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QUICK LOOK REPORT
for the INTEGRATION PHASE of the
UPGRADE PRECISION RUNWAY MONITOR (PRM)
OPERATIONAL TEST AND EVALUATION (OT&E)

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1. EXECUTIVE SUMMARY.

This Quick Look Report (QLR) provides a preliminary assessment of the Integration Test phase of the Upgrade PRM Operational Test and Evaluation (OT&E) program.

Analysis of the PRM Performance Verification, PRM/ARTS-IIIA, and ATCBI Interference test results shows that there are 3 major deficiencies (2 of which have been addressed in the AT OT&E QLR), and 14 minor deficiencies.

2. PURPOSE.

The purpose of this report is to provide an early assessment of the OT&E Integration Tests in respect to the OT&E requirements for the Upgrade PRM System.

3. SCOPE.

This document is limited to providing a preliminary summary of the Integration Phase of the Upgrade PRM OT&E Test Program. It is not the intention of this report to document the detailed analysis performed.

This report does provide a proposed solution for every deficiency. The proposed solution presents the optimal engineering solution, which may or may not be practical to implement due to cost and schedule constraints.

The final OT&E Integration test report will include details of the testing performed and will also provide updated recommendations. Solutions to deficiencies implemented at the time of the final report will be noted, along with the results of any subsequent OT&E testing.

A separate report will provide a history of the Development Test and Evaluation (DT&E) Test Program. The DT&E Test Program included Phase 3, Phase 4 and ECPI Test Phases. Included in this report will be a chronological history of each test along with a matrix of all Verification Discrepancy reports (VDRs), which served as the primary means of problem tracking throughout the DT&E Test Program. Summaries will be given for each major subsystem highlighting the critical tests and results.

4. BACKGROUND.

The Upgrade PRM OT&E test effort is being conducted in three separate phases; Integration, Air Traffic (AT) Operational, and Airway Facilities (AF) Operational. This report documents the Integration phase. This test phase has three subtests. They are;

- a. PRM Performance Verification,
- b. PRM/ARTS-IIIA Interface Tests, and
- c. ATCBI Interference Tests.

5. TEST DESCRIPTION.

The following sections provide an overview of the testing methodology employed to perform the OT&E Integration Tests. Further details can be found in Section 6. of the Upgrade PRM OT&E Test Procedures.

5.1 Description of the PRM Performance Verification.

The PRM Performance Verification is an evaluation of Upgrade PRM's functional performance in respect to the OT&E Performance requirements as listed in the VRTM. Note that many of these requirements are also tested during the OT&E Operational Tests to verify their suitability and effectiveness.

PRM Performance Verification portion of the Integration phase consisted of an evaluation of the Upgrade PRM DT&E Test Program. This evaluation consisted of:

- a. A review of the Program Requirements Document (PRD), including the Quality Verification Matrix (QVM). The QVM dictated in which DT&E test phase each requirement was to be tested.
- b. A review of the Engineering Change Proposal 1 (ECP1) Statement of Work (SOW). A separate QVM was derived from this SOW to aid in the testing of ECP1.
- c. Classifying each PRD or ECP1 requirement as PRM Performance Verification pertinent or impertinent.
- d. Assigning each pertinent requirement to OT&E Performance Objective A through F and then completing the matrix in Section 6.1.1.9, Step 2 of the Test Procedures.

e. Reviewing each pertinent requirement along with the associated test documentation. This analysis used the Success Criteria in Section 6.1.1.10 of the OT&E Test Procedures as the basis for determining success or failure. The test documentation which aided in determining the Pass/Fail of each Success Criteria were:

1. The selected Phase 3 Test Procedure(s) and Test Result(s).
 2. The selected Phase 4 Test Procedure(s) and Test Result(s).
 3. The selected ECPI Test Procedure(s) and Test Result(s).
 4. Waivers written during the Phase 3, Phase 4 and ECPI Test Program.
 5. Verification Discrepancy Reports (VDRs) written against the PRD and ECPI requirement(s).
- f. Developing a matrix of deficiencies.
- g. Reviewing the matrix with the Test Director and test team to classify the level of deficiency.
- h. Completing the Data Logs included in Section 6.1.1.10 of the Test Procedures.
- i. Completing the Data Log included in Section 6.1.1.9, Step 3 of the Test Procedures.
- j. Developing this Quick-look report to summarize the results.

5.2 Description of the PRM/ARTS-IIIA Interface Tests.

The PRM/ARTS-IIIA Interface Tests were divided into 2 sections. The first section was a review of the DT&E Test Program. This review closely followed the steps described in Section 5.1, above.

The second section of the PRM/ARTS-IIIA Interface Tests was an operational test of the PRM/ARTS-IIIA Interface. This testing examined the effect of several ARTS Interface events and the subsequent effect on the ARTS IIIA system.

5.3 Description of the ATCBI Interference Tests.

The ATCBI Interference Test determined whether the PRM had an operational effect on the performance of the RDU ATCBI-4 radar system. This testing was divided into 2 configurations, normal and degraded modes. The normal mode used the PRM in a fully operational state. The degraded mode used the PRM when the PRM's Mode 0 Phase Shifter was disabled. In both cases, unusual events were logged by the test conductors. Also, the DRAM program was used to determine if the PRM had an affect on the false target rate for the RDU ATCBI-4 and the number of fruit rejects as reported by the ASR-9 was checked.

6. TEST RESULTS.

This section provides a summary of each deficiency determined through analysis of the results collected during each OT&E Integration test.

Deficiencies are categorized as Major, Moderate, and Minor. A description of each level of deficiency follows:

Major deficiency- is a deficiency that by itself, or in combination with other factors, may preclude a deployment recommendation.

Moderate deficiency- is a deficiency that results in increased life-cycle costs or provides unsatisfactory performance. Deficiencies labeled as moderate can be worked around and eventually fixed. Moderate deficiencies should not, by themselves, prevent deployment.

Minor deficiency- is a deficiency that results in undesirable performance that is inconveniencing but does not significantly affect mission effectiveness or life-cycle costs.

Table 6-1 provides a matrix of each Upgrade PRM OT&E Integration Test deficiency with supporting information.

TABLE 6-1 PRM INTEGRATION OT&E DEFICIENCY MATRIX

#	DESCRIPTION	DEFICIENCY CLASS	PROPOSED SOLUTION
1	<p>*** This issue has been previously raised in the AT OT&E QL Report***</p> <p>Antenna Accuracy degrades in icing conditions-</p> <p>The Antenna fails in icing conditions.</p> <p>Related to: PRM Performance, Objective B, Requirement 6 Waiver(s):PRM-6/92-017, PRM-3/93-043 VDR(s):P4-108</p>	MAJOR	<ol style="list-style-type: none"> 1. Modify the critical fault response of system. 2. Add an icing sensor to inform controllers of possible degraded accuracy. 3. Add 6 more parrots to monitor each antenna octant. 4. Protect the dipole columns from the weather.
2	<p>*** This issue has been previously raised in the AT OT&E QL Report***</p> <p>Monitor Strip failures in heavy rain-</p> <p>Water on the outside of the Monitor Strip Boots can cause the Monitor Strip to fail. This has occurred in heavy rain and wind conditions.</p> <p>Related to: PRM Performance, Objective C, Requirement 60. Waiver(s): PRM-6/92-017, PRM-3/93-042 VDR(s): P4-72</p>	MAJOR	<ol style="list-style-type: none"> 1. Protect the monitor strips from the weather. 2. Modify the monitor strip fault detection algorithm to eliminate false failures.
3	<p>*** This issue has been previously raised in the AT OT&E QL Report***</p> <p>UPS Status reporting-</p> <p>Status reported by the UPS is "or"ed together. This does not permit the distinction between an UPS failure or commercial power "glitches".</p> <p>Related to: PRM Performance, Objective C, Requirement 60. VDR(s): P4-43</p>	MODERATE	<ol style="list-style-type: none"> 1. Modify the UPS status lines to allow for additional status information.
4	<p>Effect of multipath on Range and Azimuth Accuracy-</p> <p>Range and Azimuth Accuracy of the system shows a sensitivity to multipath at ranges within 10 NM. In several cases, the range accuracy measured is above the specification limits.</p> <p>Related to: PRM Performance, Objective B, Requirement 6. Waiver(s): PRM-06/93-047</p>	MINOR	<ol style="list-style-type: none"> 1. Approve Waiver.

5	<p>Target Splits-</p> <p>There are two operational situations where it is possible for a tracked target to "split" on the PRM display. They include:</p> <ol style="list-style-type: none"> 1. rapid maneuvers. 2. the area of the Zenith Cone (30 to 45 degree elevation angles). <p>Related to: PRM Performance, Objective E, Requirement 33. Waiver(s): PRM-3/93-045 VDR(s): P4-67, 78, 89</p>	MINOR	<ol style="list-style-type: none"> 1. Modify the alpha-beta tracker. 2. Implement Automatic Gain Control to adjust the STC based on the amplitude of the previous reply. 3. Employ a Zenith Cone filter to discard replies above a defined elevation angle.
6	<p>Non-Mode C pop-ins-</p> <p>When Mode C targets which are above the defined altitude filter fail to respond to Mode C interrogations, these targets are tracked and appear on the controller displays for one or more updates.</p> <p>Related to: PRM Performance, Objective E, Requirement 33.</p>	MINOR	<ol style="list-style-type: none"> 1. Track all targets above the PRM altitude filter at a 5 second update rate. This would allow the altitude of a target to be coasted when a Mode C reply is missed.
7	<p>Coast Drops on final approach-</p> <p>Target of Opportunity testing has recorded several tracks that Coast Dropped on final approach. This is caused by rapid maneuvers, shielding of transponders antenna, and poor transponders.</p> <p>Related to: PRM Performance, Objective A, Requirement 3.</p>	MINOR	<ol style="list-style-type: none"> 1. Implement Automatic Gain Control to adjust the STC based on the amplitude of the previous reply. Approximately 20% of replies will benefit.
8	<p>96.7% of on-line critical failures are detected-</p> <p>The calculated system fault detection capability is 96.7%, below the required 90% of on-line critical failures.</p> <p>The C&PM test program philosophy was to test one on-line failure for each System Performance parameter and each LRU not directly related to a System Performance parameter. This is not a complete test of every fault condition. However, the history of the DT&E test program shows that undetected failures is not a significant problem.</p> <p>Related to: PRM Performance, Objective C, Requirement 60. Waiver(s): PRM-6/92-024</p>	MINOR	<ol style="list-style-type: none"> 1. Approve waiver.
9	<p>Fault Isolation to more than 3 LRUs-</p> <p>In 14 cases, more than 3 LRUs appear on the fault isolation list. The number of LRUs range from 4 to 7.</p> <p>Related to: PRM Performance, Objective C, Requirement 60. Waiver(s): PRM-6/92-019C</p>	MINOR	<ol style="list-style-type: none"> 1. Ensure thru AF DT&E that technicians are trained to handle these cases.

10	<p>Parrot failures-</p> <p>Parrots are prone to failures due to multipath or interfering aircraft replies. In particular, the parrot located off of runway 23-Right has proven susceptible to taxiing aircraft.</p> <p>Related to: PRM Performance, Objective C, Requirement 60. VDR(s): P4-48, P4-101</p>	MINOR	1. Ensure through AF OT&E that technicians are trained to handle this event.
11	<p>Playback has been removed from the system-</p> <p>The ability to recreate operational events on the controllers display has been eliminated due to inconsistent operation, difficulty of use and many VDRs.</p> <p>Related to: PRM Performance, Objective F, Requirement 19. Waiver(s): None, Removed by ECP1 direction. VDR(s): P3-48, 78, 84, 104; P4-17, 21, 33, 42, 44, 71, 77</p>	MINOR	1. Redesign/modify Playback.
12	<p>The ATC Printer loses its setup configuration.</p> <p>The ATC Printer often loses its setup configuration due to inadvertent touching the soft-touch keys and when cycling the power up and down.</p> <p>Related to: PRM Performance, Objective F, Requirement 19. VDR(s): P3-89, 94; P4-95</p>	MINOR	<ol style="list-style-type: none"> 1. Ensure thru AT and AF OT&E that technicians and controller supervisors are provided with sufficient documentation. 2. Protect the soft-touch keys.
13	<p>Less than 10 hours of Tape Capacity-</p> <p>Under test conditions, two 9-track tapes can record 7 hours of PRM operations. This is despite using extra length tapes and eliminating Graphics Processor 3 and 4 from the recording process.</p> <p>Related to: PRM Performance, Objective F, Requirement 19. Waiver(s): PRM-9/92-025A</p>	MINOR	1. Approve waiver.
14	<p>CENRAPs cause ARTS I/F critical failure-</p> <p>When the RDU ARTS IIIA switches to Washington Center radar data, the PRM ARTS I/F units fail and cannot be cleared until after normal operations are resumed.</p> <p>Related to: PRM/ARTS Interface, Objective A, Requirement 17.</p>	MINOR	1. Investigate why this occurs and determine resolution.
15	<p>Only one ARTS I/F unit is operational-</p> <p>The minimum configuration of the PRM system requires 2 ARTS I/F units. Currently, any one ARTS I/F is available for use. In order to switch to the standby ARTS I/F, cables have to be rerouted and reconnected.</p> <p>Related to: PRM/ARTS Interface, Objective A, Requirement 17.</p>	MAJOR	<ol style="list-style-type: none"> 1. Ensure that 2 ARTS MDBMs are available for PRM use. 2. Design an alternate automatic switching scheme for the 2 PRM ARTS I/F units. 3. Design a manual switching scheme for the 2 PRM ARTS I/F units.

16	<p>ARTS I/F critical failures-</p> <p>Any disruption of ARTS data to the ARTS I/F unit(s) greater than 30 seconds causes the ARTS I/F unit(s) to fail. To correct this failure, both ARTS data and a manual reset of the ARTS I/F unit(s) are required.</p> <p>An ARTS I/F critical failure terminates the update of all ARTS information for any targets on the controllers display. If the ARTS IIIA then modifies any ARTS information for a target in PRM coverage, that target would have outdated information in it's data block.</p> <p>Related to: PRM/ARTS Interface, Objective A, Requirement 38. VDR(s): P4-1, 90</p>	MINOR	1. Modify PRM software.
17	<p>Phantom ARTS tag information after an ARTS I/F failure-</p> <p>After the ARTS I/F unit(s) become non-operational, it has been observed that outdated/incorrect ARTS Tag information can become correlated with new PRM tracks.</p> <p>Related to: PRM/ARTS Interface, Objective A, Requirement 38. VDR(s): P4-90</p>	MINOR	1. Modify PRM software.
18	<p>Non-discrete targets can have ARTS tags-</p> <p>Discrete code tracks which change to Non-discrete code tracks retain the old ARTS Tag information. This information cannot be modified or deleted.</p> <p>Related to: PRM/ARTS Interface, Objective A, Requirement 38. Waiver(s): PRM-3/93-044 VDR(s): P4-83</p>	MINOR	1. Modify PRM software.

6.2 FURTHER TESTING.

Further testing for this test effort should be limited to retesting any modifications made to the PRM/NAS system in addressing OT&E deficiencies.

7. CONCLUSIONS.

The OT&E Integration test effort has determined 1 new Major Deficiency besides those encountered in the previously conducted AT OT&E testing.

This test effort highlights 14 Minor Deficiencies. All of these Minor Deficiencies should be evaluated against the limited production PRM design and corrective action taken for those Deficiencies that apply.

8. RECOMMENDATIONS.

The Secondary Surveillance Division, ACW-100, recommends that the 3 major deficiencies be corrected, or have a corrective action plan in place, prior to the deployment of the Upgrade PRM system.

APPENDIX A. ACRONYMS

AF	Airways Facilities
ARTS	Automated Radar Terminal System
AT	Air Traffic
ATCBI	Air Traffic Control Beacon Interrogator
C&PM	Confidence and Performance Monitor
DOT	Department of Transportation
DT&E	Development Test and Evaluation
ECP1	Engineering Change Proposal #1
FAA	Federal Aviation Administration
GP	(PRM) Graphics Processor
I/F	Interface
LRU	Lowest Replaceable Unit
MDBM	Multiplex Data Buffer Memory
NAS	National Airspace System
OT&E	Operational Test and Evaluation
PRD	Program Requirements Document
PRM	Precision Runway Monitor
PSD	PRM Status Display
QLR	Quick Look Report
QVM	Quality Verification Matrix
RDU	Raleigh-Durham International Airport
SOW	Statement of Work
UPS	Uninterruptable Power Source
VDR	Verification Discrepancy Report
VRTM	Verification Requirements Traceability Matrix