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NAS OT&E/INTEGRATION OF ATCBI-5 RMS

LETTER OF FINDINGS

RICHARD L. VANSUETENDAEL

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EXECUTIVE SUMMARY

Integration testing of the Air Traffic Control Beacon Interrogator (ATCBI-5) Remote Monitoring Subsystem (RMS) was performed at the Air Route Traffic Control Center (ARTCC) in Anchorage, AK and the ATCBI-5 site in Deadhorse, AK. Testing was conducted from May 12 through May 15, 1989. ACN-250 performed integration testing according to the procedures in the Draft ATCBI-5 RMS Integration Test Plan, dated May 9, 1989.

The purpose of the test was to verify that the ATCBI-5 RMS would perform properly as an integrated component of the Remote Maintenance Monitoring System (RMMS), and that all functional and performance requirements in the RMS specifications were fulfilled. The integration test of the ATCBI-5 RMS consisted of the ATCBI-5 RMS to Interim Monitor and Control Software (IMCS) Integration Test (IT1), the New Logical Unit (LU) Test (IT2), the ATCBI-5 RMS Regression Test (IT3), and the Performance Test (IT4).

The Integration Test verified that the ATCBI-5 RMS communicated properly with the Maintenance Processing Subsystem (MPS) running IMCS and that the RMS monitoring, alarm, and remote command functions were implemented in accordance with National Airspace System (NAS) Requirements. Several problems were found during this test. These problems are identified in this test report.

The New Logical Unit Test verified that the ATCBI-5 RMS monitoring, alarm, and remote command functions were implemented for the Environmental and Interim CD-2 equipment and that the RMS/RMMS interface functions were as specified in the ATCBI-5 Interface Design Document (IDD) for the IMCS. Several problems were found during this test which are identified in this test report.

The ATCBI-5 RMS Regression Test verified the status of previously identified problems in the link level interface as well as in the functional areas of monitoring, alarm reporting, and remote command/control. Several problems still exist which are identified in this test report.

The Performance Test verified the capability of the ATCBI-5 RMS to operate within the constraints of the performance requirements outlined in NAS-SS-1000, Volume I Appendix III and Volume V. The results of this test showed that all of the RMMS performance requirements were met except for monitoring of alarms. This may have been caused by the loading of the system.

d. When the RMS sends a Scheduled Poll Request, there was a chance for lost messages because queued messages were not transmitted until a Scheduled Poll was sent from the MPS.

2.3.4 Command Regression Test (IT3.4).

2.3.4.1 Test Description.

The objective of this test was to confirm that known command and control problems, including values and response types, with the ATCBI-5 RMS were corrected. Valid and invalid commands were sent to the RMS and the responses were recorded and analyzed. Command Error messages received at the MPS simulator in response to invalid commands were analyzed for NAS-MD-790 (reference document 1.2.a) compliance.

2.3.4.2 Test Results.

The Command Regression Test was accomplished by establishing communication between the MPS simulator and the ATCBI-5 RMS. The IT3.4 Command Regression Test performed as expected with the following exceptions:

a. Command Error messages received at the MPS simulator did not contain the value field of the message received by the RMS. NAS-MD-790 (reference document 1.2.a) states that the received message shall be inserted in its entirety.

b. There was no application level response for a Reset command.

2.4 PERFORMANCE TEST (IT4).

The purpose of this test was to verify that the ATCBI-5 RMS is operating within the constraints of the performance requirements outlined in NAS-SS-1000 Volume V.

The ARTCC computer at the ARTCC in Anchorage, Alaska, was used throughout the performance tests. The test specific information was as follows:

a. Computer used - ARTCC Tandem MPS,
b. IMCS Version - PCB0600 with MMS,
c. MMS Usage - minimum MMS occurred during the test,
d. Terminal Used - $TA14 and $TA15, and
e. 25th line loc - redirected to the test terminal.

During the course of integration testing, RMMS performance was affected by numerous priority messages from Middleton Island. also, a Guardian operating system error was reported at the MPS. The ATCBI-5 RMS remained in service during the entire test period.

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EXECUTIVE SUMMARY

Integration testing of the Air Traffic Control Beacon Interrogator (ATCBI-5) Remote Monitoring Subsystem (RMS) was performed at the Air Route Traffic Control Center (ARTCC) in Anchorage, AK and the ATCBI-5 site in Deadhorse, AK. Testing was conducted from May 12 through May 15, 1989. ACN-230 performed integration testing according to the procedures in the Draft ATCBI-5 RMS Integration Test Plan, dated May 9, 1989.

The purpose of the test was to verify that the ATCBI-5 RMS would perform properly as an integrated component of the Remote Maintenance Monitoring System (RMMS), and that all functional and performance requirements in the RMS specifications were fulfilled. The integration test of the ATCBI-5 RMS consisted of the ATCBI-5 RMS to Interim Monitor and Control Software (IMCS) Integration Test (IT1), the New Logical Unit (LU) Test (IT2), the ATCBI-5 RMS Regression Test (IT3), and the Performance Test (IT4).

The Integration Test verified that the ATCBI-5 RMS communicated properly with the Maintenance Processing Subsystem (MPS) running IMCS and that the RMS monitoring, alarm, and remote command functions were implemented in accordance with National Airspace System (NAS) Requirements. Several problems were found during this test. These problems are identified in this test report.

The New Logical Unit Test verified that the ATCBI-5 RMS monitoring, alarm, and remote command functions were implemented for the Environmental and Interim CD-2 equipment and that the RMS/RMMS interface functions were as specified in the ATCBI-5 Interface Design Document (IDD) for the IMCS. Several problems were found during this test which are identified in this test report.

The ATCBI-5 RMS Regression Test verified the status of previously identified problems in the link level interface as well as in the functional areas of monitoring, alarm reporting, and remote command/control. Several problems still exist which are identified in this test report.

The Performance Test verified the capability of the ATCBI-5 RMS to operate within the constraints of the performance requirements outlined in NAS-SS-1000, Volume 1 Appendix III and Volume V. The results of this test showed that all of the RMMS performance requirements were met except for monitoring of alarms. This may have been caused by the loading of the system.

During the course of integration testing, RMMS performance was affected by numerous priority messages from Middleton Island. Also, a Guardian operating system error was reported at the MPS. The ATCBI-5 RMS remained in service during the entire test period.

Performance testing was limited to one run of monitoring, command, and alarm sequences. Restricted test time on-site prevented collection of large data samples.

The ATCBI-5 Integration Test identified several problems which affect the use of the ATCBI-5 RMS. These are stated briefly below and are described in this test report.

a. Some RMS Data Points (DPs) are not monitored by the MPS (IT1.2)

b. Differences in nomenclature between IMCS and the Local Personal Computer (PC) (IT1.2, IT2.1, and IT2.2).

c. Scaling factor error are indicated by the IMCS display of some Environmental LU DPs (IT2.1).

d. State Change, Threshold Change and Return To Normal (RTN) messages are not displayed on the MPS 25th line (IT1.3 and IT2.1).

e. The RMS does not always alert of alarms when thresholds are changed (IT3.3).

f. Command Error messages do not contain the entire command sent (IT3.4).

g. There is no application level response for a Reset command (IT3.4).

h. When the Local PC returns control to the MPS, no State Change message is sent to indicate this (IT1.5).

i. Also the keyboard of the Local PC locked up several times during the test (IT1.5).

Some other problems were identified while Integration testing the ATCBI-5 RMS. These problems are stated briefly below and are described in this test report.

j. Status requests could not be sent to the Automatic Switching Unit, LU 2A (IT1.1).

k. LU 29, the ADU Low Oil (DP 2C) was not displayed at the MPS unless the DP was in the alarm condition in IT1.2.

l. Total Reset of the CD-2 could not be performed due to possible impact on Air Traffic operation (IT2.2).

m. The method used by the RMS when a Scheduled Poll Request is sent, could cause priority messages to be lost (IT4.2).

n. The MDT was not available for the ATCBI-5 (IT1.5).

o. With RMS was under LOCAL control, alarm data was not available at the MPS (IT1.3 and IT1.5).

1. TEST IDENTIFICATION.

This document reports on the results of integration testing of the Air Traffic Control Beacon Interrogator (ATCBI-5) Remote Monitoring Subsystem (RMS). The testing was performed at the Air Route Traffic Control Center (ARTCC) in Anchorage, Alaska and the ATCBI-5 site in Deadhorse, Alaska, from May 12, 1989 through May 15, 1989. Testing was conducted by ACN-230 personnel and supported by the Federal Aviation Administration (FAA) Alaska Region. The tests described in the ATCBI-5 RMS Integration Test Plan, dated May 9, 1989 were performed.

1.1 ATCBI-5 PROGRAM DOCUMENTATION.

a. FAA Alaska Region Beacon-Only RMS Implementation and Test Plan, FAA Alaska Region, December 6, 1985.

b. FAA Alaska Region ATCBI-5 Beacon-Only RMS Software Design, FAA Alaska Region, October 4, 1985.

c. ATCBI-5 RMS Test Strategy, CDRL A089, ACT-110, FAA, October 24, 1986.

d. ATCBI-5 RMS Test Procedures, CDRL A091, ACT-110, FAA, May 1, 1987.

e. ATCBI-5 RMS Test Report, CDRL A104, ACT-110, FAA, August 30, 1988.

f. ATCBI-5 RMS Integration Test Plan, CDRL A104, ACN-230, FAA, May 9, 1989.

g. Air Traffic Control Beacon Interrogator (ATCBI-5) Interface Design Document (IDD) for the Interim Monitoring and Control Software (IMCS) PCB0600, FAA Central Region, September, 1988.

1.2 RMMS PROGRAM DOCUMENTATION.

a. NAS-MD-790, Remote Maintenance Monitoring System Interface Control Document MPS to RMS and RMSC, FAA, June 10, 1986.

b. NAS-MD-792, Operational Requirements for the Remote Maintenance Monitoring System (RMMS), FAA, June, 1984.

c. NAS-MD-793, Remote Maintenance Monitoring System Functional Requirements for the Remote Monitoring Subsystem (RMS), FAA, February 28, 1986.

d. MS 400A, Synchronous MPS Communications Simulator User's Manual, ACT-110, FAA, March, 1988.

1.3 GOVERNMENT REFERENCES.

a. DOT FAA STD-024a, Preparation of Test and Evaluation Documentation, August 17, 1987.

b. NAS-MD-110, Test and Evaluation (T & E) Terms and Definitions for the National Airspace System, March 27, 1987.

c. NAS-SS-1000, Functional and Performance Requirements for the National Airspace System Maintenance and Operations Support Element, Volume I, Appendix III, and Volume V, FAA, December 1986.

2.0 PURPOSE OF THE TEST.

The purpose of the ATCBI-5 RMS Integration Test was to perform integration testing of the ATCBI-5 RMS using Interim Monitor and Control Software (IMCS, version PCB-0600), test two logical units which were not previously tested, regression test in areas which had previously failed, and collect performance data using IMCS. These four test areas were associated with four separate tests. Test descriptions and test results for these four tests are found in the following paragraphs.

2.1 ATCBI-5 RMS TO IMCS INTEGRATION TEST (IT1).

The purpose of this test was to verify that the ATCBI-5 RMS communicates properly with the Maintenance Processing Subsystem (MPS) running IMCS, and that RMS monitoring, alarm, and remote command functions are correctly implemented for the ATCBI-5. Limited testing with the Local Personal Computer (PC) was also performed to verify the capability of the ATCBI-5 RMS to provide local control and display of data. IT1 was divided into five sequences based on functionality. These five sequences are:

a. IT1.1 Link Interface Test. This test confirmed the integrity of the communications path between the ATCBI-5 RMS and the MPS.

b. IT1.2 Monitoring Test. This test confirmed that parameters reported by the ATCBI-5 RMS were consistent with the conditions of that system.

c. IT1.3 Alarm Test. This test confirmed that the ATCBI-5 RMS would correctly respond to ATCBI-5 equipment alarm, state and threshold change conditions and provide messages to the MPS.

d. IT1.4 Command Test. This test confirmed that the ATCBI-5 RMS correctly responded to commands from the MPS.

e. IT1.5 Local PC Control Test. This test confirmed that the Local PC could be utilized for local ATCBI-5 RMS control and that it has the ability to relinquish control of the RMS to the MPS.

There was no test for certification or diagnostics because these have not been implemented for the ATCBI-5 RMS. After these are implemented on the ATCBI-5 RMS a test can be developed and performed to test these requirements.

Information regarding reference documents utilized, description of test requirements, verification method, results, and comments are included in the ATCBI-5 Integration Test Results Matrix contained in Appendix A.

The test configuration used for IT1, IT2, and IT4 is depicted in figure 2-1. The test configuration for IT3 is depicted in figure 2-2.

2.1.1 Link Interface Test (IT1.1).

2.1.1.1 Test Description.

The objective of this test was to confirm that the communication path between the ATCBI-5 RMS and the MPS could be established and maintained. Link Interface testing was conducted with IMCS using application level commands and responses. Since link level communications are not visible in IMCS, an in-line protocol analyzer was used to monitor link level responses to and from the RMS. Status requests (Specific Polls) were sent to each Logical Unit (LU) in turn, then to all LUs with a single request (Scheduled Poll). Responses received were recorded and analyzed. The RMS retry capability and RMS Reset command were also exercised.

2.1.1.2 Test Results.

The communication path between the ATCBI-5 RMS and the MPS was established and maintained with the following results to both specific and scheduled polls.

a. The MPS received status reports for the RMS Master Logical Unit (LU 20), Environmental LU (22), and ATCBI-5 Channel 1 LU (24) in response to both specific and scheduled polls.

b. An IMCS status request could not be sent to the Automatic Switching Unit, LU 2A. Status information for this LU is updated during an "All Status" request only and is available only in the IMCS history file .

c. When the RMS is disabled (i.e., disconnected in the test), notification at the MPS of a Comm Link alarm takes approximately two minutes and twenty seconds. The same results were noted when the RMS was powered down at the equipment. In both cases, the number of retries attempted before the site was declared disabled were not available in the IMCS history file.

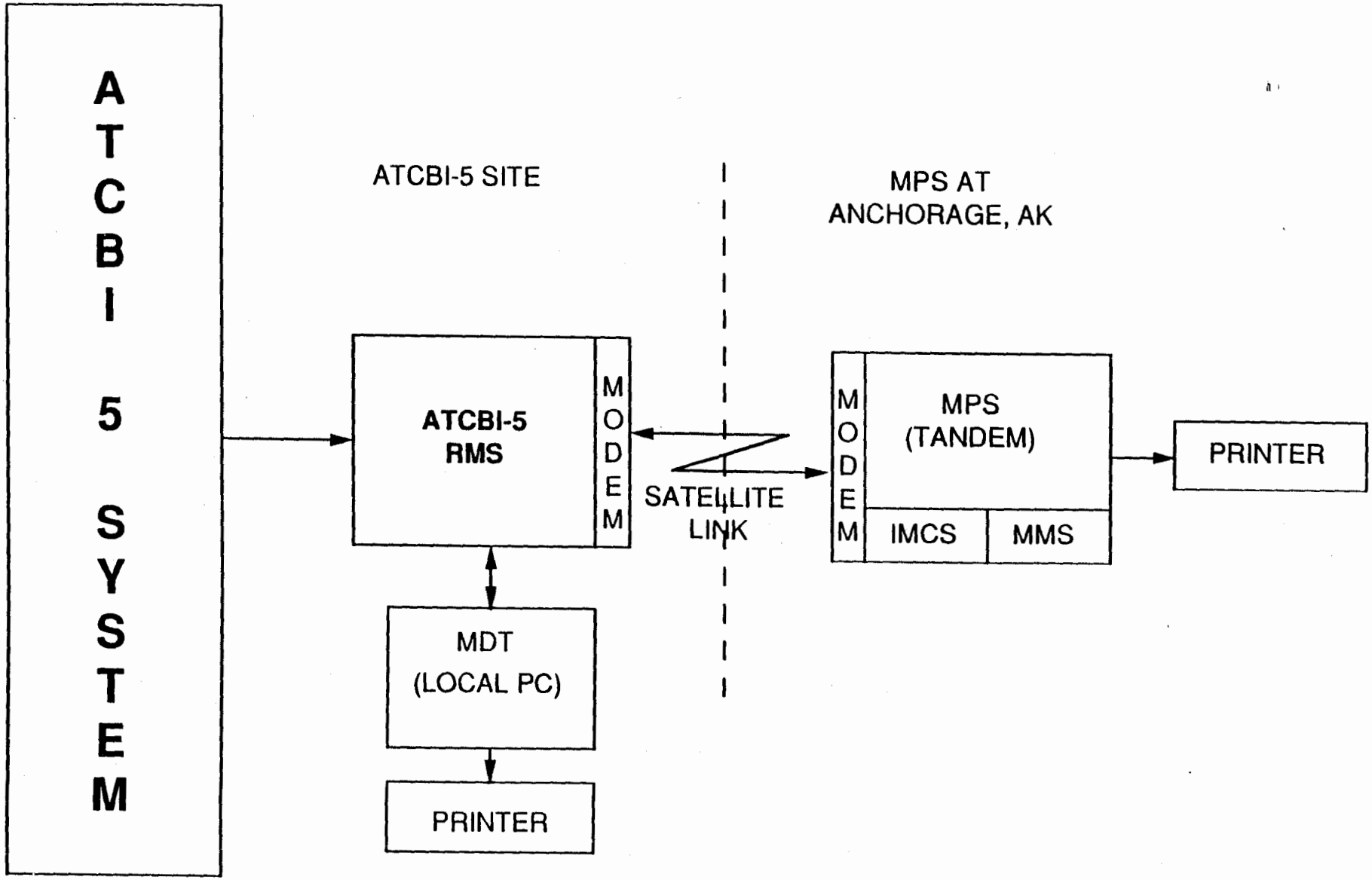


FIGURE 2-1. ATCBI-5 RMS to MPS Integration Test Configuration

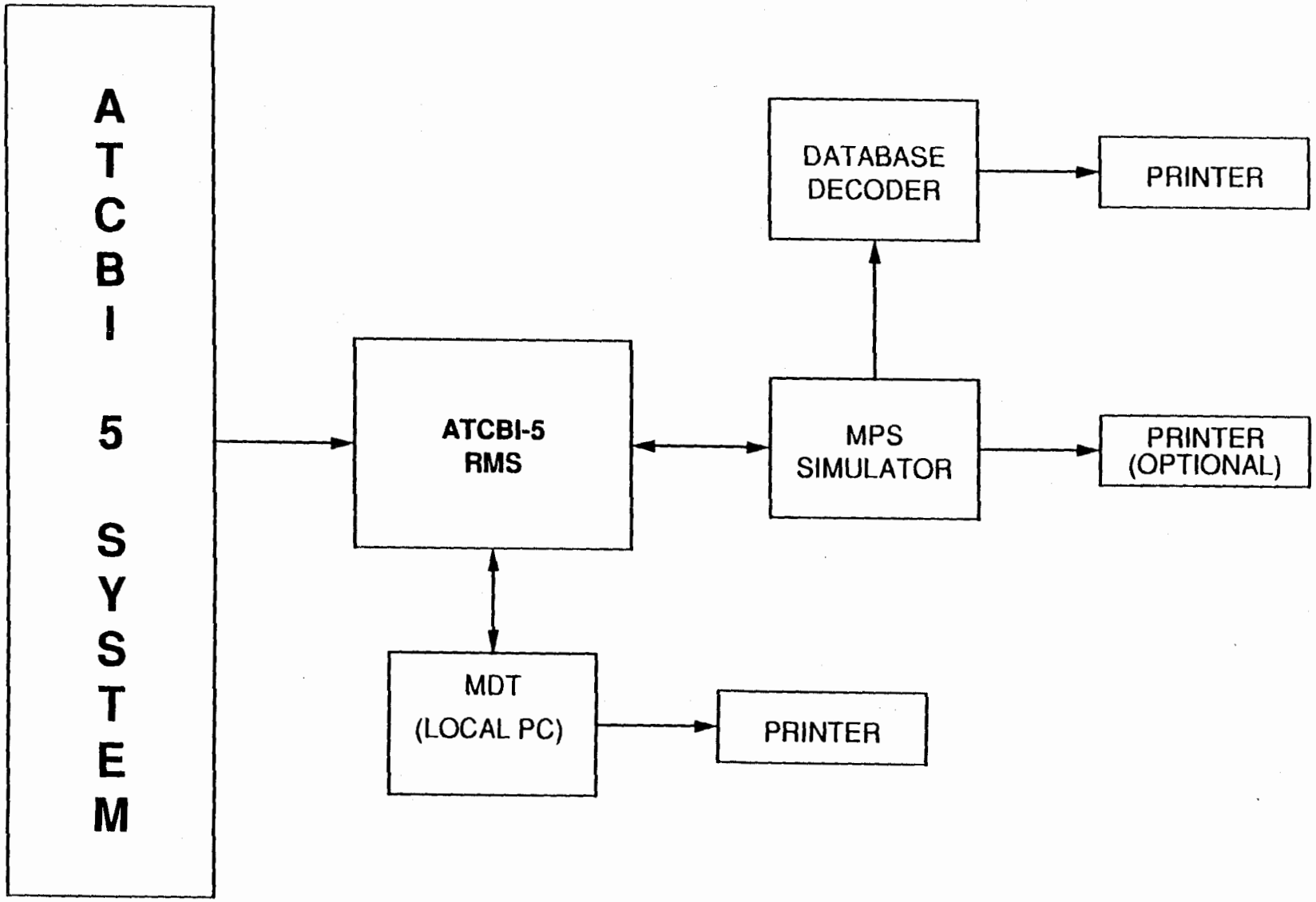


FIGURE 2-2 ATCBI-5 RMS to MPS Simulator Test Configuration

2.1.2 Monitoring Test (IT1.2).

2.1.2.1 Test Description.

The objective of this test was to confirm that each parameter reported by the ATCBI-5 RMS was consistent with the state of the ATCBI-5 system. Individual status requests were sent to each LU. Updated parameter statuses and reported values at the MPS were compared with the statuses and values reported at the Local PC.

2.1.2.2 Test Results.

Status requests to each LU and "All Status" requests for all monitored LUs were obtained to provide current status data. Parameter statuses and reported values were compared with the statuses and values displayed at the Local PC. The IT1.2 Monitoring Test results revealed a difference in the description of some data points presented at the local PC and the Screen Monitor at the MPS. The data point descriptions and values are listed below.

a. Differences in nomenclature were noted between the IMCS and the Local PC status display as follows.

Differences between status at MPS and Local PC:

LUID	Unit	DP Description	MPS Status	Local PC Status
2020	RMS MAS	COMMAND LINES	Enabled	On
2025	RMS MAS	LOST COMM	Online	Normal
2027	RMS MAS	LOST COMM	Online	Normal
244D	ATCBI CH1	ISM1-REF-TBD	OFF	OK
244E	ATCBI CH1	ISM1-REF-TRIG	OFF	OK
244F	ATCBI CH1	ISM1-REF-NO	OFF	OK
2450	ATCBI CH1	ISM1-REF-NOF	OFF	OK
2451	ATCBI CH1	ISM1-REF-CMPST	OFF	OK
2452	ATCBI CH1	ISM1-REF-RAM5V	OFF	OK
2453	ATCBI CH1	ISM1-REF-+15-VR	OFF	OK
2454	ATCBI CH1	ISM1-REF-PS	Off	OK
2458	ATCBI CH1	CHAN SELECTED	Selected	Online
254C	ATCBI CH2	ISM2-REF-TBD	OFF	OK
254D	ATCBI CH2	ISM2-REF-TRIG	OFF	OK
254E	ATCBI CH2	ISM2-REF-NO	OFF	OK
254F	ATCBI CH2	ISM2-REF-NOF	OFF	OK
2550	ATCBI CH2	ISM2-REF-CMPST	OFF	OK
2551	ATCBI CH2	ISM2-REF-RAM5V	OFF	OK
2552	ATCBI CH2	ISM2-REF-+15-VR	OFF	OK
2553	ATCBI CH2	ISM2-REF-TBD	OFF	OK
2557	ATCBI CH2	CHAN SELECTED	Not Selected	Offline

Differences between status at MPS and Local PC: (cont'd)

LUID	Unit	DP Description	MPS Status	Local PC Status
292A	ASU	CHAN 1 SELECTED	Selected	Online
292B	ASU	CHAN 2 SELECTED	Not Selected	Offline
292C	ASU	ADU LOW OIL		
292D	ASU	MOTOR A ALARM	Normal	OK
292E	ASU	MOTOR B ALARM	Normal	OK
292F	ASU	CHAN 1 LATE ACP	Normal	OK
2930	ASU	CHAN 1 ACP SPACING	Normal	OK
2931	ASU	CHAN 2 LATE ACP	Normal	OK
2932	ASU	CHAN 2 ACP SPACING		

Differences between DP descriptions at MPS and Local PC:

LUID	MPS Description	Local PC Description
244A	ISM1 Status ISM	STAT-ISM-MAINT
244C	ISM1 Status	STAT-ISM-RUN
2549	ISM2 Status ISM	STAT-ISM-MAINT
254B	ISM2 Status	STAT-ISM-RUN

b. Several Data Points (DPs) were monitored by the RMS, but were not reported:

DPs not reported at the MPS:

LUID	Unit	Data Point Description
2029	RMS MAS	GPIB WFA LOST COMMUNICATION
202A	RMS MAS	GPIB WFA TIMEOUT COUNTER
2455	ATCBI CH1	ATCBI CH 1 TRIGGER TIMING ALARM
244B	ATCBI CH1	CH 1 ISM1-STAT-STBY-HV
2554	ATCBI CH2	ATCBI CH2 TRIGGER TIMING ALARM
254A	ATCBI CH2	CH 2 ISM2-STAT-STBY-HV
2A23	ASU	ASU ALARM

DPs not reported at the Local PC:

LUID	Unit	Data Point Description
2021	RMS MAS	RMS LOCAL CONTROL
2023	RMS MAS	SIGN OUT STATUS
2024	RMS MAS	TECHNICIAN SIGN IN/OUT
2029	RMS MAS	GPIB WFA LOST COMMUNICATIONS
202A	RMS MAS	GPIB WFA TIMEOUT COUNTER
254A	ATCBI CH2	CH 2 ISM2-STAT-STBY-HV
2A21	ASU	SG-841 TRIGGER GEN #1 SEL
2A22	ASU	SG-841 TRIGGER GEN #2 SEL
2A23	ASU	ASU ALARM

c. In LU 29, the ADU Low Oil (DP 2C) was not displayed in the Status Display at the MPS unless the DP was in the alarm condition.

2.1.3 Alarm Test (IT1.3).

2.1.3.1 Test Description.

The objective of this test was to confirm that the ATCBI-5 RMS would correctly respond to ATCBI-5 equipment alarm and state change conditions. Threshold change conditions were induced by changing parameters at the Local PC, and as a result provided Threshold Change messages to the MPS. Fault conditions were induced and state changes were performed at the ATCBI-5. The resulting alarm/alert and State Change messages reported by the RMS were recorded and analyzed.

2.1.3.2 Test Results.

Induced alarm/alert and state change conditions resulted in Alarm, Return to Normal (RTN), and State Change messages received at the MPS. These messages and all most other MPS/RMS messages were recorded by IMCS and kept on the Tandem in the IMCS history file named " $DATA.MCSDB.DBH ". Each day the file was archived by creating a file LIKE MCSDB.DBH with a file name of Hmmddyy where mmddyy was the current date. Each of the archived files was copied to mag tape and carried back to the FAA Technical Center. At the FAA Technical Center, the files were backed up to the ACN-230 Tandem and printed. The printouts of these IMCS History files was analyzed for each test sequence. The IT1.3 Alarm Test met requirements with the following exceptions:

a. RTN messages received at the MPS were not displayed.

b. When the RMS was under LOCAL control, alarm data was not available at the MPS. However, it was available in the history file.

c. State Change messages received at the MPS were not displayed.

d. Threshold change messages received at the MPS were not displayed.

2.1.4 Command Test (IT1.4).

2.1.4.1 Test Description.

The objective of this test was to confirm that the ATCBI-5 RMS correctly responded to commands from the MPS. Commands were sent to the RMS and the ATCBI-5 equipment was observed to verify that each command was received and processed. In cases where command/control initiated state changes were not visible at the equipment, the Local PC was also used to observe the status of the equipment.

2.1.4.2 Test Results.

Valid remote commands sent from the MPS, resulted in the correct action being taken by the ATCBI-5. The response messages received from the RMS were recorded in the IMCS history file for analysis. ISM Reset commands for both channels failed initially. The problem was identified as a faulty optic isolator, and was corrected. Subsequent ISM Resets were successful. IT1.4 Command Test met all requirements.

2.1.5 Local PC Control Test (IT1.5).

2.1.5.1 Test Description.

The objective of this test was to confirm that the Local PC can be utilized for local ATCBI-5 RMS control and that it has the ability to relinquish control of the RMS to the MPS. Control of the RMS was assumed by the Local PC (in the local mode). Commands were sent to the RMS from the Local PC while the RMS was in both local and remote modes. Status requests were also sent from the Local PC. Results of these steps were recorded and analyzed. Control of the RMS was relinquished to the MPS (in the remote mode) at the conclusion of the test.

2.1.5.2 Test Results.

When control of the RMS was assumed at the Local PC, valid commands were sent from the Local PC to the ATCBI-5. Control was then relinquished to the MPS, and commands were again attempted at the Local PC. Local PC commands were not possible when the RMS was in Remote mode. IT1.5 Local PC Control Test met the requirements with the following exceptions:

a. The keyboard of the Local PC locked up several times during the test. The cause of this problem is unknown.

b. A State change message was expected at the MPS when RMS control was returned to REMOTE. Instead, a Site Status for each LU was received at the MPS.

c. When the ATCBI-5 RMS was under local control, alarm messages were suppressed from the MPS.

d. A Local PC was used for this test because a Maintenance Data Terminal (MDT) was not available.

2.2 NEW LOGICAL UNIT TEST (IT2).

The purpose of this test was to verify that RMS monitoring, alarm and remote command functions were correctly implemented for the Environmental and Interim CD-2 equipment, and that the RMS/RMMS interface functioned as specified in the ATCBI-5 IDD for the IMCS (reference document 1.1.g).

IT2 was divided into two sequences. The first sequence was functional testing of the Environmental LU. The second sequence was functional testing of the Interim Common Digitizer-2 (CD-2) LU. These LUs were not tested during previous ATCBI-5 tests (performed in August 1987). These sequences confirmed that Environmental and specified CD-2 LUs (26 and 27 only) were fully integrated into the RMS, and that all applicable RMS design specifications were met.

2.2.1 Environmental LU Test (IT2.1).

2.2.1.1 Test Description For IT2.1.

The objective of this test was to confirm that RMS monitoring, alarm and remote command functions were correctly implemented for the ATCBI-5 Environmental LU. Three sub-tests were defined for this purpose. These were the Monitoring Test, Alarm Test, and Command Test.

2.2.1.1.1 Monitoring Test For IT2.1.

For the monitoring test, status requests were sent to the Environmental LU. Updated parameter statuses and reported values were compared with the statuses and values reported at the Local PC for the environmental equipment.

2.2.1.1.2 Alarm Test For IT2.1.

For the alarm test, fault conditions were induced and state changes were performed at the ATCBI-5. The resulting alarm/alert and State Change messages reported by the RMS were recorded and analyzed.

2.2.1.1.3 Command Test For IT2.1.

For the command test, commands were sent to the RMS and the ATCBI-5 equipment was observed to verify that each command was received and processed. In cases where command/control initiated state changes were not visible at the equipment, the Local PC was used to observe the status of the equipment.

2.2.1.2 Test Results For IT2.1.

This section provides a summary of the Environmental LU Test results.

2.2.1.2.1 Monitoring Test For IT2.1.

Status requests to the Environmental LU resulted in current status data. Parameter statuses and reported values compared favorably with the statuses and values displayed at the Local PC. The IT2.1 Environmental LU Monitoring Test met requirements with the following exceptions:

a. Some minor differences in nomenclature were noted between the IMCS and the Local PC status displays as follows:

LUID	Unit	MPS Status	Local PC Status
2224	ENVIRO	Not Running	Off

LUID	Unit	MPS Description	Local PC Description
2226	ENVIRO	Fac 1 Load Supply	Facility Power Supply
224E	ENVIRO	Comm Power Ph A Current	Load Phase A Current
224F	ENVIRO	Comm Power Ph B Current	Load Phase B Current
2250	ENVIRO	Comm Power Ph C Current	Load Phase C Current
228D	ENVIRO	EG1 Phase A Current	Load Phase A Current
228E	ENVIRO	EG1 Phase B Current	Load Phase B Current
228F	ENVIRO	EG1 Phase C Current	Load Phase C Current

b. Some scaling factor errors in the IMCS display were noted between the RMS and the MPS for the DPs in the Environmental LU.

LUID	Unit	DP Description	Reported Value	Actual Value
2240	ENVIRO	FUEL TANK #1 LEVL	732	73.2
2258	ENVIRO	A/C INLET #1 TEMP	6.9	69
2259	ENVIRO	A/C OUTLET #1 TEMP	6.7	67
2264	ENVIRO	E/G #1 FREQUENCY	550	55.0
2265	ENVIRO	COMMERCIAL FREQUENCY	599	59.9
228D	ENVIRO	E/G #1 PHASE A CURRENT	0.4	40.2
228E	ENVIRO	E/G #1 PHASE B CURRENT	0.2	40.3
228F	ENVIRO	E/G #1 PHASE C CURRENT	0.0	32.5

2.2.1.2.2 Alarm Test For IT2.1.

Induced alarm/alert and state change conditions for the Environmental equipment resulted in the correct alarm, RTN, and State Change messages received at the MPS. These messages were recorded in the IMCS history file for analysis. All alarms tested met the requirements with the following exceptions:

a. Several environmental alarms were not tested, since changing threshold values was not effective in these areas:

LUID	Unit	Description
2220	ENVIRO	EG1 OVER SPEED LOCKOUT
2221	ENVIRO	EG1 OVER TEMP LOCKOUT
2222	ENVIRO	EG1 OIL PRESSURE LOCKOUT
2223	ENVIRO	EG1 OVER CRANK LOCKOUT

b. RTN messages received at the MPS were not displayed.

c. State Change messages received at the MPS were not displayed.

d. Threshold Change messages received at the MPS were not displayed.

2.2.1.2.3 Command Test For IT2.1.

Valid remote commands sent from the MPS, resulted in correct response messages from the RMS. These response messages were recorded in the IMCS history file for analysis. During the test, a faulty regulated power supply in the Engine Generator (EG) alarm panel created false readings at the RMS interface. After a hardware fix at the EG alarm junction box, commands performed as expected. All commands tested met the requirements.

2.2.2 Interim CD-2 LU Test (IT2.2).

2.2.2.1 Test Description For IT2.2.

The objective of this test was to confirm that RMS monitoring, alarm, and remote command functions were correctly implemented for the CD-2 equipment associated with the ATCBI-5. Three sub-tests were defined for this purpose.

2.2.2.1.1 Monitoring Test Description For IT2.2.

For the monitoring test, status requests were sent to the CD-2 LUs. Updated parameter statuses and reported values were compared with the statuses and values reported at the Local PC for the CD-2 equipment.

2.2.2.1.2 Alarm Test Description For IT2.2.

For the alarm test, fault conditions were induced and state changes were performed at the ATCBI-5. The resulting alarm/alert and State Change messages reported by the RMS were recorded and analyzed.

2.2.2.1.3 Command Test Description For IT2.2.

For the command test, commands were sent to the RMS and the ATCBI-5 equipment was observed to verify that each command was received and processed. In cases where command/control initiated state changes were not visible at the equipment, the Local PC was also used to observe the status of the equipment.

2.2.2.2 Test Results For IT2.2.

This section provides a summary of the Interim CD-2 LU test results.

2.2.2.2.1 Monitoring Test For IT2.2.

Status requests to CD-2 LUs (26 and 27) resulted in current status data. Parameter statuses and reported values compared favorably with the statuses and values displayed at the Local PC. The monitored parameters met requirements with the following exceptions:

a. Some minor differences in nomenclature were noted between the IMCS and the Local PC status displays as follows:

LUID	Unit	DP Description	MPS Status	Local PC Status
2623	CD-2	ELEVATED TEMP	Not Elevated	Normal

LUID	Unit	MPS Description	Local PC Description
2624	CD-2	CD-2 MIG Status	MIG
2625	CD-2	CD-2 MIG Alarm Stat	MIG
2626	CD-2	IRMM Comm Status	CD-2 Communication
2627	CD-2	IRMM Local/Remote	IRMM Status

2.2.2.2.2 Alarm Test For IT2.2.

Induced alarm/alert and state change conditions for the CD-2 LUs (26 and 27) resulted in the correct alarm, RTN, and State Change messages received at the MPS. These messages were recorded in the IMCS history file for analysis. All alarms tested met requirements with the following exceptions:

a. MIG alarms were not applicable to this site, and therefore could not be tested.

b. CD-2 alarm testing was limited to IRMM Comm Status and Local/Remote switch indication to minimize impact on Air Traffic Control (ATC) operation.

2.2.2.2.3 Command Test For IT2.2.

Valid remote commands sent from the MPS, resulted in response messages received at the MPS. These messages were recorded in the IMCS history file for analysis. All commands tested met requirements with the following exceptions:

a. CD-2 command testing was limited to the offline channel to minimize impact on ATC operation.

b. Total Reset of the CD-2 could not be performed without impacting ATC operation.

2.3 ATCBI-5 RMS REGRESSION TEST DESCRIPTION (IT3).

The purpose of this test was to verify the current status of previously identified problems in the link level interface, as well as in the functional areas of monitoring, alarm reporting, and remote command/control.

IT3 was divided into four sequences based on functional problems identified in ATCBI-5 RMS Design Verification testing and Integration testing performed August 3, 1987 through August 7, 1987. The objective of the regression sequences was to confirm that known deficiencies in each area had been corrected.

2.3.1 Link Interface Regression Test (IT3.1).

2.3.1.1 Test Description.

The objective of this test was to confirm that known link level problems, including response to the disconnect and bad frame detection, were corrected. Protocol error conditions, including RMS Disconnect (DISC) and frame errors, were simulated. Responses received by the MPS simulator from the RMS were recorded and analyzed.

2.3.1.2 Test Results.

The Link Interface Test successfully established communication between the MPS simulator and the ATCBI-5 RMS. The ATCBI-5 link interface performed as expected. Previously identified link interface problems no longer exist.

2.3.2 Monitor Regression Test (IT3.2).

2.3.2.1 Test Description.

The objective of this test was to confirm that known monitoring problems, including monitoring of all DPs, zero value if the DP is not monitored, and reasonable monitored values for all DPs, were corrected. A specific poll was sent to each LU and the

responses were recorded and analyzed. Specifically, test data was examined to verify that DPs contained values which were reasonable and consistent with their reported statuses. Threshold change messages were examined to verify that they contained the appropriate threshold values.

2.3.2.2 Test Results.

Communication between the MPS simulator and the ATCBI-5 RMS was established. Status requests to each LU and "All Status" requests for all monitored LUs were obtained. Parameter statuses and reported values were compared with the statuses and values displayed at the Local PC. The Monitor Regression Test performed as expected. Previously identified Monitor Test Problems no longer exist.

2.3.3 Alarm Regression Test (IT3.3).

2.3.3.1 Test Description.

The objective of this test was to confirm that known problems, including alarm, state change, threshold change, and RTN notification, were corrected. Alarm conditions were induced at the equipment or at the Local PC. The notifications sent to the MPS simulator were recorded and analyzed. When the alarm conditions were cleared, notifications were also recorded. Control commands which changed equipment or parameters from one valid status/value to another were also sent, and the RMS responses were analyzed to verify a state change rather than a RTN was received.

2.3.3.2 Test Results.

The Alarm Regression Test was accomplished by establishing communication between the MPS simulator and the ATCBI-5 RMS. Induced Alarm/alert and state change conditions resulted in alarm, RTN, and State Change messages received at the MPS simulator. These messages were recorded for analysis. This test was accomplished during IT1.4 Command Test using IMCS. The IT3.3 Alarm Regression Test met requirements with the following exceptions:

a. RTNs were not always sent for some alarms.

b. Threshold changes created to place a value in an alarm condition did not always cause hard and/or soft alarms.

c. Both a and b above were due to an RMS function which checked for a change in the measured value of the data point. If there was no change in the data point value, no message was created.

d. When the RMS sends a Scheduled Poll Request, there was a chance for lost messages because queued messages were not transmitted until a Scheduled Poll was sent from the MPS.

2.3.4 Command Regression Test (IT3.4).

2.3.4.1 Test Description.

The objective of this test was to confirm that known command and control problems, including values and response types, with the ATCBI-5 RMS were corrected. Valid and invalid commands were sent to the RMS and the responses were recorded and analyzed. Command Error messages received at the MPS simulator in response to invalid commands were analyzed for NAS-MD-790 (reference document 1.2.a) compliance.

2.3.4.2 Test Results.

The Command Regression Test was accomplished by establishing communication between the MPS simulator and the ATCBI-5 RMS. The IT3.4 Command Regression Test performed as expected with the following exceptions:

a. Command Error messages received at the MPS simulator did not contain the value field of the message received by the RMS. NAS-MD-790 (reference document 1.2.a) states that the received message shall be inserted in its entirety.

b. There was no application level response for a Reset command.

2.4 PERFORMANCE TEST (IT4).

The purpose of this test was to verify that the ATCBI-5 RMS is operating within the constraints of the performance requirements outlined in NAS-SS-1000 Volume V.

The ARTCC computer at the ARTCC in Anchorage, Alaska, was used throughout the performance tests. The test specific information was as follows:

a. Computer used - ARTCC Tandem Computer Serial Number 6,
b. IMCS Version - PCB0600 with MMS,
c. MMS Usage - minimum MMS occurred during the test,
d. Terminal Used - $TA14 and $TA15, and
e. 25th line loc - redirected to the test terminal.

During the course of integration testing, RMMS performance was affected by numerous priority messages from Middleton Island. also, a Guardian operating system error was reported at the MPS. The ATCBI-5 RMS remained in service during the entire test period.

Performance testing was limited to one run of monitoring, command, and alarm sequences. Restricted test time on-site prevented collection of large data samples.

IT4 was divided into five sequences based on functional performance. The objective of each performance sequence was to confirm that the ATCBI-5 RMS meets applicable performance requirements as an integrated component of the RMMS. These five sequences are described as follows.

a. Performance Monitoring Test (IT4.1)

b. Performance Alarm Test (IT4.2)

c. Performance Command Test (IT4.3)

d. Performance Diagnostic/Certification Test (IT4.4)

e. Performance Priority Message Test (IT4.5)

2.4.1 Performance Monitoring Test (IT4.1).

2.4.1.1 Test Description.

The objective of this test was to confirm that status data was reported by the ATCBI-5 RMS and presented by the MPS within an average time of 2 minutes and a maximum time of 10 minutes. Status requests were sent to each LU. A single Tandem 6530 terminal was used to observe RMS responses. This terminal was running IMCS/MMS and also displayed 25th line messages. Responses were timed, and the data was recorded and analyzed.

2.4.1.2 Test Results.

Status requests to each LU and "All Status" requests for all monitored LUs were used to obtain performance measurements. Response time was measured from the input of a request to the presentation of complete data on the screen. The response times for the presentation of monitored data on various IMCS screens were recorded. The average response time was 26 seconds and maximum response time was 80 seconds. The results of the IT4.1 Performance Monitoring Test met the requirements.

2.4.2 Performance Alarm Test (IT4.2).

2.4.2.1 Test Description.

The objective of this test was to confirm that alarm/alert and state change conditions were reported by the ATCBI-5 RMS and presented by the MPS within an average time of 10 seconds and a maximum time of 60 seconds. Performance measurements were recorded during various alarm test sequences and analyzed for

compliance with time constraints. Response time was measured from the time of the detection of the alarm in the ATCBI-5 RMS, to the time of presentation of the alarm on the 25th line at the MPS terminal. Whenever the 25th line message could not be confirmed, the IMCS history file was analyzed to confirm the result.

2.4.2.2 Test Results.

Due to test restrictions of on-site testing and non-interference with system operation, 14 out of the expected 30 alarm messages were created. None of these were repeated. The results of the IT4.2 Performance Alarm Test met the requirements with the following exceptions:

a. The average response time was 20 seconds and the maximum response time was 98 seconds.

Note: During the course of integration testing, numerous priority messages from Middleton Island appeared to affect response times at the Maintenance Processor Subsystem (MPS). Also, a Guardian operating system error was reported at the MPS. The cause of this error has not yet been identified. Further investigation and analysis of these conditions was attempted but no further determination on their impact, if any, on test results could be surmised.

2.4.3 Performance Command Test (IT4.3).

2.4.3.1 Test Description.

The objective of this test was to confirm that the ATCBI-5 RMS executed remote command/control messages within an average time of 5 seconds and a maximum time of 15 seconds. Also that the ATCBI-5 RMS provided acknowledgement to the MPS within an average time of 15 seconds and a maximum time of 75 seconds. Performance measurements were recorded during various command test sequences and analyzed for compliance with time constraints. The command execution time was measured from the input of a command at the MPS terminal to its execution by the ATCBI-5 RMS. The command acknowledgement time was measured from the input of a command at the MPS terminal to the time that a acknowledgement of the command was recognized on the 25th line at the MPS. Whenever the 25th line message could not be confirmed, the IMCS history file was analyzed to confirm the result.

2.4.3.2 Test Results.

Due to test restrictions of on-site testing and non-interference with system operation, 7 out of the expected 15 command messages were tested. None of these were repeated. The average command execution time was 7 seconds and the maximum command execution

time was 10 seconds. The results of the IT4.3 Performance Command Test met the requirements.

The results of the command acknowledgement time portion of the test met the requirements. The average command acknowledgement time was 13 seconds and the maximum command acknowledgement time was 32 seconds.

2.4.4 Performance Diagnostic/Certification Test (IT4.4).

2.4.4.1 Test Description.
Remote Diagnostic and Certification capabilities for the ATCBI-5 RMS/RMMS were not available at this time.

2.4.4.2 Test Results.
No test was performed for Remote Diagnostics and Certification. After these are implemented on the ATCBI-5 RMS a test can be developed and performed to test these requirements.

2.4.5 Performance Priority Messages Test (IT4.5).

2.4.5.1 Test Description.

The objective of this test was to confirm that the ATCBI-5 RMS system provides a priority scheme for the collection and presentation of priority messages. IMCS history files recorded throughout the testing were analyzed for compliance with this requirement.

2.4.5.2 Test Results.

The Performance Priority Messages Test was accomplished by analyzing the results of all tests conducted using the MPS running MMS/IMCS. No problems were identified during the analysis of these test results. The results of the IT4.5 Performance Priority Messages Test met the requirements.

3.0 TEST CONCLUSIONS AND RECOMMENDATIONS.

The integration testing of the ATCBI-5 RMS indicates that there are still a few problems with the RMS. However, these problems are minor and should not effect the performance of the integrated ATCBI-5 RMS and MPS. Specific exceptions and recommendations are listed below.

3.1 MONITORING.

3.1.1 Conclusions.

o Several Data Points (DPs) were monitored by the RMS, but not monitored by the MPS (IT1.2).

o Some minor differences in nomenclature were noted between the IMCS and the Local PC status displays in IT1.2, IT2.1, and IT2.2.

o Scaling factor errors in the IMCS display were noted between the RMS and the MPS for the DPs in the Environmental LU in IT2.1. The DPs are listed in Section 2.2.1.2.1.

3.1.2 Recommendations.

o Recommend Command access of all RMS data points upon request.

o Standard nomenclature should be established for Local PC and IMCS status displays.

o Recommend Scaling factor errors listed in Section 2.2.1.2.1 be resolved in accordance with the RMS Interface Control Document.

3.2 PRIORITY MESSAGES.

3.2.1 Conclusions.

o State Change, Threshold Change, and RTN messages received during IT1.3 and IT2.1 were not displayed at the MPS.

o Threshold changes did not always cause hard and/or soft alarms during IT3.3.

3.2.2 Recommendations.

o Verify requirement validity and modify software (IMCS) to support the requirements.

o Investigate why there is a lack of Alarm and RTN messages when thresholds change.

3.3 COMMAND.

3.3.1 Conclusions.

o Command Error messages received during IT3.4 did not contain the entire command as stated in NAS-MD-790.

o There was no indication of an application level response for a Reset command during IT3.4.

3.3.2 Recommendations.

o Command error messages should be corrected to conform with NAS-MD-790. See IT3.4.

o Master logical unit (LU20) should indicate a change of state upon completion of a reset.

3.4 Local PC Control.

3.4.1 Conclusions.

o A State Change message was expected at the MPS when RMS control was returned to REMOTE. Instead, a Site Status for each LU was received at the MPS during IT1.5.

o The keyboard of the Local PC locked up several times during the test in IT1.5.

3.4.2 Recommendations.

o Investigate the cause for reception of site status messages vice State Change messages at the MPS.

o Further investigate the cause of the Local PC keyboard lock-up and correct.

3.5 GENERAL.

3.5.1 Conclusions.

o During IT1.1 IMCS status requests could not be sent to the Automatic Switching Unit, LU 2A.

o In LU 29, the ADU Low Oil (DP 2C) was not displayed in the Status Display at the MPS unless the DP was in the alarm condition in IT1.2.

o CD-2 command testing (IT2.2) was limited to the offline channel to minimize impact on ATC operations. Total Reset of the CD-2 could not be performed.

o During the course of integration testing (Performance Alarm Testing, IT4.2), numerous priority messages from Middleton Island appeared to affect response times at the MPS. Also, a Guardian operating system error was reported at the MPS.

o When the RMS sends a Scheduled Poll Request, there was a chance for lost messages because queued messages were not transmitted until a Scheduled Poll was sent from the MPS (IT1.5).

o The Local PC was used in IT1.5 because an MDT was not available.

o When the RMS was under LOCAL control, alarm data was not available at the MPS during IT1.3 and IT1.5.

3.5.2 Recommendations.

o Investigate the inability to send IMCS status requests to the Automatic Switching Unit, LU 2A.

o ADU Low Oil (DP 2C) status should be displayed.

o A complete integration test of the CD-2 should be performed.

o Further investigation of the polling of multiple RMSs (i.e. Middleton Island, Deadhorse, AK, etc.) is required.

o Establish an ongoing data collection program to monitor Guardian Operating System problems and anomalies. With sufficient data specific problems can be further investigated.

o Re-conduct IT1.5 when MDT is available.

o Make alarm data available at the MPS in accordance with NAS requirement.

o Investigate the chance for loss of queued messages during RMS recovery after a reset command.

APPENDIX A

ATCBI-5 Integration Test Results Matrix

ATCBI-5 Integration Test Results Matrix

This table provides a classification of the test results for the requirements specified in the Verification Requirements Traceability Matrix (VRTM) Appendix A of the ATCBI-5 RMS Integration Test Plan. The requirements for this table were extracted from NAS-SS-1000, Volume I Appendix III and Volume V (reference document 1.3.d). Each test requirement is classified as one of the following:

a. P - Met the requirement
b. NI - Not Implemented
c. U - Untested
d. F - Failed
e. NP - Prerequisites not available, untested

APPENDIX A: ATCBI-5 RMS INTEGRATION TEST RESULTS MATRIX

Reference Documents/ Paragraph # NAS-SS-1000 Vol I Appx III	Requirement Description	Test Procedures	Ver. Method	Results	Test Report Comments
30.1.1.1	Provide for the monitoring of designated subsystems performance parameters.	IT1.2	D/A	F	2.1.2.2, 2.2.2.2.1
30.1.1.2	Provide subsystem operating status data including configuration and mode of operation.	IT1.2	D/A	F	2.1.2.2
30.1.1.3	Provide subsystem status reports that contain only state changes and alarms/ alerts in response to a subsystem status request.	IT1.3 IT2.2	D/A	F	2.1.3.2, 2.2.2.2.2
30.1.1.4	Automatically provide for the accumulation of current subsystem status and performance data in a local data file.		D/A	P	
30.1.1.5	Provide subsystem data in response to requests from RMMS subsystems.		D/A	P	

APPENDIX A: ATCBI-5 RMS INTEGRATION TEST RESULTS MATRIX

Reference Documents/ Paragraph # NAS-SS-1000 Vol I Appx III	Requirement Description	Test Procedures	Ver. Method	Results	Test Report Comments
30.1.1.6	Provide an alarm when any designated NAS subsystem monitored parameter is out of tolerance.	IT2.1 IT3.3	D/A	P	2.2.1.2.2 2.3.3.2
30.1.1.7	Provide an alarm when smoke, fire or physical intrusion into a subsystem facility has occurred.		D/A	P	
30.1.1.8	Provide an alarm when the electrical power or HVAC monitored parameters are out of tolerance at unmanned facilities.	IT2.1	D/A	F	2.2.1.2.2
30.1.1.9	Provide a Return-to-Normal alarm when an initial alarm condition is cleared.	IT1.3 IT2.1	D/A	F	2.1.3.2, 2.2.1.2.2
30.1.1.10	Provide an alert when selected subsystem parameters are outside a predetermined range.		D/A	P	

APPENDIX A: ATCBI-5 RMS INTEGRATION TEST RESULTS MATRIX

Reference Documents/ Paragraph # NAS-SS-1000 Vol I Appx III	Requirement Description	Test Procedures	Ver. Method	Results	Test Report Comments
30.1.1.11	Provide the capability to set or change ranges for subsystem alarm or alert parameters.		D/A	F	
30.1.1.12	Provide for the disabling of a subsystem alarm or alert by a specialist on-site.		D/A	P	
30.1.1.13	Report the disabling of a subsystem alarm or alert as performance data.		D/A	P	
30.1.1.14	Provide subsystem certification data in response to a certification exercise.	IT4.5	D/A	NI	2.4.4.2
30.1.1.15	Provide subsystem diagnostic data in response to a diagnostic test.	IT4.5	D/A	NI	2.4.4.2
30.1.1.16	Provide for the monitoring of electrical power and HVAC systems in unmanned subsystem facilities.	IT2.1	D/A	F	2.2.1.2.1

APPENDIX A: ATCBI-5 RMS INTEGRATION TEST RESULTS MATRIX

Reference Documents/ Paragraph # NAS-SS-1000 Vol I Appx III	Requirement Description	Test Procedures	Ver. Method	Results	Test Report Comments
30.1.1.17	Provide for the monitoring of smoke, fire, physical intrusion or any other site hazard in unmanned subsystem facilities.		D/A	P	
30.1.1.18	Provide for the control to change the current operating mode of a subsystem to any other proper operating of a subsystem including on/off.	IT2.1 IT3.4	D/A	F	2.2.2.2.3 2.3.4.2
30.1.1.19	Provide the capability to adjust selected subsystem parameters.		D/A	P	
30.1.1.20	Provide the capability to reset a subsystem.		D/A	P	
30.1.1.21	Provide for the initiation of subsystem diagnostic tests for the purpose of fault isolation.	IT4.5	D/A	NI	2.4.4.2
30.1.1.22	Provide for the initiation of subsystem certification exercises.	IT4.5	D/A	NI	2.4.4.2

APPENDIX A: ATCBI-5 RMS INTEGRATION TEST RESULTS MATRIX

Reference Documents/ Paragraph # NAS-SS-1000 Vol I Appx III	Requirement Description	Test Procedures	Ver. Method	Results	Test Report Comments
30.1.1.23	Provide for the control of the electrical power and HVAC system in unmanned facilities.		D/A	P	
30.1.1.24	Provide for specialist access to the RMMS network through a maintenance data terminal with proper authorization.	IT1.5	D/A	NI	2.1.5.2
30.1.1.25	Provide the capability for local input and display of data, and commands to a subsystem via the maintenance data terminal.	IT1.5	D/A	F	2.1.5.2
30.1.1.26	Provide the specialist the capability to obtain exclusive control of a subsystem while on-site.		D/A	P	

Reference Documents/ Paragraph # NAS-SS-1000 Vol V	Requirement Description	Test Procedures	Ver. Method	Results	Test Report Comments
3.2.1.1.2.2.2	Failure of RMMS subsystems or equipment shall not cause the loss or degradation of operational services.		T/A	P	
3.2.1.1.2.2.5	Collect monitored parameter data for a single report and provide an indication to the MPS within an average time of 2 minutes and a maximum time of 10 minutes.		T/A	P	
3.2.1.1.2.2.6	The RMMS shall execute control commands within an average time of 5 seconds and a maximum time of 15 seconds.		T/A	P	
3.2.1.1.2.2.7	The RMMS shall provide acknowledgement of a valid command within an average time of 15 seconds and a maximum time of 75 seconds.		T/A	P	
3.2.1.1.2.2.8	The RMMS shall provide a priority scheme for collection of alarms and state change to satisfy site-adaptive time requirements.		T/A	P	

APPENDIX A: ATCBI-5 RMS INTEGRATION TEST RESULTS MATRIX

Reference Documents/ Paragraph # NAS-SS-1000 Vol V	Requirement Description	Test Procedures	Ver. Method	Results	Test Report Comments
3.2.1.1.2.2.4	Detect an alarm/alert condition and provide an indication to the MPS within an average time of 10 seconds and a maximum time of 60 seconds.	IT4.2	T/A	F	2.4.2.2
3.2.1.1.2.2.4	Detect a change of state and provide an indication to the MPS within an average time of 10 seconds and a maximum time of 60 seconds.	IT4.2	T/A	F	2.4.2.2
3.2.1.1.4.2.3	Collect diagnostic data for a single report and provide an indication to the MPS within an average time of 50 seconds and a maximum time of 4 minutes.	IT4.5	T/A	NI	2.4.4.2
3.2.1.1.4.2.3	Collect certification data for a single report and provide an indication to the MPS within an average time of 50 seconds and a maximum time of 4 minutes.	IT4.5	T/A	NI	2.4.4.2

Reference Documents/ Paragraph # NAS-SS-1000 Vol V	Requirement Description	Test Procedures	Ver. Method	Results	Test Report Comments
3.2.1.1.4.2.6	Provide for the transfer of messages of up to 4000 characters within an average time of 50 seconds and a maximum time of 100 seconds.		T/A	U	
3.2.1.1.4.2.7	Provide positive indication of status for all subsystem operating modes.		T/A	P	
3.2.1.1.4.2.8	Transfer messages to the MPS on a priority basis, with priority being status message, message data, and performance data.		T/A	P	