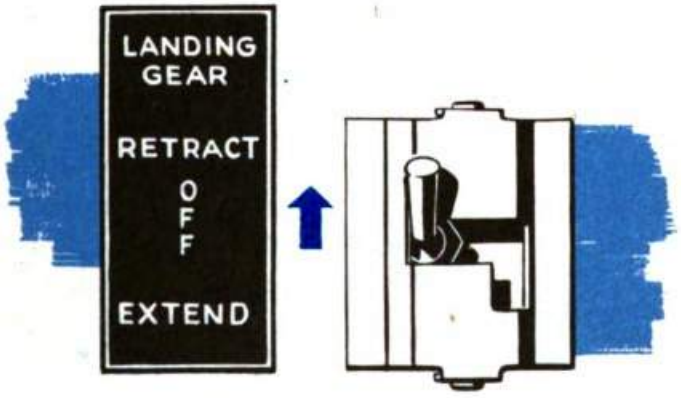
After Takeoff

AMPLIFIED CHECKLIST

*Items with asterisk for subsequent takeoffs and running takeoffs.



*1. **Brakes – APPLIED.** Before retracting wheels brake them smoothly to stop their rotation completely. Spinning of wheels or braking in any but down and locked position puts uneven strain on the gear structure.



*2. **Gear–UP.** Engineer raises gear at your command as soon as you have completed braking wheels. **Caution: Be absolutely certain airplane is definitely airborne before you call for gear up.**

Scanners in aft compartment call you at this point and report that gear is up on both sides. Engineer checks nosewheel up-lock from bombardier's compartment and reports to you.

*3. **Power reduction–42", 2400 RPM.** When you have sufficient airspeed, make your first power reduction. This reduction can come when gear is up, or in lighter airplanes when gear is coming up, depending on your own technique. Turn TBS to pull 42". Engineer reduces rpm to 2400. For operational flights you can use settings of 43" and 2400.

*4. **Wing flaps–UP.** Direct engineer to raise flaps when wheels are up and airspeed reaches

160 mph. Be prepared for tendency to nose down as flaps come up, and correct with trim. At night or when flying a heavily loaded B-32, you can handle this characteristic by having engineer raise flaps in 10° stages, allowing time between stages for you to operate trim tabs to compensate for changing flight attitude. Scanners should call you on interphone and report flap action.

*5. **Power reduction—AS REQUIRED.** For transition training airplane commander reduces manifold pressure to 38" and directs engineer to reduce rpm to 2300. For operational flights set power at predetermined settings as worked out on climb control charts.

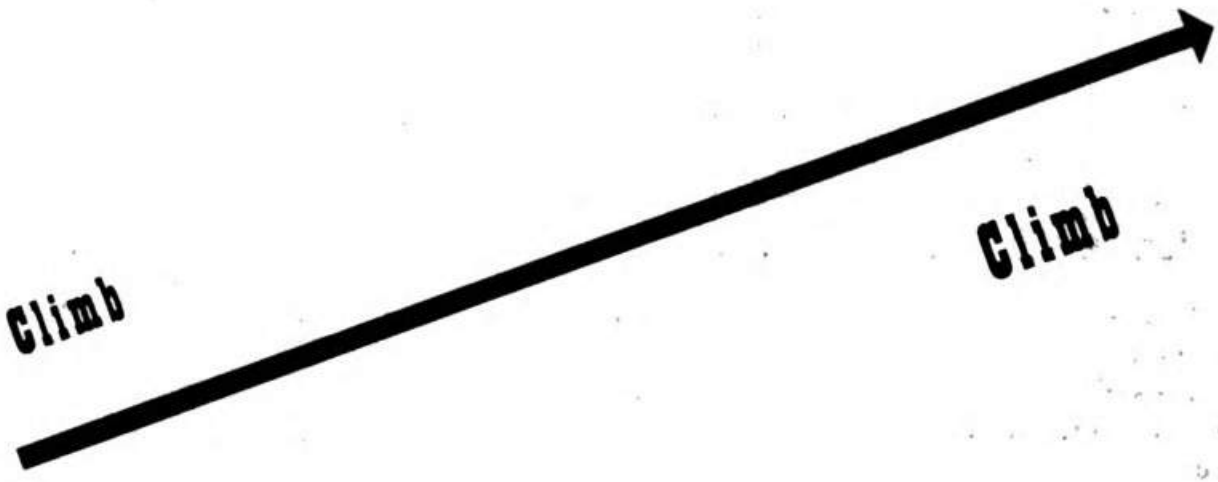
*6. **Cylinder head temperatures—CHECKED.** After power is set engineer re-checks cylinder head temperature and adjusts cowl flaps accordingly. Maximum CHT in climb is 248°C. If possible keep cowl flaps closed, achieving engine cooling with a higher airspeed. This gives more efficient climb conditions than airspeed prescribed by climb control chart for your particular load. You get a loss of approximately 1 mph for every degree cowl flaps are open.

*7. **APP—AS REQUIRED.** If you are not shooting stop landings in daytime, or do not need additional electric power, copilot turns off APP at this point. Turn off equalizer switch; then load switch; then set throttle to idle for a period before turning off APP ignition. If you are using only a few electrical units, you don't need APP. If you are operating at night or using turrets, radar, lights, radios, etc., leave it on. Check ammeters to see how much load is on line if you are not sure.

*8. **Booster pumps—OFF.** At approximately 1000 feet engineer turns off fuel booster pumps one at a time and checks fuel pressure as he does so. If you are going to fly above 10,000 feet, don't forget to turn booster pumps on again as you need them.

NOTE

Once you are in the air, your scanners should call you every 15 minutes to report condition of engines. If they don't, call them and get them on the ball or find out what's wrong.



Climb

Extended climbs require special techniques and considerations. In general these are the same for the B-32 as for any airplane. The B-32 is designed for long range high altitude bombardment, and getting up to high altitude is one of the more critical parts of any long range mission. Climb is always more or less critical because your airplane is operating under changing external conditions. You are normally using continuous high power settings and extra fuel, and you must observe the extra precautions necessitated by those conditions. The decreasing temperature and pressure which you get with altitude affects engine performance, as well as flight characteristics and the comfort of your crew.

The following tips set forth some of the factors you must take into consideration in climb:

1. Smooth flying technique becomes increasingly important if you want to stay in formation or get maximum performance from your airplane. Keep airplane trimmed at all times.

2. As you get up to altitude some degree of flaps increases efficiency of climb. With this Davis airfoil approximately 5° flaps gives you most efficient lift-to-drag ratio. On the basis of this fact, experiment will show you how much flaps to use and at what point in your climb to use them to get increased rate of climb at same airspeed.

Note: Always use 5° of flaps over 20,000 feet altitude.

3. Just as you have to smooth out and modify your flying technique as you increase altitude, so does your autopilot. Keep making flight adjustments on autopilot panel as necessary while using autopilot to climb. Remember to set up

and use autopilot as soon after takeoff as possible so that it stays warmed up during the climb. If you wait until you get to high altitude to turn the autopilot on, low temperature may prevent autopilot from warming up satisfactorily within reasonable length of time.

4. If you are using APP, remember to change altitude compensator as you ascend at 5000 feet and 10,000 feet. Above 10,000 feet keep a check on voltage output of APP; it begins to lose efficiency at this altitude. Shut it down when voltage drops below normal.

5. Although temperature is much lower at altitude, your cooling system becomes less efficient as you go up because of decrease in air density. With the aid of copilot and engineer, keep careful running check during climb on all engine instruments. If all CHT's run high during a sustained climb, hold the climbing power setting and level off until head temperatures return to normal. Then re-establish climb at slightly higher airspeed. **This gives you the necessary cooling with better rate of climb than you would get if you opened cowl flaps on all four engines at your former airspeed.** If individual CHT's run high, adjust cowl flaps to take care of the situation.

6. For long-range cruise missions climb at rated power, 42″ and 2400 rpm, regardless of gross weight. Rated power climbs result in more economical operation than climbs at lower power settings because the former get you to cruising altitudes and AUTO LEAN mixtures more quickly.

7. Turn fuel booster pumps to LOW position above 10,000 feet, and when you need extra pressure turn them to HIGH position. Decrease in atmosphere pressure increases the volatility of your fuel, in turn increasing possibility of vapor lock at altitude. Watch fuel pressures carefully and keep them within operating limits.

8. Remember that you and your crew need oxygen and heat as you ascend. See that crew begins use of oxygen at proper time. Keep them warm enough to operate efficiently.

9. See **Cold Weather Operation; Heating, Ventilating, Anti-icing and De-icing Equipment;** and **Oxygen System** sections for additional information applicable to climb.

Cruise

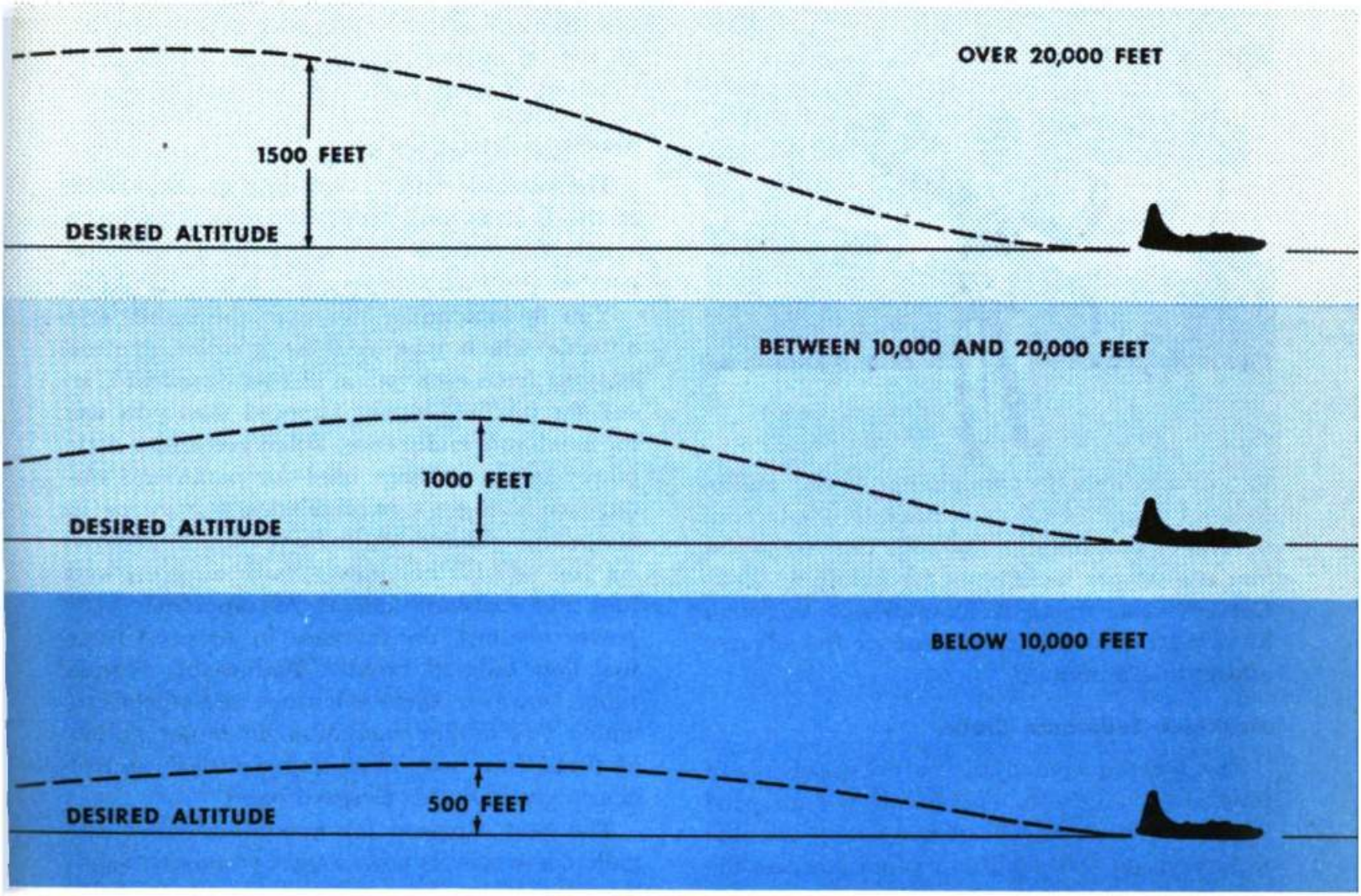
Leveling Off

Approach your cruising level from the top, in both altitude and airspeed—never from below. For cruising altitudes below 10,000, climb 500 feet higher and then come down to cruising altitude. For cruising altitudes between 10,000 feet and 20,000 feet, climb 1000 feet above; for altitudes above 20,000 feet, climb 1500 feet above. Remember to use 5° of flaps for flight above 20,000 feet.

When you reach the top of your climb, hold your climbing power and a zero rate of climb until you reach necessary airspeed (approximately 210 mph with high gross loads) and then set your pre-determined cruising power. If you make the power reduction before you reach sufficient airspeed, you may have to open cowl flaps to get proper cooling. This causes excessive drag with additional loss of airspeed and increased fuel consumption.

Next, nose the airplane down slightly and make a shallow dive to your cruising level. Trim the airplane carefully. Use elevators to hold cruising airspeed and adjust power slightly to maintain altitude.

Then complete the remaining steps in the cruising checklist, listed in the following amplification.



Cruising Amplified Checklist

1. **Power settings—29", 2000 RPM.** For training cruise set throttles for 29" manifold pressure and have engineer adjust props for 2000 rpm. For operational missions use the pre-determined power settings from your cruise control chart. In some cases, to get certain specified power settings you may find that you need more turbo boost than you get with TBS at position 8. If necessary, turn the TBS knob past the stop into the red-lined area in order to get manifold pressures within operating range for cruise. Remember that TBS positions are only relative; the safety stop and red-lined area are there mainly to prevent you from exceeding 49".

2. **Mixture controls – AS REQUIRED.** For training flights use AUTO LEAN mixtures with power settings for local cruise. On operational missions power settings and cylinder head temperatures dictate use of mixture controls. Always use AUTO LEAN for settings of 2200 rpm and 35", or below, provided you can keep CHT's below 232°.

3. **Cowl flaps – AS REQUIRED.** Use cowl flaps individually to keep CHT's within operating limits in cruising flights, below 232° for AUTO LEAN mixture, and below 248° for AUTO RICH.

Flight Planning

For any operational mission, regardless of what kind of cruise you want to accomplish, plan your fuel and power management in advance. Know how to use your climb control and cruise control charts. Consider the factors affecting cruise control—wind, rough air, altitude, trim, changes in airspeed and attitude, weather, weight, drag, power settings, and engine management—and know how to use them or control them. While any one of these factors

may or may not affect your range or endurance, certainly the combined cumulative effect of several can mean failure of your mission unless you use proper techniques for handling them. Correct basic flying techniques and thorough knowledge of your airplane reduce the adverse effects to a minimum.

Maximum Endurance Cruise

The technique of flying for long periods of time is obviously to operate at the airspeed where engines use fuel at the lowest possible rate. You get this condition when you use the least engine power that keeps the airplane flying. The precise airspeed depends on the gross weight of the airplane and is somewhat lower than IAS for maximum range. Get the proper airspeed from your cruise control charts.

Use the following procedures:

1. Establish desired airspeed from cruise control data and then fly at constant IAS for a given weight bracket. This is important in order to conserve fuel.

2. Maintain altitude by use of power. Set your rpm at 1400 and pull whatever manifold pressure is necessary to maintain airspeed and altitude. You hold 1400 rpm as a minimum to avoid loss of current from inboard generators.

3. Reduce your airspeed as weight decreases during flight. The less the airplane weighs, the longer it flies. In extreme emergencies lighten airplane by jettisoning removable equipment. Be careful not to unbalance airplane, however, as that would affect flight characteristics and cut down endurance.

4. Remember that endurance decreases with altitude. Stay down where you can get the most time out of your ship.

Maximum Range Cruise

The purpose and outstanding characteristic of the B-32 is long range bombing. Maximum range, therefore, is the most useful cruise category in the tactical operation of this airplane.

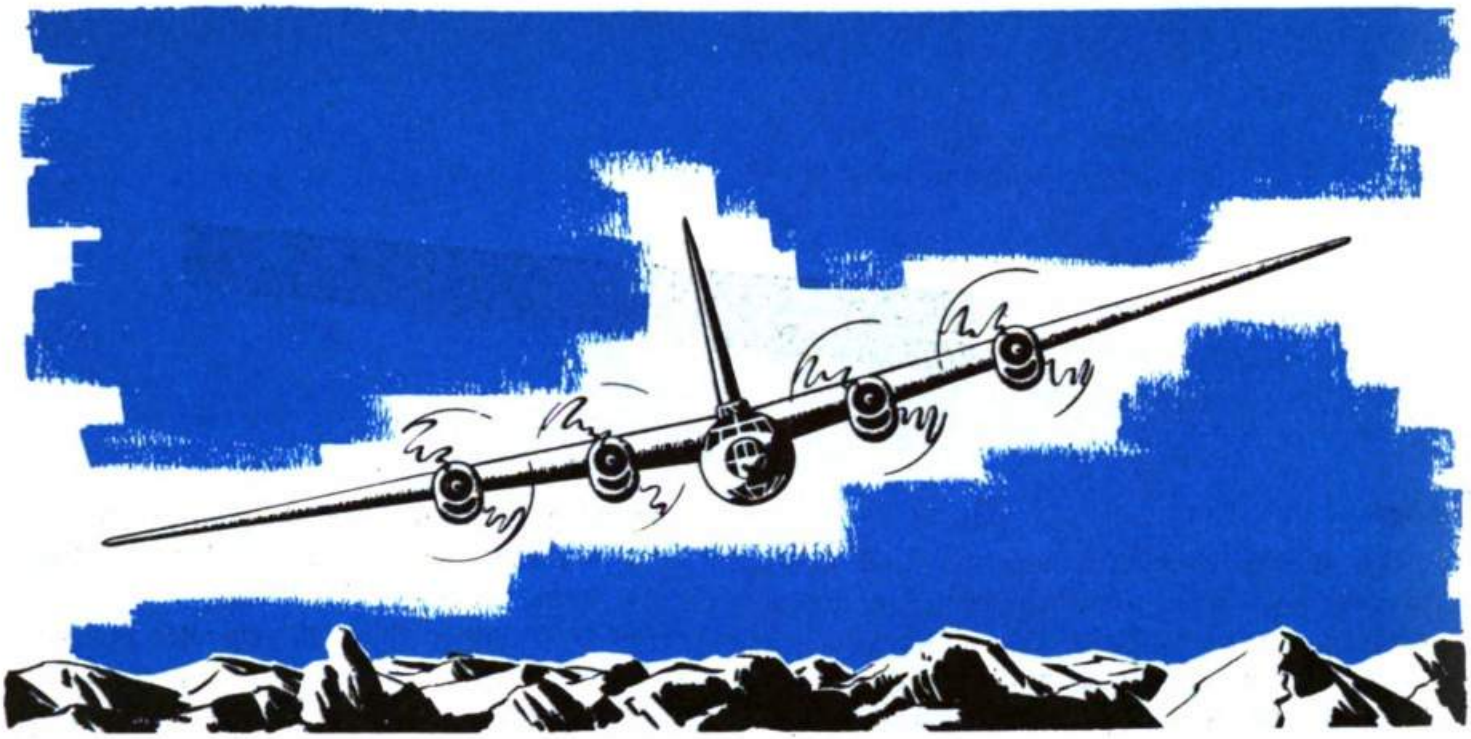
You fly maximum range at the speed and altitude which give you the greatest ground mileage from each gallon of fuel consumed. In still air this is a higher airspeed than you use for maximum endurance. When you add a little power to the settings used for maximum endurance, you get a relatively large increase in airspeed compared to the increase in fuel flow. As you add further power, both airspeed and fuel flow increase, and as you approach high power settings, the increase in airspeed over fuel flow falls off rapidly. Within this overall range, however, there is a range of airspeeds at which you obtain maximum miles per gallon of fuel. Your maximum range cruise control charts give you this airspeed band.

The best airspeed for maximum miles per gallon, however, is not enough; you must translate this into maximum ground miles, which means taking wind into consideration. With a headwind, fly at the upper limits of your maximum range band of airspeeds. With a tailwind, fly at the lower limits.

The lower portion of this airspeed band is difficult to use in formation. The formation leader should use an airspeed at the bottom of the band. This allows other airplanes in the formation to stay within the economical range of airspeeds in spite of the airspeed changes they are constantly making to stay in formation.

Weight of your airplane materially affects IAS for maximum range, as it does for maximum endurance. However, once you determine this IAS for your load condition, you keep it at all altitudes, varying power as necessary.

Make your descents in maximum cruise by holding your recommended cruising airspeed and reducing power to the lowest permissible power settings in order to extend your range.

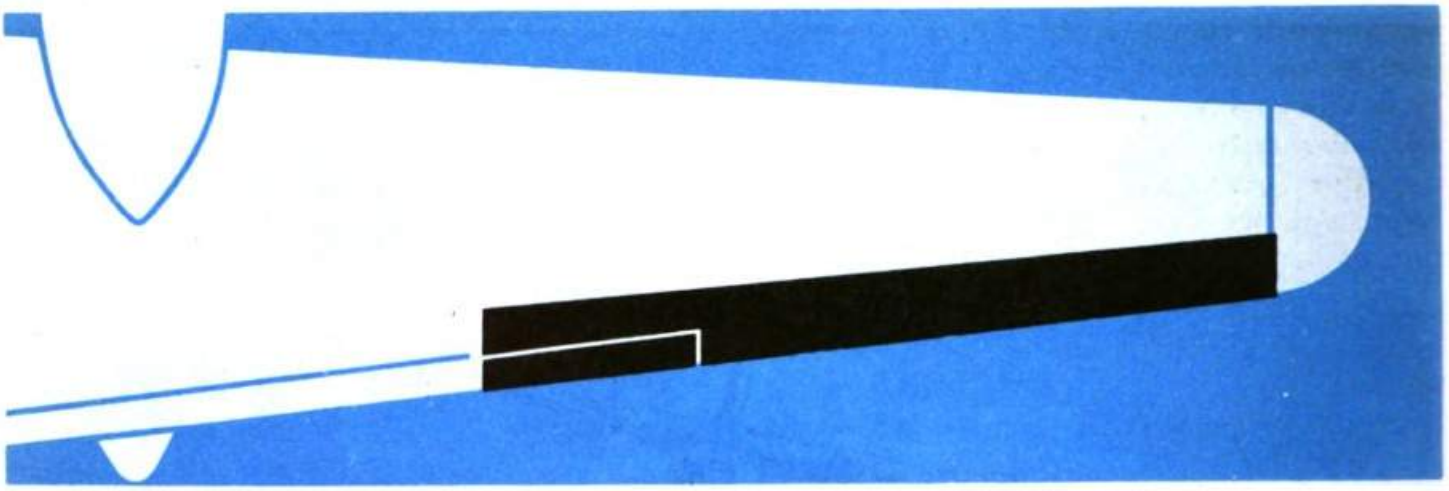


Flight Characteristics

You are not likely to have any quarrel with the flight characteristics of your B-32; you'll find them thoroughly satisfactory. All control pressures and responses are excellent for an airplane of this size. The airplane accelerates rapidly, both on takeoff and when you apply power in flight. Stalling characteristics are as good and in some cases better than those in many smaller airplanes.

Rudder

The rudder is the heaviest of the controls, but there is no delay in its reaction, even at low speeds. One of these days you'll lose an engine on takeoff and from then on rudder will be your pet control. Rudder trim is also adequately effective. A few degrees of rudder trim eliminates yaw caused by loss of an outboard engine, and approximately 7° takes care of two engines out on the same side at cruising airspeeds and power settings. However, don't let your airspeed get below 150 mph with two engines out on the same side.



Aileron

The aileron control is sensitive and light. Adverse yaw from aileron drag on entering and leaving turns is slight. The aileron is effective at the low speeds of landing and takeoff. However, the same precautions against excessive aileron control at low airspeeds which apply to any other airplane apply also to the B-32. The electric switch for aileron tab control may be unfamiliar to you at first, but it is easy to use when you get onto it, and aileron trim is sensitive.

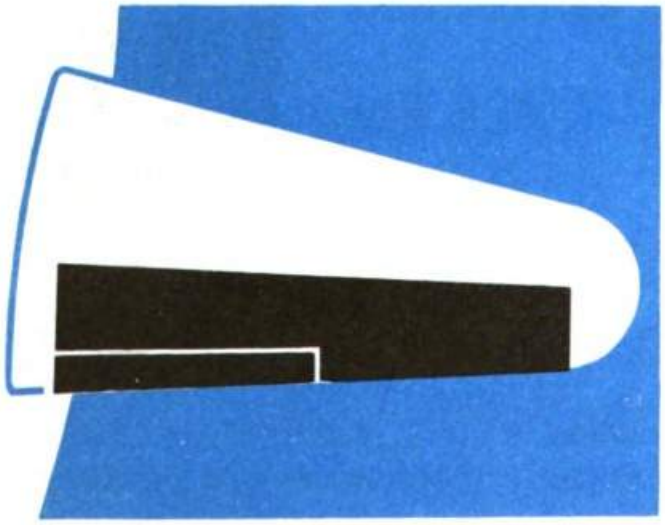
Elevators

Elevators are as smooth and light as an AT-6 . . . almost. Elevators become effective early on the takeoff run, and they give you definite positive reaction in a stall. The elevators are the only controls without servo tabs; they don't need them. Some mushiness of the elevator trim tabs makes it necessary to take special care when trimming the airplane at altitude. They are satisfactory at lower altitudes, however, once you are used to them.

For banks up to about 40° elevator pressure is normal. In banks above 40° the pressure increases rapidly, and it is difficult to hold altitude in banks of 60° or more. For this reason, don't make steep banks in the traffic pattern or any time you are close to the ground.

Flaps

With any given load, full flaps lower your power-off stalling speed about 25 mph. When you lower flaps there is a marked tendency for the airplane to nose up, and a similar tendency to nose down when you raise flaps. You have to make fairly large changes in elevator trim tab settings to take care of the situation. When lowering flaps for landing or retracting them after takeoff, you may prefer to lead this reaction with the elevator tabs to take the rush out of the procedure.

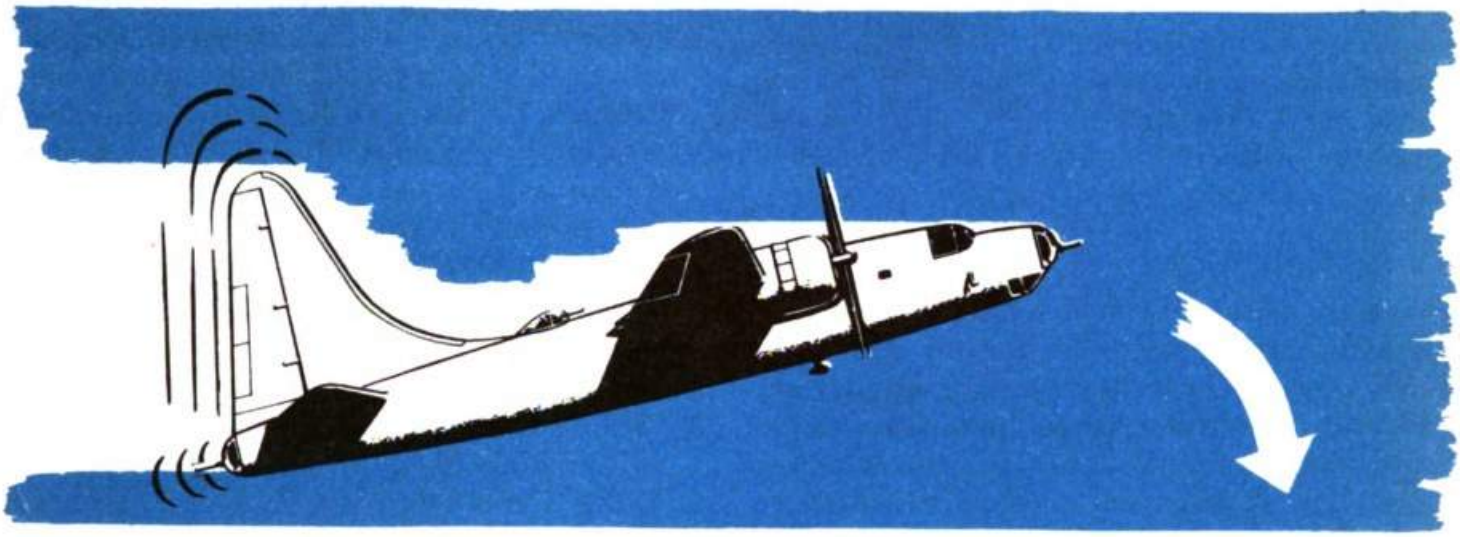


Caution

If your inboard flaps go down alone the airplane tends to nose up strongly. It may take full elevator travel to hold it down, and at low airspeeds this leaves no control margin in event of a stall. With outboard flaps alone the airplane tends to nose down, but less strongly. Be extremely cautious of this situation if you lower flaps by the emergency system. In emergency hydraulic system flap operation, the two sets of flaps operate independently. Have the crew member who operates the emergency selector

valves work closely with another man who watches coordination of flaps on the flap indicator. Get your scanners worked in on this operation also, watching through their blisters and reporting by interphone, because the flap indicator might be off.

Always use 5° of flaps for flight above 20,000 feet. This setting improves flight characteristics at altitude. For maximum performance take-offs, 40° flaps gives you the shortest ground run and the shortest distance for clearing a 50′ obstacle.



Stalls

Stalling characteristics are clean. The airplane forewarns you of a stall by a severe tail shake 3 to 5 mph before you reach stalling speed. A slight rolling movement develops in and around the ailerons prior to the actual break of the stall. During the final phase of the stall you notice aileron snatch. If you allow the stall to progress hold the wheel firmly to prevent any whip which might be transmitted from the aileron to the wheel. After complete stall the airplane falls straight forward without any tendency to spin.

*STALLING SPEEDS

Power-off—Gear Down

Gross Wt.	40° Flaps	30° Flaps	20° Flaps	0° Flaps
80,000 lbs	106	113	117	131
90,000 lbs	111	118	122	137
100,000 lbs	116	123	128	144
110,000 lbs	120	128	133	151
120,000 lbs	125	133	139	156

*Estimated figures, not flight checked.

Spins

Don't attempt spins in this airplane. If you get into a spin, however, use multi-engine spin recovery technique.

Loss of Engines

This subject has already been discussed in relation to takeoff and to rudder, under those headings. In addition to that information, there is little to say about loss of engines in normal level flight. One inboard engine out in cruise is hardly noticeable in a light airplane; 1 or 2 degrees of rudder tab adequately corrects any yaw. A few more degrees corrects for loss of an outboard engine. The airplane has been flown at approximately 90,000 lbs, with Nos. 1, 2, and 3 out. Again rudder trim, and some aileron trim to hold the left wing slightly high, adequately corrected the attitude. This fact is offered merely as a matter of interest and a basis of comparison and certainly not as a suggested practice procedure. Remember that this 1-engine operation was in a light airplane under experimental conditions. The results, however, speak well for the B-32's flight characteristics.

In addition to trim, 5° to 8° of flaps are helpful in maintaining altitude with two engines out.

Restricted Maneuvers

Don't attempt these maneuvers: loop, roll, spin, inverted flight, Immelman.

Restrict banks to 60° with light training airplanes and to 30° with 120,000 lbs. gross weight. Although Technical Order restrictions exceed these limits, remember that they are based on structural limitations and do not consider practical operating factors. Stay under these limits except in emergencies.

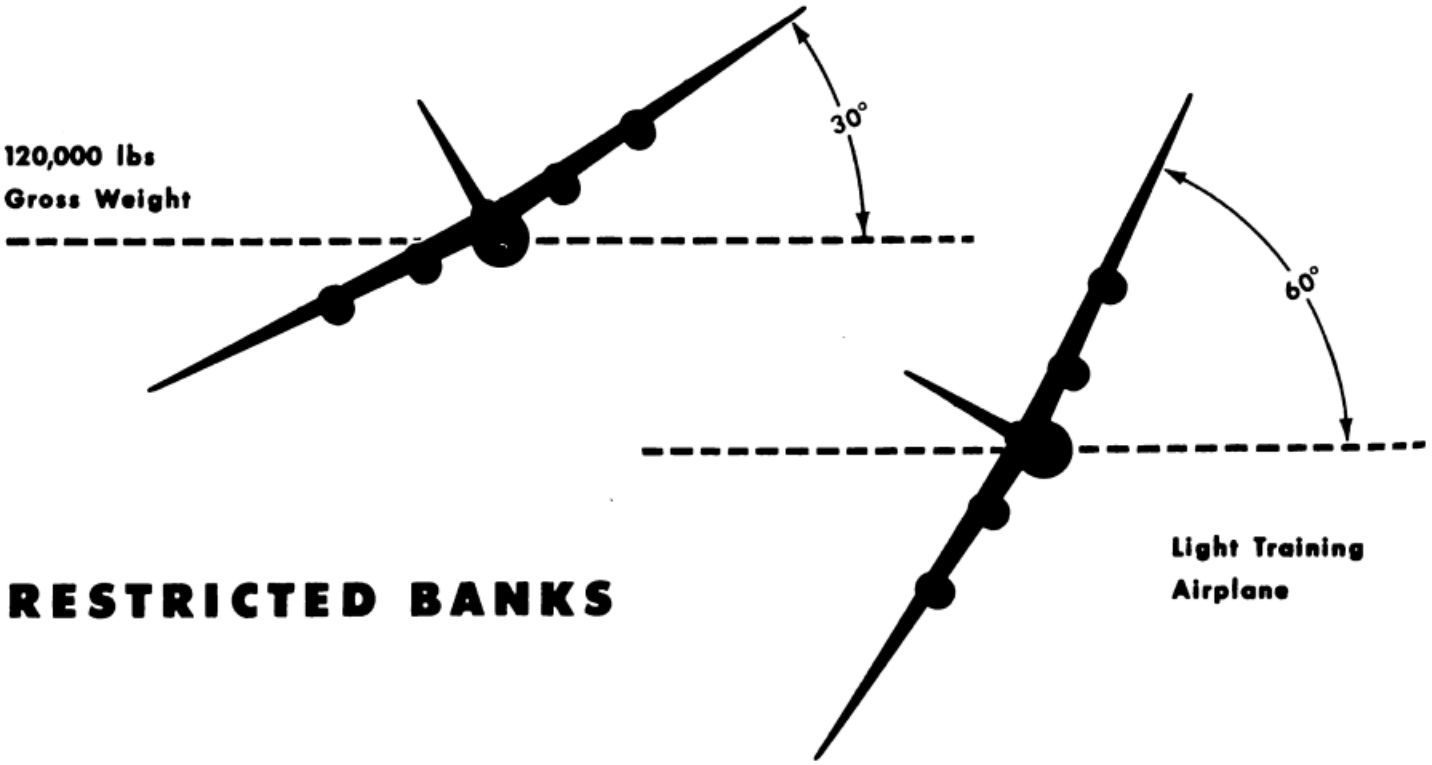
Airspeed Limitations

Don't exceed:

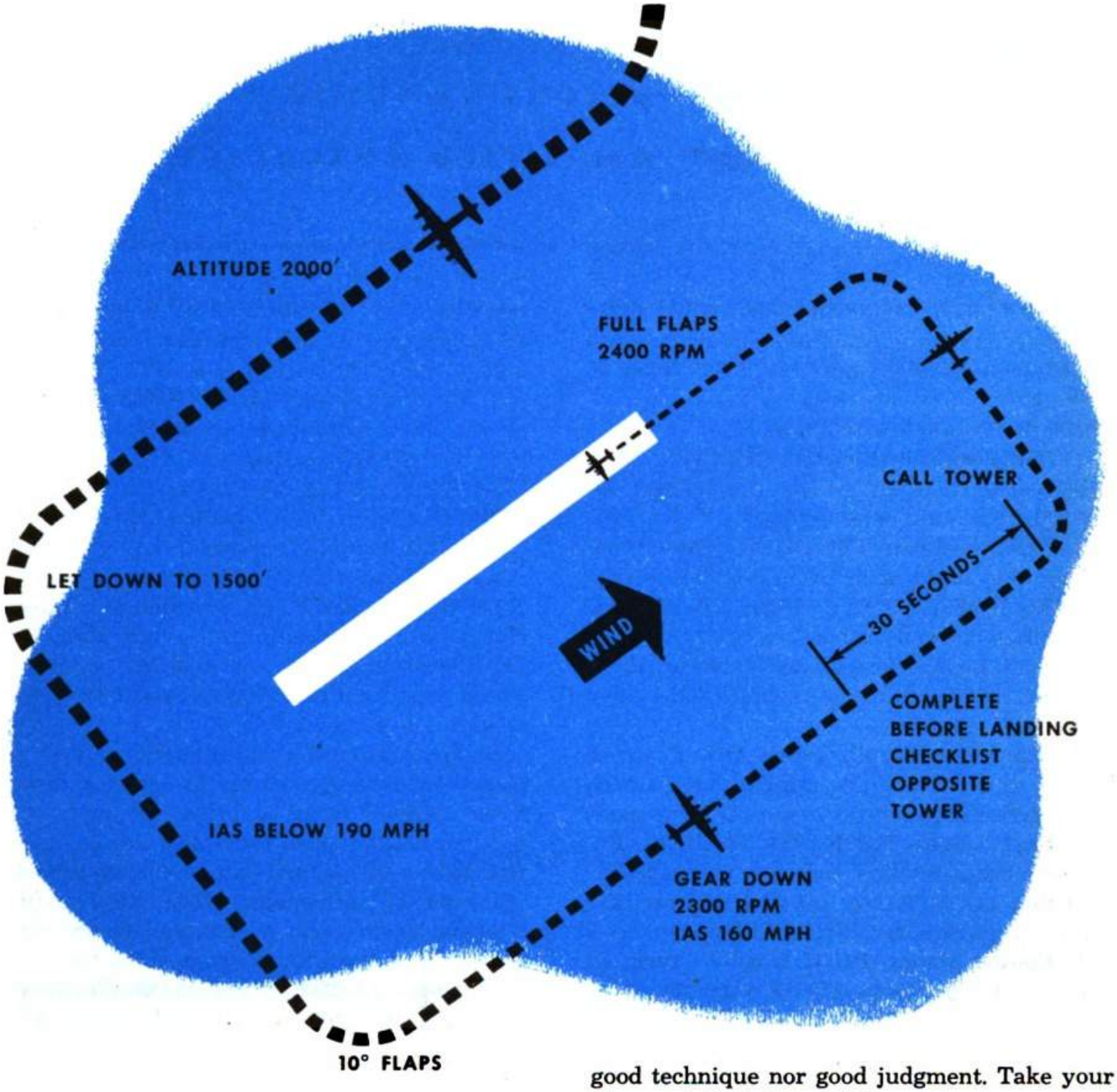
330 mph at 100,000 lbs gross

240 mph at 118,000 lbs gross

Note: These figures are Technical Order restrictions based on structural limitations. For safe practical operations, keep your airspeed well below these limits except in emergencies.



RESTRICTED BANKS



Before Landing

Start your Before Landing Checklist soon enough so that you can have it completed by the time you are opposite the tower on your downwind leg. There is no advantage to rushing through your traffic pattern and landing procedures. Such action demonstrates neither good technique nor good judgment. Take your time and do things right.

Leave yourself enough time so that while you are flying the last half of your downwind leg you can be planning the placing of your base leg. A good method to follow is to time your turn onto the base leg for about 30 seconds past the end of the runway. Call the tower as you turn onto the base leg, so that they can keep track of you for additional instructions if necessary. Advise the tower at this time of your intention to make a stop landing or a touch-and-go landing.

BEFORE LANDING

AMPLIFIED CHECKLIST

*Items with asterisk for subsequent landings and running takeoffs.

1. **APP idle, load and equalizer—ON.** Copilot starts APP about 10 minutes out in order to give it time to warm up. Then he is ready to turn on equalizer and load switches when he starts the Before Landing Checklist.

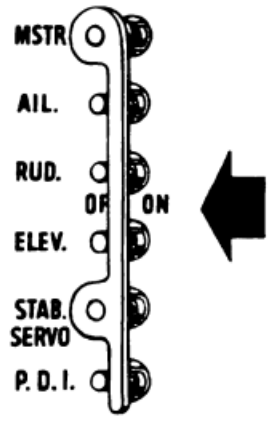
2. **Radio call and altimeter—CHECKED.** Airplane commander calls tower for landing instructions and altimeter setting.

*3. **Crew positions—CHECKED.** Copilot notifies crew in aft cabin by interphone to prepare for landing. Crew members acknowledge instruction and report that they are at stations. Airplane commander notifies crew on flight deck and also looks to see for himself that they are at their stations.

*4. **Electric hydraulic pump—ON.** Engineer checks to see that the hydraulic pump switch is in ON position and checks the circuit breaker.

*5. **Fuel valves—TANK TO ENGINE.** Engineer checks all tank selector valves to see that they are in TANK TO ENGINE position, with drain valve in CROSSFEED position.

*6. **Booster pumps—HIGH.** Engineer turns all four booster pumps to HIGH position.



*7. **Autopilot—OFF.** If the autopilot is on, airplane commander turns it off.

*8. **Brake pressure—CHECKED.** Copilot meters brakes until pressure drops to 850 psi and checks to see that the electric hydraulic pump cuts in and returns pressure to 1030 psi.

*9. **Mixture controls—AUTO RICH.** Engineer checks mixture controls to see that they are in AUTO RICH position.

*10. **APP throttle—RUN.** Copilot pulls up APP throttle to RUN position. Have copilot check this throttle regularly; it may creep down. Engineer checks APP voltage.

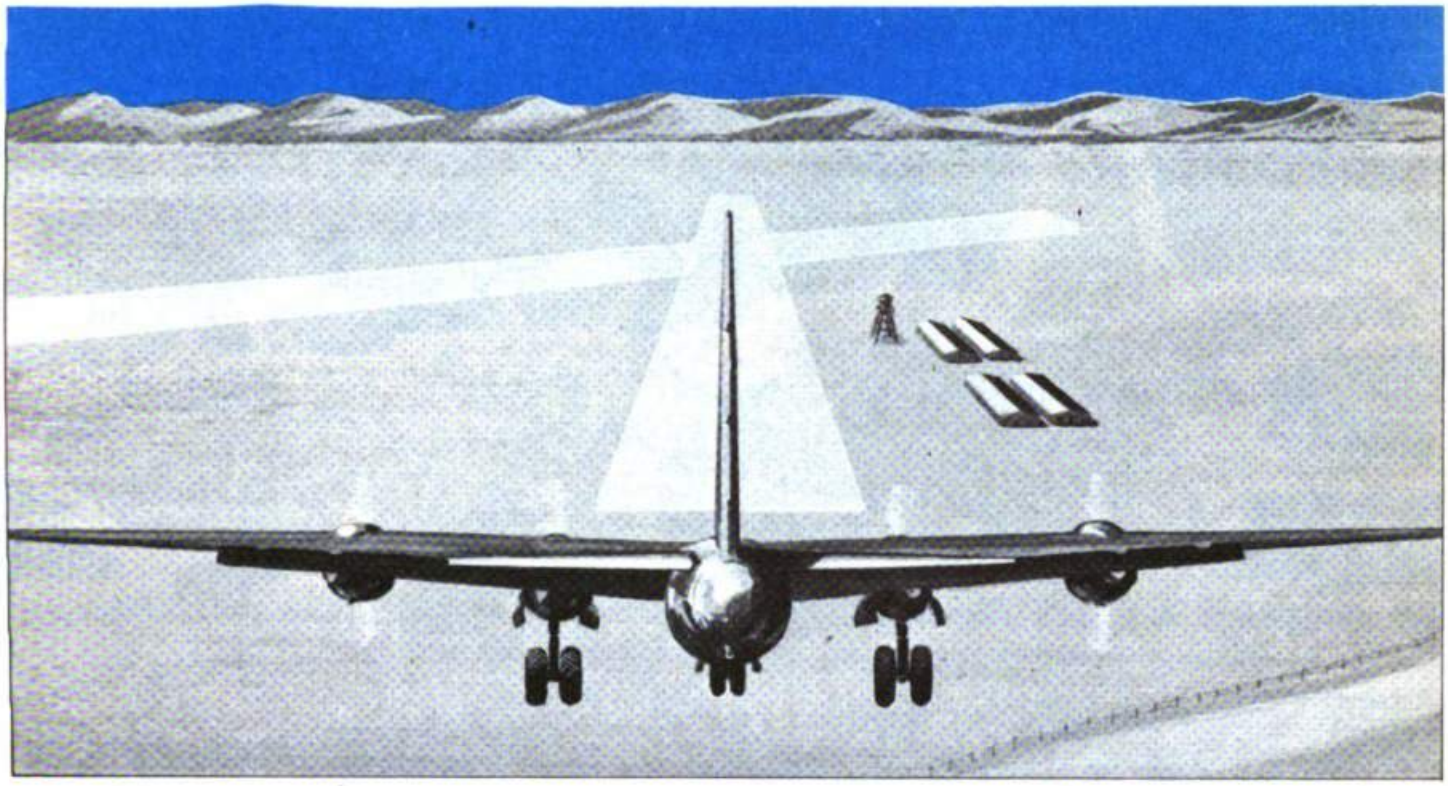
*11. **Wing flaps—10°.** At direction of airplane commander, engineer lowers wing flaps 10°. Don't lower flaps above 190 mph IAS. Scanners watch flaps from their blisters and report flap operation to copilot.

*12. **Gear—DOWN.** At the direction of the airplane commander, engineer brings gear down. Your airspeed must be below 190 mph IAS before you attempt to bring gear down; otherwise nose gear may not extend enough to lock.

*13. **Master tachometer – 2300 RPM.** After tripping landing gear switch, and before gear is down and checked, engineer turns the prop synch-control to 2300 rpm setting on the master tach. Wheels cause considerable drag. You need additional power to maintain desired airspeed after gear is down.

*14. **Gear check – DOWN AND LOCKED.** Scanners call over interphone and report gear and tailskid down. They can check tailskid through tailskid access door. Engineer also checks main gear from flight compartment windows and checks from nose compartment to see that the nose gear is locked.

*15. **Cowl flaps – AS REQUIRED.** Engineer and copilot keep a running check on engine instruments and cylinder head temperatures. Normally cowl flaps should be cracked for landing.



Final Approach

☛ AMPLIFIED CHECKLIST

*Items with asterisk for subsequent landings and running takeoffs.

Start your turn onto the final approach early, to avoid making a steep turn or going by the runway and having to S back. Use power to adjust your approach glide angle to make good a point just short of the runway.

*1. **Turbos—SET.** Airplane commander turns TBS to required setting, generally position 6 for a stop landing.

*2. **Master tachometer—2400 RPM.** Engineer sets the prop synch-control for 2400 rpm on the master tachometer.

Note: Turbo setting of 7 to 7½ with 2400 rpm gives you approximately 42″ to 43″ if you apply full throttle for a go-around.

*3. **FLAPS—40°.** At the direction of the airplane commander, engineer lowers full flaps. Normally you use full flaps for all landings. You experience no difficulty if you have to go around with full flaps down. Scanners check for full flaps and report to copilot on interphone.

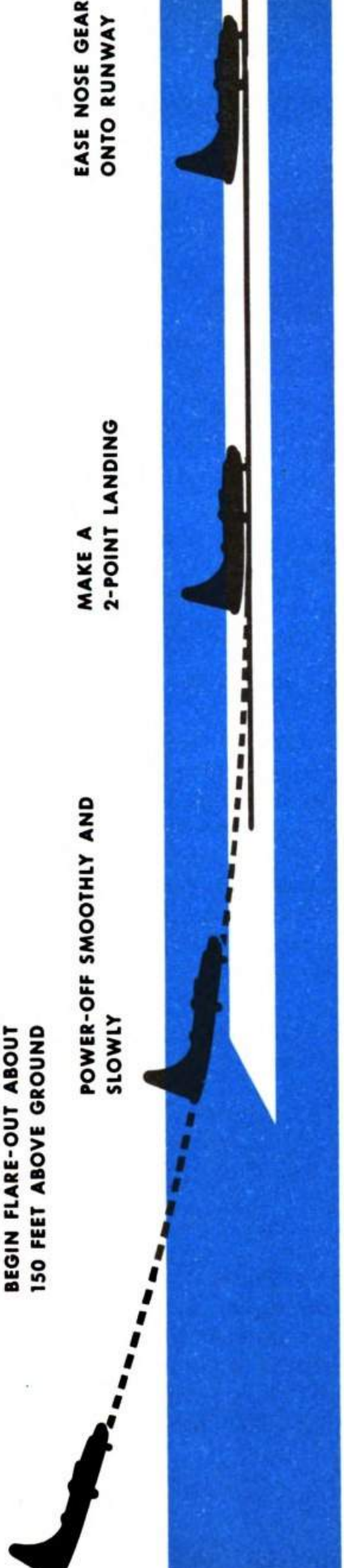
Normal Landings

Consistently good landings in the B-32 require a combination of good judgment, technique, and timing. Still this airplane is easier to land than other large airplanes. Its landing characteristics are consistently good in normal, crosswind, and emergency landings.

Get your airplane down in the first third of the landing strip. You can do this by using power carefully to adjust your approach glide and properly timing your flare-out. You can easily control your flare-out if your approach airspeed is high enough, and if you start breaking your approach soon enough. Keep your airspeed about 30 mph above power-off stalling speeds. In training airplanes this is about 140 mph indicated. But don't make a habit of a 140 mph approach. Instead learn power-off stalling airspeeds with flaps and gear down and base your landing airspeeds on the correct margin above stalling speed.

Start the flare-out about 150 feet above the ground, varying this altitude on the basis of wind velocity and your own technique. If you break your approach too soon or use too little airspeed, you tend to sink and slam onto the runway. On the other hand, if you break your approach too low or use too much airspeed, you tend to fly into the runway.

Take power off smoothly and slowly as you change attitude so that you decelerate without developing sink. Make a 2-point landing with your attitude as you make contact with the ground just about the same as takeoff attitude. Ease the nose gear onto the runway before you lose elevator control. You may notice a shrug as your nose gear touches the ground. This shrug is caused by nose drift which you can prevent by smooth technique. There should be no tendency of the nose gear to develop this shrug into a shimmy.



Ground roll procedure in this airplane is normal, with the exception of the use of reverse pitch on your props. The **After Landing Amplified Checklist** in the section following gives you precise procedure for using reverse pitch. Remember, however, that while you are using reverse props, you correct direction with the opposite throttle from the one you are used to using with conventional props. It takes a few attempts to get used to this procedure, but try to remember that **if you start rolling to the left, advance No. 3 throttle; if you start rolling to the right, advance No. 2 throttle.** The inboard throttles are a little longer than the outboard to permit easier handling in reverse pitch.

The reverse pitch is there solely to permit the use of props to stop the airplane. Reverse pitch makes possible surprisingly short stops, and saves wear and tear on brakes. However, don't run your engines up too high with props in reverse and don't use reverse pitch for ground operations other than landing, unless absolutely necessary. Without the ram cooling of landing speeds, reverse operation heats up engines too quickly. Reverse pitch wasn't added for use in parking the airplane.

Remember

WITH REVERSE PITCH—ADVANCE No. 3 THROTTLE IF ROLLING TO THE LEFT. ADVANCE No. 2 THROTTLE IF ROLLING TO THE RIGHT.

GO-AROUND

Go-arounds in the B-32 are relatively safe and easy. The airplane responds quickly to the application of power. Keep in mind the things which make a go-around critical – engine failure, full flaps, low initial airspeed, high gross loads, and low altitudes.

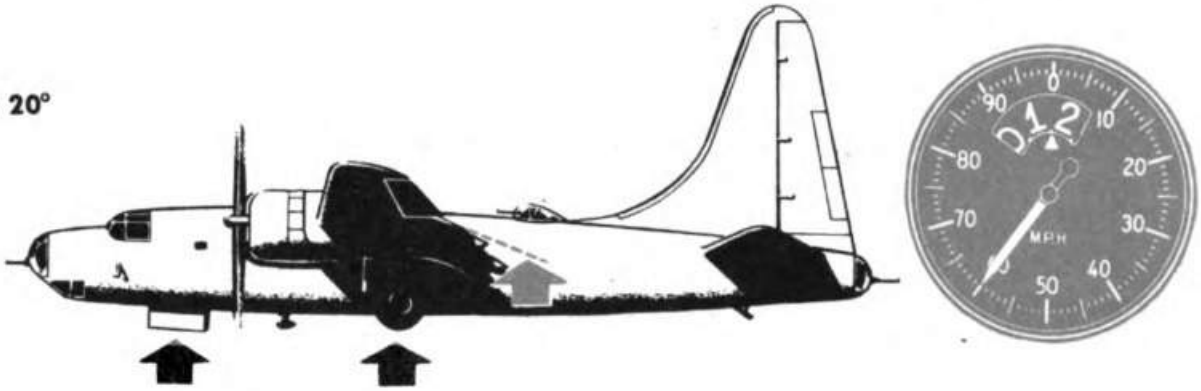
Always avoid the necessity of going around if possible. Keep the tower informed of your position. Space yourself properly in traffic. If you are in trouble, notify the tower well in advance so that the operator can clear the field for you. Use the best technique you are capable of to avoid undershooting. Follow prescribed traffic patterns so that you will not force others to go around.

Even though your own procedure may be perfect, always be ready for a go-around because one may be forced on you by unforeseen circumstances. Other traffic, accidents on the runway, misunderstood instructions, or emergency landing by another airplane are a few of the situations which might necessitate the tower operator's sending you around.

If you are already on the ground when you start your go-around, proceed as you would for a regular touch-and-go landing. If you are still in the air, use the following checklist for go-around:

1. **Power – 2400 RPM, 43″.** Engineer sets synch-control knob for 2400 rpm. Airplane commander advances throttles to full open position and turns up TBS, if necessary, to get 43″.

2. **Gear–UP.** At your direction engineer puts



gear switch in UP position. Again scanners should check and report gear action.

3. Wing flaps—20°. As soon as gear starts up have engineer raise flaps at your direction to 20°. Scanners should check and inform you of flap position.

4. Airspeed — AT LEAST 160 MPH. Keep careful running check on your airspeed. Get and keep at least 160 mph as soon as you can, nosing down slightly to get it if you have necessary altitude.

5. Cowl flaps—AS REQUIRED. Engineer and copilot keep running check on CHT's and adjust cowl flaps as needed to keep temperatures within operating limits.

6. Power—AS REQUIRED. After you have safe airspeed with flaps and wheels up, readjust power for traffic or normal climb, as desired.

CROSSWIND LANDINGS

The approved technique for crosswind landings in the B-32 is a combination of crab and upwind wing slightly low. Although you have good aileron, rudder, and elevator control throughout your landing approach, remember that your B-32 is going to take longer to respond to control pressures because of its weight. This means merely that you should anticipate control and apply the normal amount sooner, rather than using more control pressure.

The critical part of any crosswind landing is the instant you make contact with the ground, the problem being to make this contact with zero drift and with the airplane headed straight down the runway.

Follow this procedure for crosswind landings:

1. Fly normal traffic pattern with your base leg moved out past end of runway approximately a half-mile farther than for normal landing. Reason for this procedure is to allow more time to establish heading giving you correct ground track.

2. Make your approach slightly longer and the last third of approach lower than usual. Use this extra time and lower approach to line up with runway and accurately estimate your drift. Use full flaps in normal manner.

3. Crab slightly into wind and lower upwind wing to help kill drift.

4. Just before you make contact with runway, apply rudder and aileron pressure to level wings and line up airplane with center of runway. Remember to anticipate control action. You can use some throttle on outboard engine of low wing to help raise wing. Proper timing is essential for smooth execution of this maneuver. If you remove correction too soon, you are drifting again when you hit runway. If you hold correction too long, you are still in a crab when you hit. Either of these errors makes directional control more difficult in early part of landing roll and puts extra strain on gear and tires.

5. When you are on runway, lower nose gear as soon as possible to get maximum advantage from inherent stability of tricycle gear.

LOW VISIBILITY APPROACH

Low visibility, or close-in, approach is necessary when the following conditions are present:

a. When visibility is such that you cannot make a normal pattern and still maintain visual contact with the field.

b. Where there are no radio facilities for an instrument approach.

c. When no alternate field is available.

Use the following procedure for low visibility approach:

1. Call tower and get careful briefing on field conditions.

2. Give tower operator your plan of procedure so that he can clear field for you and give other assistance. If possible, get permission for left-hand pattern so airplane commander can always be on field side.

3. Approach field in direction in which you are going to land, at an altitude as high as ceiling and visibility permit.

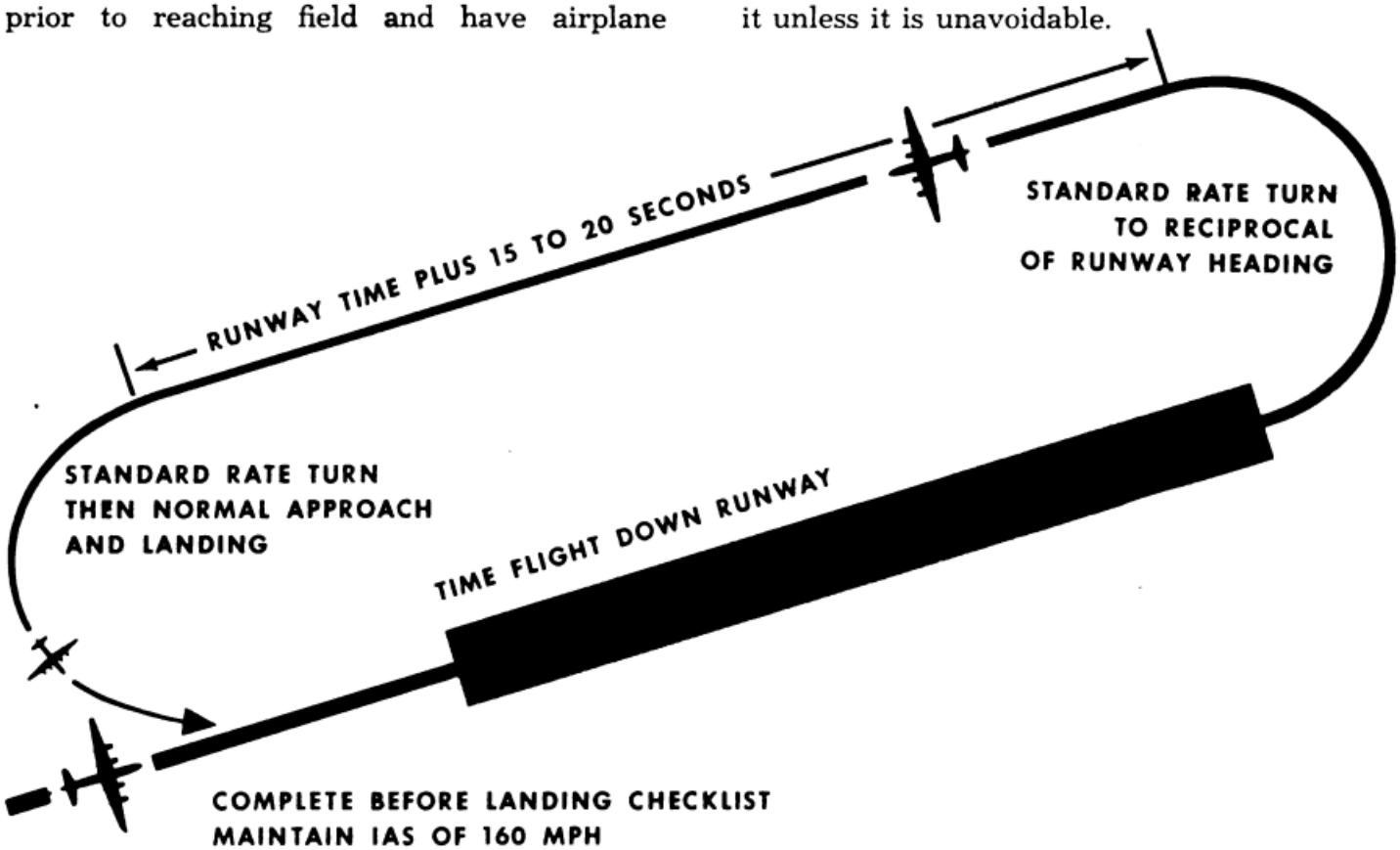
4. Complete your Before Landing Checklist prior to reaching field and have airplane trimmed with power set to maintain IAS of 160 mph.

5. Fly down runway. At end of runway make 180° standard rate turn and fly back on reciprocal heading. If necessary, time your flight down runway and fly same length of time back on reciprocal heading.

6. Fly 15 to 20 seconds past end of runway; then start another standard rate turn back to runway heading. Complete lowering of flaps and slow airplane to 30 mph above stalling speed. If necessary to make steep turn, remember that stalling airspeed is higher in turn and make allowance for it. Amount of altitude to lose during turn depends on situation. Plan your approach so there is no danger of overshooting.

7. Roll out on runway heading and proceed with normal approach and landing.

Note: Although low visibility is not necessarily emergency landing procedure, don't use it unless it is unavoidable.



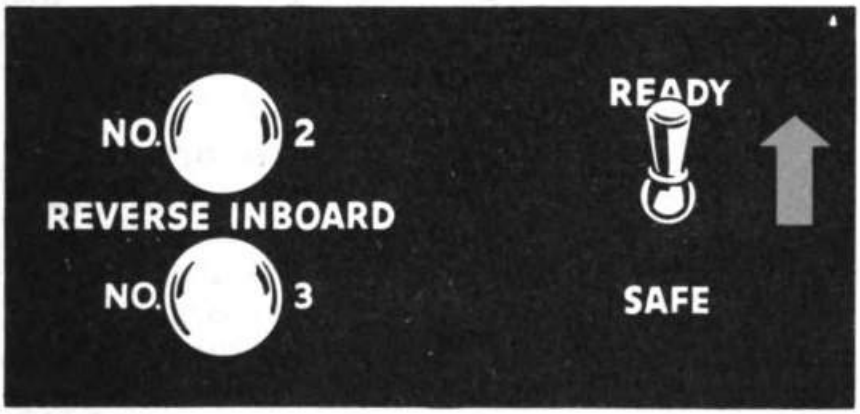
After Landing

AMPLIFIED CHECKLIST

1. **Ready and reverse—ON GROUND ONLY.** When you intend to use reverse thrust during landing, notify your crew beforehand. Proper sequence for calling for reverse switches is for airplane commander to call "READY" when the main gear comes in contact with the ground, and "REVERSE" when the nose gear is on the ground. Engineer places the ready switch in READY position and the reverse switches in REVERSE position when the airplane commander calls for them. Initiate the reverse action as early as practicable after contact with the ground in order to gain maximum effectiveness.

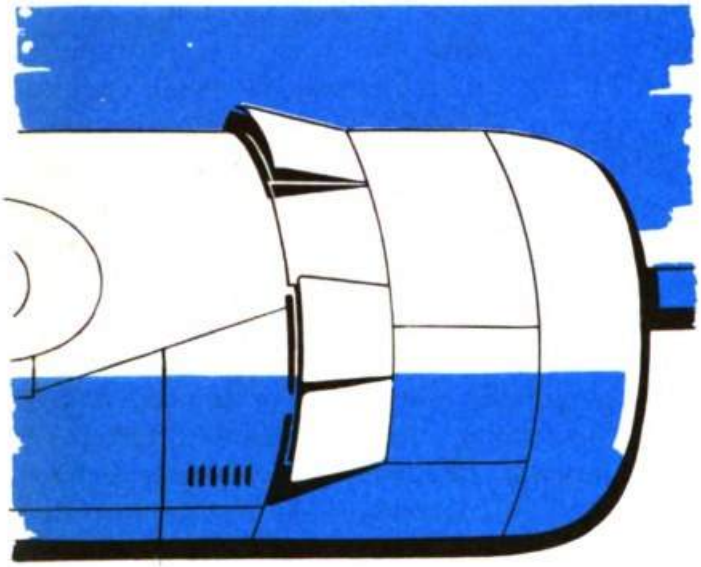
When you start the reverse action your throttles should be fully retarded. As props pass through flat pitch advance throttles slowly to keep engines from dying. When props reach full reverse pitch setting the amber tel-lights come on. Continue to advance power until you get the desired braking effect. Remember that the sound of flat pitch is the signal for advancing power. Have your copilot guard his throttles to prevent your advancing too much power during the reverse procedure. If you use more than 15" Hg during reverse action the engines overspeed at flat pitch position.

You can use throttles to maintain directional control, but remember to apply power with the right throttle if you start turning to the left, and with the left throttle if you start turning to the right. Use brakes if necessary, but reverse thrust is effective and rêduces ground roll appreciably even without brakes. It has most effect when used early, to kill initial speed after landing. Reverse thrust loses effectiveness as speed decreases. Don't ride throttles trying to bring airplane to a complete stop unless brakes are out. During normal operations reverse and ready switches should be placed to NORMAL and SAFE as soon as airspeed drops to approximately 50 to 60 mph.

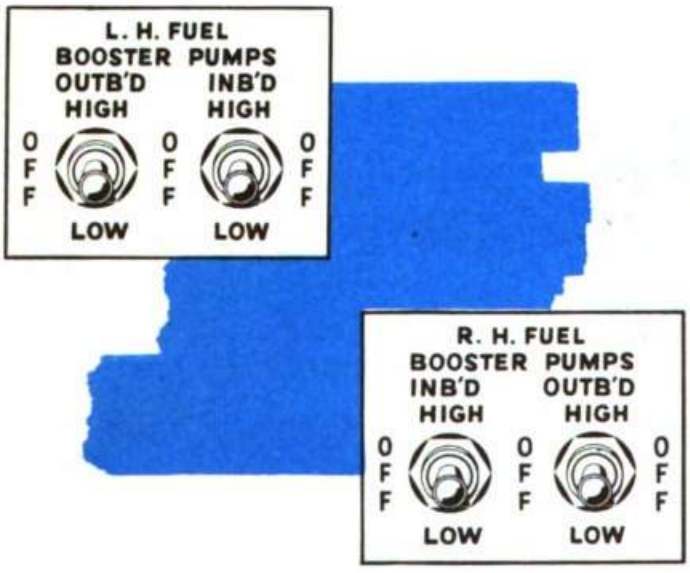


LIMIT POWER IN REVERSE TO 15" HG.

2. **Reverse switches—NORMAL AND SAFE.** At your direction engineer returns safety switch to SAFE and reverse switch to NORMAL. If you get into trouble with reverse props, you can return them to normal pitch immediately by flipping reverse and safety switches to NORMAL and SAFE. Props come back to normal pitch even if reverse cycle is not yet complete.



3. **Cowl flaps — OPEN.** Engineer operates switch to open cowl flaps fully. Airplane commander and copilot look out to check that cowl flaps open.



4. **Booster pumps—OFF.** Engineer turns all booster pump switches to OFF position.

5. **Turbos — OFF.** Airplane commander has engineer turn TBS knob to 0 setting.

6. **Master tachometer—2800 RPM.** Engineer turns synch-control knob for a setting of 2800 rpm on master tachometer.

7. **Wing flaps—UP.** Engineer operates switch to raise flaps.

8. **No. 2 and No. 3 generators—OFF.** Engineer turns off No. 2 and No. 3 generators. These generators do not generate power at low rpms of taxiing, and are kept in OFF position in case of possible failure of reverse current relays.

9. **Bomb doors—OPEN.** (Airplane commander's option). Airplane commander opens bomb doors with bomb salvo switch if desired. You can leave bomb doors open for all ground operation so that crew members can use bomb bays as a quick exit in case of fire on ground. This procedure also eliminates fire hazard by ventilating bomb bays where fuel fumes might accumulate. Keep them closed in bad weather, however, to prevent splashing of mud and water into bomb bays.

Emergency Landings

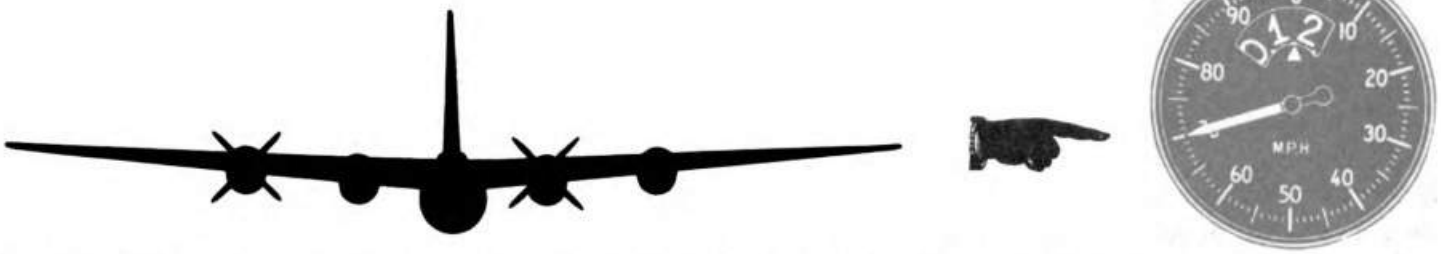
Landing With One or More Engines Out

Successful landings with engines out in your B-32 take skill, caution, and a good knowledge of your airplane. When you bring those factors to bear, such landings are not overly difficult. Exercise proper respect for these emergencies but don't be unreasonably afraid of them just because you're in a bigger airplane. The general rules for engine-out landings which you followed with your last 4-engine airplane apply as well to the B-32. In addition, observe the following precautions:

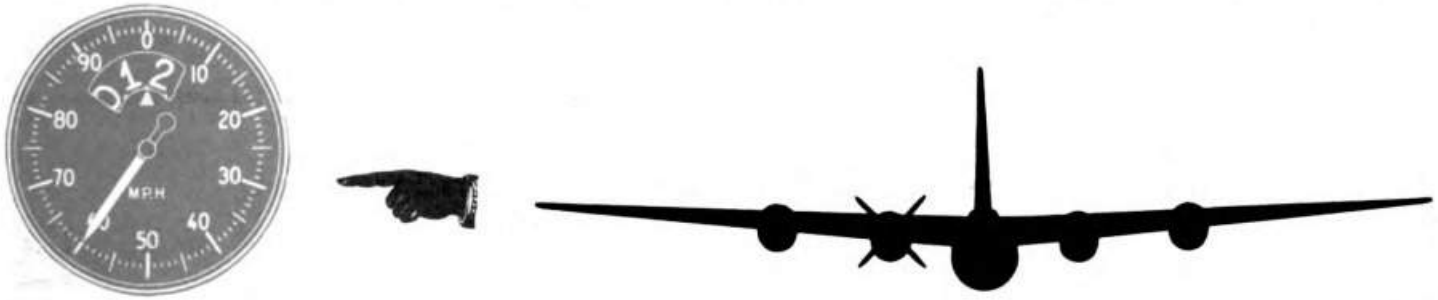
1. Notify tower as soon as possible of your predicament and intentions, so that tower personnel can prepare for you and give you all possible help.

2. Fly traffic at a higher altitude and maintain safe airspeeds: at least 160 mph for one engine out; at least 170 mph for two engines out; and all you can get for three engines out. This is one occasion when you don't have to comply with traffic altitudes, airspeeds, or patterns. Take advantage of this fact to plan and fly an approach which gives you plenty of safety margin.

3. Use all your skill to avoid undershooting or overshooting, if possible. You can safely



REMEMBER, YOU DON'T HAVE TO COMPLY WITH TRAFFIC ALTITUDES • FLY HIGHER



make go-arounds with one or even two engines out in a lightly loaded airplane, but why take a chance?

4. Training procedures prescribe traffic patterns and airspeeds for simulated engine-out landings. Remember, however, that these are for training purposes, and they don't necessarily limit your actions in real emergencies. Use training procedures as a basis and apply your best judgment to conditions affecting your own situation.

5. Keep gear up until you are on final approach.

6. Use 8° to 10° flaps in traffic at low airspeeds. Don't put full flaps down until field is "made."

7. Back off on trim as you make power reductions.

8. Flare out and land as you do in normal landings.

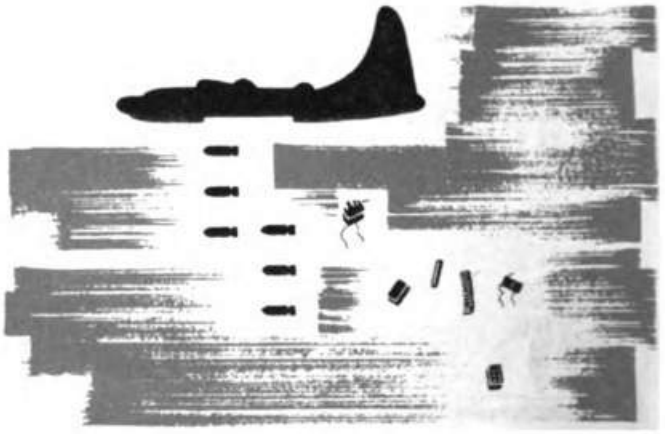
9. In any emergency situation where danger exists of crack-up, ground loop, or any severe impact, notify all crew members to brace themselves adequately for landing. Use all cushioning, seat belts, and shoulder harnesses available. See additional instructions for crash landings under the following heading.

Crash Landing—General Procedure

The conditions affecting each emergency landing are different. No one set of rules applies to all cases. These general instructions may or may not fit your own situation. Be familiar with all crash landings procedures and use judgment in picking those which apply to your own emergency.

1. First decide whether situation calls for crash landing or bailing out whole crew if choice is possible. Choose bailout unless you are reasonably sure you can make successful landing. Be sure you have tried all emergency procedures possible to correct failures which produced emergency. If you decide to crash land, notify crew so they can begin preparations. Start emergency radio procedure immediately.

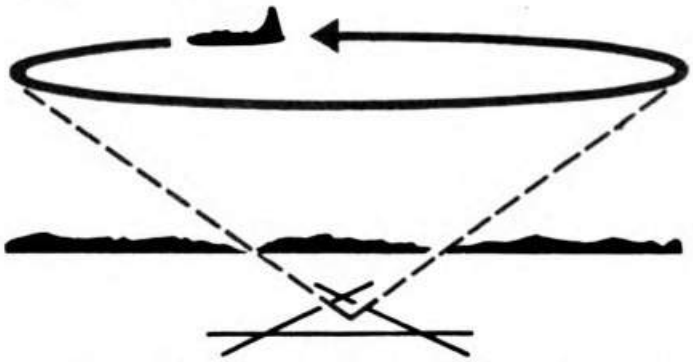
2. Jettison un-needed removable equipment. What to jettison and what to keep depends on particular emergency, but have crew throw



out everything possible to lighten airplane and prevent injury on impact. Anything loose may become a lethal projectile inside airplane when you hit. Following are some things you may be able to get rid of: bombs (jettison in safe, over uninhabited or enemy terrain), bomb sight, sun visors, radio receivers, navigator's table and drafting machine, cup container, map case (save maps if needed), back to navigator's seat, transmitters, liaison set, headsets, portable oxygen units, oxygen hoses, ammunition and ammunition boxes.

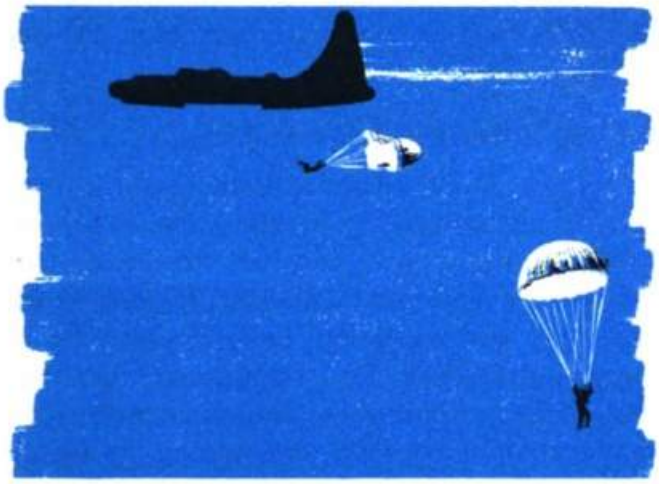
If crash landing far from bases, save any radio equipment you may be able to use to direct searchers, particularly emergency set which is light and portable. Save fire extinguishers, axes, and flashlights; you may need them to help in getting out of airplane. If landing in wild country, save first aid kits, sextants, canteens, and any rations aboard. If you have a copy of **AAF Survival Manual**, hang onto it. If you don't have a copy, get one before you start operations over wild country.

Be sure that anything you keep in airplane is securely fastened or held, so it won't hit somebody on impact.



3. If possible, circle until fuel supply is less than 200 gallons per tank.

4. Remove top hatches and windows. Jettison covers or put them in bomb bay. Use axe if necessary to remove astro hatch cover and interior doors, to prevent jamming. Be sure bomb bay and bottom hatches are closed, bottom turret retracted.



5. When general preparations are complete and if situation permits, notify crew members that those not necessary to landing may bail out if they choose.

6. See that everybody remaining on board gets into crash position. Precise crew positions for crash landing are not yet prescribed for this airplane, but crew members should pick spots where they can face aft, with backs braced against solid structures. Use parachutes for cushioning if possible. Airplane commander and copilot check safety belts and wear shoulder harnesses, correctly adjusted and locked. See your **Pilots' Information File** if you are not familiar with shoulder harness use. Have crew members keep fire extinguishers, axes, and other necessary equipment accessible for quick exit but secured against impact. Stay out of nose compartment for landing and stay away from turrets if possible.

7. If your gear works, **land wheels down.**

8. Make long approach, so crew members can complete at your direction as many as possible of following procedures:

a. Lower full flaps.

b. Lower gear.

c. Stop APP.

d. Feather inboard engines, to prevent getting blade through cabin.

e. Turn off generators.

f. Shut off fuel boost.

g. Close fuel selector valves when sure of landing. At low power settings 10 to 15 seconds fuel remains in lines.

9. If possible, just before hitting, warn crew members.

10. Just before touching ground, throttle clear back and put mixture controls in IDLE CUT-OFF; then gradually open throttles to clear fuel from carburetor without causing surge in power.

11. Turn off all ignition switches and battery switch.

12. Have everybody get out quick, taking fire extinguishers and axes with them. You may have to use this equipment to get someone else out.

13. If hatches jam and you have to chop holes in the airplane to get trapped crew members out, chop at the areas marked on the fuselage for emergency entry. Check on these locations now so you know where they are.

Airfield Crash Landing Procedures

Follow these additional procedures if you are making a crash landing at an airfield:

1. Call tower early so that crash facilities are ready.
2. Contact operations officer through tower for additional instructions. It may be preferable for you to go to another base.
3. **Land on runway,** with or without landing gear.

Specific Gear Failure Procedures

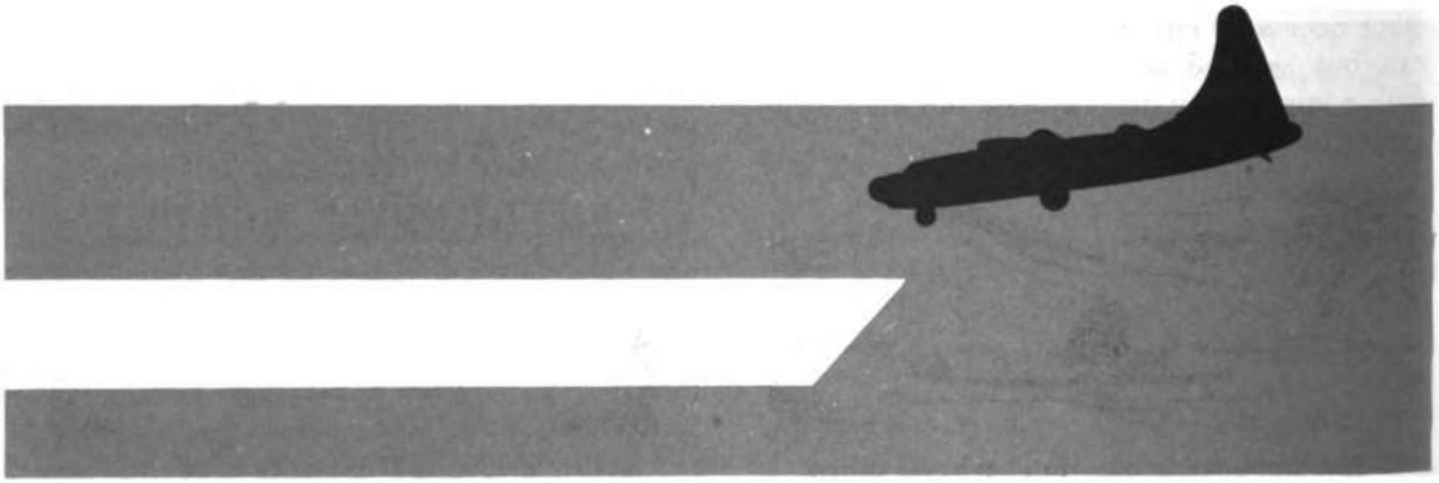
Consider general crash landing instructions, and if they apply, follow them. In addition, follow these specific procedures:

1. With no gear down, use normal landing attitude and slide airplane in on its belly.
2. With main gear down, nose gear up or flapping, land in normal attitude but hold nose up as long as practicable, then lower it gently if you can. Prop tips do not touch ground in this situation. Whether or not to use brakes and reverse props is still problematical. If you use them they throw more weight on nose structure; but on the other hand, if you don't use them, the abrasive action continues longer. The only time this situation occurred to date, pilot did not use brakes or reverse props and airplane slid approximately 2600 feet with negligible damage.
3. With one main wheel down, nosewheel down or up, land in normal attitude but with wing slightly low on good wheel side. Hold other wing up as long as possible, then be prepared for sharp ground loop when wing hits. Use opposite brake to minimize ground loop, if possible.
4. With nosewheel down, main gear up, proceed as for belly landing.

Landings After Hydraulic Failures

If your normal hydraulic system fails and you use the emergency hydraulic system for the operation of any units, consider the subsequent landing as an emergency landing. Be sure to call the tower and have the field cleared for an emergency landing. Everything may be operating properly, with gear and flaps lowered in proper position by the emergency hydraulic system, but remember that you can't get them up if you have to go around. Go-around with full flaps and gear down would necessitate excessive power, with resulting excessive engine temperatures. This situation would increase the possibility of engine fire or failures. Losing an engine at low airspeeds, with full flaps and gear down would mean a crash landing straight ahead as your only procedure. Therefore, have the tower clear the field, and use every precaution possible to make the first landing attempt good.

Remember **THE FIRST LANDING ATTEMPT MUST BE GOOD**



Securing Airplane

AMPLIFIED CHECKLIST

Don't neglect your checklist just because you're back on the ground again. Double-check everything, if necessary. Remember you have to fly the airplane again.

1. **Parking brakes—ON.** Airplane commander sets parking brakes.

2. **Master ignition—CHECKED** (700 RPM). Engineer turns master ignition switch off and on momentarily to check by sound that it grounds out complete ignition system. If switch is working, all engines stop firing. Don't let engines stop completely, however.

Then run engines at 1200 rpm for 30 seconds in order to scavenge oil properly and avoid possible liquid lock.

3. **No. 1 and No. 4 engine generators—OFF.** Engineer turns outboard generators off. If these generators are left on at low rpms, there is a slow drain on battery from reverse current relay cut-outs.

4. **Mixture controls—IDLE CUT-OFF.** Engineer moves mixture controls to IDLE CUT-OFF one at a time, in order 3, 4, 2, 1. After cutting No. 3 and before cutting No. 2, airplane commander checks suction gage for operation of No. 2 vacuum pump. Engineer starts flaps down and then raises them, checking operation of No. 2 hydraulic pump by noting rise on main hydraulic pressure gage. Let No. 3 engine stop completely before making these checks, as both gages show pressure as long as both engines are turning.

5. **Ignition switches – OFF.** Engineer turns ignition switches to OFF position, one at a time.

6. **Fuel valves—OFF.** Engineer turns fuel selector valves to OFF position. Do this while you still have electrical power or valves do not operate.

7. **Electrical units—OFF.** Crew members turn all electrical unit switches OFF. See item 6 in **Before Starting Engines, Amplified Checklist.**

8. **Flight controls—LOCKED.** Airplane commander locks controls in following order: rudder, elevators, aileron. Always try control column and pedals to be sure they are securely locked.

9. **Wheel chocks—IN PLACE; brakes—OFF.** Airplane commander and copilot look back from windows to make sure scanners have put wheel chocks in place. Airplane commander releases parking brakes.

10. **Load, equalizer, and battery—OFF.** Engineer turns APP load switch to neutral, equalizer switch and battery switch to OFF positions.

11. **APP—IDLE, THEN OFF.** Copilot pushes APP throttle down to IDLE position, allowing APP to idle for short period, then turns APP ignition switch to OFF position.

Your airplane and everything in and about it operates exactly the same at night as it does in the daytime. Everything, that is, except you. Your own vision is the only thing affected by the darkness. But this fact merely means that night flying requires more exacting technique on your part. Darkness, in affecting your vision, puts limitations on your judgment of distance, altitude, and speed. It makes it easier to overlook faulty maintenance in inspections, to misread instruments, or switch and control settings, and to detect equipment failures. It also increases the possibility of taxiing accidents. You can neutralize these night hazards, however, by increased vigilance and extra precautions. Re-read the information on night vision in your **PIF**, and keep in mind the special techniques for night operations included in the following paragraphs.

Night Inspections

Night inspections of airplane and crew are doubly important, because it is easier to miss sources of trouble and because any trouble which shows up later in flight is always harder to cope with at night. Be sure that at least you, your copilot, and your engineer always have a good flashlight handy for preflight inspections and for possible flight compartment use.

While you are making your exterior inspection have your engineer turn on the battery switch, start the APP and turn on all exterior and interior lights so you can check their operation. The interior lights make your interior inspection easier. Location and uses of interior and exterior lights are described in **Electrical System** section of this manual.

Check windows, windshields, and scanning blisters to be sure they are clean. Scattered light on unclean surfaces reduces the contrast between faint lights and their backgrounds. Check radio operation and set proper frequencies, and have your radio operator double check all radio equipment. Radio failure at night is more serious than in daytime.

Ground Operation at Night

When taxiing at night use your landing lights alternately to reduce the load on the electrical system imposed by both lights, and to prolong their life. However, don't hesitate to use both of them if necessary. If you taxi toward a landing runway, turn off your landing lights to avoid blinding incoming pilots. Turn flight compartment lights as low as possible to reduce glare and aid forward visibility. Make turns with the inside landing light on.

In congested taxiing areas, have a man walk ahead of each wing to direct taxiing by light signals. Post an observer in the astro glass hatch to help watch ground traffic. In case of brake trouble, stop immediately and have your airplane towed to the line. Faulty brakes are almost certain to cause taxiing accidents at night.

If in doubt where to turn, ask the tower. Get tower clearance for crossing runways.

When you park at the end of the runway for run-up, make certain you have left enough clearance for incoming aircraft to land. Turn off your landing lights for run-up to relieve the system and avoid overheating the lights. Turn flight deck lights as bright as possible to give you all the light necessary to check everything before takeoff. When you complete your run-up and finish with the checklist, turn off the flight deck lights you don't need and turn the rest as low as possible for takeoff. Be doubly sure all crew members are at their proper stations and set for takeoff; check them by interphone.

Night Takeoffs

Get tower clearance for takeoffs before taxiing onto the runway. Use your landing lights momentarily, if necessary, to line up straight with the runway. Be sure that your nose gear is straight. Flash your landing lights down the runway long enough to see that the way is clear.

If you have good visibility at night, with clear ground references, you can take off contact. If visibility is poor and no horizon is visible, take off on instruments. If you are taking off on instruments, stay on them. Never try to fly half instruments and half contact.

Maintain proper airspeed and a constant heading. It is imperative to hold a constant heading until you reach sufficient altitude for a turn. Be particularly careful to hold your heading while you are braking your wheels after takeoff, before bringing up the gear.

Have all crew members briefed to watch for traffic throughout the flight as well as on takeoff.

Night Flight Precautions

Remember the illusions possible in night flying. Don't try to orient yourself with the terrain by single or scattered lights. Unless you have excellent visibility on a bright night, ground references are unreliable except over large cities where there are enough lights to make a good pattern. Depend on your instruments as your major reference at night; use scattered lights only as a secondary reference. Check instruments more frequently than in daytime, with a filtered flashlight, if necessary. Don't unnecessarily increase the intensity of flight deck lights. This impairs vision for at least 30 minutes after the lights are turned down. Remember also that flashes of lightning can temporarily blind you. If there are repeated flashes of lightning it may be necessary to turn all flight deck lights on as bright as possible and go entirely on instruments.

In case of radio failure, attract the attention of the tower by flying over the field 500 feet above traffic and repeatedly flashing landing lights, or signalling with the recognition lights. Get clearance to enter traffic by light gun signals from the tower.

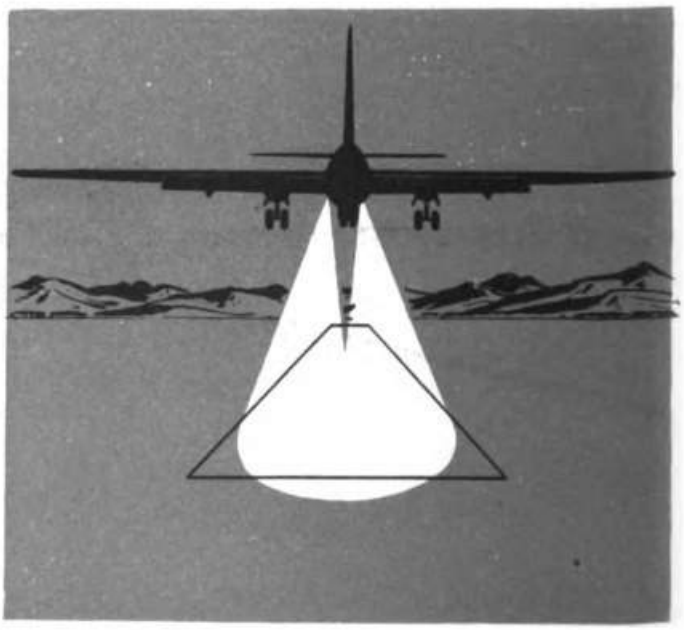
Night Landings

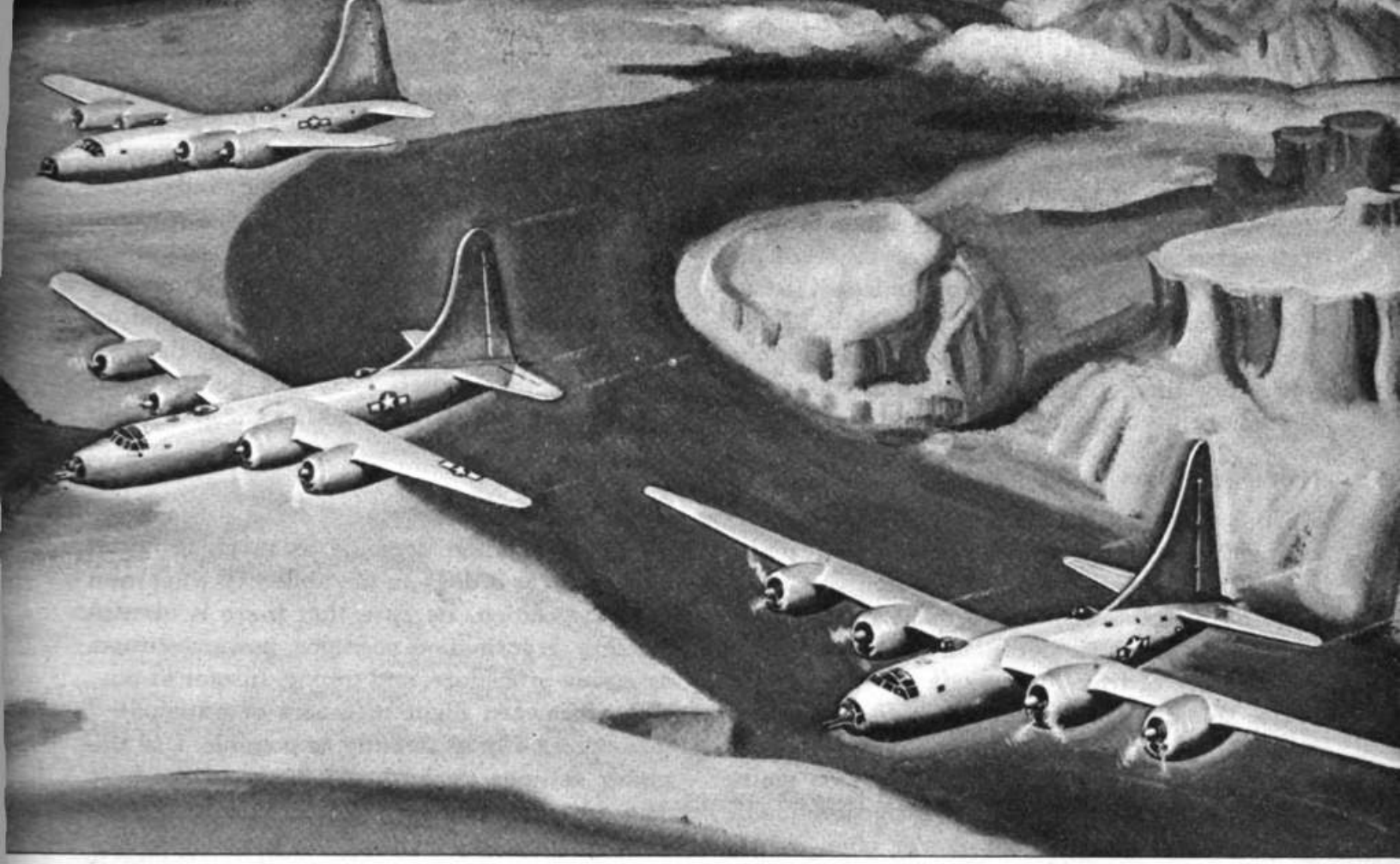
Fly compass headings on the different legs of the traffic pattern. Judge where to start your turn onto the final approach by the appearance of the runway lights. As you come along the base leg, the runway lights look like a single row of lights. Start your turn onto the approach at the moment the two rows of lights seem to separate. Make a medium turn, and complete roll-out from the turn just as the two rows of runway lights are squared away at full width.

Avoid a low approach at night. Maintain constant glide, constant airspeed, and constant rate of descent, by making slight changes in power and attitude.

Your landing lights are most effective from about 500 feet. They are helpful in picking up the ground for you, but don't sight down the beam. Instead use the whole lighted area ahead and below for reference. Don't rely on landing lights alone; use runway lights as secondary reference. Landing lights alone may induce you to level off for landing too late. Runway lights alone may cause you to level off too high, especially if there is dust or haze over the field.

If you are uncertain of your final approach, carry a little more power. This prevents stalling out high. Carry power until you are sure of making contact with the ground. Avoid cutting power too high or too soon.





Formation Flying

Since most B-32 transition students are returned combat pilots, you probably know that the formation flying you get in transition training can only review basic principles for you and help you familiarize yourself with handling a bigger airplane in formation. The changing tactical situations, differences in practices among the various theaters, and the new uses to which formation flying is being put, all make it impractical to teach combat formation in transition.

In the final analysis, good formation technique is a matter of practice, once you learn the basic principles and problems. If you don't know them already, you must learn these basic principles as applied to the particular model you fly during transition training. Practice them until you can assemble and hold your B-32 in any formation, at any altitude, regardless of size, shape, or tightness of the formation.

Formation Principle

Formation flying is based on a double principle: the formation affords the greatest concentration of striking power, in both time and degree, and also the greatest protection. There is no way other than flying a formation to hit a target hardest in the shortest possible time. The matter of protection is simple mathematics: three times as many eyes to spot an enemy and three times as many guns to bring him down in each 3-plane element, plus the advantages of combination of angles of fire and angles of protection.

Along with the advantages of formation flying come disadvantages. It's more difficult than individual flying. It takes more precise and skillful technique. It increases the seriousness, from a technical standpoint, of all the factors which affect normal flight, both those factors inherent in the airplane and those inherent in the atmosphere. You have to minimize all these adverse factors by perfecting your skill, in order to get the most out of the potential striking power and the potential protection of your own element of the formation.

Holding Position

No formation is any better than its individual elements. Your primary job is to hold your position in the formation. Out of position you may expose yourself to enemy fire, make your bombs ineffective, disrupt other elements, and restrict fields of fire of friendly aircraft.

Use smooth coordinated power to hold your position. Think ahead and anticipate changes. If and when you get formation sticks on your airplane this problem will be greatly simplified. Use your TBS control for power changes. If you are using power below that requiring turbo boost, set power on your outboard engines and use your inboard throttles to hold position. Use the latter procedure also at high altitudes where use of turbo boost would cause manifold pressure surge. The greater length of the inboard throttles makes them fairly easy to operate separately.

The response of your airplane to changes in power and airspeed varies considerably with changes in load and altitude. Under similar conditions it takes twice as long to make a given correction at 25,000 feet as it does at 5000 feet.

Rapid changes in airspeed, altitude, and direction are likely to be necessary just before and after you reach the target area. Be prepared for them; there may not be time for adequate signals. Keep thinking ahead of what you're doing.

Formation Leadership

Good formation depends as much on good leadership as it does on the ability of wing men to hold position. Be sure that there is careful briefing on formation positions, power settings, assembly procedure, and timing. Insofar as possible, forewarn flight members of anticipated maneuvers. Fly as steadily as possible. Use the power settings at the lower range of the best cruise band, on the cruise control chart. Signal in time to let wing men anticipate maneuvers.

In training, as well as combat, insist on good formation discipline. Don't allow single-engine fighter maneuvers in a 4-engine formation.

Work from a standard set of formation signals so that all members recognize them immediately.

FORMATION SIGNALS

ASSUME NORMAL FORMATION

SIGNAL

Rock the wings. A slow, repeated rocking motion of the airplane around its longitudinal axis. Wing movement to be slower and of greater amplitude than in "flutter ailerons."

MEANING

Assume normal formation. From any other formation, go into normal close-up formation.

OPEN UP FORMATION

SIGNAL

Fishtail or yaw. By rudder control, cause the airplane to move alternately and repeatedly right and left.

MEANING

Open up formation. Where applicable, this signal may be used to order a search formation.

ATTENTION

SIGNAL

Flutter ailerons. Repeated and comparatively rapid movements of the ailerons.

MEANING

Attention. This signal is used on the ground and in the air to attract the attention of all pilots. Airplane commanders should stand by for radio messages or further messages. When on the ground in proper position to take off, the signal means "Ready to take off."

CHANGE FORMATION

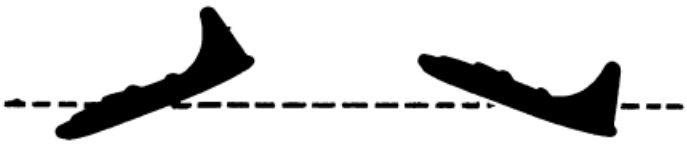
SIGNAL

Dip right or left wing.

MEANING

Change formation. (a) From any formation other than echelon, go into echelon of flights to the right or left. (b) If in echelon of flights, right or left, go into echelon of individual airplanes to the same side. (c) If in echelon of individual airplanes, go into echelon of flights on the same side if the wing is dipped to the side on which the aircraft are echeloned. (d) If in echelon of flights or individual airplanes and wing is dipped on side away from echelonment, form same echelon to the opposite side.

PREPARE TO LAND



SIGNAL

Series of small dives or zooms.

MEANING

Prepare to land. This signal is an order to each airplane commander in the formation to take the necessary steps preparatory to landing. In the absence of additional signals, land in the normal landing formation of the unit. Any change in the landing formation is given by radio or Aldis lamp.

KEEP YOUR EYE ON LEAD AIRPLANE

Cold Weather Operation

Cold weather operation presents special problems for you to solve. These problems are present in the case of B-32's as much as for any other airplane. Remember that cold weather operation of airplanes doesn't necessarily imply sub-arctic latitudes. It gets cold even in Texas. Whenever you start putting on extra clothing, it's cold enough to think of special care for your airplane.

The following paragraphs include most of the procedures you should add to your checklists when the temperature is below 0°C. Consult also the **Aircraft Checker's Report, Winterization Check List,** AAF Form 263B, in the airplane data case.

Preflight

Most preflight procedures for cold weather operation fall within the scope of duties of your engineer and ground crew. It is your responsibility as airplane commander, however, to know what these procedures are and see that they are carried out.

1. Before each flight in freezing weather check all fuel strainers and sumps for evidence of ice. If airplane is stored in heated hangar, drain some fuel off at fuel cocks to get water out of tanks before taking airplane into cold for starting.

2. Inspect fuel tank vents, on under side of wing, outboard of No. 1 and No. 4 engines, to be sure they are free from ice. If vents are ice-plugged, condensation may take place in fuel cells, and resulting water may freeze and stop fuel flow.

3. Check oil drains and sumps for fluid oil. If no oil comes out when cocks are open, drains are clogged with ice and congealed oil. Apply heat to thaw them. After you drain off water and as soon as oil begins to flow, be sure to close and safety drains.

4. Wipe shock strut piston tubes and all other exposed hydraulic piston tubes clean of snow, dirt, or ice. Then wipe pistons with rag soaked in type of hydraulic fluid used in system.

5. Remove all snow, ice, and frost from external surfaces, checking hinges and controls for freedom from ice. Get snow off wings, fuselage and tail surfaces by gentle brushing with brooms or evergreen boughs. Removing ice is

more difficult; use great care not to scratch or mar wing surfaces in any way. Two men can clear ice from wing by vibrating a rope across the surfaces. Moisture condensation may cause ice accumulation inside wings. Remove this ice with heat before takeoff. You can get stubborn ice formations off any part of airplane by use of portable heater or by applying hot water on small areas and flushing with denatured alcohol.

6. When temperatures fall below —21°C., apply external heat to bombardier's and pilots' compartments. You can bring in heat through bombardier's access door and bomb bay doors. Warm instrument panels with radiant bathroom type heater. Don't allow heated blast to play directly on instruments. As soon as engines start firing, check instruments for irregularities.

7. Warm bombsight and autopilot units with heated covers provided with each unit. If conditions permit, warm up these units for two hours. In any case, run them one-half hour prior to takeoff with heated covers on and operating.

8. In cold weather starting with temperatures below 0°C., apply external heat to both fore and aft sections of engine until CHT's reach 20°C. Allow at least an hour for this operation.

9. Under low temperatures, battery loses efficiency. If cold weather operation is over extended period, remove battery and store in temperature of about 20°C. In any case make sure that specific gravity of battery is high enough to prevent battery freezing. Always use external source of power to start APP and engines in cold weather. APP may need preheating, as well as engines.

10. Operate ailerons, elevators, rudder, and all trim tabs through their full travel three or four times to check ease of operation and to see that they are not frozen up.

11. Check engine breather line outlets for frozen condensation.

Starting Engines

Follow normal starting procedures, observing the following precautions:

1. Always use external source of power.

2. If external power supply is not available or if weather is cold but not to the degree making external power necessary, use APP but be sure to let APP come completely up to speed before applying load to it.

3. Don't close cowl flaps to speed engine warm-up.

4. After starter engages and engine is turning over, wet blower by moving mixture control momentarily out of IDLE CUT-OFF. Then operate primer in normal manner. If you suspect underpriming, you can get better priming spray by putting booster pump in HIGH position. If necessary, you can get additional prime by use of mixture control. However, operation of primer and mixture control together discharges large amount of raw fuel into blower section. Always keep in mind that priming fuel goes to blower section and not into cylinders; it takes several engine revolutions before good mixture of fuel and air reaches engine. Don't mistake this delay in firing for evidence of underpriming.

PRIME *Cautiously* WITH MIXTURE

Raw fuel draining from supercharger drains indicates overpriming. If this happens, shut off ignition switch, open throttles, and have engine pulled through by hand to eliminate excess fuel.

5. Don't set throttle so far open for cold weather starting as for normal starts. Smaller throttle opening gives you richer mixture for cold weather starts.

6. Operate engine on primer alone for first few seconds after cold weather start to insure that engine is going to run and to prevent operating at too high rpm before engine is sufficiently lubricated.

7. If engines do not start after three or four

attempts, make a thorough check of everything before trying another start. If engine is not sufficiently pre-warmed, these unsuccessful starting attempts may cause formation of ice on spark plug points. In this case, have plugs removed and cleaned.

Engine Warm-up

1. After oil dilution, ground run engines for 30 minutes with oil temperature at 70°C. in order to evaporate gasoline from oil. If you don't do this, it is possible to get scavenging difficulties during or just after takeoff with excessive discharge of oil through breather lines. The results are dangerous loss of oil and fire hazard.

2. Keep cowl flaps open.

3. Don't operate above 1200 rpm until oil temperature reaches 40°C.

4. High oil temperatures may develop rapidly, causing oil cooler shutters to open wide if oil coolers are in AUTOMATIC position. If this happens, close shutters with switch in MANUAL CLOSE and watch oil temperature carefully. If cause of trouble is congealed oil in cooler core by-passing hot oil back to engine, closing of shutters dissipates congealed oil and brings temperature back down again.

5. After starting, oil pressures may send gage needle clear up against peg. If this happens when you don't have time for normal warm-up, you can operate oil dilution system. Don't overdo oil dilution, but remember that properly diluted cold oil has same lubricating effect as warm oil. Fuel pressure drop occurs during oil dilution; this indicates that dilution system is working. If you don't get this drop during dilution, stop and investigate.

Taxiing and Takeoff

1. Don't turn on electrically heated clothing or any other electrical equipment not absolutely needed, until generators are operating.

2. Leave covers on all surfaces if possible until just before takeoff to prevent formation of frost.

3. Use extreme caution when taxiing on snow or ice.

4. Use extra care in checking instruments prior to takeoff. Remember that cold weather affects operation of instruments.

5. Use brakes sparingly and slowly; expander tubes become brittle in cold weather.

6. Just after takeoff raise and lower gear and flaps several times to keep accumulated slush and mud from freezing gear or flaps in up or down position.

During Flight

1. If you have any suspicions that carburetor icing conditions prevail, use carburetor preheat immediately after takeoff. It is easier to prevent carburetor ice than to eliminate it.

2. If you are in icing zone, check immediately after takeoff on operation of wing anti-icing system, tail de-icing system, propeller and windshield anti-icing systems, pitot heat system, and cabin heat and defrosting system.

3. Heating system becomes effective as soon as you are airborne. Use it to keep crew comfortable. Re-check your **Pilots' Information File** for information on use of heated clothing and care of personnel in cold weather operations.

4. Utilize all your anti-icing and de-icing systems properly if you get into icing conditions. Operate tail de-icer boots intermittently instead of continuously. Be sure to turn them off before landing; otherwise they affect control action. Keep your windshields free of frost and your pitot tubes free of ice.

Preparation for Landing

1. Keep cowl flaps closed when approaching for landing with low power settings in order to avoid excess cooling. Open them again when you are on ground.

2. Use a flatter approach and more power than normal to insure within-limits engine operating temperatures in case go-around becomes necessary.

3. Use higher airspeeds for approach and landing when you have ice on wing and tail surfaces to prevent stall.

4. Use reverse props for stopping, instead of brakes. Braking action may be unpredictable on ice or snow; besides, cold makes expander tubes brittle and liable to failure.

After Landing

Use all normal after-landing procedures with the addition of the following points:

1. Dilute oil when oil temperature has cooled to 40°C.

a. Operate engines at 1000 to 1200 rpm.

b. Maintain oil temperature below 50°C. If necessary shut down engine and dilute in two or more periods to keep oil temperature below this limit.

c. Keep main oil pressure above 15 psi. If necessary shut down engine and dilute in two or more periods to keep oil pressure above this limit.

d. Oil dilution temperature chart:

IF OAT is:	Dilute for:
−4° to −12°C	2 minutes
−12° to −29°C	4 minutes
−29° to −46°C	7 minutes
−46° to −51°C	8 minutes
−51° to −56°C	9 minutes

e. Release dilution switch only after engine stops. This is important because only diluted oil must be circulated through the oil system.

f. Clear spark plugs after oil dilution by brief engine run-up: 1300 to 1400 rpm should be sufficient. Don't let oil temperature rise above 50°C. or oil pressure drop below 15 psi.

g. If oil servicing is necessary, dilute oil in two periods, one before and one after adding oil.

2. After completing oil dilution open each sump draincock and drain off any condensation or oil sludge.

3. Clean fuel strainers and drain all fuel tank sumps immediately.

4. Remove ice and frost from propellers. Move propellers by hand to check for free action. If they rotate with difficulty, remove lower spark plugs and allow diluted oil to drain from bottom cylinders.

5. Install protective covers on airplane surfaces.

6. If necessary to park on snow or ice, place a layer of fabric, straw, boughs, or other material under wheels to prevent tires from freezing to surface.

7. Leave parking brakes off to prevent freezing.

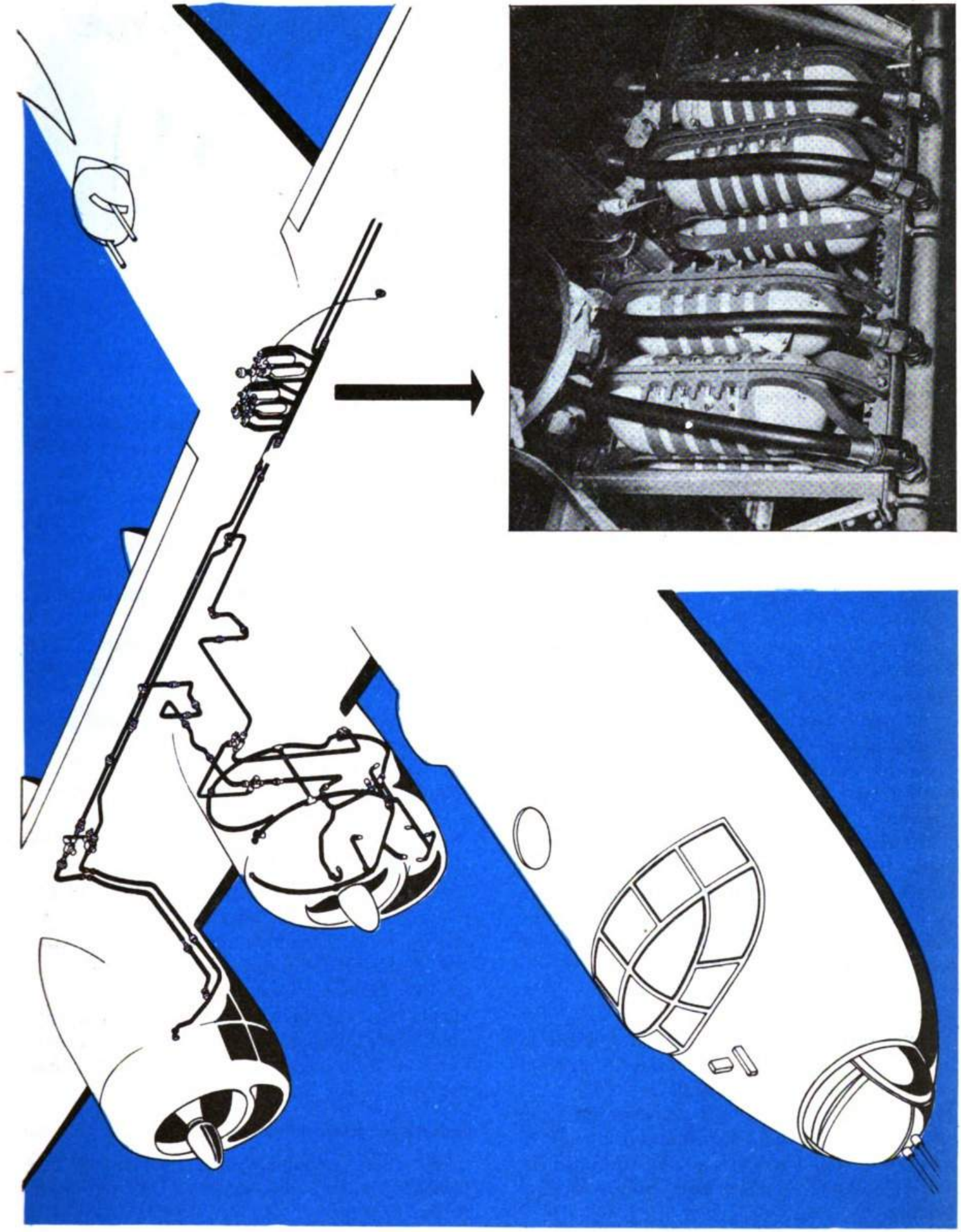
8. If weather permits, leave sliding windows in flight compartment partly open to permit circulation of air and prevent frosting of windows.

Fire

Fires in B-32's and other airplanes with a similar power plant set-up have received considerable attention. Many of the early causes of fires have since been eliminated by design and equipment changes. Many other causes have been identified as faulty operation.

Don't approach your B-32 training so fire-conscious that you fly with one hand on the wheel and the other on the fire extinguisher switch; but on the other hand, don't discount fire hazards. Under certain conditions of repeated faulty operation, fires are certainly likely to occur. Be sure you know and follow correct procedures. Know your extinguisher system and its limitations. Know procedures for combatting fires. But remember that it is of more immediate importance to know how to prevent the starting of fires.

The procedures discussed in this section are based on the best available data to date. Keep in mind that new information on prevention and handling of fire will develop as additional B-32 experience accumulates. Be sure you are constantly up to date on all procedures which might bear on prevention of fires in your airplane.



Fire Extinguisher Systems

The first 35 B-32's incorporate a fire extinguisher system comprising 24 CO_2 bottles, 12 in the aft section of each outboard nacelle. The bottles are connected by tubing to each nacelle. This system provides a CO_2 supply sufficient to put out fires in all four engines. Control T handles on the floor to the right of the copilot permit the discharge of six CO_2 bottles to the engine selected.

Airplanes subsequent to No. 35 incorporate a one-shot fixed system, consisting of seven CO_2 bottles located in the aft bomb bay. Operation of this system discharges the total supply of CO_2 to extinguish a fire in any one selected engine. Four guarded electrical toggle switches, located to the right of the copilot, operate the system. Setting a switch for a given engine directs the flow from all seven bottles to that engine nacelle. There is no means of operating this system manually. If the switch fails to work it, check the circuit breaker.

The fire extinguisher system directs the flow of CO_2 to the nacelle accessory section and in addition to the following units: one line to the oil cooler, two lines to exhaust tail pipe shrouds, two lines into the turbo inlets of the induction system, one line to the primary heat exchangers.

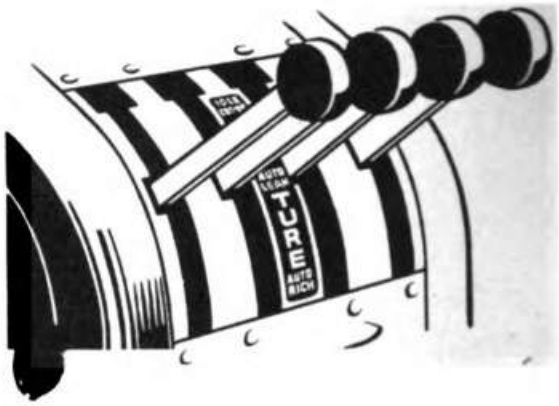
A rupture disc is connected to the CO_2 lines, to indicate whether or not the bottles have been discharged. The aerial engineer should inspect the rupture disc in his preflight inspection.

Standard equipment aboard the airplane includes two CO_2 hand fire extinguishers for combatting cabin fires. One is in the forward cabin, on the floor between stations 2.0 and 3.0 on the right side. The other is mounted at station 8.0, on the aft wall of the aft cabin.

Induction System Fires—Prevention

Note: Aerial engineer's carburetor check in his preflight inspection is an initial fire prevention check, and must be made regularly.

1. Induction system fires are most likely to occur during ground operation and takeoff, as a result of rapid changes in throttle opening, and during cruise, when you attempt manual leaning.



Caution

NEVER LEAN MIXTURE MANUALLY BETWEEN AUTO LEAN AND IDLE CUT-OFF.

2. Induction fire prevention is a problem of maintenance as well as operating technique. During engine starting and subsequent warm-up, when you encounter backfires or erratic engine operation, have the following checks performed:

a. Check carburetor idle adjustment.

b. Check for leaks in induction system.

c. Check exhaust valves for guttering or burning.

d. Check mixture control travel with AUTO RICH and AUTO LEAN positions on carburetor.

e. Check carburetor impact tubes and pressure metering screen for foreign matter.

3. During starting and warm-up observe the following operating precautions:

a. Avoid overpriming.

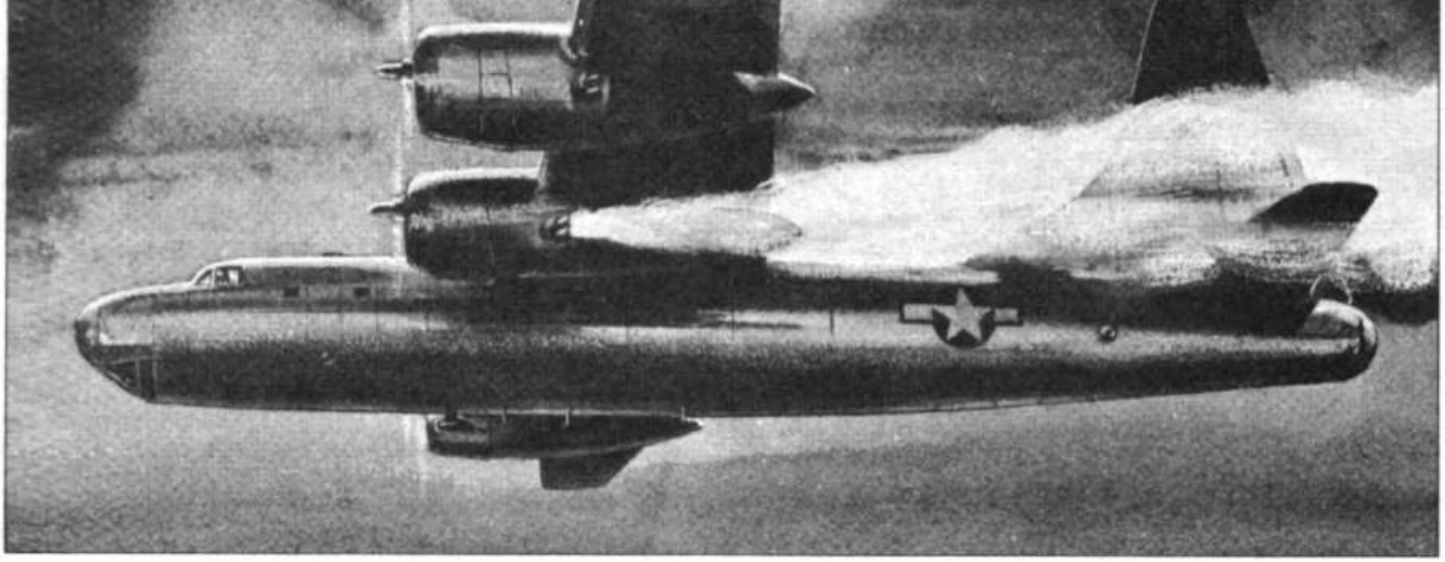
b. Use correct throttle settings and correct procedures for starting.

c. Warm up engines in prescribed manner, making sure that cylinder head temperatures are up to 50°C. before applying full throttle.

4. During takeoff apply power smoothly and steadily. Have scanners watch for any unusual smoke from engines and report to you immediately. Don't jockey throttles. If you get evidence of prop overspeeding, you are probably applying power too rapidly.

Induction System Fires—Indications

Induction system fires are indicated by the following conditions, occurring in the order listed:



1. Sudden drop in manifold pressure and rpm.

2. Regaining or partial pick-up of the initial loss in manifold pressure and rpm, resulting from windmilling.

3. Heavy black smoke from engine exhaust.

4. Final phase: heavy white smoke billowing from exhaust.

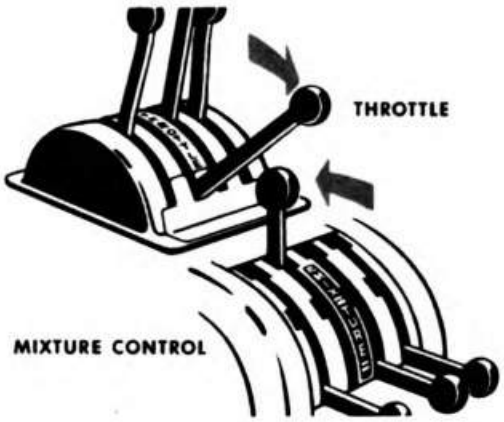
Note: In ground operation a series of backfires may cause induction system fire. Backfires indicate too lean a mixture. Treat all backfires as an indication of induction system fire and handle accordingly. Flames and black smoke from the exhaust tailstack during ground operation indicate too rich a mixture. In this case momentarily open the throttle fully to lean out the mixture.

Induction System Fires—Procedure

If you can snuff out an engine induction fire before the white smoke occurs by closing the throttle to cut off air and closing mixture control to cut off fuel, you are not likely to get engine damage. You can probably resume operation of the engine. If on the other hand you allow the fire to progress, you are apt to lose not only the engine but the whole airplane.

The following procedure is only for induction system fires. Procedure for nacelle fires is listed under that heading in this section. Follow this procedure for any induction system fire, regardless of whether or not you think you can control it by simply throttling back. If you get the fire on takeoff when it would be unsafe to cut an engine because of low airspeed or high gross weight, throttle back as much as practicable; get safe airspeed and altitude, and then complete this procedure.

1. Crew member spotting fire announces **"Fire in No. .....,"** using CALL position on radio box.



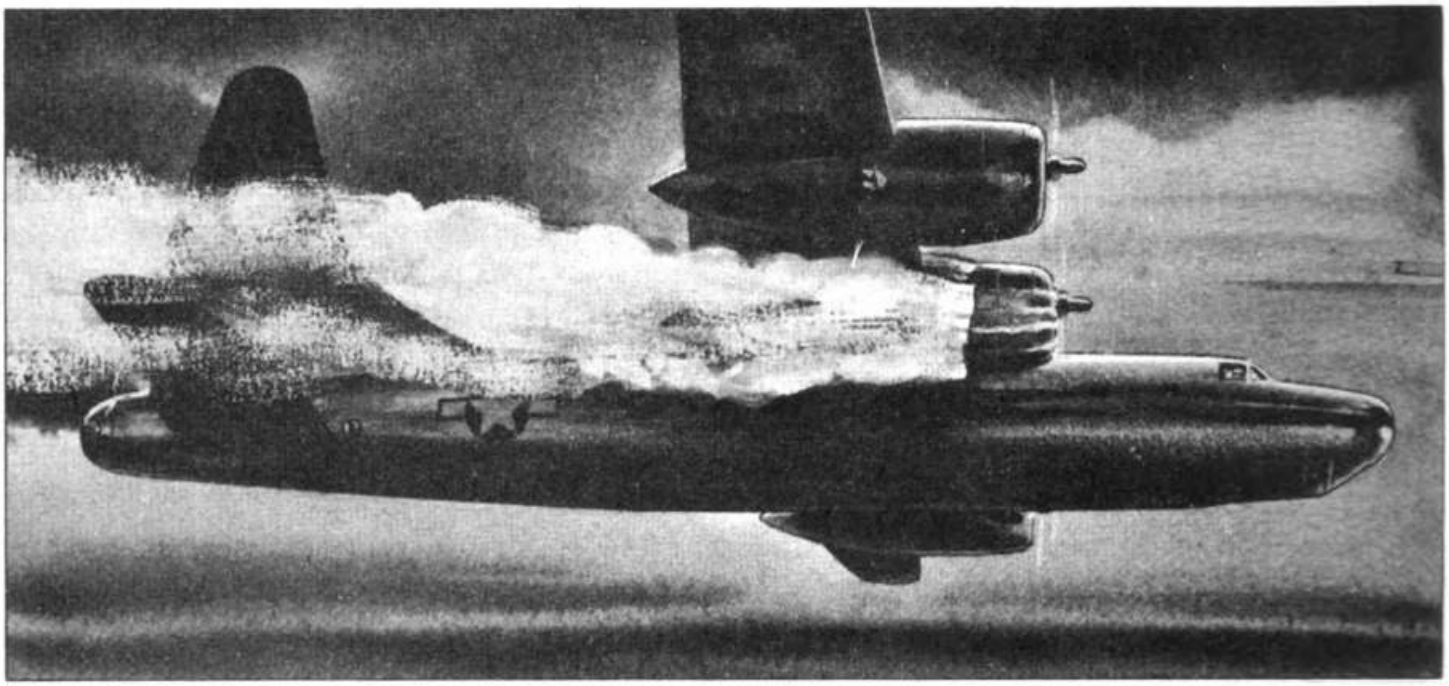
2. Close throttle of engine on fire.

3. Have engineer or copilot move mixture control to IDLE CUT-OFF; turn booster pump to OFF position and fuel selector valve to OFF position.

4. If smoke stops immediately, apply engine power normally. Advance throttle smoothly, watching engine operation and exhaust carefully.

5. If smoke does not stop in approximately 10 seconds, follow feathering procedure, and have copilot operate fire extinguisher system.

6. During foregoing procedure keep cowl flaps open until fire is out; then close them to reduce drag.



Nacelle Fires

From the standpoint of discussing exact handling procedures, the distinction between induction system fires and nacelle fires is sometimes impractical. Generally, however, induction system fires are confined to the induction system when they start, and if handled soon enough by correct action, they may be extinguished without loss of the engine.

Nacelle fires are identifiable by smoke or flame around the nacelle, other than from the exhaust alone, particularly around cowlings or issuing from cowl flaps. The joker in the situation is that any induction system fire can become a nacelle fire and eventually a whole wing or fuselage fire.

Oil, fuel, and foreign material in the engine nacelles are fire hazards. Maintain clean engines. Make sure that the carburetor is checked for leaks and that excess oil is cleaned from the nacelle. Have all oil and fuel line connections checked for security and freedom from chafing and rubbing. Check induction system for leaks. Check oil dilution solenoid for proper seating. If oil was diluted, be sure to ground run engines for 30 minutes with oil temperature at 70°C.

If a nacelle fire is reported, proceed as follows:

1. Turn fuel selector valve and oil cut-off, if present, to OFF position.
2. Move mixture control to IDLE CUT-OFF.
3. Close throttle.
4. Feather propeller.
5. Open cowl flaps.

Note: Although the foregoing steps are necessarily listed in sequence, they are actually done as nearly as possible all at once. The precise order of action is determined by whatever control is handiest, with copilot, engineer, and airplane commander cooperating in the necessary actions.

6. When engine stops, have engineer turn off ignition switch immediately.
7. Have engineer turn off generators.
8. Have copilot operate fire extinguisher for affected engine.
9. Determine cause of fire as early as possible. If you can continue flight, come back in immediately.
10. If you succeed in extinguishing fire, close cowl flaps to reduce drag.

Cabin Fires

Cabin or bomb bay fires may result from electrical faults, advanced engine fires, or crew carelessness, among other things. Use all preventive precautions possible. Have somebody wipe up spilled hydraulic fluid. Don't allow