ORDER

AL 6368.1A

FACILITIES AND EQUIPMENT MAINTENANCE HANDBOOK APOLLO GROUND-BASED TRANSCEIVER (GBT) 2000

April 21, 2006

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
ALASKAN REGION

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CHANGE TO BASIC	SUPPLEMENTS	OPTIONAL USE	CHANGE TO BASIC	SUPPLEMENTS	OPTIONAL USE

FOREWORD

1. PURPOSE. This handbook provides guidance and prescribes technical standards, tolerances, and procedures applicable to the maintenance and inspection of the Apollo model GBT2000 Ground-Based Transceiver (GBT), which is the remotely located data link portion of the Automatic Dependent Surveillance-Broadcast (ADS-B) service. It also provides information on special methods and techniques that will enable maintenance personnel to achieve optimum performance from the equipment. This handbook augments information available in instruction books and other handbooks, and compliments the latest edition of FAA Order 6000.15, *General Maintenance Handbook for Airway Facilities*.

2. DISTRIBUTION. This order is distributed to Airway Facilities branch level in the Alaska Region Headquarters, and according to standard distribution requirements to all Airway Facilities (AF) field stations and facilities.

3. CANCELLATION. AL6368.1, Facilities and Equipment Maintenance Handbook Ground-Based Tranceiver (GBT) dated, September 29, 2003, is canceled.

4. MAINTENANCE AND MODIFICATION POLICY. FAA Order 6000.15 (latest edition), this maintenance handbook, and the applicable equipment instruction handbooks shall be consulted and used together by the maintenance technician in all duties and activities for the maintenance of the Apollo GBT2000 facilities and equipment. These documents shall be considered collectively as the single official source of maintenance policy and direction authorized by the Operational Support organization (AOS). References located in the chapters of this handbook entitled *Standards and Tolerances* and *Periodic Maintenance* shall indicate to the user whether this handbook, and/or the equipment instruction book shall be consulted for a particular standard, key inspection element or performance parameter, performance check, or maintenance procedure.

The latest edition of FAA Order 6032.1, *National Airspace System Modification Program*, contains comprehensive policy and direction concerning the development, authorization, implementation, and recording of the modifications to facilities, systems, and equipment in a commissioned status. It supercedes all instructions published in earlier editions of maintenance technical handbooks and related directives.

5. FORMS. Current forms can be found at feds.faa.gov.

6. RECOMMENDATIONS FOR CHANGES. This handbook is under configuration management control as defined in the latest edition of FAA Order 1800.66, *Configuration Management in the National Airspace System*, and NAS-MD-001, *National Airspace System Master Configuration Index*. Any changes to the baseline document or requests for deviation from the established standards shall be processed through the NAS Change Proposal (NCP) process. A copy of the NAS Change Proposal form, FAA Form 1800-2 (appendix 3-2), is provided in the back of this handbook for the convenience of the handbook users.

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Chapter 1 - GENERAL INFORMATION AND REQUIREMENTS

100. OBJECTIVE.

The objective of this directive is to provide the necessary guidance for proper maintenance of the Apollo GBT2000 Ground-Based Transceiver (GBT). This directive is to be used in conjunction with information available in the technical instruction books and other directives.

101. SAFETY.

Personnel shall observe all safety precautions when performing maintenance on the equipment covered in this manual. Refer to FAA Order 6000.15, *General Maintenance Handbook for Airway Facilities*, for guidance.

102. CERTIFICATION.

Refer to FAA Order 6000.15 for general guidance on the certification of systems, sub-systems, and equipment. Refer to Appendix 1 of this handbook for the specific certification requirements for the Apollo GBT2000.

103. AIRCRAFT ACCIDENTS.

The responsibilities of Airway Facilities (AF) personnel following an aircraft accident or incident are defined in FAA Order 8020.11, *Aircraft Accident and Incident Notification, Investigation, and Reporting*. For each accident or incident for which AF notification is required, the regional Airway Facilities Aircraft Accident Representative (AFAAR) determines which facilities require certification and data archiving, and/or removal from service for more thorough investigative work. Facilities removed from service may be restored via certification, flight inspection, or both depending upon AFAAR decisions. The AFAAR will communicate these decisions to field personnel through the appropriate Control Center. In general, a certified technician should take the following actions:

a. If the AFAAR or designated representative identifies the Apollo GBT2000 as one of the facilities to be certified, perform the following:

(1) Measure and record the "as found" values of the designated systems key parameters identified in chapter 3, Standards and Tolerances, providing the actions required to measure the parameters do not affect the operational system.

(2) At the earliest time agreeable with Air Traffic operations, complete the remaining checks of key performance parameters. The results of all diagnostic runs must be recorded and turned over to the applicable section supervisor for safekeeping.

(3) If Air Traffic Operations does not release the operational system for Airways Facilities to complete the required checks within 30 minutes, the AFAAR or designated representative shall be notified.

b. All station records such as facility logs, meter readings, forms, etc., are official documents. As such, they will need to be retained in case of an investigation regarding a local aircraft accident. Additionally, these records will be used for investigation of other situations where operation of the facility is in question.

104. COORDINATION.

Maintenance activities shall be closely coordinated with Air Traffic Operations (ATO) personnel in order to prevent unanticipated interruption of services. Certified electronic technicians assigned to the facility where the equipment is installed shall be responsible for maintaining the equipment. Appropriate ATO personnel shall be advised immediately of equipment failure, restoration to service, or out-of-tolerance conditions. ATO personnel shall be advised of any situation that may adversely affect equipment operation. Air Traffic personnel are expected to release the equipment to maintenance in a timely manner when requested to do so.

105. FLIGHT INSPECTION.

a. FAA directives do not address flight inspection for ADS-B or GBT systems. Flight inspection aircraft or ADS-B equipped aircraft flying specified profiles may be required on a case-by-case basis at the discretion of AF or AT management. Flight inspections are further discussed in Chapter 7 of this order that also makes references to the United States Flight Inspection Manual 8200.1 being used as a guide. For Alaska Regional flight inspection protocols see "Capstone Decision Paper #28; Flight Inspection" dated 7/30/02.

b. In lieu of flight inspections, targets of opportunity will be used whenever practical. Analysis prior to commissioning will include the following: determine coverage along expected flight routes, investigate holes in coverage, and review presentation of aircraft in sensor overlap areas.

106. TECHNICAL INSPECTION.

Objectively conducted facility inspections are one of the most effective tools for assuring the reliability of the NAS. See FAA Order 6000.15 and 6040.6, *Airways Facilities Technical Inspection Program,* for the details on the intervals and requirements for formal inspection.

107. PERIODIC MAINTENANCE.

a. Chapter 4, *Periodic Maintenance*, of this handbook establishes the tasks and schedules that are required for the periodic maintenance of the Apollo GBT2000. These tasks, as scheduled, are the minimum requirements for each of the systems to meet minimum performance standards.

b. Related information useful to maintenance personnel may be found in the FAA orders, handbooks, maintenance manuals, and diagnostic operating procedures listed in Appendix 3, *Documents and Forms*.

108. ELECTROSTATIC DISCHARGE AND ELECTROMAGNETIC INTERFERENCE PROTECTION.

a. Refer to FAA-STD-020b, *Transient Protection, Grounding, Bonding and Shielding Requirements for Electronic Equipment,* which sets forth requirements for Electrostatic Discharge control and protection from electromagnetic interference.

b. Although no maintenance is to be performed which involves opening the GBT unit, care should be taken concerning electrostatic discharge protection, as the equipment is highly susceptible to damage from this hazard. In addition, during scheduled routine maintenance the equipment should be inspected to ensure that grounding, bonding, and shielding requirements are being met.

109. TEST EQUIPMENT AND TOOLS FOR PERIODIC MAINTENANCE.

Test equipment required for performing routine maintenance of established systems is located in the latest edition of FAA Order 6200.4, *Test Equipment Management Handbook*. Tools and supplies required for performing routine maintenance of established systems are specified and managed by the latest edition of FAA Order 4630.2, *Standard Allowance of Supplies and Working Equipment for National Airspace System Facilities*. Until the above directives are updated to include the Apollo GBT2000, test equipment, special tools, and standard allowance supply support items are specified in Appendix 4.

110. MODIFICATION POLICY.

a. No unauthorized modifications to standard equipment, facilities, or procedures are permitted. It is recognized that there will be occasions when certain temporary repairs will be necessary when approved parts are not readily available or a design deficiency is discovered. Under such circumstances, a complete report shall be submitted to the appropriate supervisor, explaining the nature of the problem, describing the changes made, and an estimate of when the equipment will be restored to its original condition. The affected equipment shall be restored to its original condition as soon as possible.

b. Until an Integrated Product Team (IPT) is assigned to the GBT, prior coordination with the following is required before a test modification can be undertaken: Capstone Program Office (CPO), AAL-400, AAL-500, and AOS-363. These organizations may grant approval for a temporary test modification for test purposes or to determine the feasibility of a proposed improvement. Refer to Order 1800.66, *Configuration Management in the National Airspace System*, and Order 6032.1, *National Airspace System Modification Program* for further information.

c. Proposed modifications to improve system performance, increase reliability, minimize safety hazards, or increase maintenance efficiency may and should be suggested by any field technician or engineer. Such proposed modifications must be described in detail and submitted through the proper channels as a NAS Change Proposal (NCP) on FAA Form 1800-2. A Blank NCP worksheet and form (Appendix 3-1 and 3-2) can be found at the back of this handbook.

111. MAINTENANCE AND DIAGNOSTIC DIRECTIVES.

A list of maintenance and diagnostic directives applicable to this equipment is included in Appendix 3. These directives shall be readily available for reference in the performance of preventive and corrective maintenance as well as certification of the equipment.

112. FAA FORMS.

Current forms can be found at feds.faa.gov.

113. FAA ORDERS AND HANDBOOKS.

Appendix 3 lists the latest edition of directives referenced within this document, at time of publication. Personnel should check directive checklists to ensure they reference the current edition.

114. SYSTEM SECURITY.

a. Refer to the latest edition of FAA Order 1600.54, *FAA Automated Information Systems Security Handbook*, for detailed security requirements for FAA automated systems. Personnel are specifically directed to paragraphs 331, 332, and 803.

b. The sites are expected to maintain physical security, user identification (ID), and password protection for the diagnostics performed on the equipment. The Apollo GBT2000 does not currently have user ID and password protection at the unit itself. This protection is only available through the remote interfacing facility. Until upgraded equipment is acquired, caution should be observed in maintaining physical and electronic security at the remote facility.

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Chapter 2 - TECHNICAL CHARACTERISTICS

200. PURPOSE.

This chapter provides a general description of the technical characteristics of the Apollo GBT2000 and its function in the ADS-B system.

201. SYSTEM INTRODUCTION.

a. The GBT is the remote, ground-based component of the overall ADS-B system. The purpose of the GBT is to pass the air-to-ground ADS-B track data (down link path) via data lines to other facilities. Uplink services such as Flight Information Services – Broadcast (FIS-B) and Traffic Information Services - Broadcast (TIS-B) will be furnished when they are available and provided to the GBT. The GBT can be configured to operate as a Fixed ADS-B Beacon (FAB), commonly referred to as a Permanent Echo (PE) or "parrot". Figure 2-1 shows how the GBT fits into the overall data link system. The complete remote GBT facility consists of two each of the following components:

Apollo GBT2000 Ground Based Transceiver.

28 Volt DC, 12.5 Amp Power Supply (If required).

GPS Antenna.

Universal Access Transceiver (UAT) Antenna.

Interconnecting cables and transmission lines.

b. The internal components of the Apollo GBT2000 are identified in Figure 2-2. There are no field serviceable items in the GBT and it requires no internal manual adjustments. The Lithium battery has a normal life expectancy of seven to ten years and will normally be replaced at the factory. Future maintenance concepts will likely include field replacement of lithium batteries as required.

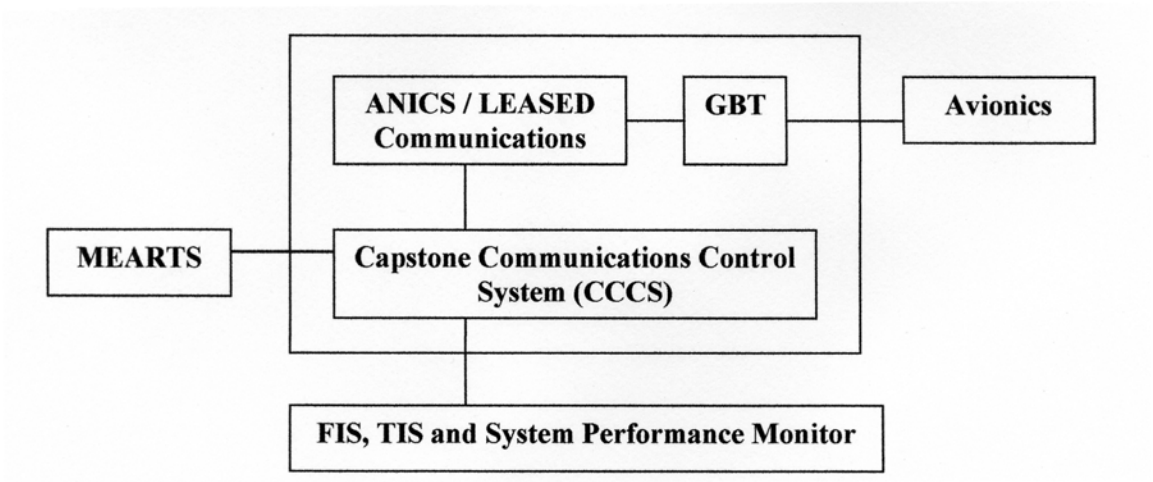

Figure 2-1 CAPSTONE BLOCK DIAGRAM

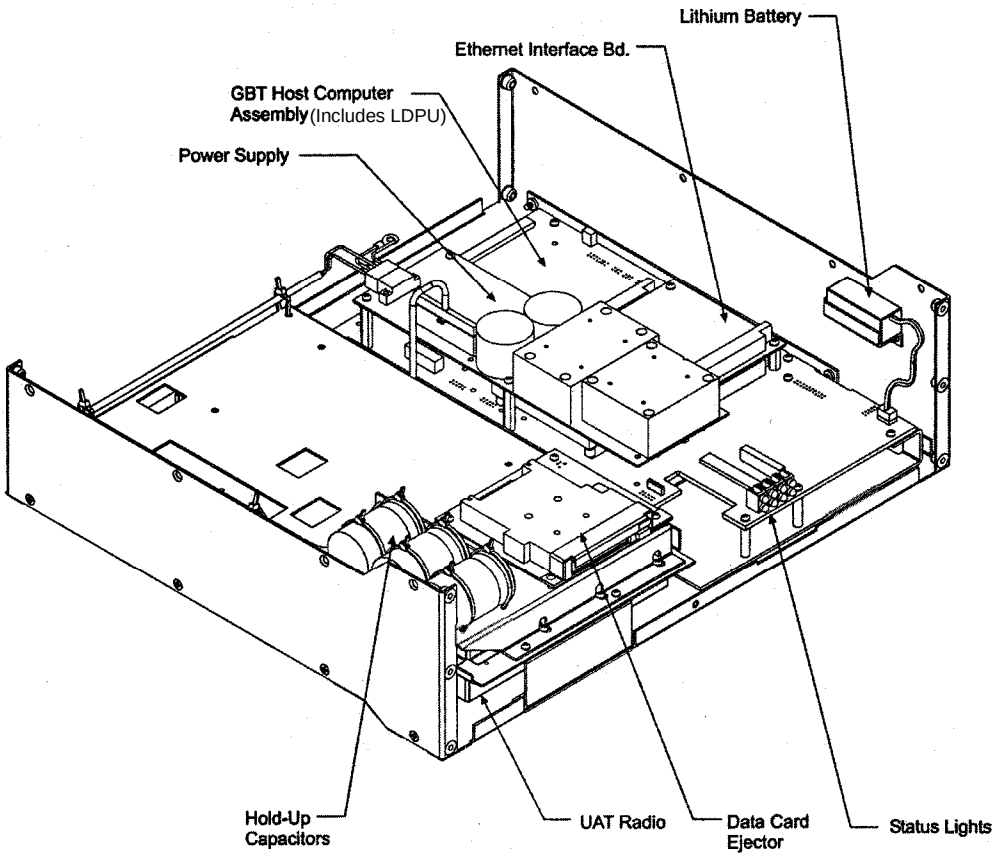

Figure 2-2 INTERNAL PARTS IDENTIFICATION

202. SYSTEM FUNCTIONAL DESCRIPTION.

a. Ground-Based Transceiver. The GBT serves as the data interface providing serial or TCP/IP digital data to other ground equipment. It transmits and receives, providing an air-ground link for ADS-B information. Figure 2-3 is a functional block diagram of the GBT.

b. Universal Access Transceiver (UAT). The UAT operates at 981 MHz (+/- 30 kHz). The transmitter power output is 50 watts typical (+44 dBm to +50 dBm) with a receiver sensitivity of –94 dBm for greater than 90% Message Success Rate (MSR) measured in a 3 MHz bandwidth. The UAT does not generate or consume ADS-B data. It acts merely as a medium through which data are communicated.

c. GPS Sensor. The Global Positioning System (GPS) sensor has the purpose of supplying timing and position information. The GPS timing signal is critical to proper operation of the system because it is the basis for synchronizing all data transceivers. The GPS position data is applied to the fixed ADS-B beacon, or "parrot," for transmission in that application. The option is available (but currently not utilized) to use pre-determined fixed location coordinates rather than GPS supplied position input.

d. Pentium Processor. The Pentium module, mounted on the motherboard, makes up the GBT Host Computer Assembly and runs the application software.

e. System Software. GBT system software is contained on a data card accessible through a door on the front panel. Recording and storing data can be done on the data card if the appropriate software is installed. This capability is not presently enabled.

203. CERTIFICATION REQUIREMENTS.

Refer to FAA Order 6000.15, *General Maintenance Handbook for Airway Facilities*, for general guidance on the certification of systems, subsystems, and equipment. Appendix 1 of this directive gives the specific requirements applicable to the certification of the GBT facility.

a. Certification Rationale. The ADS-B system is one subset of hardware components used in making up the services provided by the ARTCC. Service level and system level certifications are accomplished at the end point (ARTCC). The ADS-B system consists of the GBT, Telecommunications Link to the CCCS at the ARTCC, and the MEARTS. The GBT certification constitutes the sensor portion of the system certification. The Telecommunications certification constitutes the communications portion of the system certification and is performed separately. The CCCS certification constitutes the interface to MEARTS portion of the system and is performed separately. The En Route Surveillance Target Dependent Display (ESTDD) certification for the MEARTS constitutes the service certification.

b. Certification Statement. Upon completion of the required parameter checks, the engineer/technician shall document the action in the facility maintenance log and the maintenance management system. The certification entries should also be made on the FAA Form 6000-8, Technical Performance Record. The Form 6000-8 can be found in Appendix 3 (Form 3-3 & 3-4), Documents and Forms.

c. Certification Procedures. The GBT facility is an integral portion of the IFR surveillance service provided by the ADS-B system. As a part of system certification, verification that the GBT meets certification criteria as listed in Appendix 1 of this directive is necessary. The certification of the GBT attests only to the fact that the facility is operating within the prescribed tolerances or limits at the time the entry in the appropriate log is made.

204. GBT BLOCK DIAGRAM.

Figure 2-3 shows the functional block diagram of the GBT, Figure 2-4 shows a view of the front panel and Figure 2-5 shows a view of the back panel.

205. CCLI MANTAINENCE SERVICE PORT (RMM).

a. The Common Command Line Interface (CCLI) is an interface to the command groups within the GBT. The CCLI (SERVICE) port is a serial port, located on the front panel of the GBT, that allows viewing of selected data on a laptop PC or other computer equipped with terminal emulation software such as the HyperTerminal software set. Commands within the CCLI command set allow control of the various User Interfaces (UIs) to enable or disable their outputs to the SERVICE port for observation. There are two modules used for configuration changes and limited maintenance support utility. These modules can be utilized for initial setup and customizing the GBT operations.

Function	Description
CONFIG	Setup configuration
GBT	Setup GBT parameters

b. There are six modules for troubleshooting and maintenance support that can be accessed, four command modules and two data log modules.

Function	Description
CSIO	Display hardware and software version numbers
CCLI	Configure the command line interface
CERR	Error reporting and filtering
UAT	Control UAT operations
Maintenance Log	Display and reset maintenance logs
MotoGPS Log	Display and control GPS data logs

(1) CONFIG - Configuration mode (CONFIG) selects the uplink format to be used by the GBT. The choices are: 1090, UAT, or VDLM4. The only format currently available for the Apollo GBT2000 is UAT.

(2) GBT - GBT mode (GBT) allows configuration of the GBT for the local requirements. This includes positioning, identification, slot assignment for FIS and TIS, and other site-specific items.

(3) CSIO - The Common Standard Input/Output (CSIO) lists the version numbers of the various hardware and software components installed in the GBT.

(4) CCLI – The Common Command Line Interface (CCLI) is an interface to the Link and Display Processing Unit (LDPU) within the GBT. The LDPU can be visualized as a common interface to observe the operation of the functions within the GBT. Commands within the CCLI command set allow control of the various User Interfaces (UIs) to enable or disable their outputs to the SERVICE port for observation. All UIs are factory set to ENABLE by default.

(5) CERR - The Common Error Reporting Routine (CERR) tracks and reports errors that occur within the GBT subsystems. CERR will log to the FLASH card any fatal errors that cause a reset (CRASH) before the reset occurs. Non-fatal errors are reported through the CCLI via the Maintenance Log function.

(6) UAT - The Universal Access Transceiver (UAT) is the radio format for transmitting and receiving data within the GBT. The UAT can transmit over one antenna (as in the ground configuration), or over two antennas (as in the airborne configuration) if a larger volume of coverage is desired due to obstructions of a single antenna.

(7) Maintenance Log - The Maintenance Log records all non-fatal data that is reported from the various functions within the GBT. There are two forms to the Maintenance Log, the Terse and the Complete. The Terse Maintenance Log is an abridged log that only displays the entries that have recorded data (values greater than 0). The Complete Maintenance Log displays all parameter data and their current status, regardless of content. The Maintenance Log also includes the CSIO log entries in both its formats.

(8) MotoGPS Log - The Motorola Global Positioning System receiver (MotoGPS) is an independent module within the GBT. It uses the 24-satellite constellation of the GPS system to identify its location and the correct time, to include the 1 Pulse Per Second (PPS) timing signal. The MotoGPS has its own separate data log that is accessed through the MotoGPS command line of the CCLI. This data log displays the current status of the GPS, the accuracy of its outputs, and the known status of the satellites being tracked.

206. GBT COMMUNICATIONS DATA PORTS.

a. The RS232 SERIAL port (DB-9 connector) in the rear panel (Figure 2-3 & 2-5) is used for asynchronous serial data flow. The RS232 SERIAL port (DB-9 connector) on the front panel (Figure 2-4) is used for CCLI-RMM and on-site maintenance data access and command inputs. The SYNC SERIAL port (DB-25 connector, Figure 2-5) is not internally connected therefore rendering it NOT useable.

b. The 10 BASE T (Figure 2-5) data port can be activated through a special software configuration but is NOT operational at this time in the GBT 2000.

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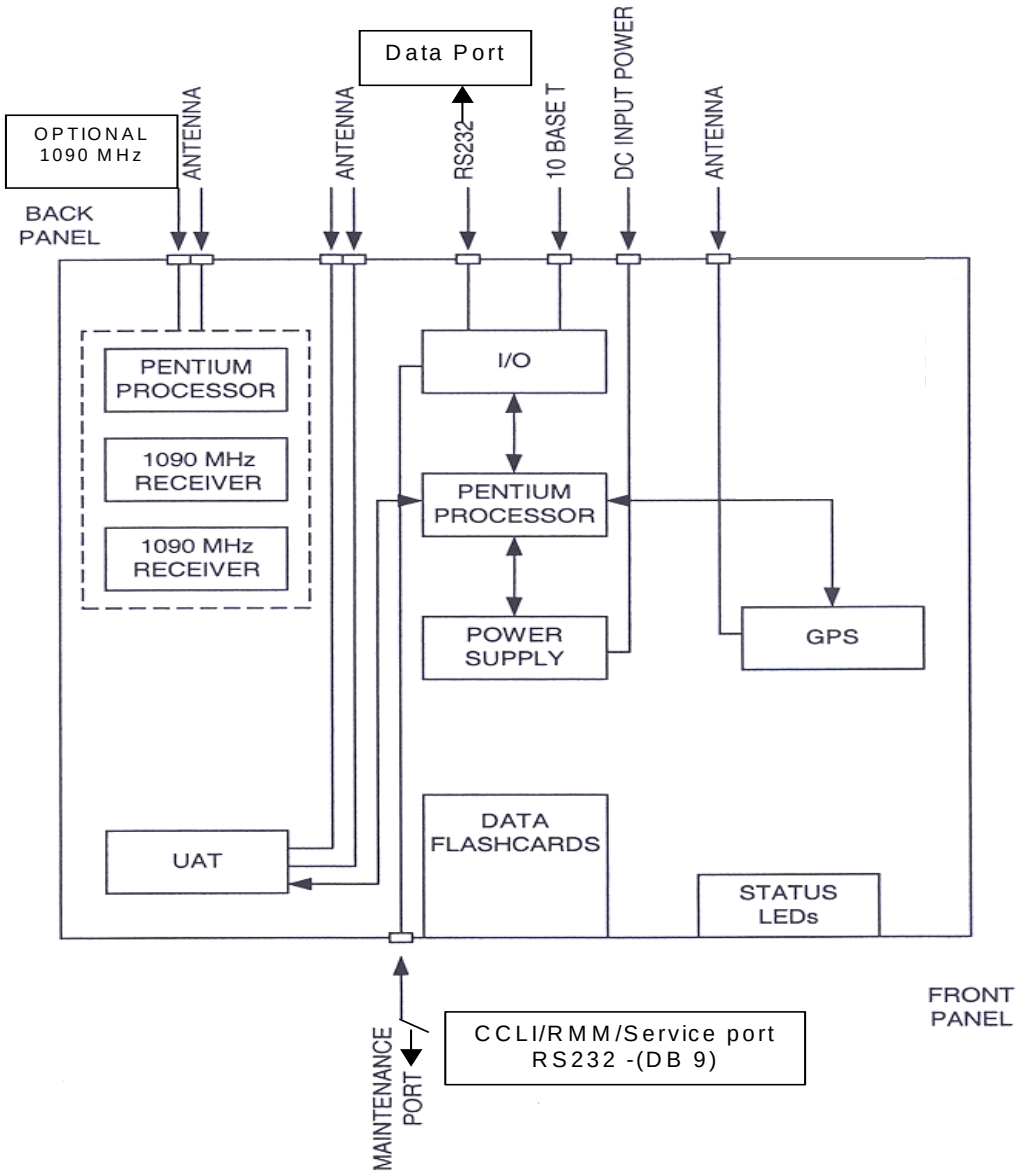

Figure 2-3 GBT FUNCTIONAL BLOCK DIAGRAM

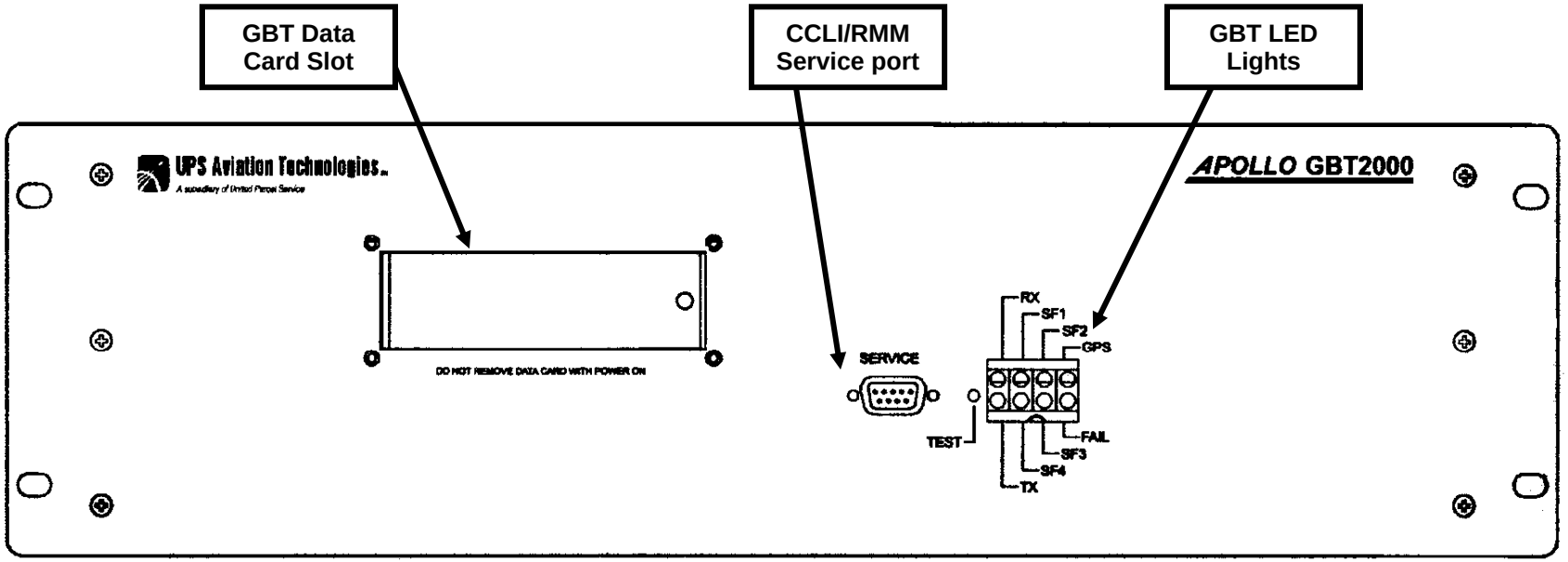

Figure 2-4 GBT FRONT PANEL

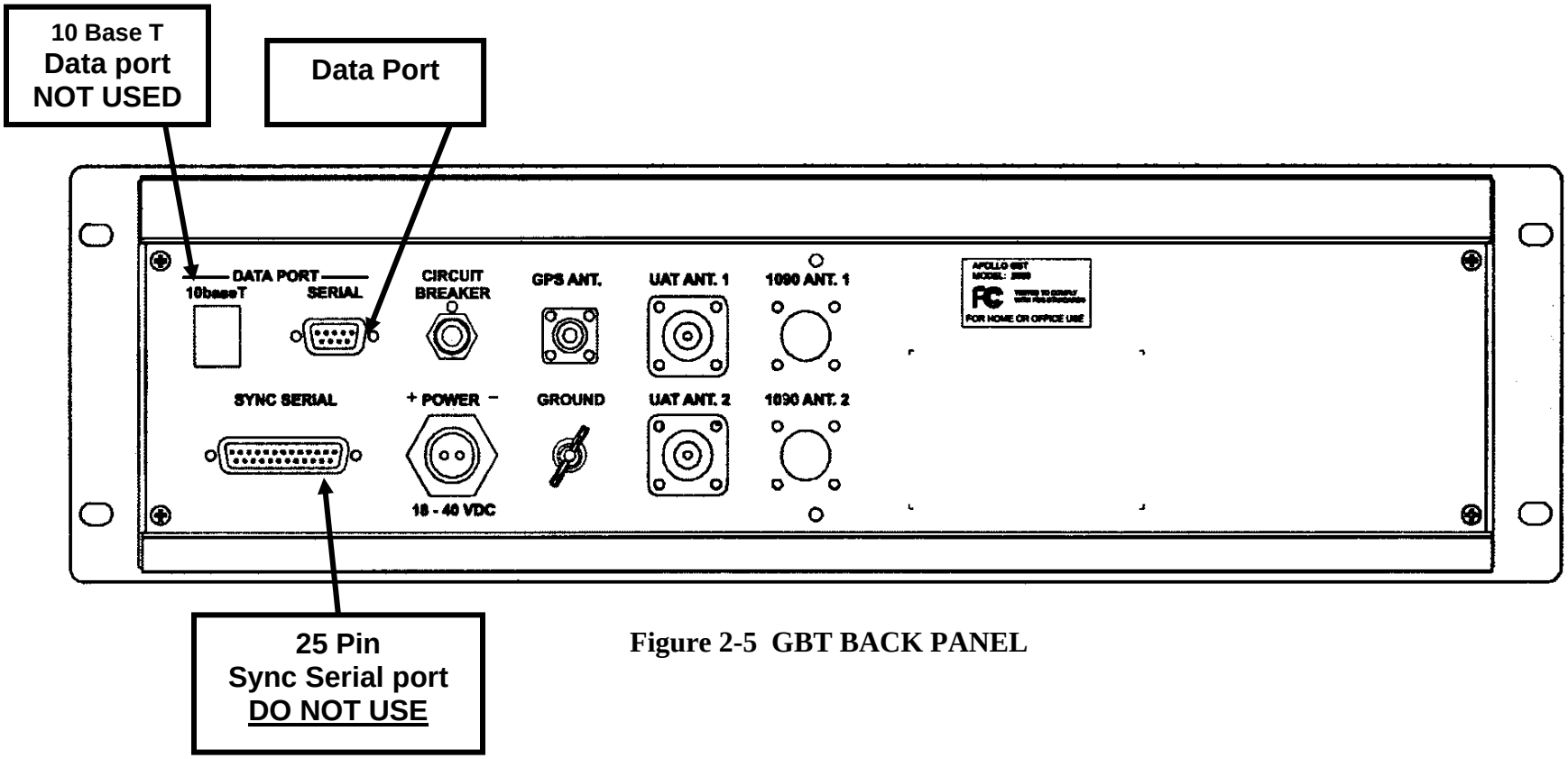

Figure 2-5 GBT BACK PANEL

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Chapter 3 - STANDARDS AND TOLERANCES

300. GENERAL.

This chapter prescribes the standards and tolerances for the Ground-Based Transceiver (GBT) facilities, as defined and described in Order 6000.15, *General Maintenance Handbook for Airway Facilities*. All key performance parameters and/or key inspection elements are clearly identified by an arrow (→) placed to the left of the applicable item.

Entries in the reference paragraph column refer to this handbook, AL 6368.1.

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SECTION 1.
GBT UNIVERSAL ACCESSS TRANSCEIVER (UAT)

		Parameter	*Reference Paragraph*	*Standard*	*Tolerance/Limit* *Initial*	*Operating*
→	309.	POWER SUPPLY, 28 Vdc	Para. 502	+28 Vdc	+/- 5 Vdc	+/- 10 Vdc
	310.	UAT TRANSMITTER				
→		a) Output Power	Para. 507.a	+47 dBm	+/- 3 dBm	+/- 3 dBm
→		b) Carrier Frequency	Para. 504	981 MHz	+/- 0.03 MHz	+/- 0.03 MHz
		c) LED Indicator:				
→		(1) "GPS" LED	Para. 505	Steady Green	Steady Green	Steady Green
→		(2) "FAIL" LED	Para. 505	OFF	OFF	OFF
→		(3) "TX" LED	Para. 505	Flashing Red	Flashing Red	Flashing Red
→		(4) "RX" LED	Para. 505	Flashing Red	Flashing Red	Flashing Red
→		d) Transmit Data	Para. 506	Note 1	Note 1	Note 1

SECTION 1. GBT UNIVERSAL ACCESSS TRANSCEIVER (UAT) *Cont.*

	Parameter	*Reference Paragraph*	*Standard*	*Tolerance/Limit* *Initial*	*Operating*
→	e) UAT Antenna	Para. 507			
	(1) VSWR	Para. 510	< 1.5:1	< 1.5:1	≤ 1.7:1
	(2) Impedance		≤ 10 Ohms	≤ 10 Ohms	≤ 10 Ohms
→ 311.	UAT RECEIVER SENSITIVITY	Para. 508 & 510	-94 dBm	-92 dBm minimum	-92 dBm minimum
→ 312.	GBT CONFIGURATION	Para. 515	Note 2	Note 2	Note 2
→ 313.	UAT CONFIGURATION	Para. 515	Note 3	Note 3	Note 3

NOTE 1 – The MX20 Data Link Status window of the GBT test set displays ADS-B target numbers. The Traffic page shows proper GBT position data. Nine TIS targets should be displayed. The FIS page should display a FIS text message.

NOTE 2 – The GBT configuration settings are set according to site requirements at the time of installation and are recorded on the Facility Reference Data File (FRDF) for the GBT under test.
Default GBT configuration settings are:

Source Identity Code: 0
Source Area Code: 0
TIS-B Timeout: 5
FIS-B Slot Allocation: 2
TIS-B Slot Allocation: 32
FISB Slot Count: 1
TISB Slot Count: 1
TIS-B Service Range: 1
Beacon Mode: ON
Position Source: GPS
ICAO Address: 3333333
ID: NAME
Latitude: 90°0’0.0” N
Longitude: 180°0’0.0” W
Altitude: 80000
Target Rate: 5 sec

NOTE 3 – The UAT configuration settings are set at the time of installation. The UAT settings should not vary from the Default settings unless a specialized application is desired from the GBT. Default UAT configuration settings are:

RX and TX
Antenna Diversity=One Antenna
Base Station mode
Slot Offset=0

SECTION 2.
GBT GLOBAL POSITIONING SYSTEM (GPS)

	Parameter	*Reference Paragraph*	*Standard*	*Tolerance/Limit* *Initial*	*Operating*
→ 314.	GPS SIGNAL QUALITY	Para. 509	Note 4	Note 4	Note 4
→ 315.	GPS ANTENNA	Para. 510	Note 5	Note 5	Note 5
→ 316.	GPS Lock and LEDs	Para. 505	Note 6	Note 6	Note 6

NOTE 4 – The GBT Test Set MX20 should display 4 to 8 active satellites. The MX20 "PORT STATUS" displays Internal and NUC 4 or higher. The displayed Lat/Lon position of the GBT under test from the terminal is within 328 feet (100 meters) (FOM $\leq$4) of the surveyed position. The SNR displayed from the terminal is a value greater than 5.

NOTE 5 – The GPS Antenna output voltage, on the rear of the GBT panel at the GBT GPS antenna output connector, should be 5VDC +/- 0.25VDC. Using the diode test mode on a DVM, at the GBT end of the GPS antenna coax cable connector, the reading should be 0.6V – 1.2V. Also see Para. 510.

NOTE 6 – This procedure will verify that the LED's are operating properly and verify the GPS LED is emitting a steady green illumination indicating a GPS satellite lock.

SECTION 3.
GBT DATA FLOW CONFIRMATION

→ 317.	Data Flow/Transmission to ARTCC	Para. 511	Note 7	Note 7	Note 7

NOTE 7 – Confirm with the ARTCC that proper data flow is occurring and being received, resulting in an alarm free operation.

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Chapter 4 - PERIODIC MAINTENANCE

400. GENERAL.

This chapter establishes the maintenance activities required for the Apollo GBT2000 Ground-Based Transceiver system on a periodic recurring basis, and the schedules for that accomplishment. The chapter is divided into two sections. The first section identifies the performance checks and normal control functions for the GBT that are necessary to determine that the system is operating within established tolerances and limits. The second section identifies other tasks that are necessary to prevent deterioration and ensure reliability of the system.

SECTION 1. SYSTEM PERFORMANCE CHECKS.

The System Performance Checks section identifies checks (i.e., tests, measurements, and observations) of normal operating parameters that are necessary to determine whether operation is within established tolerances and limits.

	Performance Checks	**Reference Paragraph**	
		Standards and Tolerances	**Maintenance Procedures**
Semi-Annually	Perform the following semi-annual checks using calibrated external test equipment and complete Form 6000-8, Appendix 3-3 & 3-4.		
401.	UAT Power Supply	309	502
402.	UAT Transmitter & Antenna	310	
	a. Output Power	310.a	507.a
	b. Carrier Frequency	310.b	504
	c. UAT LED Indicator	310.c	
	(1) "GPS" LED	310.c.1	505
	(2) "FAIL" LED	310.c.2	505
	(3) "TX" LED	310.c.3	505
	(4) "RX" LED	310.c.4	505
	d. Transmit Data	310.d	506
	e. UAT Antenna VSWR	310.e 1	507.b
	f. UAT Antenna Impedance	310.e 2	510
403.	UAT Receiver Sensitivity	311	508
404.	GPS Signal Quality, and Antenna	314, 315	509, 510
405.	Data Flow / Transmission to ARTCC	317	511

	Performance Checks	Reference Paragraph	
		Standards and Tolerances	Maintenance Procedures
Annually	Perform the following annual checks using a laptop computer and complete FAA Form 6000-8, Appendix 3-3& 3-4.		
406.	GBT Configuration	312	515
407.	UAT Configuration	313	515

SECTION 2.
OTHER MAINTENANCE REQUIREMENTS.

Other Maintenance Requirements section will identify other tasks that are necessary to prevent deterioration and/or ensure reliable operation. These maintenance tasks are listed by the maximum intervals permitted between performances. The performance interval for the tasks listed as "As Required" means when the opportunity exists in conjunction with other scheduled activities. (For guidance, refer to Order 6000.15C, *General Maintenance Handbook for Airway Facilities*.)

	Performance Checks	Reference Paragraph	
		Standards and Tolerances	Maintenance Procedures
Annually			
408.	Inspect antenna and foundation for damage and corrosion protection. Clean, galvanize, paint and lubricate as required.	See Order 6000.15C for details.	See Order 6000.15C for details.
409.	Inspect all cables, connectors and hardware. Clean, repair and replace as required.	See Order 6000.15C for details.	See Order 6000.15C for details.
410.	Clean equipment. As required.	See Order 6000.15C for details.	See Order 6000.15C for details.

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Chapter 5 - MAINTENANCE PROCEDURES

500. GENERAL.

This chapter establishes the maintenance procedures required for the Apollo GBT2000 Ground-Based Transceiver system on a periodic recurring basis. The chapter is divided into two sections. The first section identifies the performance checks and normal control functions for the GBT that are necessary to determine that the system is operating within established tolerances and limits. The second section identifies software maintenance diagnostic tasks that are necessary to prevent deterioration and ensure reliability of the system.

SECTION 1. HARDWARE MAINTENANCE.

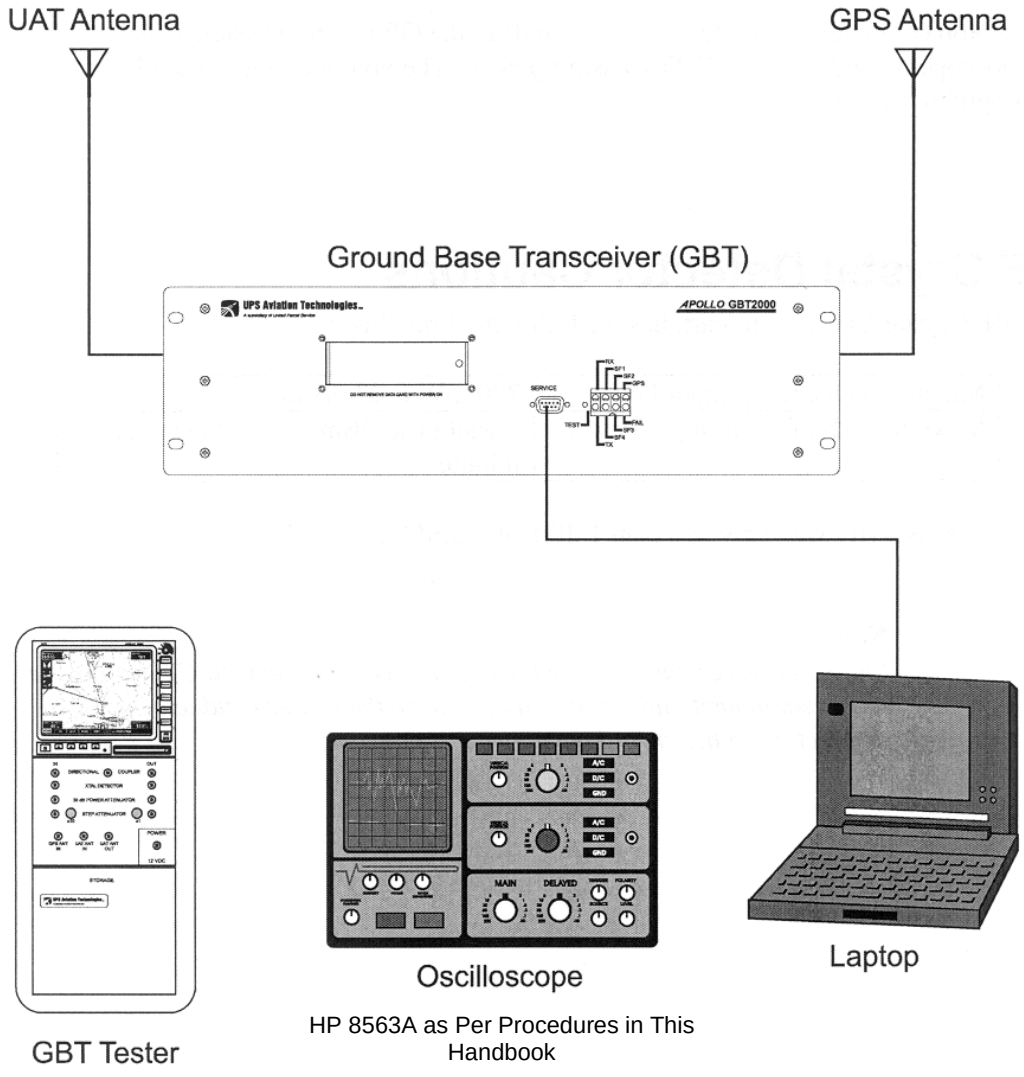

Figure 5-1 SYSTEM TEST SETUP

501. PERFORMANCE CHECKS.

a. The system must be removed from service in order to perform testing. Initial GBT Test Set setup must be performed in preparation for the performance tests. The following setup sequence is a general starting setup. Each test procedure will have specific information to modify this standard setup for the particular test being performed. The system test setup is shown in Figure 5-1.

b. PREPARATION: Coordinate with the appropriate organization(s) to remove the GBT system from service.

NOTE: When GBT's are installed as redundant systems, it will normally be necessary to remove from service only the particular GBT under test.

c. INITIAL SETUP:

(1) Ensure the MX20 power knob (located in the upper right corner) of the GBT test set is off by rotating it fully counter-clockwise. A "click" will be felt.

(2) Connect power to the GBT Test Set. If an AC to DC power supply is used, connect the power supply to an AC power source.

(3) Turn on the MX20 portion of the tester by rotating the MX20 power knob to the right until a "click" is felt.

(4) Connect the laptop computer COM1 serial port to the SERVICE port on the front panel of the GBT under test with the provided serial cable.

(5) Power-up the laptop computer and click the "Start" button. Select "Programs" from the popup menu. Select "Accessories" from the popup sub-menu. Select "HyperTerminal" from the popup sub-menu.

(6) Type "GBT" in the name space in the "HyperTerminal" window and click "OK".

(7) In the "Connect using" item, choose "Direct to Com1". Click "OK" to continue.

(8) In the "Port Settings" window, choose the following configuration:

-Bits per Second: 9600
-Data bits: 8
-Parity: None
-Stop bits: 1
-Flow control: None
Click "OK" to continue.

(9) Turn on the GBT under test.
At the laptop computer type command: "cerr glbl f". Press ENTER and observe that data is not scrolling on the computer display.

(10) From the MX20 screen, after the startup routine has finished, select the System Info page by pressing the soft key. Verify that the HB (Heart Beat) data counter is incrementing. Figure 5-2 shows the layout of the System Info page.

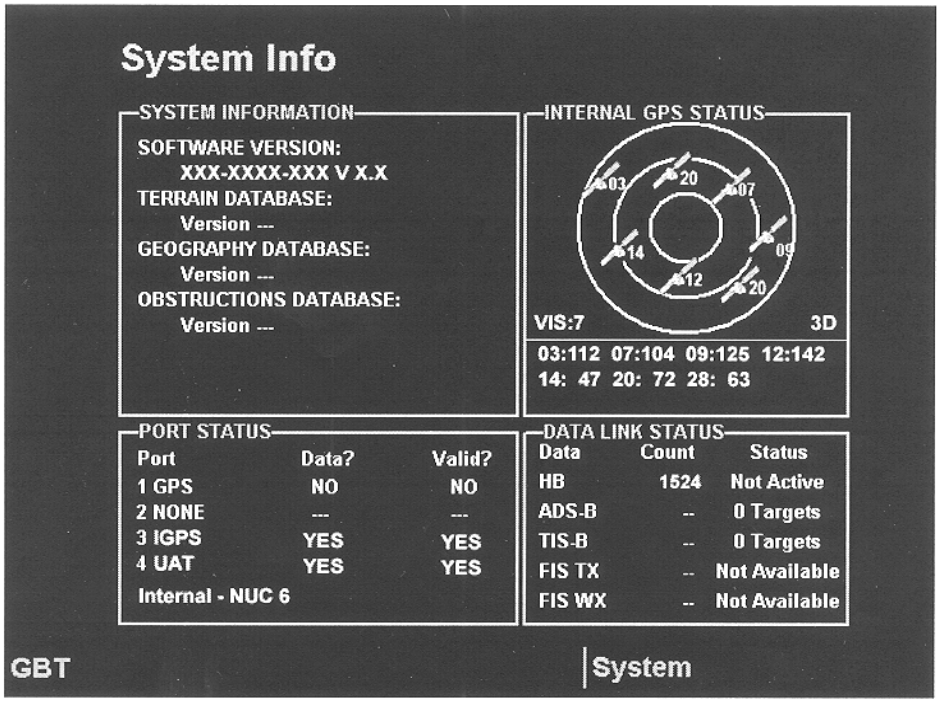

Figure 5-2 MX20 SYSTEM INFO PAGE

(11) At the laptop computer, type the command: "gbt beacon off", then press ENTER. Note that the status will be returned on the computer display indicating that the beacon is OFF and the Tx LED on the GBT front panel does not flash.

502. GBT POWER SUPPLY, 28 VDC.

a. This procedure verifies the power supply is operating within the prescribed standard and tolerance specified in Chapter 3.

b. The GBT will operate from 18 to 40 Vdc. The included rack mount Power Supply, if used, connects to 60 Hz 110 VAC power via a standard three-prong line cord provided. The rack mount power supply provides 28 Vdc to power the GBT. If site battery power is used, this typically provides 24 Vdc. No standby power supply capability (UPS) is provided by GBT components, though it may be provided separately if required.

c. The following test equipment is required:

- Calibrated Digital Voltmeter (DVM)

d. POWER SUPPLY TEST PROCEDURES.

(1) Turn off the external power supply to the GBT under test and remove the power cable connector from the GBT back panel.

(2) Set the DVM to Vdc mode. Place the black (-) lead to one lead of the 28 Vdc cable connector of the power supply and place the red (+) lead to the other lead of the 28 Vdc cable connector.

(3) Turn on the external power supply to the GBT under test. The DVM should read +28Vdc $\pm$ 5Vdc.

(4) Record the value on FAA Form 6000-8 (Appendix 3-3).

(5) Turn off the external power supply to the GBT under test. Connect the power supply cable to the GBT power connector.

(6) Return the GBT to normal operations.

503. GBT TESTER TRANSMITTER POWER.

a. This procedure measures the transmitter power to verify that it is within the standard and tolerance specified in Chapter 3. While performing the following procedures, reference paragraph 505 for LED test to be performed during this phase.

b. The following test equipment is required:

- Calibrated Oscilloscope
- GBT Test Set
- GBT test cables
- Laptop Computer

The test setup connection is shown in Figure 5-3.

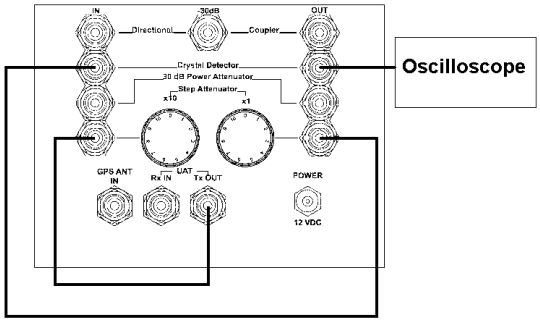

Figure 5-3 Power Output Test Setup

c. TRANSMITTER POWER TEST PROCEDURES.

CAUTION!

Static discharge can damage the crystal detector element. Connect cables to the equipment under test and discharge the center conductor prior to connecting to the crystal detector.

(1) Perform the initial setup as described in Paragraph 501.

(2) Ensure the GBT Test Set is powered off.

(3) Connect a TNC patch cable between the UAT Tx OUT connector of the GBT Test Set and the IN port of the Step Attenuator.

(4) Connect a TNC patch cable between the OUT port of the Step Attenuator and the IN port of the Crystal Detector.

(5) Connect a cable from the GBT Test Set Crystal Detector OUT port to Channel 1 of the oscilloscope.

(6) Turn the Step Attenuator to 10 dB.

(7) Turn on power to the GBT Test Set. Turn on the MX20 and wait for the startup routine to finish then type "gbt beacon on" and Press ENTER.

(8) Measure the power output of the GBT Test Set with the oscilloscope. Initial scope settings are: 100 mV/div Vertical, 100 μS/div Time base. Trigger on the rising edge at 20 mV.

(9) Using the RF crystal detector calibration chart supplied with the GBT Test Set, convert the voltage measurement into an RF power level in dBm, and then add 10 dB to the measured value. The final calculated value should read between 18 and 22 dBm.

(10) Record the transmitter power value for future use in measuring GBT receiver sensitivity.

(11) Turn off the GBT Test Set and disconnect all the test cables.

(12) Return the GBT system to normal operations.

504. TRANSMITTER CARRIER FREQUENCY.

a. This procedure will verify that the UAT Transmitter carrier frequency is within the standard and tolerance in chapter 3.

b. The following test equipment is required:

- Spectrum Analyzer
  (HP-8563A or equivalent)
- 60 dB In-line Attenuator
- Laptop Computer

c. UAT TRANSMITTER TEST PROCEDURES.

(1) Perform the initial setup as described in paragraph 501.

(2) Connect the UAT ANT 1 port of the GBT under test through a 60 dB in-line attenuator to the input of the HP 8563A spectrum analyzer.

(3) At the laptop computer, type in the following command: "cerr glbl f". Press ENTER.

(4) Type "gbt beacon on". Press ENTER.

(5) Type, "gbt rate 1". Press ENTER.

(6) Set the spectrum analyzer to the following settings:

- Sweep Time	24 sec
- Center Frequency	981 MHz
- Resolution BW	100 kHz
- Video BW	1 MHz
- Vertical Sensitivity Log Scale	10dB/div
- Input Attenuation	10 dB
- Reference Level	0 dBm
- Span	5 MHz
- Trace	Max Hold A

(7) Observe the Spectrum analyzer until a full picture of the spectrum is displayed (approximately 4-6 sweeps in Peak Hold).

(8) Observe the Spectrum Analyzer until a full picture of the spectrum is displayed (approximately 4-6 sweeps in Peak Hold), similar to the presentation in Figure 5-4.

Figure 5-4 Spectrum Measurement

(9) Locate the Main Lobe (highest lobe at the center of the spectrum displayed).

(10) Mark the lowest point at the high frequency side of the Main Lobe. Record this value.

(11) Mark the lowest point at the low frequency side of the Main Lobe. Record this value.

(12) Subtract the low frequency measurement from Step (11) from the high frequency measurement from Step (10). Record this value.

(13) Divide the value from Step (12) by two. Record this value.

(14) Add the value from Step (13) to the value noted in Step (11). This is the center frequency of the transmitter.

(15) Record the frequency on FAA Form 6000-8, (Appendix 3-3).

(16) Return the GBT system to normal operations.

505. GBT FRONT PANEL LED'S.

a. This procedure will verify that the LED's are operating properly as specified in Chapter 3.

b. The following test equipment is required:

- GBT Test Set
- Laptop Computer

c. LED TEST PROCEDURES.

(1) Press the TEST switch on the GBT front panel and verify all LEDs illuminate.

(2) While performing the Receiver Sensitivity test in paragraph 508, verify that the GBT RX LED flashes.

(3) While performing the GBT Transmitter data test in paragraph 506, verify the GBT TX LED flashes in accordance with the GBT "Rate" setting.

(4) Verify the GPS LED is steady green while the GBT is in an operational mode.

(5) Verify the FAIL LED is off while the GBT is in an operational mode.

(6) Record the results on the FAA Form 6000-8, (Appendix 3-3).

506. GBT TRANSMIT DATA.

a. This procedure verifies proper data transmission from the GBT.

b. The following test equipment is required:

- GBT Test Set
- Laptop Computer
- Serial Cable

The test setup connection is shown in Figure 5-4.

c. TRANSMIT DATA TEST PROCEDURES.

(1) Perform the initial setup as described in paragraph 501.

(2) Turn off power to the GBT Test Set by turning off the power supply. Ensure that the MX20 power knob is off. Power off the GBT under test.

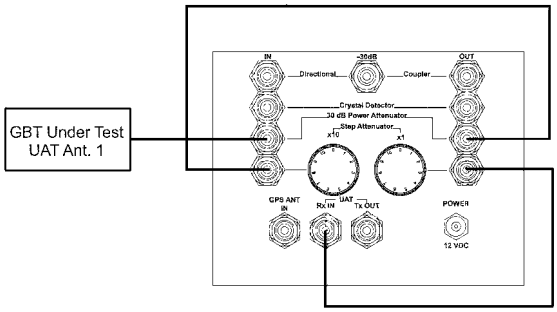

Figure 5-5 Transmit Data Test Setup

(3) Connect a cable between the GBT UAT ANT. 1 connector and the 30 dB Power Attenuator IN port on the GBT Test Set.

(4) Connect a TNC patch cable between the 30 dB Power Attenuator OUT port and the IN port of the Step Attenuator.

(5) Connect a TNC patch cable between the OUT port of the Step Attenuator and the UAT Rx IN connector on the GBT Test Set as in Figure 5-5.

(6) Set the Step Attenuator to 60 dB.

(7) Turn on power to the GBT under test.

(8) Turn on power to the GBT Test Set. Turn on the MX20 and wait for the startup routine to finish. Press the TRAF soft key to display the Traffic page with Traffic enabled.

(9) At the laptop computer, type the command: "GBT beacon on". Press ENTER.

(10) View the MX20 for the display of Traffic information.

(11) Press the FN key and then the SYS soft key. View the System Info page on the MX20 and ensure that the DATA LINK STATUS shows the HB and ADS-B counters incrementing.

(12) At the laptop computer, type command: "uat gbssimon". Press ENTER.

(13) The Status column in the "Data Link Status" window of the System Info page will show that TIS-B and FIS-B targets are detected and will increment the counter.

(14) At the MX-20 screen, press the FN key and then press the TRAF soft key. The Traffic page will show GBT position data. Nine TIS targets should be displayed.

(15) At the MX-20 screen, press the FN key and then press the FIS soft key. The FIS page will display a FIS test message.

(16) Record test result on the FAA Form 6000-8, (appendix 3-3).

(17) At the laptop computer type: "uat gbssimoff". Return the GBT system to normal operation.

507. GBT OUTPUT POWER AND UAT ANTENNA VSWR.

a. This procedure measures the UAT forward and reverse power. The values are used to calculate the Voltage Standing Wave Ratio (VSWR). The VSWR value should be within the standard and tolerance specified in chapter 3. The transmitter forward power should be within the standard and tolerance as specified in Chapter 3 and is also important for certification.

b. The following test equipment is required:

- GBT Test Set
- Calibrated Oscilloscope
- GBT test cables
- Laptop Computer

The test setup connection is shown in Figures 5-5 and 5-6.

c. UAT VSWR TEST PROCEDURES.

CAUTION!
Static discharge can damage the crystal detector element. Connect cables to the equipment under test and discharge the center conductor prior to connecting to the crystal detector.

d. Measure UAT Antenna Forward Power (GBT Output Power).

(1) Perform the initial setup procedure from paragraph 501.

(2) Turn off the power to the GBT under test.

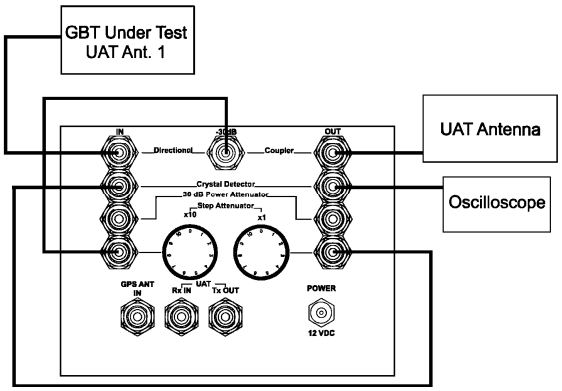

Figure 5-6 Forward Power to UAT Antenna Test Setup

(3) Connect a cable between the UAT ANT. 1 connector on the back panel of the GBT under test to the IN port of the Directional Coupler on the GBT Test Set as shown in Figure 5-6.

(4) Connect the UAT antenna cable to the Directional Coupler OUT port on the GBT Test Set.

(5) Connect a TNC patch cable between the center -30 dB OUT port of the Directional Coupler on the GBT Test Set and the IN port of the Step Attenuator.

(6) Connect a TNC patch cable between the OUT port of the Step Attenuator and the IN port of the Crystal Detector.

(7) Connect a cable from the GBT Test Set RF Crystal Detector OUT port to the oscilloscope.

(8) Turn the Step Attenuator to 10 dB.

(9) Turn on power to the GBT under test. Turn on the MX20 and wait for the startup routine to finish.

(10) At the laptop computer, type the command: "gbt beacon on". Press ENTER.

(11) Measure the power output with the oscilloscope. Initial scope settings are: 100 mV/div Vertical, 100 μS/div Time Base. See Figure 5-7.

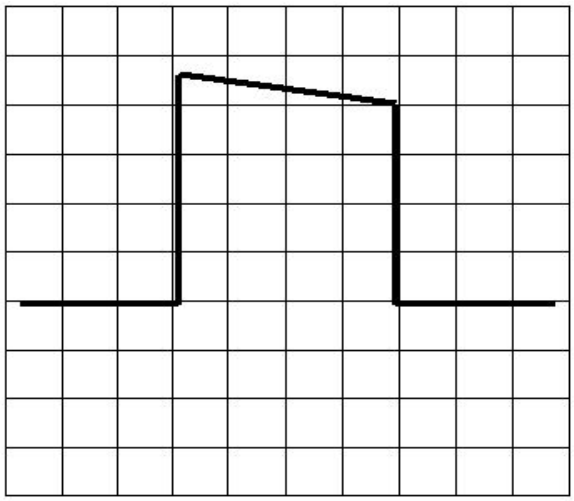

Figure 5-7 Expected Waveform

(12) Using the chart supplied with the GBT Test Set, convert the voltage measurement to an RF level in dB, add 40 dB to the measured value and record the value as Pf. This is equal to UAT antenna power forward or (Pf).

(13) At the laptop computer, type the command: "gbt beacon off". Press ENTER.

e. Measure UAT Antenna Reverse Power.

(1) Turn off power to the GBT under test.

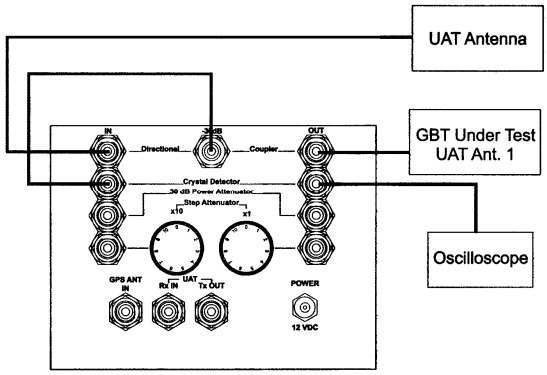

Figure 5-8 Reverse Power from UAT Antenna Test Setup

(2) Connect the UAT antenna cable to the Directional Coupler IN port on the GBT Test Set as shown in Figure 5-8.

(3) Using a patch cable, connect the UAT ANT. 1 connector at the back of the GBT under test to the OUT port of the Directional Coupler on the GBT Test Set.

(4) Connect a TNC patch cable between the center -30 dB OUT port of the Directional Coupler to the RF Crystal Detector IN port.

(5) Connect a cable from the GBT Test Set RF Crystal Detector OUT port to the oscilloscope.

(6) Turn on power to the GBT under test. Turn on the MX20 and wait for the startup routine to finish.

(7) At the laptop computer, type the command: "gbt beacon on". Press ENTER.

(8) Measure the power output with the oscilloscope. Initial scope settings are: 100 mV/div Vertical, 100 μS/div Time Base. See Figure 5-6 for test setup.

(9) Using the chart supplied with the GBT Test Set, convert the measured voltage to an RF level in dB, add 30 dB to the measured value and record the value as Pr.

(10) At the laptop computer, type the command: "gbt beacon off". Press ENTER.

(11) Subtract Pr from Pf (Pf – Pr). The difference is the Return Loss. See Table 4-1 in Appendix 4 to determine the VSWR.

Note: GBT output power measured and recorded in 507(a) equals or is the same as UAT antenna power forward or (Pf).

(12) Record the VSWR value on FAA Form 6000-8 (appendix 3-3).

(13) Turn off the GBT under test and disconnect all the test cables.

(14) Return the GBT system to normal operations.

508. UAT RECEIVER SENSITIVITY.

a. This procedure measures the UAT receiver sensitivity to ensure it is within the standard and tolerance in Chapter 3.

NOTE: The procedure in paragraph 503 must be completed prior to performing this procedure

b. The Receiver Sensitivity Test checks for proper reception by the GBT under test. ADS-B data is sent by the internal UAT in the GBT Test Set at the rate of one per second.

c. The following test equipment is required:

- GBT Test Set
- GBT cables
- Laptop Computer

The test setup connection is shown in Figure 5-9.

d. RECEIVER SENSITIVITY TEST PROCEDURES.

(1) Perform the initial setup procedure as described in paragraph 501.

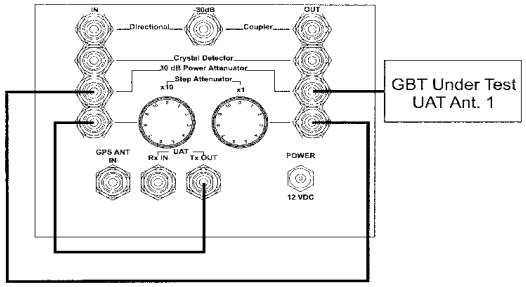

Figure 5-9 Receiver Sensitivity Test

(2) Connect a TNC patch cable between the UAT Tx OUT port on the GBT Test Set and the IN port of the Step Attenuator.

(3) Connect a TNC patch cable between the IN port of the 30 dB Power Attenuator on the GBT Test Set and the OUT port of the Step Attenuator.

(4) Connect a cable from the OUT port of the 30 dB Power Attenuator to the UAT ANT. 1 connector on the back of the GBT under test.

(5) Turn on power to the GBT Test Set. Turn on the MX20 and wait for the startup routine to finish.

(6) At the laptop computer, type the command: "cerr mdl gbt T T T T" (note spaces btwn Ts). Press ENTER.

(7) View the SERVICE port data stream sent to the laptop computer to ensure that data is being sent and verify the RX LED on the front panel of the GBT is flashing.

(8) Adjust the Step Attenuator slowly until the RX LED on the front panel of the GBT under test is extinguished, or the GBT data sent to the laptop computer stops.

(9) Compute the receiver sensitivity of the GBT under test using the following formula:

GBT Test Set Transmitter power computed from paragraph 503.

+ Fixed Attenuator (-30 dB)
+ Variable Attenuator setting from the GBT Test Set
+ Cable loss (-1db)
= Receiver Sensitivity

(10) Record the value on FAA Form 6000-8, (appendix 3-3).

(11) Turn off the GBT Test Set and disconnect all the test cables.

(12) Return the GBT system to normal operations.

509. GLOBAL POSITIONING SYSTEM (GPS) RECEIVER SIGNAL QUALITY.

a. This step verifies the signal quality received from the GPS antenna is within the standard and tolerance in Chapter 3.

b. The following test equipment is required:

(1) GBT Test Set
(2) Laptop computer
(3) Serial cable

(4) GPS SIGNAL QUALITY TEST PROCEDURES.

(1) Turn off the power to the MX20 on the GBT Test Set by turning the rotary knob fully counter-clockwise.

(2) Connect the GBT site GPS antenna cable to the GBT Test Set. Reference the Initial Setup instructions for cable connections in paragraph. 501.

(3) Turn on the MX20 in the GBT Test Set by turning the rotary knob clockwise.

(4) Wait for the startup routine to complete, and then press the "SYS" soft key.

(5) Check the "INTERNAL GPS STATUS" pane on the MX20; the active satellites should display in green.

(6) After no more than 20 minutes, verify the "PORT STATUS" on the MX20 System Info is Internal and NUC 4 or higher.

(7) Reconnect the GBT site's GPS antenna cable to the GBT being tested.

(8) At the laptop computer, type the command: "motogps status on". Press ENTER.

(9) At the laptop computer, type the command: "motogps status off". Press ENTER.

(10) The GPS Status Report should be displayed on the terminal screen. Check the SNR values, they should be greater than 5.

(11) At the laptop computer, type the command: "gbt help". Press ENTER.

(12) Locate the Latitude and Longitude readings and verify that the displayed position is within ± 3" (seconds Lat, Lon) of the surveyed position.

(13) Record the results on FAA Form 6000-8, (Appendix 3-3).

(14) Turn off the GBT Test Set and disconnect all the test cables.

(15) Return the GBT system to normal operations.

510. GPS and UAT ANTENNA PERFORMANCE CHECKS.

a. These procedures verify that the connections to the GPS and UAT antennas are made properly. To perform these tests the system must be removed from service.

b. Test Equipment Required:

Digital Voltmeter (DVM)

c. CABLE INSPECTION.

(1) Verify that all cables are secured properly.

(2) Look for cables across sharp edges and pinch points.

(3) Check all connections.

(4) Visually inspect the antenna for damage or deterioration.

d. GPS ANTENNA.

GPS Antenna: Using the diode test mode of the DVM, check the GPS antenna at the cable end near the GBT.

(1) Place the black (-) lead to the center conductor and the red (+) lead to the coax shield.

(2) The DVM should read between 0.6 V and 1.2 V.

e. UAT ANTENNA.

UAT Antenna: Using the ohms mode of the DVM, check the resistance of the UAT antennas at the cable end near the GBT connector.

(1) Apply one test lead to the coax connector center conductor and the other lead to the coax shield.

(2) The impedance should show less than 10 ohms.

(3) Visually inspect the antenna for damage or deterioration.

(4) Record on FAA Form 6000-8 (Appendix 3-3).

511. ADS-B DATA FLOW TO ARTCC CONFIRMATION.

a. This procedure verifies that GBT data is being received at the ARTCC. If En-Route Surveillance Target Dependant Display (ESTDD) certification is not performed with the GBT certification, confirm the ADS-B Data Flow to ARTCC as described in this section. This confirmation is not required if ESTDD certification is performed.

b. The GBT sends packetized data each second to the CCCS and the MEARTS located at the ARTCC. The data flow is

easily confirmed by viewing the MEARTS Communications Gateway (CGW) display. To verify data flow, contact the Automation Specialist at the ARTCC (through the SOC) and perform the following steps:

(1) Request the Automation Specialist to reset the counters on the CGW display.

(2) Wait at least ten minutes and ask the Automation Specialist to provide the CGW display readings listed below to be recorded on the FAA Form 6000-8 (Appendix 3-4) at the GBT facility.

(3) Verify that the counters represent expected GBT operations as per the examples listed in the table below.

ADS-B Data Flow to ARTCC Confirmation (cont.)

Reading	Definition	Expected Indication (10 minutes since counter reset)	Description
UTC date/time	Universal Time Constant	mm/dd/yyyy hh:mm:ss	Current time and date
UTC date/time of last counter reset		mm/dd/yyyy hh:mm:ss	Date/time of last counter reset
SOURCE	Source GBT ID	xxx	Three-letter source ID (GBT identifier set during configuration)
RX	Receiver	0	For indications other than 0: GBT UAT RF receiver is not valid
TX	Transmitter	0	For indications other than 0: GBT UAT RF transmitter is not valid
SR	System Resource	0	For indications other than 0: GBT internal UAT communications are not valid
PP	Pulse Pair (Pulse Per Second verifier)	0	For indications other than 0: If GPS position is present, the GBT is not receiving valid 1 PPS output from the GBT's GPS receiver. If GPS position is not present, the GPS position has been absent for more than 10 minutes
STAT	Status	20	Status message count (once per 30 seconds)
SURV	Surveillance	Varied	Surveillance (ADS-B) message count. Varies depending on aircraft UAT traffic
CRC	Cyclical Redundancy Checksum	0	Cyclical Redundancy Checksum errors encountered
INVMS	Invalid message counter	0	An invalid message is a message with a missing field
INVSS	Invalid SIC/SAC	0	SIC/SAC has not been adapted in MEARTS

Reading	Definition	Expected Indication (10 minutes since counter reset)	Description
SERER	Serial Error	0	Incorrect serial connection - mismatch of GBT SAC and CCCS UDP port. Normally caused by a swapped cable.
FIXPE	Fixed Permanent Echo	120	"Parrot" count received by the GBT from other GBTs (once per 5 seconds from co-located GBT; higher if GBT is receiving parrots from other GBTs)

512. OTHER MAINTENANCE REQUIREMENTS.

a. The following activities shall be accomplished on a systematic basis, with appropriate corrective action taken as warranted by the conditions and findings. Activities found in subparagraphs (1) and (2) are to be performed as required, with no activity records required.

b. Antenna cable connector maintenance is to be performed in conjunction with the annual antenna transmission line routine checks, and does require periodic maintenance form records.

(1) Cleaning. Periodic cleaning of equipment and facilities should be scheduled in accordance with local conditions, but at least annually. Schedules for a particular site should be varied as a function of seasonal or environmental conditions. Replacement of air filters that affect the equipment should be performed as needed. Inspect parts for overheating, as evidenced by discoloration, blistering, or bulging of parts or containers, and peculiar odors or excessive heat. Remove any accumulations of dirt, corrosion, rust, mildew, and fungus growth. Inspect for loose mounting bolts, screws, and connections.

Housekeeping. Maintenance personnel shall ensure that equipment in their charge presents a clean, well-ordered, professional appearance at all times. Equipment storage and work areas shall be kept clean with supplies and working equipment stored in a neat and orderly manner. Safety and professional decorum are directly related to a neat and well-ordered workplace.

System Grounding. Section 810 of the National Electric Code provides information on proper grounding of the transceiver, size of required grounding conductor, route, connection to grounding electrode, and requirements for grounding electrode. The code specifies #10, or larger copper conductor. A lug is located on the back panel for grounding purposes. Inspect to ensure that the antenna system is grounded so as to provide some protection against voltage surges and build-up of static charge. Section 810 of the National Electric Code provides information on proper grounding of the mast and support structure, grounding of the lead-in wire to an antenna discharge unit, size of the grounding conductor, location of the antenna discharge unit, connection to grounding electrodes, and requirements for a grounding electrode.

(2) Moisture proofing of Radio-Frequency (RF) Cables. The RF cables, connectors, and terminations shall be inspected at least annually and repaired as required. This should be done in conjunction with any routine that requires disconnection of the cables. Facility outages have been attributed to moisture accumulation in RF coaxial cable connectors. Procedures for moisture proofing cable connections are found in FAA Order 6000.15.

SECTION 2. SOFTWARE DIAGNOSTICS.

513. DIAGNOSTIC OVERVIEW.

a. The diagnostic procedures in this section are primarily for use in verifying a GBT system configuration and to assist in local troubleshooting.

b. The GBT/UAT Configuration procedures allow the existing configuration to be viewed and verified. These configuration parameters can also be changed, as for installing a new or replacement GBT, to meet specific requirements.

c. The Maintenance Log views an internal error history log for the GBT. The entries can be reset to start a new recording period. There are two logs:

(1) Terse – shows only the entries that have a change since the last reset.

(2) Full–shows all 93 possible log entries.

d. The MOTOGPS views a GPS specific log that indicates the health and activity of the GPS subsystem and of the satellites it is tracking.

e. The CERR diagnostics describe how to perform a software reset of the GBT and how to view additional data on the GPS interface to the GBT system.

514. GBT DIAGNOSTICS SETUP.

a. Using a laptop computer, appropriate diagnostic software, and a straight-through serial cable, connect the laptop serial port to the SERVICE port on the front panel of the GBT. The following setup sequence is a general starting setup. Each diagnostic procedure will have specific information to modify this standard setup for the particular procedure being performed. The test setup is shown in Figure 5-1.

b. PREPARATION: Coordinate with the appropriate organization(s) to remove the GBT system from service.

c. INITIAL SETUP:

(1) Using the serial cable, connect the laptop computer COM1 port to the SERVICE port on the GBT front panel.

(2) Set the computer terminal connection according to Paragraph 501, steps 4 through 8.

(3) If not powered up, apply power to the GBT.

(4) At the laptop computer, type the command: “cerr glbl f”. Press ENTER. This stops all reporting to the service port.

515. GBT/UAT CONFIGURATION.

a. This procedure views the configuration settings for both the GBT and UAT. The following table lists all commands that can be performed under the Universal Access Transceiver (UAT) diagnostics.

b. The following test equipment is required:

- Laptop computer
- Serial Cable

UAT Command	Description
HELP	Lists all commands and brief descriptions
BASE	Places the UAT into Base Station Mode
AIR	Places the UAT in Airborne Mode
RXONLY	Places the UAT in Receive Only Mode.
RXANDTX	Places the UAT in Receive and Transmit Mode. This enables FIS-B and TIS-B if they are otherwise available
ONEANT	Configures the UAT to use one antenna
TWOANT	Configures the UAT to use two antennas
SLOT	Set the slot offset for transmitted data. 0 = random and 1 – 31 = use specified slot

c. GBT & UAT CONFIGURATION TEST PROCEDURES.

(1) Perform the initial setup as described in paragraph 501 for both the GBT and/or the UAT depending on the component to be tested.

(2) At the laptop computer, type the command: "gbt help" for the GBT, or "uat help" for the UAT, depending on the configuration to be tested, then press ENTER.

(3) The configuration settings for the GBT or the UAT, as appropriate, will show on the laptop display. Verify the settings with the recorded data in the FRDF.

(4) If a different configuration is desired, type the appropriate command as listed in the GBT or UAT "help" listing, then press ENTER. Reference paragraphs, 610 for the GBT and 605 for the UAT detailed procedures.

516. MAINTENANCE LOG DIAGNOSTICS.

a. This procedure views the maintenance log options available at the SERVICE port.

b. The following test equipment is required:

- Laptop computer
- Serial Cable

c. MAINTENANCE LOG DIAGNOSTICS PROCEDURES.

(1) NOTE: Perform the initial setup as described in paragraph 514.

c. MAINTENANCE LOG, TERSE.

This procedure will list the maintenance log parameters that have a value greater than zero. This indicates the log parameters that have noted a fault condition since the last maintenance log reset. This log will also indicate the Common Standard Input/Output (CSIO) data.

(1) At the laptop computer, type the command: "maint_log print terse". Press ENTER.

(2) The screen will display information similar to the left-hand column of the following table. Interpretation of the data is provided in the right-hand column.

Displayed format	Meaning of data
92 : UAT One PPS Failure	Monitored parameter title
First occurrence:	Date and time of first occurrence
2001-03-15|06:38:55	
Last occurrence:	Date and time of most recent occurrence
2001-11-27|23:24:56	
Count : 139162	How often an occurrence has happened
Task ID : 158	Task ID
Task Priority : 100	Task priority
Module name : GBT	Module (system) name
Line number : 1353	Line number in software
2002-11-27|22:23:56	Date and time of up to 10 most recent resets
2002-11-27|16:35:35	(Power off /crash resets)
2002-11-26|18:00:32	
2001-07-25|22:32:11	
2001-07-12|19:45:36	
2001-07-06|19:47:09	
2001-06-15|17:50:33	
2001-05-11|05:46:12	
2001-02-23|08:10:00	
2001-02-23|07:01:44	
138-0452 GBT SOFTWARE 31.20.00	CSIO Data. Software version for GBT
139-0250 1090 SOFTWARE ----	CSIO data. Not used
MAGVAR DATABASE: 04 2000	CSIO data. Magnetic Variation database date
139-0244 PARALLEL HS PLD 08	CSIO data. Address of Parallel HS PLD
139-0253 DIGITAL IO PLD 10	CSIO data. Address of Digital I/O PLD
139-0254 SERIAL IO PLD 02	CSIO data. Address of Serial I/O PLD
139-0255 ARINC 429 PLD ----	CSIO data. Not used
139-0256 ARINC 561 PLD ----	CSIO data. Not used
139-0249 UAT FPGA 09	CSIO data. Address of UAT FPGA
139-0247 UAT SOFTWARE 02.20	CSIO data. UAT software version
139-0245 1090 FPGA ----	CSIO data. Not used
139-0246 BUS INTF PAL ----	CSIO data. Not used
428-0043 GPS SOFTWARE 2.3	CSIO data. GPS software version
415-6015 MOTHERBOARD 01	CSIO data. Address of motherboard
415-6014 INTERFACE BOARD 00	CSIO data. Address of interface board
LDPU Serial number 0	GBT data. LDPU serial number
LDPU ICAO Address 898779	GBT data. ICAO address

e. MAINTENANCE LOG, FULL.

This procedure will show all monitored log parameters. The maintenance log monitors 94 parameters and the CSIO data. All parameters are displayed each time the MAINT_LOG PRINT command is used regardless of the count levels for each monitored item. Many of these 94 logged parameters listed in the table below, are legacy items from the airborne avionics configuration of the hardware being used, and may not be monitored in the Base Station Mode.

Item	Description	Item	Description	Item	Description

0	Arinc traffic data A Invalid	32	DIO Time Mark Select Out	64	Transponder (#2) ownship fail
1	Arinc traffic data B Invalid	33	DIO Internal GPS Avail Out	65	Transponder (#2) ownship corrupt
2	Control Panel Fail	34	DIO UAT Reset Out	66	DIO Altitude Error
3	CDTI Feedback Bus Fail	35	DIO Reserved 2 Out	67	DIO magheading error
4	Control Panel to CDTI Bus Fail	36	DIO APM Clock Out	68	DIO Landing Gear Error
5	CDTI Display Fail	37	DIO APM Out	69	DIO air_ground error
6	GPS position fail	38	DIO APM WEN1 Out	70	DIO Radio Altimeter Error
7	GPS time mark fail	39	DIO APM WEN2 Out	71	DIO performance error
8	Arinc (#1) pressure alt fail	40	DIO APM EN1 Out	72	DIO ADVISEIN1 Error
9	Synchro (#1) pressure alt fail	41	DIO APM EN2 Out	73	DIO ADVISEIN2 error
10	ARINC 429Mag heading fail	42	LDPU to 1090 datalink fail	74	DIO ADVISEIN3 Error
11	Synchro mag heading fail	43	1090 to LDPU datalink fail	75	DIO ADVISEIN4 Error
12	MSP (#1) data link fail	44	UAT ownship fail	76	DIO Climb1 Error
13	Transponder (#1) ownship fail	45	VDLM4 ownship fail	77	DIO Climb2 Error
14	Transponder (#1) ownship corrupt	46	Discrete reference voltage fail	78	DIO Climb3 Error
15	1090 top antenna fail	47	Lithium Battery over voltage	79	DIO Climb4 Error
16	1090 bottom antenna fail	48	Lithium Battery under voltage	80	DIO DL2 Enable Error
17	1090 top antenna sensitivity	49	Air/Ground state mis-match	81	DIO Inc Climb1 Error
18	1090 bottom antenna sensitivity	50	APM’s CRC check on bank1 failed	82	DIO Inc Climb2 Error
19	LDPU over temperature	51	APM’s CRC check on bank 2 failed	83	DIO Inc Climb3 Error
20	UAT transmitter fail	52	APM bank 1&@ match failed	84	DIO Inc Climb4 Error
21	UAT top antenna fail	53	VDLM4 Tx Antenna fail (BITE)	85	DIO Transponder Stby A Error
22	UAT bottom antenna fail	54	VDLM4 Rx Antenna fail (BITE)	86	DIO Transponder Stby B Error
23	UAT receiver sensitivity	55	VDLM4 1PPS fail (BITE)	87	DIO TIS DisableIN Error
24	UAT tx power output threshold fail	56	VDLM4 GPS Input fail (BITE)	88	DIO ADC SelectIN Error
25	UAT rx loopback fail	57	VDLM4 R/T #1 fail (BITE)	89	Arinc 429 From FMC Fail
26	DIO LDPU Status Out	58	VDLM4 R/T #2 fail (BITE)	90	Arinc 561 Input Fail
27	DIO (Corrective) Annunciator Out	59	VDLM4 R/T #3 fail (BITE)	91	UAT Heartbeat Failure

Item	Description	Item	Description	Item	Description
28	DIO (Preventive) Annunciator Out	60	VDLM4 R/T #4 fail (BITE)	92	UAT One PPS Failure
29	DIO (TA) Annunciator Out	61	Arinc (#2) pressure alt fail	93	Radio Altimeter Failure
30	DIO Advisory 1 Out	62	Synchro (#2) pressure alt fail		
31	DIO Advisory 2 Out	63	MSP(#2) data link fail		

(1) At the laptop computer, type the command: "maint_log print". Press ENTER.

(2) The screen will display the same format as for the TERSE maintenance log. The maintenance log will display all 70 logged parameters and CSIO data. The data is interpreted in the same manner as for the TERSE maintenance log.

517. MOTOGPS DIAGNOSTICS.

a. This procedure views the MotoGPS (Motorola GPS) options available at the SERVICE port.

b. The following test equipment is required:

- Laptop computer
- Serial Cable

c. MotoGPS DIAGNOSITCS PROCEDURES.

Perform the initial setup procedures described in paragraph 501.

At the laptop computer, type the command: "motogps status on". Press ENTER.

(3) The screen will step through GPS status reports approximately every second. A typical status report format will look similar to the following:

```
11/14/2002 23:01:02
Visible   Sats:11   Tracked   Sats:8
Fix:00100000
ID  Mode  SNR   Status  Elev  Azimuth
19  SRCH  000  00000000  12     109
27  SRCH  000  00000000  14     098
26  DATA  162  00100000  20     320
13  DATA  171  10100000  50     154
10  TRCK  089  10100000  29     257
08  TRCK  044  10100000  79     041
07  TRCK  079  10100000  12     190
02  TRCK  092  10100000  55     249
Motogps Lat 44 deg 54 min N
Motogps Lon 122 deg 59 min W
HFOM = 0.090000  HAL = 371
```

(4) To stop the GPS status report stepping, type "motogps status off" and press ENTER at the laptop computer.

(5) Interpreting the log data.

(a) First line: Date and time from the GPS receiver.

(b) Visible Sats: Number of visible satellites available.

(c) Tracked Sats: Number of satellites actually being tracked.

(d) Fix: See Note 1 below.

(e) ID: The ID number for the satellite being tracked.

(f) Mode:
SRCH for searching for satellite,
DATA for tracked data available for position calculation.
TRCK for tracking satellite data,

(g) SNR: Signal to Noise Ratio. Higher numbers indicate higher signal quality.

(h) Status: See Note 2 below.

(i) Elev: Elevation of satellite above horizon (0 to 90 degrees).

(j) Azimuth: Azimuth of satellite from north (0 to 359 degrees).

(k) Lat: Latitude of the GBT

(l) Lon: Longitude of the GBT

(m)HFOM: Horizontal Figure of Merit in nautical miles.

(n) HAL: Horizontal Alarm limit in 0.5 meter units, 3704 equals one nautical mile.

NOTE 1: Fix description. These eight bits denote the value of the GPS receiver status message. "1" represents a condition that is present. "0" represents a condition that is not present. The bits in left-to-right order are:

Bit #	Description	Comments
Bit 7	Position propagate	Left most (MSB)
Bit 6	Poor geometry	
Bit 5	3D fix	
Bit 4	Altitude hold (2D fix)	
Bit 3	Acquiring Satellite/position hold	
Bit 2	Not used	
Bit 1	<3 visible satellites	
Bit 0	Bad almanac	Right most (LSB)

NOTE 2: Status description. These eight bits denote the status of the GPS receiver channel for each satellite. "1" represents a condition that is present. "0" represents a condition that is not present. The bits in left-to-right order are:

Bit #	Description	Comments
Bit 7	Used for position	Left most (MSB)
Bit 6	Sat momentum alert	
Bit 5	Sat anti-spoof flag	
Bit 4	Sat unhealthy	
Bit 3	Sat inaccurate	
Bit 2	Not used	
Bit 1	Not used	
Bit 0	Parity error	Right most (LSB)

518. CERR DIAGNOSTICS.

a. This procedure views the Common Error Reporting Routine (CERR) data options available at the SERVICE port. More parameters than are given here are available, but they are not exercised during maintenance activities. Only those parameters that are of use for maintenance procedures are discussed.

b. The following test equipment is required:

- Laptop computer
- Serial cable

c. CERR DIAGNOSTICS PROCEDURES.

Perform the initial setup procedures described in paragraph 514.

d. SYSTEM RESET (cerr crash).

(1) At the laptop computer, type the command: "cerr crash". Press ENTER.

(2) The laptop may display a line of random characters. The GBT LED panel will indicate a self-test sequence.

(3) After no more than 5 minutes, the laptop will display a format similar to the following:

```
Verifying EEPROM Configuration
Using EEPROM Shadow APM 0

021212 012929 M 104:2 KLOGT:332
'key.log file: write error'

021212 012929 M 15:200
U_IFOOPN:562 'UAT log file open
error'

021212 012929 s 18:200
P_UI_OUT:215 'Couldn't open
traffic bus A'
```

```
021212 012929 s 18:200
P_UI_OUT:237 ‘Couldn’t open
traffic bus B’

021212 012929 M 11:200 U_CSA:520
‘CSARM log file open error’

021212 012929 s 113:20 UAT:1725
‘Event Message” [09][43]

021212 012929 s 113:20 UAT:1725
‘Event Message” [09][43]
021212 012929 s 113:20 UAT:1725
‘Event Message” [09][43]
```

e. CERR MOTOGPS.

(1) At the laptop computer, type in the command: “cerr mdl motogps t t t t”. Press ENTER.

(2) The screen will display a message similar to the following:

```
changed module: MOTOGPS to F:T S:T
M:T I:T
```

(3) The screen will also step through a format approximately once every second similar to the following:

```
021127 232237 I 110:20 MOTOGPS:1024
‘’    Motogps    Year/Month/    Day
2002/11/28

021127 232237 I 110:20 MOTOGPS:1029
‘’ Motogps Hour:Min:Sec   6:04:03

021127 232237 I 110:20 MOTOGPS:1142
‘’ Motogps Lat 61 deg 15 min N

021127 232237 I 110:20 MOTOGPS:1146
‘’ Motogps Lon –149 deg –31 min W

021127 232237 I 110:20 MOTOGPS:1235
‘’ Receive raim stat. Alert = 1 HAL
= 3704

021127 232237 I 150:30 MOTOGPS:1508
‘’ HFOM = 10.010000  HAL = 3704
```

(4) To stop the stepping, type “cerr mdl motogps f f f f” and press ENTER at the laptop computer.

(5) To interpret the CERR data use the following format:

(year/month/day)(hour/min/sec)(level) (task ID)(task priority)(module):(line #) message

For example, the line entry:

```
021127 232237 I 113:20 UAT:1377
‘Recvd
 Msg” Type = 0 Name = Heart Beat
Message
```

Has the meaning: Received on November 27, 2002 at 11:22 and 37 seconds P.M., Informational data, task 113 with priority 20, from the UAT module at line 1377. The received message, type is 0 and name is *Heart Beat Message*.

519 thru 599 RESERVED

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Chapter 6 – REMOTE MAINTENANCE MONITORING (RMM).

600. GENERAL.

a. Figure 6-1 depicts the structure of the Remote Maintenance Monitoring (RMM) connectivity. Through a computer set up for the purpose, it is possible to access each GBT individually and verify or modify configuration and maintenance functions. These functions are resident within software modules as described in Chapter 2, paragraph 205. There are several functions within these modules that are of a specialized nature and not directly associated with routine maintenance functions. These specialized functions will not be discussed. Only those functions related to routine maintenance and troubleshooting will be discussed. It should be noted that all these RMM functions could be accessed directly at the GBT front panel for local maintenance support, as well.

b. There are several functions that may change or inhibit the data to the Status Report, GBT Beacon, or both. To avoid an unnecessary and potentially undesirable situation,
RMM operations should be performed on systems that have been released from operational use. If it is necessary to perform RMM operations on a GBT while it is still in operational use, the following functions should be avoided to prevent erroneous data transmissions.

CERR Commands	GBT Commands	UAT Commands
Crash	Altitude	Rx only
Date	Beacon	Rx and Tx
Time	ICAO	
	ID	
	Latitude	
	Longitude	
	Position	
	Rate	
	SAC	

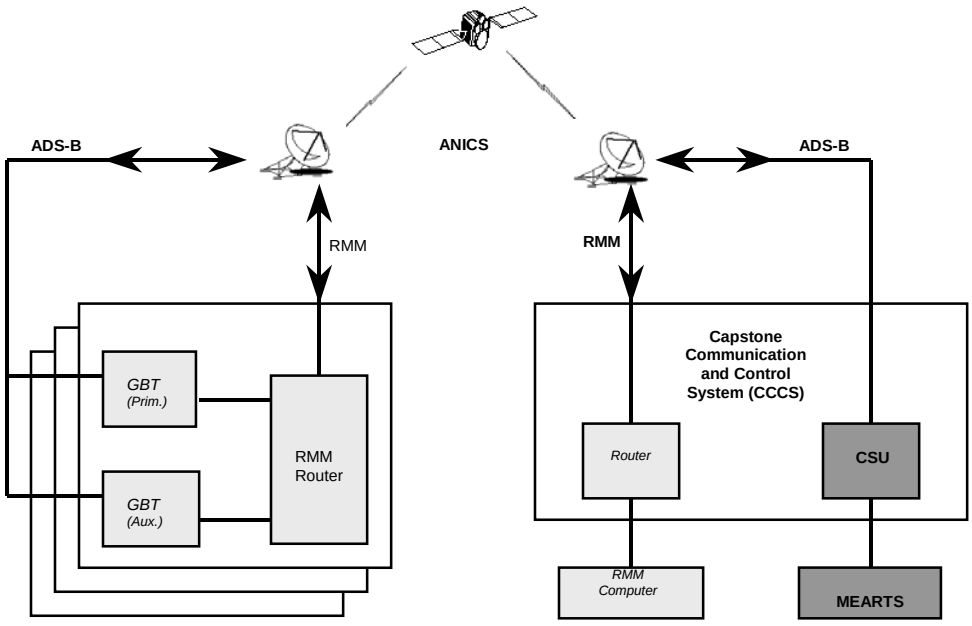

Figure 6-1 RMM Structure

NOTE: Where the word **FORMAT** is seen, the displayed message will be similar, but not exactly as shown; there may be more or fewer lines, or dates may be different, or some other difference may appear that is standard within the function. Where the word **MESSAGE** is seen, the displayed message will be exactly as depicted.

601. INITIAL SETUP.

a. PC Connectivity. If a dedicated computer is available, proceed to paragraph 602.

b. In the event a dedicated computer is not available, a computer can be connected using the following procedures.

(1) Connect the CONSOLE port of the RMM router to the COM1 port of the selected RMM computer utilizing the appropriate cable (CISCO type).

(2) Power the computer on and click the "Start" button. Select "Programs" from the popup window. Select "Accessories" from the popup window. Select "HyperTerminal" from the popup window.

(3) Type "GBT" in the name space in the "HyperTerminal" window and click "OK".

(4) In the "Connect using" item, choose "Direct to Com1". Click "OK" to continue.

(5) In the "Port Settings" window, choose the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

Click "OK" to continue.

(6) The HyperTerminal data window will appear. Click "START" and press <ENTER>.

(7) The screen will display the following message:

```
PASSWORD
```

(8) Type in the RMM router password.

(9) Type in the command for connection to the desired site. For example, to connect to the Unalakleet Alternate GBT type the command: "telnet unka" and press <ENTER>.

(10) The screen will display the following similar format:

```
Trying UNKA (10.0.240.6, 2035) … open (format)
User Access Verification
Password:
```

(11) Type in the password.

(12) The screen will display the following message:

```
Password OK
```

NOTE: While the GBT is not case sensitive (commands may be typed in upper or lower case), it is sensitive to spaces and underscores. Pay close attention to spaces and underscores since any typographical errors will be ignored and require the operator to re-enter the entire command.

602. CSIO COMMAND TESTING.

a. The following table lists the maintenance commands that can be performed under the Common Standard Input/output (CSIO) command list. A test procedure for each command follows the table.

CSIO Command	Description
HELP	Lists all commands and brief descriptions
IDCPU	Identifies the CPU in use, LDPU or 1090. 1090 isn't currently available.
VERSION	Shows versions of all hardware and software in the system.

b. CSIO HELP – The CSIO Help command will list all commands available within the CSIO module.

(1) Type in the command: "CSIO HELP". Press <ENTER>.

(2) The screen will display the following similar message:

```
Command Parameters Description
--------- ------------ ---------------
Help                   This screen

Idcpu                  Identifies
                       cpu(ldpu or 1090)

Version                Shows system wide
                       version info

Case is not significant.
Maximum command length is 200. The
default input receive user I/F may
be temporarily overridden and
another user I/F may be accessed by
entering the target user I/F's UI
name as a prefix (separated by a
space) to the desired command.
```

CSIO IDCPU.

(1) Type in the command: "CSIO IDCPU". Press <ENTER>

(2) The screen will display the following similar message:

```
LDPU Cpu
```

c. CSIO VERSION – This command lists the version of all software subsets within the GBT.

(1) Type in the command: "CSIO VERSION". Press <ENTER>.

(2) The screen will display the following format. The data may differ from that shown.

```
ADSB  Version Information
138-0452 GBT SOFTWARE  31.20.OO
139-0244 PARALLEL HS PLD 08
139-0253 DIGITAL IO PLD 10
139-0254 SERIAL IO PLD 02
139-0255 ARINC 429 PLD ----
139-0256 ARINC 561 PLD ----
139-0247 UAT SOFTWARE 02.20
139-0249 UAT FPGA 09
139-0250 1090 SOFTWARE ----
139-0245 1090 FPGA ----
139-0246 BUS INTF PAL ----
MAGVAR DATABASE: 04 2000
428-0043 GPS SOFTWARE 2.3
```

603. CCLI COMMAND TESTING.

a. The following table lists the maintenance commands that can be performed under the Common Command Line Interface (CCLI) command list. A test procedure for each command follows the table.

CCLI Command	**Description**
HELP	Lists all commands and brief descriptions
LIST	Lists the available user interfaces (UI) and the UI output status.
DSBLOUT	Disable the output of a specified UI.
ENBLOUT	Enable the output of a specified UI.
DFLTIN	Sets the specified UI to the default UI. CCLI is the usual default UI.
LOGSZ	Sets the size of the log file in bytes
LOG	Lists the log setup data
LOGALL	Turns the log file on and off. This command is not available for 1090

b. CCLI HELP - The CCLI Help command will list all commands available within the CCLI module. Some of these commands do not have a maintenance application and will not be described in the following procedures.

(1) Type in the command: "CCLI HELP". Press <ENTER>.

(2) The screen will display the following similar message:

```
Command  Parameters   Description
Help                  This screen
Lis                   List user
                      interfaces
DsblOut  UIName       Disable a user
                      interface's
                      output
EnblOut  UIName       Enable a user
                      interface's
                      output
DfltIn   UIName       Set the default
                      input receive
                      user I/F
Log      On/Off       Turn logging
                      ccli output to
                      a file on or
                      off
LogDrv   Drive        Drive for log
                      files
LogSz    Size         Set the size of
                      the log file
                      (in bytes)
LogAll   ON/Off       Turns master
                      control of file
                      logging on or
                      off. This
                      command is NOT
                      available for
                      the 1090
```

NOTE: The default input receive user I/F may be temporarily overridden and another user I/F may be accessed by entering the target user I/F's UI name as a prefix (separated by a space) to the desired command.

c. CCLI LIST – This command lists all the User Interfaces (UI) and whether or not they are enabled. The default setting is for all to be enabled.

(1) Type in the command: "CCLI LIST". Press <ENTER>.

(2) The screen will display the following format.

```
  Name       Output   Title

  CIDE       Enabled  IDE routines
  CCLI       Enabled  ccli Task
  CSIO       Enabled  CSIO
  CERR       Enabled  Error
                      Reporting
  EEPROM     Enabled  EEPROM
  DMA        Enabled  dma Task
  LAPM       Enabled  LAPM
  MAINT_LOG  Enabled  Maintenance
                      Log Task
  CONFIG     Enabled  LDPU Config
  PLAYBACK   Enabled  playback
  GBT        Enabled  GBT
  MOTOGPS    Enabled  Motogps Task
  UAT        Enabled  uat Task
```

```
LADIO      Enabled  LADIO Task
```

d. CCLI DISABLE OUTPUT – This command allows a UI output to be disabled. This will not affect the maintenance log function.

(1) To disable a UI output, type the appropriate command. For example, to disable the CSIO UI, type in the command: "CCLI DSBLOUT CSIO". Press <ENTER>.

(2) The screen will display the following similar format:

```
output disabled for user
interface CSIO
```

e. CCLI ENABLE OUTPUT - This command allows a UI output to be enabled.

(1) To enable a UI output, type the appropriate command. For example, to enable the CSIO UI, type in the command: "CCLI ENBLOUT CSIO". Press <ENTER>.

(2) The screen will display the following similar format:

```
output enabled for user
interface CSIO
```

f. CCLI DEFAULT INPUT – This command sets a specified UI to be the default UI at the CCLI. If a command is not started with a UI title, the port will output the response for the default UI.

(1) To enable a UI as the default input, type the appropriate command. For example, to enable the CSIO UI, type in the command: "CCLI DFLTIN CSIO". Press <ENTER>.

(2) The screen will display the following similar message:

```
the default input receive
user interface is now CSIO
(CSIO)
```

g. CCLI LOG SIZE – This command sets the maximum size of the log file within memory.

(1) To set the log size, type in the desired size. For example, to set the log size to 102400 (the default setting), type in the command: "CCLI LOGSZ 102400". Press <ENTER>.

(2) The screen will display the following similar message:

```
Log file size has been set to
102400 bytes.
```

h. CCLI LOG - These commands enable or disable a list of the log setup data and the log function itself.

(1) To turn off the CCLI log data list, type in the command: "CCLI LOG OFF". Press <ENTER>.

(2) The screen will line space, but display no new message.

(3) To view the CCLI log data, type in the command: "CCLI LOG ON". Press <ENTER>.

(4) The screen will display the following similar format:

```
Logging Turned On

Log file size is set to
102400 bytes.

Log file drive is set to:  C:
```

(5) To disable all logging functions, type in the command: "LOGALL OFF". Press <ENTER>.

(6) The screen will display the following similar message:

```
Master Logging Turned Off.
```

(7) To enable all logging functions, type in the command: "CCLI LOGALL ON". Press <ENTER>.

(8) The screen will display the following similar message:

```
Master Logging Turned On.
```

604. CERR COMMAND TESTING.

a. The following table lists the maintenance commands that can be performed under the Common Error Reporting Routine (CERR) command list. A test procedure for each command follows the table.

CERR Command	Description
HELP	List all commands and brief descriptions
MDLLVL	Change the status of the specified module and level. A state indication is included to determine if an error will be reported. The valid parameters are: Level: F (Fatal), S (Severe), M (Mild), or I (Informational) State: T (True, report it), or F (False, do not report it)
MDL	Set the state of the specified module. Used by entering the module name and the desired state for the F, S, M and I levels State: T (True, report it), or F (False, do not report it)
LVL	Change the state of a specified level Level: F (Fatal), S (Severe), M (Mild), or I (Informational)
GLBL	Use to enable all levels to the specified state
DFLT	Use to set the default enable state of each level
TIME	Use to set the real-time clock and 24 hour clock
DATE	Use to set the real-time clock date
GETERR HIST	Retrieve the error history from the FLASH disk. Only errors that caused a crash or reset will be displayed.
CLEAR ERRHIST	Clear the error history from the FLASH disk
CRASH LEVEL	Set the crash (reset) level to S (severe) or F (fatal). An error at the set level or more severe will cause a reset
CRASH	Cause the GBT to reset to the debugger program and restart all major functions
MotoGPS	Display a GPS status summary log

b. CERR HELP - The CERR Help command will list all commands available within the CERR module. Some of these commands do not have a maintenance application and will not be described in the following procedures.

(1) Type the command: "CERR HELP". Press <ENTER>.

(2) The screen will display the following similar message:

```
Command     Parameters    Description
Help                      This screen
MdlLvl      Mdl Lvl St    Change
                          Module/Level
                          enable to
                          State Lvl:
                          F, S, M, or
                          I; St: T or
                          F
Mdl         Mdl FSt SSt   Change
                          Module
                          enables
                          toMSt Ist
                          States
Lvl         Lvl St        Change level
                          enables to
                          State
Glbl        St            Change all
                          enables to
                          State
```

Command	Parameters	Description
Dflt	FSt SSt MSt Ist	Change default enables to States
Time	HH MM SS	Set RTC and VRTX times (24 hr clock)
Date	YY MM DD	Set RTC date
NvRead	Adr	Reads NVRAM from location Adr
NvWrite	Adr Value	Writes NVRAM Adr location with Value
ERG	ReportGroup	Enable report group(s)
Command	Parameters	Description
DRG	ReportGroup	Disable report group(s)
GRG		Get report groups
GetErrHist		Display Error History Config Memory
Clear ErrHist		Clear Error History Config Memory
CrashLevel	Lvl	Reset or Crash to dbgr at this level or more severe (Lvl = 'F' or 'S')
Crash		Crashes to debugger or resets

Case is not significant.
Maximum command length is 200.

Error report format: hh:mm:ss.ss Lvl Id:Pri Mdl:Lin 'msg' ...

c. CERR MODULE LEVEL – Changes the Level and State settings of a specific module in one step. Setting a level determines when a State will report its activity. A True State will report every time it has a change. Informational Level will report every second, all other Levels will report when they occur. A False State will not report to the computer. This does not disable the maintenance log reporting.

(1) To set the module Level and State, type in the appropriate command. For example, to set UAT severe modules to True, type in the command: "CERR MDLLVL UAT S T", then press <ENTER>.

(2) The screen will display the following similar format:

```
changed module: UAT, level: S
to T
```

NOTE: If informational modules are set to True, the screen will step through a format similar to the following approximately once every second.

```
021127 232237 I 113:20 UAT:1377
'Rcvd Msg:' Type = 0 Name =
Heart Beat Message

021127 232237 I 113:20 UAT:1423
'Rcvd HB Msg:' 09 07
```

d. CERR MODULE – This command allows the setting of all states in a particular module.

(1) To set all the states in a particular module, type the appropriate command in the following similar format:

CERR MDL UAT F F F F

Press <ENTER>.

(2) The screen will display the following similar format:

```
changed module: UAT to F:F
S:F M:F I:F
```

NOTE: “F” disables a module so it does not report. “T” enables a module so it does report.

(3) If the module is commanded in the similar format:

```
CERR MDL UAT T T T T
```

(4) The screen will display the following similar format:

```
changed module: UAT to F:T
S:T M:T I:T
```

(5) The screen will step through a format similar to the following approximately once every second.

```
021127 232237 I 113:20 UAT:1377
‘Rcvd Msg:’ Type = 0
                Name = Heart
     Beat Message
021127 232237 I 113:20 UAT:1423
‘Rcvd HB Msg:’ 09 07
```

e. CERR LEVEL – This command will set the Level state of all Levels of the same value.

(1) To set all Level states, type in the appropriate command. For example, to set all Informational levels to True (report) state, type the command: “CERR LVL I T”. Press <ENTER>.

(2) The screen will display the following similar message:

```
changed Level: I to T
```

Approximately once every second the screen will step through a format similar to the following:

```
021127 232237 I 12:190 U_INFOAD:535
‘’ Idle 962

021127 232237 I 110:20 MOTOGPS:1024
‘’ Motogps Year/Month/Day
2002/11/28

021127 232237 I 110:20 MOTOGPS:1029
‘’ Motogps Hour:Min:Sec  6:04:03

021127 232237 I 110:20 MOTOGPS:1142
‘’ Motogps Lat 61 deg 15 min N

021127 232237 I 110:20 MOTOGPS:1146
‘’ Motogps Lon –149 deg –31 min W

021127 232237 I 110:20 MOTOGPS:1235
‘’ Receive raim stat. Alert = 1 HAL
= 3704

021127 232237 I 150:30 MOTOGPS:1508
‘’ HFOM = 10.010000  HAL = 3704

021127 232237 I 12:190
P_ONWSHI:1915 ‘Write to 1090 Err’

021127 232237 I 113:20 UAT:1377
‘Rcvd Msg:’ Type = 0 Name = Heart
Beat Message

021127 232237 I 113:20 UAT:1423
‘Rcvd HB Msg:’ 09 07
```

f. CERR GLOBAL – This command will set the Level States of all CERR modules.

(1) To enable reporting of all Levels of all modules, type the command: “CERR GLBL T “. Press <ENTER>.

(2) The screen will display the following similar message:

```
changed all modules, all levels to T
```

The screen will step through a format similar to the following approximately once every second.

```
021127 232237 I 12:190 U_INFOAD:535
‘’ Idle 962

021127 232237 I 110:20 MOTOGPS:1024
‘’Motogps Year/Month/Day 2002/11/28

021127 232237 I 110:20 MOTOGPS:1029
‘’Motogps Hour:Min:Sec 6:04:03
021127 232237 I 110:20 MOTOGPS:1142
‘’ Motogps Lat 61 deg 15 min N

021127 232237 I 110:20 MOTOGPS:1146
‘’ Motogps Lon –149 deg –31 min W
```

```
021127 232237 I 110:20 MOTOGPS:1235
'' Receive raim stat. Alert = 1 HAL
= 3704

021127 232237 I 150:30 MOTOGPS:1508
'' HFOM = 10.010000 HAL = 3704
021127 232237 I 12:190P_ONWSHI:
1915 'Write to 1090 Err'

021127 232237 I 113:20 UAT:1377
'Rcvd Msg:' Type = 0 Name = Heart
Beat Message

021127 232237 I 113:20 UAT:1423
'Rcvd HB Msg:' 09 07
```

(3) If it is desired to disable reporting all Levels of all modules, type the command: "CERR GLBL F". Press <ENTER>.

(4) The screen will stop stepping and display the following similar message:

```
changed all modules, all levels to F
```

g. CERR DEFAULT – This command will set the default State of all Levels within CERR.

(1) To set all Levels to a default report setting, type in the command: "CERR DFLT T T T T". Press <ENTER>.

(2) The screen will display the following similar message:

```
changed default to F:T, S:T, M:T, I:T
```

(3) To set all Levels to a default no-report setting, type the command: "CERR DFLT F F F F". Press <ENTER>.

(4) The screen will display the following similar message:

```
changed default to F:F, S:F,
M:F, I:F
```

h. CERR TIME – It is not necessary to set the time if the GPS subsystem is operational. However, if during maintenance it is necessary to disconnect the GPS antenna, the internal clock can be set by the following procedure.

(1) To set the time in the GBT, type in the correct time using the following format (HH MM SS):

```
CERR TIME 23 15 00
```

Press <ENTER>.

(2) The screen will display the following similar format:

```
current time 00:00:30
HH:MM:SS)

changed time to 23:15:00
(HH:MM:SS)
```

i. CERR DATE – It is not necessary to set the date if the GPS subsystem is operational. However, if during maintenance it is necessary to disconnect the GPS antenna, the internal date can be set by the following procedure.

(1) Type in the correct date using the following format (YY MM DD):

```
CERR DATE 03 02 22
```

Press <ENTER>.

(2) The screen will display the following similar format:

```
current date: 02/12/11(YY:MM:DD)

changed date to 03/02/22 (YY:MM:DD)
```

j. CERR GET ERROR HISTORY – This command allows the display of the error history contained within the FLASH non-volatile memory.

(1) To download the FLASH memory history, type in the command: "CERR GETERRHIST". Press <ENTER>.

(2) The screen will display a similar format to either of the following:

```
No error history available.

Last Clear History Performed on:
12/12 at: 01:20
```

or a format similar to:

```
The Last Error Occurred on: 03/29

ERROR:      operator induced crash
from ccli

RESETS:     76
LAST CLEAR: 11/00 at 01:40

PREVIOUS ERRORS: DATE   MESSAGE
03/29 101031 613748 P_Ownship
```

k. CERR CLEAR ERROR HISTORY – Clearing the error history will not clear the power failure or Crash command history from the FLASH memory.

(1) To clear the FLASH error history, type in the command: "CERR CLEARERRHIST". Press <ENTER>.

(2) The screen will display the following similar message:

```
Error History Cleared
```

l. CERR CRASH LEVEL – The Crash routine is a software reset that goes back to the debug/boot stage and restarts the GBT. This includes restarting the GPS subsystem and forcing it to reacquire all satellites. The Crash routine can be generated automatically or on demand. To generate an automatic Crash routine, perform the following procedures:

(1) To verify the current Crash level setting without making a change, type in the command:

```
CERR CRASHLEVEL
```

Press <ENTER>.

(2) The screen will display the following similar format:

```
Crash Level = F

Crash Level not changed
```

(3) To set the level at which the system will automatically initiate a Crash routine (system reset), type in the appropriate command. For example, to initiate a reset after any fatal error (recommended), type the command: "CERR CRASHLEVEL F". Press <ENTER>.

(4) The screen will display the following similar format:

```
Crash Level = S

Crash Level changed to F
```

m. CERR CRASH – CRASH is a software system reset command that forces the system to a debug/boot condition, thereby resetting all the GBT operations, including the GPS functions. May be used to clear fault.

(1) To manually initiate a Crash routine, type in the command: "CERR CRASH". Press <ENTER>.

(2) The screen may display some random characters.

(3) After no more than 5 minutes, the screen will display the following similar format:

```
Verifying EEPROM Configuration
Using EEPROM Shadow APM 0

021212 012929 M 104:2 KLOGT:324
'key.log file: cannot open/ create'
```

```
021212 012929 M 104:2 KLOGT:332
'key.log file: write error'

021212 012929 M 15:200 U_IFOOPN:562
'UAT log file open error'

021212 012929 s 18:200 P_UI_OUT:215
'Couldn't open traffic bus A'

021212 012929 s 18:200 P_UI_OUT:237
'Couldn't open traffic bus B'

021212 012929 s 19:200 P_UI_INP:
8887 'Couldn't connect to Control
Panel' (5)audioTask  0

021212 012929 M 11:200 U_CSA:520
'CSARM log file open  error'

021212 012929 s 113:20 UAT:1725
'Event Message" [09][43]

021212 012929 s 113:20 UAT:1725
'Event Message" [09][43]

021212 012929 s 113:20 UAT:1725
'Event Message" [09][43]
```

n. CERR MOTOGPS – This command will display the GPS output data.

(1) To monitor the current GPS data, type the command: "CERR MDL MOTOGPS T T T T". Press <ENTER>.

(2) The screen will display the following similar message:

```
changed module: MOTOGPS to
F:T S:T M:T I:T
```

(3) The screen will immediately approximately once every second start stepping through a similar format to the following:

```
021127 232237 I 110:20 MOTOGPS:1024
'' Motogps Year/Month/Day 2002/11/28

021127 232237 I 110:20 MOTOGPS:1029
'' Motogps Hour:Min:Sec 6:04:03

021127 232237 I 110:20 MOTOGPS:1142
'' Motogps Lat 61 deg 15 min N

021127 232237 I 110:20 MOTOGPS:1146
'' Motogps Lon –149 deg 31 min W

021127 232237 I 110:20 MOTOGPS:1235
'' Receive raim stat. Alert = 1 HAL
= 3704

021127 232237 I 150:30 MOTOGPS:1508
'' HFOM = 10.010000 HAL = 3704
```

605. UAT COMMAND TESTING.

a. The following table lists the maintenance commands that can be performed under the Universal Access Transceiver (UAT) command list. A test procedure for each command follows the table.

UAT Command	Description
HELP	List all commands and brief descriptions
BASE	Place the UAT into the Base Station Mode
RXONLY	Place the UAT in Receive Only Mode.
RXANDTX	Place the UAT in Receive and Transmit Mode. This enables FIS-B and TIS-B if they are otherwise available.
ONEANT	Configure the UAT to use one antenna
TWOANT	Configure the UAT to use two antennas
SLOT	Set the slot for transmitted data. 0 = random 1 – 31 = use the specified slot

b. UAT HELP - The UAT Help command will list all commands available within the CSIO module. Some of these commands do not have a maintenance application and will not be described in the following procedures.

(1) Type in the command: "UAT HELP". Press <ENTER>.

(2) The screen will display the following similar format:

```
Command     Description
-------      -----------
BASE         Put UAT into Base
             Station Mode.
AIR          Put UAT into Airborne
             Mode.
RXONLY       Put UAT in RX only
             mode.
RXANDTX      Put UAT into RX/TX
             mode.
ONEANT       Force UAT to use only
             the TOP antenna.
TWOANT       Force UAT to use both
             antennas.
SLOT xxx     Set the slot offset to
             a fixed number.
             0 -> UAT selects random
             slot.
GBSSIMON     Turns on generation of
             TISB and FISB simulated
             msgs.
GBSSIMOFF    Turns off generation of
             TISB and FISB simulated
             msgs.

CURRENT CONFIGURATION
RX and TX
Antenna Diversity = One Antenna
Base Station mode
SlotOffset = 0
```

c. UAT BASE MODE – This command sets the UAT to base (ground) operations.

(1) To set the UAT operations to Base Mode (recommended), type in the command: "UAT BASE". Press <ENTER>.

(2) The screen will line step, but display no new message. If it is desired to verify the operation was successfully completed, repeat the procedure for UAT Help (605.b) and check the lower section of the display for CURRENT CONFIGURATION.

d. UAT RECEIVE ONLY MODE – This command enables the UAT receiver while disabling the UAT transmitter.

(1) To set the UAT to Receive Only Mode, type the command: "UAT RXONLY". Press <ENTER>.

(2) The screen will line space, but display no new message. If it is desired to verify the operation was successfully completed, repeat the procedure for UAT Help (605.b) and check the lower section of the display for CURRENT CONFIGURATION.

e. UAT RECEIVE and TRANSMIT – This command enables both the UAT receiver and UAT transmitter at once.

(1) To set the UAT to Receive and Transmit Mode, type in the command: "UAT RXANDTX". Press <ENTER>.

(2) The screen will line space, but display no new message. If it is desired to verify the operation was successfully completed, repeat the procedure for UAT Help (605.b) and check the lower section of the display for CURRENT CONFIGURATION.

f. UAT TWO ANTENNA MODE – This command enables two antenna ports for providing additional coverage if one antenna will experience an excessive amount of interference from surrounding obstructions. This mode is normally only used in airborne applications for views above and below the aircraft.

(1) To set the UAT to Two-Antenna Mode (recommended only for special situations), type in the command: "UAT TWOANT". Press <ENTER>.

(2) The screen will line space, but display no new message. If it is desired to verify the operation was successfully completed, repeat the procedure for UAT

Help (605.A) and check the lower section of the display for CURRENT CONFIGURATION.

g. UAT ONE ANTENNA MODE – This command enables one antenna port for all receiving and transmitting operations (recommended).

(1) To set the UAT to One-Antenna Mode (recommended), type in the command: "UAT ONEANT". Press <ENTER>.

(2) The screen will line space, but display no new message. If it is desired to verify the operation was successfully completed, repeat the procedure for UAT Help (605.b) and check the lower section of the display for CURRENT CONFIGURATION.

h. UAT SLOT – This command sets the time slot (1-31) within which the UAT will transmit. Normal operation is to set this command to "0" so that the UAT will transmit within random slots, thus avoiding the possibility of extended interference from, or to, other systems.

(1) To set the time slot the UAT will transmit over, select the appropriate slot command. For example, to set the slot to position 0 (recommended), type in the command: "UAT SLOT 0". Press <ENTER>.

(2) The screen will line space, but display no new message. If it is desired to verify the operation was successfully completed, repeat the procedure for UAT Help (605.b) and check the lower section of the display for CURRENT CONFIGURATION.

606. MAINTENANCE LOG TESTING.

a. The following table lists the maintenance commands that can be performed under the Maintenance Log list. A test procedure for each command follows in the table.

Maint Log Command	Description
HELP	List all commands and brief descriptions
PRINT	Print the entire maintenance log
PRINT TERSE	Print maintenance log entries with a count higher than 0
RESET	Clear the maintenance log

b. MAINTENANCE LOG HELP - The Maint_Log Help command will list all commands available within the maintenance log module.

(1) Type in the command: "MAINT_LOG HELP". Press <ENTER>.

(2) The screen will display the following similar message:

```
PRINT -       Prints entire
              maintenance log to
              CCLI port.

PRINT TERSE - Prints maintenance
              log entries which
              have a count > 0

RESET -       Clears maintenance
              log.

HELP -        Displays this command
              list.
```

c. MAINTENANCE LOG, TERSE – This command will display only those maintenance log entries that have a value greater than "0". These are the only entries that have experienced activity since the last maintenance log reset.

(1) To display the terse form of the maintenance log, type in the command: "MAINT_LOG PRINT TERSE". Press <ENTER>.

(2) The screen will display the following similar format:

```
92 : UAT One PPS Failure
First occurance:2001-03-15|06:38:55
Last occurrence :2001-11-
27|23:24:56
Count :          139162
Task ID :        158
Task Priority :  100
Module name :    GBT
Line number :    1353

2002-11-27|22:23:56
2002-11-27|16:35:35
2002-11-26|18:00:32
2001-07-25|22:32:11
2001-07-12|19:45:36
2001-07-06|19:47:09
2001-06-15|17:50:33
2001-05-11|05:46:12
2001-02-23|08:10:00
2001-02-23|07:01:44
138-0452 GBT SOFTWARE  31.20.00
139-0250 1090 SOFTWARE ----
MAGVAR DATABASE: 04 2000
139-0244 PARALLEL HS PLD 08
139-0253 DIGITAL IO PLD 10
139-0254 SERIAL IO PLD 02
139-0255 ARINC 429 PLD ----
139-0256 ARINC 561 PLD ----
139-0249 UAT FPGA 09
139-0247 UAT SOFTWARE 02.20
139-0245 1090 FPGA ----
139-0246 BUS INTF PAL ----
428-0043 GPS SOFTWARE 2.3
415-6015 MOTHERBOARD 01
415-6014 INTERFACE BOARD 00
LDPU Serial number 0
LDPU ICAO Address  898779
```

d. MAINTENANCE LOG, FULL - The maintenance log monitors 94 parameters and the CSIO data. All parameters are displayed each time the MAINT_LOG PRINT command is used regardless of the count levels for each monitored item. Many of these logged parameters are legacy items from the airborne avionics configuration of the hardware being used, and may not be monitored in the Base Station Mode. The 94 logged parameters are similar to the following:

Item	Description
0	Arinc traffic data A Invalid
1	Arinc traffic data B Invalid
2	Control Panel Fail
3	CDTI Feedback Bus Fail
4	Control Panel to CDTI Bus Fail
5	CDTI Display Fail
6	GPS position fail
7	GPS time mark fail
8	Arinc (#1) pressure alt fail
9	Synchro (#1) pressure alt fail
10	ARINC 429Mag heading fail
11	Synchro mag heading fail
12	MSP (#1) data link fail
13	Transponder (#1) ownship fail
14	Transponder (#1) ownship corrupt
15	1090 top antenna fail
16	1090 bottom antenna fail
17	1090 top antenna sensitivity
18	1090 bottom antenna sensitivity
19	LDPU over temperature
20	UAT transmitter fail
21	UAT top antenna fail
22	UAT bottom antenna fail
23	UAT receiver sensitivity
24	UAT tx power output threshold fail
25	UAT rx loopback fail
26	DIO LDPU Status Out
27	DIO (Corrective) Annunciator Out
28	DIO (Preventive) Annunciator Out
29	DIO (TA) Annunciator Out
30	DIO Advisory 1 Out
31	DIO Advisory 2 Out
32	DIO Time Mark Select Out
33	DIO Internal GPS Avail Out
34	DIO UAT Reset Out
35	DIO Reserved 2 Out
36	DIO APM Clock Out
37	DIO APM Out
38	DIO APM WEN1 Out
39	DIO APM WEN2 Out
40	DIO APM EN1 Out
41	DIO APM EN2 Out
42	LDPU to 1090 datalink fail
43	1090 to LDPU datalink fail
44	UAT ownship fail
45	VDLM4 ownship fail
46	Discrete reference voltage

Item	Description
	fail
47	Lithium Battery over voltage
48	Lithium Battery under voltage
49	Air/Ground state mis-match
50	APM's CRC check on bank1 failed
51	APM's CRC check on bank 2 failed
52	APM bank 1&@ match failed
53	VDLM4 Tx Antenna fail (BITE)
54	VDLM4 Rx Antenna fail (BITE)
55	VDLM4 1PPS fail (BITE)
56	VDLM4 GPS Input fail (BITE)
57	VDLM4 R/T #1 fail (BITE)
58	VDLM4 R/T #2 fail (BITE)
59	VDLM4 R/T #3 fail (BITE)
60	VDLM4 R/T #4 fail (BITE)
61	Arinc (#2) pressure alt fail
62	Synchro (#2) pressure alt fail
63	MSP(#2) data link fail
64	Transponder (#2) ownship fail
65	Transponder (#2) ownship corrupt
66	DIO Altitude Error
67	DIO magheading error
68	DIO Landing Gear Error
69	DIO air_ground error
70	DIO Radio Altimeter Error
71	DIO performance error
72	DIO ADVISEIN1 Error
73	DIO ADVISEIN2 error
74	DIO ADVISEIN3 Error
75	DIO ADVISEIN4 Error
76	DIO Climb1 Error
77	DIO Climb2 Error
78	DIO Climb3 Error
79	DIO Climb4 Error
80	DIO DL2 Enable Error
81	DIO Inc Climb1 Error
82	DIO Inc Climb2 Error
83	DIO Inc Climb3 Error
84	DIO Inc Climb4 Error
85	DIO Transponder Stby A Error
86	DIO Transponder Stby B Error
87	DIO TIS DisableIN Error
88	DIO ADC SelectIN Error
89	Arinc 429 From FMC Fail
90	Arinc 561 Input Fail
91	UAT Heartbeat Failure
92	UAT One PPS Failure
93	Radio Altimeter Failure

(1) To display the full maintenance log, type in the command: "MAINT_LOG PRINT". Press <ENTER>.

(2) The screen will display the following similar format. The Maintenance Log will display all 94 logged functions and CSIO data.

```
0 : Arinc traffic data A invalid
First occurrence : No_Occur
Last occurrence:   No_Occur
Count :           0
Task ID :         0
Task Priority :   0
Module name :     0
Line number :     3145728
                  •
92 : UAT One PPS Failure
First occurrence 93 : Radio
Altimeter Failure

First occurrence : No_Occur
   Last occurrence:   No_Occur
   Count :           0
   Task ID :         0
   Task Priority :   0
   Module name :     0
   Line number :     1353
2002-12-12|01:58:52
2002-12-12|01:29:29
2002-12-12|00:04:28
2002-12-10|20:15:55
2002-09-17|22:26:56
2002-09-17|16:15:44
2002-09-16|16:38:28
2002-09-13|23:31:21
2002-09-13|16:20:01
2002-09-12|16:25:38
138-0452 GBT SOFTWARE  31.20.00
139-0250 1090 SOFTWARE ----
MAGVAR DAABASE: 04 2000
139-1244 PARALLEL HS PLD 08
139-0253 DIGITAL IO PLD 10
139-0254 SERIAL IO PLD 02
139-0255 ARINC 429 PLD ----
139-0256 ARINC 561 PLD ----
139-0249 UAT FPGA 09
139-0247 UAT SOFTWARE 02.20
139-0245 1090 FPGA ----
139-0246 BUS INTF PAL ----
428-0043 GPS SOFTWARE 2.3
415-6015 MOTHERBOARD 01
415-6014 INTERFACE BOARD 00
LDPU Serial Number 6022988
LDPU ICAO Address  898779
```

e. MAINTENANCE LOG RESET – This command will reset the maintenance log count levels for each monitored parameter to "0". It will not change the monitored parameters.

(1) Type in the command: "MAINT_LOG RESET". Press <ENTER>.

(2) The screen will line step, but display no new message.

607. MOTOGPS TESTING.

a. The following table lists the maintenance commands that can be performed under the MotoGPS command list. A test procedure for each command follows the table.

MOTOGPS Commands	Description
HELP	List all commands and brief descriptions
STATUS ON	Print the GPS status log
STATUS OFF	Terminate printing of the GPS status log

b. MOTOGPS HELP - The MotoGPS Help command will list all commands available within the MotoGPS module.

(1) Type in the command: "MOTOGPS HELP". Press <ENTER>.

(2) The screen will display the following similar message:

```
Command  Parameters  Description
-------- ----------  -----------
HELP                 This screen
STATUS   ON/OFF      Turns Satellite
                     Display On or
                     Off
```

c. MOTOGPS STATUS ON/OFF – This command will enable or disable screen-printing of the Motorola GPS (MotoGPS) engine data log. This log provides data on each tracked satellite as well as GPS health, position, and time data.

(1) To monitor the current condition and all eight channels of the GPS receiver, type in the command: "MOTOGPS STATUS ON". Press <ENTER>.

(2) The screen will step through GPS status reports approximately every second. A typical status report format will look similar to this:

```
    11/14/2002 23:01:02
    Visible Sats: 11
    Tracked Sats: 8 Fix: 00100000
ID  Mode SNR Status    Elev Azimuth
19  SRCH 057 10100000  24   109
27  SRCH 180 10100000  50   098
26  SRCH 162 10100000  20   320
13  SRCH 171 10100000  15   154
10  SRCH 089 10100000  29   257
08  SRCH 044 10100000  79   041
07  SRCH 079 10100000  12   190
02  SRCH 092 10100000  55   249
Motogps Lat 44 deg 54 min N
Motogps Lon 122 deg 59 min W
HFOM = 0.090000  HAL = 371
```

(3) To stop the display scrolling, type in the command: "MOTOGPS STATUS OFF". Press <ENTER>.

(4) The data will stop scrolling, with several seconds of data remaining visible for viewing.

608. COMMAND IDE (CIDE) TESTING.

a. The following table lists the maintenance commands that can be performed under the Command Integrated Drive Electronics (CIDE) command list. A test procedure for each command follows the table.

CIDE Commands	Description
HELP	Lists all commands and brief descriptions
DIR	List drive directories

b. CIDE HELP - The CIDE Help command will list all commands available within the CIDE module. Some of these commands do not have a maintenance application and will not be described in the following procedures.

(1) Type in the command: "CIDE HELP". Press <ENTER>.

(2) The screen will display the following similar message:

```
Command Parameters  Description
-------  ----------  -----------
Help                This screen
Mount    drive      Mounts the
                    specified drive
Unmount  drive      Unmounts the
                    specified drive
Dir      dir        List directory
                    of drive
Mkdir    dir        Make a
                    directory
Rmdir    dir        Remove a
                    directory
Chdir    dir        change
                    Directories
```

c. CIDE DIRECTORY LIST – This command will list all the directories within the selected drive. All Apollo2000 GBT systems use drive C.

(1) To view the current directory list, type in the command: "CIDE DIR C:". Press <ENTER>.

(2) The screen will display the following similar format:

```
Directory of c:\
CONFIGLDPU.ABS
PRODTEST.ABS
HARDSECT.BIN
HARDBOOT.BIN
LCHKDATA.DAT
PCHKDATA.DAT
PARTSECT.SAV
LOGFILES
FATALERR.HST
SYNCHRO.LOG
CCLI.LOG
```

609. CONFIGURATION CONTROL TESTING.

a. The following table lists the maintenance commands that can be performed under the Configuration Control command list. A test procedure for each command follows the table.

Config Commands	Description
HELP	Lists all commands and brief descriptions
LINK PRESENT	List present data links

b. CONFIGURATION HELP - The Config Help command will list all maintenance commands available within the configuration module.

(1) Type in the command: "CONFIG HELP". Press <ENTER>.

(2) The screen will display the following similar message:

```
Config Help Command
Usage:       Help
```

```
Description: Displays this text.

Datalink Present Command

Usage:       config LinkPresent
             [<1090|UAT|VDLM4>
             <T|F>]

Description: If this command is
   invoked with no  parameters
   it will output which
   datalinks are present or
   not. If it is invoked with
   a datalink name and a 'T'
   or 'F' as parameters, then
   the LDPU will consider that
   datalink to be present or
   absent, respectively.
NOTE THAT THE LDPU MUST BE RESET
BEFORE THESE CHANGES WILL TAKE
EFFECT.

Case is not significant.
Maximum command length is 200.
```

c. CONFIGURATION LINKS PRESENT – This command will display all configuration formats currently linked to the GBT. The Apollo 2000 GBT only utilizes the UAT configuration at this time.

(1) To view the current configuration link format, type in the command: "CONFIG LINKPRESENT". Press <ENTER>.

(2) The only configuration currently supported is UAT. The screen will display the following similar format:

```
1090 datalink is absent
UAT datalink is present
VDLM4 datalink is absent
```

610. GBT SETUP TESTING.

a. The following table lists the maintenance commands that can be performed under the Ground Based Transceiver (GBT) command list. A test procedure for each command follows the table.

GBT Commands	Description
HELP	Lists all commands and brief descriptions
SIC	Sets the Source Identity Code
SAC	Sets the Source Area Code
ADDFIS	Adds slots for FIS data transmission
DELFIS	Deletes slots for FIS data transmission
ADDTIS	Adds slots for TIS data transmission
DELTIS	Deletes slots for TIS data transmission
BEACON	Turns Beacon Mode ON and OFF
POSITION	Selects Beacon position to be GPS input or a fixed value
LAT	Sets the latitude coordinate for the fixed position
LON	Sets the longitude coordinate for the fixed position
ALT	Sets the altitude coordinate for the fixed position
RATE	Sets the rate, in seconds, the Beacon mode will transmit
ICAO	Sets the ICAO code for the GBT
ID	Sets the ID code for the GBT

b. GBT HELP - The GBT Help command will list all commands available within the GBT module. Some of these commands do not have a maintenance application and will not be described in the following procedures

(1) Type in the command: "GBT HELP". Press <ENTER>

(2) The screen will display the following similar format:

```
Command Parameters Description
------- ---------- -----------
SIC     value      Sets the Source
                   Identity Code to
                   <value>
SAC     value      Sets the Source
                   Area Code to
                   <value>
TISB    Timeout    How many seconds
                   is TIS-B   data
                   treated as valid
```

```
AddFIS  slot_num    Adds <slot_num>
                    to list of slots
                    for FIS-B

DelFIS  slot_num    Deletes lot_num>
                    from list of
                    slots for FIS-B

AddTIS    slot_num  Adds <slot_num>
                    to list of slots
                    for TIS-B

DelTIS    slot_num  Deletes
                    <slot_num> from
                    list of slots
                    for TIS-B

TISBSrvRng range    TIS-B Service
                    Range

BEACON    OFF/ON    Toggle Beacon
                    Mode

POSITION  GPS/FIXED Should Beacon
                    send GPS or
                    Fixed position

ICAO      address   Octal Address
                    (Valid Range
                    3000000-3377777)

ID        name      7 Character name
                    of GBT

LAT    DD MM.MM N/S Latitude of
                    Beacon

LON    DD MM.MM N/S Longitude of
                    Beacon

ALT       altitude  Altitude of
                    Beacon in feet

RATE      seconds   Send Beacon
                    target once
                    every X seconds
```

```
Source Identity Code:  0
Source Area Code:  188
TIS-B Timeout:  5
FIS-B Slot Allocation:  2
TIS-B Slot Allocation:  34
FISBSlotCount:  1
TISBSlotCount:  1
TIS-B Service Range:  1
Beacon Mode:  ON
Position Source:  GPS
ICAO Address:  3333333
ID:  CAPSTON
Latitude:  90°0′0.0″ N
Longitude:  180°0′0.0″ W
Altitude:  80000
```
Target Rate: 1 sec

c. GBT SIC (Source Identity Code) – This command allows changing the SIC as required for system installation.

(1) To set the SIC value, type the command in the following format: "GBT SIC 0". Press <ENTER>.

(2) The screen will display the following similar format:

```
New SIC:  0
```

d. GBT SAC (Source Area Code) – This command allows changing the SAC as required for system installation.

(1) To set the SAC value, type the command in the following format: "GBT SAC 197". Press <ENTER>.

(2) The screen will display the following similar format:

```
New SAC:  197
```

e. GBT ADD FIS SLOT – This command allows adding time slots for transmission of FIS-B data. Normally only one time slot will be assigned, but more can be assigned if required.

(1) To set a FIS-B time slot, type the command in the following format: "GBT ADDFIS 5". Press <ENTER>.

(2) The screen will display the following similar format:

```
New FIS-B Slot Allocation:  2 5
```

f. GBT DELETE FIS SLOT - This command allows deleting of FIS-B time slots if required.

(1) To delete a FIS-B time slot, type the command in the following similar format: "GBT DELFIS 5". Press <ENTER>.

(2) The screen will display the following similar format:

```
New FIS-B Slot Allocation:  2
```

g. GBT ADD TIS SLOT - This command allows adding time slots for transmission of TIS-B data. Normally only one time slot will be assigned, but more can be assigned if required.

(1) To set a TIS-B time slot, type the command in the following format: "GBT ADDTIS 33". Press <ENTER>.

(2) The screen will display the following similar format:

```
New TIS-B Slot Allocation:  33 34
```

h. GBT DELETE TIS SLOT – This command allows deleting of TIS-B time slots if required.

(1) To delete a TIS-B time slot, type the command in the following format: "GBT DELTIS 33". Press <ENTER>.

(2) The screen will display the following similar format:

```
New TIS-B Slot Allocation:  34
```

i. GBT BEACON MODE – This command allows the Beacon Mode to be turned on or off.

(1) To turn the Beacon Mode off, type in the command: "GBT BEACON OFF". Press <ENTER>.

(2) The following screen will display the following similar message:

```
Beacon Mode:  OFF
```

(3) Type in the command: "GBT BEACON ON". Press <ENTER>

(4) The screen will display the following similar message:

```
Beacon Mode:  ON
```

j. GBT POSITION MODE – This command allows the position to be read from either a fixed programmable reference or from the GPS reference.

(1) To select a fixed programmable position reference, type in the command: "GBT POSITION FIXED". Press <ENTER>.

(2) The screen will display the following similar message:

```
Position Source: FIXED
```

(3) To select the GPS subsystem to provide the position reference, type in the command: "GBT Position GPS". Press <ENTER>.

(4) The screen will display the following similar message:

```
Position Source: GPS
```

k. GBT LATITUDE SETTING – When the POSITION FIXED mode is used, this command allows the latitude to be programmed into the GBT. The FIXED position will be transmitted through the Beacon mode, but will not be included in the STATUS message to the MEART. The STATUS message will always get its position data from the GPS.

(1) Type in the appropriate latitude using the format: "GBT LAT 61º 15.30 N". Press <ENTER>.

(2) The screen will display the following similar format:

New Latitude: 61°15'18.0" N

l. GBT LONGITUDE SETTING - When the POSITION FIXED mode is used, this command allows the longitude to be programmed into the GBT. The FIXED position will be transmitted through the Beacon mode, but will not be included in the STATUS message to the MEART. The STATUS message will always get its position data from the GPS.

(1) Type in the appropriate longitude using the format: "GBT LON 149º 31.50 W". Press <ENTER>.

(2) The screen will display the following similar format:

```
New Longitude:  149°31'30.0" W
```

m. GBT ALTITUDE SETTING – The altitude of the GBT can be programmed into the GBT using this command. If the GBT is to be used with Beacon ON, this should be a test altitude rather than the actual altitude. The test altitude most commonly used is 80,000 feet to ensure no interference with actual aircraft.

(1) Type in the desired altitude using the format: "GBT ALT 80000". Press <ENTER>.

(2) The screen will display the following similar message:

```
New Altitude:  80000
```

n. GBT REPORT RATE – This command allows the rate of the Beacon mode to be set. The recommended rate is every 5 seconds.

(1) Type in the command: "GBT RATE 5". Press <ENTER>.

(2) The screen will display the following similar message:

```
Target Rate: 5 sec
```

o. GBT ICAO – This command allows the assigned ICAO address for the GBT to be programmed into the GBT.

(1) Type in the appropriate ICAO address using the format: "GBT ICAO 3377777". Press <ENTER>.

(2) The screen will display the following similar format. The first line only may be displayed:

```
ICAO Address: 3377777
Header checksum Passed 69
Total bytes 200 ApmCrc f400
```

p. GBT ID – This command allows the GBT location ID to be programmed into the GBT. The ID field can be from one to seven characters.

(1) Type in the location ID using the format: "GBT ID UNKA". Press <ENTER>.

(2) The screen will display the following similar format. The first line only may be displayed:

```
GBT ID:  UNKA
Header checksum Passed 69
Total bytes 200 ApmCrc f400
E2CRC b500
```

611. CLOSING THE ROUTER CONNECTIVITY.

a. The router must be closed to terminate the session with the remote GBT.

b. If a dedicated terminal is used, follow the procedures for the dedicated terminal. If a dedicated terminal was not use, perform the following steps at the RMM PC:

(1) Type in the command: "<CTRL SHIFT>6".
Type in the command: "X".

(2) The screen will display the following similar format:

```
ZAN>
```

(3) Type in the command: "DISCONNECT 1". Press <ENTER>.

(4) The screen will display the following similar format:

```
Closing connection UNKA (confirm)
```

Press <ENTER>.

(5) The screen will display the following similar format:

```
ZAN>
```

(6) Type in the command: "SHOW SESSIONS". Press <ENTER>.

(7) The screen will display the following similar format:

```
No connection open
```

(8) Type in the command: "EXIT". Press <ENTER>.

(9) The screen will display the following similar format:

```
ZAN Con0 is now available

Press RETURN to get started
```

(10) Terminate HyperTerminal operations and return all systems to normal operational conditions. This includes enabling FIS-B, if required.

612 thru 699 RESERVED

Chapter 7 - FLIGHT INSPECTIONS

700. GENERAL.

a. Flight checks are made to verify the overall performance of a communication facility. Current guidance is contained in Order 8200.1, *United States Standard Flight Inspection Manual.* To summarize key relevant portions of the order, communications checks can be performed using computer analysis and targets of opportunity. Radar checks should be performed the same way to the maximum extent practical unless flight inspection is required by the manual or engineering. Flight inspections must be well defined to check specific AT requirements using calibrated equipment. For specific Alaska Regional requirements, refer to the *Capstone Decision Paper #28, Flight Inspections.*

b. The expense of a special trip or priority flight inspection is not warranted in most situations provided sufficient and timely targets of opportunity are available from which to obtain adequate data. The following activities may warrant a confirming flight inspection if sufficient targets of opportunity are not available:

(1) Major changes in local obstructions or buildings that may affect signal strength or coverage.

(2) Replacement, relocation, or reorientation of antennas.

c. Electronic technicians may accomplish the following without recourse to renewed computer analysis or flight inspection:

(1) Replace or repair any or all sub-assemblies of the GBT.

(2) Perform any of the maintenance procedures contained in this manual.

(3) Perform any of the measurement procedures contained in this manual.

(4) Accomplish other maintenance procedures, provided the conditions are restored to those that existed at the time of the last computer analysis or flight inspection.

d. Until national guidance is provided, regional guidance will address the procedures for GBT site performance analysis, including requirements for flight check inspections.

701 thru 799 RESERVED

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Appendix 1 CERTIFICATION REQUIREMENTS

CERTIFICATION REQUIREMENTS.

a. This appendix conveys the requirements applicable to the certification of the following:

(1) Ground Based Transceiver (GBT) equipment.

(2) Automated services to the users.

(3) Associated certification parameters.

(4) References to governing standards and tolerances.

(5) Normal and maximum certification intervals.

(6) Recommended type of personnel responsible for certification.

(7) Prescribed certification statements for the maintenance log or the maintenance management system.

b. The user is urged to reference Order 6000.15 for general guidance on the certification of systems, subsystems, and equipment, including special aspects such as partial or exception certification.

2. EXCEPTIONS.

Order 6000.15 permits certification with exceptions where a system provides somewhat less than it's full functional benefit but is still useable. Outstanding exceptions may be certified in accordance with the following table. Additional guidance is given for the specific purpose of removing the exceptions.

(1) If a lower than certifiable UAT transmitter output power specification is present in either of the two co-located GBTs, the GBT site may still be certified with an exception to low UAT Tx power output (GBT [xxx]), so long as the parrot signal can still be detected. This will allow the site to remain in service until a future corrective maintenance of the GBT can be scheduled.

(2) If one GBT at a site fails to meet certification parameters for other reasons, the GBT site may be certified with the exception that one GBT [xxx] is unavailable. This will allow the site to remain in service under a reduced service status until future corrective maintenance can be scheduled and performed.

(3) Upon returning the *Exception* GBT to a certified state of service, the exception shall be removed by performing a normal, W*ithout Exception,* GBT certification.

GBT Equipment Certification Table

Service	Certification Parameter	Reference Paragraph Standards and Tolerance/Limits
Coverage	GBT Configuration	312
	UAT Configuration	313
	UAT TX power output	310 a.
	GBT TX Frequency	310 b.
	UAT RX sensitivity	311
	UAT Antenna	310 e., (1) and (2)
	GPS Antenna	315
	GPS Signal Quality	314
	Data Flow/Transmission to ARTCC	317
NORMAL CERTIFICATION INTERVAL: Semi-annual		
MAXIMUM CERTIFICATION INTERVAL: 245 days		
ALLOWABLE EXCEPTIONS: Low UAT TX power output, single GBT unavailable.		
PERSONS RESPONSIBLE FOR CERTIFICATION: Authorized ATSS.		
CERTIFICATION ENTRY IN GBT FACILITY MAINTENANCE LOG OR MMS: *Without Exception:* GBT Certified. *With Exception:* Low UAT TX Power Output GBT [xxx]. or, GBT [xxx] unavailable. *Removing Exception:* GBT Certified.		

Appendix 2 ACRONYMS

This appendix provides a glossary of the acronyms, abbreviations, and units referred to in this FAA Order.

AC	Alternating Current
ADS-B	Automated Dependent Surveillance - Broadcast
AF	Airway Facilities
AFAAR	Airway Facilities Aircraft Accident Representative
Alt	Altitude
ANICS	Alaska NAS Interfaculty Communications System
ANT	Antenna
AOS	FAA Operational Support
ARINC	Aeronautical Radio Inc.
ARTCC	Air Route Traffic Control Center
ATO	Air Traffic Operations
AUA	Office of Air Traffic Systems Development
BITE	Built In Test Equipment
BW	Bandwidth
CCCS	Capstone Communications and Control System
CERR	Common Error Reporting Routine
CCLI	Common Command Line Interface
CIDE	Command Integrated Drive Electronics
CGW	Communications Gateway
CPO	Capstone Program Office
CRC	Cyclical Redundancy Check
CSIO	Common Standard Input / Output
dB	Decibel
Dbgr	Debugger
dBm	Decibel, milliwatt reference
DC	Direct Current
Deg	Degree(s)
Dflt	Default
DIO	Data Input / Output
div	Division
DVM	Digital Volt Meter
EEPROM	Electrically Erasable Programmable Read Only Memory
Elev	Elevation
ESTDD	En-Route Surveillance Target Dependent Display
FAA	Federal Aviation Administration
FAB	Fixed ADS-B Beacon
FIS	Flight Information Services
FIS-B	Flight Information Service - Broadcast
FN	Function
FOM	Figure Of Merit
FPGA	Field Programmable Gate Array
FRDF	Facility Reference Data File
FSt	Fatal State
GBT	Ground Based Transceiver
GLBL	Global
GPS	Global Positioning System
HAL	Horizontal Alarm Limit
HB	Hard Boot
HFOM	Horizontal Figure of Merit
HS	High Speed
Hz	Hertz
ICAO	International Civil Aviation Organization
ID	Identification
IFR	Instrument Flight Rules
INTF	Interface
IO, I/O	Input / Output
IPT	Integrated Product Team
ISt	Informational State
kHz	Kilohertz
Lat	Latitude
Lat/Lon	Latitude / Longitude
LDPU	Link and Display Processor Unit

LDRCL	Low Density Radio Communications Link
LED	Light Emitting Diode
Lon	Longitude
Mag	Magnetic
Magvar	Magnetic variation
Mdl	Module
MEARTS	Micro En-Route Automated Radar Tracking System
MHz	Megahertz
Min	Minute(s)
MMS	Maintenance Management System
MotoGPS	Motorola GPS
MSR	Message Success Rate
µS	Microsecond
MSt	Mild State
mV	Millivolt
NAS	National Airspace System
NCP	National Change Proposal
NUC	Navigational UnCertainty
PAL	Programmable Array Logic
Para.	Paragraph
PLD	Programmable Logic Device
PPS	Pulse(s) Per Second
RF	Radio Frequency
Rx	Receive
RMM	Remote Maintenance Monitoring
SAC	Source Area Code
Sat(s)	Satellite(s)
SIC	Source Identity Code
SIP	Site Implementation Plan
SMO	System Management Office
SNR	Signal to Noise Ratio
SRCH	Search
SST	
St	State
SYS	System
TCP/IP	Transmission Control Protocol/Internet Protocol
TIS	Traffic Information Service
TIS-B	Traffic Information Service - Broadcast
Tx	Transmit
UAT	Universal Access Transceiver
UPS	Uninterruptible Power Supply
UPSAT	UPS Aviation Technologies
Vdc	Volts direct current
VDLM4	VHF Data Link Mode 4
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

Appendix 3 DOCUMENTS AND FORMS

FAA Documents

FAA Order 1370.82	Information Systems Security Program
FAA Order 1800.66	Configuration Management in the National Airspace System
FAA Order 4630.2	Standard Allowance of Supplies and Working Equipment for National Airspace System Facilities
FAA Order 6000.15	General Maintenance Handbook for Airway Facilities
FAA Order 6032.1	National Airspace System Modification Program
FAA Order 6040.6	Airway Facilities Technical Inspection Program
FAA Order 6200.4	Test Equipment Management Handbook
FAA Order 8020.11	Aircraft Accident and Incident Notification, Investigation, and Reporting
FAA Order 8200.1	United States Standard Flight Inspection Manual
FAA Notice AL 6368.5	Interim Standards and Tolerances for Ground-Based Transceivers (GBT)
FAA-STD-020b	Transient Protection, Grounding, Bonding and Shielding Requirements for Electronic Equipment
NAS-MD-001	National Airspace System Configuration Index
AUA-650 Memo	Dated June 12, 2000, Capstone ADS-B Accuracy
AAL SIP	Site Implementation Plan for Commissioning Ground Based Transceivers Into the Operational MEARTS
Capstone Decision Paper	Capstone Decision Paper #28, Flight Inspections July 30, 2002

Commercial Documents

Battery Engineering Materials Safety Data Sheet, Lithium Thionyl Chloride Cell

Ground-Based Transceiver (GBT) Installation Manual UPS Aviation Technologies

Ground Broadcast Transceiver (GBT) Test Set Operation Manual, UPS Aviation Technologies

FAA FORMS

NCP Change Form Worksheet	FAA Form 1800-2 Case File/NCP Worksheet
NCP Change Form	FAA Form 1800-2
Technical Performance Record	FAA Form 6000-8 for GBT
Technical Performance Record	FAA Form 6000-8 for GBT/ARTCC Data Flow

Case File Number	NCP Number	Page 1 of

EFFECTS ON PRODUCT CONFIGURATION DOCUMENTATION, LOGISTICS AND OPERATIONS

Applicable		Element	Case File/NCP Costs (Savings)				
YES	NO			Recurring			
		1. Effect on product configuration documentation	Non-recurring	Unit	Quantity	Total (recurring)	Total
☐	☐	a. Performance					
☐	☐	b. Technical data/drawings					
☐	☐	c. Nomenclature change					
		2. Effect on NAS Integrated Logistics Support (NAILS)					
☐	☐	a. NAILS plans					
☐	☐	b. Maintenance concept, plans & procedures					
☐	☐	c. Logistics support analyses					
☐	☐	d. Interim support programs					
☐	☐	e. Spares and repair parts					
☐	☐	f. Tech manuals/programming Media					
☐	☐	g. Facilities					
☐	☐	h. Support equipment					
☐	☐	i. Operator training					
☐	☐	j. Operator training equipment					
☐	☐	k. Maintenance training					
☐	☐	l. Maintenance training equipment					
☐	☐	m. Contractor maintenance					
		3. Effect on operational Deployment					
☐	☐	a. Safety					
☐	☐	b. Reliability					
☐	☐	c. Maintainability					
☐	☐	d. Service life					
☐	☐	e. Operating procedures					
☐	☐	f. Electromagnetic interference					
☐	☐	g. Implementation schedule					
☐	☐	h. Critical single point failure items					
		4. Other considerations					
☐	☐	a. Interface					
☐	☐	b. Other affected equipment					
☐	☐	c. Physical constraints					
☐	☐	d. Computer programs and resources					
☐	☐	e. Rework of other equipment					

Appendix 3-1 FAA Form 1800-2 Worksheet, Case File / NCP Worksheet

Case File Number			NCP Number				Page 2 of
EFFECTS ON PRODUCT CONFIGURATION DOCUMENTATION, LOGISTICS AND OPERATIONS							
Applicable			Case File/NCP Costs (Savings)				
YES	NO	Factor		Recurring			
		4. Other considerations (Continued from previous page)	Non-recurring	Unit	Quantity	Total (recurring)	Total
☐	☐	f. Testing Impacts					
☐	☐	g. Parts control					
☐	☐	h. Life cycle costs					
☐	☐	i. Remote Maintenance Monitoring System (RMMS)					
		5. Miscellaneous (as required)					
☐	☐	a.					
☐	☐	b.					
☐	☐	c.					
☐	☐	d.					
☐	☐	e.					

6. Comment Field for Blocks 1 through 5, Include Basis for Cost Estimates

7. Alternate solutions

8. Developmental status

9. Recommendations for retrofit

Submitted by: _____ Organization: _____ Date: _____

CASE FILE/NAS CHANGE PROPOSAL (PLEASE TYPE OR PRINT (NEATLY)

Page 1 of

1. Case File Number	2. FOR CM USE: Case File Received Date	NCP Issuance Date	NCP Number

3. Scope of Change	4. Reason For Change		
☐ Local ☐ National	☐ Safety	☐ Technical Update	☐ System Interface
☐ Test	☐ Requirements Change	☐ Design Error	☐ Parts Unavailability
	☐ Baseline	☐ Other	

5. Priority	6. Justification of Time Critical/Urgent Priority	7. Supplemental Change Form
☐ Normal		☐ ECR/ECP ☐ TES ☐ N/A
☐ Time-Critical		
☐ Urgent		7a. Supplemental Change No:
		7b. Supplemental Change Initiation Date:

8. Case File Originator	9. Originator's Organization	10. Telephone Number	11. Case File Initiation Date

12. Type of Document Affected	13. Baseline Document Number(s)
☐ CPFS ☐ SPEC ☐ MTBK ☐ ☐ TI ☐ DWG ☐ IRD/ICD	

14. CI Subsystem Designator	15. FA Type	16. CI Component Designator

17. Family Identifier (FACID)	18. Family Code (FACCODE)	19. Cost Center Code	20. System Software Version

21. Title

22. Description: (a) Identification of problem, (b) proposed change, (c) interface impact, (d) cost estimate (e) funding source (f) benefits/risks, (g) Schedule (h) Other (e.g. logistics, quality, etc.)

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

Blocks 1 through 22 are to be completed by originator and/or the NCP coordinator. If a block is not applicable, write n/a. Attach additional sheets if necessary. See current revision of NAS-MD-001 for detailed completion instructions.

Appendix 3-2 FAA Form 1800-2, NCP Change Form

Case File Number - -	NCP	Page 2 of

23. Name and Title of Originator's Immediate Supervisor (Type/Print Clearly)	Signature	Date

24. Facility/SMO Review (AT/AF)

Name	Routing Symbol	Date	Concur	Non-Concur
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐

25. Regional Review

Name	Routing Symbol	Date	Concur	Non-Concur
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐

☐ Recommend Approval ☐ Disapprove

Routing Symbol	Signature	Routing Symbol	Signature
Date		Date	
Routing Symbol	Signature	Routing Symbol	Signature
Date		Date	

24a. Comments

Routing Symbol	Signature/configuration Mgr/NCP Coordinator/Reg Exec Sec
Date	

25a. Comments

(Attach additional sheets if necessary)

26. PRESCREENING

Prescreening Office

Prescreening Comments

(Attach additional sheets if necessary)

Reviewers	Routing Symbol	Date	Concur	Non-Concur

☐ Recommend Approval ☐ Recommend Disapproval
☐ New Requirement

(Return original to originating Office through the Regional NCP Coordinator)

Recommended Must Evaluators	Routing Symbol	Signature
	Date	

27. For Internal Configuration Management Use Only

TECHNICAL PERFORMANCE RECORD										CONTINUATION OR TEMPORARY RECORD/REPORT FORM										
FACILITY			GBT (ATCT, FSS, ARTCC, VOR, LOC, ECT.)				DATES			FROM			TO			SUPERVISOR'S SIGNITURE			
LOCATION			(City, Sate, Airport, Other)				EQUIPMENT			(A/G, DF, Components, Etc.)				FREQ.						REMARKS
DATE	TIME	28 Volt Power	UAT Tx Power (Pf)	UAT Tx Frequency	LED GPS	LED Fail	LED Tx	LED Rx	TX Transmitted Data	UAT Ant. Reverse Power (Pr)	UAT Antenna VSWR	UAT Antenna Impedance	UAT Rx Sensitivity	GPS Rx Signal Quality	GPS Antenna	GBT Configuration	UAT Confiuration	Data Flow Confirmation to ARTCC		
Standards →		28 VDC	+47 dBm	981 MHz	Steady Green	Off	Flashing Green	Flashing Green	Para 506	Para 507	<1.5:1	≤ 10 ohms	-94 dBm	Para 509	Para 510	Para 312	Para 313	Para 317		

Appendix 3-3 FAA Form 6000-8 for GBT

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TECHNICAL PERFORMANCE RECORD										CONTINUATION OR TEMPORARY RECORD/REPORT FORM										
FACILITY			GBT (ATCT, FSS, ARTCC, VOR, LOC, ECT.)				DATES			FROM			TO			SUPERVISOR'S SIGNITURE				
LOCATION			(City, Sate, Airport, Other)				EQUIPMENT			(A/G, DF, Components, Etc.)				FREQ.						
DATE	TIME	UTC Date and Time	UTC Date and Time of Last Counter Reset	SOURCE	RX	TX	SR	PP	STAT	SURV	CRC	INVMS	INVSS	SERER	FIXPE					REMARKS
Standards →		mm/dd/yyyy hh:mm:ss	mm/dd/yyyy hh:mm:ss	GBT ID xxx	0	0	0	0	20	Varied	0	0	0	0	120					

Appendix 3-4 FAA Form 6000-8 for GBT/ARTCC Data Flow Confirmation

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Appendix 4 TEST EQUIPMENT & SPECIAL TOOLS

TEST EQUIPMENT, SPECIAL TOOLS, AND STANDARD ALLOWANCE SUPPLY SUPPORT

Attenuator, In-Line	60 dB, or equivalent
Digital Multi Meter	Fluke 73, or equivalent
GBT Test Set	UPS Aviation Technologies GBT Tester
To include:	Patch cable set, power supply, and calibration charts
Laptop Computer	Pentium and WIN95, or equivalent/higher
To include:	Serial cable for COM 1 port and HyperTerminal Software
Oscilloscope	HP-54615B, or equivalent
Spectrum Analyzer	HP8563A or equivalent

VSWR	RETURN LOSS	REFLECTION COEFFICIENT	POWER RATIO	PERCENT REFLECTED
1.01	46.1 dB	0.0050	0.00002	0.002%
1.02	40.1 dB	0.0099	0.00010	0.010%
1.04	34.2 dB	0.0196	0.00038	0.038%
1.06	30.7 dB	0.0291	0.00085	0.085%
1.08	28.3 dB	0.0385	0.00148	0.148%
1.10	26.4 dB	0.0476	0.00227	0.227%
1.20	20.8 dB	0.0909	0.00826	0.826%
1.30	17.7 dB	0.1304	0.01701	1.7%
1.40	15.6 dB	0.1667	0.02778	2.8%
1.50	14.0 dB	0.2000	0.04000	4.0%
1.60	12.7 dB	0.2308	0.05325	5.3%
1.70	11.7 dB	0.2593	0.06722	6.7%
1.80	10.9 dB	0.2857	0.08163	8.2%
1.90	10.2 dB	0.3103	0.09631	9.6%
2.00	9.5 dB	0.3333	0.11111	11.1%
2.20	8.5 dB	0.3750	0.14063	14.1%
2.40	7.7 dB	0.4118	0.16955	17.0%
2.60	7.0 dB	0.4444	0.19753	19.8%
2.80	6.5 dB	0.4737	0.22438	22.4%
3.00	6.0 dB	0.5000	0.25000	25.0%
3.50	5.1 dB	0.5556	0.30864	30.9%
4.00	4.4 dB	0.6000	0.36000	36.0%
4.50	3.9 dB	0.6364	0.40496	40.5%
5.00	3.5 dB	0.6667	0.44444	44.4%
6.00	2.9 dB	0.7143	0.51020	51.0%
7.00	2.5 dB	0.7500	0.56250	56.3%
8.00	2.2 dB	0.7778	0.60494	60.5%
9.00	1.9 dB	0.8000	0.64000	64.0%
10.00	1.7 dB	0.8182	0.66942	66.9%
15.00	1.2 dB	0.8750	0.76563	76.6%
20.00	0.9 dB	0.9048	0.81859	81.9%
30.00	0.6 dB	0.9355	0.87513	87.5%
40.00	0.4 dB	0.9512	0.90482	90.5%
50.00	0.3 dB	0.9608	0.92311	92.3%

Appendix 4-1 Voltage Standing Wave Ratio Relationships

NOTES