A C. BRAND

RESTRICTED

PILOT'S HANDLING INFORMATION

FOR

B-29 SUPERFORTRESS

EXTRACTS FROM S.A.C. MANUAL 50/1

RESTRICTED

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PREFLIGHT INSPECTIONS

CHAPTER 2

AIRPLANE COMMANDER'S AND PILOT'S PRE-FLIGHT INSPECTION

Section I - General

1. The responsibility concerning the safe operation of the aircraft, safety of the crew, and the efficient accomplishment of the assigned mission, is delegated to the airplane commander.

2. Each member of the crew has received a thorough course of technical training pertinent to his particular speciality; therefore, certain duties concerning the pre-flight inspection should be delegated to each crew member. These duties, when so assigned, are performed under the airplane commander's supervision and command.

3. Performance of the general pre-flight inspection should be assigned to the flight engineer, since he is the best qualified member of the crew to determine the proper condition of the airplance

4. Certain other crew members should be made available to the engineer to aid in accomplishing certain portions of this inspection (see the Flight Engineer's SOP for details of the Engineer's pre-flight inspection).

5. In addition to the general pre-flight inspection, each specialist should accomplish that portion of the pre-flight pertinent to his specialty.

Section II - Inspection Procedure

1. Parachutes and personal equipment: placed on the ramp to the left of the nose section in order of crew inspection.

2. Form 1A - check the Form 1A for aircraft status, remarks, aircraft and engine time. Sign the exceptional release if necessary.

3. Form F - check for proper completion and computations. If properly accomplished, sign and dispatch to operations.

4. Visual inspection - visually check the landing gear, fuselage, props, engines, wings, stabilizers and control surfaces for condition, cleanliness and security, landing and navigation lights operative.

5. Pitot tubes - covers off and tubes open.

6. Static sources - open. Check static holes for freedom from obstruction.

7. Liquid locks - In event engines have not been run up, or propellers pulled through, within thirty (30) minutes prior to flight propellers will be pulled through twelve (12) blades using only two (2) men per blade. In case liquid lock is encountered crew chief will be notified and crew will not attempt start until liquid lock is cleared.

8. Crew inspection - after the propellers have been pulled through, have the crew line up for inspection in the following order: pilot, navigator, bombardier, flight engineer, radar observer, radio operator, top gunner, left gunner and tail gunner. (extra passengers will line up in rear of flight crew, in order of rank). Check each crew member for physical condition and proper equipment for the assigned mission.

9. Down locks (gear and bomb door) - have the down locks removed and properly stowed in the aft unpressurized compartment.

10. Final inspection - Airplane commander will make visual inspection to see that down locks and pitot covers and bomb door locks are removed.

Section III - Standard Check List

BEFORE STARTING

1.	Preflight	Completed
2.	Forms 1A & F	Checked
3.	Crew inspection	Completed
4.	Down locks & pitot cover .	Removed
5.	Personal equipment	Checked
6.	Seat and pedals	Adjusted
7.	Parking brakes	Set
8.	Wheel chocks	In place
9.	Emerg. bomb door release handle	In place
10.	Emerg. cabin press release handle	In place
11a	Landing gear switch	Down
11b	Landing gear fuse	In place
12.	APU	On line
13.	Hydraulic pressure	Normal (1225)

14. Propellers ..... High RPM
    *a. Mstr motor sw ..... On
    *b. RPM sel sw ..... Auto
    *c. Auto tel lights ..... On
    *d. Circ brkrs ..... On
    *e. Mstr control ..... High RPM
    *f. Reverse pitch ..... Normal
15. Bomb doors ..... Closed
16. Tank safety switches ....."Can Salvo"
17. Turbos ..... Off
18. Flight controls ..... Checked
19. Radios ..... Checked
20. Altimeters ..... Set
21. Turrets ..... Stowed
22. Lights ..... Checked
23. Oxygen chk by stations .... PSI
24. Engineers report ..... Ready to start engines
25. Fire guard ..... Clear Rt & Left
26. Start engines ..... Notify engineer
27. Start engines #3,#4, #2, #1

BEFORE TAXIING

1. Vacuum ..... Checked
2. Gyros ..... Uncaged
3. Instruments ..... Checked
4. Alarm bell & phone call light ..... Checked
5. Ready to taxi ..... Notify crew
6. Parking brakes ..... Off

*Curtis Electric Propellers

WHILE TAXIING

1. Emerg Brakes ..... Checked
2. Reservice emerg ..... Reserviced
3. Hydraulic press ..... Normal
4. De-icer boots ..... Checked

BEFORE TAKE-OFF

1. Nose wheel ..... Straight
2. Parking brakes ..... Set
3. Engine run up ..... Completed

A. Prop Check

1. Run props through 2 cycles, (decrease - increase)

*B. Prop Check ..... 1500-21" HG

1. Feather check ..... Completed
2. Generator check ..... Completed
3. Fixed pitch ..... Checked
4. Reverse check ..... Test hop only
5. Auto check ..... Completed
6. Protective relay .... Checked
7. Throttle back Engs 2, 3, & 4

C. Engine Check

1. Master motor ..... 2800RPM or High RPM
2. No boost full power check ..... 40" HG (sea level)
3. Check mags ..... 2200 RPM
4. Synch check ..... 2000 Auto
5. Check Engs 2,3,&4 ... same manner

D. Maximum Manif Variat .... 2" HG

*Curtis Electric Propellers

4. Wing flaps ..... Set 25°
5. Trim tabs ..... Set for TO
6. Auto pilot ..... Off
7. Props ..... High RPM
   - *a. Mstr motor sw ..... On
   - *b. RPM Sel Sw ..... Auto
   - *c. Auto tel lights ..... On
   - *d. Circ brkrs ..... On
   - *e. Master control ..... High RPM
   - *f. Reverse pitch controls . Normal
8. Turbos ..... Set for TO
9. Windows and hatches ..... Closed
10. Radio call ..... Completed
11. Crew report ..... Ready for TO
12. Flight controls ..... Checked
13. Safety belts ..... Fastened
14. Throttle brake ..... Set
15. Flight instruments ..... Checked
16. AC on interphone for TO
17. ENGINEERS REPORT
    - a. Best TO speed ..... MPH
    - b. Best flap up speed ..... MPH
    - c. Minimum 3 eng climb speed MPH
18. Check list completed.
19. Full power check ..... 1st 3rd runway

BEFORE LANDING

1. Notify crew ..... Prepare to land

*Curtis Electric Propellers

2. Safety belts fastened ..... Fastened
3. Radio call ..... Completed
4. Altimeters ..... Set
5. Auto pilot ..... Off
6. Turrets ..... Stowed
7. Hydraulic press ..... Normal
8. Engineers report ..... Gross wt
   CG % MAC
   Ready to land
9. Stalling speed & CG ..... _____MPH
10. Props ..... 2400 RPM
11. Landing gear ..... Down (lights on)
12. Wing flaps ..... Set 25°
13. Turbos ..... Set
14. Radio call ..... Completed
15. Stand by full flaps ..... On final

AFTER LANDING

1. Hydraulic press ..... Normal
2. Turbos ..... Off
3. Props ..... High RPM
4. Wing flaps ..... Up
5. Post flight check 66-8, ... Notify Eng
6. Bomb door ..... Open
7. Parking brakes ..... Set
8. Bomb door safety valves ..... Safe
9. Radios ..... Off
10. Controls ..... Locked
11. Chocks ..... In place
12. Parking brakes ..... Off

13. Post flight inspect ..... Completed

14. Forms 1 &1A ..... Completed

Section IV - Amplified Check List

BEFORE STARTING

1. Pre-flight inspection - completed.

2. Forms 1A and F - signed and on board.

3. Crew inspection - completed.

4. Down locks (gear and bomb doors) - removed.

5. Personal equipment - checked.

   a. Parachutes and dinghies - put on parachutes and check the "seat type" dinghies.

   b. Clothing - be sure that proper clothing is aboard for the mission to be performed.

   c. Life vests - check for presence of CO_2 cartridges and make sure they have not been accidentally discharged (check safety wire at the release plunger). Wear the parachute over the life vest.

6. Seat and Pedals - adjusted. Adjust the seat and rudder pedals as necessary.

7. Parking brakes - set. Depress the brake pedals, pull the parking brakes handle out, and release the brake pedals.

8. Wheel chocks (right and left) - in place. Chocks should be set 2" fore and aft of each tire (Fore of each outboard and aft of each inboard.)

9. Emergency bomb door release handle - in place. The T-handle, on the airplane commander's control stand, should be down and safetied with light gage wire.

10. Emergency cabin pressure release handle - in place. The T-handle, on the airplane commander's control stand, should be down and safetied with light gage wire.

11. Landing gear switch and fuse - switch down, fuse in place. The gear switch should remain in the down position at all times when the gear is extended to prevent "gear collapse" in case the screw is not securely set against the down lock bumper. See that the fuse is in place and not burned out.

12. Battery switch - on. Call the engineer and notify him to turn the battery switch on - APU on the line.

13. Hydraulic pressure - normal (1225 PSI). The pilot obtains the emergency hydraulic pressure reading from the engineer. Depress the brake pedals until the normal pressure drops to approximately 1000-1100 PSI. The automatic pressure switch should cut in and return the pressure to 1224 PSI. The pilot reports: "Hydraulic pressure normal."

14. Propellers - high RPM. Move the RPM selector switch to High RPM and check the indicator lights on the pilot's instrument panel.

a. Master motor switch - on.

b. RPM selector switches - automatic (auto-tel lights on).

c. Circuit breakers - on.

d. Master control - high RPM.

e. Reverse pitch normal - check to see that 1 & 4 and 2 & 3 are in the unarmed (normal position.

15. Bomb doors - closed; light out. The airplane commander orders the bombardier to close the doors and checks to see that the indicator light is out. The radio operator and gunner report "Bomb doors closed."

16. Tank safety switch - can salvo. The bombardier is responsible for the "can salvo" position of the tank safety switch.

17. Turbo-off. Turn the turbo selector to zero.

18. Flight controls-checked. As the controls are moved, the pilot orders: "check ailerons". The gunners will report right and left aileron direction of movement to the pilot. Repeat this procedure for the elevators and rudder. While making this directional check, the controls should operate smoothly throughout their entire travel range.

19. Radios-checked. While the pilot is checking the flight controls, the airplane commander turns on the radio and requests taxi information. The pilot after checking controls, turns on the radio compass and checks for proper operation on nearest radio range and leaves the control on compass position. He then stands by on the interphone so that he can be in continuous contact with the crew.

20. Altimeters-set. The airplane commander and pilot set their altimeters by the tower altimeter setting. Check the altitude reading against the known field elevation. If the altimeter setting given by the tower indicates an altitude different from the known field elevation, check the setting again and note the difference in elevation so you can use it in correcting the reading when landing. Note excessive deviation in the Form 1A (plus or minus 100 feet).

21. Turrets - stowed. The airplane commander checks all turret warning lights on his instrument panel to see that all turrets are properly stowed. Turret lights should be out.

22. Lights - checked. If any night operation is contemplated on the flight, check all lights -- flourescent lights, identification lights, landing lights, and position lights (switches on control and aisle stands). A member of the ground crew should be instructed to check the landing lights and position lights. Wing position lights are not visible from the airplane in flight. They can be inspected at night from inside the airplane only by checking the reflection on the ground. The airplane commander, flight engineer, and one gunner will possess a serviceable flashlight on each flight. Also an aldis lamp will be carried on all flights.

23. Oxygen - _____PSI. Airplane commander and pilot check their oxygen pressure gages and walk-around bottles for proper pressure (400 to 450 PSI). Auto-mix should be on and the emergency valve off. At this time all crew members (starting with the bombardier and working aft to tail gunner) will check in by interphone, giving station oxygen pressure.

24. Flight Engineer's report - ready to start engines. The pilot calls on the interphone: "Engineer's report". The flight engineer reports "Ready to start engines." (at this point, if the flight engineer has not completed his checklist, the airplane commander waits before giving the command to start engines.)

25. Stand clear; fire guard - clear left, clear right. When ready to start the engines, both the airplane commander and the pilot give the command, "Stand clear" to the ground crew (clear right, clear left). When the fire guard is ready, pilot says on interphone "Stand by to start engines."

26. Start engines - notify engineer.

a. The engines are started, 3, 4, 2 & 1. The airplane commander signifies to the ground crew that No. 3 engine is ready to be started, and then tells the flight engineer to start No. 3 engine. The number of fingers held up

by the airplane commander or pilot indicates the number of the engine to be started. When the engine starts, the flight engineer ordinarily reports "Engine operating normally." Then he announces "Ready to start No. 4 engine." Follow a similar procedure for the other engines. The flight engineer handles the throttles throughout the starting procedure, keeping the RPM between 1000 and 1200. When an engine is running smoothly, the flight engineer sets the throttle at 700-1000 (1000 RPM if oil temperature is below 40°C). Thereafter the airplane commander will control the throttles except when asking for engine-driven generators and during the mag check. If any crew member detects an engine loading up (black smoke, or RPM drop, or both), he informs the pilot on interphone. In the event of engine fire, place the jack-box in the call position and make the necessary report.

b. Starting Don'ts.

(1) Don't start the engines until the Before Starting Checklist has been covered item by item.

(2) Don't start the engines until the propellers have been pulled through to eliminate any possibility of liquid locks.

(3) Don't jam throttles forward at any time, especially during the starting procedure.

(4) Don't start engines until a fire guard is posted.

(5) Don't continue to run an engine if the nose and rear oil pressures do not build up within 30 seconds after starting.

BEFORE TAXIING

1. Vacuum - engineer's report, light checked. The pilot tells the flight engineer "Check vacuum." The flight engineer, after checking the vacuum reading for both pumps (gage on engineer's panel should read 3.8" to 4.2" Hg.), reports to the pilot "Vacuum checked". If the vacuum selector or valve is stopped between number 2 or 3 engine positions, or if the vacuum pressure is low, the light on the airplane commander's instrument panel will flash on.

2. Gyros - uncaged. Airplane commander and pilot check their gyro instruments to make sure they are uncaged and operating correctly. At this time, set the directional gyros to conform with the mag compass heading.

3. Instruments - checked. The airplane commander and pilot check their respective instrument panels for proper readings and operation of all instruments.

4. Alarm bell and phone call light - checked; crew report. The airplane commander turns on the alarm bell and phone call light and calls for the crew report. The pilot calls the crew and orders "Crew report." The crew reports "Station check complete; phone call light and alarm bell okay."

5. Chocks (right and left) - out. The airplane commander and pilot signal the ground crew to "pull the chocks."

6. Ready to taxi - notify crew.

a. The airplane commander notifies the crew "Stand by to taxi." The crew reports "Ready to taxi."

NOTE: Like all tricycle-landing gear aircraft, the B-29 taxis easily. The brakes are good and have four expander tubes per wheel. Remember, however, that the B-29 is big and heavy. It gains momentum and because of its size you have to depend on your side and top gunners to act as observers to warn you of obstacles.

b. For all ground operations, set the props at 700-1200 RPM and the mixture in auto-rich. Never use autolean for taxiing. If the carburetors are adjusted properly the engines idle as low as 550 RPM without loading up. (600 RPM for fuel injection pumps). Always return throttles to 700 RPM when parked.

c. For maximum cooling and prevention of backfires control both the speed and direction with brakes alone. Starting a taxi turn with outside throttle does not save your brakes because the speed of the airplane accelerates quickly with this extra power and the brakes must be used to decelerate. If excessive speed is obtained bring the airplane almost to a stop, straight ahead, then stay off the brakes as long as possible to let them cool.

7. Parking brakes-off.

WHILE TAXIING

1. Emergency brakes-checked. As the airplane begins to roll, notify the engineer "checking emergency brakes". The airplane commander pulls the emergency brake levers (checking for even application of braking action). The engineer recharges the emergency accumulator.

2. Hydraulic pressure - normal (1114 PSI). In congested areas and before the aircraft starts a turn, the pilot informs the airplane commander whether or not the hydraulic pressure is up (every 30 seconds in congested areas).

3. De-icer boots - checked. Check proper operation of all de-icer boots if icing conditions will be encountered during the flight.

BEFORE TAKE-OFF

1. Nose wheel - straight. Before engine run-up, the pilot checks through the cockpit floor observation window to make sure the nosewheel is straight.

2. Parking brakes - set.

3. Engine run-up-completed. The airplane commander gives the command "Stand by for engine run-up," and the pilot repeats the command over the interphone. The engine run-up for first take-off should be accomplished in the following manner (for the subsequent take-offs, items a. through g. may be eliminated):

a. Airplane commander increases all throttles to 1500 RPM (automatic control set at 1500 RPM); approximately 21"HG is necessary to obtain this RPM. The airplane commander commands "Check generators" while performing feathering check (decrease approximately 200 RPM).

NOTE: Feathering check at this time will place enough electrical load on the main bus line, so the flight engineer may properly check the generators (Hamilton standard propellers. Place load on main bus line by extending flaps to 25°, then return flaps to full up position).

b. The airplane commander operates all four propeller switches to full decrease, then to full increase (from limit warning light to limit warning light) to test the propeller governors. At full decrease RPM, before returning switches to increase RPM, check tachometers for stable, uniform readings of 1200-1300 RPM. When propellers are again returned to high RPM, tachometers should all read 1500 as before. Any propeller overshooting the original setting is not being properly governed and must be corrected before take-off. With Curtiss propellers, use the following procedure during prop and magneto check at the engine run-up. These procedures check the fixed pitch, reverse,

and automatic operation of your props. The putt-putt and the generators must be on for the checks. Leave the generators on during flight and the landing roll.

(1) With all four throttles at 1400 RPM, hold No. 1 propeller selector switch in the decrease RPM position until the prop speed drops approximately 200 RPM.

(2) Place the switch in the fixed pitch position and check to see that the RPM remains at 1300.

(3) Place the switch in the increase RPM position. As soon as propeller has increased approximately 100 RPM, move the switch to automatic and check to see that the RPM returns to 1500.

(4) Repeat the procedure on engines No. 2, 3, and 4.

(5) On test hops place the inboard propeller pre-selector switch to reverse.

(6) Depress the actuating switch, just above the airplane commander's throttles. Note that the engine RPM goes from 1500 to approximately 1800 and then returns to 1500, at which time the props are in reverse pitch.

(7) Return the pre-selector switch to the normal position. The propellers should return to the normal angle. Note that the engine RPM again increases as the propeller blades pass through flat pitch and that the in-board propeller tel-lights flash on when the propellers reach the low angle. The engine tachometers should return to the original RPM.

(8) Repeat the procedure on the outboard propellers, this time having the pilot depress the actuating switch under his throttles.

(9) When the props are again in normal pitch (1500 RPM, automatic), advance manifold pressure to 26"HG, and check the automatic operation as follows: Turn the master synchronizer control switch off. In this position, the engines should remain constant at the same RPM.

(10) Turn the master synchronizer control

switch on and turn the control in a counter-clockwise direction until the engine tachometers indicate a drop of approximately 200 RPM. All tachometers should show stable, uniform readings. Then turn the master synchronizer control switch in a clockwise position to 2800 RPM. CAUTION: On cold days, the indicator may not read 2800 RPM, DO NOT FORCE CONTROL KNOB to obtain proper reading.

c. When the propellers and generators are checked, the airplane commander retards No. 2, 3, & 4 throttles to 700-1000 RPM and tells the flight engineer to "Run up engines". With the master synchronizer control set at 2800 RPM, #1 throttle is advanced to full power to clear engine out. A full power, no boost run-up at sea level, approximately 40" is normal manifold for 2800 RPM. The flight engineer then retards No. 1 throttle to 2200 RPM, reports manifold pressure to the pilot, checks magnetos, and calls out "Right, both; left both" (maximum allowable drop in RPM is 50).

NOTE: Above sea level, subtract one-inch for each thousand feet of altitude. Changes in temperature will vary these settings, but the variation will be the same for all engines. Excessive manifold pressure on one engine is an indication of a bad cylinder, a bad valve, or some other engine malfunction.

The flight engineer then retards No. 1 throttle to 2000 RPM and checks for synchronization drop by placing the mixture control in auto-lean position and notes drop in RPM (max allowable 50 RPM).

d. After the four engines are checked, the airplane commander sets the turbo selector to take-off position and advances the throttles, one at a time, full open, to check manifold pressure and RPM. For this ground check, the gages should read between 2700-2800 RPM and 48"-49" manifold pressure for each 50 RPM below maximum governor speed.

NOTE: The airplane commander may, at his option, perform the turbo full power check on the first one third of the runway as an aid in reducing engine ground time. Some cylinders run up to 100° hotter than is recorded on #18 cylinder head temperature gauge.

4. Wing flaps - set to 25°. Lower the wing flaps to 25° and have the gunners report "left flap down 25°", "Right flap down 25°".

5. Trim tabs - neutral. The airplane commander checks to see that all trim tabs controls are in the neutral position.

6. Auto-Pilot - off. The airplane commander makes sure that all auto-pilot switches (pilot's aisle stand) are off.

7. Propellers - high RPM. The pilot operates the propeller switches (on aisle stand) to increase RPM (forward) until the propeller limit lights on his panel flash on.

a. Master motor switch - on.

b. RPM selector switches - automatic (auto-tel lights on).

c. Master control - high RPM.

d. Reverse pitch control - normal (not armed).

8. Turbos - set for take-off. On most airplanes take-off setting on TBS will be position No. 8. Some airplanes are equipped with the Type B-7 control on the TBS(check if B-7 removed) to provide for water injection. On these airplanes, the take-off setting is marked at 3-3/4 on the TBS. Emergency power is obtained by increasing the TBS to 5. Above 5, however, the pressuretrol will automatically anticipate water injection and reduce the manifold pressure accordingly. Full power check will be made only when necessary to set individual turbo's for take-off power.

9. Windows and hatches - closed. As the airplane commander closes and secures his window, the pilot closes his, checks to see that the forward compartment entrance hatch is closed, and orders the tail gunner to "Close the rear entrance door and escape hatch."

10. Landing lights (night) - night light 45° down.

11. Radio call - completed. The airplane commander calls the tower and requests permission to take off.

12. Crew report - ready for take-off. The pilot calls on interphone "Prepare for take-off", and notifies the airplane commander that the crew is ready.

13. Flight controls - checked. Check controls for freedom of movement. The airplane commander, just prior to taking the runway, notifies the flight engineer to "Stand by for take-off." The engineer reports "Ready for take-off."

14. Safety belt - fastened.

15. Throttle brake - adjusted. The airplane commander adjusts the throttle brake for desired friction to prevent slipping.

16. Flight instruments - checked. Check gyros and re-set gyro compass. Pilot have navigator take variation out of flux-gate compass and cage.

17. Airplane commander on interphone for take-off. Pilot will go to VHF.

18. Engineer reports:

    a. Best take off speed - in MPH.

    b. Best flaps up speed - in MPH.

    c. Minimum 3 engine climb speed - in MPH.

19. Check list completed - pilot verifies.

20. Full power check - first third of runway.

CHAPTER 3

IN FLIGHT PROCEDURES

Section I - Amplified Check List

TAKE-OFF PROCEDURE.

1. The cylinder head temperature (CHT) before take-off will not exceed 22°C (fuel injection 180°).

2. Use the minimum of brakes and throttles to line up on the runway. As the airplane starts to roll, advance the throttles slowly. The rudder begins to be effective at approximately 60 to 65 MPH. In this way, you can maintain directional control first with throttles, then with rudder.

3. The brakes should not be used to hold the airplane straight on the runway, except in emergencies, since this increases the take-off distance and wears out the tires. If brakes are not used, the airplane will gain speed continuously from the point of run-up to the point where the wheels leave the ground.

4. If the throttles are advanced too quickly at the beginning of the roll, the necessary reserve power will not be available to hold the airplane straight with throttles and, until the airplane picks up speed, brakes may have to be used to stay on the runway.

5. The pilot follows through on the throttles, making a continuous power check as the throttles are advanced during the initial take-off roll. Full power should be obtained during the roll down the first third of the runway. If any unusual power conditions are noted, the pilot notifies the airplane commander, who still has time to retard the throttles if he decides that take-off is inadvisable.

6. Never attempt take-off with less than full power. Full power take-offs are not harmful to the engines as long as the CHT's stay within limits. Take-offs with reduced power prolong the time required to obtain the minimum speed at which adequate engine cooling can be obtained.

CAUTION: Upon reaching 500' when adjusting propeller RPM make sure that none of the propeller RPM switches stick in the decrease RPM position. To be sure, always use both gang plates when operating the switches.

7. At 90 MPH, relieve the pressure on the nose wheel oleo by easing the control column back. As soon as the ship is safely off, the airplane commander brakes wheels and calls for gear up.

NOTE: The nose wheel should not be pulled off the ground. Just relieve pressure so as to lengthen the oleo strut. The airplane will become airborne in a good safe flight an attitude which will facilitate a steady climb and a rapidly accelerating airspeed.

NOTE: All operation of the gear switch, flap switch, propellers, and power reductions will be done by the pilot, the airplane commander will direct his attention to flying the airplane.

8. Raising Flaps. Upon reaching a safe airspeed (minimum airspeed of 150 MPH), the flaps may be raised to 10°. Continue climb to 500 feet at this minimum safe airspeed if the cylinder head temperatures remain within limits (260°C). The airplane commander then calls for flaps up easy. The pilot retracts the flaps, 5° at a time. CAUTION: Noticeable change in lift will be encountered when the remaining 10° of flaps are raised, unless the airplane is equipped with an elevator overbalance control.

9. Power Condition Two. After the aircraft is aerodynamically clean, the airplane commander calls for power condition two (43-1/2" and 2400 RPM at sea level) when the airspeed reaches 180 MPH.

10. Gear and flaps pull a total of 965 amperes and may be safely raised together. The gunners will report on operation of the gear and flaps.

11. When making power reductions, reduce the manifold pressure with the turbo selector dial until turbos are off, at which time the pilot announces to the flight engineer, "Turbos off." Make subsequent manifold pressure reductions with the throttles.

12. Cowl flaps, which are 15° open as the airplane takes the runway, are closed to 7-1/2° or less (depending on cylinder head temperatures) by the time the airplane leaves the ground. This setting permits a rapid increase of airspeed and should keep all cylinder head temperatures below 260°C.

13. If cylinder head temperatures rise above 260° on take-off, or stay above 248° after the power reduction, the flight engineer informs the airplane commander and opens the cowl flaps on the hot engine to a maximum of 10°. (Never open cowl flaps more than 10° in flight. Larger openings provide little, if any, additional cooling and reduce cruising ranges considerably.) If advisable, a slight reduction of manifold pressure will reduce cylinder head temperature within operating limits. The throttle should not be pulled back unless the airplane has reached 170 MPH.

14. Cowl flaps should be set at the smallest opening to maintain cylinder head temperatures below the required maximum.

NOTE: On all take-offs, first climb to 500 feet above the terrain at an airspeed of 150-170 MPH. Then, before continuing the climb, level off until reaching climbing airspeed of 190 or until CHT's are below 248° C.

15. Take-Off Emergencies. Just remember these points if an engine fails on take-off:

a. Get directional control first, using rudder and minimum aileron, then pick up airspeed before trying to climb. Because of the large flap area on the B-29, the total or partial loss of an engine on one side creates an unbalanced blast against the flaps which tends to raise one wing and lower the other. Ailerons may not be effective enough to counteract this tendency to roll unless power is balanced. However, if one engine has been retarded to balance power, restore power as soon as the airplane is under control.

b. Drag with gear and flaps down is excessive, so raise gear immediately and bring up flaps at 150 MPH, even if gear is not all the way up.

c. If turbo position No. 10 is used, reduce power as soon as possible.

d. Determine which engine has failed and whether it is delivering some power or should be feathered.

e. Should two engines fail on take-off, be prepared to crash-land straight ahead.

f. Avoid climbing below 170 MPH, if possible.

WARNING: Under no conditions attempt a turn until you have directional control and a safe flying speed. If there is no alternative, crash-land straight ahead.

CLIMB.

1. If all cylinder head temperatures run high during a sustained climb, hold the climbing power setting and level off until the cylinder head temperatures return to normal, then start climbing again.

2. Climb at rated power, regardless of the gross weight. Rated power climbs use less fuel, provided the cylinder head temperatures can be maintained within limits during a sustained climb.

CRUISING.

1. Efficient cruising of the B-29 requires the maintenance of a recommended calibrated airspeed. The recommended airspeeds are obtained from the cruise control charts. The desired airspeed should be maintained by use of the elevators and by varying power settings slightly to maintain altitude. The airspeed should not be allowed to drop; if unable to maintain altitude with given airspeed, add power as necessary.

2. In order to use minimum power for any given cruising speed, the drag must be reduced as much as possible. Use the smallest possible cowl flap and inter-cooler door openings which will keep cylinder head temperatures at or below maximum and carburetor air temperatures within desired limits. Trim the airplane properly. Related manifold pressures and RPM as given in the BMEP Power Schedule in Appendix 1-A of AN 01-20EJA-1 should be used.

3. It is recommended that the following procedures be used to establish cruising conditions from climb:

a. If cylinder-head temperatures are not excessive, level off at the desired altitude and continue to use rated power until desired airspeed is obtained. Set power to hold desired airspeed.

b. If cylinder-head temperatures are excessive, climb above the desired altitude and hold rated power at zero rate of climb until 210 MPH CAS is obtained. Set pre-determined cruising power, open the cowl flaps to 10^{0}, and descend to the desired altitude at 210 MPH CAS. Level off at desired altitude, close the cowl flaps to the predicted setting, and use elevators to hold the desired cruising airspeed. It may be necessary to vary settings slightly to maintain altitude. After the desired airspeed has been established and cylinder-head temperatures have stabilized, cowl flaps should be opened or closed individually to maintain proper cylinder-head temperatures.

4. To obtain maximum range it is necessary to control the airplane's drag and weight. For each 6 lbs. added to the empty weight of the airplane, it is necessary to add approximately one gallon of fuel to get the same range. This increases the gross weight 12 lbs. Every degree of cowl flap opening used above that required to cool the engine increases the fuel consumption 15 gallons per hour. The airplane is clean and added drag affects it considerably. Everything added to the outside of the airplane, whether it is streamlined or not, adds drag and decreases range. If difficulty in maintaining proper performance is encountered, it is probably because of extra drag or weight.

5. To extend the maximum range, make descents at the recommended long-range cruising speeds and the lowest power setting at the end of a long-range flight. (See cruise control section.)

TRIMMING:

1. Rudder. Hold wings level and center ball with rudder trim tab.

2. Ailerons. Hold wings level with ailerons and remove control pressure with aileron trim tab.

3. Elevators. Hold the desired airspeed with elevators and remove control pressure with elevator trim tab.

NOTE: If possible, make no turns with unbalanced power until after the airplane is trimmed for the condition. When using unbalanced power, make all speed and power changes smoothly and make approximate change in trim immediately.

BEFORE LANDING:

1. Notify crew- prepare for landing. The before landing check starts upon returning from a mission, about 8 to 10 minutes before landing. For transition missions, take-offs can be spaced 10 minutes apart so that the airplane will not have to leave the traffic pattern. The airplane commander announces "Prepare for landing," at which time the flight engineer orders the tail gunner to start the putt-putt. Crew members acknowledge in the following order: bombardier, navigator, flight engineer, radar observer, radio operator, top gunner, left gunner, right gunner, and tail gunner.

2. Safety belt - fastened.

3. Radio call - completed. The airplane commander calls the tower for landing information.

4. Altimeters - set. The airplane commander and pilot set their altimeters to the setting given by the tower.

5. Auto-pilot - off. The airplane commander makes sure that all switches for the auto-pilot (on aisle stand) are off.

6. Turrets - stowed. The airplane commander checks to see that the turret warning lights on his instrument panel are out.

7. Hydraulic pressures - normal (1225 PSI). The pilot asks the flight engineer to check the emergency hydraulic pressure. The engineer reports: "Emergency hydraulic pressure normal." The pilot pumps the brake pedals until the pressure is returned to normal (1225 PSI). He then reports to the airplane commander "Hydraulic pressure normal."

8. Engineer's report - gross wt,_____pounds; CG_____ %MAC; Putt-putt on the line: ready to land. The pilot calls for the engineer's report. He then relays this information to the airplane commander.

9. Stalling speed - _____MPH. The pilot finds the stalling speed, based on the gross weight, by referring to the table mounted on his instrument panel and informs the airplane commander.

10. Propellers - 2400 RPM. The pilot adjusts Propellers to 2400 RPM at the airplane commander's request.

a. Master motor - on.

b. RPM selector switches - automatic (auto-tel lights on)

11. Landing gear - down; gunners report; lights checked. The pilot on command from the airplane commander, lowers the landing gear and announces over the interphone: "Gear coming down." The gunners check the main gear and report in order: "Left gear coming down" and "Right gear coming down." When the gear is completely down, the gunners report again; "Left gear down and locked," and "Right gear down and locked." (For all night operation, the gunners will use the Aldis lamp for checking the gear down.) The pilot checks the nose wheel through the observation window in the floor of the cockpit and checks the landing gear warning lights on his instrument panel. After receiving the pilot's report that the gear is down, the airplane commander will check to see that the red light is off, and the three green lights are on. The gear switch will be left in the "down" position.

NOTE: The indicated airspeed must be less than 180 MPH before the gear is lowered. A visual check by the gunners is important. The red warning light, the green down and locked lights, are not position indicators except in the late series airplanes. They only indicate that the limit switches have stopped the operation of the gear motors. If the switches open the circuit too soon, the gear will be only partially down and warning of this danger can come only from the visual check. The gear will support the weight of the airplane if the retracting screw is not more than 4 inches from the full down position. Have the putt-putt operator report when the tailskid is down.

12. Wing flaps - set. At the airplane commander's order, the pilot extends the wing flaps 25° just before turning into the base leg. Later, on the final approach, and at the airplane commander's order, he extends full flaps, at which point the airplane commander retrims the elevators. The gunners check the position of the flaps and inform the pilot. Do not lower full flaps above 180 MPH indicated. (Note yellow line on airspeed indicator.)

13. Turbos - set. The airplane commander calls for turbos on base leg. Pilot announces: "Turbos on" to flight engineer and turns selector dial to 8 and informs the airplane commander. (Some airplanes are equipped with Type B-7 control for TBS to provide for water injection. On these airplanes, the take-off setting is marked at 3-3/4 on the TBS.)

14. Radio call - Base leg.

15. Stand by full flaps - on final.

LANDING PROCEDURE:

1. Don't lower full flaps until you are lined up with runway and sure of making the field. Go-arounds are difficult only when full flaps are down. After putting down full flaps, maintain an airspeed of 30 MPH, indicated, above the power-off stalling speed. Don't chop the power at any point on the approach. Long approaches are unnecessary, even for narrow runways.

2. Crosswind Landings. a. When turning on the approach in a crosswind, be careful not to allow the wind to force you off your approach to a degree where it is impossible to align with the runway. There are three possible ways of making a crosswind approach and landing:

(1) Holding the airplane straight toward the runway, dropping one wing into the wind with just enough top rudder to counteract drift.

(2) Heading the airplane into the wind (crabbing) just enough to keep a straight ground path.

(3) A combination of the first two methods.

b. The combination of methods is preferred, because it eliminates the possibility of dropping the wing too low, or of crabbing too much, and decreases the amount of correction needed to straighten out and level off during the roundout.

3. Landing Roll. Don't use your brakes more than necessary after the wheels touch the ground. On a long runway, let the airplane roll until it loses speed (tap brakes gently to insure braking action later on). Lower the nose gently at 90 MPH, and when nearing the end of the roll, apply the brakes evenly and smoothly.

4. Use of Reverse pitch. a. Reverse pitch can be used as a brake during landings. Always remember to notify the pilot, before landing, which engines are going to be used in reverse pitch. Do not use reverse pitch on the ground to back up the airplane, since the nosewheel does not have full castering and the engines will heat up excessively without the cooling effect of ram air.

b. The following is the airplane commander's operating procedure for using reverse pitch:

(1) When the main gear touches down, the airplane commander will instruct the pilot to

place the arming switch (reverse-normal switch on aisle stand) in the reverse position. Inboard engines only should be used to prevent extreme lateral reaction in event of improper reversing action. Outboard reversing is provided for landings involving a feathered inboard.

(2) When the nose wheel touches down, the airplane commander only will depress the actuating switch for actual propeller reversal.

NOTE: For the purposes of this procedure the term "airplane commander" is defines as:

The person actually landing the aircraft regardless of the seat occupied.

(3) Be ready to "nurse" the throttles to keep the engines from stalling after the propeller blades have gone thru the flat blade angle. You can tell when the blades have gone through flat pitch by the sound, engine tach indication, and manifold pressure. Push the throttles forward until a desired RPM indication is obtained on the engine tachometer not more than 35" to prevent overspeeding of props.

CAUTION: Have the flight engineer watch the tachometers for indication of overspeeding props.

(4) To return the propeller from reverse to normal pitch, operate the engines at idling and return the reverse-normal switch to the normal position. When the reverse tellights go out (obsolete on most aircrafts) and the auto-tel lights come on, the blades have reached the low pitch angle and normal operation may be resumed.

5. Go-Around. The procedure for a normal go-around is not complicated. Raise the flaps from the full down position to 25° as power is applied and continue on the same approach angle until safe flying speed is reached. Retract the gear as soon as you are sure that the runway will not be touched, and start the climb. Raising the flaps all in one movement to 25° is important. Don't wait for a safe flying speed---with flaps full down, you cannot attain a safe flying speed because of the high full flap drag and reduced acceleration. Follow this procedure:

a. Notify the flight engineer that you are going around.

b. Apply throttle gradually as needed.

c. Raise flaps to 25°.

d. Set full high RPM.

e. Don't try to climb until you reach a safe flying speed.

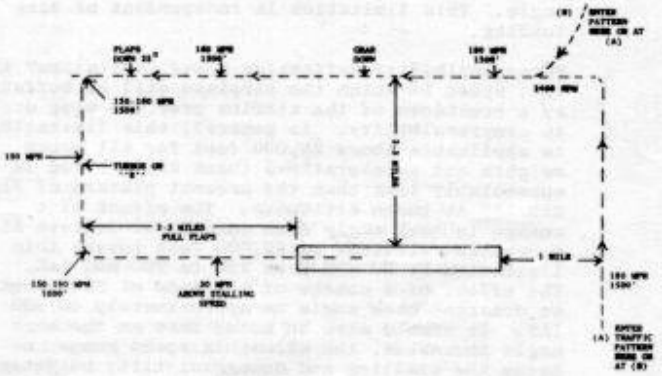
f. Retract the gear when safely clear of the ground.

g. Proceed as in normal take-off.

h. If needed, apply emergency power by advancing the TBS to emergency power marking.

WARNING: Go arounds on less than four engines is not recommended.

TRAFFIC PATTERN



Section II - Airspeed Limitations

1. Many requests have been received for information regarding those structural and aerodynamic characteristics of the B-29 which determine the maximum allowable airspeed at various altitudes. The information contained in this article will provide flight personnel with additional information to be used in the analysis of certain types of flying.

2. Airspeed limitations are usually specified to safeguard either directly or indirectly the structure of the airplane. In any case, structural failure is the ultimate result if one, or a combination of the following limitations are exceeded:

a. Design Structural Speed.

b. Flutter Speed.

c. Compressibility Buffetting Speed.

3. Definitions. a. "Structural Speed Limitation" is that speed at which the wing structure will be permanently set by an effective sharp edged gust of 30 ft./sec. This limitation should be observed in rough air if diving turns are made in which the bank angle is 30 degrees or more; this limitation is especially applicable at altitudes below 25,000 ft. where gusts are most apt to be encountered.

b. "Flutter Speed Limitation" is the maximum speed at which the airplane may be flown in order to avoid structural destruction by flutter. The limit flutter speed governs at intermediate altitudes from 17,000 to 30,000 feet if turns are restricted to not more than a 30 degree bank angle. This limitation is independent of wing loading.

c. "Compressibility Buffetting Speed Limitation" is that speed at which the airplane will be buffeted by a breakdown of the airflow over the wing due to compressibility. In general, this limitation is applicable above 25,000 feet for all gross weights and accelerations (bank angles) and is appreciably less than the present placard of 310 MPH IAS at those altitudes. The effect of a change in bank angle from zero to 60 degrees at a constant altitude of 30,000 feet lowers this limitation by 20 MPH from 280 to 260 MPH IAS. The effect of a change of altitude of 5000 feet at constant bank angle is approximately 40 MPH IAS. It should also be noted that as the bank angle increases, the allowable speed range, between the stalling and compressibility buffeting speeds, decreases rapidly at high altitudes.

4. Buffetting may be eliminated by immediately doing three things in the order named:

a. Decrease the bank angle, which effectively decreases the wing loading.

b. Decrease the airspeed by throttling, which effectively adds drag to the airplane.

c. Decrease the rate of descent.

5. If it is necessary to fly a B-29 into the speed range in which compressibility will be encountered, do so with full power on. When buffetting is experienced, the safest way to slow down is to immediately add drag to the airplane. This can be done by throttling the engines and allowing the propellers

CHAPTER 4

AFTER LANDING AND POST FLIGHT CHECK

to windmill. If in a turn, decrease the angle of bank. If buffetting is severe and the decrease of bank angle and altitude show little effect, then as a last resort open the outboard cowl flaps, intercooler and oil cooler flaps--not the various inboard flaps since they cause tail buffetting. Do not lower the wing flaps. If the landing gear is lowered at speeds greater than 230 MPH IAS the wheel well doors may come off, but the resultant structural damage is apt to be quite small in comparison with the total destruction which will result if the airplane is not slowed down.

6. Under normal flying conditions, bank angles should be restricted to about 45 degrees in turns during which no altitude is lost. Higher bank angles should particularly be avoided under conditions of rough air.

7. In conclusion, two tables are presented. Table 1 is a tabular summary of the data given for a B-29 of 100,000 pounds gross weight. The maximum permissible airspeeds to the nearest five miles per hour are tabulated against density altitude for bank angles of 0°, 30°, 45°, and 60°. The reason for the limitation is given in parentheses under the tabulated airspeeds. For instance, at 30,000 feet density altitude the maximum allowable airspeed is 270 MPH (pilot's airspeed indicator reading) at 45 degrees bank angle and is established by compressibility buffetting.

DENSITY ALTITUDE FEET	MAXIMUM ALLOWABLE IAS, IN BANK TURNS OF			
	0°	30°	45°	60°
5,000	380 (Flutter)	355 (Structural)	320 (Structural)	230 (Structural)
10,000	360 (Flutter)	345 (Structural)	310 (Structural)	225 (Structural)
20,000	315 (Flutter)	315 (Flutter)	300 (Structural)	220 (Structural)
30,000	275 (Flutter & Buffetting)	275 (Flutter & Buffetting)	270 (Buffetting)	215 (Structural)
35,000	245 (Buffetting)	240 (Buffetting)	240 (Buffetting)	225 (Buffetting)

LIMITATIONS: (1) STRUCTURAL - BASED ON 30 FT/SEC EFFECTIVE EQUIVALENT SHARP EDGED GUST
(2) FLUTTER - LIMIT FLUTTER SPEED
(3) BUFFETTING - COMPRESSIBILITY BUFFETTING

8. Table 2 briefly lists indicated airspeeds in a form more suitable for cockpit use. It is applicable to the full operating range of gross weights (up to 135,000 pounds) and to bank angles up to 45° at 25,000 ft. (60° above 25,000 ft). The present placard limit of 310 MPH is considered reasonable for altitudes below 20,000 feet; however, it is strongly recommended that the B-29 placard speed of 310 MPH be reduced 30 MPH per each 5000 feet above 20,000 feet in order to establish safe limiting airspeeds for all weights and banked turns.

DENSITY ALTITUDE	MAXIMUM AIRSPEED, MPH (PILOT'S INDICATOR READING) (45° MAXIMUM BANK)
S.L.	310
15,000	310
20,000	310
25,000	280
30,000	250
35,000	220

Section III - Normal Instrument Readings

	Minimum	Desired	Maximum
Nose oil pressure	20	30-50	50 PSI
Rear oil pressure		60-80	80 PSI
Oil temperature	40	50-85	95°C
Fuel pressure	15	16-18	19 PSI
De-icer pressure		7-7.5	10 PSI
Vacuum pressure		3.8-4.2"Hg	
Oxygen pressure		400-425(cold)	450 PSI
Hydraulic pressure		1000-1225 PSI	
CAT		20-35°C	38°C

Section I - Amplified Check List

AFTER LANDING:

1. Hydraulic pressures-normal (1225 PSI). The pilot checks the pressure gage for normal reading.

2. Turbos-off. Toward the end of the landing roll, turn the TBS to zero.

3. Propellers-high RPM. The pilot puts the propellers in high RPM position.

4. Wing flaps-up. a. At the airplane commander's order, near the end of the landing roll, the pilot raises the flaps (all the way, if this is the last landing; to 25° if planning to make another take-off). Gunners report on the position of the wing flaps.

   b. At night, after turning off runway, stop the airplane, and run up the coolest engine to supply power to raise flaps. The power available from the putt-putt is not sufficient to carry the load of the landing lights, radio, and wing flaps.

5. Engine run-up (notify the engineer). The airplane commander says: "Run-up engines." The pilot repeats command on interphone. The flight engineer follows the procedure outlined in his check list and reports to the pilot when it is completed. If practicable, 6608 will be performed before reaching parking area, with aircraft headed into the wind.

6. Bomb bay doors-open. Upon reaching the parking apron, the airplane commander notifies the bombardier to open the bomb bay doors.

7. Parking brakes-set.

8. Bomb door safety valves-safe. The radio operator and gunner will turn the bomb bay door safety shut-off valve to "safe," turn the bomb bay tank safety switches to the "no salvo" position and report: "Bomb bay doors open, safety valve safe."

9. Engines-cut. The airplane commander then notifies the engineer to cut the engines.

10. Radios-off. The airplane commander turns off the command set and the pilot turns off the radio compass.

11. Controls-locked. The airplane commander pulls the lock handle on the aisle stand to the "up" position and sees that the flight controls are securely locked.

12. Master synch motor off. Place master synchronizer circuit breaker switch to the off position.

13. Gear switch neutral. Place the gear switch in the neutral position.

14. Chocks (right and left) - in place. The airplane commander and pilot check to see that the chocks are in place.

15. Parking brakes-off.

16. Crew inspection-completed. Crew members leave the airplane and line up as before flight to be checked by the airplane commander. At this time, defects in the airplane, not already noted, are reported to the flight engineer.

17. Forms 1 and 1A-completed and signed. The flight engineer completes Forms 1 and 1A and presents them to the airplane commander for check and signature.

CHAPTER 5

EMERGENCIES PROCEDURES

Section I - General

1. Emergencies require the full coordinated effort of each crew member for its success. Drill is the nearest reality to the actual accomplishment and should be practiced at every opportunity so the crew will know every procedure, learn to move quickly, and make every movement count.

2. A well trained crew will know the problem and, if properly disciplined, will react properly and efficiently under any condition.

3. The success of a survival depends critically on the following items:

   a. Communications equipment; to send frequent and accurate position reports.

   b. Water, medical supplies, and food that is salvaged and accompanies the crew.

   c. Crew discipline; this is vitally important.

   d. The ability of the airplane commander to cope with any emergency. With the above items in mind, plan the emergency, time and circumstances permitting.

4. Emergency Signals:

   a. Prepare to bail out: three short rings on the alarm bell.

   b. Bail out: One long sustained ring.

   c. Prepare for ditching or crash landing: six short rings on the alarm bell.

   d. Ditching or crash landing: one long sustained ring.

NOTE: If time and circumstances permit, the crew should be warned, and acknowledgement received, by interphone.

Section II - Bail Out

1. Bail-Out Over Land. a. The airplane commander will not give the order to bail out until he is certain that the altitude is sufficiently high for safety, nor will any crew member leave the airplane until ordered to do so by the airplane commander, who will use the standard signals as outlined in Section I.

   b. When bail-out is inevitable, the airplane commander will:

(1) Order the bombardier to open the bomb bay doors, salvo the bombs and/or the bomb bay tanks and leave the doors open.

(2) Order the radio operator to obtain from the navigator and broadcast a position report.

(3) Turn IFF switch to emergency position.

(4) Order all Confidential and Secret equipment destroyed and all injured crew members prepared for bail-out.

(5) Order the pilot to lower the landing gear for approximately 10 seconds or until the nose gear is completely extended (if the aircraft is equipped with a separate nose gear emergency switch, order the flight engineer to extend the nose gear rather than the pilot using the main gear switch).

(6) If at night, order the pilot to turn on the landing lights.

(7) If at altitude, and time permits, descend to 10,000 feet above the surrounding terrain and release the cabin pressure.

c. After the above procedures have been accomplished and acknowledgement received from each crew member, the airplane commander will order the crew to bail out. The crew members will bail out through the following exits:

(1) Navigator, radio operator, bombardier, flight engineer, pilot and airplane commander, in that order, through the nose wheel well (secondary exit through the forward bomb bay).

(2) Right, left, and top gunner, in that order, through the aft bomb bay (secondary exit through the rear entrance door).

NOTE: For tanker and receiver type aircraft, primary and secondary path of egress will be through the rear entrance door.

(3) Tail gunner and radar operator, in that order, through the rear entrance door (secondary exit through the aft bomb bay).

d. When bailing out, place your feet against the airplane and dive, head first, towards the ground. If at altitude, fall "free" (without pulling the rip cord) until approximately 10,000 feet above the terrain. If you feel yourself losing

consciousness, whatever your altitude, pull the rip cord. In any case, check your bail-out bottle before leaving the airplane and attach it to your oxygen mask.

2. Bail-Out Over Water. a. In some instances, ditching the airplane will be impossible. In such cases, the plan for bail-out is important. Certain things are important to remember:

(1) If surface help is available, it is much easier for rescue crews to find and rescue 2 or 3 men at a time in a small area than to rescue 10 or more men strung out in a long line in the water.

(2) If surface help is not available, it is still important to keep the crew as close together in the water as possible. Individual members can aid each other, especially in regard to injured crew members. Most important of all, a group of men or life rafts are much easier to find than a single individual. This is true whether the search is from a surface vessel or aircraft. In view of the above, the airplane should be flown in as tight a circle as conditions will permit, then come around in relation to the other men or the surface vessel, before bailing out the other crew members. This should be accomplished to place the crew members as close as possible to the other men or the surface vessel.

b. When the bail-out warning is given, each crew member removes the individual life raft (dinghy) from its position near his station and snaps it on to his parachute harness and on to the ring of his life vest waist strap. This method of attachment should be tested to insure that when the parachute is released in the water, the laynard is so arranged that it does not become entangled with the parachute harness. Crew members should check the equipment of each other to insure that all straps and packs are properly secured and adjusted. Upon receiving the bail-out signal, crew members will exit with the least possible delay, through the normal bail-out exits, in accordance with the above procedure, or as prescribed by the airplane commander to cope with the present emergency.

c. Before giving the bail-out signal, the airplane commander will:

(1) Order the radio operator to obtain from the navigator and broadcast a position report.

(2) Order the navigator or radio operator to pull the life raft release handles in the forward pressurized compartment on either side of the tunnel entrance and throw the lift raft, stowed in the forward compartment, overboard and order the tail gunner to throw the life raft, stowed in the rear unpressurized compartment, overboard.

NOTE: The aircraft should be circled, as specified above, in order for equipment and personnel to be deposited in the same vicinity.

d. When approximately 500 feet above the water, push your body as far back into the parachute seat as possible. Unfasten the leg straps and the chest strap, making sure to hold your body into the parachute harness with your arms and shoulders. When approximately 15 to 20 feet above the water, slide out of the parachute harness and swim free, underwater, to avoid being trapped and possibly drowned by becoming entangled in the parachute or shroud lines.

WARNING: Do not inflate the life vest until returning to the surface.

e. After the life vest is inflated, inflate the one man life preserver (dinghy) and climb in from the end, being careful not to capsize the raft. Check all emergency equipment in the raft and attempt to locate other crew members.

Section III - Bomb Door Operation

1. With proper pressure in both normal accumulators and the electrical system inoperative:

a. To open the doors: Pull the emergency release handle at the airplane commander's position or aft of bulk-head 218 until both the forward and aft doors open.

b. To close the doors:

(1) Pull the emergency retraction "T" handle aft of bulk-head 218 to close the forward doors.

(2) Pull the emergency retraction "T" handle on the right rear cat-walk to close the rear doors.

2. With proper pressure in only one normal accumulator:

a. Open the interconnect valve on the forward bomb bay valve panel.

b. Operate the doors manually as listed above.

3. When pressure is absent from both normal accumulators and the emergency accumulators are charged:

a. To open the doors: Pull the emergency release handle at the airplane commander's position or aft of bulkhead 218.

b. To close the doors:

(1) Open the emergency actuating valve.

(2) Pull the emergency retraction handle at either station 218 or on the right rear cat-walk to close forward or aft doors as desired.

4. If electrical power is present, the doors may be operated from the pilot's aisle stand or bombardier's panel in place of using the retraction handles.

CAUTION: Before any emergency operation is attempted, the bombardier's master switch and circuit breakers must be turned off to prevent the loss of all air pressure.

5. Later model aircraft have a manually operated cable retraction system for both the forward and aft bomb doors. This system consists of a ratchet jack and drum attched to each set of doors by cables. The jack for the forward doors is located in the floor alongside the navigator and the jack for the aft doors is located in the floor forward of the top gunner's seat support. Also included on the jackshaft is a plate which is connected by a cable to the four-way selector valve and by a push rod to the jack access door. This plate also acts as a cam and disengages the ratchet pawls when the access door is closed. When emergency retraction of the bomb doors is required, the operator lifts the access door in the floor. This exerts tension on the four-way selector valve control cable actuating the selector valve to the "door close" position, and at the same time engages the ratchets between the retraction handle and retraction drum. Since lifting the access door throws the four-way selector valve to the "door close" position, if any reserve air remains in the pneumatic system, the doors will close or partially close. If sufficient air is not available for closing the doors, the retraction handle may be inserted in the retraction mechanism and pumped until the doors are closed. Closing the access door after emergency closing the bomb doors will disengage the retraction mechanism ratchets and allow the doors to be operated normally.

Section IV - Brake Procedure

1. The hydraulic brake system is so designed that, in the event of a ruptured expander tube or hydraulic line, 50%

of the normal braking action is still obtained on that side by using the emergency brake levers on the pilot's aisle stand. This is accomplished through a series of shuttle and lock-out valves and an emergency accumulator that may be recharged, by the flight engineer, from the normal fluid supply. Once this emergency accumulator is charged, a check valve and an emergency system filler valve prevent the pressure from being lost except by using the emergency brake handles or by leaks. If the normal braking system fails, proceed as follows:

a. The airplane commander advises the flight engineer of the emergency and applies the emergency brakes.

b. The engineer places the emergency system filler valve in the "open" position.

c. If the normal system pressure is below 200 PSI, use the emergency over-ride switch to maintain pressure in the emergency accumulator.

CAUTION: When using the emergency brakes, apply a steady pressure and hold it until the airplane is brought to a stop; cut the engines and have the airplane towed to the ramp. If the brakes are applied intermittently, all the fluid may be exhausted since it returns to the normal system when it is released from the brakes.

Section V - Crash Landing

1. Crash Landing, Wheels up. a. The B-29 can be crash-landed with a minimum of injury to the crew. Land on hard surface whenever possible in preference to sod or dirt. Do not feather props unless engine trouble requires feathering. All crew positions for crash landing B-29's equipped with four gun turrets are the same as those specified for ditching, with exception to the radio operator, who will assume a sitting position facing aft against the flight engineer's control stand, back well braced and cushioned, hands behind head, and knees flexed. Crew positions for crash landing B-29's not equipped with four gun turrets are the same as those specified for ditching.

b. With wheels up, drag is reduced considerably, so plan your approach to land short.

(1) If feasible, circle landing field until remaining fuel supply is 200 gallons per engine.

(2) Clear traffic and call for crash trucks, if possible.

(3) Give crew members, not essential to crash landing, permission to bail out. Remaining crew members will take up crash landing positions. Clear lower turret areas for crash landing, as turrets are likely to tear loose and be forced up into the cabin.

(4) Drop all bombs, auxiliary bomb bay tanks, and flares. To prevent jamming, leave all emergency escape hatches open, except the bomb bay doors. Close bulkhead doors in order that an explosion or fire will be confined to the bomb bay. Drain the oxygen system.

(5) Close the wheel well nacelle doors, if possible.

(6) Make a normal approach sufficiently far back from the field, and high enough, to allow remaining crew members to perform the following last minute preparations at the command of the airplane commander:

(a) Lower full flaps for landing.

(b) Stop the auxiliary power plant.

(c) Turn the boost pumps off.

(d) Close the fuel shut-off valves (toggle switches on engineer's panel) on the final approach, when certain of making the field. (Approximately 10 to 15 seconds of fuel, at low power, remains in the lines after closing the fuel shut-off valves.)

(7) Just prior to contact with the ground, throttle the engines back and place mixture controls in fuel cut-off.

(8) Turn the master switch, generator switches, and battery switch off.

(9) See that the flight engineer is prepared to set the engine nacelle fire extinguisher selector to any engine that may catch fire after landing.

(10) Warn crew members just prior to ground contact, then make normal landing by sliding the airplane in on its belly.

2. Emergency Landing on a Hard Surface Runway:

a. Both Main Gears Down, Nose Wheel Partially Up or All the Way Up:

(1) Follow steps (1) through (9) as for crash landing. Except for wheel doors (leave open) and shift the load to place the CG as far aft as possible, then proceed as follows:

(a) Hold the nose of the airplane in the air as long as possible with the elevators and then lower it gently until it strikes the runway.

After the nose of the airplane strikes the runway, apply brakes as necessary to bring the airplane to a stop.

b. One Main Wheel Up, Nose Wheel and One Main Wheel Down:

(1) Follow steps (1) through (9) as for crash landing, except for wheel doors (leave open). Then proceed as follows:

(a) Make a normal landing on the good wheel, with the wing tip slightly low on the good wheel side.

(b) Hold the wing on the bad wheel side up as long as possible with ailerons.

(c) Be prepared for an extremely sharp ground loop in the direction of the crippled wheel, when the wing tip and the nacelle dig into the runway. Use brakes to minimize ground loop.

c. Both main gear inoperative - retract nose gear and belly land.

d. Nose gear and one main gear inoperative - retract remaining main gear and belly land.

e. Land on hard surface in preference to sod or dirt.

f. Emergency landing off an airport: Raise all wheels and make crash landing.

Section VI - Detonation

1. Detonation is explosion of the mixture within the cylinder in contrast with the normal controlled burning of the mixture. Detonation exerts excessive pressure against the cylinder walls because all the mixture burns at once, rather than over a period of time.

2. Detonation can be identified by high cylinder-head temperatures, rough engine operation, and puffs of black smoke from the exhaust. Detonation is a result of high temperatures and pressures and it becomes pronounced and destructive as these factors increase. Therefore, detonation can be caused by:

a. A climb or maneuver which tends to cut down the cooling air flow and raise head temperatures.

b. Increasing carburetor air temperatures in an attempt to avoid icing.

c. High cylinder pressures and temperatures caused by an increase in power.

d. Closing the cowl flaps.

e. Lean fuel-air mixture, increasing combustion temperature.

3. Proper correlation between RPM, manifold pressure, and CAT is necessary to prevent excessive BMEP which causes detonation. Poor spark plug operation will cause pre-ignition and detonation at high power settings. Use fuel of correct octane rating to prevent detonation. If detonation should occur, enrich the mixture, lower the manifold pressure, lower the carburetor air and cylinder head temperature, by opening the cowl flaps or increasing airspeed.

Section VII - Ditching

1. If ditching becomes inevitable, there are some vitally important factors to be taken into consideration. They are as follows:

a. Wind Direction: Wind is one of the uncontrollable factors; plans for ditching cannot be made without taking this factor into consideration. Waves move down-wind; spray from the wave crest is also blown down-wind. Swells, however, do not always indicate wind direction and can, in fact, be very large when the wind is calm. Swells are a result of past disturbance. Study the sea whenever possible and become cognizant of its characteristics.

b. Wind Speed: Surface winds are fairly predictable by the way they affect the water. Here are some pointers that will aid in estimating surface wind velocity:

(1) No white caps; zero to 10 knots.

(2) A few white caps; can be 20 knots.

(3) Many white caps; 20 to 30 knots.

(4) Foam streaks on the water; 30 to 40 knots.

NOTE: From lower altitude spray will be visible sometimes with many white caps. This indicates a very strong wind (40 to 50 Knots).

c. Altitude: Altitude may be judged without difficulty if there is considerable wind. On a calm sea however, the airplane commander must be more alert in his judgement of altitude. There are many advantages that accompany a forced landing on a calm sea. If power is available, and the altitude is not required to search for land or surface vessels, descend to a lower altitude and observe the surface conditions. At night, the landing lights should be tried at various angles to assist in determining the altitude above the water. If fog or spray is present, however, they may be more harmful than good.

2. Handling the Airplane. a. Experience gained in ditching B-29 aircraft has proven that the best results are obtained by ditching while power is still available. By doing so, the airplane commander may choose the spot for ditching to obtain the best possible sea conditions and the most favorable landing position and attitude. The following points are well to remember:

(1) Ditch at the lowest possible airspeed consistent with safe control of the airplane, since this will reduce the landing impact. Under no circumstances should the airplane be stalled in as this will result in a severe impact and cause the airplane to nose into the sea and possibly break in half.

(2) Ditch at the lowest possible rate of descent (100 feet per minute is recommended) with a 5° nose high attitude. This attitude gives the best distribution of the landing shock over the entire fuselage.

(3) In most cases, a wing flap setting of 25° should be used. With a very heavy airplane, however, the stall speed will be high and the use of full flaps will be necessary to avoid bouncing. Bouncing is usually caused by too high an airspeed or too flat a landing approach.

(4) During day light hours, the airplane should be ditched along the top of the swell, parallel to the rows of swells, if the wind does not exceed 30 to 40 knots. In high winds, ditching should be conducted up-wind

to take advantage of the reduced forward speed. It must be remembered that the possibility of ramming nose-on into a wave is increased as is the possibility of striking the tail section on a wave crest and nosing in.

b. Power Off Ditching. With one or more engines inoperative, the following should be borne in mind:

(1) With 2 engines inoperative on the same side of the airplane, use power on the inboard engine only.

(2) When power is available from one inboard and one outboard engine, on opposite sides of the aircraft, balance the power condition by using high power on the inboard and a lower power condition on the outboard engines.

(3) With symmetrical power conditions, use power as required to allow the flattest approach (5° nose high) and the lowest possible forward speed.

(4) It is advisable to hold the speed 30 MPH above power of stalling speed until the flare out is started, at which time the speed will be reduced to just above stalling speed and the airplane set up for a 5° nose high landing.

c. Cross-Wind Ditching. The basic rules as listed above will apply in addition to the following:

(1) Crab the airplane to kill drift and land on the down-wind side of the swell or wave.

d. Up-Wind Ditching. The basic rules above will apply in addition to the following:

(1) Maintain a nose-up condition to avoid the nose striking the face of the wave.

(2) Touch down immediately before the crest of a rising wave.

(3) Hold the nose up, if possible, after the first impact.

e. Night Ditching. The basic rules outlined above, in addition to the following, will apply except that ditching shall be conducted with the aid of instruments to establish the proper attitude of the airplane.

(1) Hold the wings level to avoid digging a wing tip into the sea and cart-wheeling the airplane.

(2) Maintain an up-wind heading; use will be made of the known prevailing winds and the wind fix established by the navigator and/or radar operator.

(3) Make an instrument let-down maintaining an airspeed of 30 MPH above the power off stalling and at the lowest possible rate of descent. Landing attitude should be 5° nose-high with 25° flaps. (The landing lights turned 45° down will aid in judging height in leveling off.)

(4) If power is available, drop flares (15 to 18 minutes duration) in a string, make a procedure turn and land alongside the flares.

NOTE: On a moonlight night, land toward the moon and into the wind as much as possible.

f. Preparation. Ditching equipment should be in readiness at all times when flying over water. As soon as the necessity for ditching is evident and the airplane commander has given the order to prepare for ditching, all unessential equipment that might tear loose on impact should be jettisoned. Some of these items include the bomb sight, bombs, flares, fuel tanks, gun sights, cameras, putt-putt, and all escape hatches that are removable. After the equipment is jettisoned, close the bomb bay doors and order the ditching braces installed.

WARNING: It is vitally important that the ditching braces be installed to prevent the pressure bulkhead doors from being broken in on impact with the water.

g. Procedure for Ditching B-29's Equipped With Four Gun Turrets.

(1) The following procedure will be used during all ditchings of aircraft equipped with four gun turrets. The repeated loss of personnel, because of failure to comply with established procedures, must be reduced. Parachutes and one-man rafts will not be removed until the altitude is less than 1,000 feet above the water.

(2) Each crew will practice assuming ditching positions during an assigned period. Each

position during practice will be checked by the airplane commander and the personal equipment officer.

h. Crew Procedure.

(1) Airplane Commander.

(a) Give the warning, if interphone is operative, "Prepare for ditching in_____ minutes." If the interphone is inoperative, give six short rings on the alarm bell and turn the IFF emergency switch on.

(b) Open and secure the window; jettison if possible.

(c) Remove the flak suit and parachute. Remove the one-man raft from the parachute harness and leave it in the seat. Wear the flak helmet, emergency kit, life vest, gloves, and if installed, the shoulder harness.

(d) Radio other aircraft of your distress and have the radio operator broadcast a position report.

(e) Give the order: "Stations for ditching impact in _____seconds."

(f) Keep the knees flexed at impact.

(g) Check to see that the crew is clear; throw the one-man raft from, and exit through, the left window. If the aircraft is not on fire, inflate the life vest on the window ledge and climb atop the aircraft, using the guns as a hand hold.

(h) Supervise the removal of injured crew members and securing the emergency equipment and life rafts.

(i) Take position in the life raft at the left wing, proceed away from the aircraft, and when at a safe distance, order the life rafts tied together with the ropes provided.

(2) Pilot.

(a) Relay the airplane commander's instructions over the interphone (if operative); receive acknowledgment from the

crew. Inform the airplane commander that the crew has been notified.

(b) Open the window; jettison if possible.

(c) Remove the flak suit and parachute. Remove the one-man life raft from the parachute harness and leave in the seat. Wear the flak helmet, emergency kit, life vest and flying gloves. Fasten the safety belt, and if installed, the shoulder harness.

(d) Stand by on interphone to relay the airplane commander's orders.

(e) Keep the knees flexed at impact. Take the first aid kit, stored above the engineer's seat, throw the one-man raft from, and exit through, the right window. If the aircraft is not on fire, inflate the life vest on the window ledge and climb atop the aircraft, using the guns as hand holds. Assist the airplane commander in supervising the removal of injured crew members and emergency equipment.

(f) Proceed to the right wing, climb aboard the life raft and proceed to a safe distance from the aircraft, join up with the other rafts and assist in connecting all rafts together with the ropes provided.

(3) Flight Engineer.

(a) Acknowledge the ditching order.

(b) Remove the flak suit and parachute and use for padding behind the head and shoulders. Remove the one-man raft from the parachute harness and leave it in the seat. Wear the flak helmet, emergency kit, life vest, and gloves. Fasten the safety belt.

(c) Open the emergency escape hatch and pass it to the navigator to be jettisoned through the bomb bay.

(d) Remove the first aid kit from the engineer's stand; secure it to the arm.

(e) Be prepared to cut engines as outlined in the flight engineer's SOP.

(f) Throw the one-man raft from, and exit through, the escape hatch.

(g) If the aircraft is not on fire, inflate the life vest on the window ledge and climb atop the aircraft. Assist in removing injured crew members as directed by the airplane commander or pilot.

(h) Proceed to the right wing and climb aboard the life raft.

(4) Bombardier.

(a) Acknowledge the ditching order.

(b) Remove the flak suit and parachute. Remove the one-man raft from the parachute harness; use all available padding against ditching impact. Wear the flak helmet, gloves, emergency kit and life vest.

(c) Pass the bomb sight back to the navigator to be jettisoned through the bomb bay. Assist in jettisoning all unnecessary equipment.

(d) Assume ditching position next to the engineer with back and head padded and braced against the pilot's armor plate. Fasten the safety belt, if installed.

(e) Throw the one-man raft through the escape hatch and exit after the flight engineer.

(f) If the aircraft is not on fire, inflate the life vest on the window ledge. Climb atop the aircraft and assist in removing injured crew members as directed by the airplane commander or pilot.

(g) Proceed to the right wing and climb aboard the life raft.

(5) Navigator.

(a) Acknowledge the ditching order.

(b) Remove the flak suit and parachute. Remove the one-man raft from the parachute harness; use all available padding against ditching impact. Wear the flak helmet, gloves, emergency kit and life vest.

(c) Through coordination with the airplane commander and flight engineer, calculate the course, altitude, and position upon ditching and give this information to the radio operator so that he may broadcast a position report.

(d) Remove the flare kit and tuck inside clothing or in a water-proof bag.

(e) Aid in jettisoning all unnecessary equipment.

(f) Pass the fire axe from the engineer's panel to the gunner and aid in installing ditching braces.

(g) Remove the table corner and assume the ditching position on the floor, with the back braced against the parachute and seat cushions placed against the navigator's cabin. The one-man raft may be used as additional padding or may be placed in the lap.

(h) Throw the one-man raft from the engineer's escape hatch and exit after the bombardier.

(i) If the aircraft is not on fire, inflate the life vest on the window ledge and climb atop the aircraft.

(j) Assist in removing injured crew members and emergency equipment as directed by the airplane commander or pilot.

(k) Proceed to the right wing and climb aboard the life raft.

(6) Radio Operator.

(a) Acknowledge the ditching order.

(b) Remove the flak suit and parachute. Remove the one-man raft from the parachute harness; use all available padding against ditching impact. Wear the flak helmet, gloves, emergency kit and life vest.

(c) Check IFF setting.

(d) Continue to send emergency signals and on command of the airplane commander, clamp the transmitter key down.

(e) Assume ditching position on the lower turret with the back and head braced and padded against the upper turret. Brace the legs against the bulkhead door. Fasten the safety belt and place the one-man raft on your knees (raft may be used as additional padding if necessary).

(f) When the forward movement of the aircraft has ceased, pull both life raft release handles at the tunnel entrance.

(g) Throw the one-man raft from the astrodome and climb atop the aircraft. If the aircraft is not on fire, inflate the life vest.

(h) Aid in removing injured crew members and emergency equipment from the aircraft as directed by the airplane commander or pilot.

(i) Proceed to the right wing and climb aboard the life raft.

(7) Top (RCT) Gunner.

(a) Acknowledge the ditching order.

(b) Remove the flak suit and parachute. Remove the one-man raft from the parachute harness; use all available padding against the ditching impact. Wear the flak helmet, gloves, emergency kit and life vest.

(c) Take the one-man raft and go forward through the tunnel to the forward cabin. Remove the astrodome by pulling the release cord. If the release cord does not function, remove the astrodome with the axe.

(d) Be sure that all loose equipment has been jettisoned through the bomb bay.

(e) Install the ditching braces.

(f) Assume the ditching position on the lower turret, the same as the radio operator. Verify that the life raft release handles have been pulled.

(g) Throw the one-man raft from the astrodome and climb atop the aircraft. If the aircraft is not on fire, inflate the life vest.

(h) Aid in removing injured crew members and emergency equipment as directed by the airplane commander or pilot.

(i) Proceed to the left wing and climb aboard the life raft.

(8) Right Gunner (A.G.):

(a) Acknowledge the ditching order.

(b) Wear the emergency kit, life vest, helmet and gloves.

(c) Remove the parachute and flak suit, take the one-man raft and proceed to the forward end of the tunnel.

(d) Aid in installing ditching braces.

(e) Assume a reclining position in the tunnel. Brace your feet against the four gun turret, keeping the knees flexed.

(f) Throw the one-man raft from, and exit through, the astrodome and receive the equipment passed out by the radio operator and top gunner. If the aircraft is not on fire, inflate the life vest and assist in removing injured crew members and emergency equipment as directed by the airplane commander or pilot.

(g) Proceed to the left wing and climb aboard the life raft.

(9) Left Gunner (E.S.G.):

(a) Acknowledge the ditching order.

(b) If the interphone is operative, report the progress in the gunner's compartment to the airplane commander.

(c) Install the ditching braces.

(d) Proceed to the rear unpressurized section with the radar operator. Take parachutes, one-man raft, and seat cushions for padding.

(e) Use the fire axe to chop away the camera and putt-putt supports. Remove the battery and bend the supports back. Jettison all loose equipment through the rear

entrance door and open the escape hatch. (The rear entrance door should be closed, after equipment is jettisoned.)

(f) Make sure that the extra life raft and emergency kits are securely lashed down.

(g) Assume ditching position with the head and back securely braced and padded against the left side of the bulkhead.

(h) Fasten the safety belt. Wear flak helmet, emergency kit, life vest and gloves.

(i) Throw out one-man rafts and all emergency equipment, and exit through the escape hatch.

(j) If the aircraft is not on fire, inflate the life vest atop the escape hatch ledge and climb atop the aircraft.

(k) Assist in removing injured crew members and emergency equipment as directed by the airplane commander, or pilot.

(l) Proceed to the left wing and climb aboard the life raft.

(10) Radar Operator:

(a) Duties before impact.

1. Acknowledge ditching order.

2. Check IFF emergency switch "on."

3. Remain at position as long as pertinent information concerning altitude and other matters may be relayed to pilot.

(b) Position.

1. Proceed to rear unpressurized compartment and close door carefully, being sure it is securely latched. Remain on interphone if possible.

2. Take position with back and head against bulkhead, cushioned with parachute and with hands clasped behind head.

(c) Duties after impact.

1. Exit through rear escape hatch and proceed to the left wing. Aid in stowing equipment.

(11) Tail Gunner (C.G.):

(a) Acknowledge the ditching order.

(b) Remove the parachute. Wear the flak helmet, emergency kit, life vest and gloves.

(c) Jettison the escape hatch and sight.

(d) Pad against ditching impact and fasten the safety belt.

(e) Throw out the one-man raft and exit through the escape hatch.

(f) If the aircraft is not on fire, inflate the life vest on the escape hatch ledge and climb atop the aircraft.

(g) Assist in removing injured crew members and emergency equipment as directed by the airplane commander or pilot.

(h) Proceed to the left wing and climb aboard the life raft.

(12) Extra Passenger:

(a) Acknowledge the ditching order.

(b) Aid in jettisoning unnecessary equipment.

(c) Assume the ditching position in the radio operator's seat, safety belt fastened, facing aft, with the back braced against the turret, or in the tunnel beside the gunner with the feet braced against the turret, knees flexed, or in the unpressurized section braced against the knees of the left gunner.

(d) Throw the one-man raft from, and exit through, the appropriate escape hatch and proceed as have the other crew members.

(e) The airplane commander or pilot will direct which raft the passenger will board.

i. Procedure for Ditching B-29's Not Equipped With Four Gun Turrets. The following procedure will be used during all ditchings of aircraft not equipped with four gun turrets:

j. Crew Procedure:

(1) Airplane Commander. Procedure same as for B-29's equipped with four gun turrets.

(2) Pilot. Procedure same as for B-29's equipped with four gun turrets.

(3) Flight Engineer. Procedure same as for B-29's equipped with four gun turrets.

(4) Bombardier. Procedure same as for B-29's equipped with four gun turrets with exception to item (g), which is changed to read, "Lie on side, facing aft, against nose wheel well step, head toward engineer's control panel and back braced firmly and well padded, knees drawn up and feet flat against the step."

(5) Radio Operator. Procedure same as for B-29's equipped with four gun turrets with exception to item (e), which is changed to read, "Take sitting position facing aft against flight engineer's control stand, back well braced and cushioned, hands behind head, and knees flexed."

(6) Right Gunner (A.G.). Procedure same as for B-29's equipped with four gun turrets.

(7) Left Gunner (E.S.G.). Procedure same as for B-29's equipped with four gun turrets with exception to item (d), which is changed to read, "Proceed to the rear unpressurized section. Take parachutes, one-man raft, and seat cushions for padding."

(8) Radar Operator.

(a) Acknowledge the ditching order.

(b) Remove the flak suit and winter flying shoes. Keep flak helmet on. Remove the parachute and pass it to the navigator.

(c) Remove the thermos bottle and bracket, or other equipment from back of the engineer's control stand and prepare all loose equipment for jettisoning.

(d) Grasp the leather thong below the astrodome and pull the sealing strip away. If the astrodome does not fall free, jerk sharply on the center stud. If difficulty is experienced, chop out with an axe. Acknowledge to the airplane commander: "Astrodome removed." Remove and jettison radar indicator. Assist in jettisoning other loose equipment.

(e) Pull the chair full forward, place the parachute along the back edge of table, rest head in arms on the table top, with chest against padding, feet braced against step, and safety belt fastened.

(f) Throw the one-man raft from, and exit through the astrodome. If the aircraft is not on fire, inflate the life vest atop of the escape hatch ledge and climb atop the aircraft.

(g) Assist in removing injured crew members and emergency equipment as directed by the airplane commander or pilot.

(h) Proceed to the left wing and climb aboard the life raft.

(9) Extra Passenger (Forward).

(a) Acknowledge the ditching order.

(b) Remove the flak suit, flying boots, and parachute. Wear flying gloves.

(c) Aid in jettisoning loose equipment.

(d) On order from the airplane commander, assume seated position in front of radio operator, sitting bob-sled style, with back well up against the radio operator's chest, and head supported in his interlaced hands.

(e) Exit through the astrodome and proceed to left wing.

(10) Extra Passenger (Rear).

(a) Acknowledge the ditching order.

(b) Remove the flak suit, flying boots, and parachute. Loosen collar and wear flying gloves.

(c) Proceed to the rear unpressurized section and aid in jettisoning loose equipment.

(d) Take ditching position in front of right gunner, seated bob-sled style, facing aft with back up against chest of gunner and head supported by his interlaced hands.

(e) Throw one-man raft from, and exit through the rear escape hatch and proceed to the right wing.

Section VIII - Feathering Propeller

1. The airplane commander will close the throttle and tell the engineer: "Feathering No.____engine," and depress the feathering button, or switch. If time permits reduce RPM to high pitch prior to feathering.

2. The flight engineer will proceed as follows:

a. Mixture control-fuel cut-off.

b. Fuel boost pump-off.

c. Fuel shut-off valve closed.

d. Generator(s) off.

e. Cowl flaps, intercooler, and oil cooler closed.

f. Ignition switch off (after the prop stops).

3. If an inboard engine is feathered, close the cabin air valve and transfer the vacuum pump selector valve to the remaining engine.

Section IX - Fire

1. General. a. The B-29 is equipped with an engine fire extinguisher system supplied by two high pressure CO_2 bottles, mounted on either side of the nose wheel well, and controlled by the flight engineer with a selector valve and individual release cables mounted on the engineer's auxilliary panel.

b. The CO_2 discharge ring for each engine was reworked to conduct CO_2 into the impeller housing. All but 5 of the holes in discharge ring are plugged and one end is connected to the impeller housing just below the carburetor. Thus, 90% of the CO_2 is discharged into the impeller housing. A check valve, set to open 15 PSI, is installed

to take care of pressure differentials between the impeller housing and outside air.

c. On fuel injection engines it is not necessary to direct the CO_2 into the impeller housing. The discharge ring has not been reworked so all the CO_2 is discharged into the accessory section.

d. In addition, each airplane is equipped with three portable CO_2, hand operated, extinguishers; one each in the fore and aft pressurized compartments and one in the aft unpressurized compartment.

2. Cabin Fires in Flight. a. Depressurize the cabin by pulling the emergency cabin pressure release cable on the airplane commander's control stand.

b. Close the cabin air control valves; controls located on the engineer's control stand.

c. All crew members will go on pure oxygen, and if smoke in pressurized compartments becomes too intense, lower nose gear and open nose gear hatch and aft pressurized bulkhead door.

d. Direct the CO_2 charge at the base of the fire until the fire is extinguished.

e. If the fire originates from a short circuit in the electrical system, turn the generators, battery, and putt-putt off before using the fire extinguisher. Repair the malfunction before turning the power on.

CAUTION: Engine driven fuel pumps not sufficient for fuel flow above 15,000 feet.

f. If the fire is uncontrollable and there is danger from an explosion, the airplane commander will order the crew to bail out.

WARNING: If the cabin becomes excessively smoky or gaseous, oxygen masks will be worn and plugged into either the station outlets or portable bottles and the auto-mix control set on pure oxygen.

3. Nacelle Fires on the Ground. If the fire is known to be a torching turbo, put it out by momentarily increasing the throttle setting. For other engine or nacelle fires, proceed as follows:

a. The airplane commander notifies the control tower to send a fire truck.

b. Mixture controls - fuel cut-off.

c. Fuel shut-off valves - off.

d. Fuel boost pumps - off.

e. All switches - off.

f. Set the CO_2 selector on the proper engine and pull the CO_2 release cable(s).

g. If necessary, direct the ground crew or flight crew members to use the portable CO_2 extinguishers.

NOTE: The engine CO_2 system is for fires in the nacelle and is not effective against fires in the engine proper.

4. Nacelle or Engine Fires in Flight. a. The crew member spotting the fire places his jackbox position selector on "c 11" and reports "Fire on___engine" (if possible, the crew member identifies the type and location of the fire).

b. The airplane commander closes the throttle, feathers the propeller, and orders the flight engineer to "use the engine fire procedure."

c. The engineer moves the mixture control on the feathered engine to fuel cut-off, closes the fuel shut-off valve, turns the boost pump off, and opens the cowl flaps to 10°. (Oil shut-off valve "off," if applicable.)

d. The airplane commander will increase the airspeed by diving the airplane, in an attempt to blow out the fire.

CAUTION: Do not dive the airplane unless the propeller is fully feathered, and close cabin air valves to keep smoke out of pressurized compartments.

e. If the fire cannot be blown out, set the CO_2 selector valve to the proper engine and pull the release cable(s).

f. If the fire is uncontrollable, the airplane commander will order the crew to abandon the airplane.

NOTE: If the fire is in an inboard engine, close the proper cabin air valve control and transfer the vacuum selector valve to the remaining inboard engine. The airplane commander orders the gunner to open the aft pressure door for ventilation. If additional ventilation is required, the pilot may open nose gear hatch.

5. Induction Fires. Indications of an induction fire are as follows:

a. A sudden increase in CAT to the maximum limit.

b. A decrease in manifold pressure.

c. Dense black smoke from the exhaust.

d. Dense white smoke billowing from the exhaust (advanced stage). The fire procedure is the same as for nacelle or engine fires.

Section X - Flap Operation

1. A portable emergency motor in the aft bomb bay, at the rear wing spar, permits the emergency operation of wing flaps and, depending on the airplane series, may be used for emergency operation of the landing gear. This motor is normally stowed in the flap operating position. If the normal system fails to operate the flaps, place the flap switch in neutral and check the fuse. If the fuse is good, proceed as follows:

a. Connect the cannon plug and place the switch on top of emergency motor in the "flaps down" position. Return the switch to normal when informed by the pilot that the flaps are in the desired position.

WARNING: Do not operate the motor beyond the flaps up or down position. When operating the emergency motor, stay on the interphone at all times.

b. Use the reverse procedure to raise the flaps.

c. As a last resort, place the normal flap and emergency motor switch in the "flaps up" or "down" position as may be desired. This will allow both the normal and emergency motors to operate the flaps in case of binding actuating screws or a warped torque shaft. However, the switch on top of the emergency motor must be in the same cooresponding position as the normal flap switch or the normal and emergency motors will work against each other.

2. Recent airplanes incorporate a control for the emergency wing flap motor on the pilot's aisle stand. This switch is connected in parellel with the switch on the emergency motor noted in the preceding paragraph. Care should be taken in using this switch. It is placed in the "off" position when the flap indicator shows the flaps to be at the desired position. This precaution must be observed since there are no limit switches in this circuit.

NOTE: For emergency flap operation, do not depend on the hand crank stowed forward of the rear entrance door, or the landing gear crank. Neither of these cranks will fit the flap socket.

Section XI - Icing Conditions

1. Carburetor Ice. a. To eliminate carburetor ice, indicated by engine roughness and a drop in manifold pressure, increase power to 2400 RPM and appropriate manifold pressure and close the intercoolers, and by use of interwarmer to maintain CAT in modified aircrafts. When the ice is eliminated, maintain carburetor air temperature (CAT) between 25 and 38°C by closing the intercoolers and, if necessary, by increasing the turbo boost and decreasing the throttle setting.

   b. On airplanes that have been modified to include the interwarmer type carburetor heat system the following procedure will be used to avoid carburetor icing:

      The intercooler flaps will be in the fully closed position. To apply carburetor heat place the interwarmer heat valve switches in the hot position, and open intercooler flaps slowly. The carburetor air temperature depends directly on the intercooler flap opening. The heat rise will increase very rapidly as the intercooler flaps are opened, which will result in excessive carburetor air temperature if the temperature gages are not watched very closely. The green range is the normal operating range of the intercooler shutter, with the heat valve in the hot position, very little additional heat rise will be available by further opening of the intercooler shutter and should not be used during flight, because of the drag imposed.

2. To prevent or eliminate PITOT TUBE ICE, turn the pitot heaters on before entering icing conditions.

3. Propeller Ice. a. To prevent propeller ice, turn on the anti-icing pumps and control the speed with the rheostats, mounted below the engineer's control stand, according to the severity of icing.

NOTE: If icing is anticipated before take-off apply a coating of 314 compound to the prop blades and cuffs. To eliminate Wing Ice, use the de-icers intermittently to break the ice off after a thin sheet has formed.

b. On airplanes that have been modified to include the prop thermal de-icing system, to avoid prop ice, place the control switches (Engineer's position) in the ON position. Check the lights for operation of the system. Each light should stay on 12 to 15 seconds.

NOTE: Coating of 314 compound is unnecessary with this type of de-icing equipment.

4. On aircrafts that have the NESA GLASS TYPE WINDOWS installed, electrical heating of the glass is provided by turning on switches on engineer's panel. Windows 1, 2 and 5 on both the airplane commanders and pilots side are heated. This is to prevent the loss of visibility due to frost covered windows. Windshield wiper is also provided (Control valve located to left of Instrument panel).

Section XII - Landing Gear Operation

1. Electrical Operation. Some early airplanes are equipped with normal and emergency motors for the operation of the landing gear. These motors are remotely controlled from inside the airplane and obtain power from dual normal electrical systems. If normal operation fails, proceed as follows:

a. Make sure all operating generators and the putt-putt are turned on.

b. Check the fuse in the pilot's aisle stand. If this fuse is burned out, replace the fuse and try the normal gear switch again. If the fuse burns out again, return the gear switch to neutral. Replace the fuse and continue with the emergency procedure.

c. Pull the emergency landing gear door release handle and hold it out until the doors are fully opened, place the emergency gear switch in "up" position for approximately five seconds in order to lift the gear off the doors. If the doors still do not open, continue holding the door release handle out and try to force the gear through the doors. The emergency gear motor, in some cases, will force the gear to push the door open, provided the release handle is held completely out during the operation of the emergency motor.

d. If the emergency gear switch does not operate the emergency motors as indicated by current draw or motion of the gear, it may be possible that the solenoid is not operating. This may be checked by removing the cover of the solenoid and watching for operation of the plunger while the switch is actuated. If the solenoid fails

to close electrically, it may be closed manually by pushing on the contact arm. If the defective gear does not move within ten seconds, return the emergency gear switch to neutral or discontinue manual operation of the solenoid.

CAUTION: If more than one gear is defective, operate only one emergency gear switch at a time. When the gear is down, do not continue operating the emergency motor since there are no limit switches in this system. Operator should always be on interphone while performing emergency operations.

e. If the foregoing attempts to lower the gear have been unsuccessful, and the nacelle doors are open and have operated electrically, it is possible to energize the gear screw with both the normal and emergency gear motors. This may be accomplished by placing both the normal and emergency gear switches to the "down" position at the same time.

f. If the nose gear alone fails to extend, the emergency procedure outlined above may be followed, except that the wheel well doors operate mechanically and have no effect on lowering the gear.

2. Mechanical or Manual Operation. A manual system for the extension and retraction of the landing gear is installed in recent airplanes. Drive shafts from the main landing gear retraction screws are routed into the rear bomb bay where they may be operated by the portable emergency motor, or by a hand crank. Cable control clutches disconnect the normal motors from the landing gear mechanism when the manual system is to be used. The same cable also releases the nacelle doors.

NOTE: On later airplanes, the nacelle door motors have been removed and replaced by a mechanical linkage. Pull handles, which formerly released the nacelle doors and disengaged the normal landing gear motor, now perform only the latter operation.

3. Main Gear Operation. a. The main landing gear is operated manually from a gear box installed aft of the rear wing spar and above each cat-walk in the rear bomb bay. The gear box on the right side (facing forward) operates the right gear; the box on the left operates the left gear.

b. If the gear fails to extend normally, return the switch to the "off" position and check the fuse in the pilot's aisle stand. If the fuse is not blown, proceed as follows:

(1) Pull the nacelle door release and clutch engagement handle. Allow the swaged ball on the cable to drop into the slot in the

handle bracket which retains the cable in the extended position. This puts a spring tension on the clutch lever, and also moves to mesh the clutch when the jaws are aligned. The engagement of the clutch on the manual side is simultaneous with the release of the clutch on the motor side.

(2) To raise the gear, insert the portable motor into the lower gear box socket and lock it in position. The switch on the motor controls the direction in which the gear travels. A decal on the motor and also on the airplane gives the correct switch position for both right and left gear operation.

CAUTION: The motor should be stopped approximately 2 to 3 seconds after the gear reaches either limit of travel. This is necessary since there are no limit switches in the circuit and damage to the motor or clutch will result if operation in excess of the above time limit is attempted.

(3) Always return the clutch handle to the normal (or in) position immediately after emergency extension or retraction is completed.

(4) In case of complete electrical power failure, the main gear may be operated by the hand crank. It is necessary to pull the clutch shifting cable as above in order to lower the gear by the hand crank. Use the upper position for retracting the gear and the lower position for extending the gear. It requires approximately 30 minutes to retract and approximately 20 minutes to extend the gear.

WARNING: Do not use the emergency flap switch on the pilot's aisle stand to control the portable emergency motor, when lowering the gear, since there is no good indication to the airplane commander when the portable motor clutch is slipping. The switch on the portable motor should be used by the operator in the bomb bay. Interphone connections are provided on the tunnel wall just aft of the rear wing spar and the operator should be on interphone at any time operation is attempted.

4. Nose Gear Operation. a. The nose gear may be operated manually from a gear box installed at the top of the nose gear screw. To operate the nose gear with this emergency system, proceed as follows:

(1) Remove the beam from the clamp on the pilot's armor plate stanchion and rotate to a horizontal position.

(2) Secure the beam with the eye bolt and wing nut to the bracket on the airplane commander's armor place stanchion.

(3) Remove the hand crank from under the entrance hatch and insert into the hole in the beam. Disengage the motor with the clutch lever. Moving the lever towards the right (facing forward) disengages the motor. A spring clip is provided on the handle to retain it in the engaged or released position.

(4) Unscrew the pressure sealing plug in the floor, using the hand crank as a wrench.

(5) Insert the crank in the gear box. Extension and retraction are each accomplished in 3 to 5 minutes.

(6) Always return the clutch handle to the engaged position after hand cranking, if the clutch has been released. Remove the crank and stow the beam.

NOTE: Instruction decals are installed in the airplane near the gear boxes to explain the operation of the manual landing gear systems.

b. On later model airplanes, a separate nose gear switch has been installed on the upper left of the engineer's station, near the cabin heat control switches, to provide for extension of the nose gear in case of fire or may be used for emergency extension of the nose gear if the motor is not burned out.

Section XIII - Runaway Propeller

1. Normal overspeeding of the prop, up to 3150 RPM should not be confused with a runaway prop, since it will normally be returned, to the pre-set RPM, by the governor. If the governor will not control the prop, proceed as follows:

a. Throttle back and bring the RPM and manifold pressure within limits (reduce manifold pressure to 40" or less to prevent excessive leaning out of the mixture and possibly detonation).

b. Maintain control of the RPM by intermittent use of the feathering button until a safe altitude is attained and then, if necessary, feather the

prop. On the Curtiss prop, control the RPM with either the RPM selector or feathering switch, leave the selector switch in the fixed pitch position and control the RPM manually or with the throttle.

CAUTION: On Hamilton props, do not use the feathering button over three times to control the prop. If, after three attempts, the prop is not brought under control, the prop must be feathered before all feathering oil is exhausted.

c. If the prop is not brought under control by the above procedures, reduce the CAS to a minimum consistent with safe control of the aircraft.

NOTE: Never feather an engine unless absolutely necessary. A little extra power may mean the difference between a crash landing or a successful take-off.

Section XIV - Runaway Turbo

1. A malfunctioning amplifier, high DC bus voltage or an overspeeding prop may cause a runaway turbo. If this situation is encountered, proceed as follows:

a. Throttle back until manifold pressure is below 40".

b. Check the bus voltage.

c. Check the amplifier and turbo control fuses or circuit breakers.

d. Change the malfunctioning amplifier.

e. If the malfunctions still exist, disconnect the amplifier and control the manifold pressure with the throttle until further trouble-shooting may be accomplished. If the power supply to the TBS becomes inoperative during flight, turn the TBS to zero and watch for a power surge when the power is returned. This surge is small and may be controlled with the throttle.

2. On aircraft with emergency turbo control switches, proceed as follows:

a. Place the emergency turbo control system automatic-manual selector switch to "manual."

b. Move the "open-close" control switch to desired MP.

c. Proceed as outlined in b, c, d and e above.

Section XV - Salvo

1. With normal electrical power, salvo release of bombs, unarmed, is accomplished by closing any one of three salvo switches located on the pilot's aisle stand, bombardier's panel, and the right sighting station in the aft pressurized compartment. With anyone of the salvo switches closed and the bomb bay tank safety switches in the "can salvo" position, power goes directly to the bomb door open solenoid, salvo indicator lights, and the bomb salvo relay.

2. If the electrical system is inoperative, open the bomb doors by pulling the emergency bomb door release, located on the airplane commander's control stand. Bombs may then be dropped singly by manually tripping the release lever on each bomb shackle.

3. Emergency Bomb Release (Revised): a. On later model aircraft fuel tank safety switches are arranged to salvo bomb bay tanks selectively. By this means, both tanks, or the lower tank only, in either or both bomb bays, may be salvoed. The switches for the forward bomb bay tanks are located in a salvo shield on the forward side of bulkhead 218. The switches for the rear bomb bay tanks are located in the salvo shield on the rear side of bulkhead 646.

b. This installation allows operation of the tank safety switches from within the pressurized compartments. The salvo time delay relays formerly located in the forward and aft bomb bays are included in the new salvo shields.

c. When the tank safety switches are in the "off" position, their respective tanks will not be salvoed even when the switches are thrown. In order to salvo any particular tank, its safety switch must be "on" and one of the four salvo switches must be held close for a period of four seconds.

CAUTION: Before entering the bomb bay when the airplane is on the ground, always turn safety shut-off valves to the "safe" position.

Section XVI - Turbo Surge

1. To eliminate manifold pressure surge at high altitude, advance the RPM and MP on the outboard engines until a fully opened throttle and related power setting is obtained, or until surge is eliminated. Reduce MP and RPM on inboard engines to balance this condition for best long range airspeed, or until cabin pressurization can just be maintained.

2. If the manifold pressure surge persists, advance RPM (approximately 50 to 100 RPM) on all affected engines, or until surge is eliminated. Balanced power between the opposite sides of the airplane must be maintained.

CAUTION: The above procedure may give unrelated power settings which are undesirable and should be eliminated as soon as possible.

3. A few other measures that can be taken, if turbo-surge persists are as follows:

a. Place propeller(s) on engine(s) that are surging in fixed pitch.

b. Have engineer place the manual control for the waste gate in the Manual position.

c. A third method is to reduce the manifold pressure and still have full throttle position by individual re-setting the set-screw(s) for the turbo(s), on pilot's aisle stand.

NOTE: Be sure to reset screws before landing as an unbalanced power condition is effected.

Section XVII - Unfeathering Propeller

1. The airplane commander will close the throttle, set the RPM at the low limit, and tell the engineer: "Unfeathering No.___engine," and depress the feathering button until 600-1000 RPM is obtained. The flight engineer will proceed as follows:

a. Ignition switch-on.

b. Fuel shut-off valve-open.

c. Fuel boost pump-on.

d. Mixture control-auto-rich.

e. Warm up the engine at 1200 RPM, then notify airplane commander to synchronize the power with that of the other engines.

CAUTION: On the Hamilton propeller, only enough of oil is available for 1 1/2 cycles of operation; i.e., feathering, unfeathering and feathering.

2. The procedure for Curtiss props is the same as for the Hamilton except the RPM selector switch must be placed in the manual position.

CHAPTER 6

AIRCRAFT SYSTEMS

Section I

Cabin Pressurization and Air Conditioning

1. Compressed air, for pressurizing the fuselage compartment, is supplied by the inboard turbos of the inboard engines. The duct take-off is located between the turbo compressor and the intercooler. Compressed air is inducted through this cabin air duct, through the aftercooler, and into the cabin through the cabin air valve. This applies only when the cabin air valve is open.

2. When the cabin air conditioning system is used, the aftercooler flap is closed to provide heat and opened to provide cooling. With the after cooler flap closed hot air from around the exhaust shroud is directed through the aftercooler to heat the cabin air. With the aftercooler flap open, cool air is directed through the aftercooler, overcoming the heat of compression and reducing the temperature of air going into the cabin.

3. Air is released from the cabin by two automatic regulators in the rear pressurized compartment, which maintain the following cabin pressures:

0 to 8,000 feet - Pressure differential of 1" Hg.
8,000 to 30,000 feet - Cabin altitude 8,000 feet.
30,000 to 40,000 feet - Constant differential 13.34" Hg. Cabin altitude increases from 8,000 to 12,000 feet.

4. Pressurizing procedure. a. Under normal conditions, begin pressurization immediately after the putt-putt is stopped. Close all windows, pressure doors, and the cabin pressure relief valve (under left side of engineer's seat). Open the cabin air valves on the engineer's control stand.

NOTE: Be sure that the knurled knobs on top of cabin pressure regulators, located at forward end of rear pressure compartment are unscrewed, as these regulators will not operate if the knobs are screwed down. When leveling out for cruising, the airplane commander sets up predetermined power. If cabin air flow is then too low with cabin air valves full open, the airplane commander will increase turbo boost slightly and retard throttles to desired manifold pressure.

b. Cabin air flow desired is the minimum flow which will maintain cabin altitude (see above table), and not more than low flow at altitudes above 33,000 feet.

c. For maximum engine efficiency, set turbos at a minimum to maintain the desired cabin air flow. If the cabin pressure regulators are not operating properly, screw down the knurled knobs on

the cabin pressure regulators and regulate the cabin pressure with the cabin air valves and cabin pressure relief valve.

d. When operating above 30,000 feet, the flight engineer should not allow the cabin pressure differential to exceed 13.34" Hg.

e. Either the airplane commander or the pilot in the front pressurized compartment, and one crew member in the rear pressurized compartment will use oxygen when pressurized above 15,000 feet. Each remaining crew member will have his oxygen mask attached to the left side of his helmet, with the hose plugged into the oxygen system, ready for instant use. If the cabin is suddenly de-pressurized, crew members should use oxygen immediately to prevent suffering from the lack of oxygen. A sudden increase in cabin altitude should not be harmful unless flying above 30,000 feet, in which case some crew members may experience a temporary painful reaction from the "bends."

f. If power is set for long range cruising, it may be necessary to run the inboard engines at a higher RPM than the outboard engines, to provide the additional boost necessary to pressurize the cabin.

g. When pressurizing at high altitudes, open the cabin air valves slowly to maintain a 1,000 ft. per minute rate of descent. Differential pressure may sometimes seal up a leak, suddenly, during pressurization procedure. This might cause a rate of descent far beyond 1,000 feet per minute. So while pressurizing, until cabin altitude is stabilized, watch the cabin rate of descent closely and be prepared to adjust the cabin air valves if the rate of descent changes.

NOTE: Manifold pressure changes should be made gradually, as rapid throttle movement will interrupt the cabin air flow, resulting in a rapid change in cabin altitude.

CAUTION: The right hand valve at station 646, controlling the flow to the tail gunner, should never be more than one-half closed.

5. Depressurization procedure. a. The cabin may be depressurized by closing the engineer's cabin air valves and opening the engineer's cabin pressure relief valve, if necessary. In emergencies the cabin may be depressurized by pulling either of two emergency cabin pressure release handles (airplane commander's control stand, and right side wall of the rear pressure compartment near the forward bulkhead).

b. Always depressurize in case of fire or when preparing to abandon plane.

6. Air conditioning procedure. a. The 4-position switches, to the left of the engineer's panel, control the position of the aftercooler flaps, thereby heating or cooling the cabin. To air condition the cabin, the airvalves must be open to allow an air flow; however, the cabin need not be sealed or pressurized. With the switches set at "heat," aftercooler flaps are closed to provide maximum cabin heat. With switches set at "cool," aftercooler flaps are full open to provide maximum cooling. When operating manually, these switches are spring loaded to the off position.

b. Hot weather operation.

(1) Open all pressure doors.

(2) Cabin temperature controls torheostat.

(3) Cabin air valves open.

c. Cold weather operation.

(1) Close all doors.

(2) Cabin temperature controls to rheostat.

(3) Cabin air valves open.

7. Cabin heater micropositioner. a. The micropositioner installation comprises two manually controlled rheostats on a common shaft mounted in a control box on the engineer's auxiliary instrument panel. One rheostat is wired to the left heat control dampner motor; the other is wired to the right motor. Each rheostat is in series with a polarized relay which controls the direction of rotation of its own dampner motor housing, driven by the dampner motor, maintaining voltage balance in the bridge circuit with the rheostat at the micropositioner.

b. The two, four-position toggle switches, at the engineer's auxiliary switch panel, are used for cabin air conditioning control. Switch positions are: off, cool, heat, and rheostat. With the control switch in rheostat the micropositioner dial may be set to the desired position and the dampner will assume the same relative position. If both switches are in rheostat position, both dampner motors act together. Selective operation of either (or both) dampner motors is optional, each dampner being positioned individually by its

control switch. The heat and cool positions of the switch are momentary positions and over-ride the micropositioner for selective control of the dampner motors. After selective positioning, the spring loaded switch returns to off, and the dampner remains fixed until additional heating or cooling is desired.

c. The dampner control motor operates through a 90 degree range. Cam operated limit switches are installed in the motor housing to limit the travel when the direct motor control switch is used. (selective operation). Since no adjustment is provided in this limit switch assembly, any regulation between the motor and the dampner travel must be made in the connecting linkage. When making motor replacements, it is recommended that the dampner be closed before installing the serrated bell-crank on the new motor shaft. Also, make certain that the motor is in the closed position. This permits correct travel of the complete assembly without disturbing the connecting linkage.

8. Cabin leakage test. a. Altitude from 20,000 to 25,000 feet.

b. One cabin air valve closed; one set to give air flow reading of 6.

c. Cabin rate of climb indicator should stay at zero, and cabin altimeter should indicate constant altitude.

Section II

C-1 Autopilot System

1. Operation:

a. Turn control "center."

b. Turn on master switch (Pilot).

c. Wait 10 minutes.

d. Turn on Servo-PDI switch (Pilot).

e. Manually trim airplane for straight and level flight (Pilot). Check with instruments.

f. Disengage autopilot clutch (Bombardier).

g. Move clutch arm to center PDI (Bombardier).

h. Press down on directional arm lock to keep PDI centered (Bombardier).

i. Put out both aileron tell-tale lights by adjusting aileron centering knob (Pilot).

j. Snap on aileron switch (Pilot).

k. Check gyro horizon and readjust aileron centering knob to level wings (Pilot).

l. Put out rudder tell-tale lights with rudder centering knobs (Pilot).

m. Snap on rudder switch (Pilot).

n. Reengage autopilot clutch (Bombardier).

o. Release directional arm lock (Bombardier).

p. Readjust rudder centering knob to center PDI if necessary (Pilot).

q. Put out elevator tell-tale lights with elevator centering knob.

r. Snap on elevator switch (Pilot).

s. Check altimeter and readjust elevator centering if necessary (Pilot).

(1) CAUTION: Never adjust mechanical trim tabs when the autopilot is fully engaged.

(2) EMERGENCY: The autopilot may be disengaged by one flip of the master bar. The pilot can also overpower the autopilot.

t. To adjust sensitivity (Pilot): Turn sensitivity knobs clockwise until controls chatter, then back off until continuous chatter stops.

u. To adjust ratio (Pilot): Adjust ratio knobs to give quick recovery without over-shooting. Observe wing tips, horizon, and PDI for evidence of plane hunt. If hunting exists, reduce the ratio in the corresponding axis.

v. Loosen dashpot (Bombardier) if minimum ratio settings fail to eliminate "hunting" of ship. Tighten dashpot if PDI recovery is still too slow after maximum ratio settings.

w. Coordinate Bombardier turns in the following manner:

(1) Be sure airplane is flying straight and level with PDI on zero (Pilot).

(2) Disengage autopilot clutch and move directional arm to extreme right or left. Hold against stop (Bombardier).

(3) Adjust turn compensation knobs (Pilot).

(a) Set bank trimmer to give an 18° bank (single ship only, 12 degrees maximum desirable by lead ship in formation).

(b) Set skid trimmer to center ball.

(c) Set up-elevator trimmer to maintain altitude.

(4) Engage autopilot clutch and allow stabilizer to recenter PDI (Bombardier).

(5) For a final adjustment of rudder and aileron ratio, watch closely the recovery from the bombardier's turn. If PDI returns to center before wings are level, rudder ratio is too high for aileron ratio. Reduce rudder ratio or increase aileron ratio, depending on whether recovery is too fast or too slow. If wings are level before PDI returns to center, aileron ratio is too high for rudder ratio. Reduce aileron ratio or increase rudder ratio, depending on whether recovery is too fast or too slow. (Pilot).

Section III

Maladjustments and their Correction

1. PDI CENTERED, BALL NOT CENTERED, IN STRAIGHT FLIGHT. This condition is caused by improper trimming, or centering with one wing low and opposite rudder applied to keep the airplane from turning. If this happens when flying on autopilot:

a. Readjust aileron and rudder centering, or

b. Disengage both rudder and aileron switches.

c. Disengage autopilot clutch and recenter PDI.

d. Adjust centering and reengage rudder and aileron switches.

2. BALL CENTERED, BUT PDI OFF. Correct by one of the following steps:

a. Readjust rudder centering, or

b. Disengage both rudder and aileron switches.

c. Disengage autopilot clutch and recenter PDI.

d. Adjust centering and reengage rudder and aileron switches.

3. PLANE HUNTS IN RUDDER AXIS, AND PDI WAVERS. This is caused by improper setting of ratio or dashpot. To correct:

a. Loose locking collar and unscrew dashpot 1/8 turn while holding down locking solenoid. Repeat this process until hunting ceases.

b. If loosening the dashpot does not eliminate the rudder hunt, reduce rudder ratio. After changing the ratio, check rudder centering and skid trimmer adjustments; then tighten dashpot to a setting just above that which produces a hunt.

4. TURN COORDINATED IN ONE DIRECTION, BUT NOT IN OTHER. Plane not properly trimmed before starting turns.

a. Return to level flight and readjust aileron and rudder centering, or

b. Disengage rudder and aileron switches, retrim manually, then recenter PDI before reengaging.

5. PLANE SKIDS WHEN TURNING ONE DIRECTION AND SLIPS WHEN TURNING THE OTHER DIRECTION. Disengage autopilot and check manual trim of airplane; then recenter and reengage.

6. HUNTING IN A TURN, AND NOT IN STRAIGHT AND LEVEL FLIGHT. Readjust skid trimmer until hunt ceases, even if necessary to introduce a slight skid.

7. LOSS OR GAIN OF ALTITUDE.

a. In straight and level flight, correct by using the elevator centering knob.

b. In bombardier's turn, adjust up-elevator trimmer (elevator compensation) and increase elevator ratio. In a bombing run, maintain altitude by use of elevator centering knob.

8. PLANE WALLOWS OR LACKS STABILITY. For a condition of general lack of stability (not a hunt), increase sensitivity adjustments.

9. PDI OVERSHOOTS. In Bombardier's levelout, if the PDI overshoots, increase the aileron ratio.

10. PDI UNDERCORRECTS. In Bombardier's levelout, if the PDI undercorrects, decrease the aileron ratio until the PDI comes back to center.

Section IV

Electrical System

1. General. a. The electrical power is supplied by six, 28 volt, 300 amperes, engine-driven generators, a 24 volt, 34 ampere battery, a 28 volt, 200 ampere auxiliary generator, and two 750 volt-ampere inverters (recent B-29A aircraft have two 2500 volt-ampere inverters).

   NOTE: Amperage pull for various electrical units in aircraft are as follows:

   ATC Radio - - - - - - - - - 35 AMPS

   C-1 AUTO PILOT - - - - - 6 "

   Flaps - - - - - - - - - - - 350 "(in flight)

   Hydraulic pressure pump - 110 "

   Landing lights - - - - - 52 "

   Main Landing Gears - - - 460 "

   Nose Landing Gear - - - - 155 "

   b. The engine-driven generators cut in at 1100 RPM and reach their maximum voltage out-put at 1375 RPM. These generators are controlled by switches on the engineer's control stand.

   c. Seven load indicators, on the engineer's panel, provide a system for checking the amperage load on each generator, including the auxiliary generator. A voltmeter, with a selector switch, provides a system of checking the voltage out-put of the engine-driven and auxiliary generator.

   d. The electrical current terminates at a main bus bar and is distributed to the various electrical equipment through a series of bus bars, power junctions, and electrical conductors.

2. Electrical System (Revised). a. On later model aircraft, the DC power system is revised as follows:

   (1) The reverse current relays, current limiters, capacitors, and circuit breakers have been relocated from the nacelle solenoid panels into two electrical shields inside the fuselage. The new shields are located on the upper surface of the center wing section at approximately the intersection

of body station 400 with right and left wing stations 40.

(2) The generator positive circuits, consisting of three wires each, are brought directly into these shields along the front spars. The generator negative circuit has not been changed. A double wire runs from each reverse current relay shield to the inboard nacelle relay panels and a single wire connects the inboard and outboard solenoid panels. The right and left reverse current relay shields are interconnected by two wires. The fuselage power feeder system has been revised by adding a new circuit on the left side leading aft, and a new circuit on the right side leading forward. The aft power circuits are connected between junction shields 195 and 539 aft of bulkhead station 834. The forward circuits are joined between the engineer's aft fuse panel and junction shield 586. The forward and aft power circuits form two complete loops, thus decreasing the system's vulnerability.

(3) The reverse current relay shields are vented to the left side of the fuselage just forward of the wing leading edge.

(4) The purposes of these changes are:

(a) To improve voltage regulation.

(b) To improve accessibility of generator control.

(c) To decrease airplane weight.

(d) To decrease electrical system vulnerability to gunfire. (See the DC power distribution chart on page 84 .)

(5) The formation, position, identification and landing lights are of the conventional type. Wheel well spot-lights, controlled from the engineer's panel, illuminate the gear at night for a visual check.

b. Paralleling the generators.

(1) Start the putt-putt, leaving the generator and equalizer switch off.

(2) Adjust the voltage regulators, one at a time, to read 28 volts at the bus bar. The generator switch should be turned off while adjusting the regulator for voltage out-put.

NOTE: Voltage regulator should be allowed to warm up thoroughly before paralleling is attempted.

(3) Turn all engine-driven generators on.

(4) Parallel the system by adjusting the voltage regulators until the generators give an equal load indication (10% differential indication allowable).

(5) Turn the putt-putt generator and equalizer switches on, then parallel with one engine-driven generator, as above, so the putt-putt takes approximately one-half of the load.

NOTE: Only qualified personnel will parallel the generators. Three or four gun amplidynes should be turned on to give a 100 to 150 amp load.

c. Putt-Putt.

(1) The auxiliary generator is driven by a ten horse power putt-putt. This unit should be serviced with 100 octane fuel and SAE No. 30 oil.

(2) Starting.

(a) Equalizer switch - off (if applicable).

(b) Throttle lever - idle (If OAT is 0°C or below, place the lever in the choke position).

(c) Ignition switch - on (may be controlled by the engineer or putt-putt operator).

(d) Place the gang switch to the start position. When the putt-putt is running, return to the off position.

(e) Warm up the putt-putt at idle for approximately three minutes.

(f) Advance the throttle to the run position.

(g) Generator switch - on.

(h) Equalizer switch - on. (if applicable).

(3) Stopping.

(a) Equalizer switch - off (if applicable).

(b) Generator switch - off.

(c) Retard the throttle to idle and allow the putt-putt to cool a few minutes.

(d) Ignition switch - off.

NOTE: The control switch on the engineer's panel is for stopping the putt-putt only in emergencies.

(4) Emergency operation. In the event of complete electrical power failure, emergency operation is accomplished by placing the emergency ignition switch in the on position and using the hand cranking rope.

3. AC Power System. a. The alternating current is supplied by two, 400 cycle, 750 volt-ampere inverters, controlled by switches on the engineer's panel.

b. Normal operation is accomplished by placing the control switch in the main position. In case of normal inverter failure, or if the voltage drops below 70 volts, an automatic change-over relay automatically switches the alternate inverter on. A manual over-ride switch also operates the alternate inverter in case the automatic change-over relay is inoperative.

c. A voltmeter and two indicator lights are mounted on the engineer's panel, to check the operation and voltage out-put of both the main and alternate inverters. The normal voltage out-put is 110 to 120 volts. The minimum and maximum voltage limits are 105 to 130 volts.

d. On later model aircraft, the alternating current is supplied by two 2500 volt-ampere inverters. The automatic change-over relay and indicator light operation remain the same as on the older system. A volt-meter and selector switch is provided to check the normal and alternate (primary and secondary) inverter voltage.

e. The normal operating procedure is as follows:

(1) Secondary inverter switch - on.

(2) Voltage selector switch - on secondary. Check the voltage for 110 to 120 volts.

(3) Secondary inverter switch - off (this switch must be off to complete the automatic change-over relay circuit).

(4) Primary inverter - on main. Check voltage on the primary voltmeter.

(5) Primary inverter switch - off.

(6) After approximately five seconds, return the primary switch to main (this should transfer the inverter out-put to the secondary system). Check the voltage on the secondary voltmeter.

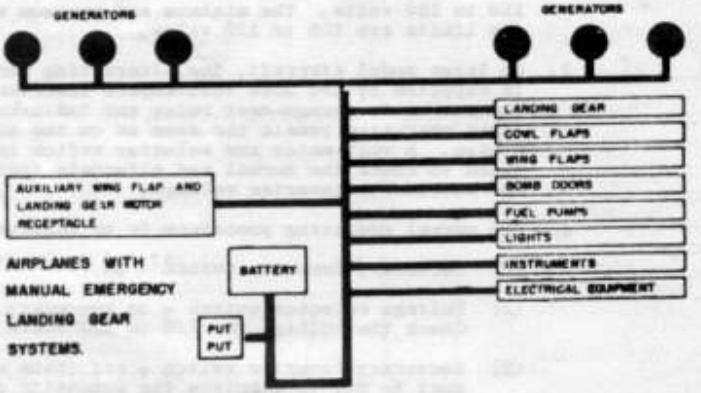
(7) Return the primary inverter switch to the off position. After 60 to 90 seconds, return the primary inverter switch to the main position.

(8) Operate in the main position.

(9) After take-off, and before any radar equipment is turned on, turn the secondary inverter switch on.

NOTE: In case either the primary or secondary inverter fails, turn off all unnecessary AC electrical equipment to prevent overloading the remaining inverter. (For distribution details, see the AC Power System on page 85)

D. C. POWER DIAGRAM



Section V - Fuel Systems

1. Transfer type. a. Fuel is carried in four wing tanks, a center wing tank, and auxiliary bomb bay tanks. The capacities are: inboard, 1415 gallons each; outboards, 1320 gallons each; center wing, 1315 (B-29A, 1120) gallons; auxiliary bomb bay, 640 gallons each. Various combinations of auxiliary tanks may be used.

   b. The wing tanks are vented to positive pressure, anti-syphon vent valves, on either side of the fuselage, near the leading edge of the wing. The auxiliary tanks are vented to the lower side of the fuselage.

   c. Fuel boost pumps, operated by switches on the engineer's control stand, supply pressure for engine starting, vapor elimination at altitude, and for engine operation in case of engine-driven fuel pump failure. In case of engine pump failure, the engine should not be operated with turbo boost, since the boost pump fuel pressure will not increase with carburetor deck pressure.

   d. If turbo boost is used, dangerously lean mixtures will result in detonation and possibly in induction fires.

   e. Fuel shut-off valves are provided to stop the fuel flow in case of line failure, fire, etc. These valves are electrically controlled by switches on the engineer's control stand.

   f. Fuel is transferred by two reversible pumps, controlled by circuit breakers, directional control switches, and tank selector valves on the engineer's control stand.

   g. Fuel may be transferred as follows:

      (1) Between the front and rear bomb bay tanks.

      (2) Between the rear bomb bay and tanks three and four.

      (3) Between the front bomb bay and tanks one and two.

      (4) From the center wing tank to any other tank and vice versa.

      (5) Across the center line of the airplane; i.e., tanks one and two, to three and four (to transfer fuel from tank three to tank four, the fuel must be transferred across the center line of the airplane to tanks one or

two or to the center wing tank and then to tank four).

h. Fuel flow indicator lights are provided as a positive check on fuel transfer. These lights will operate only if fuel is flowing, under pressure, from one tank to the other.

NOTE: Leave transfer circuit breakers on at all times to prevent excessive chipping and arcing.

2. Manifold type fuel system. a. The manifold fuel system comprises a single manifold line, along the aft side of the rear wing spars, through which fuel is routed to the engines from any one or all tanks, through a series of fuel shut-off and check valves.

b. Each tank has an individual fuel boost pump to supply fuel to the manifold line and to the engine fuel pump. (See diagram on page 90)

c. The boost pumps and fuel shut-off valves are controlled by switches on the engineer's control.

d. Normal operation. The correct operating procedure is as follows:

(1) Engine starting, take-off and landing.

(a) Auxiliary tank boost pumps - off.

(b) Auxiliary tank and manifold shut-off valves - closed.

(c) Engine and main tank shut-off valves - open.

(d) Main tank boost pumps - on normal.

(2) Auxiliary tank use.

(a) Auxiliary tank and manifold shut-off valves - open.

(b) Auxiliary tank boost pump - on.

(c) Main tank boost pumps - off.

(d) When approximately 60 gallons of fuel remain in the auxiliary tank, turn on the main tank boost pumps for three engines, operating only one engine on the auxiliary tank until the fuel supply is exhausted. Turn on the remaining main tank boost pumps. Repeat this procedure for the remaining tanks.

NOTE: Fuel should be used from the auxiliary tanks as soon as a safe altitude is attained (3,000 feet above the ground).

(3) Operational check of fuel shut-off valves. To check No. 1 engine and main tank shut-off valve:

(a) Turn off all manifold shut-off valves.

(b) Turn off the No. 1 main tank shut-off valve. Note drop in fuel pressure. Open the valve and pressure should return to normal.

(c) Repeat this procedure for the No. 1 engine shut-off valve.

(d) Repeat for the remaining engine and main tank shut-off valves.

(4) Auxiliary tank and manifold shut-off valve check.

(a) Auxiliary tank shut-off valve - open.

(b) Boost pump - on.

(c) No. 1 manifold shut-off valve - open.

(d) No. 1 main tank shut-off valve - closed.

(e) Auxiliary tank shut-off valve - closed. Note fuel pressure drop. Open the valve. Pressure should return to normal.

(f) No. 1 manifold valve - closed. Note fuel pressure drop. Open the valve. Pressure should return to normal.

(g) Repeat for all auxiliary tank and manifold shut-off valves.

(h) Main tank shut-off valves - open.

(i) Auxiliary tank boost pumps - off.

(j) Auxiliary tanks and manifold shut-off valves - closed.

NOTE: Valves are checked with the engines running to obtain a more accurate check.

3. Emergency operation.

a. Boost pump failure.

(1) Turn off defective boost pump.

(2) Supply the single engine from this tank using the engine pump to draw fuel provided airplane is operating below 15,000 feet. Above this altitude, it will be necessary to use the remaining tanks boost pumps pressure to eliminate vapor locks. It is possible to supply fuel to any engine without use of boost pumps; however, when using fuel from a tank without a boost pump, operate the shut-off valves so that the tank with the defective boost pump will supply fuel to the corresponding engine but will be isolated from any other tank which has its boost pump in operation.

b. Tank rupture.

(1) Manifold shut-off valve switches - open.

(2) Boost pump on high speed for the damaged tank.

(3) Boost pumps on all other tanks off. This will prevent all the fuel in the damaged tank from being lost. When fuel is consumed, turn on the remaining boost pumps and operate from the manifold. Place tank shut-off switch for ruptured tank to closed position.

c. Engine failure.

(1) Engine shut-off valve switch closed for the defective engine.

(2) Open all manifold shut-off valves and operate the remaining engines from the manifold.

(3) Make certain all four tanks are supplying fuel to manifold.

d. Manifold line rupture.

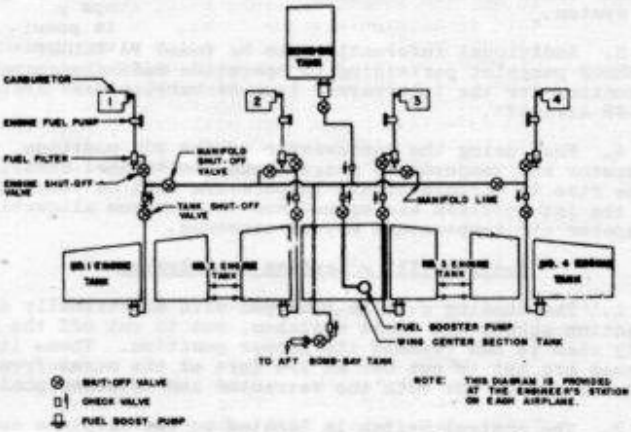
(1) Block the fuel supply to the damaged section of the manifold line by closing the necessary manifold shut-off valves.

(2) Operate tank to engine in region of failure.

NOTE: Damage to most sections of the manifold line will render it inoperative for further use. Thus, it would be impossible to balance all of the fuel supply or to make the fuel for a defective engine available to all operating engines.

MANIFOLD FUEL SYSTEM DIAGRAM

B-29 MANIFOLD FUEL SYSTEM



Section VI - Hydraulic System

1. The hydraulic panel, located under the floor at station 218, comprises an electrically driven hydraulic pump, pressure accumulator, cuno filter, automatic pressure switch, pressure relief valve, shut-off valve, and a check valve. Quick disconnect fittings allow the panel to be removed without losing the hydraulic fluid. The accumulator pressure should be bled before the panel is removed.

2. The pressure is automatically controlled by the pressure switch, between 1025 and 1225 PSI (plus or minus 25 PSI).

3. If all the fluid is lost, or the system is bled below 200 PSI, the pump will not operate.

4. A manual over-ride switch, on the engineer's control stand, provides manual control in case the automatic system fails or if the pressure is below 200 PSI. The switch is spring loaded to the automatic position.

Section VII

Interwarmer Type Carburator Heat System

Interwarmer Operation:

1. The control panel is located on the left side of the Engineer's panel above the cowl flap switches. This

panel contains four switches (hot and cold position) and four circuit breakers. The fuses for the intercooler flap motors are located in the Engineer's aft fuse panel.

2. Check lists are installed in each airplane using this system.

3. Additional information can be found in WRIGHT PATTERSON pamphlet pertaining to operation and maintenance instruction for the interwarmer type carburetor heat system on B-29 Aircraft.

4. When using the interwarmer in the HOT position, the carburetor air temperature gauge should be watched closely, as the rise in carburetor air temperature will be very rapid when the intercoolers are opened and the maximum allowable carburetor air temperature may be exceeded.

Section VIII - Landing Gear System

1. The landing gear is equipped with electrically driven retraction screws and limit switches, set to cut off the power supply when it has reached its proper position. These limit switches are set to cut out at 1/4 turn of the screw from the mechanical stops for both the retracted and extended positions.

2. The control switch is located on the airplane commander's aisle stand, or above and between the airplane commander and pilot, and serves to energize the solenoids according to the desired direction of gear travel.

3. Normal landing gear switch, main gear door motors, and normal nose gear motor are fused (the nose gear fuse is in the nose wheel well).

4. Two electrical retraction motors are installed for each gear (normal and emergency) with a 100 to 1 gear reduction. The emergency electrical system is replaced by a manual emergency system on all production airplanes. The operating circuit is as follows:

a. When the switch is placed in the down position, it energizes the down solenoid, which sends the current to the correct set of field windings in the nacelle door motor. When the doors are one-half turn from down position, power is transferred to the down field of the gear motor by a cam operated micro switch (in the wheel well). When the gear is down, power is cut off by the above mentioned limit switches.

b. For retraction, the power first goes to the up-fields of the gear motor. When the gear is 1/4 turn from the up position, power is transferred to the nacelle doors by the micro switch and power is cut from the nacelle doors at 1/2 turn from the fully retracted position, by cam limit switches.

5. The landing gear may be lowered at airspeed below 180 MPH.

6. Operation takes 40 seconds on the normal system; not less than 1 1/2 minutes on the emergency system.

7. A conventional system of warning lights is located on the pilot's instrument panel.

8. New system with mechanically operated doors takes 23 seconds for operation.

Section IX - Modified Cabin Heating

CABIN HEAT OPERATION:

1. The cabin heat is derived from two Stewart-Warner internal combustion heaters located adjacent to the tunnel over the front wing spar. The cabin air is heated as it passes through the heat exchanger within the combustion heater. Fuel for the heater is obtained from No. 2 Engine through a fuel panel on the left rear wing spar.

2. Additional information may be obtained from T/O 01-20ELA-2, however this T/O does not concern the B-29 directly.

3. Controls for the heaters are located to the left of the Engineer's panel over the intercooler switches. The blower switch and the blower and heater circuit breakers are located over the Engineer's Instr. panel.

4. The blower switch will be in the blower and ram air position for ground operation and operation up to eight thousand feet. A safety switch on each main landing gear prevents the operation of the blowers when the weight of the airplane is not on the landing gear. For operation above 8000 feet, the switch will be in the turbo position.

Section X - Nesa Glass System

NESA GLASS OPERATION:

1. The controls for the nesa glass are located on an auxiliary panel located to the right of the Engineer's Main Instrument Panel. This panel contains circuit breakers for the alternators, alternator controls, alternator failure lamps, inverter failure lamps, AC power selector switch and voltmeter, alternator switches for #1, #2, spare alternators and the switches for the operation of the nesa glass. Two circuit breakers for the nesa glass operation are located to the right of the Engineer and above the prop booster motors.

2. To avoid over heating and possible breaking of the nesa glass windows when the airplane is on the ground, use only the low side of the de-icing circuit momentarily.

3. The nesa controls and alternator switches will all be turned OFF before stopping engines to avoid possible draw on the batteries.

Section XI - Oil System

1. Each engine is supplied from an individual, 85 gallon capacity, self-sealing, hopper type oil tank. The oil is gravity-fed to the pump. The engine incorporates the oil and scavenger pumps, a cuno filter, and a relief valve.

2. An oil cooler is located in the oil return line, between the engine and oil tank. The oil temperature is controlled automatically by an automatic oil cooler shutter control, located in the oil cooler valve unit. A four position switch, on the engineer's control stand, provides manual operation in case the automatic control is inoperative. The switch positions are: open, close, automatic, and off. The switch is normally in the automatic position unless manual control is desired.

3. An oil dilution solenoid is incorporated and is connected into the "Y" drain. The solenoid is electrically controlled from the engineer's control stand.

4. If anticipated temperatures require oil dilution, refer to the pertinent T.O. for the required dilution periods. Oil dilution should be accomplished after the last flight of the day or when no warm-up take-offs are anticipated.

NOTE: Later model aircraft incorporate "gate type" shut-off valves. The valves cannot be operated until the fuel shut-off valve is closed. This prevents inadvertently stopping oil flow on an operating engine. Also, fuel flow may be stopped while oil circulation is maintained through a windmilling engine. Hence, in case of a fire, the following procedure must be used to shut off fuel and oil:

1. Place the fuel shut-off valve on affected engine in the off position.

2. Place oil shut-off valve in the off position (valve closing time is approximately five seconds).

3. No maintenance, adjustments, or test should be attempted on the valve.

Section XII - Oxygen System

1. The Demand Oxygen System is supplied by eighteen, type G-1, low pressure, shatterproof oxygen cylinders. The entire system is filled from one filler valve, located on the outside of the fuselage just forward of the wing root on the left side.

2. Each of the thirteen oxygen stations is supplied from two distinct distribution lines. The loss of one line, or its associated cylinder, still leaves each station with an alternate source of oxygen. The entire system is equalized by the use of crossfeeds, controller by automatic check valves. In the event of partial destruction of the system, all stations have equal access to the remaining oxygen supply.

3. Each oxygen station consists of the following equipment: either Demand or pressure regulator, pressure gage, flow indicator, low pressure supply cylinders, and filler and distribution manifolding.

4. The length of time that the oxygen supply will last varies with the individual requirements of the crew, their activity, temperature, altitude, and the equipment. However, with 400 to 450 pounds of pressure, and the automix on, there is more than ten hours' supply of oxygen for a crew of eleven men flying at 15,000 feet. The system is least economical at altitudes between 20,000 and 30,000 feet. Portable oxygen bottles are provided which may be refilled from the main oxygen system. A-4 bottles last approximately 4 to 8 minutes, depending upon the activity of the user and the altitude. These bottles are not equipped with auto-mix features and give only pure oxygen upon demand.

5. When a crew member is suffering from the lack of oxygen, open the emergency valve on his regulator, but leave the valve open only as long as necessary, as it will empty the system quickly. Leave auto-mix on at all times to conserve the oxygen supply.

Section XIII - Propeller System

1. Hamilton Hydromatic.

   a. The 16 1/2 diameter, four bladed propeller is a Hamilton Hydromatic, constant speed, full feathering type.

   b. The governor, mounted on the engine nose section, receives its normal oil supply from the nose section oil pump.

   c. The governor pilot valve is controlled by an electric head, by either increasing or decreasing the tension on the speeder spring. The electric head is controlled by RPM selector switches on the pilot's aisle stand.

   d. The feathering pump, controlled by feathering button on the pilot's aisle stand, receives its oil supply from a separate reservoir, containing a solution of hydraulic fluid and aircraft engine oil sufficient for 1 1/2 cycles of operation. (See feathering and unfeathering of propeller in emergency section)

2. Curtiss Electric Propeller.

a. The Curtis propeller installed on the B-29 is provided with hollow steel blades and incorporates an automatic synchronizer control system, an auxiliary selective fixed pitch control, reverse thrust control for landing, and a feathering system.

b. The electrical energy for changing the propeller blade angle passes through brushes, mounted on the rear base of the propeller hub, and to the electric blade angle change motor through connector leads passing through the hub. Electrical energy, directed by either the automatic synchronizer or the selective fixed pitch control to the electric motor, causes the blade angle to increase or decrease as required. The automatic synchronizer control system accomplishes synchronization of the four engines.

c. The synchronizer incorporates a master motor which drives four contactors, one for each propeller. Each contactor is electrically connected to an alternator (a 3-phase AC generator) mounted on the governor drive pad of each engine. The RPM of the master motor, selected by the airplane commander or pilot, maintains constant RPM at the selected setting. The contactors compare the speed of their respective engines, as indicated by the alternators, to the speed of the master motor and direct electrical energy to the blade angle change mechanism of the propellers of the maintaining the desired RPM.

d. In automatic operation, select the desired engine RPM by rotating the master RPM control, located on the aisle stand. The RPM at which the engines will synchronize is indicated by the master tachometer located on the pilot's instrument panel.

e. Propellers are controlled by switches located on the aisle stand and the reverse-actuating switches, located near the throttles, at the airplane commander's and pilot's stations. To operate the propellers automatically, place the master motor switch in the on position, and turn the master RPM control until the desired RPM reading is indicated by the master tachometer. Place the selector switch for each propeller in the automatic positions and, at the same time, check to see that the propeller circuit breakers, located just below the selector switches, are in the on position and that the auto-operation tellights, just above the selector switches, come on. The circuit breakers are in the automatic and selective fixed pitch circuits to protect them in the event of an electrical overload.

They may be reset by pushing in on the button until the red and white luminous bands are no longer visible. By placing the selector switch to fixed pitch position, you can use selective fixed pitch, as auxiliary control. Adjust engine RPM by holding the switch in the increase or decrease RPM position as required. Four feathering switches, under plastic guards, are installed on the aisle stand for feathering the propellers. Four voltage boosters are incorporated within the system for speeding up the blade angle change for feather, reverse, and return from reverse.

f. Reverse pitch is provided for use as a brake during landing. Propellers may be reversed either in pairs (i.e., inboards or outboards), or all four simultaneously.

g. Before starting. The following procedures must be worked into the proper sequence of the Before Starting Checklist when operating B-29 Curtiss electric propellers:

(1) Master synchronizer switch - on. Turn on the switch early enough to give the master synchronizer time to warm up.

(2) Propeller selector switches - automatic (Auto-tel-lites on).

(3) Propeller circuit breakers - on. Check the selector switches. Check the circuit breakers to be sure they are on.

Section XIV - Turbo - Supercharger System

1. Each engine has two turbo-superchargers which boost the manifold pressure for take-off and provides increased air pressure at high altitudes. Engine exhaust gas, passing through the collector ring and tailstack to the nozzle box of each supercharger, expands to atmosphere through the turbine nozzle, and drives the bucket wheel.

2. A ram air inlet duct supplies air to the turbo impeller which increases its pressure and temperature. In order to avoid detonation, the air is supplied to the carburetor by way of the intercooler, where its temperature is controlled. After entering the engine, the air is further pressurized by the internal impeller, resulting in a greater power output.

3. Turbo Control System.

a. A Minneapolis-Honeywell Electronic Turbo Regulator System is used to control the boost and is regulated by a master control located on the pilot's aisle stand. It contains one maste

potentiometer and four small calibrator potentiometers which require adjustment only to compensate for small differences in engine or turbo performance. Once the system is calibrated, the airplane commander may control the boost on all four engines simultaneously, by operating the master potentiometer.

b. The Pressuretrol is the sensing element and measures electrically the pressure of the air supplied by the turbo to the carburetor. This unit controls the automatic operation of the system to maintain pressure as pre-selected, regardless of atmospheric pressure changes caused by altitude variation. It is located on the upper left side of the engine nacelle, just above the access plate.

c. The turbo governor is a dual safety device driven by the turbo-supercharger through a flexible drive shaft. One part of the mechanism is called the overspeed control and prevents the turbo from exceeding its safe operating RPM limit. The other part, the accelerometer, anticipates the pressure increase from turbo acceleration and provides a signal to the amplifier, which opens the waste gate and prevents overshooting of the manifold pressure. This unit is located on the right side of each engine, directly in the rear of the turbo drive shaft. One governor is used to control both turbos.

d. The amplifier is an intermediate unit between the control units and the waste gate motors. It receives a positive or negative signal, according to the changes in manifold pressure and turbo speed, and sends the proper signal to the waste gate motor, opening or closing the waste gates as required. Amplifiers No. 1, 2 and the Spare are located above the navigator's table. Amplifiers No. 3 and 4 are under the navigator's table.

e. The waste gate motor operates in response to the amplifier current and control signals. It also operates a balancing potentiometer, producing a signal opposed to the original control signal. When the two signals completely neutralize, the waste gate motor stops. Therefore, the amount of waste gate operation is controlled by the size of the original signal. One waste gate motor operates the two waste gates through a mechanical linkage. It is located directly above and between the turbos.

NOTE: Normal overspeeding of the propellers up to 3150 RPM, caused by a power surge, should not

be confused with a runaway propeller. An overspeeding propeller will normally be returned by the governor to the set speed within a few seconds. Sometimes, after the feathering button has been used to return the prop to normal RPM, the governor will control the prop, if the airplane commander is careful not to apply sudden power to the engine. In this case, it would not be necessary to feather. Come in for a landing as soon as possible.

f. Runway turbo. The following is recommended on take-off or in flight for an electronic controlled turbo:

(1) Throttle back, bring RPM and manifold pressure within limits.

(2) Check fuses or circuit breakers in inverter relay shield.

(3) Change amplifier on turbo.

(4) If this does not remedy the trouble, leave the amplifier cannon plug disconnected.

NOTE: In event of runaway propeller or turbo, never feather an engine unless absolutely necessary.

g. If for any reason (such as electrical fire or excessive voltage) the inverters or power to the inverters is turned off during flight, the TBS should be set on "0". When power is returned to the amplifiers there will be a surge of manifold pressure, but if the waste gates are open and the pilot has his hands on the throttles it will be controllable. This surging lasts for only the short time that the amplifiers are warming up and should be anticipated.

h. In the case of only one amplifier being removed, anticipate the surge and control it with the throttle.

4. Turbo-supercharger emergency control system.

a. A new turbo-supercharger emergency control installation consists of a switch panel located directly above the engineer's escape hatch and provides a more flexible means of controlling the waste gate position in the event of failure to any part of the Electronic Turbo-Control Circuit.

b. The system provides a selector switch which is the two-pole, double-throw gang switch. This

switch transfers control of the turbo waste gate motor from automatic to manual in the event of a failure in the electronic circuit. Voltage from the ship's inverters, by-passing the amplifier circuit through the emergency control switch panel, is fed directly to the waste gate motor fields. Final control of the circuit to the waste gate motor fields is by the "open-close" control switch. In the event of failure in the turbo-control system, the desired manifold pressure will be set by the flight engineer, coordinating use of the emergency control system and the proper settings of the throttle.

c. Emergency operation.

(1) Place the automatic-manual selector switch to manual.

(2) Operate the open and close switch to maintain the desired manifold pressure.

CAUTION: Be on the alert to prevent turbo overspeeding and unrelated power conditions as affected by altitude changes. Excessive part throttle operations at higher powers should be avoided to prevent lean mixtures. The flight engineer must be especially careful in switching from automatic to manual during take-off. It would be disastrous to have a power loss of one engine and make an improper switch selection to that of an engine putting out maximum power. Always be on the alert and make the proper electrical power transfer for the defective engine.

Section XV - Vacuum System

1. Vacuum is maintained by the use of two vacuum pumps, on each inboard engine. Selection of these pumps is made by a cable controlled selector valve, with the control lever mounted on the engineer's stand.

2. Normal vacuum should read 3.8" to 4.2" Hg and is regulated by:

a. A relief valve (set at 6") in the engine nacelle.

b. Two Schwien regulators (under the navigator's chart case).

3. The air intake is at the airplane commander's instrument panel, and the air filter should be cleaned in accordance with the appropriate technical order.

4. Vacuum is supplied to the camera shutters at 2" Hg, and is regulated by a needle valve restrictor.