HEADQUARTERS SECOND AIR FORCE
Office of the Commanding General
Colorado Springs, Colorado

319.1 E

28 September 1943

SUBJECT: Standard Check Lists, Amplified Check Lists, Emergency Procedures, Pilot Transition Training Record, and Aerial Engineer's Pre-Flight Report.

TO : See Distribution.

1. By direction of the Assistant Chief of Air Staff, Training, a conference was held at Fort Worth by representatives of this Air Force and the Training Command for the purpose of standardizing subject matter.

2. It was agreed at this conference that the standardized check lists, amplified check lists, emergency procedures, and aerial engineer's pre-flight report would be put into effect immediately in both the Training Command and the Second Air Force. In order to do this, such forms as necessary will be reproduced locally, and all other forms in conflict therewith will be removed from the airplane or files and destroyed when substitution of the approved forms is made.

3. The pilot transition training record will be adopted immediately by the Training Command's Four-Engine Transition Schools and will be forwarded to the group concerned at the time of the pilot's transfer to the Second Air Force. A copy of this record is included for your information only. When sufficient Airplane Commanders are received from such Transition Schools to necessitate their going through the 18th Replacement Wing, this record will be sent to the 18th Replacement Wing and forwarded by them to the group concerned upon assignment of the pilot.

4. In order to place these approved forms into effect as quickly as possible, distribution of samples will be made direct to the groups concerned. The groups will reproduce the appropriate forms locally (i.e., B-24 Groups will only need to reproduce B-24 check lists; B-17 check lists for their information only). These forms will be reproduced exactly, including the heading. No deviation is authorized except upon authority of this headquarters.

By command of Major General STREETT:

G. R. DOUGHERTY,
Major, A. G. D.,
Asst. Adjutant General.

5 Incls:
#1 - Standard Check List
#2 - Amplified Check List
#3 - Emergency Procedures
#4 - Pilot Transition Training Record
#5 - Aerial Engineer's Pre-Flight Report

DISTRIBUTION: A-2, A-3, A-4, A-6.

Adopted
7 September 1943

OFFICIAL CHECK LIST

B-24D, E, AND G

BEFORE STARTING ENGINES

1. Form No. 1 Loading and Passenger List.
2. Engineer's Report.
3. Parking Brakes. --ON
4. Wheel Chocks.
5. Pitot Head Covers. --OFF
6. Control Check.
7. Generators. --OFF
8. Fuel Valves. --ON
9. Auto Pilot. --OFF
10. De-icers and Anti-icers Wing, Prop. and Carburetor. --OFF
11. Inter-Coolers. --OPEN
12. Main Line, Battery & Master Elec. --ON
13. Auxiliary Power Unit. --ON
14. A. C. POWER. --ON
15. Auxiliary Hydraulic Pump. --ON
16. Cowl Flaps. --OPEN
17. Turbo Controls --OFF
18. High RPM.
19. Idle Cut-Off.
20. Gyros Uncaged
21. Carburetor Air Filter. --AS REQUIRED

STARTING ENGINES

1. Fire Guard.
2. Ignition Switches. --ON
3. Booster Pump For Engine To be started. --ON
4. Start Engines
5. Flight Indicator. --CHECK OPERATION

BEFORE TAXIING

1. Check all Instruments
2. Vacuum Pressures. CHECK
3. Altimeter.
4. Brake Pressure

ENGINE RUN UP

1. Exercise Turbos, Flaps and Props.
2. Run Up Engines.

BEFORE TAKE OFF

1. Gyros. --UNCAGED
2. Wing Flaps. 20°
3. Generators. --ON
4. Booster Pumps. --ON
5. High RPM.
6. Trim Tabs.
7. Check Controls.
8. Cowl Flaps. TRAIL
9. Auto Rich.
10. Aux. Hydraulic Pump. --OFF
11. Doors and Hatches. CLOSED

AFTER TAKE OFF

1. Wheels.
2. Power Reduction.
3. Wing Flaps.

BEFORE LANDING

1. Radio Positions.
2. Crew Positions.
3. Automatic Pilot. --OFF
4. Booster. --ON
5. Auto Rich.
6. Inter-Coolers. --OPEN
7. Wing De-icers. --OFF
8. Auxiliary Power Unit. --AS REQUIRED
9. Landing Gear.
   a. Pressure
   b. Visual Locks.
   c. Light.
10. Electric Hydraulic Pumps. --ON
11. Brake Pressure
12. RPM.
13. Wing Flap Setting

FINAL APPROACH

1. Turbo Controls
2. Flap Setting
3. Airspeed Call-Out

END OF LANDING ROLL

1. Cowl Flaps. --OPEN
2. Wing Flaps. --UP
3. Turbos --OFF
4. High RPM.
5. Auto Lean.
6. Booster Pumps. --OFF
7. Trim Tabs-Reset
8. Generators. --OFF
   Aux. Power Unit - AS REQUIRED.

SECURING AIRPLANES

1. Engines
2. Radio
3. Switches
4. Chocks.
5. Gear Lever.
6. Controls Locked.

AAF TRAINING COMMAND AND SECOND AIR FORCE
OFFICIAL
PILOTS AMPLIFIED CHECK-OFF LIST
B-24D, E, AND G AIRPLANES

Adopted
7 September 1943

GENERAL

1. Form No. 1 -- Loading and Passenger List.
   a. Pilot will thoroughly check the Form No. 1 and Form No. 1A, and sign the exceptional release if necessary. He will ascertain that the passenger list is correct, that the proper type and number of parachutes and oxygen masks are aboard and that the airplane is loaded within the allowable C.G. limits.
2. Engineer's Report. See Annex #1. Contains all items on engineer's pre-flight check.
3. Set Parking Brakes. Depress pedals fully and set lever in UP position. Adjust seat, rudder pedals and safety belts.
4. Wheel Chocks. It is recommended that wheel chocks be used according to existing Technical Orders, with such variations as may be necessary to suit local conditions.
5. Pitot Head Covers removed.
6. Control Check.
   a. Unlock and stow strap.
   b. Check for fully depressed position of locking lever.
      (1) Full forward and full right on wheel. Full right rudder.
      (2) Full rear and full left on wheel. Full left rudder.
      (3) Controls Neutral.
      The sequence in 1,2,and 3 above may be varied.

Engineer will check and call out positions of control surfaces. Order of calling out will be Aileron; Rudder; Elevator.

7. Pilot will check with engineer to ascertain that generators are OFF.
8. Fuel Valves.
   a. 1 to 1, 2 to 2, 3 to 3, 4 to 4, for take-off.
9. Auto Pilot.
   a. All Auto Pilot switches must be OFF for take-off. This applies under ALL conditions.
10. De-icers (Wing).
    a. Valve in OFF position.
    b. Check full deflation of all boots, visually.

Anti-icers.
Check Propeller Anti-icer Rheostat OFF.
Check Carburetor Anti-icer Switches OFF.

11. Intercoolers OPEN. In the OPEN position cooling of the air being compressed by the Turbo supercharger is accomplished.
12. Main Line, Battery, and Master Electric Switches.
    a. Upon direction from pilot, co-pilot will check magneto switches OFF and turn on battery switches, Main Line "bar" switch and Master electric switch.
13. Auxiliary Power Unit.
    a. To be started by engineer at pilot's direction and left running until generators are turned on just before takeoff.
14. A. C. POWER.
    a. Check both inverters.
15. Auxiliary Hydraulic Pump.
    a. Leave off until other main switches are ON. Pilot checks with engineer that it is turned on at this time.
16. Cowl Flaps.
    a. Pilot and co-pilot check visually to be sure all Cowl Flaps are in full open position.
17. Turbo Controls.
    a. Place controls in OFF position.
18. High RPM.
    a. Hold switches in increase position and check all four lights ON.
19. Idle Cut-Off.
    a. Place mixture controls in Idle Cut-Off position.
20. Check Directional Gyro and Flight Indicator UNCAGED.
21. Check Carburetor Air Filter for proper setting. Filter should be used for dusty operations but should NOT be used when no dust is being encountered. Specific instructions will be issued when tests are complete.

STARTING ENGINES

1. Fire Guard.
    a. Visually check that Fire Guard is posted at proper station for engine to be started. ALL propellers must be clear during entire starting procedure.
2. Ignition Switches.
    a. Turn all ignition switches to "Both ON" before starting first engine.
3. Booster Pumps.
    a. Turn booster ON-only on engine being started.
    b. Check fuel pressures. Booster pumps should supply approximately 8 lbs. pressure before engines are started.

4. Start Engines.
   a. Prime 4 to 5 seconds with individual engine priming switch while starter is being energized. Energizing requires 12 seconds on NEW type starters and 20 seconds on OLD type starters.
   b. Set all Throttles at 1/3 open position.
   c. Mesh Starter. On OLD type starters the energizing switch is thrown over to MESH position. On NEW type, continue to hold energizing switch down and operate meshing switch.
   d. If engine does NOT fire immediately use additional prime.
   e. As soon as engine fires, move Mix Control to Auto Lean and check for oil pressure rise. Oil pressure MUST come up in 30 seconds to prevent damage to engine.
   f. If engine stops, return Mix to Idle Cut-Off and repeat whole procedure to re-start.
   g. Set throttle to obtain a steady idling speed of 1000 RPM.
   h. Turn booster pump off after engine is idling.
   i. Starting sequence:
      (1) Electrically: 3,4,2,1.
      (2) Manually: 1,2,3,4.

5. Flight Indicator.
   a. When engine operating vacuum pump is started, check Flight Indicator for rapid erection. This is an important operational test of the instrument and must be carefully checked to assure the pilot that this instrument is in good condition. Vacuum pumps are operated by No. 1 and No. 2 engines.

RADIO ON

1. Turn switches on desired Command Receiver to proper positions. Turn transmitter switch to ON. Set selector to desired transmitting frequency. Turn volume controls on Jack boxes to maximum output. Set selector switch on Filter box to Voice and selector switch on Jack box to Command.

BEFORE TAXIING

1. Check All Instruments for proper operation. Tolerable limits permit so much variance that no readings need be considered at this time.
   a. Oil Pressure.
   b. Oil Temp
   c. Head Temp.

d. Fuel Pressure.
e. Carburetor Air Temperature.
f. Free Air Temp.
g. Tachometers.
h. Manifold Pressures.
i. Hydraulic Pressures.
j. Clock.
k. Magnetic Compass.
l. Landing Gear Warning Light.

2. Vacuum Pressures.
   a. Switch valve and check pressure on both No. 1 engine and No. 2 engine. Pressure should be between 4 and 4-1/2 at 1000 RPM.
3. Altimeter.
   a. Radio check with tower. Obtain Landing Pressures, set on Altimeter, compare reading with surveyed elevation of field. Report any discrepancy of 50 feet or more to tower. Note whether instrument reads too high or too low, and how much, for future reference.
4. Brake Pressure
   a. Test brake pressure by depressing brakes and noting change in gauge reading.

ENGINE RUN UP

Note: All power settings in this manual are for 100 octaine fuel ONLY.

1. Exercise Turbos, Flaps, and Props.
   a. Place all mixture controls in Auto Rich and set throttles to obtain 1500 RPM.
   b. At 1500 RPM with Props in full high RPM position (lights on) slowly push turbo regulators to full ON position. Run Props to full low RPM. (Check for Maximum RPM drop and lights on,) then after 5 seconds, back to high RPM (Check for maximum RPM gain and lights on), and slowly return turbos to OFF position. Repeat procedure three times, if outside Air Temp is below 0° Centigrade.
   c. Co-pilot runs flaps down full 40° and up while pilot is exercising props.
   d. Set throttles at 1200 RPM. Return Mix to Auto Lean.
2. Run Up Engines in order No. 4, No. 3, No. 2, and No. 1.
   a. Set Mix to Auto Rich for engine to be run up. No. 4 engine.
   b. Open No. 4 throttle to 2000 RPM. Check mags. (Turn to L mag. and back to Both, turn to R. mag. and back to Both. Do not operate on one Mag. for more than 5 seconds at one period.) Roughness as determined by visual check of nacelles is a better check of ignition operation than RPM drop. Check BOTH.
   c. Advance throttle to full open position and HOLD. Check Engine instruments for proper readings.

d. Advance Turbo and set carefully to 47 inches. This setting allows 2 inches for ram during take-off run. Maximum allowable is 49 inches. During this operation the Turbo control lock should be tightened to provide the friction necessary to hold the control at set position. Excessive tightening is not desirable. Check RPM to read 2700 maximum.
e. Reduce throttle slowly to 1200 RPM and return Mix to Auto Lean.
f. Repeat with No. 3, No. 2 and No. 1 engines in this sequence.

BEFORE TAKE-OFF

1. Gyros.
   a. Pilot will set directional gyro to correspond to magnetic compass. When lined up for take-off, check reading to correspond with runway heading. This provides two checks, one on the Magnetic Compass and one on runway to be used.
2. Wing Flaps.
   a. Upon direction from pilot, Co-pilot will extend flaps to 20° down and confirm to Pilot. Old procedure of running flaps down on No. 3 engine run up is discontinued as unnecessary.
3. Generators.
   a. Upon direction from pilot, engineer will turn all four Generators ON. Turn auxiliary power unit OFF.
4. Booster Pumps.
   a. Upon direction from pilot, co-pilot will turn fuel booster pumps ON.
5. High RPM.
   a. Pilot will move gang switch to High RPM (forward position) and check all four green lights on.
6. Trim Tabs.
   a. Pilot will check Trim Tabs for proper take-off setting. Normal settings are 3° Right Rudder; 0° Aileron and 0° Elevator.
7. Check Controls.
   a. Pilot will move controls to Full Forward and Right on wheel. Full right rudder.
   b. Pilot will move controls to Full Rear and Left on wheel. Full left on rudder.

8. Cowl Flaps.
   a. Co-pilot will set Cowl Flaps to Trail, i. e., between 1/4 open and 1/3 open. Excessive Cowl Flap opening may cause tail buffeting on the take-off.
9. Auto Rich.
   a. Upon direction from pilot, co-pilot will place all Mix Controls in Auto Rich position.
10. Auxiliary Hydraulic Pump.
   a. Pilot will direct engineer that auxiliary hydraulic pump be turned off.
11. Doors and Hatches.
   a. Close Bomb Doors.
   b. Close and latch Top Hatch.
   c. Check Main Entrance Hatch. Closed and secure.

TAKE-OFF PROCEDURE

1. Rolling starts are normal and more easily controlled in the B-24 airplane. Standing starts present a problem in that it is desirable to make a Standing Start take-off, the brakes may be held until 25" of MP is attained and brakes then released carefully to maintain heading. Special attention must be paid to the alignment of the nose wheel. It MUST be allowed to roll as it is set for a few feet before turning air plane in with brakes.
2. Apply power smoothly until take-off power is attained. Co-pilot will follow through with left hand and when throttles are against Stop, will snub throttles enough to prevent creeping. (During take-off, co-pilot will watch to insure manifold pressure does not exceed 49" and props do not exceed 2700 RPM. Any power reduction necessary to maintain the maximum of 49" will be made with the throttles, Not with the turbo regulators.)
3. Pilot will allow ship to attain 70 MPH in 3 point position, then put ship in slightly nose high altitude and hold to 110 to 130 MPH, depending on load.

AFTER TAKE-OFF

1. Co-pilot will raise gear upon signal from pilot, this signal only to be given when pilot is positive airplane is flying and under complete control.
   a. If hand signal is used the standard thumb up signal will apply.
   b. Pilot will brake wheels before retraction is complete.
2. When sufficient airspeed is obtained pilot will reduce turbo regulators to approximately 45 1/2". Upon signal from pilot, co-pilot will reduce props to 2550 RPM. Co-pilot will then make even adjustment on turbo regulators at 45 1/2" and synchronize propellers. AT NO TIME WILL PROPS BE REDUCED BEFORE REDUCTION OF MANIFOLD PRESSURE.

3. At 800 ft. above terrain flaps will be retracted. It is recommended that flaps be left at 5° to 10° position for climbs on instruments and/or in turbulent air due to increased stability.

Engineer checks Wheels up and Turbos for torching at pilot's direction. Check wheels with flashlight at night.

CLIMB

1. a. Power Setting 2550 -- 45-1/2" maximum.
   b. Power Setting 2550 -- 41" minimum.
   c. Intermediate settings should be discouraged for training purposes to insure standard operation of the engines.
   d. Airspeed 150 to 160 MPH.
2. In setting turbos and throttles in the air it has been found desirable to adjust Outboards and Inboards in pairs; i. e., reduce or increase No. 1 and No. 4 together and No. 2 and No. 3 together to approximately the new settings, then adjust all four accurately.
3. Booster pumps should be turned off by co-pilot at pilot's direction. Co-pilot checks Fuel Pressure prior to turning off boosters and checks again as each pump is turned off in turn No. 1, No. 2, No. 3, No. 4.
4. Cowl Flaps.
   a. Cowl Flaps are to be used to regulate head temperatures. Co-pilot closes when and if temperatures permit. If cowl flaps are opened too far, tail buffeting will ensue.

CRUISE

1. Approach the cruising level from top side. After reaching cruising altitude, level off, get "ON THE STEP" and pick up speed before power is reduced to cruising requirements. If power is reduced too soon and before the airplane has picked up full momentum for cruising it will mush along in a high attack, high drag attitude in trying to gain speed under reduced power and will probably be quite sluggish. Approach the cruising condition from the top, both speed and altitude, NEVER FROM BELOW.
   a. Power Settings.
      (1) 35.5"--2325 RPM (75% of 1100) Auto Rich (maximum for continuous cruise).
      (2) 32"--2200 RPM (65% of 1100) Auto Lean (maximum for Auto Lean cruise).

b. Setting for ordinary training operation.
   (1) 30"--2000 RPM--Auto Lean.
c. Maximum Range Setting.
   (1) No average maximum range setting is practical. Refer to Cruising Control Charts in airplane and in manual.

2. a. Requirements for Automatic Lean Cruising.
   (1) Mixture Controls -- Automatic Lean.
   (2) Oil Temperature; 75° C. Max.
   (3) Oil Pressure; 65 to 100 PSI.
   (4) Cylinder Head Temperature: 232° C. Max.
   (5) Fuel Pressure: 14 to 16 PSI.
   (6) Cowl Flaps -- Closed if possible -- or as required.
   b. Setting for ordinary training operation 30" -- 2000 RPM -- Auto Lean. At altitudes where the manifold pressure available with turbo OFF permits, set throttles to 28" with turbo controls off. Then advance turbo control to obtain additional 2". At altitudes where less than 28" is available with wide open throttle (approx. 9000' and above), set throttles against the stop and adjust to 30" by advancing turbo controls.

3. Mixture Controls.
   a. If selected cruising power setting is within Auto Lean Power Limits, mixture controls may now be moved to Auto Lean position. Move controls one at a time No. 4, No. 3, No. 2, No. 1. Co-pilot's duty.

4. A. C. Power.
   a. Check both inverters by observing operation of Auto-Syn Instruments.

5. A visual check of Turbos, Cowl Flaps, Nacelles, etc., should be made at least every half hour. Engineer must go to rear of ship for this inspection: Extreme care must be exercised at High Altitude to avoid accidents due to oxygen want among personnel. This check may be postponed at 15000 ft. and above at discretion of pilot.

6. Fuel Gauges and Checks.
   a. Set up Form and take hourly readings, regardless of Gauge dependability. Save completed Form for future comparison. See back of Annex#1.

BEFORE LANDING

1. Pilot or co-pilot will call Control Tower on Radio and get Altimeter Setting and landing information for field. Should repeat Altimeter setting to tower to eliminate any mistake.

2. Pilot will check crew positions for proper loading and ascertain that nose is clear.
3. Pilot will turn off Automatic Pilot. ALL switches to eliminate possibility of accidental engaging.
4. Pilot will direct co-pilot to put Booster Pumps in the ON position. At this time, all booster pumps may be turned on at once as no advantage accrues from noting gauge readings separately.
5. Upon direction from pilot, co-pilot will set mixtures in Auto Rich.
6. Pilot will check intercoolers for desired position. Open unless icing is suspected.
7. Upon direction from pilot, co-pilot will check Wing De-icers for OFF position. A visual check should be made for deflation of Boots, if possible.
8. Auxiliary Power Unit OFF unless required due to generator failure; Engineer will leave generators ON.
9. Landing Gear: Pilot will reduce throttle to obtain Airspeed of 155 and will direct co-pilot to lower landing gear by either a verbal command or a thumb down movement of the hand.
   a. Put the gear lever in the UP position, check kick-out pressure 1050-1100, then place the gear lever in the DOWN position.
   b. Check pressure on gauge as nose wheel kicks out. After the gear is down a visual check must be made by the engineer for proper locking of Main and Nose Gear. Flashlight will be used for checking locks at night.
   c. Pilot checks green light ON.
10. Pilot will direct engineer to turn on Electric Hydraulic Pump.
11. Pilot will check Brake Pressure Gauge for proper pressure. 850 lbs. to 1125 lbs.
12. Upon direction from pilot, co-pilot will increase RPM to 2550.
13. Upon direction from pilot, co-pilot will lower Wing Flaps. Lower 20° of Flaps before entering turn onto base leg. The pilot may give this order verbally or with a hand movement. A palm down movement of the hand is the standard signal.

FINAL APPROACH

1. Pilot will set Turbo Controls to take-off position to insure sufficient power if approach is missed.

2. Upon direction from pilot, co-pilot will extend the flaps to landing position. The full 40° will be used for all normal landings.

3. Co-pilot will call out airspeed to pilot on final approach to insure safe flying speed.

END OF LANDING ROLL

1. Co-pilot will open the Cowl Flaps after the airplane is on the ground and under control.
2. After the plane has lost momentum and the taxiing has started, pilot will direct co-pilot to retract Wing Flaps.
3. Pilot will place the Turbos in the OFF position.
4. Pilot will direct co-pilot to place the props in high RPM and check lights.
5. Co-pilot will place Mixtures in Auto Lean.
6. Co-pilot will turn off Booster Pumps.
7. Pilot will reset trim tabs to normal take-off settings.
8. Pilot will direct Engineer to turn generators off. Auxiliary Power Unit as required.

SECURING AIRPLANE

1. Engines.
   a. Co-pilot will advance throttle to 1200 RPM and place Mixture controls in Idle Cut-Off at pilot's direction. After engines stop, co-pilot will turn all ignition switches to OFF, CAUTION: Do NOT advance throttles until propellers have stopped dead.
2. Radio.
   a. Co-pilot will turn Compass Receiver, Command Receiver, and Transmitter to OFF and check Liaison Set Off.
3. Switches.
   a. All electrical switches should be turned OFF before turning off Main Line (Bar switch above ignition switches) and Battery Switches (above ignition and main line switches), A. C. Power switch must not be turned OFF until ingines are stopped and engine instruments have settled at neutral positions. Turn OFF Main Line, Battery Switches and Master Electric Switch LAST. This procedure will eliminate arcing of relays at this time and heavy load on battery, when these switches are again turned on.
4. Chocks.
   a. Pilot will hold ship stopped with brakes until chocks are in place. Brakes should then be released to facilitate cooling and prevent expander tube failure.
5. Gear Lever.
   a. Pilot will place Gear Lever in DOWN position before leaving seat to insure proper equalization of pressures in the hydraulic system.

6. Controls Locked.
   a. Pilot will align controls in neutral position. Co-pilot will slowly engage lever and secure with strap and hook provided. Pilot will check to be sure that controls are actually locked against movement in any direction. Pawls engage in following sequence: Rudder, Elevators, and Ailerons.

B-24 EMERGENCY PROCEDURE
FLIGHT CHECK

Adopted
7 September 1943
By Second Air Force &
Army Air Forces Training
Command

FORM #1 TIME_____ AIRPLANE NO._____

Student_____ Date_____

Instructor_____

1. Flying with one inboard feathered and repeat with one outboard feathered.

2. Demonstration of drag difference between windmilling and feathered engine.

3. Feather one engine and simulate feathering on the same side. Turns both ways.

4. Demonstration of 3-engine, 2-engine, and 1-engine operation.

5. Demonstration of full low R.P.M. performance.

6. Demonstrate engine failure on simulated take-off. This is to be done at altitude.

7. Make not over a 30° bank and pull back both engines on the low wing.

8. Power-on stalls at 25 inches and 2200 R.P.M.

   a. No flaps.
   b. 1/2 flaps.
   c. Full flaps
   d. Full flaps with gear down.
   e. Full flaps with gear down and one engine simulated feathered.

9. Demonstration of secondary stalls and rate of sink on stall recoveries.

10. Power-off stalls.

   a. No flaps

      (1) Power-off recovery
      (2) Power-on recovery

   b. 1/2 flaps

      (1) Power-off recovery
      (2) Power on recovery

11. Demonstration of stalls in steep banks.

12. Demonstration of minimum performance.

13. Demonstration of stall under standard instrument let-down conditions.

14. Two and three-engine approach landings.

15. Cut engine on take-off.

AMPLIFICATION

1. Demonstration of difference in drag between an outboard and an inboard engine feathered. Turns both ways (not to exceed 30° of bank) to be done at altitude. Do not recommend dead engine low, except in emergency.

2. Feather one outboard engine and trim ship to fly "hands off." Leave trim tabs as set. Unfeather the engine and pull back throttle to full windmilling position. Note yaw of ship into dead engine. Apply sufficient power to bring ship back into trim. (Approximately 12" hg). Recommended airspeed 150 MPH and RPM 2200.

3. Feather inboard and simulate feathering outboard on same side. Turns both ways with bank not to exceed 30° into feathered engine. This is a confidence building maneuver and should be done at altitude.

4. Three-engine, two-engine and one-engine operation.

   a. Feather an outboard and demonstrate power settings and airspeed for level flight and climb. Maintain at least 150 M.P.H. in both maneuvers.

   b. Feather an outboard and windmill an inboard on same side. Demonstrate necessary minimum amount of power to maintain altitude or minimize rate of sink (5° to 8° of flaps and airspeed approximately 145 M.P.H.).

   c. Feather an outboard and simulate feathering both inboards. Use maximum allowable power on remaining outboard, 8° of flaps, and approximately 145 M.P.H. to demonstrate minimum rate of sink. Repeat above, using inboard instead of outboard.

5. From cruising power settings, decrease M.P. to 20 inches, then put props into full low R.P.M. position. Note lack of response to power application

6. At 25 inches and 2200 R.P.M. at 110-115 M.P.H. with half flaps pull two engine off on the same side. Stress proper method of recovery, dropping nose and getting dead engines high, using sufficient <u>rudder</u> for directional control.

7. This is to be done with cruising airspeed and power settings. Recover to straight flight by use of <u>rudder</u> and aileron. Maintain safe airspeed.

8. Make normal recovery at first indication of burble by forward wheel pressure and maintaining lateral control with use of <u>rudders</u> only. On (e) note loss of directional control due to unbalanced power.

9. Self explanatory.

10. On power-off recovery, note high rate of sink and tendency to approach secondary stall. On power-on recovery note reduced sink and effectiveness of controls. Apply power smoothly to avoid surge.

11. From cruising, stall ship in bank of approximately 50° by tightening turn. Recover by forward elevator pressure and rolling into level flight.

12. This to be done at altitude as a confidence maneuver and is not to be practiced by students. With gear down and full flaps, gradually slow ship down until stalling speed is approached. As airspeed is further reduced, apply power to compensate for loss of lift until airspeed is approximately 95 M.P.H. Shallow turns in both directions can be demonstrated.

13. Place airplane in standard let down, then lose airspeed until stall is reached. Recover in normal manner.

14. Simulate feathering one (or two) engines before or on downwind leg, stressing close base leg and high approach. Emphasize danger of going around.

15. Cut outboard engine at point where take-off is mandatory (at approximately 110-120 M.P.H.).

APPROVED B-17F CHECK LIST
SECOND AIR FORCE TRAINING COMMAND
(For use at Transition Schools)

PILOT

Before Starting

1. Pilots Pre-flight - Complete
2. Form 1A - Checked
3. Controls and Seats - Checked - Checked
4. Fuel Transfer Valves & Switch - Off
5. Intercoolers - Cold
6. Gyros - Uncaged
7. Fuel Shut-off Switches - Open
8. Gear Switch - Neutral
9. Cowl Flaps - Open Right - Open Left - Locked
10. Turbos - Off
11. Idle cut-off - Checked
12. Throttles - Closed
13. High RPM - Checked
14. Auto Pilot - Off
15. De-icers and Anti-Icers Wing & Prop. - Off
16. Cabin Heat - Off
17. Generators - Off

Starting Engines

1. Fire Guard and Call Clear - Left-Right
2. Master and Ignition Switches - On
3. Battery switches and Inverters - On & Checked
4. Parking Brakes-Hydraulic Check-On-Checked
5. Booster Pumps-Pressure - On & Checked
6. Carburetor Filters - Open
7. Fuel Quantity - Gallons per tank
8. Start Engines
9. Flight Indicator and Vacuum Pressures-Checked
10. Radio - On
11. Check Instruments - Checked
12. Crew Report
13. Radio Call and Altimeter - Set

Engine Run Up

1. Brakes - Locked
2. Trim Tabs - Set
3. Exercise Turbos and Props
4. Check Generators - Checked & Off
5. Run Up Engines

Tab "G"

CO-PILOT

Before Take Off

1. Tail Wheel - Locked
2. Gyro - Set
3. Generators - On

After Take Off

1. Wheels - Pilots Signal
2. Power Reduction
3. Cowl Flaps
4. Wheel Check-OK Right-OK Left

Before Landing

1. Radio call altimeter-Set
2. Crew Positions - OK
3. Auto Pilot - Off
4. Booster Pumps - On
5. Mixture Controls-Auto Rich
6. Intercooler - Set
7. Carburetor Filters-Open
8. Wing De-Icers - Off
9. Landing Gear
   a. Visual -Down Right, Down Left, Tail Wheel Down, Antenna In
   b. Light - OK
   c. Switch Off - Neutra
10. Hydraulic Pressure-OK-Valve closed
11. RPM 2100 - Set
12. Turbos - Set
13. Flaps 1/3 - 1/3 Down

Final Approach

14. Flaps - Pilots Signal
15. High RPM-Pilots Signal

After Landing

1. Hydraulic Pressure - OK
2. Cowl Flaps - Open and Locked
3. Turbos - Off
4. Booster Pumps - Off
5. Wing Flaps - Up
6. Tail Wheel - Unlocked
7. Generators - Off

End of Mission

1. Engines - Cut
2. Radio - On ramp
3. Switches - Off
4. Chocks -
5. Controls - Locked
6. Form 1

Go Around

1. High RPM & Power - High RPM
2. Wing Flaps - Coming up.
3. Power Reduction
4. Wheel Check - OK Right - OK Left.

Running Take Off

1. Wing Flaps - Coming up
2. Power
3. Wheel Check - OK Right -OK Left

Subsequent Take Off

1. Trim Tabs - Set
2. Wing Flaps - Up
3. Cowl Flaps - Open R, Open Left
4. High RPM - Checked
5. Fuel - Gal. per tank
6. Booster Pumps - On
7. Turbos - Set
8. Flight Controls - Unlocked
9. Radio Call

Subsequent Landing

1. Landing Gear
   a. Visual-Down Right, Down Left, Tail Wheel Down.
   b. Light - On

2. Hydraulic Press - OK
3. RPM 2100 - Set
4. Turbo Controls - Set
5. Wing Flaps 1/3 - 1/3 Down
6. Radio Call

Final Approach

7. Flaps - Pilots Signal
8. High RPM - Pilots Signal

(Items not underline in black
co-pilot answers.)

APPROVED B-17F CHECK LIST
SECOND AIR FORCE - AAF TRAINING COMMAND

Before Starting

1. Pilots Pre-Flight
2. Form 1A
3. Controls and Seats
4. Fuel Transfer Valves & Switch
5. Intercoolers
6. Gyros
7. Fuel Shut-Off Switches
8. Gear Switch
9. Cowl Flaps
10. Turbos
11. Idle cut-off
12. Throttles
13. High RPM
14. Auto Pilot
15. De-icers and Anti-icers Wing & Prop.
16. Cabin Heat
17. Generators

Starting Engines

1. Fire Guard and Call Clear
2. Master and Ignition Switches
3. Battery Switches and Inverters
4. Parking Brakes - Hydraulic Check
5. Booster Pumps - Pressure
   Carburetor Filters
7. Fuel Quantity
8. Start Engines
9. Flight Indicator and Vacuum Pressures
10. Radio
11. Check Instruments
12. Crew Report
13. Radio Call and Altimeter

Engine Run Up

1. Brakes
2. Trim Tabs
3. Exercise Turbos and Props.
4. Check Generators
5. Run Up Engines

Before Take Off

1. Tail Wheel
2. Gyro
3. Generators

After Take Off

1. Wheels
2. Power Reduction
3. Cowl Flaps
4. Wheel Check

Before Landing

1. Radio Call-Altimeter
2. Crew Positions
3. Auto Pilot
4. Booster Pumps
5. Mixture Controls
6. Intercoolers
7. Carburetor Filters
8. Wing De-Icers
9. Landing Gear
   a. Visual
   b. Light
   c. Switch Off
10. Hydraulic Pressure
11. RPM 2100
12. Turbos
13. Flaps 1/3

Final Approach

14. Flaps
15. High RPM

After Landing

1. Hydraulic Pressure
2. Cowl Flaps
3. Turbos
4. Booster Pumps
5. Wing Flaps
6. Tail Wheel
7. Generators

End of Mission

1. Engines
2. Radio
3. Switches
4. Chocks
5. Controls
6. Form 1

Go Around

1. High RPM & Power
2. Wing Flaps
3. Power Reduction
4. Wheel Check

Running Take Off

1. Wing Flaps
2. Power
3. Wheel Check

Subsequent Take Off

1. Trim Tabs
2. Wing Flaps
3. Cowl Flaps
4. High RPM
5. Fuel
6. Booster Pumps
7. Turbos
8. Flight Controls
9. Radio Call

Subsequent Landing

1. Landing Gear
   a. Visual
   b. Light
2. Hydraulic Pressure
3. RPM 2100
4. Turbo Controls
5. Wing Flaps 1/3
6. Radio Call

Final Approach

7. Flaps
8. High RPM

B-17F AMPLIFIED CHECK LIST

Introduction

The number of controls necessary for the operation of an airplane the size of the B-17F make it essential that check lists be used. Even the most experienced Pilots on this airplane cannot consistently remember all the things that must be done for continuously safe operation. The pilot does not suffer loss of dignity with his crew for having to use a check list. On the contrary, he gains their respect and confidence, and the surety of proper operation. DO NOT TRUST YOUR MEMORY. Wait for and insist that the co-pilot use the check list properly. Check each item and wait for proper indication. Do not arbitrarily state "It's Okay."

BEFORE STARTING ENGINES

1. Pilots Pre-flight

a. Power plant.

(1) Propellers and Anti-icer Boots. Check for nicks, torn or loose Anti-icer Boots, if installed, and for leaking anti-icer fluid.
(2) Check Nacelles for loose fasteners or cowl flaps, and check entire Nacelle for oil leaks.
(3) Check Turbos for freedom of bucket wheels and clearance.
(4) Check exhaust system for loose joints.
(5) Check Waste Gate for looseness and full open position.

b. Wings.

(1) Inspect De-icer boots for condition.
(2) Check for fuel leaks in center section area. Determine that Flight engineer has checked gas and oil caps for tightness.

c. Landing Gear

(1) Main wheels and assemblies. Check for worn spots on tires, cracks in rims, condition of hydraulic lines, proper inflation of tires, and condition of drag line and drag strut. Check for cleanliness of exposed portions that would obstruct pistons.

d. General Exterior of the airplane.

(1) Visual check of pitot tubes. Covers removed.
(2) Belly, whip and clothes line antennas.
(3) Trailing antenna retracted.

Tab "H"

(4) Lower ball turret in locked position, door fully closed and locked.
(5) Doors and hatches should be observed, particularly the tail gunner's escape hatch and window.
(6) Control service and trim tab alignment. Controls in neutral. External locks removed.

(7) Tail wheel. Condition inspection of tire for inflation, wear, and condition of entire assembly.

e. Airplane Interior

(1) While going through plane, check and clear aerial engineer's report to be sure that the C.G. is between 19% and 32% of the mean Aerodynamic chord. For all normal landings of the airplane, the C.G. will be forward of 32%. However, if an excessive load is placed in the rear of the airplane, airplane will have neutral or negative stability. It is possible to trim the airplane with an unstable loading, but it is difficult to fly, especially if instrument flight is necessary. It is also much easier to inadvertently stall when flying an unstable airplane on instruments. Loading for forward C.G. positions is preferred because in addition to being easier to fly, it gives a smooth increase in elevator forces required to pull out of dives. An airplane that is made unstable by improper loading has reversed force-velocity relation in dive pul-outs so that a structural failure resulting from improper use of the elevator is more likely to occur than if the airplane were stable.
(2) Learn proper application of and use of the LOAD ADJUSTER Check main passageway, compartment doors, turrets, and side guns not obstructed.
(3) Check control cables.
(4) Check bomb bay tanks, covers, for fumes or gasoline leaks.
(5) Check storage of miscellaneous equipment in bomb bay.
(6) Check to see that emergency landing gear drop crank is in place.
(7) Check bombs for proper installation.
(8) Check to see that proper number of parachutes are on board and in proper position.
(9) Check oxygen masks to see that all personnel are equipped. Check condition of masks, condition of main oxygen system, and all walk-around bottles for proper pressure.

f. Flight Deck.

(1) Turret caged.
(2) Check maps to be sure all necessary maps are aboard.
(3) Check copies of instrument let-down procedure, radio facility chart, and radio aid to navigation, for condition and to be sure they are current issues in all cases.

(4) CLEAR COMBUSTION CHAMBERS. Pull propellers through a minimum of three complete revolutions.

2. FORM 1A

a. Check items on red diagonal, if any, check radio status, and items written up by previous pilots and sign exceptional release. A knowledge of what is wrong with the plane may save worry later. The Form 1A is for your protection.
b. Loading List-Names of passengers properly filled in, signed by pilot, and sent to Base Operations.

3. CONTROL AND SEAT CHECK - UNLOCKED, CHECKED VISUALLY.

a. Rudder, elevators, and ailerons will be checked by free movement of the controls and by visual inspection. Operate through the full range to insure proper movement for both travel and in correct direction.
b. Adjust seat, rudder pedals and safety belts, pilot and co-pilot, to insure proper control through the full range. Particularly applicable where use of full rudder is necessary.

4. FUEL TRANSFER VALVES & SWITCH - OFF. If they are not off it would be possible to pump one of the engine tanks dry and waste gas out of the overflow of the tank to which the gas is being pumped.

5. INTERCOOLERS cold. Due to heat generated by supercharging (compressing) air, cooling of that compressed air is necessary before it enters the carburetor to avoid loss of power. Intercooler controls are connected to shutters allowing cold air in at the leading edge of the wing, to cool the hot supercharged air. In the "hot" position the cold air is by-passed so that the hot supercharged air may enter the carburetor. This will cause a loss of power but not as much as ice either in intercooler or in carburetor itself. When it is necessary to use it, only enough should be used to prevent or knock out this ice. Of themselves the intercoolers will produce no heat nor will intercoolers be effective unless superchargers are being used.

6. GYROS. - The instruments must always remain in the UNCAGED position.

7. FUEL SHUT-OFF - These switches control fuel supply valves from tanks to engine. They will be left open at all times except in emergencies. They are spring loaded to stay open in case of electrical failure, so they will only stay closed when electrical system and switch are functioning.

8. GEAR SWITCH - OFF. Before turning on battery switches it is important to note that the landing gear switch has NOT been placed in the UP position while batteries were OFF. SEE THAT THE SWITCH GUARD IS IN POSITION.

9. COWL FLAPS - Open right, open left, locked. Regardless of outside air temperature cowl flaps must be OPEN for engine starting. Cowl flap valves must always be returned to the LOCKED or neutral position to avoid creeping of flaps and loss of pressure.

10. TURBOS OFF. Waste gate is closed with superchargers ON. A backfire could blow out waste gate or damage supercharger; therefore, leave waste gate OPEN DURING starting.

11. IDLE CUT-OFF - Placement of control in idle cut-off position.

12. THROTTLES - CLOSED AND THIN CRACK TO 1000-1200 RPM. Engines will start much easier if the throttles are placed in this position to starting and after the engine has been started and begun to run smoothly, the throttles are pulled back to 1000 RPM. Moving the throttle back and forth in an effort to smooth the engine out should not be attempted as this results in a lean mixture, back fire, and increases the fire hazard.

13. HIGH RPM - Place propeller control levers in FUL UP (HIGH RPM) position and adjust lock to hold.

14. AUTO PILOT - Place the auto pilot switches in OFF positions and lever switches OFF until after take-off. Taking off with automatic pilot on has caused several accidents. Although pressure is supposed to be low enough so that it may be overpowered, in taking off there would be considerable mental lag before trouble was realized and sufficient pressure applied.

15. DE-ICERS AND ANTI-ICERS WING & PROP. The action of the wing de-icer boots disturbs the flow of air over the lifting surfaces and materially increases the stalling speed. These should be in the OFF position except when testing or actually needed. The rheostats of the propeller de-icers are normally set at a pre-determined rate of flow. Their adjustment should not be changed. They should be cut on and off by the toggle switch provided. When flights into icing conditions are anticipated these systems should be thoroughly checked by the crew chief before flight.

16. CABIN HEAT OFF - This will allow unrestricted flow of air through and from the heating system radiator, and will prevent boiling out of the heating system fluid during ground running of the engines. USE HEATER ONLY IN THE AIR. Place in the OFF position for ground operation.

17. GENERATORS - To avoid closing of points on generator cut-out relays and consequent reverse flow of current while taxiing, generators are left OFF until after airplane is in its take-off position with engines running up.

STARTING ENGINES

1. FIRE GUARD AND CALL CLEAR -

   a. Pilot visually checks that fire guard is posted at proper station for engine to be started. Proper station is behind and to the right of engine being started. Propellers must be clear during entire starting procedure.

b. Pilot will call CLEAR LEFT and co-pilot will call CLEAR RIGHT. Be sure that mechanic hears you and signified that all is clear.

2. MASTER AND IGNITION SWITCHES - Place bar switch in ON position. Turn on all ignition switches to both ON positions.

3. BATTERY SWITCHES AND INVERTER - Turn inverter ON. With either inverter operating check each battery switch separately for individual battery out-put. In case of failure, the fuse and solenoid should be checked. Return all three battery switches to ON. Check alternate inverter position for inverter operation.

4. PARKING BRAKES ON HYDRAULIC CHECK - Parking brakes will be locked. Pressure guages will be checked for sufficient hydraulic pressure. Check switch on pilot's switch panel for AUTO or ON position depending on the type of switch used. If emergency pressure system is low, recharge by opening manual shut-off (STAR) valve. This will build up a pressure of approximately 800 lbs. for both systems; after servicing, close manual shut-off (STAR) valve.

5. BOOSTER PUMPS ON AND CHECK - Check to see that each reads 6-8 PSI. The fuel booster pump is an independent electric motor providing an extra source of fuel pressure. It takes the place of wobble pump for starting and emergency and augments engine driven fuel pump for high altitudes. As a safety measure, it is turned on for landing and take-off, and for flight below 1000 feet altitude, and for flights above 10,000 feet.

6. CARBURETOR FILTERS - ON

a. Carburetor air filters must be in the ON or OPEN position for engine starting and must remain on for all ground operations. Check all yellow warning lights ON.

b. They should remain ON for climbing and operation in dust conditions up to 8000 feet. Under no circumstances should they remain in the OPEN or ON position above 15,000 feet, as extremely high carburetor inlet temperatures will occur, resulting in detonation and turbo over speeding. Some assistance may be had from the carburetor air filters in conjunction with the inter-coolers in eliminating the formation of carburetor ice, as the filters draw slightly warmer air from the inside of the wing. It must be remembered, however, that this heat will be of no avail if the inter-coolers are in the OFF or COLD position, as this warm air will be quickly cooled off by the cold air passing through the inter-cooler system.

7. FUEL QUANTITY - Fuel gauges are electric and will not operate unless electrical circuit is open, battery switches on, and inverter on. Fluctuation of needles while flying is caused by lack of baffle plates in gas tanks.

8. START ENGINES

a. Sequence #1, #2, #3, #4.
b. Be sure the engine has been pulled through three or four complete revolutions.
c. Set fire extinguisher selector to engine being started.
d. Indicate to the ground crew which engine is to be started by holding up the number of fingers to correspond to the number of the engine.
e. When the co-pilot is ready he should notify the pilot he is "standing by to start one".
f. The pilot should then direct the co-pilot to "start one". The co-pilot should then energize #1 starter and at the same time expel all air from the primer line of the engine affected by slowly pumping the primer through the necessary number of strokes until a solid charge of fuel is obtained. HOLD THE PRIMER DOWN UNTIL NEEDED FOR FURTHER PRIMING.
g. After approximately 30 seconds the pilot will direct the co-pilot to "mesh one". The co-pilot will continue to hold the "start switch" in the "ON" position and will move the "mesh switch" to the "ON" position. At the same time he will prime the engine with quick strokes to atomize the charge, continuing until the engine fires. Should the engine fail to start care will be taken to release both switches promptly WHILE THE PROPELLER IS STILL TURNING to prevent the starter from being damaged and becoming stuck.
h. Immediately after the engine fires the pilot will move the mixture control to "automatic rich".
i. If the engine stops return the mixture control to the "off" position immediately and repeat starting procedure. If no oil pressure is indicated within 30 seconds after starting, stop the engine and determine the cause.
j. Warm engine up at 1000 RPM till an oil temperature of 40° C. is indicated.
k. If necessary to engage by hand (pull handle on nacelle) indicate this to the ground crew by raising a clenched fist and pulling down an imaginary starter handle and hold both the "start" and "mesh" switches in the "on" position as the booster coil will function only when the "mesh" switch is on.

1. Repeat starting procedure #2, #3, and #4 engines.

9. FLIGHT INDICATOR AND VACUUM PRESSURES - At the time engines are started pilots can note position of selector switch for vacuum pump and also the speed with which the flight indicator comes to an upright position. Sluggish operation of the flight indicator during its erection period is indicative of ppor operation of this instrument. Vacuum pressure at this point should be noted (approximately 3.75 to 4.25 inches). Both pumps should be checked for proper operation at this time.

10. RADIO ON

a. Turn switches on desired command receiver to proper positions. Turn transmitter switch to ON. Set selector to desired transmitting frequency. Turn volume controls on Jack Boxes to maximum output. Set selector switch on Filter Box to Voice and Selector Switch on Jack Box to Command.

11. CHECK INSTRUMENTS

a. Check instruments for proper operation and ascertain if all readings are within the tolerable limit.

(1) Oil Pressure
(2) Oil Temperature
(3) Head Temperature
(4) Fuel Pressure
(5) Carburetor Air Temperatures
(6) Free Air Temperature
(7) Tachometers
(8) Manifold Pressures
(9) Hydraulic Pressures
(10) Clock
(11) Magnetic Compass

b. Check all warning lights including the Fuel Guage warning light, which is tested by pushing in on the warning light bulb. If the flight is to extend into the hours of darkness, check the functioning of all other plane lights: Landing, Passing, Wing Tip, Formation, Phone Call, Bomber Call, Electrical Panel, Flourescent, Compartment, Radio Compass, and Identification lights. A flashlight in good working order should always be carried in the airplane. Fuse panel covers should be checked for ample supply of extra fuses.

12. CREW REPORT - Doors and hatches closed and crew in proper position.

13. RADIO CALL AND ALTIMETER - Obtain altimeter setting and set altimeter and taxi instructions.

NOTE: While taxiing out check rims for "wobbling". This is an indication of a cracked wheel. If wobbling is noticed, come to a gentle stop and do not move until wheel is thoroughly checked. Frequent check of hydraulic pressure is desired.

1. BRAKES - LOCKED - Co-pilot sets parking brake on pilot's signal.

2. TRIM TABS. - Trim tabs SET FOR TAKE-OFF. Be sure to look at all three tabs, as an incorrect setting of any one tab may cause an accident on the take-off, especially if the airplane is heavily loaded. Normal settings are "0" for all three tabs.

3. EXERCISE TURBOS AND PROPS

   a. Set all throttles to obtain 1500 RPM.
   b. Place all turbo controls in full ON position. Run propellers to full low RPM. Allow ample time for propellers to change pitch.
      NOTE: Drop indicated by tachometers (Drop will be 300-400 RPM). Return propellers to full high RPM.
   c. Repeat Turbo and Propeller exercise a third and a fourth time if outside air temperature is below 0° Centigrade.
   d. Set all turbos to OFF.

4. CHECK GENERATORS - With all engines operating at 1500 RPM. Check all generators for ample output and by using voltage selector for voltage output. Turn generators off. Tail wheel in unlocked position.

5. RUN UP ENGINES

   a. Open No. 1 throttle to 28". Check mags. (turn to L mag. and back to both) turn to R mag. and back to both. Do not operate on 1 mag. for more than 5 seconds at one period. Roughness as determined by visual check of nacelles is a better check of ignition operation than RPM drop. Check both. If much roughness is noticed, on either magneto, run the engine on up to full throttle without turbo, pause for about 3 seconds and then return to 28" and check again.
   b. Advance throttle to full OPEN position and hold, only long enough to check engines and instruments for proper readings and set turbos.
   c. Advance turbo and set carefully to desired MP. During this operation the turbo control lock should be tightened to provide the friction necessary to hold the control at set position. Excessive tightening is not desirable. Check RPM to read 2500 Maximum.
   d. Reduce throttle slowly to 800-1000 RPM.
   e. Cowl Flaps must always be open during this Run Up procedure. If prolonged taxiing becomes necessary after Run Up, turbos must be cut off to prevent possible damage to Turbo bucket wheel or waste gate by back fire of engine.

BEFORE TAKE-OFF

1. TAIL WHEEL LOCKED (on runway) at pilot's signal. Be sure the ship is true with the runway and signal light is out.

2. GYRO SET

a. Pilot will set directional gyro to correspond with the magnetic compass. When lined up for take-off, check reading to correspond with runway heading. This provides two checks, one on the magnetic compass and one on runway to be used.

3. GENERATORS - ON

AFTER TAKE-OFF

1. WHEELS-PILOTS SIGNAL

a. Co-pilot will raise gear upon signal from pilot, this signal only to be given when pilot is positive airplane is flying and under complete control.
b. Brakes should be applied gradually when well up off the runway to stop the rotation of the wheels, and then the gear is retracted with visual inspection of the gear and warning light. The switch is then placed in the neutral position.

2. POWER REDUCTION

a. Upon attaining an airspeed of 130 MPH, Pilot will reduce turbo regulators to desired setting. Upon signal from pilot, co-pilot will reduce props to desired RPM. Co-pilot will then make even adjustment on turbo regulators and synchronize propellers. At no time will props be reduced before reduction of manifold pressure.
b. In reducing power, Manifold pressure is reduced first, then RPM. For increasing power, RPM is increased first, then Manifold Pressure.
c. Flaps, if used during take-off, are not retracted until the airplane is at least 500 feet above the terrain.

3. COWL FLAPS

a. Cowl Flaps are to be used to regulate head temperature. Co-pilot closes when and if temperature permits.

4. WHEEL CHECK

a. Wheels can only be checked if landing gear is being left down. Check should be made while wheel is still rotating. If gear has been retracted report position as "UP RIGHT" "UP LEFT".
b. Check visually to see that both wheels and tail wheel are retracted, before returning gear switch to neutral. If necessary to retract

one with the wheel crank, make sure the switch is in the neutral position before inserting the crank in the fitting.

NOTE: Booster pumps will be turned off when leaving traffic. Booster pumps are used for landing and take-offs for operations below 1000 feet altitude above ground and above 15,000 feet altitude.

BEFORE LANDING

1. RADIO CALL-ALTIMETER

   a. Pilot or co-pilot will call Control Tower on Radio and get altimeter setting and landing information for field. Repeat altimeter setting to tower to eliminate any mistake. Final radio call will be made in traffic.

2. CREW POSITIONS

   a. Have engineer check the crew members for proper position for landing.
   b. Radio operator will be responsible that trailing wire antenna is retracted.
   c. All gunners to be responsible that guns are in proper position and checked for landing.

3. AUTO PILOT

   a. The Auto Pilot must be turned OFF. All switches off to eliminate possibility of accidental engagement.

4. BOOSTER PUMPS - ON

5. MIXTURE CONTROLS - AUTO RICH

   a. Pilot checks mixture controls to AUTO RICH.

6. INTERCOOLERS

   a. Intercoolers should be on the OFF or COLD position for landing, as loss of power and detonation might occur if emergency power were necessary during the landing attempt. If freezing precipitation is present during the approach glide to the runway, and Intercoolers are needed to prevent carburetor icing, all persons in the cock pit should be notified that Intercoolers are ON, to serve as reminders in the event of an emergency when they should immediately be placed in the OFF position.

7. CARBURETOR FILTERS

a. The Filters must be placed in the On or OPEN position for landing, since the supercharger was adjusted for maximum MP at take-off with the filters open. With the Filters OFF (closed), a resultant rise in available manifold pressure will take place, and if left OFF for landing, excessive and dangerous manifold pressures would result in the event of emergency power of full throttle use during the landing attempt.

8. WING DE-ICERS

a. The action of the wing de-icer boots disturbs the flow of air over the lifting surfaces and materially increases the stalling speed. These should be in the OFF position except when testing or actually needed. The rheostats of the propeller de-icers are normally set at a predetermined rate of flow. Their adjustment should not be changed. They should be cut ON and OFF by the toggle switch provided. When flights into icing conditions are anticipated these systems should be thoroughly checked by the crew chief before flight.

b. Wing De-Icer boots shall be visually checked to assure that they are properly deflated before final approach.

9. LANDING GEAR, DOWN

a. Upon direction from the pilot (GEAR DOWN under 180 MPH) place landing gear controlling switch in a DOWN position. Visual check of the wheel will be made by pilot Down Left, co-pilot, Down Right. Engineer by, Tail Wheel Down, to assure that main wheels and tail wheel are properly extended. In checking tail wheel down, engineer will inspect to assure that no threads of the worm gear are showing. (This check will be made only from the rear of the airplane). Report trailing antenna in will be made at this time.

b. Lights checked by pilot for ON signal.

c. Switch Off. Co-pilot returns switch to the neutral position checking warning light for green light ON.

10. HYDRAULIC PRESSURE

a. After landing gear has been extended, pilot will check hydraulic pressure by noting gauge indication.

b. Hydraulic pressure indicated on guage should be checked. Normal pressure is 800 pounds.

c. The Accumulators should be serviced, if needed. Note carefully to see that the Cowl Flap controls are in the "Locked" or neutral position to guard against loss of oil supply through leaks in the actuating mechanisms. In case of doubt as to hydraulic pressure co-pilot should be instructed to stand by on the hand pump for pilot's signal.

11. RPM 1200 - On signal from pilot, co-pilot will increase RPM to 2100 in traffic pattern.

12. TURBOS - On signal from the pilot, co-pilot will place turbos controls in the full ON position. Note: Pilot will decrease manifold pressure approximately 2 inches prior to placing turbo controls in full forward positions. Pilots will be extremely careful that allowable manifold pressures are not exceeded when turbos are in full ON position, particularly if an emergency take-off or go around should immediately follow the attempted landing. Normally full take-off pressure is not needed as the airplane is already at or near flying speed and there is no original inertia to overcome.

13. FLAPS 1/3 - Upon downward leg of traffic pattern, upon command from pilot the co-pilot will lower 1/3 flaps. Note: Speed must be below 147 miles per hour.

FINAL APPROACH

14. FLAPS

a. For normal landing the wing flaps are placed in the full down position on the final approach. In the event of heavy headwinds, or heavy cross winds, partial flaps produce better results. In the event of an emergency takeoff following an attempted landing, flaps should not be retracted until full power has been applied.

15. HIGH RPM - On pilot's signal propellers are moved to full high RPM position. This signal should be given simultaneously with full retardation of throttle.

AFTER LANDING

1. HYDRAULIC PRESSURE - Co-pilot checks for proper pressure.

2. COWL FLAPS OPEN & LOCKED - Co-pilot opens and locks cowl flaps in order to cool engines and help slow down the airplane.

3. TURBOS OFF - Co-pilot turns turbos off.

4. BOOSTER PUMPS - When no further take-offs are to be made before stopping engines, co-pilot will turn off all booster pumps.

5. WING FLAPS

a. Wing flaps are to be raised on the pilot's signal.
b. Wing flaps are an aid in decreasing speed in landing roll and will normally be raised at a speed of approximately 30 miles per hour.
c. When possibility of damage to flaps exists due to mud or slush

they should be retracted soon after ground contact is made.

6. TAIL WHEEL

a. Tail wheel will not be unlocked before end of landing roll except in emergency.

b. Tail wheel lock will be operated by co-pilot upon command from pilot.

7. GENERATORS - Pilot will move all generator switches to off positions.

END OF MISSION

1. ENGINES

a. If "After Landing Check" has been completed, and no further takeoff is contemplated, co-pilot upon signal from the pilot will cut inboard engines after 30 seconds operation at 1200 RPM.

b. Engine should not fire after mixture controls have been placed in the "OFF" position. Advance throttles slowly so the accelerating pump of the carburetor will not throw an extra charge in the cylinders and cause them to fire. After airplane is on the ramp, outboard engines may be cut in a similar manner.

2. RADIO - To let tower know that the ship is on the ramp.

3. SWITCHES

a. All electrical switches should be turned OFF before turning off Main Line (Bar switch above ignition switches) and Battery Switches. A.C. Power switch must not be turned OFF until engines are stopped and engine instruments have settled to neutral positions. Turn OFF Main line and Battery Switches LAST. This procedure will eliminate arcing of relays at this time and heavy load on batteries, when these switches are again turned on.

4. CHOCKS

a. Pilot will hold ship stopped with brakes until chocks are in place. Brakes should then be released to facilitate cooling and prevent expander tube failure.

5. CONTROLS LOCKED

a. Pilot will move control column to full forward position, then operate lock on floor to right of pilot's seat to UP position.

b. Place aileron lock in control wheel.

6. Time ends when airplane is in position on the ramp. Compute pilot time carefully. Make notations of things found wrong in the [illegible] and discuss the more serious items with the ground crew chief.

GO AROUND

1. HIGH RPM & POWER - Throttles ON. Throttles will be advanced slowly. Pilot assures himself that he has the proper RPM for the MP he is using. Throttles following RPM.

2. WING FLAPS - Immediately after power application. Do not try to climb while flaps are retracting. Do not allow ship to settle. Co-pilot will call airspeed while flaps are retracting.

3. POWER REDUCTION

   a. Upon attaining an airspeed of 130 MPH, pilot will reduce turbo regulators to desired setting. Upon signal from pilot, co-pilot will reduce props to desired RPM. Co-pilot will then make even adjustment on turbo regulators and synchronize propellers. AT NO TIME WILL PROPS BE REDUCED BEFORE REDUCTION OF MANIFOLD PRESSURE.

   b. In reducing power, Manifold pressure is reduced first, then RPM. For increasing power, RPM is increased first, then Manifold Pressure.

4. WHEEL CHECK

   a. Wheels can only be checked if landing gear is being left down. Check should be made while wheel is still rotating. If gear has been retracted report position as "UP RIGHT" "UP LEFT".

   b. Check visually to see that both wheels and tail wheel are retracted, before returning to gear switch neutral. If necessary to retract one with the wheel crank, make sure the switch is in the neutral position before inserting the crank in the fitting.

   NOTE: Booster pumps will be turned off when leaving traffic. Booster pumps are used for landing and take-offs for operations below 1000 feet altitude above ground and above 15,000 feet altitude.

RUNNING TAKEOFF

1. WING FLAPS - Wait for pilot's signal. Switch stays in "UP" position by itself. May be done with right hand while left hand is on propeller controls. Indicate to pilot by calling "FLAPS UP" when indicator is in "UP" position. Call "110 MPH" when 110 MPH airspeed is reached.

2. POWER - Power applied same as in original takeoff. Co-pilot will be certain that props are in high RPM. Pilot will ask for high RPM as he applies take-off power.

3. WHEEL CHECK

a. Wheels can only be checked if landing gear is being left down. Check should be made while wheel is still rotating. If gear has been retracted report position as "UP RIGHT" "UP LEFT".

b. Check visually to see that both wheels and tail wheel are retracted, before returning to gear switch neutral. If necessary to retract one with the wheel crank, make sure the switch is in the neutral position before inserting the crank in the fitting.

Note: Booster pumps will be turned off when leaving traffic. Booster pumps are used for landing and take-offs for operations below 1000 feet altitude above ground and above 15,000 feet altitude.

SUBSEQUENT TAKE-OFF

1. TRIM TABS - Set for take off.
2. WING FLAPS - Wing flaps up - switch to neutral position.
3. COWL FLAPS - Open Right, Open Left, and locked.
4. HIGH RPM.
5. FUEL - Checked
6. BOOSTER PUMPS - ON
7. TURBOS - Set for take-off
8. FLIGHT CONTROLS - Unlocked and free. Operate through entire range.
9. RADIO CALL - Hold call until reasonably certain you will be cleared for take-off, thereby avoiding unnecessary radio conversation.

SUBSEQUENT LANDING

1. LANDING GEAR DOWN

a. Upon direction from the pilot (GEAR DOWN) under 180 MPH place landing gear controlling switch in a DOWN position. Visual check of the wheel will be made by pilot Down Left, co-pilot Down Right. Engineer, by, Tail Wheel Down, to assure that main wheels and tail wheel are properly extended. In checking tail wheel down, engineer will inspect to assure that no threads of the worm gear are showing. (This check will be made only from the rear of the airplane). Report of trailing antenna in will be made at this time.

b. Light-checked by pilot for "on" signal.

2. HYDRAULIC PRESSURE

a. After landing gear has been extended, pilot will check hydraulic pressure by noting gauge indication.
b. Hydraulic pressure indicated on gauge should be checked. Normal pressure is 800 pounds.
c. The Accumulators should be serviced, if needed. Note carefully to see that the Cowl Flap controls are in the "Locked" or neutral position to guard against loss of oil supply through leaks in the actuating mechanisms. In case of doubt as to hydraulic pressure, co-pilot should be instructed to stand by on the hand pump for pilot's signal.

3. RPM 2100 - On signal from pilot, co-pilot will increase RPM to 2100 in traffic pattern.

4. TURBO CONTROLS - On signal from the pilot, co-pilot will place turbo controls in the full ON position. Note: Pilot will decrease manifold pressure approximately 2 inches prior to placing turbo controls in full forward positions. Pilots will be extremely careful that allowable manifold pressures are not exceeded when turbos are in full ON position, particularly if an emergency take-off or go around should immediately follow the attempted landing. Normally full take-off pressure is not needed as the airplane is already at or near flying speed and there is no original inertia to overcome.

5. WING FLAPS 1/3 - Upon downward leg of traffic pattern, upon command from pilot the co-pilot will lower 1/3 flaps. Note: Speed must be below 147 miles per hour.

6. RADIO-CALL - Co-pilot will make call as turn is made on to base leg.

FINAL APPROACH

7. FLAPS

a. For normal landing the wing flaps are placed in the full down position on the final approach. In the event of heavy head-winds, or heavy cross-winds, partial flaps produce better results. In the event

of an emergency take-off following an attempted landing, flaps should not be retracted until full power has been applied.

8. HIGH RPM - On Pilot's signal propellers are moved to full high RPM position. This signal should be given simultaneously with full retardation of throttle.

STANDARDIZED TWO & THREE ENGINE OPERATION
(B-17 TYPE AIRPLANES)

Student in left seat.

Instructor (safety pilot) in right seat.

1. - Two engine failure on same side after take-off.

Method - Normal take-off by student
Instructor closes two throttles on one side simultaneously after super-chargers, manifold pressure, RPM and cowl flaps have been set for climb.

Recovery - Apply opposite rudder, opposite aileron, forward stick, until dead wing is well above horizon and nose is slightly below horizon; at same time open good engines simultaneously to maximum allowable MP and RPM and call for wheels up. Do not bother with trim tabs at this time. There will be plenty of time to trim plane if recovery is successfully made. Do not try to climb at this time.

NOTES FOR INSTRUCTOR -

1. Watch cylinder head temperature on all engines, use cowl flaps as required.
2. Instructor will apply 12" to two dead engines after power has been applied to good engines and directional control has been established to simulate feathered performance.
3. Student may attempt to climb before recovery, as outlined above, has been fully accomplished. If this is done before the limitations of the airplane under two engines and various load combinations are fully understood, plane may be lost even after successful recovery.
4. These limitations should be shown to student as follows: Hold constant altitude, set MP and RPM at 36" and 2300 respectively, wheels down. At first plane will appear to hold its own, then it will be noticed airspeed slowly drops off, angle of attack increases, amount of aileron and rudder to hold dead wing up and directional control both increase. When airspeed has dropped to about 120 miles per hour, amount of control surfaces necessary to hold altitude increases rapidly until eventually dead wing drops and directional control is lost. It is then just a matter of seconds until plane stalls and spins in. At this point open throttles to 43.5" and 2500 RPM on 91 grade fuel or 46" and 2500 on 100 Oct. fuel and raise wheels. It will be noted that airspeed <u>does not</u> increase and general effect is only to make plane turn more rapidly into dead engines.

5. The limitations therefore are as follows:

a. There is a critical speed below which the plane will not sustain flight on two engines. This speed is between approximately 115 and 125 miles per hour and is governed by the load, and distribution of the load, how much power the good engines will put out and what combination of engines are dead.

b. The airplane will not accelerate on two engines at or below the critical speed regardless of how much addi tional power is applied.

6. Recovery can only be effected after critical speed has been reached by nosing plane down sharply, applying full power and raising wheels, if this has not already been done, picking up airspeed and dead wing and re-establishing directional control as soon as possible. A slow climb may then be established with careful attention to airpseed. If plane will not hold a constant airspeed which is above critical airspeed, it indicates that plane will not climb with load on board. It must be remembered that it is difficult for a pilot to bring himself to nose down an airplane under emergency conditions when only 200 or 300 feet of altitude remains unless he has been fully convinced by actual demonstration that this is the only possible way to save his airplane. If unable to maintain altitude or return to field use performance available to make planned crash landing.

7. Point out to student the importance of having all movable load as near center of gravity as possible under actual two engine operation conditions.

8. The #3 and #4 throttles are closed so that student will not be forced to turn away from traffic. (NOTE: Normal traffic is left hand.) Also closing throttles on right side eliminates necessity of student and instructor crossing hands which might result in momentary confusion should instructor find it necessary to open the two closed throttles rapidly. This state of confusion should be simulated at least once later during other type missions.

9. The entire sequence from time throttles are first closed until demonstration has been completed should be carried out as rapidly as possible due to excessive wear on the two wide open engines.

II. - Go around with one engine out.

Method - Student will make normal approach and start to make a normal landing. Instructor will hold one throttle closed and tell student to go around when plane is approximately 25 feet in air or when airspeed reaches 115 miles per hour.

Plane must be allowed to come down almost to runway to derive maximum benefit from maneuver. This puts plane in almost a landing position from which a go-around under emergency conditions would be the most difficult.

Recovery - Student fully opens three good throttles simultaneously. Instructor precedes throttles with all four propellers to full high RPM and immediately raises flaps to 1/3 then raises wheels. Student applies necessary opposite rudder to dead engine, raises dead wing slightly above horizontal with minimum use of aileron. At this point instructor, on pilot's order, applies 12" on dead engine to simulate feathering.

NOTES FOR INSTRUCTOR -

1. If recovery is effected as outlined there will be no settling as flaps come up. However, there will be a slight change in the angle of attack as the flaps go from one-third down to all the way up. This will necessitate the student's moving the wheel back slightly to maintain the same altitude and may lead him to believe the airplane is settling unless it is properly explained.
2. Student should be impressed with necessity of opening all three good throttles fully and immediately and not trying to get directional control by differentiating with throttles as plane will drop in and hit runway with wheels and flaps down under less than three engines.
3. Student should be impressed with necessity of raising flaps immediately rather than waiting until a safe airspeed has been reached. A safe airspeed will never be reached as long as the flaps are fully down due to the lack of acceleration under three engines.
4. In order to insure students getting all three throttles open simultaneously, it will be necessary to rehearse method of grasping these throttles prior to actual approach.
5. Instructor will open the closed inboard throttles as soon as student has complete control of airplane and a straight climb at a safe airspeed has been established.
6. The final type airplane when loaded near 60,000# will accelerate and climb very slowly on three engines.
7. After completion of this demonstration, while the student is making his first turn after take-off, the outboard engine on the inside of the turn should be cut.

   Demonstration of recovery from loss of outboard engine on inside of steep turn if rudder will not pick up low wing. Immediately close top throttle, roll airplane level with rudder and slight aileron and then reapply power on three good engines.

III. - Running Take-Off with one engine out.

Method-Student will make normal approach and landing. When plane is rolling three points instructor will start flaps up.

Recovery - Pilot will call for high RPM, fully open throttles of parallel good engines (both inboard or both outboard), simultaneously calling for full permissible power and establish directional control with rudder. Co-pilot will check to determine that props are in high RPM, raising all four to full high RPM, if not already raised. If there is any cross wind some differentiation of these two throttles will be necessary until enough speed has been obtained to allow rudder to hold plane straight. When directional control can be maintained with these two throttles fully open, co-pilot will hold them and pilot will open the remaining good throttle as rapidly as possible, counteracting turning moment due to this engine with rudder as necessary. It is difficult to counteract all of turning moment of an outboard good engine with rudder, and, therefore, this throttle will have to be advanced and retarded two or three times before take-off speed can be reached and throttle can be held fully open. Be sure that all three throttles are fully open when plane leaves ground. Pilot will call for wheels up as soon as plane is airborne. (For demonstrational purposes instructor may desire to leave wheels down.)

NOTES FOR INSTRUCTOR -

1. The student must be impressed with the importance of getting full power on the three good engines as soon as possible. If student waits to open the odd throttle until a speed where little or no rudder is required to counteract its pull, a technique will be developed that, although safe enough on a recovery with inboard engine out, will become increasingly dangerous as the more difficult recoveries are attempted. Sufficient speed for take-off will never be gained by this method on recoveries where an outboard engine is out. The student must be impressed with the difference between lightly loaded and final type airplanes.
2. The technique of handling the odd throttle that will give best directional control and result in the least side load on the landing gear is as follows: open throttle and apply counteracting rudder together. When full rudder has been applied and plane continues turning into dead engine, retard throttle until turning has stopped and plane is again going straight down runway with rudder still full on, then re-open throttle and repeat procedure. Continue this technique until sufficient speed to take-off has been obtained.
3. It should be pointed out to student that the plane will accelerate a great deal more rapidly once it becomes airborne, and that directional control is twice as easy to maintain on three engines once plane is in the air.
4. The instructor should approach all recoveries outlined herein with the idea of presenting it to the student in such a way that he can picture each emergency taking place under the most difficult conditions. These would include a field

of 3000 to 4000 feet with high obstructions to be cleared at the end. By doing this, the student will become a great deal more proficient in handling plane should the emergency actually occur.

5. As soon as take-off has been completed, student will call for feathering of dead engine by number. The instructor will simulate feathering by applying 12" to the dead engine. After this the engine will be opened by instructor.

IV. -- Two Engine Landing.

Method - Instructor closes two throttle on same side simultaneously on base leg.

Recovery-Same as outlined in recovery of #I with following exceptions: Use MP only as required, leave wheels down unless base leg is abnormally far back. A slow shallow turn toward the landing runway should be started immediately. Allow plane to lose altitude at a constant rate of descent so as to land in the first third of runway. Keep airspeed above 130 miles per hour. Lower third flaps when it is apparent runway will safely be reached, reducing power at the same time and allowing the airspeed to drop to between 120 and 125 miles per hours. When it is obvious that plane will clear last obstruction and will not undershoot back edge of runway, lower remainder of flaps, further reducing power and allow airspeed to drop to 115 miles per hour. Close throttles completely before making actual landing. 12" should be used on cut engines to simulate feathering. This should be reduced as speed falls off.

NOTES FOR INSTRUCTOR -

1. This approach does <u>not</u> mean a low dragging approach. Direction or altitude cannot be maintained with full flaps and wheels down with full power on two engines on one side. Plane will turn rapidly into dead engines if nose is held up and if nose is shoved down plane will go into steep spiral under the above conditions.
2. The reactions described in #1 can be illustrated graphically by putting down full flaps somewhere in the pattern, closing throttles on one side, and having student apply full power on other side and hold altitude at the same time. Plane can be allowed to lose a couple of hundred feet in this manner without danger and student will then be thoroughly convinced of impossibility of dragging plane up on a two-engine landing.
3. It should be pointed out to the student that the two most important reasons for making a two-engine approach, as described in "Recovery" of IV, are:

a. To utilize, as far as possible, a power approach type of landing right to the ground, thus eliminating any guess work on the part of the pilot.

b. Not getting full flaps on airplane until it is in a position from which a successful landing is practically assured, since dragging up or going around once the flaps are fully down is virtually impossible. The altitude from which a go-around could be affected is so high that pilot is in no position to decide whether or not he is going to get in.

4. When possible turn into good engines. However, demonstrations will be given turning into dead engines. To simulate conditions whereby it will be necessary to get into the field by the shortest route possible. All turns will be made at reduced power.

V. Take-off from a dead stop with one engine out.

Technique-- Pilot will fully open throttles of parellel good engines (both inboard or both outboards) simultaneously and establish directional control with rudder. Super-chargers will have been set at permissible power. If there is any cross wind, some differentiation of these two throttles will be necessary until enough speed has been obtained to allow rudder to hold plane straight. When directional control can be maintained with these two throttles fully open, instructor will hold them and student will open the remaining good throttle. When this throttle is part way open, the propeller will take hold abruptly tending to turn plane toward the dead engine. As this turning force is felt, full rudder is applied to counteract it and throttle retarded until plane is again running straight down runway under the two open engines. At this time, throttle is again opened and procedure repeated as many times as necessary until sufficient speed has been reached to leave throttle open and hold plane straight with rudder. It will be found that the number of times it is necessary to open the odd throttle will depend on the load on the plane, the velocity of the wind and its direction with relation to the take-off runway. Raise wheels when flying speed has been attained.

NOTES FOR INSTRUCTOR -

1. The instructor's notes on III, above, apply again on the above outlined technique with one exception; take-off speed may never be reached on a relatively short runway with a medium load or even on a 5000 foot runway with a full load if the student hesitates in opening the odd throttle.

2. This maneuver with an outboard engine dead is more difficult than one of the preceding recoveries or maneuvers due to

the relative inefficiency of the two inboard engines after they have been fully opened due to the vacuum formed behind obstructions such as struts, wheels, and more skin friction, and the great increase in the turning moment of the good outboard engine at slow speeds.

3. The method of advancing and retarding the good odd throttle as outlined above will have to be repeated until directional control can be maintained by use of the rudder with three throttles full on.
4. Instructor will open the closed throttle after the take-off has been completed.

VI. - GENERAL NOTES FOR INSTRUCTORS:

A. It will be found that most rapid progress will be made if the following sequence is followed in the instruction. Note the maneuvers become progressively more difficult and are given in the order that will best build up the student's experience. After the initial periods of this training have been completed, subsequent practice should be done by giving greater weight to take-off with an outboard engine idle, since proficiency in this operation makes relatively simple the maneuvers with an inboard engine dead. The sequence for this instruction is as follows:
   1. Cutting two engines on one side after take-off.
   2. "Go-around" with inboard engine idle.
   3. Running take-off with inboard engine idle.
   4. Landing with two engines idle on one side.
   5. Take-off with inboard engine idle.
   6. "Go-around" with outboard engine idle.
   7. Running take-off with outboard engine idle.
   8. Take-off with outboard engine idle.

B. During all practices of these maneuvers, the student should be made to feel that the practice is the solution of a real problem. He should visualize his runway and the obstacles near it; in each case he should make a decision whether to complete his take-off or bring his airplane to a full stop. (For practice purposes, the instructor may tell him to continue his take-off even though the student's decision is to make full stop.)

C. The selection of the engine to be closed by the instructor should be governed by the height and distance of any obstacles from the runway being used and the amount and direction of any cross wind on this runway. The dead engine should be on the side of the airplane from which any cross wind may be blowing. If the cross wind is on the side opposite the dead engine, the student will gain a false impression of the characteristics of the airplane under various three-engine conditions due to the relative ease with which he is able to handle it. Remember he may be operating in a strong cross wind when an engine is actually lost on the upwind side.

ANNEX NO. 1

PRE-FLIGHT REPORT *

I. ENGINEERING

1. Form 1 - Status of aircraft _____.
2. Fuel in tanks ---1_____2_____3_____4_____LBS_____RBB_____LA_____RA_____
3. Oil in tanks_____
4. Engines pulled through by hand 5 times _____.
5. Chocks in place_____.
6. Pitot covers removed_____Heater check_____.
7. Air intake covers removed_____.
8. Landing gear and nose wheel inspected for defects_____.
9. Ailerons, elevators, rudders, and tail section inspected for defects_____.
10. Cowling inspected for proper fastening_____.
11. Gas caps inspected for security_____.
12. Bomb bay doors inspected for proper operation_____.
13. All deflectors--CLOSED.
14. Tires inspected for proper inflation_____.
15. Load adjuster on board_____.
16. Spare fuses and bulbs in airplane_____.
17. All windows clean, including turrets_____.
18. Gross weight of airplane by Bal-O-Dial_____.
19. CG of airplane by Bal-O-Dial or load adjuster_____.
20. Kit apprentice in airplane_____.
21. Check lists in place_____.
22. Reading of pressure in system_____. (Oxygen)
23. Operational check of gauges at all stations_____.
24. Check oxygen shut-off valves in bomb bay_____.
25. Oxygen walk-around bottles_____No. of bottles_____Reading of each bottle._____ _____ _____ _____ _____ _____ _____ _____ _____.

II. ARMAMENT

1. Nose guns
   A. Operational test_____.
   B. Ammun. loaded_____.
2. Top turret
   A. Operational test_____.
   B. Ammun. loaded_____.
3. Lower turret
   A. Operational test_____.
   B. Ammun. loaded_____.

_____
(Signature of Engineer)

4. Waist guns
   A. Operational test_____.
   B. Ammun. loaded_____.
5. Tail turret
   A. Operational test_____.
   B. Ammun. loaded_____.

_____
(Signature of Armorer-Gunner)

III. COMMUNICATIONS

1. Interphone checked at all stations_____.
2. Command set
   A. Operational test_____.
   B. Frequency of transmitter_____KCS.
3. Liaison set
   A. Operational test_____.
   B. Frequency of transmitter_____KCS.
4. Radio compass
   A. Operational test_____Comp_____Ant_____Loop_____.
5. Trailing antenna checked_____.
6. All other antenna checked_____.
7. Frequency meter on board_____.
8. Headsets and microphones for all stations_____.
9. Compass loop and housing checked for security_____.
10. Radio facility charts in airplane_____.
11. Necessary spare tubes_____.

_____
(Signature of 1st Radio Operator)

IV. BOMBS AND BOMBSIGHT

1. Bombsight checked for operation_____.
2. No. and size of bombs loaded_____No_____Size_____.
3. Position of bomb loading_____.
4. Indicator lights_____.

_____
(Signature of Bombardier)

All above items have been checked and completed as shown.

_____
(Signature of Crew Chief)

All above entries have been noted and checked by the crew and by myself as shown by signatures.

_____
(Signature of Pilot)

*Crew chief will complete this report prior to the arrival of the crew at the airplane and will present it to the crew upon their arrival for their inspection and signature.

AIRPLANE NO. | DATE | PILOT | WT. AT T.O. | TOTAL OIL AT T.O. | MISSION

TIME OF T.O. | TO | COPILOT | C.G. AT T.O. | TOTAL FUEL AT T.O. | FROM:

TIME	I.A.S.	ALT.	FREE AIR TEMP	FUEL IN TANKS								FUEL CONSUMED IN LAST PERIOD		R P M				MANI. PRESS.				MIX. CONT.				CYL. HEAD TEMP.				OIL PRESS				OIL TEMP.				WT.	POS OF C.G.
				1	2	3	4	LBB	RBB	L. AUX	R. AUX.	GALS.	GALS PER HR *	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4		

* USE CRUISE CONTROL CHART

ARMY AIR FORCES PILOT TRANSITION SCHOOL (FOUR-ENGINE)

(Name of School)

(Location)

PILOT TRANSITION TRAINING RECORD

* * * * * * * * * * * * * * * * * * * *

TO BE FORWARDED AIR MAIL TO 2ND AIR FORCE GROUP TO WHICH STUDENT IS ASSIGNED IMMEDIATELY UPON ASSIGNMENT

* * * * * * * * * * * * * * * * * * * *

Name _____ Rank _____ Asn. _____

Date of Pilot Rating _____

Received Advanced SE / TE Training at _____

The above named officer has completed the items initialed and has the following flying time to his credit.

Total Hours Prior to Four-Engine Phase _____

_____ Hrs. Pilot P- _____ _____ Hrs. Co-Pilot P- _____

_____ Hrs. Day _____ Hrs. Night _____ Hrs. Instrument

Total Hrs. at this Station _____ Previous Link Trainer Hrs. _____

Total Hrs. Four-Engine Time _____ Link Trainer Hrs. Here _____

Total Military Time to Date _____ Link Trainer Check _____

TRAINING GROUP _____ SQUADRON _____

TAB "J"

Transition Training For Pilot

BEFORE EVERY FLIGHT: Check weather. Secure weather code. Pick alternate base. Obtain necessary maps and forms. Check airplane and equipment before flight.

	Rating				Date Qualified	Instructor's Initial	Student's Initial
	Not Checked	Good	Fair	Poor			
PRE-FLIGHT INSTRUCTIONS							
1. Read pertinent Technical Orders							
2. Read Group Information File							
3. Familiarization with complete airplane							
4. Emergency procedures							
5. Cockpit drill and check list familiarization							
6. Forms 1 and 1A, Loading List							
7. Clearances and metro code forms							
8. Blindfold Cockpit Check							
FLIGHT TRAINING							
1. Day Transition							
a. Starting engines--Check list procedure							
b. Taxiing							
c. Takeoff							
Pilot procedure							
Co-pilot procedure							
d. Air work							
Banks 15°, 30°, and 45°							
Precision turns							
Glides and climbs--proper power setting							
Spirals, up and down, maintaining given air-speed and degree of bank							
Approaches to stalls and recovery (Primary & Secondary)							
Gear and flaps up							
Gear and flaps down							
De-icers on							
e. Emergency procedure practice							
Three-engine operation							
two-engine operation							
Prop feathering and unfeathering							
Auxiliary equipment lost on feathering each eng.							
Fire extinguishing procedure							
Emergency bail-out procedure practice							
Opening of bomb bay doors and hatches							
Life rafts and dinghy drill (On ground at end of mission)							
Fuel transfer (on navigation flight)							
Manual operation of landing gear							
Manual operation of flaps							
Three-engine takeoff							
Run-away prop or turbo							
f. Landing procedure							
Traffic pattern, normal							
Traffic pattern, close in							
Use of power in approach							
Landings							
Normal Landing							
Cross-wind landing							
Maximum performance landing (minimum roll after landing)							
Go-around procedure							
g. Three-engine approach to landing simulated two-engine approach							

	Rating				Date Qualified	Instructor's Initial	Student's Initial
	Not Checked	Good	Fair	Poor			
2. Night Transition							
a. Familiarization with lighting equipment							
b. Taxiing							
c. Takeoff							
d. Use of power in climb cruise and approach							
e. Air work							
f. Landing pattern							
g. Landings							
h. Night solo transition							
3. Instrument Flying							
a. Hooded takeoff							
b. Climbs							
c. Straight flight holding course and altitude							
d. Turns--various degrees of precision banks and turns--altitude constant							
e. Airwork with gyro instruments caged							
f. Spirals, up and down, airspeed constant							
g. Orientation by automatic loop-- marker receiver							
h. Orientation--true fade method							
i. Let-down procedure--including initial, final, and low approach over airport							
j. Pull-up--go-around procedure							
k. Air work on two and three engines							
l. Air work at low speed (half-flap)							
m. Instrument solo practice							
n. Instrument check per AAF Reg. 50-3							
4. Formation							
a. Assembly from single plane takeoff							
b. Relative position in 3-plane V							
Straight and level							
Turns--10°, 20°, and 30° bank							
c. Relative position in 3-plane echelon							
Straight and level							
Turns away from echelon							
d. Landing							
Assuming proper spacing from 3-plane V and echelon							
5. Altitude Flying							
a. Use of power in climb, cruise and descent							
b. Use and knowledge of oxygen equipment							
Low pressure system							
Demand system							
Emergency equipment							
c. Use and knowledge of heating equipment							
d. Knowledge of proper precautions to take on altitude flight							
6. Navigation--Day and Night							
a. Flight planning							
b. Clearances and weather (metro codes)							
c. Pilotage							
Day							
Night							
d. Dead reckoning							
e. Radio navigation							
Use of radio aids							
Automatic Loop							
Aural Null							
DF fixes							
f. Radio position reports and use of radio equipment							

	Rating						
	Not Checked	Good	Fair	Poor	Date Qualified	Instructor's Initial	Student's Initial
g. Cruising and loading data							
h. Strange field landings (Minimum of 3 fields)							
i. Team work with navigator							
j. Instrument calibration							
k. Solo navigation flight							
7. Additional Flying Instruction							
a. Altitude formation							
b. Bomb Approach and P.D.I. Procedure							
c. Auto Pilot Instruction							
d. _____							

GROUND INSTRUCTION

	Date	Grade	Instructor
1. Theoretical engineering			
2. Navigation			
3. Practical meteorology			
4. Oxygen (altitude flying and use of equipment)			
5. First aid			
6. Code and signal lamp review			
7. Radio			
8. Bomb approach theory			
9. Practical engineering maintenance			
Pre-flight inspection			
25-hour inspection			
50-hour inspection			
Engine change			
10. Organization of Second Air Force			
11. Duties of Airplane Commander			
12. Aircraft recognition			

QUESTIONS TO BE ANSWERED BY INSTRUCTOR:

1. Does Student handle airplane with confidence?____ Yes ____ No
2. Does Student show excessive nervousness?____ Yes ____ No
3. Does Student show any indications that he has developed a fear of flying?____ Yes ____ No
4. Does Student seem eager to go to combat?____ Yes ____ No ____ Indifferent
5. Are you aware of any domestic or financial difficulties which might keep him unsettled?____ Yes ____ No
6. Would you want this officer for a wing man in combat?____ Very Much ____ Yes ____ No
7. Has this man repeatedly complained of physical ailments during his training period?____ Yes ____ No

Note below any further explanations of above answers if desired.

REMARKS: (Give brief estimate of student's flying ability listing any flying or command deficiencies)

_____

Training Squadron Commander