***TM 55-1510-215-MTF**

MAINTENANCE TEST FLIGHT MANUAL

ARMY MODEL RU-21H (GUARDRAIL V) AVIONICS UPGRADE AIRCRAFT

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

***This manual supersedes TM 55-1510-200-MTF of 7 April 1981, including all changes, inasmuch as pertains to RU-21H (GR-V) Aircraft.**

HEADQUARTERS
DEPARTMENT OF THE ARMY

28 MAY 1993

WARNING

A maintenance test flight is an exceptionally demanding operation and requires a thorough flight readiness inspection (PREFLIGHT). The flight readiness inspection is prescribed in TM 55-1510-215-10-2 operator's manual and must be completed prior to each maintenance test flight. Emergency procedures are found in the applicable -10 or checklist (-CL) and are not duplicated in this publication. Prior to each maintenance test flight, the pilot will contact maintenance/quality control personnel to determine the maintenance that has been performed. This manual should be used only by qualified maintenance test flight pilots as required in AR 95-1.

TABLE OF CONTENTS

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of the applicable Aircraft Operator's Manual (when using the 2028-2 from the Operator's manual, insure the publication number and title reflect this MTF) direct to Commander, US Army Aviation and Troop Command, ATN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

*This manual supersedes TM 55-1510-200-MTF of 7 April 1981, including all changes, inasmuch as pertains to RU-21H (GR-V) Aircraft.

TABLE OF CONTENTS (CONT)

SECTION I. INTRODUCTION

1. Purpose. The purpose of this manual is to provide complete instructions for performing a maintenance test flight of the RU-21H (GR-V) avionics upgrade aircraft with MWO 1-1510-215-55-1 installed. For the specific conditions which require a general or limited maintenance test flight, refer to TM 1-1500-328-25 and the applicable aviation unit and intermediate maintenance manual.

2. Definition.

a. Maintenance Test Flight. A functional test flight for which the primary purpose is to determine whether the airframe, powerplant, accessories and other equipment are functioning in accordance with predetermined requirements while subjected to the intended environment.

b. Warnings, Cautions, and Notes. Warnings, Cautions, and Notes are used to emphasize important and critical instructions and are used for the following conditions:

WARNING

An operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, will result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which is essential to highlight.

3. General Information.

a. This manual covers only maintenance test flight of the RU-21H(GR-V) avionics upgrade aircraft and in no way supersedes any information contained in TM 55-1510-215-10-2, or -CL but is to be used in conjunction with the -10 or -CL. For the purpose of maintenance test
flights only, this manual satisfies all the requirements of the -CL from Interior Check through Engine Shutdown.

b. Crew requirements will be as specified in TM 55-1510-215-10-2 and AR 95-1.

c. The duration of a general or limited test flight will be in accordance with the requirements of TM 1-1500-328-25.

4. Special Instructions.

a. Cargo and Passengers. *Cargo and passengers are prohibited* on maintenance test flights.

b. Forms and Records. Forms and records will be checked prior to the maintenance test flight to determine what maintenance has been performed and the type of maintenance test flight required (i.e., general or limited).

c. Configuration. The configuration of the aircraft should be determined prior to each maintenance test flight in order to determine performance parameters.

d. Post Test Flight Inspection. A thorough visual inspection will be performed to the extent necessary to assure that deficiencies or short-comings that may have developed as a result of the maintenance test flight are detected.

e. References. When a maintenance test flight is required to assure proper operation of a specific system(s), refer to the applicable maintenance manual for the limits of that system.

f. Asterisked Checks. An asterisk (*) prior to a check requires that the Test Flight Check Sheet be annotated with a specific reading. Also a check (V) for satisfactory performance, or an (X) for problem detected will be recorded and a short statement entered in the remarks block of the Check Sheet.

g. An (0) prior to a check indicates a requirement if the equipment is installed.

h. Maintenance Test Flight Check Sheet. The Check Sheet contained in Section V will be used for all test flights. When a test flight is performed to determine if specific equipment or systems are operating properly, completion of only that portion of the maintenance test flight Check Sheet applicable to the specific equipment or systems being tested is required. The aircraft test flight Check Sheets may be locally reproduced. Continuation sheets may be used when necessary. Items that prove to be unsatisfactory during the test flight and require corrective action, shall be listed in the remarks block during flight and transferred to DA Form 2408-13 immediately after termination of the flight. The sheet will be attached to the DA Form 2408-13 upon completion. After accumulation of two or more sheets, the data should be reviewed to determine if trends are developing.

SECTION II. MAINTENANCE TEST FLIGHT CHECKLIST

General. This section contains the maintenance test flight requirements peculiar to Army model RU-21H (GR-V) avionics upgrade aircraft. Conditions requiring accomplishment of test flights shall be in accordance with TM 1-1500-328-25. The requirements contained herein are established to assure a thorough inspection of the air- craft before flight, during flight and upon completion of the maintenance test flight. The right side of the checklist (Troubleshooting Reference) is cross indexed to the troubleshooting guides contained in Section III. A dash between references means 'through'; a comma means 'and'. The references list the possible abnormal conditions, indications or malfunctions which could be encountered while performing the procedure.

PROCEDURE	TROUBLESHOOTING REFERENCE

PRIOR TO MAINTENANCE TEST FLIGHT

*1. Forms and records - Check.

*2. Weight and balance - Maintenance test flights shall be flown at the weight of 9500 ±350 lbs and center of gravity between stations 153.2 and 160.4.

*3. Thorough flight readiness inspection in accordance with the requirements contained in TM 55-1510-215-10-2 - Performed.

PROCEDURE	TROUBLESHOOTING REFERENCE
PRIOR TO MAINTENANCE TEST FLIGHT (CONT)	
*4. Special pre-flight checks:	
a. Battery switch- ON.	C7,11
b. Check all interior and exterior lights and press to test lights.	C24,25,26 36,37,41 45,46
(1) Check fuel gages to insure indications agree with fuel quantity.	
c. Fuel control panel - Check the following items by listening to them operate as they are turned on and off one at a time:	
(1) Auxiliary fuel pumps (2).	B13-15
(2) Transfer pumps (2).	C39
(3) Fire wall shutoff valves (2).	
(4) Crossfeed valve.	C38
d. Pitot heat and stall warning heat- Check by feel for heating.	C29,32
e. Flaps - Check in full down and full up positions.	C27,C28

f. Windshield anti-ice operation - Check. The electrothermal windshield will prevent initial ice adhesion to the glass, but will not remove ice already formed on the windshield. Therefore, anti-icing switches must be placed ON before entering icing conditions. When glass temperature exceeds 43°C, operational checks of the electrothermal windshields will be unreliable.

g. Battery switch- OFF.

h. Seat belts - Check for proper installation. Check date marked on seat belts with 2408-16.

i. Mission equipment - Check for and cable installations (Mission Test Flight).

j. Aircraft loading: Each aircraft shall be flown as follows: Pilot, observer, full fuel, optional equipment, and ballast if required to remain within CG limits. The average takeoff weight is 9500 ±350 lbs for the maximum power and speed check and stall flights. All other tests shall be conducted within normal weight limits.

PROCEDURE **TROUBLESHOOTING REFERENCE**

PRIOR TO MAINTENANCE TEST FLIGHT (CONT)

k. Check all interior and exterior placards and markings. Refer to TB 746-93-2.

l. Trim Tab travel and Direction Check. Trim tabs shall be operated through the full range of travel, noting any excessive friction or binding. Tab direction and neutral position will be verified at the control and the surface.

m. Flight controls Check operation and direction. Check movement of control surfaces for direction with movement of cockpit controls. Check for any abnormal friction or obstructions through full range of travel. With the elevator control pulled fully aft, there will be no tendency for the control wheels to swing to either side.

5. Inertial navigation system - Check as required (Section IV).

INTERIOR CHECK

1. Ladder- Stowed.

2. Cargo/loose equipment- Secured.

3. Cargo door- LOCK.

PROCEDURE	TROUBLESHOOTING REFERENCE
4. Main entrance door- LOCK.	
*5. Cabin emergency exit hatch - Secured (safety seal intact).	
6. MASTER AVIONICS switch - ON.	
7. Flare/chaff dispenser preflight test - completed.	
8. Flare/chaff dispenser rearm test - Conducted (prior to each rearming of a dispenser).	
9. Crew briefing - As required.	
10. Auxiliary equipment rack - Equipment installed/keyed as required.	
11. MASTER AVIONICS switch - OFF.	
BEFORE STARTING ENGINES	
1. Seats, pedals, belts, harnesses - Adjust.	
*2. Cockpit emergency entrance/exit hatch- Secured (safety seal intact).	
*3. Overhead control panel switches - Set, check interior lights.	C37
*4. Magnetic compass - Check for fluid, heading, and correction card.	

PROCEDURE	TROUBLESHOOTING REFERENCE

BEFORE STARTING ENGINES (CONT)

*5. Free air temperature gage - Note condition of indicator and verify current reading.

6. Fire detection test switch - OFF.

*7. Power levers - IDLE. E7

*8. Propeller levers - HIGH RPM. E8
Check for smoothness and binding throughout travel from the HIGH RPM (low pitch) stop back through low RPM (high pitch) to feather, being sure to check detent restrict- ing prop controls from being moved into feather.

9. Condition levers - FUEL CUTOFF.

10. Flaps - UP.

*11. Flight controls - Check for excess friction and obstructions through the full range of travel of all controls. A visual check shall be made to insure that the exterior surfaces move in the proper direction with a corresponding move of the controls.

PROCEDURE	TROUBLESHOOTING REFERENCE

*12. Trim tabs - Check by operating through their full range of travel, noting any excessive friction or binding. Tab direction and neutral position shall be checked on the indicator and at the surface. Maximum indicated up and down travel shall be checked and correct direc- tion confirmed.

13. Flare/chaff dispenser control panel - Check.

14. Control pedestal radios - As required.

15. Autopilot (AP) switch - OFF.

16. Flight director (FD) switch - OFF.

17. Landing gear emergency clutch disengage lever - Stowed.

18. Landing gear emergency extension handle - Stowed.

19. Fuel system circuit breakers - Check in.

20. Auxiliary fuel pumps - OFF.

21. Transfer pumps - OFF.

22. Crossfeed - CLOSED.

23. Keylock switch - ON.

PROCEDURE	TROUBLESHOOTING REFERENCE

BEFORE STARTING ENGINES (CONT)

24. INS/GYRO switch - As required.

25. Pilot's FREE SLAVE switch - As required.

26. Pilot's flight instruments - Check for correct readings.

*27. Engine instruments - Check range markings and slippage marks.

28. Flight management system - OFF.

29. INS MODE SELECT switch - As required. K52

30. Instrument panel radios and radar equipment- OFF.

31. RAD ALT switch - OFF.

32. Copilot's flight instruments - Check

33. Copilot's FREE SLAVE switch - As required.

34. Emergency static air source - EMERGENCY, then NORMAL (closed).

35. Copilot's circuit breaker panel - Check in.

36. Right subpanel circuit breakers - Check in.

37. Vent blower- OFF.
38. Heater- OFF.
39. Gear handle - DN.
40. Windshield anti-ice - OFF.
41. Inlet air separator - OFF.
42. Left subpanel light switches - OFF.
43. Deice cycle switches - Centered (off).
44. Autofeather system - OFF.
45. Heat switches - OFF.
46. Bus ISO switch - Down (off).
47. Landing lights - OFF.
48. Engine ice vanes - As required.
49. Auto ignition (or igniter power switches) - OFF.
50. Ignition/start switches (2) - OFF.
51. AC POWER switch - OFF.
52. INVERTER TEST switch - NORM.
53. Mission power switch- OFF.

PROCEDURE	TROUBLESHOOTING REFERENCE

BEFORE STARTING ENGINES (CONT)

54.	DC GPU - Connect as required.	C12
55.	Battery- ON.	C7-11
56.	Generators - OFF.	
*57.	Voltage - Check (28 VDC maximum).	C5-8,10
*58.	Annunciator panel - Test.	D1-4
*59.	Landing gear handle lights (2) - Test.	C26
*60.	Landing gear down indicator lights (3) - Illuminated.	C24
*61	Fire detection system - Test. Verify warning horn sounds; simultaneously the red MASTER WARNING light flashes and FIRE L ENG and FIRE R ENG lights illuminate in each (3) numbered fire detection system test switch positions.	C41-46

STARTING ENGINES (BATTERY/GPU)

1. Rotating beacons - ON.
2. Navigation lights - ON as required.
3. Auxiliary fuel pump - ON.

PROCEDURE	TROUBLESHOOTING REFERENCE
4. Engines - Start as follows:	A1-A8
a. Propeller- Clear.	
b. Ignition/start switch - ON.	
c. IGN ON light - Check illuminated.	
d. Condition lever - LOW IDLE (after N1 stabilizes at or above 12%).	
e. ITT Monitor (1090°C maximum for engine being started. 750°C maximum for operating engine).	
f. Ignition/start switch - OFF after ITT has stabilized. IGN ON light extinguished.	
g. Condition lever - As required. HIGH IDLE (first engine battery start only). LOW IDLE for second engine start.	
h. Generator (for battery or second engine start) - ON or RESET, then ON as required. GEN light extinguished.	
i. Propeller - Check unfeathered to insure adequate engine oil pressure.	

PROCEDURE	TROUBLESHOOTING REFERENCE

STARTING ENGINES (BATTERY/GPU) (CONT)

j. Loadmeter - Monitor, 0.5 or below.

5. Second engine - Start using steps (a.) through (i.),

6. DC GPU - Disconnect.

7. Fuel control heat- ON.

8. AC POWER- ON. C34

9. Inverters - Check as follows: C34, 35

   a. INVERTER TEST switch#1 OUT. INV 1 caution light illuminated and MSTR CAUT flashes.

   b. INVERTER TEST switch - NORM then reset MSTR CAUT.

   c. INVERTER TEST switch #2 OUT. INV 2 caution light illuminated and MSTR CAUT flashes.

   d. INVERTER TEST switch - NORM then reset MSTR CAUT.

10. MASTER AVIONICS switch - ON.

PROCEDURE	TROUBLESHOOTING REFERENCE

ABORT START

1. Condition lever - FUEL CUTOFF.
2. Ignition/start switch - STARTER ONLY.
3. ITT - Monitor for drop in temperature.
4. Ignition/start switch - OFF.

ENGINE CLEARING

1. Condition lever- FUEL CUTOFF.
2. Ignition/start switch - OFF (allow 30 seconds delay after engine run-down).
3. Ignition/start switch - STARTER ONLY (for 30 to 40 seconds).

BEFORE TAXIING

1. Altimeter - Set.
2. Avionics - As required.
3. Taxi clearance - As required.
4. Deice boots - Check antennas (upper and lower) and airfoils.

    a. Condition levers - High idle.

    b. Outside observer- Check boots for proper inflation and deflation.

PROCEDURE	TROUBLESHOOTING REFERENCE

TAXIING

*1. Brakes- Check. G4, 6-8

NOTE

If brakes have been overhauled they should be "burned-in" by applying near maximum braking (short of locking) for one or two landings or high speed taxi runs. After this, brakes should be checked for any tendency to drag.

*2. Flight instruments - Check settings and operation. B1-12

*3. Nosewheel steering Check. No turning tendency should exist while taxiing straight ahead with the same RPM on both engines with no braking and no rudder applied to either side. (This check must be performed with minimum cross wind.) Check freedom of movement and ability to turn aircraft using rudder pedals, engines and brakes. Note any indication of nosewheel vibration or shimmy during takeoff or landing.

*4. Magnetic compass - Check for freedom of movement. B4

ENGINE RUNUP

1. Aircraft - Position crosswind.

2. Nose wheel- Center.

PROCEDURE	TROUBLESHOOTING REFERENCE
*3. Parking brake - Set (keep feet on rudder pedals). The parking brake must lock without undue pressure on the brake pedals and release cleanly when parking brake handle is reset.	G5
*4. Fuel transfer pumps - Check as follows:	C39
a. Transfer test switch - Hold to "R"'	
b. Right transfer pump switch (while watching annunciator panel) - ON.	
c. Monitor R FUEL XFR light - Check for momentary flash.	
d. Repeat check procedure for left transfer pump system.	
*5. Fuel system crossfeed operation - Check as follows:	C38
a. Left and right auxiliary fuel pumps - ON.	
b. Crossfeed- OPEN.	
c. Annunciator panel - Observe that CROSSFEED light is illuminated.	

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE RUNUP (CONT)

d. Left hand auxiliary fuel pumps - ON.

e. Repeat for right hand system.

*6. Flaps - Check operation of four panels and flap position indicator. C27,C28

*7. Propeller manual feathering - Check by pulling propeller levers aft through detent to FEATHER. Check that propeller will feather, then advance lever to HIGH RPM. F17,18

8. Power levers - Set 70% N1.

*9. Instrument vacuum or pressure system Check. Instrument vacuum or pressure system reads 4.3 - 5.9 in. Hg.

*10. Deicing gage pressure - Check.

*11. Engine auto ignition system - Check.

a. Power levers - Advance to **500 FT-LB TORQUE**.

b. Auto ignition - ARM (check green IGNITION ARM lights illuminated).

PROCEDURE	TROUBLESHOOTING REFERENCE
c. Power levers - Retard. At approximately **350 FT-LB TORQUE** annunciator L and R IGN ON lights illuminated, green IGNITION ARM lights extinguished.	
d. Autoignition - OFF.	
*12. Propeller autofeather system - Check.	F7-17
a. Power levers - Advance to 500 ft-lb torque.	
b. Autofeather test switch - TEST. Hold to TEST position and check both AUTO- FEATHER lights illuminated; retard one power lever. **AT 350 - 450 FT-LB TORQUE**, check opposite AUTOFEATHER light extinguished. **AT 160 - 290 FT-LB TORQUE**, check both AUTOFEATHER lights extinguished; check propeller starts to feather.	
c. Power lever - Return to **500 FT-LB TORQUE.**	
d. Repeat steps b. and c. using the other power lever.	
e. Propeller autofeather test switch - ARM.	

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE RUNUP (CONT)

f. Both power levers Advance to 88-92% N1 (observe ITT and torque limits). Check both AUTOFEATHER lights illuminated. Retard each power lever individually below 88-92% N1. Check both AUTOFEATHE R lights extinguished.

*13. Overspeed governor - Check by setting RPM to 2100. Hold PROP GOV TEST switches UP. RPM should **DECREASE TO 1980 - 2060**. Release test switches. RPM should return to 2100. F1-6

*14. Engine ice vanes (Pull to EXT) - Check operation by observing drop in torque reading, verify that handle remains extended when released, then push to RET.

*15. Primary governor - Check. Set 1900 RPM with power levers. Retard propeller levers to detent position. Check for 1725 - 1775 RPM then advance propeller lever to HIGH RPM. F1-6

*16. Propeller low pitch blade angle - Check on one engine at a time as follows: E4

a. Read the corrected propeller torque in ft-lb at 2000 RPM from Propeller Torque Chart (figure 1).

PROCEDURE	TROUBLESHOOTING REFERENCE
b. Propeller levers - HIGH RPM (full forward).	
c. Power levers - Set 2000 RPM.	
d. Torquemeter - Read and record torque.	
e. Power levers - IDLE.	
f. Torque reading taken in step d. must equal the corrected torque read from figure 1 in step a. within ± 60 ft-lb.	
17. Aircraft - Turn into wind.	
*18. Engine acceleration - Check as follows:	
a. Condition levers - HIGH IDLE.	E2
b. Turbine tachometers Verify that engine accelerates smoothly from 50-53% N1 to 70-73% N1 in not more than four seconds. Time to accelerate will vary with temperature, altitude, and engine specification.	
*19. Secondary idle stop- Check:	F1-6
a. Condition levers - HIGH IDLE.	
b. Power levers - IDLE.	

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE RUNUP (CONT)

c. Test switches - TEST.

d. Cushions - Check as required (Section IV).

e. Power levers - Move AFT until primary pitch or secondary LOW Pitch STOP lights illuminate.

f. RPM - Note rise, 170 to 250 RPM.

g. Test switch - Release (note RPM increase).

h. Condition Levers - LOW IDLE.

*20. Propeller reversing - Check as follows: E3-5

a. Propeller levers - HIGH RPM (full forward).

b. Condition levers - Low idle.

c. Power levers - Slowly pull into full reverse position.

d. Turbine tachometers - Read. Maximum N1 must be 82 to 88%.

e. Propeller tachometers - Read. Propeller tachometers should read within 100 RPM of each other.

PROCEDURE	TROUBLESHOOTING REFERENCE

f. Power levers - IDLE.

21. Condition levers - HIGH IDLE.

22. Generators and regulators - Check by observing volt-loadmeters for the following characteristics: C1-6

a. Positive charging rate.

*b. Regulated voltage of 27.5 to 29.0 volts.

*23. Inlet air separator system - Check as follows at 70% N1:

a. Inlet air separator switch - AUTO. Observe the following:

(1) Torque should decrease on both engines.

(2) ITT should increase on both engines.

(3) MASTER CAUTION lights will flash, and the PARTICLE SEPARATOR light will illuminate.

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE RUNUP (CONT)

b. Inlet air separator switch - OFF. Monitor for deactivation of both left and right systems. The torque and ITT should return to initial values, the PARTICLE SEPARATOR light should extinguish, and the MASTER CAUTION lights should stop flashing after reset.

24. Condition levers - LO IDLE. E1

*25. Health indicator test (HIT) - As required (Section IV).

26. Condition levers - HIGH IDLE.

27. Engine instruments - Check all engine instruments for indications within the following markings:

*a. Oil temperature:

0-85°C	(when using MIL-7808 oil).
0-99°C	(when using MIL-23699 oil).

* b. Oil pressure: 65-85 PSI.

28. Condition levers - LO IDLE. E16

*29. Autopilot system check - Check as required (Section IV).

PROCEDURE	TROUBLESHOOTING REFERENCE

30. Radar altimeter (KRA 405) - Check as follows:

    a. Decision height knob (radar altimeter) - Adjust for height of 25 feet (shown by DH bug).

    b. Press TEST pushbutton - Observe indicated altitude of 50 ± feet, warning flag comes into view and DH indicator is not lit.

    c. DH knob - Slowly adjust until DH indicators light (TEST pushbutton must still be depressed). Observe DH bug is at 50 ± feet. — B8, B9

    d. TEST pushbutton - Release. Observe that warning flag retracts from view and indicates altitude is 0 feet, nominal.

NOTE

Strong radar reflections from nearby objects may cause radar altimeter indicator needle to remain in view. This does not indicate a radar altimeter system malfunction.

BEFORE TAKEOFF

1. Fuel panel - Check switches and circuit breakers set.

PROCEDURE **TROUBLESHOOTING REFERENCE**

BEFORE TAKEOFF (CONT)

2. Auxiliary fuel pumps - ON.
3. Annunciator panel - Test (check lights extinguished).
4. Engine and flight instruments - Check.
5. Propeller levers - Check HIGH RPM.
6. Friction locks - Set.
7. Flaps - As required.

WARNING

Ensure that the autopilot has been disengaged and check that the aircraft manual trim indicator is set to the takeoff position before takeoff. Operating the autopilot on the ground may cause the autotrim to run because of back force generated by the elevator downsprings or pilot induced forces.

8. Autopilot- Disengaged.
9. Flight director- As required.

PROCEDURE	TROUBLESHOOTING REFERENCE
10. Trim - Set.	
11. Engine ice vanes - As required.	
12. Fuel control heat- Check ON.	
13. Autofeather system - ARM.	
14. Flight controls - Check for full travel and proper response.	
15. Mirror - Retracted.	
16. Navigation radios - Set as required.	
17. Autopilot system check - Check as required (Section IV).	
18. Windows and doors - Secure (DOOR OPEN light extinguished).	
19. Takeoff clearance - As required.	
20. Anti-icing/deicing/pitot heat - As required.	
LINE UP	
1. Transponder - As required.	
2. INS/GYRO switch- As required.	
3. Power- Stabilized (70-80% N1).	E6,19-21, 28,29,J1
4. Autoignition - On.	
5. Landing/taxi lights - As required.	
6. Flight director - As required.	

PROCEDURE			TROUBLESHOOTING REFERENCE
DURING TAKEOFF			
*1.	Propeller tachometers - Check. During takeoff, tachometers must indicate 2200 to 2225 RPM.		
2.	Engine limits - Check. All engine instruments must not exceed the following prescribed limits with a minimum of fluctuation:		
*a.	Torque:	1315 ft-lb	E22,25, 26,30
*b.	ITT	750°C	B16,E24, 25,28
*c.	N1	101.5%	E17,18,29
*d.	Oil pressure	85 PSI	E9-11
*e.	Oil temperature:		E12
85°C	(when using MIL-7808 oil)		
99°C	(when using MIL-23699 oil)		
AFTER TAKEOFF			
After the aircraft is positively airborne, perform the following checks as applicable.			

PROCEDURE		TROUBLESHOOTING REFERENCE
1.	Gear-UP.	C13,17 23,25,26

NOTE

Listen for unusual noises during landing gear retraction.

2.	Flaps- UP.	C27,28
3.	Climb power - Set (1900-2000 RPM).	
4.	Auxiliary fuel pumps - OFF.	
5.	Autofeather system - OFF.	
6.	Landing/taxi lights - As required.	
7.	Wings and nacelles - Check for fuel and oil leaks.	E13,14,31
8.	YAW DAMP - As required.	

DURING CLIMB

1.	Engine and flight instruments - Monitor. All instruments must give proper indication with minimum fluctuation.	E26-30, B1-12
*2.	Engine controls - Check for alignment.	E7,8

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CLIMB (CONT)

*3. Vertical speed indicators - Check one at a time against altimeter as follows:

a. Read altimeter at beginning of timing for exactly one minute.

b. Read altimeter at end of minute.

c. Read vertical speed indicator.

d. Compare the second altimeter reading less the first with the vertical speed indicator reading.

e. The indication derived from the altimeter and the vertical speed indicator reading must agree within ± 100 ft/min.

*4. Surface and antenna deicing system - Check as follows: C40

a. Surface and antenna deicer switches - SGL. All surface boots should inflate for one cycle (they should stay inflated for 6-7 seconds).

b. Surface and antenna deicer switches Hold in MNL position. Boots should stay inflated until switch is released.

PROCEDURE	TROUBLESHOOTING REFERENCE
c. Surface and antenna deicer switches - Release. Check boots visually to see that they are sucked down flat after use.	
*5. Propeller deicer- Check as follows:	C53
a. Make four separate checks. Each time momentarily move the switch to PROP position and check propeller ammeter normal operation (14-18 amperes).	
b. Propeller deicer switch - ON.	
c. Propeller deicer ammeter Monitor for two minutes. A small momentary needle fluctuation must occur every thirty seconds when the propeller deicer timer is switching.	
*6. Cabin and cockpit ventilation system Check the following items for flow of air, binding controls, and the capability of being shut off by its own control:	
a. Eye ball cold air vents.	
b. Pilot's and copilot's vents.	
c. Windshield defroster ducts.	
d. Main cabin air ducts.	

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CLIMB (CONT)

*7.	Cabin and cockpit heating and defrosting system - Check as follows:	C47-52
	a. Heater switch- MANUAL.	
	b. Cabin temp control - INCREASE.	
	c. Cabin air control - Pull on.	
	d. Defrost air control - Pull on.	
	e. Check the following vents for heat flow:	
	(1) Pilot's and copilot's vents.	
	(2) Windshield defroster ducts.	
	(3) Main cabin air ducts.	
*8.	Carbon monoxide - Check the cock- pit and cabin for the presence of carbon monoxide. Maximum carbon monoxide allowable is 0.005%.	

LOW SPEED SYSTEMS CHECK

*1.	Stall characteristics (clean) - Check as follows:	C22
	a. Gear- UP.	
	b. Flaps- UP.	

c. Power- IDLE.

d. Trim aircraft to trim speed (132 ± 3 knots).

e. Airspeed - Reduce by one knot/ second until aircraft stalls (92 ± 3 knots).

*f. Roll must be controllable within 30 degrees left or right.

2. Stall characteristics (dirty) - Check as follows:

a. Gear - DN, below 154 KIAS.

b. Flaps - Down (100%), below 127 KIAS.

c. Power levers - IDLE.

d. Trim aircraft to trim speed (132 ±3 knots).

e. Airspeed - Reduce by one knot/ second until aircraft stalls (92 ±3 knots).

*f. Roll must be controllable within 30 degrees left or right.

3. Stall speed and stall warning (clean) - Check as follows:

a. Gear-UP.

PROCEDURE	TROUBLESHOOTING REFERENCE

LOW SPEED SYSTEMS CHECK (CONT)

b. Flaps - UP.

c. Power- IDLE.

d. Trim aircraft to trim speed (132 ± 3 knots).

e. Airspeed - Reduce by one knot/ second until aircraft stalls (92 ± 3 knots).

*f. Airspeed - Record when stall warning horn is first heard. C30

g. Silencer switch - DISABLE (stall warning horn should be silenced). C33

h. Silencer switch - ARM.

*i. Airspeed (at stall) - Record (KIAS).

j. Roll must be controllable within 30 degrees left or right.

4. Stall speed and stall warning (dirty) - Check as follows:

a. Gear- DN, below 154 KIAS.

b. Flaps - Down (100%), below 127 KIAS.

c. Power- IDLE.

d. Trim aircraft to trim speed (132 ± 3 knots).

e. Airspeed - Reduce by one knot/ second until aircraft stalls (92 ± 3 knots).

*f. Airspeed - Record when stall warning horn is first heard.

g. Silencer switch - DISABLE (stall warning horn should be silenced).

h. Silencer switch - ARM.

*i. Airspeed (at stall) - Record (KIAS).

j. Roll must be controllable within 30 degrees left or right.

*5. Flap operation - Check as follows:

a. Airspeed - Reduce to 173 KIAS

b. Flaps APPROACH. Check flaps for freedom and smoothness of operation and for excessive aircraft roll.

c. Airspeed - Reduce to 127 KIAS or below.

PROCEDURE	TROUBLESHOOTING REFERENCE

LOW SPEED SYSTEMS CHECK (CONT)

d. Flaps - 100%. Check flaps for freedom and smoothness of operation and for excessive air- craft roll.

*6. Carbon monoxide - Check the cock- pit and cabin for the presence of carbon monoxide. Maximum carbon monoxide allowable is 0.005%.

7. Flaps - UP.

8. Gear- UP.

*9. Propeller feathering - Check each engine as follows:

a. Airspeed- 115 KIAS.

b. Autofeather switches - OFF.

c. Power lever (engine to be feathered) - IDLE.

d. Condition lever (engine to be feathered) -IDLE CUTOFF.

e. Propeller lever (engine to be feathered) - FEATHER. Time to feather must not exceed 10 seconds from wind-milling at 2200 RPM to no rotation in the feathered position. F17

f. Engine restart.

(1) Electrical load - Reduce to minimum.

(2) Power lever (dead engine) -IDLE.

(3) Propeller lever (dead engine) - FEATHER.

(4) Condition lever (dead engine) - FUEL CUTOFF.

(5) Boost pumps (2) - ON.

(6) Crossfeed- OPEN.

(7) Fuel control heat- ON.

(8) N1 (live engine) - Reduce (90% or below).

(9) Ignition/start switch - On.

(10) ITT (live engine) - Monitor (750°C maximum).

(11) Condition levers - LO IDLE.

(12) ITT and N1 - Monitor (1090°C maximum).

(13) Ignition/start switch - OFF.

PROCEDURE	TROUBLESHOOTING REFERENCE

LOW SPEED SYSTEMS CHECK (CONT)

(14) Oil pressure - Check (40 PSI minimum).

(15) Generator- ON.

(16) Propeller- Synchronize.

(17) Power- As required.

(18) Electrical equipment - As required.

(19) Auxiliary fuel pumps (2) - As required.

(20) Crossfeed - As required.

*10. Propeller autofeathering system and propeller unfeathering - Check each engine as follows: F7-12, 17,18

NOTE

It may not be possible to perform an autofeathering check in low ambient temperatures.

a. Climb power - Set (N1 above 92%).

b. Autofeather switch - ARM.

c. Airspeed- 100 KIAS.

d. Propellers - 2200 RPM.

e. Condition lever (engine to be feathered) - IDLE CUTOFF.

f. Record the time from fuel cutoff until propeller rotation stops. Autofeather time is a function of oil temperature as shown in figure 2. Excessive autofeather time may indicate a system malfunction.

g. Propeller lever (dead engine) - FEATHER.

h. Engine restart.

(1) Electrical load - Reduce to minimum.

(2) Power lever (dead engine) - IDLE.

(3) Propeller lever (dead engine) - FEATHER.

(4) Condition lever (dead engine) - FUEL CUTOFF.

(5) Boost pumps (2) - ON.

(6) Crossfeed- OPEN.

(7) Fuel control heat - ON.

PROCEDURE	TROUBLESHOOTING REFERENCE

LOW SPEED SYSTEMS CHECK (CONT)

(8) N1 (live engine) - Reduce (90% or below).

(9) Ignition/start switch - On.

(10) ITT (live engine) - Monitor (750°C maximum).

(11) Condition levers - LO IDLE.

(12) ITT and N1 - Monitor (1090°C maximum).

(13) Ignition/start switch - OFF.

(14) Oil pressure - Check (40 PSI minimum).

(15) Generator - ON.

(16) Propeller- Synchronize.

(17) Power- As required.

(18) Electrical equipment - As required.

(19) Auxiliary fuel pumps (2) - As required.

(20) Crossfeed - As required.

PROCEDURE **TROUBLESHOOTING REFERENCE**

DESCENT AND LOW LEVEL CRUISE

1. Maximum rate (VMO) descent. If the test pilot is satisfied that the entire aircraft is functioning properly perform the maximum rate descent check as follows:

   a. Pressure altitude - 10,000 feet.

   b. Power - 800-1000 ft.-lbs. torque.

   c. Propellers- Set 1900 RPM.

   d. Gear- UP.

   e. Flaps - UP.

   f. Airspeed - 206 KIAS maximum.

   g. Stall warning silencer switch -ARM.

Immediately reduce airspeed if any flutter, oscillation or vibration is encountered.

*h. Flight controls - Check for any indication of flutter, oscillation, vibration or malfunction.

PROCEDURE	TROUBLESHOOTING REFERENCE

DESCENT AND LOW LEVEL CRUISE (CONT)

*i. Windows and doors - Check for wind noise indicating air leaks.

j. Level off aircraft at 5000 feet.

*2. Attitude indicators - Check for proper attitude indication during level flight and for immediate response to changes in aircraft attitude. Check appropriate system as follows: B6-12

a. Gyro systems - Check as follows:

(1) INS/GYRO switch - GYRO.

NOTE

The INS/GYRO switch affects only the pilot's attitude indicator (P/O KCI 310).

(2) Level aircraft by visual reference.

(3) Attitude indicators - Check both to assure proper indication.

(4) Slowly make a 360° turn using a 4° or less angle of bank.

PROCEDURE	TROUBLESHOOTING REFERENCE

(5) At end of turn, again level aircraft by visual reference.

(6) Attitude indicators - Check both to assure proper indication.

(7) Repeat above procedure using a 10° angle of bank.

(8) Set INS/GYRO switch to INS and repeat steps (2) through (7).

*3. Directional gyros - Check for operation and precession. The maximum allowable precession in any 15-minute interval is 5°.

*4. Turn and slip indicators - Check as follows: B5

a. Airspeed - 143 ± 4 KIAS.

b. Both left and right-timed turns shall be accomplished. With turn indicator deflected one needle width (two-minute turn) aircraft should turn 180° ± 5° in 60 seconds.

PROCEDURE	TROUBLESHOOTING REFERENCE

DESCENT AND LOW LEVEL CRUISE (CONT)

5. Landing gear warning horn and silence button- Check as follows: C18,20,22

   a. Power levers - Retard slowly individually until landing gear warning horn first sounds.

   *b. Turbine tachometers - Read N1 on first hearing landing gear warning horn. The landing gear warning must sound when power levers are retarded below 77-81% N1.

   c. Landing gear warning horn silence button - Press. Landing gear warning horn should be silenced.

   d. Power levers - Advance past 77-81% N1. Landing gear warning horn should be armed again.

*6. Emergency landing gear extension system - Check operation and condition as follows:

   a. Airspeed - Below 154 KIAS.

   b. Gear power circuit breaker - Out (pulled).

   c. Gear handle - DN.

PROCEDURE **TROUBLESHOOTING REFERENCE**

d. Gear emergency clutch disengage lever - Pull up and turn 90° clockwise. Motor must be disengaged and re-engaged smoothly by action of this lever.

e. Gear emergency extension handle Pump the handle up and down until the three GEAR DOWN green lights illuminate. In the event of complete electrical failure, pump until resistance is felt. Approximately 70 complete strokes of the ratchet handle are required for complete gear extension.

7. Particle separator switch - AUTO.

DURING CRUISE

1. Power - Set. Do not exceed normal rated power torque setting.

2. Propellers - Set 1900 RPM (1800 - 2200 RPM optional).

3. Wings and nacelles - Check for fuel and oil leaks.

4. Volt loadmeter - Check.

*5. Speed-power check - As required (Section IV).

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

*6. Engine ice vanes - Check operation as follows:

a. Engine ice vane controls (left and right) - Pull.

b. Torquemeters - Read. Each engine should experience a 50 + 10 ft-lb torque loss when its vane is extended.

*7 Engine lip ice boots - Check by activating switches one at a time and monitoring loadmeter for momentary fluctuation.

*8. Trim and rigging - Check as required (Section IV).

*9. Autopilot - Check as required (Section H1-7 IV).

*10. INS - Check as required (Section K52IV).

*11. Carbon monoxide - Check the cock- pit and cabin for the presence of carbon monoxide. Maximum carbon monoxide allowable is 0.005%.

PROCEDURE REFERENCE	TROUBLESHOOTING	
*12	Audio control panel (C-10414/ ARC) and interphone system - Check each unit as follows:	
	a. Interphone functional check:	
	(1) RADIO MON/NAV switches - As required.	
	(2) Transmitter - interphone selector switch (on pilot's and copilot's audio control panel) - PVT. This activates hot mike feature. Pilot and copilot should be able to converse without pressing microphone switches.	K1, K2
	(3) Transmitter - interphone selector switches (on pilot's and copilot's audio control panel) - ICS. This will allow the pilot to talk to the copilot by pressing a microphone switch and speaking into microphone or vice-versa from copilot's position.	
	(4) Microphone switches - Actuate one at a time and speak into appropriate microphone. Side tone should be heard and speech should be heard in other headset.	

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

(5) Volume control - Check for function. K2

b. Receiver and transmitter facilities - Check as follows:

(1) Receiver volume controls. Turn all fully counterclockwise.

(2) RADIO MON/NAV switches (audio control panel) - Turn on one at a time and increase volume of appropriate receiver, listening for either radio reception or background noise.

(a) Cycle propeller deicer.

(b) Cycle fuel boost and fuel transfer pumps.

(3) Return each RADIO MON/NAV switch to the off position and the volume control fully counterclockwise.

(4) Transmitter -interphone selector switches (pilot's and copilot's) - ICS.

(5) Audio control panel volume control (pilot's) - Turn fully clockwise. Listen for excessive noise.

(6) Repeat for other audio control panel.

c. Receiver/transmitter selectors - Check as follows:

(1) Transmit and receive on each radio using the microphone switches one at a time.

(2) Repeat entire procedure for the other audio control panel.

d. RADIO MON selector switch - No. 5 position.

e. Operate the HF/VOW switches (located on the instrument panel adjacent to each audio control panel) as required to select either the HF receiver- transmitter or the VOW (mission secure UHF) receiver- transmitter.

*13. UHF command set (AN/ARC-164) - Check as follows:

a. Altitude - 1200 feet above ground level.

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

b.	RADIO MON selector switch (audio control panel) - No. 2 position.	
c.	Function selector switch (UHF command set) - BOTH.	K6
d.	Frequency selector switches - Select required test frequencies.	K4
e.	Mode selector - As required.	
f.	VOL control - As required.	K3
g.	SQUELCH control - As required.	K5
h.	TONE control- As required.	
i.	Fly aircraft from ground test station to a point 35 nautical miles away.	
j.	Communicate with ground station when 20 miles away and again at 35 miles.	K7

k. At 35 nautical miles maintain continuous communication with test station while flying a 360° turn. Communication should be uniformly loud and clear through these tests.

NOTE

It may be necessary to make this turn a level wing, flat turn.

1. Repeat step k. above for all assigned frequencies in the low, middle, and high ranges.

m. ECCM operation.

(1) Transmitter - interphone selector switch - No. 2 position.

(2) Function selector switch (UHF command set) - As required.

(3) Manual frequency (100 MHz)/ECCM selector - A.

(4) Preset channel selector - Select desired ECCM net.

(5) Conduct a two-way communications check.

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

*14. VHF command radio set (KTR- 908) - Check as follows:

a. Transmitter-interphone selector switch (audio control panel) - No. 3 position.

b. RADIO MON-3 switch (audio control panel) - On, as required.

c. Mode CHAN switch - As required.

d. Frequency - Set, as required.

e. Volume control - Adjust, as required. K9

f. Microphone switch - Press.

g. Establish communications with another station at least 1 mile away. Note the level and quality of both transmission and reception. All airborne test transmissions (above 1200 ft. Above ground level) to ground stations or other aircraft within 35 nautical miles shall be loud and clear. K8

h. Set RADIO MON and transmitter-interphone switches to No. 4 position and repeat steps c. through e. for VHF-AM 2.

PROCEDURE	TROUBLESHOOTING REFERENCE
*15. HF radio set (AN/ARC-199) - Check as follows:	
a. Transmitter-interphone selector (audio control panel) - No. 5 position.	
b. RADIO MON -5 switch - ON.	
c. HF/VOW switch (instrument panel) - HF.	
d. Frequency - Select test frequency (or channel).	
e. Volume - Set as desired.	
f. Squelch - Set as desired.	
g. Transmit power - Set as desired.	K11
h. Tuning mode - Initiate as required: Tuning sequence should last no more than 3 sec.	
i. Establish communications with ground station at least 150 miles distant on at least three frequencies (one each from the lower, middle and upper frequency ranges). Establish two way communications on AM and, when possible, on USB and LSB. Obtain signal quality reports from the other station and note received signal quality.	K10

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

j. When possible, check selective address (transmit and receive) operating mode.

*16. HF voice security mode (TSEC/ KY-75) - Check as follows:

a. Ensure HF radio set is operable (15. above).

b. PLAIN/CIPHER switch (TSEC/ KY-75 control) - CIPHER.

c. RMT/LOCAL/SIG CLR switch - RMT.

d. PWR/FILL switch - Set to desired fill register.

e. Secure voice (SV-DATA) mode (HF radio set) - Select as required.

f. Microphone switch - Press. Wait for the preamble to stop, then talk into the microphone.

PROCEDURE	TROUBLESHOOTING REFERENCE

g. Microphone switch - Release. Wait for the postamble to stop.

NOTE

The SIG/CIPHER RCV indicator light will flash during receipt of secure voice communications. After receiving a secure communications, wait until the postamble stops before initiating any transmission.

h. Obtain signal quality reports K12 from other station and note received signal quality.

*17. FM liaison set (AN/ARC-201(V) or AN/ARC-186(V)) - Check as follows:

a. Altitude - 1200 feet above ground level.

b. Transmitter-interphone selector (audio control panel) - No. 1 position.

c. RADIO MON -1 switch - ON.

d. MODE selector (AN/ARC-201(V)) - SC or (AN/ARC- 186(V))-TR. K13

e. FUNCTION selector - SQ as desired. K14

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

f. Frequency - Select test frequency (or channel).

g. Fly aircraft from ground test station to a point 35 nautical miles away.

h. Communicate with ground staion when 20 miles away and again at 35 miles. K15

i. At 35 nautical miles maintain continuous communication with test station while flying a 360° turn. Communication should be uniformly loud and clear through these tests.

NOTE

It may be necessary to make this turn a level wing, flat turn.

j. Repeat step i. above for all assigned frequencies in the low, middle, and high ranges.

NOTE

Steps k. through p. apply to AN/ARC-201(V) installations only.

PROCEDURE	TROUBLESHOOTING REFERENCE
k. TIME button - Press then check that correct day is displayed; press again and check for correct hours and minutes, then a third time and check for correct minutes and seconds.	
1. Frequency - Select operating frequency (or channel) of an FM station of known bearing.	
m. MODE selector - HOM.	
n. HSI select switch panel (instrument panel) - HOME.	
o. HSI (instrument panel) Observe bearing to station displayed on course pointer and signal strength displayed on glideslope deviation indicator.	
p. When possible, check frequency-hop (FH MODE) operations for loud and clear communications.	K16
*18. UHF/FM voice security sets (TSEC/KY-58) - Check as follows:	
a. Ensure associated radio set (FM liaison, 17. above, or UHF command, 13. above) is operable.	
b. MODE switch (voice security set) - C (cipher).	

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

c. Register/zeroize switch - Select desired fill register.

d. OFF/ON/TD switch - ON (interrupted tone should be heard in headset). K17

e. Microphone switch - Press momentarily (interrupted tone in headset should cease). K18

f. Microphone switch - Press (do not talk). When beep is heard in headset, conduct two way communication check.

g. Check the following modes of operation:

(1) Aircraft and ground station- both in CIPHER mode, operating the aircraft and the ground station each in turn, as the transmitting station. K19

(2) Aircraft and ground station in PLAIN mode, operating each in turn as the transmitting station.

(3) Aircraft in CIPHER mode, and the ground station in PLAIN mode, operating the ground station as the transmitting station.

h. Repeat entire procedure for remaining voice security sets (TSE C/KY-58).

*19. Gyromagnetic compass sets (KCS 305 and KCS 55A) - Check as follows:

a. FREE/SLAVE switches - As desired.

b. All operable aircraft systems shall be in normal operation.

c. Operate aircraft on four headings approximately 90° apart over known ground references.

d. Verify the following:

(1) HSI and RMI headings agree with the known heading within + 4 degrees.

(2) HSI headings agree within + 2 degrees.

(3) RMI headings agree K20 within ± 2 degrees.

*20. ADF radio set (KDF 806) - Check as follows:

a. NAV B switch (audio control panel - ON).

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

b.	OFF/VOL control (ADF control) - Turn clockwise, out of the OFF position.	
c.	Frequency - Select operating frequency (or channel) of an LF station of known bearing.	
d.	PUSH MODE switch - Press to select ADF or ADF BFO as required.	
e.	Volume control - Adjust as required.	K23,K25
f.	Pilot's HSI and/or either RMI- Set to display ADF bearing. Bearing pointer should indicate correct bearing to station.	K21,K22, K24
g.	When possible select at least two different operating frequencies to verify ADF opera- tion in the low, middle and high portions of the frequency range.	
*21.	VHF Navigation set (KNR 634) - Check as follows:	
a.	NAV A switch (audio control panel) - ON.	
b.	OFF/VOL control - Rotate clockwise out of the OFF position.	

PROCEDURE	TROUBLESHOOTING REFERENCE
c. HSI's/RMI's - Set to display NAV/VOR.	
d. Frequency selectors - Set test frequency: Verify station identification (audio).	K26
e. Fly directly toward a VOR station of known direction and near enough to provide a reliable signal.	
f. Course selector knob (HSI) - Set indicator needle on course to station. The course deviation bar should be centered and the to/from indicator should read to. The GS off indicator should be visible but the NAV off warning flag should be concealed.	K27,K28
g. Course selector knob (HSI) - Set indicator needle on reciprocal of course to station. The course deviation bar should be centered and the to/from indicator should read from.	K28
h. Course selector knob (HSI) - Set indicator needle on course to station. The course deviation bar should be centered and the to/from indicator should read to.	

PROCEDURE	TROUBLESHOOTING REFERENCE
DURING CRUISE (CONT)	
i. Fly a 90° right turn such that the flight path is at a 90° angle to the direction to the station. The course deviation bar should deflect noticeably to the left after one or two miles of flight (assuming the station is 25 to 50 miles from the aircraft).	K28
j. VOR range test: Achieve adequate usable reception at 45 miles at 1,250 feet above station antenna altitude.	
k. Verify that HSI's and RMI's display the same bearing and course indications within ± 4 degrees.	
l. Ground-track accuracy test: Fly aircraft over a predetermined ground check point. The maximum error shall not exceed the specified minimums for IFR flight in FAR 91.25.	
m. Glideslope/marker beacon functions - Check as follows:	
(1) Frequency selectors (VOR control panel) - Set test frequency.	
(2) Fly an ILS approach monitoring localizer and glideslope indicators for proper operation.	K31

PROCEDURE	TROUBLESHOOTING REFERENCE
(3) Also during ILS approach, check that marker beacon indicators and audio function properly.	K29,K30
*22. Transponder (XPDR 2) set (AN/APX-100 and AAU-32A) -	
Check as follows:	
a. XPDR 1/XPDR 2 switch (instrument panel) - XPDR 2.	
b. MASTER control - STBY (allow 2 minute warm up).	
c. MASTER control- NORM.	
d. Mode switches - Set test mode.	
e. Code selectors - Set test code.	
f. Fly aircraft within line of sight of interrogating stations.	
g. Contact the facility by radio and request that the aircraft be interrogated and that the reply be checked for satisfactory response.	B17, K33,K34
h. Repeat steps d. through g. For all possible modes.	
*23. Transponder (XPDR 1) set (KXP 756 and KEA 346) - Check as follows:	
a. XPDR 1/XPDR 2 switch (instrument panel) - XPDR 1.	

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

b. ON/OFF switch- Rotate clockwise from OFF position.

c. Mode selector - ON.

d. Code selector - Set test code.

e. Fly aircraft within line of sight of interrogating stations.

f. Contact the facility by radio and request that the aircraft be interrogated and that the reply be checked for satisfactory response. K33

g. Mode selector - ALT.

h. Contact ground radar facility and request them to give you their altitude readout. Ground facility altitude readout must agree with aircraft altitude within ± 100 feet. K17,K33

*24. Radar set APN-215(V) - Check while airborne as follows:

a Turn on procedure: Function switch - TEST (information will appear after time delay period). K35

b. Initial adjustments:

(1) BRT control - As required. K43

PROCEDURE	TROUBLESHOOTING REFERENCE
(2) MODE switches - As required.	
(3) RANGE switches - 80.	K38
(4) 120/60 degree button - OFF.	
(5) TILT control - Move up or down to observe targets above or below aircraft. Echo display will change in shape and location only. Weather targets will not change shape or location. Ground targets are selected as a function of tilt.	K40,K42
c. Test procedure: Observe screen for proper display.	K37,K39, K41
Test display consists of two green, two yellow, and a red band on a 120 degree scan. The word TEST will be displayed in upper right corner. Operating mode selected by MODE switches, either MAP, WX, or WXA will be displayed in lower left corner. If WXA has been selected, red band in the test pattern will flash on and off. Range will be displayed in upper right corner beneath TEST and appropriate range mark distances will appear along right edge of the screen. Complete test patterns may be seen only on 80 mile range or	K36

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

higher. Flying level at an altitude of 8,000 to 10,000 feet will allow mapping of ground targets to a range of approximately 100 miles.

d. Antenna stabilization check:

NOTE

The pitch and roll output levels from the vertical gyro are governed by the 115 volt, 400 Hz excitation and, the linearity of the gyro, plus the ability of the gyro to follow the motion of the aircraft. The accuracy contributed by the antenna is its ability to respond to the gyro outputs. As a result of these factors, the stabilization system accuracy can vary up to ± 10% of the pitch or roll angle of the aircraft.

(1) Fly to an altitude above 10,000 feet.

(2) MODE switches - WX.

(3) RANGE switches - 120 or 60. K44

(4) STAB OFF switch - push on.

(5) While flying level (0° pitch, 0° roll), adjust TILT control to obtain a video pattern throughout the upper range marks. Note TILT control setting. If the inner ring of video is not parallel to the range mark, the error is caused by mechanical displacement of the antenna about the roll axis of the aircraft. Use TILT control to determine exact error. Correct on ground, if necessary, before further in-flight calibration. K40

(6) Push off the STAB OFF button to restore stabilization.

(7) Pattern observed in step (5) should not change. If the pattern shifts either left or right around the second range marks, ground check leveling of the gyro and accuracy of the horizon indicator. Use TILT control to find exact error.

(8) Roll the aircraft 20° right. For perfect stabilization, the terrain band should be displayed throughout the third range marks.

DURING CRUISE (CONT)

(9) If the terrain band shifts to the right around the second range marks, increase tilt angle using TILT control until pattern is displayed throughout the third range marks. Note new position of TILT control. It should not be more than two degrees above that noted in step (5).

(10) If the terrain band shifts (in step (8)) to the left around the second range marks, decrease tilt angle using TILT control until pattern is displayed throughout the third range marks. Note new position of TILT control. It should not be more than two degrees below that noted in step (5).

(11) If the differences between steps (10) and (5) or steps (9) and (5) are greater than two degrees, recalibrate roll stabilization circuitry to the gyro using the following procedure:

(a) Reset the TILT control under the flight conditions of step (5) with stab on. Then roll the aircraft 20° right.

(b) If the pattern shifts to the right around the second range mark, slowly adjust the ROLL TRIM potentiometer until the terrain band is displayed throughout the third range marks. Usually a clockwise adjustment is required.

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

(c) If the pattern shifts to the left around the second range mark, slowly adjust the ROLL TRIM potentiometer until the terrain band is displayed throughout the third range marks. Usually a counterclockwise adjustment is required.

(d) If the pattern shifts toward the center of the second and third range marks, there is no roll stabilization.

NOTE

Refer to TM 1-300 for weather observation, interpretation, and application.

e. NAV switch - Press, verify navigation data displayed as selected by GRAPHICS INS/ FMS switch. K45

f. Ground mapping operating procedure: MODE switch - MAP.

g. Standby procedure: Function switch - STBY.

h. Shutdown procedure: Function switch - OFF.

*25. TACAN radio set (AN/ARN- 136(V)) - Check as follows:

a. Turn on and self test.

(1) OFF/VOL/PUSH TST control - Rotate clockwise from OFF position. K46

(2) Channel/Frequency controls - Set to channel 129x in active display field.

(3) HSI's and RMI's - Set to display TACAN information.

(4) HSI's - Rotate COURSE select knob to select 180 degrees.

(5) OFF/VOL/PUSH TST (TACAN) - Depress and hold.

(6) Verify both RMI's indicate 180 degrees, both HSI course deviation bars center, TO/FROM indicators indicate TO, and range indicators read approximately 0 nautical miles. K47

(7) OFF/VOL/PUSH TST button - Release.

PROCEDURE	TROUBLESHOOTING REFERENCE
DURING CRUISE (CONT)	
b. Channel selector - Set test channel. Station should be near enough to provide reliable signal and direction to the station should be known: Verify station identification (audio).	K50
c. Verify that RMI's indicate bearing to station.	
d. COURSE select knob (HSI) - Rotate until course arrow indicates bearing shown on RMI (c. above).	K48,K49
e. Verify that HSI course deviation bar is centered, TO/FROM indicator reads TO, GS OFF flags are visible and NAV warning flags are hidden from view. Also verify that DME indicators display correct range, speed and time to station.	
f. COURSE select knob (HSI) - Rotate until course arrow indicates RMI reciprocal bearing.	
g. Verify that HSI course deviation bar is centered and TO/FROM indicator reads FROM.	

h. COURSE select knob (HSI) - Rotate until course arrow again indicates bearing on RMI, c. above, and TO/FROM indicator reads TO.

i. Fly a 90° right turn such that the flight path is at a 90° angle to the direction to the station. The vertical needle on the course indicator-selector should deflect noticeably to the left after one or two miles of flight (assuming the station is 25 to 50 miles from the aircraft).

j. TACAN range test: Achieve adequate usable at 45 miles at 1,250 feet above station antenna altitude.

k. TACAN ground-track accuracy test: fly aircraft over a predetermined ground check point. The maximum error shall be ± 3°.

1. Check TACAN distance indicator for accuracy by comparing indicated distances with known distances, speed, and elapsed time.

m. Check air-to-air mode when a similarly equipped aircraft is available at a known range.

PROCEDURE	TROUBLESHOOTING REFERENCE

DURING CRUISE (CONT)

*26. Microwave landing system (MLS 21) - Check as required (Section IV).

*27. Flight management system (KNS 660) - Check as required (Section IV).

*28. Autopilot flight check - Check as required (Section IV).

DESCENT-ARRIVAL CHECK

NOTE

All operational procedures must agree with TM 55-1510-215-10-2.

Perform the following checks prior to traffic pattern entry:

1. Seat belts and shoulder harnesses Secure.
2. Fuel panel- Check.
3. Inlet air separator- As required.
4. Engine ice vanes - As required.
5. Stall warning switch - Arm.

BEFORE LANDING

Perform the following checks upon pattern entry:

PROCEDURE	TROUBLESHOOTING REFERENCE
1. Auxiliary fuel pumps - ON.	
2. Autofeather- ARM.	
3. Flaps - APPROACH (below 173	C27,28 KIAS).
4. Gear- DN (below 159 KIAS) check lights.	C13,15 16,17,21, 24
5. Landing lights - On.	
6. Autopilot - Disengaged.	

LANDING

Perform the following checks during final approach to runway:

1. Gear - Recheck DN (check lights).	C21,C24
2. Propellers - As required (high RPM if beta or reversing is required).	
3. Brake operation - Check during landing roll for any tendency to bleed down, drag after release or indicate asymmetrical braking power.	G1-4,6-8
*4. Propeller tachometers (idle) - Check. Propeller RPM must match within 30 RPM at IDLE.	
5. Oil temperature - Monitor. Ground idle limits are 0°-85°C using MIL- 7808 oil or 40°-99°C using MIL- 23699 oil.	E12

PROCEDURE	TROUBLESHOOTING REFERENCE

GO AROUND

1. Power - Maximum allowable.
2. Airspeed - Establish 100 KIAS minimum.
3. Gear- UP (descent stopped).
4. Flaps - UP (APPROACH until 100 KIAS).
5. Climb power - Set (1900-2000 RPM).
6. Auxiliary fuel pumps - OFF.
7. Landing/taxi lights - As required.
8. Inlet air separator- OFF.

AFTER LANDING (CLEAR OF THE RUNWAY)

Complete the following procedures after the aircraft has cleared the runway:

1. Landing/taxi lights - As required.
2. Propellers - HIGH RPM.
3. Flaps - UP.
4. Particle separator light Illuminated.
5. Auxiliary fuel pumps - OFF.
6. Autoignition - OFF.

7. Anti-icing/deicing- OFF.
8. Inlet air separator - OFF.
9. Engine ice vanes - As required.
10. Radar/Transponder- Standby.
11. Voice security- ZEROIZE.

ENGINE SHUTDOWN

1. Parking brake - Set.
2. Heater - OFF.
3. Vent blower - OFF.
4. Radios/radar/Transponder - OFF and zeroized.
5. Autofeather system - OFF.
6. Heat switches (9) - OFF.
7. I NS and GPS - OFF.
8. AVIONICS MASTER switch - OFF.
9. AC POWER switch- OFF.
10. Propellers - FEATHER.
11. Condition levers - FUEL CUTOFF (ITT 610°C or less).
12. Transfer pumps - OFF.

PROCEDURE	TROUBLESHOOTING REFERENCE

ENGINE SHUTDOWN (CONT)

13. Crossfeed- CLOSED.
14. Oxygen regulator - NORMAL, 100%, and OFF.
15. Beacon/lighting systems - OFF.
16. Keylock switch- OFF.
17. Master switch - Down.

BEFORE LEAVING AIRCRAFT

1. Wheels - Chocked.
2. Parking brake - Release.
3. Flights controls - Locked.
4. Voice security computers (if installed) - Remove.
5. Transponder computer - Remove.
6. Windows and doors - As required.
7. Walk around inspection - Completed.
8. Check sheet (figure 3) - Completed and signed.

SECTION III. TROUBLESHOOTING

General. This section contains troubleshooting information that has been referenced in Section II checklist. This section lists possible conditions, abnormal conditions, and indications and probable causes. The information is to be used only as a quick reference and may not be all- encompassing.

TROUBLESHOOTING GUIDE A- STARTING

CONDITION

PROBABLE CAUSE

Al. Both starters inoperative.

a. Circuit breaker tripped in starter switch circuit.

b. Battery relay inoperative.

c. Low battery.

d. Loose connection or open circuit between battery relay and left starter relay.

A2. One starter inoperative.

a. Starter relay inoperative.

b. Poor ground at starter.

c. Open circuit.

d. Defective starting motor.

e. Switch defective.

A3. Engine slow to start or does not start.

a. Low battery.

b. Generator field grounding relay or generator field grounding disconnect relay defective.

c. High resistance starter circuit.

d. Defective starter-generator.

e. Turbine dragging.

A4. Excessive starting RPM.

a. Accessory gearbox input shaft coupling not engaged.

b. Accessory gear drives, bushings or compressor rear hub splines defective.

A5. Engine fails to light up.

a. Improper engine starting procedure.

b. Ignition system.

(1) No power to ignition exciter.

(2) Defective wiring or components.

c. Fuel system.

(1) Debris or ice in fuel system.

(2) Air lock in fuel control unit

(3) Engine driven primary high pressure pump.

A6. Engine fails or is slow to accelerate to idle N1 speed.

a. Improper engine starting technique or premature removal of starter from line.

b. Leaks or restrictions on fuel control unit pneumatic system.

c. Leaks in pneumatic line of propeller governor.

d. Fuel control unit contaminated with water or ice or corroded.

A7. Hot start or delayed light up.

a. Improper starting procedure.

b. Insufficient power from battery or ground power unit.

c. Poor connections on power input lines or starter- generator.

d. Low power to ignition exciter.

e. Defective ignition cable.

f. Defective igniters.

g. Defective ignition exciter.

h. Engine control linkage improperly rigged.

i. Fuel nozzle restrictions.

A8. Engine fails to or is slow to accelerate propeller to idle speed, N2.

a. Propeller oil transfer sleeve binding.

**TROUBLESHOOTING GUIDE B-
INSTRUMENTS**

CONDITION

PROBABLE CAUSE

B1. Airspeed indicator reading remains fixed.

a. Pitot pressure line clogged with ice or debris.

B2. Vertical velocity indicator inaccurate or inoperative.

a. Static line clogged.

b. Leak in line or instrument case or loose fittings.

c. Defective indicator.

B3. Airspeed indicator reads incorrectly or fluctuates excessively.

a. Pitot tube or pressure line partially restricted or leaking.

b. Static port or line clogged or static line leaking.

c. Faulty airspeed indicator.

B4. Magnetic compass inaccurate, sluggish or erratic.

a. Insufficient liquid.

b. External magnetic interference.

c. Defective compass.

B5. Turn-and-slip indicator inoperative or erratic (pilot's).

a. Tripped turn-and-slip circuit breaker.

b. Defective instrument.

B6. KCI 310 does not display proper attitude (GYRO selected).

a. Defective vertical gyro.

b. Defective INS/GYRO switch.

c. Defective navigation junction box No. 2.

d. Defective indicator.

B7. Copilot's attitude indicator does not display proper attitude.

a. Aircraft pressure or vacuum lines clogged.

b. Defective instrument.

B8. Neither indicator decision height annunciator lights.

a. Defective navigation junction box No. 2.

b. Defective dc junction box.

c. Defective radar altimeter.

B9. Pilot's or copilot's decision height annunciator does not light.

a. Defective navigation junction box No. 2.

b. Defective indicator.

B10. KCI 310 does not display proper attitude (INS selected).

a. Defective INS/GYRO switch.

b. Defective navigation junction box No. 2.

c. Defective INS computer.

B11. KCI 310 displays excessive difference between GYRO attitude and INS attitude.

a. Vertical gyro installed off-level.

b. INS computer installed off-level.

B12. FAST ERECT switch does not stop gyro tumble.

a. Defective switch.

b. Open wiring between switch and vertical gyro or switch and TB 2001-7 in nose avionics compartment.

c. Defective vertical gyro.

B13. Fuel quantity indicator fluctuates or reads low.

a. Defective pins in connector on harness that mates with gage.

b. Defective pins in connector on fuel probes and wing harness used to connect fuel probes.

B14. Fuel quantity gage pegs down scale against stop.

a. Defective probe.

b. Defective pins on connectors on both gage and probes.

c. Nacelle probe body is making contact with metal braided hose inside of nacelle tank.

d. Defective component on printed circuit board.

B15. Fuel quantity indicator needle pegs up scale against stop.

a. Defective component on printed circuit board.

B16. Interstage turbine temperature indicator inoperative or indicates inaccurately.

a. Defective or out of adjustment balance resistor.

b. Defective interstage temperature harness.

c Defective temperature indicator.

B17. Encoding altimeter defective or indicates inaccurately.

a. Power interruption to altimeter.

b. Altimeter setting incorrect

c. Altimeter defective.

d. Static port or line clogged.

TROUBLESHOOTING GUIDE C - ELECTRICAL

CONDITION

PROBABLE CAUSE

C1. Zero or low voltage indicated.

a. Engine speed too low.

b. Loose connection.

c. Open or shorted field circuit in generator or defective armature.

d. Brushes not contacting commutator.

e. Brushes worn out.

f. Dirty commutator.

g. Defective voltage regulator.

C2. No generator output.

a. Improper connections.

b. Tripped circuit breaker.

c. Open circuit.

d. Loss of residual magnetism.

e. Defective generator control switch.

f. Starter switch on.

g. Generator overvoltage circuit defective.

h. Paralleling circuit open.

i. Defective voltage regulator.

j. High resistance field circuit.

k. Shorted field.

l. Circuit breaker tripped.

C3. Low generator output.

a. Generators not paralleled.

C4. Low voltage.

a. Malfunctioning voltage regulator.

C5. Volt-loadmeter reads off scale in wrong direction.

a. Generator field magnetized in wrong direction.

b. Generator leads reversed.

C6. Volt-loadmeter does not indicate.

a. Tripped circuit breaker.

b. Open volt-loadmeter lead.

C7. No power indicated with battery master switch ON.

a. Battery discharged or defective.

b. Open circuit between battery and master switch.

c. Master switch defective.

d. Defective relay.

C8. Power on with master switch in OFF position.

a. Master switch defective.

b. Relay contacts stuck

C9. Apparent loss of battery capacity.

a. Cells unbalanced.

b. Electrolyte level too low.

c. Charging rate too low in aircraft.

d. Too little usage or shallow discharges.

C10. Complete failure of battery to operate.

a. Loose or brokenlead.

b. Loose or disengaged terminals in battery.

c. Battery not charged.

d. Cell open internally.

C11. Below normal battery output.

a. Battery switch left ON.

b. Voltage regulator set too low.

c. Internal connection links loose.

d. External connector burned or pitted.

e. Defective or reversed cells.

f. Cell case current leakage.

C12. External power fails to energize aircraft system.

a. Defective or incorrectly polarized external power source.

b. Defective external power receptacle.

c. Defective external power relay.

d. Loose or wrong connection in external power circuit

C13. Landing gear will not retract or lower.

a. Circuit breaker tripped in control or motor circuit.

b. Loose motor ground connection.

c. Open circuit.

C14. Landing gear will lower but not retract.

a. Open circuit between landing gear switch and control relay.

b. Up solenoid of control relay inoperative.

c. Open circuit between control relay and up winding in motor.

C15. Landing gear will retract but not lower.

a. Open circuit.

b. Down limit switch inoperative.

c. Open circuit between control relay and down winding of motor.

C16. Landing gear circuit breaker trips.

a. Grounded control circuit.

b. Grounded motor circuit.

c. Mechanical defect in gear causing overload.

C17. Landing gear operation noisy.

a. Loose chain.

b. Broken gear door linkage.

c. Worn actuator bearings.

C18. Landing gear warning horn inoperative.

a. Defective silence switch.

b. Defective warning horn.

c. Defective warning horn flasher.

d. Power lever switch out of adjustment.

e. Defective horn deactivate relay.

f. Defective landing gear control switch.

g. Defective safety switch.

h. Defective wiring.

C19. Landing gear warning horn inoperative when landing gear control switch is in the up position and weight of aircraft is on struts, but operates when a power lever is closed and the gear is retracted.

a. Poor ground at landing gear control switch.

b. Defective wiring between landing gear control switch, fire warning horn relay, and landing gear safety switch.

C20. Landing gear warning horn inoperative when power lever is closed and landing gear is up.

a. Defective or out of adjustment power lever switch.

b. Defective wiring between power lever switches and terminal 2 of pedestal terminal board (TB100) and between landing gear control switch and horn deactivate relay.

C21. Landing gear warning horn fails to shut off when landing gear is lowered.

a. Defective or out of adjustment down lock switches.

C22. Landing gear silencer button fails to silence warning horn.

a. Flap switch not in up position.

b. Defective silencer switch.

c. Defective horn deactive relay.

d. Defective flap control switch.

e. Defective wiring.

C23. Landing gear down position indicator lights are illuminated with landing gear retracted.

a. Defective or out of adjustment down lock switch.

b. Wrong connection in light test circuit.

c. Ground between light and down lock switch.

C24. Landing gear down position indicator light inoperative.

a. Defective or out of adjustment down lock switch.

C25. Landing gear handle light is illuminated with gear up and locked.

a. Defective or out of adjustment up-lock switch.

C26. Landing gear handle light inoperative.

a. Defective or out of adjustment up-lock or down-lock switch.

b. Defective landing gear control switch.

C27. Flaps fail to extend or retract.

a. Tripped circuit breaker.

b. Defective flap motor.

c. Defective flap control switch.

d. Defective mechanical component in actuator system.

e. Defective wiring.

C28. Flap position indicator inoperative.

a. Tripped circuit breaker.

b. Defective position indicator.

c. Defective position transmitter.

d. Defective wiring.

C29. Pitot tube heater fails to operate.

a. Tripped circuit breaker.

b. Defective heater.

c. Defective wiring.

C30. Stall warning system inoperative. (Battery switch either position.)

a. Defective stall warning switch.

b. Defective stall warning horn.

c. Defective wiring.

C31. Stall warning system inoperative with battery switch in off position (operative with battery switch in ON position).

a. Tripped stall warning safety circuit breaker.

C32. Stall warning horn sounds continuously.

a. Defective stall warning switch.

b. Defective wiring.

C33. Stall warning disable switch inoperative.

a. Defective stall warning disable switch.

b. Defective wiring.

C34. One inverter inoperative.

a. Tripped inverter control circuit breaker.

b. Tripped generator fault circuit breaker.

c. Defective current limiter.

d. Defective inverter.

e. Defective inverter power relay.

f. Loose ground connection.

g. Defective wiring to inverter.

h. Defective INVERTER TEST switch.

C35. More than one inverter inoperative.

a. Tripped inverter control circuit breakers.

b. Defective INVERTER TEST switch.

c. Defective wiring in inverter system.

C36. Battery charge light on annunciator panel inoperative.

a. Defective light bulb.

b. Connections on current detector loose or corroded.

c. Defective current detector printed circuit board assembly.

C37. One portion of interior lighting or lighting control system inoperative.

a. Defective edge lighting.

b. Defective components in overhead control panel.

c. Defective lighting inverter.

C38. Fuel crossfeed valve inoperative or fuel fail light remains illuminated.

a. Defective auxiliary fuel pump.

b. Defective crossfeed valve.

C39. Fuel transfer pump inoperative.

a. Defective transfer pump relay.

b. Defective transfer switch in fuel management panel.

c. Defective fuel transfer pressure switch.

C40. Pneumatic surface deicer system inoperative.

a. Defective surface deicer control relay.

C41. Annunciator panel right and left fire warning lights do not illuminate and warning horn does not sound in any test position of fire warning test switch.

a. Cowling not closed tightly or light deflector plates not in place.

b. Tripped fire detector circuit breaker.

c. Defective fire detection test switch.

d. Defective wiring.

C42. Engine fire detection system wholly or partially inoperative.

a. Defective flame detector.

b. Defective fire detection test switch.

c. Defective fire warning horn relay.

C43. Fire detector circuit breaker trips.

a. Short circuit in wiring or components.

C44. Fire warning horn will not sound.

a. Defective warning horn.

C45. Annunciator panel left fire warning light illuminates in all test positions but right fire warning light does not.

a. Defective right fire detection control amplifier.

b. Defective wiring between fire warning power circuit breaker and right control amplifier.

C46. Annunciator panel right fire warning light illuminates in all test positions but left fire warning light does not.

a. Defective left fire detection control amplifier.

b. Defective wiring between fire warning power circuit breaker and left control amplifier.

C47. Ventilation blower will not run.

a. Tripped vent blower circuit breaker.

b. Defective motor brushes.

c. Defective wiring.

C48. Ventilation blower draws excessive current.

a. Misaligned or preloaded bearings.

b. Defective bearings.

C49. Ventilation blower runs at reduced speed.

a. Brushes not seated properly.

C50. Ventilation blower draws excessive current and runs at high speed.

a. Shorted turns in field windings.

C51. Ventilation blower draws excessive current and speed surges.

a. Shorted turns in armature.

C52. Ventilation blower has excessive vibration.

a. Armature out of balance.

b. Propeller blade damaged.

c. Propeller blade out-of-balance.

C53. Propeller deicer inoperative.

a. Circuit breaker tripped.

b. Propeller deice switch defective.

c. Ammeter defective.

TROUBLESHOOTING GUIDE D - CAUTION PANEL

CONDITION

PROBABLE CAUSE

D1. Placard light (annunciator panel) will not illuminate when press-to-test button is pressed.

a. Defective placard light.

D2. Fault warning light will not flash for any faults.

a. Defective fault warning light.

b. Defective fault warning light resistor.

c. Defective annunciator control box.

D3. Depressing the press-to-test switch has no effect on fault warning system operation.

a. Defective switch.

b. Defective annunciator control box.

D4. Dim control does not function properly.

a. Defective rheostat.

b. Defective dim bias resistor.

c. Defective annunciator control box.

TROUBLESHOOTING GUIDE E - POWER PLANT

CONDITION

PROBABLE CAUSE

E1. LOW IDLE speed is either high or low.

a. LOW IDLE speed improperly adjusted.

E2. HIGH IDLE speed improperly adjusted.

a. HIGH IDLE speed is either high or low.

E3. Uneven torque in reverse mode.

a. Barrel adjustable stop improperly adjusted.

E4. Low or high torque is observed during torque check.

a. Barrel adjustable stop is improperly adjusted.

E5. Reverse torque, N1, and propeller RPM is too high or low.

a. Reverse adjusting screw is improperly adjusted.

E6. Newly rigged engine accelerates faster or slower than opposite engine.

a. Engine is mismatched.

E7. Power levers are not aligned.

a. Fuel control rod improperly adjusted.

E8. Propeller levers not aligned.

a. Propeller control cable improperly adjusted.

E9. High engine oil pressure.

a. Defective oil pressure indicating system.

b. Defective pressure relief valve.

E10. Low engine oil pressure.

a. Insufficient oil.

b. Defective oil pressure indicating system.

c. Dirty oil filter.

d. Leak in oil lines or oil cooler.

e. Defective pressure relief valve.

f. Excessive hot air leakage through faulty heat shielding.

E11. Fluctuating engine oil pressure.

a. Insufficient or excess oil.

b. Defective oil pressure indicating system.

c. Dirty oil filter.

d. Defective pressure relief valve.

E12. High oil temperature.

a. Insufficient oil supply.

b. Defective oil temperature indicating system.

c. Excessive idling in feather.

d. Restriction in oil cooler.

e. Excessive hot air leakage through faulty heat shielding.

E13. Oil leak from compressor inlet.

a. Defective preformed packing and plastic ring on oil filter housing.

b. Defective preformed packings on accessory gearbox.

E14. Excessive discharge from overboard breather.

a. Excess oil in oil tank.

b. Defective preformed packing and plastic ring on oil filter housing.

c. Excessive back pressure in scavenge system due to restrictions in oil scavenge tubes, pump screen or oil-to-fuel heater tubes.

E15. Excessive engine oil consumption.

a. Excess oil in tank.

b. Leak or restriction in pressure or scavenge oil tubes.

c. Defective preformed packing and plastic ring on oil filter housing.

d. Leakage in oil to fuel heat exchanger.

e. Defective centrifugal breather carbon seal.

f. Defective air seals.

E16. Failure of engine to decelerate.

a. Fuel control unit.

b. Disconnected or improperly adjusted linkage.

E17. Gas generator overspeed.

a. Defective turbine tachometer system.

b. Sheared or worn fuel control unit splined coupling or drive spline.

c. Defective fuel control unit.

E18. Gas generator uncontrolled acceleration.

a. Sheared or worn fuel control unit splined coupling or drive spline.

b. Defective fuel control unit.

E19. Surge during acceleration.

a. Defective compressor bleed valve.

b. Defective fuel control unit.

c. Compressor damaged.

E20. Slow to accelerate.

a. Leak or restriction in fuel control unit sense tubes.

b. Fuel control contaminated with ice or corrosion.

c. Defective fuel control unit.

E21. Flame out.

a. Fuel supply contaminated with ice, water or debris.

b. Engine driven high pressure fuel pump.

c. Fuel control unit contaminated or corroded.

d. Manifold adapter or fuel nozzles restricted.

E22. Low power output.

a. Defective indicating system.

b. Operating procedures incorrect.

c. Control linkages incorrectly adjusted or disconnected.

d. Propeller governor defective.

e. Leaks or restrictions in fuel control unit pneumatic system.

f. Fuel nozzles restricted.

E23. High fuel flow at altitude.

a. Defective indicating system.

b. Defective compressor bleed valve.

E24. Maximum operating ITT has been exceeded.

a. Faulty instrumentation, thermocouples or wiring.

b. Excessive accessory power being pulled due to failure or overload.

c. Torquemeter system reading low.

E25. ITT limited (turbine temperature is at maximum limit before target torque is reached).

a. Defective instruments, thermocouple, or wiring.

b. Improper operating procedure.

c. Dirty compressor.

d. Excessive accessory power being pulled due to failure or overload.

e. Defective compressor bleed valve.

f. Damaged compressor.

g. Air leaks in engine flanges or fittings.

h. Hot section distress.

i. Torquemeter system reading low.

E26. Fluctuating torque indication.

a. Faulty instrumentation system.

b. Airframe resonance affecting control lever.

c. Defective power turbine governor.

d. Engine driven high pressure pump shaft seal leakage.

e. Defective or out of adjustment propeller overspeed governor.

f. Defective propeller primary governor.

g. Sticking beta mechanism.

E27. Fluctuating fuel flow.

a. Faulty instrumentation system.

b. Airframe resonance affecting control lever.

c. Defective power turbine governor.

d. Engine driven high-pressure fuel pump shaft seal leaking.

e. Defective propeller overspeed governor.

f. Sticking beta mechanism.

E28. Fluctuating ITT.

a. Faulty instrumentation system.

b. Airframe resonance affecting control lever.

c. Defective power turbine governor.

d. Defective engine driven high pressure fuel pump shaft seal.

e. Defective or out of adjustment propeller overspeed governor.

f. Defective propeller primary governor.

g. Sticking beta mechanism.

E29. Fluctuating gas generator speed.

a. Faulty instrumentation system.

b. Airframe resonance affecting control lever.

c. Defective power turbine governor.

d. Defective engine driven primary high pressure fuel pump shaft seal.

e. Defective or out of adjustment propeller overspeed governor.

f. Defective propeller primary governor.

g. Sticking beta mechanism.

E30. Fluctuating torque and propeller RPM.

a. Defective or out of adjustment propeller overspeed governor.

b. Defective propeller primary governor.

c. Sticking beta mechanism.

E31. Fuel leaking overboard.

a. Fuel cap not seated.

b. Filler cap or O-ring defective.

c. Fuel transfer pump relay defective.

d. Fuel lever transmitter defective.

TROUBLESHOOTING GUIDE F- PROPELLERS

CONDITION

PROBABLE CAUSE

F1. Propeller governor and secondary low pitch stop system partially or wholly inoperative.

a. Defective blocking diode on propeller governor-secondary low pitch stop test switch.

b. Defective propeller governor test panel.

c. Secondary stop sensor out of adjustment or defective.

d. Defective arc suppression capacitor or diode on propeller reset or governor test solenoid.

F2. Both propeller governor and secondary low pitch stop test systems inoperative.

a. Tripped propeller governor test circuit breaker.

b. Defective wiring.

F3. Both propeller governor and secondary low pitch stop test systems inoperative on one engine.

a. Defective propeller governor-secondary low pitch stop system test switch.

F4. Neither propeller governs at specified RPM during propeller governor tests.

a. Defective secondary low pitch power lever switch.

F5. Annunciator panel secondary stop lights illuminate during normal propeller reversing.

a. Defective secondary low pitch power lever switch.

F6. One propeller does not govern at specified RPM during propeller governor tests.

a. Defective propeller governor secondary low pitch stop test switch.

F7. Propeller autofeather system completely inoperative (propeller autofeather switch in ARM or TEST position).

a. Tripped circuit breaker.

b. Defective arming light out relay or feathering relay.

c. Defective arc suppression diode on relays or feather dump valve.

d. Defective ground blocking diode.

F8. Autofeather circuit breaker trips (auto-feather switch in ARM or TEST position).

a. Defective ARM-TEST switch.

b. Defective wiring.

F9. One autofeather arm light illuminates when power setting is less than 90 percent N1 (AUTOFEATHER switch in ARM position).

a. Defective or out of adjustment power switch.

F10. Neither autofeather arm light illuminates when power levers are advanced (AUTO-FEATHER switch in ARM position).

a. Defective autofeather switch.

F11. One arm light does not illuminate when power levers are advanced (AUTO-FEATHER switch in ARM position).

a. Defective or out of adjustment power switch.

b. Defective No. 1 (12 PSI) torque pressure switch.

F12. Both arm lights remain illuminated when one power lever is retarded (AUTOFEATHER switch in ARM position).

a. Defective or out of adjustment power switch.

F13. Propeller does not start to feather after engine torque falls below 160 ft-lbs (AUTO-FEATHER ARM-TEST switch in TEST position).

a. Defective No. 2 (6.5 PSI) torque pressure switch on retarded engine.

b. Defective autofeather dump valve.

F14. One arm light does not illuminate when power levers are advanced to 90 percent N1 (AUTOFEATHER ARM-TEST switch in TEST position).

a. Defective No. 1 (12 PSI) torque pressure switch.

F15. Both arm lights go out when one power lever is retarded (engine torque 160-290 ft-lbs on retarded engine, AUTOFEATHER ARM-TEST switch in TEST position).

a. Defective No. 2 (6.5 PSI) torque pressure switch on retarded

F16. One arm light remains illuminated after torque of one engine falls below 160 ft-lbs (AUTOFEATHER ARM-TEST switch in TEST position).

a. Defective No. 2 (6.5 PSI) torque pressure switch on retarded engine.

b. Defective autofeather dump valve.

F17. Propeller slow to feather.

a. Preformed packing leak at transfer tube or transfer housing.

b. Defective propeller governor.

F18. Propeller slow to unfeather.

a. Defective propeller governor.

TROUBLESHOOTING GUIDE G - HYDRAULIC CONDITION

PROBABLE CAUSE

G1. Solid pedal, no brakes.

a. Brake linings worn beyond allowable limits.

G2. Spongy brakes.

a. Air in brake hydraulic system.

b. Low hydraulic fluid.

G3. Unable to hold brake pressure.

a. Leak in brake hydraulic system.

b. Brake cylinder seal leaking.

G4. Brake pedals bottom, no brakes.

a. Broken or leaking hydraulic lines.

b. Brake cylinder seal failure.

G5. Parking brake will not hold.

a. Air in brake hydraulic system.

b. Defective parking brake valve.

c. Parking brake control out of adjustment.

G6. Brakes grab.

a. Stones or foreign matter locking brake disc.

b. Warped or bent disc.

G7. Brakes drag.

a. Packing nut or threaded bushing, as applicable, too loose.

G8. Brakes weak.

a. Packing nut or threaded bushing, as applicable, too tight.

TROUBLESHOOTING GUIDE H-FLIGHT CONTROLS

CONDITION

PROBABLE CAUSE

H1. Autopilot is inoperative in all modes.

a. No power to equipment.

b. Defective autopilot computer.

H2. Autopilot circuit breaker does not hold in.

a. Computer shorted to ground.

H3. Pressing AP DISC/TRIM INTER switch on control wheel does not disengage autopilot.

a. Defective AP DISC/TRIM INTER switch.

H4. ALT switch does not hold on.

a. Defective pilot's encoding altimeter.

b. Defective aircraft wiring.

H5. NAV switch does not hold on.

a. Defective pilot's HSI.

b. Autopilot not receiving selected navigation input signal.

H6. Autopilot does not hold heading.

a. Heading selector not engaged.

b. Defective mode controller.

c. Defective computer.

H7. V-bar commands not displayed on flight director-indicator.

a. Defective flight director-indicator.

b. Defective computer.

TROUBLESHOOTING GUIDE I-NOT APPLICABLE

TROUBLESHOOTING GUIDE J- VIBRATIONS

CONDITION

PROBABLE CAUSE

J1. Engine vibration.

a. Propeller damaged or blade angle slipped.

b. Loose engine mounting bracket bolts.

c. Compressor damaged.

d. Turbine damaged.

TROUBLESHOOTING GUIDE K-COMMUNICATION/NAVIGATION EQUIPMENT

CONDITION

PROBABLE CAUSE

K1. Interphone system: No audio signals heard in headsets.

a. No power to audio system.

b. Defective microphone, control wheel microphone switch, or microphone footswitch.

c. Defective headset-microphone cord or jack

d. Defective microphone jack.

e. Defective audio control panel.

K2. Interphone system: Audio signals can be heard at other headset stations when transmitter selector switches at audio control panels are at different positions.

a. Defective audio control panel.

b. Defective wiring.

K3. UHF VOL control has no effect on receiver noise or incoming signal.

a. Defective UHF command set.

K4. UHF channeling tone not heard.

a. Defective UHF command set.

K5. UHF SQUELCH switch has no effect on receiver noise.

a. Defective UHF command set.

K6. UHF Guard receiver noise not audible.

a. Defective UHF command set.

K7. Cannot establish UHF two-way communications.

a. Defective audio distribution channels.

b. Defective antenna or antenna cabling.

c. Defective UHF command set.

KS. Cannot establish VHF two-way communications.

a. Defective audio distribution channels.

b. Defective antenna or antenna cabling.

c. Defective VHF control panel.

d. Defective VHF receiver-transmitter.

K9. VHF VOL control does not affect received audio level.

a. Defective VHF control panel.

b. Defective VHF receiver-transmitter.

K10. HF transmitted or received signal or sidetone not clear (CLR VC mode).

a. Defective HF.

b. Defective antenna or cabling.

c. Defective HF control panel.

d. Defective audio control panel.

e. Defective HF/VOW switch.

K11. HF communications loud and clear at one power setting but not at others.

a. Defective amplifier-coupler.

b. Defective HF control panel.

K12. HF transmitted or received signal or sidetone not clear (SV model

a. Incorrect fill register data.

b. Defective voice security computer.

K13. No FM receiver noise.

a. Defective FM liaison set.

b. Interference from Carousel IV-E blower motor.

K14. FM SQUELCH switch does not squelch receiver noise.

Defective FM liaison set.

K15. Cannot establish FM two-way communication (single channel mo

a. Defective FM liaison set.

b. Defective antenna or cabling.

c. Defective voice security computer.

d. Defective audio control panel.

e. EMI from Carousel IV-E blower motor (AN/ARC-186 only).

K16. Cannot establish FM two way communication (frequency hop mode).

a. Incorrect fill register data.

b. Incorrect time/date reference in radio set.

K17. No voice security alarm tone heard in headsets.

a. Defective voice security computer.

b. Defective voice security receiver-transmitter (UHF or FM).

K18. Voice security alarm tone still audible with microphone button depressed.

a. Defective voice security computer.

b. Defective receiver-transmitter (UHF or FM).

K19. Quality of secure transmitted or received signals inadequate.

a. Defective voice security computer.

b. Defective receiver-transmitter (UHF or FM).

c. Defective audio control panel.

K20. Copilot's RMI does not agree with pilot's RMI within two degrees.

a. Defective RMI.

b. Defective compass set.

K21. ADF heading on pilot's HSI course-indicator does not agree with corrected magnetic reading of aircraft deviation.

a. Defective gyro compass set.

b. Incorrect deviation card.

K22. ADF radio set inoperative.

a. No power to ADF receiver.

K23. No ADF audio heard in headsets.

a. Defective ADF receiver.

b. Defective ADF control panel.

c. Defective ADF antenna.

d. Defective audio control panel.

K24. ADF radio magnetic indicator does not indicate magnetic bearing to station.

a. Defective ADF receiver.

b. Defective RMI.

c. Defective ADF antenna.

d. Defective ADF control panel.

K25. Quality of ADF reception is poor.

a. Defective ADF control panel.

b. Defective audio control panel.

c. Defective ADF receiver.

K26. No VOR audio tone heard in headset.

a. Defective VOR receiver.

b. Defective VOR control panel.

c. Defective audio control panel.

K27. NAV warning flag on one or both HSI's remains in view when a VOR/ILS frequency is set on VHF NAV control panel and is being received.

a. Defective VHF NAV receiver.

b. Defective VHF NAV control panel.

c. Defective navigation junction box.

d. Defective HSI.

K28. Lateral deviation indicator on one HSI does not deflect properly.

a. Defective HSI.

b. Defective HSI select switch panel.

c. Defective navigation junction box.

K29. Marker beacon indicator lights do not light.

a. Defective marker beacon light(s).

b. Defective VHF NAV receiver.

c. Defective antenna or cabling.

K30. Marker beacon audio not heard in headset.

a. Defective audio control panel.

b. Defective MKR SENS switch.

K31. Both glideslope deviation indicators remain flagged when glideslope is operating.

a. Defective VHF NAV receiver.

b. Defective glideslope antenna or cabling.

c. Defective VHF NAV control panel.

K32. Glideslope deviation indicator on one HSI remains flagged when glideslope receiver is operating.

a. Defective HSI.

b. Defective HSI select switch panel.

c. Defective navigation junction box.

K33. Transponder cannot be interrogated or provides unsatisfactory altitude response.

a. Mode C (ALT) not set or defective.

b. Defective encoding altimeter.

c. Defective antenna or cabling.

K34. Transponder (XPDR 2) cannot be interrogated or provides unsatisfactory mode 4 response.

a. Incorrect KIT-1A/TSEC fill register data.

b. Defective KIT-1A/TSEC.

c. Defective transponder (XPDR 2).

d. Defective antenna or cabling.

K35. Radar inoperative.

a. System circuit breaker not set.

b. Defective radar control-indicator.

c. Defective receiver-transmitter.

K36. Radar antenna does not scan.

a. No power to radar antenna.

b. Defective radar antenna.

K37. No display on radar control-indicator.

a. Defective radar control-indicator.

b. Defective radar receiver-transmitter.

c. Defective radar antenna.

K38. Wavy, chopped or missing range circles or indicator.

a. Defective radar control-indicator.

b. Defective radar receiver-transmitter.

K39. Improper display on radar control-indicator (track line bent or folded or does not begin at proper position).

a. Defective radar receiver-transmitter.

b. Defective radar control-indicator.

K40. No targets on radar-control-indicator or targets do not move with TILT control.

a. Defective radar control-indicator.

b. Defective radar receiver-transmitter.

c. Defective radar antenna.

K41. Radar GAIN control has no effect on display.

a. Defective radar control-indicator.

K42. Radar TILT control inoperative.

a. Defective radar control-indicator.

K43. Radar BRT control inoperative.

a. Defective radar control-indicator.

K44. Radar range does not vary when RANGE switch is changed to various positions.

a. Defective radar control-indicator.

K45. Radar control-indicator does not display navigation data, weather display is normal.

a. Defective GRAPHICS switch.

b. Defective interface unit.

K46. TACAN inoperative.

a. No power to equipment.

b. Defective TACAN control panel.

c. Defective TACAN receiver-transmitter.

d. Defective TACAN azimuth computer.

e. Defective antenna or cabling.

K47. With TACAN operating, vertical needles of HSI's and double needle pointers of RMI's do not deflect.

a. Defective TACAN receiver-transmitter.

b. Defective TACAN azimuth computer.

c. Defective TACAN control panel.

d. Defective TAC A/A switch.

K48. Copilot's HSI lateral deviation indicator does not deflect properly, all other indications normal.

a. Defective converter.

K49. Pilot's or copilot's HSI does not display TACAN data.

a. Defective HSI select switch panel.

b. Defective navigation junction box.

K50. No TACAN audio heard in headsets.

a. Defective TACAN receiver-transmitter.

b. Defective TACAN control panel.

c. Defective audio control panel.

d. Defective antenna or cabling.

K51. TACAN gives improper indications in air-to-air mode.

a. Defective TAC A/A switch.

b. Defective wiring between TAC A/A switch and TACAN receiver-transmitter.

c. Defective TACAN receiver-transmitter.

K52. INS inoperative.

a. Defective circuit breaker or INS interface unit.

NOTE

INS malfunction codes and corrective actions are listed in TM 55-1510-215-10-2.

K53. MLS fails self-test.

a. Defective wiring.

b. Defective control-display.

K54. MLS/DME annunciator does not come on when MLS selected on HSI select switch panel or will not reset.

a. Defective annunciator.

b. Defective DC junction box.

K55. MLS data cannot be displayed on selected HSI.

a. Defective HSI select switch panel.

b. Defective navigation junction box No. 1.

c. Defective receiver.

K56. MLS display field will not illuminate.

a. Defective control-display.

b. Defective lighting junction box.

c. Defective lighting inverter.

K57. No MLS audio.

a. Defective audio amplifier.

b. Defective nonsecure audio junction box.

c. Defective control-display.

d. Defective receiver.

e. Defective antenna or cabling.

K58. FMS inoperative.

a. Defective circuit breaker.

b. Defective control-display.

c. Defective computer.

K59. FMS cannot be displayed on color radar.

a. Defective GRAPHICS switch.

b. Defective FMS computer.

c. Defective navigation junction box No. 2.

K60. FMS data cannot be displayed on selected HSI.

a. Defective HSI select switch panel.

b. Defective navigation junction box No. 2.

c. Defective FMS computer.

SECTION IV. SPECIAL PROCEDURES

General. This section contains the special procedures that were referenced in section II.

***A. Cushion Check.** The secondary idle stop check shall include the cushion check (if applicable).

***B. Health Indicator Test (HIT) (figure 4)** - Perform as follows:

NOTE

The HIT provides a go-no-go condition check prior to takeoff. HIT is performed after completing the ENGINE RUNUP check, when both engines are warmed and instruments stabilized. Test one engine at a time. Adjust engine N1% to the N1% value shown in the ITT log (figure 4) for a FAT value which most closely matches the FAT on the free air temperature gage. After comparing indicator - read ITT with the proper log-given baseline ITT, the difference number is recorded in the log space provided. Appropriate actions depend upon the size of the difference number.

(1) Face aircraft into wind and insure that deice system is OFF.

(2) Set both engines at LO IDLE.

(3) Read free air temperature.

(4) Enter log FAT line at value nearest to free air temperature.

(5) Adjust engine N1% to value shown in log N1% line.

(6) Adjust propeller speed of engine in check to 1900 RPM and stabilize instruments (minimum 30 seconds).

(7) Read ITT from indicator.

(8) Compare indicator ITT with log value shown in line labeled "Baseline ITT".

(9) Record aircraft or engine hours and difference (±) between indicated ITT and Baseline ITT in log section provided.

(10) If the ITT difference is 20°C or greater, perform the following actions:

(a) 20°C to 29°C, aircraft may be flown, but an entry shall be made on DA Form 2408-13.

(b) 30°C or greater, aircraft shall not be flown until the cause of excessive ITT is determined. An entry shall be made on DA Form 2408-13.

*C. Autopilot System Check (KFC 250).

WARNING

Ensure that the autopilot has been disengaged and check that the aircraft manual trim indicator is set to the takeoff position before takeoff. Operating the autopilot on the ground may cause the autotrim to run because of back force generated by the elevator downsprings or pilot induced forces.

NOTE

If the AUTOPILOT circuit breaker is pulled, the red TRIM failure annunciator light on the autopilot annunciator panel will be disabled and only the aural alert will sound if an electric trim malfunction occurs.

(1) Verify that all autopilot modes are disengaged.

(2) Preflight test button (autopilot mode controller) - Press and hold.

(3) Autopilot mode annunciator panel annunciator lights - Check all illuminated. TRIM annunciator light should flash at least four times, but no more than six times.

(4) Aural trim alert - Listen for sound.

(5) YAW DAMP indicator light (autopilot mode controller) - Check illuminated.

(6) Arm and alert annunciator lights (altitude selector panel) - Check illuminated.

(7) Computer flag (pilot's flight director control-indicator) - Check in view.

(8) Manual electric trim system - Check as follows:

(a) Electric trim switch (pilot's control wheel) - Move the left side of the trim switch to the forward and aft position, while moving the pitch-trim control wheel. The pitch-trim solenoid should engage making it more difficult to move the pitch-trim control wheel, but the electric trim motor should not run. Move the right side of the trim switch to the forward and aft positions. The pitch-trim solenoid should not engage and the electric trim motor should not run.

(b) Overpower capability - Check by moving the pilot's electric trim switch to the forward and aft positions while holding the manual pitch-trim control wheel.

(c) Trim test switch (pedestal extension) - Depress and hold then run the electric trim up and down using the pilot's electric trim switch (control wheel).

(d) Trim annunciator light (autopilot annunciator panel) - Check illuminated.

(e) Aural trim alert- Listen for sound.

(f) Autopilot disconnect/trim interrupt switch (control wheel) - Depress and hold then attempt to run the electric trim up and down using the pilot's electric trim switch (control wheel). The trim system should not run either up or down.

(g) Repeat steps (a) through (f) using the copilot's electric trim switch.

(h) Pilot's and copilot's electric trim switches - Simultaneously move the pilot's switch forward and the copilot's switch aft. The electric trim should run up.

(9) Flight director (FD) switch (autopilot mode controller) - Press on.

(10) Autopilot (AP) switch (autopilot mode controller) - ON.

(11) Control wheel steering switch (control wheel) - Depress and hold.

(12) Control wheel - Manually move to neutral position.

(13) Control wheel steering switch - Release.

(14) Control wheel - Apply force to all axes. Determine that autopilot can be overpowered.

(15) Autopilot/YAW DAMP/TRIM disconnect switch (control wheel) - Depress to disconnect autopilot.

(16) Manual trim - Set for takeoff.

(17) Autopilot (AP) switch (autopilot mode controller) - ON.

(18) Roll test switch (control pedestal) - Hold to LT position for approximately two seconds. Autopilot should disconnect and the aural alert should sound.

(19) Autopilot (AP) switch (autopilot mode controller) - ON.

(20) Roll test switch (control pedestal) - Hold to RT position for approximately two seconds. Autopilot should disconnect and the aural alert should sound.

(21) Autopilot (AP) switch (autopilot mode controller) - ON.

(22) Pitch test switch (control pedestal) - Hold to UP position for approximately two seconds. Autopilot should disconnect and the aural alert should sound.

(23) Autopilot (AP) switch (autopilot mode controller) - ON.

(24) Pitch test switch (control pedestal) - Hold to DN position for approximately two seconds. Autopilot should disconnect and the aural alert should sound.

(25) Autopilot (AP) switch (autopilot mode controller) - ON.

(26) Vertical trim (DN/UP) control (autopilot mode controller) - Move to insert a pitch-up command.

(27) Control wheel- Hold to keep from moving and observe that the trim wheel moves in the nose up direction after a three-second delay.

(28) Control wheel steering switch (control wheel) - Depress momentarily.

(29) Vertical trim (DN/UP) control (autopilot mode controller) - Move to insert a pitch-down command.

(30) Control wheel - Hold to keep from moving and observe that the trim wheel moves in the nose down direction after a three-second delay.

(31) Control wheel steering switch (control wheel) - Depress and center the control wheel about the roll axis, then release.

(32) Heading (HDG) switch (autopilot mode controller) - Press ON.

(33) Heading selector knob (horizontal situation indicator) - Set indicator to command a right turn. The control wheel should rotate clockwise.

(34) Heading selector knob (horizontal situation indicator) - Set indicator to command a left turn. The control wheel should rotate counterclockwise.

(35) Autopilot (AP) switch (autopilot mode controller) - OFF.

(36) Flight director (FD) switch (autopilot mode controller) - Disengage.

(37) Electric trim switch (control wheel) - Move aft until the full nose-up trim position has been attained, then move switch forward and simultaneously begin timing. When the full nosedown trim position has been attained, release switch and read time. The time required for trim system to run from full nose up to full nose down should be 45 ± 9 seconds.

(38) If the autopilot fails the preflight test, the AUTOPILOT circuit breaker should be pulled. Manual electric trim may still be used.

If the electric trim system fails the preflight test, the ELECT TRIM circuit breaker should be pulled and neither the electric trim nor the autopilot may be used.

***D. Speed-Power Check.**

(1) Altimeters- Set at 29.92.

(2) Pressure altitude - 8000 feet.

(3) Propellers - Set 1900 RPM.

(4) Power levers- Set 800 ft-lbs.

(5) Allow speed and systems to stabilize, then record the following:

a. FAT (°C).

b. KIAS.

c. ITT (°C).

d. NI (%).

e. Fuel flow (lb/hr).

f. Subtract 4°C from FAT to obtain true FAT (TFAT).

g. Compare with speed power results below (aircraft at 8000 feet pressure altitude):

IAS (Kts)	159	158	156	155	153	152	151
TFAT (°C)	-30	-20	-10	0	10	20	30

NOTE

Speed-power check must be performed with the inertial separator in the clear air (retract) position.

*E. Trim and Rigging. Check as follows:

(1) In smooth air, at Cruise power, the aircraft will fly hands off, straight and level with the ailerons symmetrically aligned at the trailing edge and the aileron adjustable tab set to zero.

(2) For additional trim and rigging checks refer to TM 55-1510-215-23.

*F. Microwave Landing System (MLS) Check:
Check as follows:

(1) Perform MLS preflight/self-test as described in TM 55-1510-215-10-2.

NOTE

The remaining steps in this procedure can only be performed when a ground station with microwave landing system capabilities is available.

(2) Pilot's or copilot's HSI select switch panel - MLS.

(3) NAV-A switch (audio control panel) - ON.

(4) MLS channel (MLS control-display) - Set published channel and check audio identification of station (Morse code identifier).

(5) Check manual approach mode as follows:

(a) Select manual (MAN) mode.

(b) Set published azimuth.

(c) Set published glideslope.

(d) Set published back azimuth (if applicable).

(e) On TACAN control-display, set DME station (channel) and check station identification.

(f) Fly an approach to the station and verify proper operation of lateral (course) and horizontal (glideslope) deviation indicators on the HSL

(6) Check automatic approach mode as follows:

(a) Select automatic (AUTO) mode.

(b) Check that AZ indication (MLS control-display) is the same as that shown for inbound course on approach plate.

(c) Check that GS indication is the same as that shown on the approach plate.

(d) On TACAN control-display set DME station (channel) and check station identification.

(e) Fly an approach to the station and verify proper operation of lateral (course) and horizontal (glideslope) deviation indicators on the HSI.

*G. Flight Management System (FMS) Check:
Check as follows:

(1) Perform self-test as described in TM 55-1510-215-10-2.

(2) Perform initialization as described in TM 55-1510-215-10-2.

(3) Check data base as described in TM 55-1510-215-10-2.

(4) Check that TACAN, INS, and BLEND can be used as sensors.

(5) Verify operation in OBS and AUTO/LEG methods as described in TM 55-1510-215-10-2.

(6) Verify that FMS data can be displayed on color radar display.

*H. Autopilot Flight Check: Check as follows: Observe that all channels operate positively and smoothly with no oscillation of any flight control.

WARNING

When the autopilot is engaged, manual application of a force to the pitch axis of the control wheel for a period of three seconds or more will result in the autotrim system operating in the direction creating a force opposing the pilot. This opposing mistrim force will continue to increase as long as the pilot applies a force to the control wheel and will ultimately overpower the autopilot. If the autopilot is disengaged under these conditions, the pilot may be required to exert control forces in excess of 50 pounds to maintain desired aircraft attitude. The pilot will have to maintain this control force until he manually retrims the aircraft.

WARNING

Do not engage the autopilot into large unsatisfied flight director commands as displayed on the flight director control-indicator or any large mistrim conditions in any axis.

(1) Trim aircraft for straight and level flight.

(2) Heading selector knob (HSI) - Set indicator to aircraft heading.

(3) Flight director (FD) switch (autopilot mode controller) - Press On.

(4) Autopilot switch (autopilot mode controller) - ON.

(5) Check autopilot heading preselection as follows:

(a) Autopilot heading selector knob (HSI) - Set indication on test heading.

(b) Heading (HDG) switch (autopilot mode controller) - Press On.

(c) Aircraft should automatically turn and roll out on preselected heading.

(6) Check altitude control and selection as follows:

(a) Altitude (ALT) switch (autopilot mode controller) - Press On.

(b) Vertical trim (DN/UP) control (autopilot mode controller) - Move to UP and DN positions while observing that aircraft and pitch trim indicator respond properly.

(7) Check altitude preselection as follows:
   (a) Altitude selector knobs (altitude selector control panel) - Set test altitude.
   (b) Establish a climb or descent as appropriate.
   (c) Flight director (FD) switch (autopilot mode controller) - Depress on.
   (d) Autopilot (AP) switch (autopilot mode controller) - ON.
   (e) Arm switch (altitude selector control panel) - Depress. Check that ALT ARM annunciator on the autopilot annunciator panel is illuminated, and that the ARM annunciator light on the altitude selector panel is illuminated.
   (f) At 1,000 feet prior to reaching selected altitude, the ALERT annunciator on the altitude selector panel should illuminate, and a two second aural tone should sound.
   (g) At 300 feet prior to reaching selected altitude, the ALERT annunciator should extinguish.
   (h) The aircraft should smoothly level itself off at the selected altitude, the aural alert tone should sound, the ALT ARM annunciator should extinguish, and the ALT HOLD annunciator should illuminate.

(8) Autopilot NAV operation - Check as follows:

   (a) Desired navigation aid - Set as required and select as pilot's HSI signal source.

   (b) Fly aircraft so as to intercept desired radial or glideslope.

(c) Navigation (NAV) switch or approach (APPR) switch (autopilot mode controller) - Press on.

(d) When the aircraft is within 10 degrees of the selected radial, it should begin a gradual interception of the radial or glideslope signal.

(9) Go-around mode - Check as follows:

(a) Flight director (FD) switch (autopilot mode controller) - Depress on.

(b) Autopilot (AP) switch (autopilot mode controller) - ON.

(c) With aircraft flying straight and level on autopilot, depress go round switch on left power lever.

(d) Check that autopilot disengages and that the command bars on the flight director control-indicator commands an 8° nose up attitude and that the GO AROUND annunciator on the autopilot annunciator panel illuminates.

***l. INS Flight Test**. A triangle test flight shall be performed. Satisfactory navigation shall be demonstrated by flying over three known checkpoints, and comparing the inertial present position readouts with the coordinates of the checkpoints. Figure 5 shows allowable position error. The aircraft shall establish a low altitude, compatible with aircraft safety and applicable Laws and Codes of Flight which will allow accurate sighting of ground landmarks. An altitude of 1000 feet is recommended whenever possible.

(1) INS - Align in accordance with TM 55-1510-215-10-2.

(2) Insert checkpoints for flying a one-hour triangular closed course.

(3) Select the first checkpoint for the aircraft to fly.

(4) Data selector switch - Set to the appropriate positions and observe range, heading and ground speed.

(5) Fly the preselected triangular course and monitor the navigation instruments for proper operation. Verify that the ALERT indicator illuminates when the aircraft is approximately 1.3 minutes flying time from each checkpoint.

(6) Change to the next checkpoint.

NOTE

When second checkpoint is reached, change to starting checkpoint.

(7) During return flight to starting point, set the data selector switch to the appropriate positions and monitor the following control-indicator readouts for proper operation:

(a) Wind direction and wind speed.

(b) Track and ground speed.

(c) Heading and time to destination.

(d) Range and bearing to destination.

(e) Local magnetic variation.

(8) GRAPHICS FMS INS switch (instrument panel) - INS: verify navigation data is displayed on color radar display.

(9) When local conditions permit, verify that TACAN then GPS aiding operations can be performed.

***J. Engine Performance**. Perform only when directed by the maintenance officer:

(1) Record the following:

*(a) Engine serial number.

*(b) Engine hours since new.

*(c) Engine hours since overhaul.

(2) Copilot's altimeter- Set 29.92 In. Hg.

(3) Altitude - 10,000 feet pressure altitude.

(4) Propeller - Set 2200 RPM.

(5) Special electronic equipment (including INS) - OFF.

(6) Ice vanes - Retract.

*(7) Torque (engine being checked) - Set based on Figure 6, Section V, or ITT of 750°C (whichever is reached first).

(8) Power (opposite engine) - Set to maintain 130 KIAS.

(9) Allow conditions to stabilize for one minute then record the following for engine being tested:

*(a) Airspeed (KIAS).

*(b) Pressure altitude.

*(c) Free air temperature.

*(d) ITT.

*(e) Propeller RPM.

*(f) Torque.

*(g) N1%.

(10) Repeat steps (7), (8) and (9) for other engine.

(11) Copilot's altimeter - Set to agree with pilot's altimeter.

SECTION V. CHARTS AND FORMS

General. This section contains the necessary charts and forms required to ascertain that the aircraft is performing to establish standards and to record readings, pressures, RPM, etc., obtained during maintenance test flight.

List of Charts

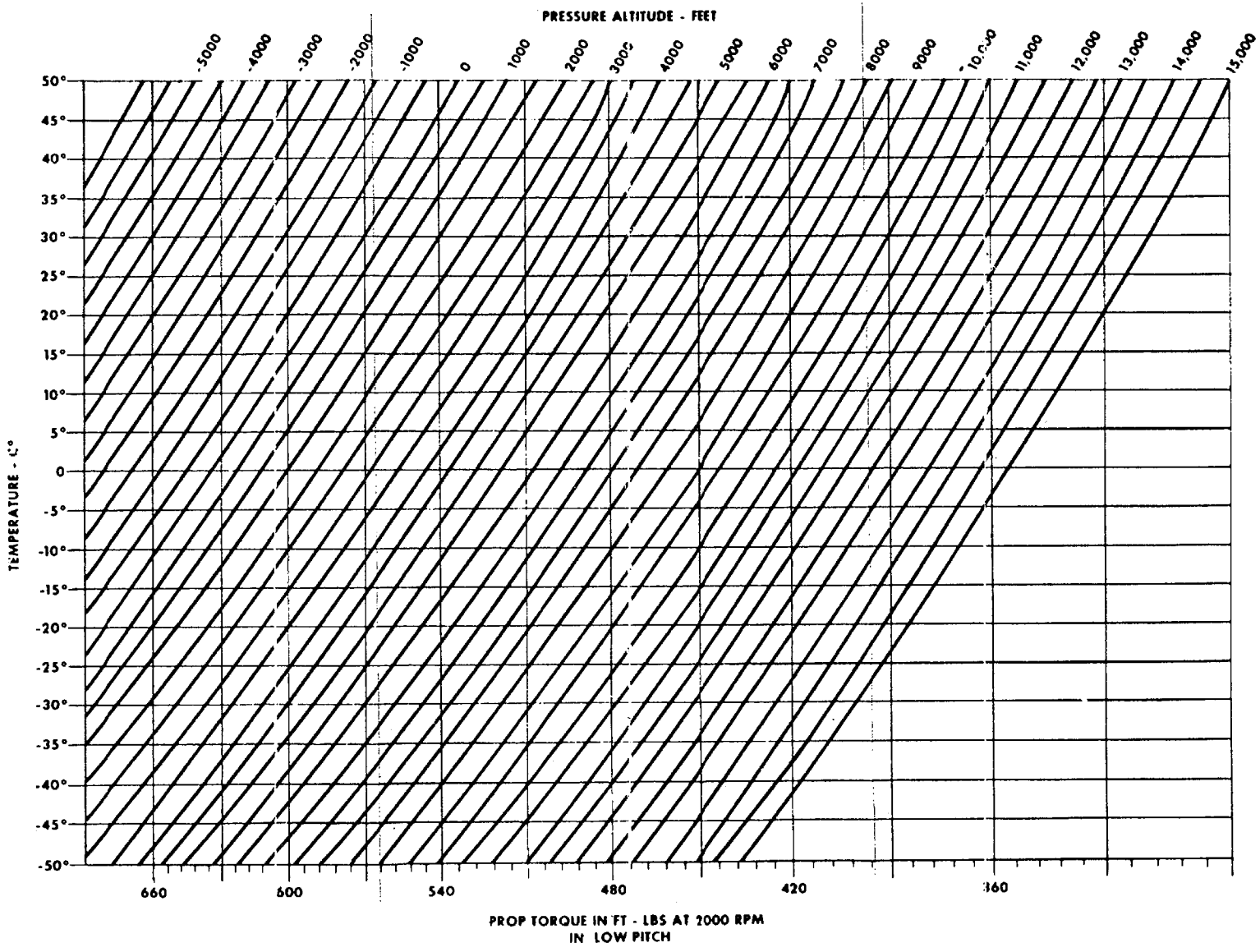

FIGURE 1. Propeller Torque

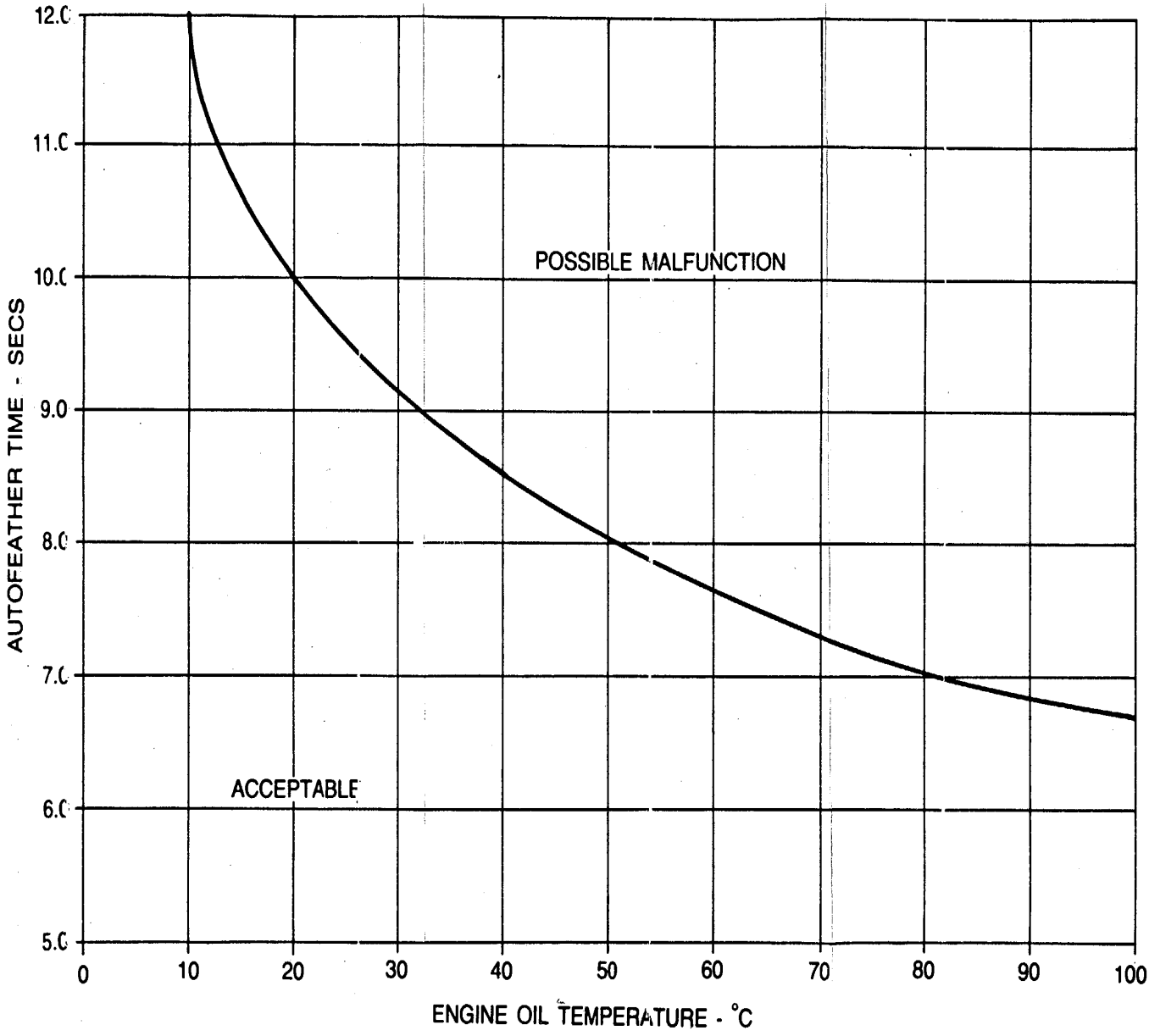

Figure 2. Autofeather Time

RU-21H AVIONICS UPGRADE MTF CHECK SHEET			
PURPOSE OF MTF	FAT	ACFT MODEL & SN	DATE
PILOT		UNIT	
SYMBOLS: ✓ = SATISFACTORY, X = DEFICIENCY			

	PRIOR TO MTF		2. Stall characteristics (dirty),
	1. Forms and records		roll _____ °L or R
	2. Weight and balance		3. Stall warn (clean), _____ KIAS
	3. Flight readiness inspection		4. Stall speed (clean), _____ KIAS
	4. Special pre-flight checks		5. Stall warn (dirty), _____ KIAS
	INTERIOR CHECK		6. Stall speed (dirty), _____ KIAS
	1. Cabin exit hatch		7. Flaps
	BEFORE STARTING ENGINES		8. Carbon monoxide
	1. Cockpit exit hatch		9. Prop feathering
	2. Interior lights		10. Prop autofeather
	3. Mag compass		DESCENT AND LOW LEVEL CRUISE
	4. Free air temp gage		1. Max rate descent (V_{mo})
	5. Power levers		(1) Flight controls
	6. Prop levers		(2) Windows and doors
	7. Flight controls		2. Attitude indicators
	8. Trim tabs		3. Directional gyro
	9. Engine instruments		4. Turn and slip
	10. Voltage (battery) _____ VDC		5. Ldg warn horn, first heard,
	11. Annunciator panel		L _____ N1, R _____ N1
	12. Ldg gear handle lights		6. Emerg ldg gear extension
	13. Ldg gear down lights		DURING CRUISE
	14. Fire det system		1. Ice vanes
	TAXIING		2. Lip ice boots
	1. Brakes		3. Carbon monoxide
	2. Flight instruments		4. Audio control panel
	3. Nosewheel steering		5. UHF
	4. Mag compass		6. VHF (2)
	ENGINE RUNUP		7. HF
	1. Parking brake		8. HF voice security
	2. Transfer pumps		9. FM
	3. Crossfeed		10. UHF and FM voice security
	4. Flaps		11. Gyromagnetic compasses
	5. Prop manual feathering		12. ADF
	6. Instrument vacuum _____ In. Hg.		13. VHF Navigation set
	7. Deicing pressure _____ PSI		14. Transponder/altimeter (XPDR 2)
	8. Autoignition		15. Transponder/altimeter (XPDR 1)
	9. Autofeather		16. Radar
	10. Overspeed governor		17. TACAN
	11. Ice vanes		LANDING
	12. Primary governor		1. Prop tachometers (idle)
	13. Prop low pitch blade angle		L _____ RPM, R _____ RPM
	14. Low to high idle acceleration		SPECIAL PROCEDURES
	L _____ sec, R _____ sec		1. Cushion
	15. Secondary idle stop		2. HIT
	16. Prop reversing		3. Autopilot system check
	17. Generator voltage, L _____, R _____		4. Speed – power
	18. Inlet air separator		5. Trim and rigging
	19. Oil temperature,		6. MLS
	L _____ °C, R _____ °C		7. FMS
	20. Oil pressure,		8. Autopilot flight test
	L _____ PSI, R _____ PSI		9. INS
	DURING TAKEOFF		10. Engine performance
	1. Prop tachometers,		(1) Engine SN, L _____, R _____
	L _____ RPM, R _____ RPM		(2) Engine hours since new
	2. Torque,		L _____, R _____
	L _____ ft.-lb., R _____ ft.-lb.		(3) Engine hours since overhaul
	3. ITT, L _____ °C, R _____ °C		L _____, R _____
	4. N1, L _____ %, R _____ %		(4) Airspeed
	5. Oil Press, L _____ PSI, R _____ PSI		L _____ KIAS, R _____ KIAS
	6. Oil temp, L _____ °C, R _____ °C		(5) Pressure altitude,
	DURING CLIMB		L _____ feet, R _____ feet
	1. Engine controls alignment		(6) Free air temp, L _____ °C, R _____ °C
	2. Vertical speed indicators		(7) ITT, L _____ °C, R _____ °C
	3. Surface deice		(8) Prop RPM,
	4. Prop deice		L _____ RPM, R _____ RPM
	5. Ventilation		(9) Torque, L _____ ft.-lb., R _____ ft.-lb.
	6. Heating and defrosting		(10) N1,
	7. Carbon monoxide		L _____ %, R _____ %
	LOW SPEED SYSTEMS		REMARKS
	1. Stall characteristics (clean),		
	roll _____ °L or R		

Figure 3. Maintenance Test Flight Checksheet

ACFT S/N

HIT ITT LOG

ENGINE NO. _____
ENGINE S/N

FAT °C	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0	-2	-4
N1%	95.5	95.2	94.9	94.5	94.2	93.9	93.6	93.3	93.0	92.7	92.4	92.1	91.7	91.4	91.0	90.7	90.4	90.1	89.9	89.6	89.3	89.0	88.7	88.3	88.0	87.7	87.4	87.0
BASELINE ITT																												

FAT °C	-6	-8	-10	-12	-14	-16	-18	-20	-22	-24	-26	-28	-30	-32	-34	-36	-38	-40	-42	-44	-46	-48	-50	-52	-54	-56	-58	-60
N1%	86.7	86.3	86.0	85.7	85.4	85.0	84.7	84.4	84.0	83.7	83.4	83.0	82.7	82.3	82.0	81.6	81.3	81.0	80.6	80.3	79.9	79.6	79.2	78.8	78.5	78.1	77.8	77.7
BASELINE ITT																												

Figure 4. Health Indicator Test (Sheet 1 of 2)

ACFT OR ENG HRS (-13)	DIFF. FROM BASE LINE ITT (±)	ACFT OR ENG HRS (-13)	DIFF. FROM BASE LINE ITT (±)	ACFT OR ENG HRS (-13)	DIFF. FROM BASE LINE ITT (±)	ACFT OR ENG HRS (-13)	DIFF. FROM BASE LINE ITT (±)	ACFT OR ENG HRS (-13)	DIFF. FROM BASE LINE ITT (±)

Figure 4. Health Indicator Test (Sheet 2 of 2)

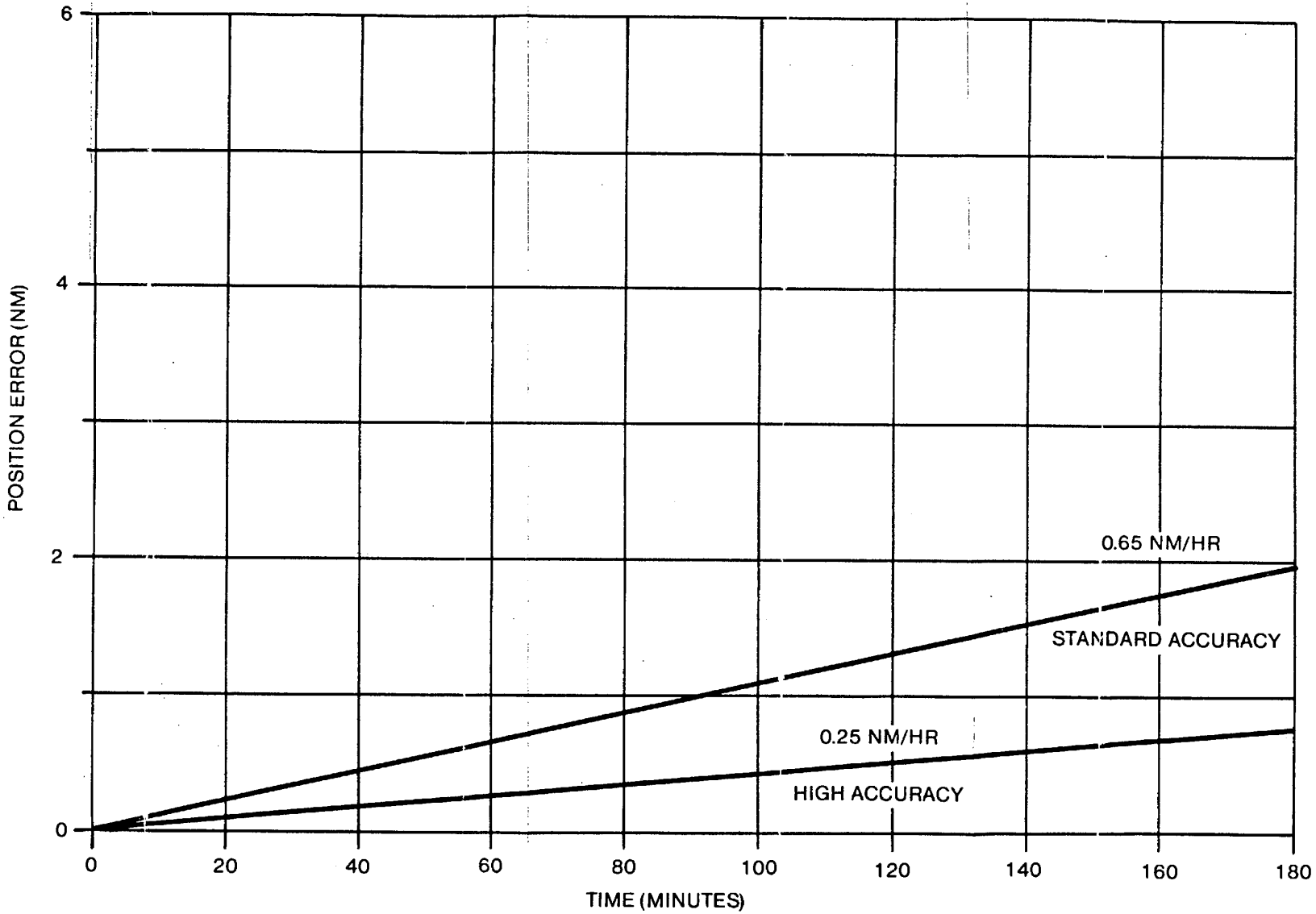

Figure 5. INS Allowable Position Error

ENGINE PERFORMANCE CHECK TORQUE VS FREE AIR TEMPERATURE (FAT)

FAT °C	Torque Ft-Lbs	FAT °C	Torque Ft-Lbs
-22	1300	- 1	1095
-21	1290	0	1084
-20	1280	+ 1	1075
-19	1270	+ 2	1066
-18	1260	+ 3	1057
-17	1250	+ 4	1048
-16	1240	+ 5	1039
-15	1230	+ 6	1030
-14	1220	+ 7	1021
-13	1210	+ 8	1012
-12	1200	+ 9	1003
-11	1190	+10	994
-10	1180	+11	985
- 9	1170	+12	976
- 8	1160	+13	967
- 7	1150	+14	958
- 6	1140	+15	949
- 5	1131	+16	940
- 4	1122	+17	931
- 3	1113	+18	922
- 2	1104		

*Tests shall not be performed at temperatures colder than -22°C to avoid overtorquing the engine.

Figure 6. Engine Performance Torque Chart

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
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