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**AWIPS Migration
Delivery Test Plan
for
Task Order 11 (TO11)**

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**National Weather Service
Office of Science and Technology
Systems Engineering Center**

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Table of Contents

1. OVERVIEW	3
2. ASSUMPTIONS.....	5
3. TEST METHODOLOGY.....	6
4. DELIVERY ACCEPTANCE.....	13
5. PROBLEM REPORTING, ESCALATION, AND ISSUE RESOLUTION.....	15
6. TEST TEAM AND ENVIRONMENT/CONCEPT OF OPERATIONS.....	16
7. TO11 DELIVERY TESTING RESOURCE NEEDS	16
8. SCHEDULE	17
9. TESTING CATEGORIES.....	20
APPENDIX A -- BASIS OF ESTIMATE OF RESOURCE NEEDS.....	23
DIAGRAM 1 – TESTING FLOW CHART	24

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AWIPS Migration Task Order 11 (TO11) Delivery Test Plan

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1. Overview

1.1 Objectives

AWIPS Migration Task Order 11 (TO11) is scheduled to include software that is functionally equivalent to AWIPS-I, excepting any mutually agreed upon variances. For this reason, it is critical that the review and acceptance of TO11 verifies the functionality, stability, and performance of the software.

This document contains a detailed description of the assumptions, test environments & locations, test specifics, required resources, schedule, and participants & roles as they each relate to the TO11 delivery. This document does NOT provide all details of all testing planned for TO11. For fine scale details, please review the supporting documents listed below and found at the AWIPS Evolution Test website (<http://www.nws.noaa.gov/ost/SEC/AE/Testing.htm>):

- TO11D#_IV&V_Test_Plan.doc (Where # = 1-6, representing each TO11 slice)
- UFE Plan_ver1bb.pdf
- Local Apps and Side-by-Side AWIPS Configuration.doc
- Operational Test & Evaluation (OT&E) Plan

1.2 Test Validation Techniques

The success of TO11 and its associated testing relies on COMPLETE and THOROUGH test procedures. In an effort to ensure this, the NWS will use several different methods, each described in this section.

1.2.1 MDM

The Master Deliverables Matrix (MDM) represents the best effort thus far to create a listing of the contents of AWIPS. It will be one of the main tools the NWS will use to determine if the Task Order is on schedule.

The MDM contains a menu map and functional map of AWIPS, linked to existing test cases/procedures and delivery dates. By linking these data, one can tell which AWIPS items have test coverage, when each AWIPS item will be delivered, and which test cases need to be executed with each TO11 delivery. Thus, the MDM will steer the testing for multiple test efforts as TO11 (and beyond) are delivered. A high-level depiction of the MDM can be found in Figure 1-1.

Comment [JEC1]: Make sure all are eventually posted there.

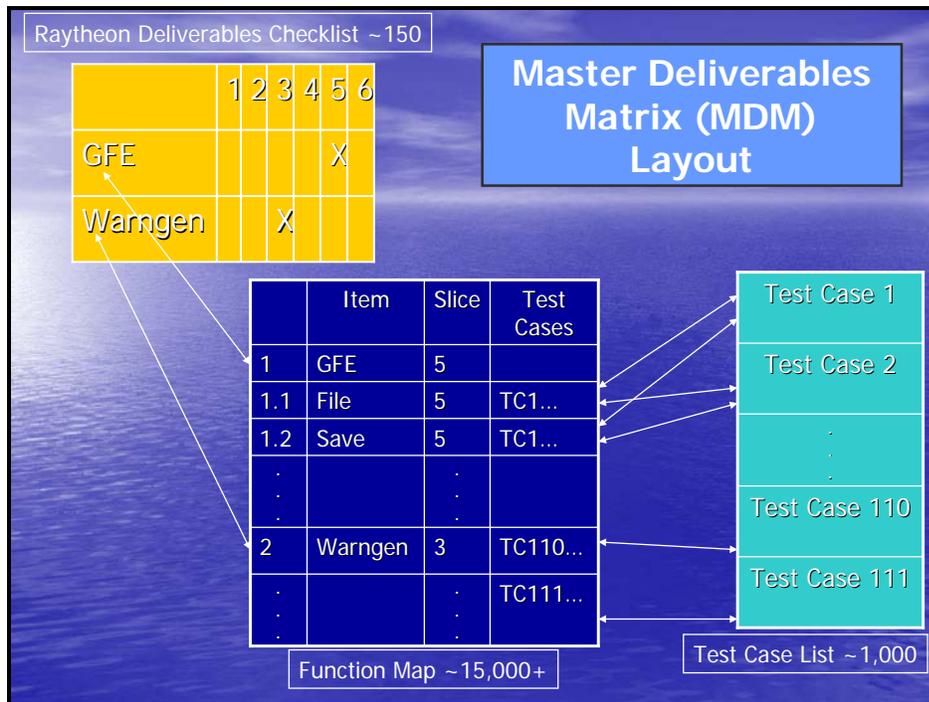


Figure 1-1. MDM Overview

1.2.2 Other Test Validation Techniques

This test plan also employs other test methods such as side-by-side testing, use cases and scenarios, and ad-hoc testing. Each of these is discussed in detail in Section 3.

All test validation techniques aim to satisfy the high-level requirements for TO11 Delivery. These requirements include (but are not limited to) the following:

- The TO11 software shall be functionally equivalent to AWIPS Build **OB9.3**, excepting any mutually agreed upon variances.
- The performance of the TO11 software shall meet or exceed the performance of AWIPS Build **OB9.3**.
- The TO11 software must meet all Operational Test & Evaluation (OT&E) entrance requirements no later than 11/30/09.
- There shall be no critical defects in the TO11 software upon entering OT&E.
- There shall be less than 100 overall defects in the TO11 software upon entering OT&E.

Comment [JEC2]: Correct?

Comment [JEC3]: Correct?

<2009 Annual Operating Plan Milestones – EdM?>
<Is C&A in scope for this document?>

2. Assumptions

The following are assumptions that were made when creating this test plan. If any of these assumptions prove to be false then this test plan may need to be modified in part or in whole. Furthermore, if multiple and/or significant assumptions prove to be false, early failure of the OT&E Entrance Criteria is an option.

- 1) This document will be treated as the government's Statement of Objectives, for Raytheon's TO11 proposal. Raytheon and the government will negotiate and agree upon the details of this document, prior to delivery of Raytheon's TO11 proposal and it (this document) will be incorporated into Raytheon's TO11 proposal, by reference.
- 2) The system installation and configuration will be representative of how Raytheon proposes the system will be deployed to the field. This includes demonstration of any proposed methods of parallel, concurrent, or complete replacement (with rollback) capabilities.
- 3) All end-to-end network capabilities associated with the AWIPS Migration software are expected to be in place and tested as specified in the Test Categories section(s), including GFE intersite coordination (ISC), product receipt, product issuance and dissemination, IFPS Service Backup, and NDFD grid submission.
- 4) The scope of the TO11 testing will include work accomplished in all previous AWIPS Migration task orders (TO6, 8, 9 and 10), as well as all functionality contained in OB9.3.
- 5) AWIPS Migration software shall run on RHEL5u2 in TO11.
- 6) TO11 software will be delivered incrementally in vertical slices of complete functionality (e.g. "slices") that allow for earlier testing of completed functionality.
- 7) The installation procedures for each slice shall be well documented.
- 8) Each slice will be delivered along with the entire TO11 software package.
- 9) The functionality delivered in each slice will be sufficiently identified by supporting documentation from Raytheon.
- 10) Each slice will represent complete "ready for operations" functionality of a portion of TO11 (e.g., GFE, AvnFPS, Service Backup, etc.).
- 11) Each slice will be tested by Raytheon/Silver Spring using SWIT-style test procedures, supplemented by additional test procedures that are deemed necessary to demonstrate the functionality contained in the slice.
- 12) Raytheon will be responsible for creating test cases to sufficiently test any portions of AWIPS not currently covered by test cases (i.e., "gaps").
- 13) Automated test tools, in particular for GFE, shall be used in an effort to decrease testing time and increase testing reliability and will be critical for effective and practical regression testing.
- 14) Problems discovered will be categorized per the operational view of the problem (see description in appendix <TBD>) and each will be documented as a government Trouble Ticket Report (TTR). All problems categorized as critical operational TTRs by the government must be resolved prior to entry into OT&E. See TTR Review Team (TTRT) charter and membership in appendix <TBD>

Comment [JEC4]: Correct?

Comment [JEC5]: Contingent upon Raytheon's proposal.

- 15) Critical missing or incomplete functionality identified during TO11 Delivery Testing (DT), will be treated as critical TTRs.
- 16) All variances will be documented as TTRs and will be classified and prioritized in the same way as other TTRs. Variances are also voted upon by the SREC and classified as “acceptable” or “unacceptable.” Any unacceptable operationally critical variances identified will be resolved prior to Final Delivery. The process for resolution of variances is documented in appendix <TBD>.
- 17) Many of the Government Subject Matter Experts will be field forecasters that have been brought in on previous Forecaster Initial Testing (FIT) efforts, which is part of the government’s overall AWIPS Migration Independent Verification and Validation (IV&V) testing effort.
- 18) All OT&E Entrance Criteria will be clear and measurable.
- 19) The OT&E Entrance Criteria will be met or exceeded no later than the OT&E Readiness Review.
- 20) After successfully completing TO11 Delivery Testing (DT), the AWIPS Migration software will be ready for the OT&E Readiness Review.
- 21) The AWIPS Migration software remains in the development phase of its life cycle until it has entered OT&E and the first OT&E site has successfully installed, tested, and transferred operations to the new software. As soon as that point has been reached, the AWIPS Migration software will be considered operational.
- 22) Operational AWIPS Migration software shall be fully supported 24/7, including tier 3 support.
- 23) It is expected that Raytheon will develop and deliver the test cases described in section 9 of this document. As many as possible should be automated to support regression testing as we proceed through the slices.
- 24) Sufficient time must be provided for government review of each slice’s test cases and updated Raytheon Deliverables Checklist, prior to delivery of each slice. At least one week is expected to facilitate the creation of the IV&V Test Plan in a timely manner.
- 25) All or nearly all functional tests will need to be compared directly to corresponding AWIPS I functions as verification unless variances are deemed acceptable.

3. Test Methodology

3.1 Overview

Testing of the TO11 software will occur in a fashion that is similar to existing test methodologies used in AWIPS-I. However there are some key differences due to the unique “vertical slices of complete functionality” delivery method of TO11.

Raytheon will deliver six slices during the TO11 development phase. Each vertical slice will contain complete functionality for a portion of AWIPS-I software. For example,

AvnFPS may be considered as part of a vertical slice. As each slice is delivered by Raytheon/Omaha, it will undergo the following test phases:

- Installation and SWIT testing at Raytheon/Silver Spring (ASM)
- IV&V Testing
- User Functional Evaluation (UFE)

See Figure 3-1 for a depiction of the slice delivery test method.

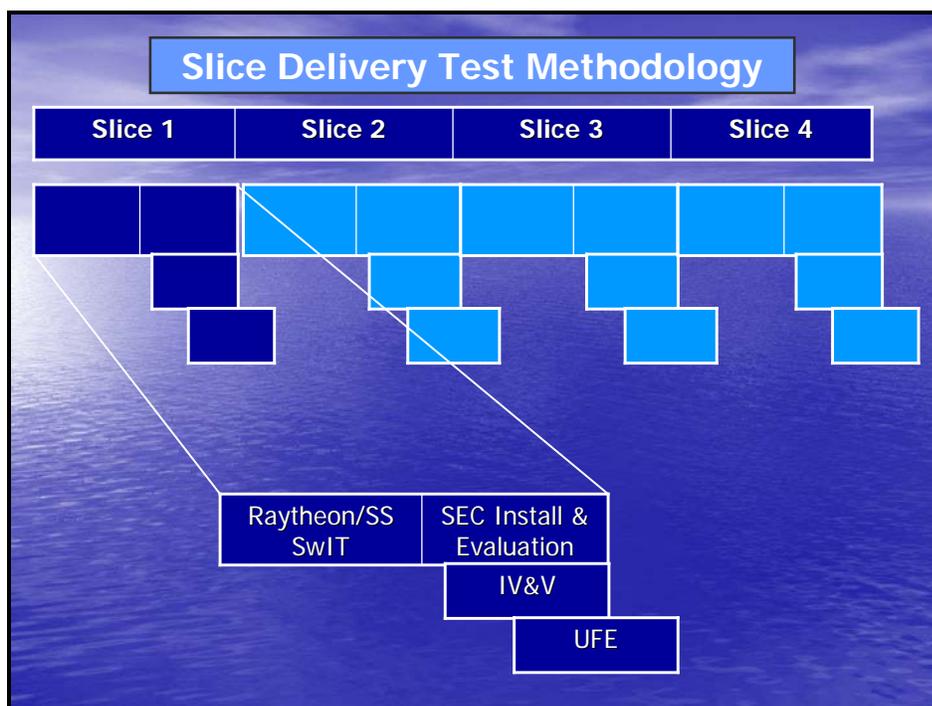


Fig. 3-1 Slice Delivery Test Process

The MDM will show which test cases should be executed as each slice is delivered by Raytheon. The government expects that Raytheon will have executed the test cases identified by the MDM as well as any new/modified test cases that cover the “orphaned” functionality in the MDM for the delivered slice. It is expected that Raytheon will perform these tests, in Omaha and/or Silver Spring before the slice is delivered to the government.

The government will have the option to have one or more Subject Matter Experts (SMEs) and/or one witness present for each SWIT test at Raytheon/Silver Spring.

During SWIT, IV&V, and UFE, TTRs/DRs will be written on any defects or variances found in the software. See Figure 3-2 for a depiction of this process. The government and Raytheon shall hold meetings or conference calls no less than once per week to discuss and categorize the new TTRs. Raytheon will address Critical or High Priority TTRs more quickly than other TTRs.

Prior to the OT&E Readiness Review, a 20 working day SIT test will take place. During this test period, the AWIPS Migration software used for the SIT shall be frozen in order to ensure reliable testing and to allow for overall performance testing. There will be an opportunity for delivery of DR fixes after the SIT period, followed by a 7 working day DR/Regression Test period.

The OT&E Readiness Review will then take place in order to determine if the TO11 software has met the OT&E Entrance Criteria. If the TO11 software passes this review, it will be made available to the OT&E sites for installation and testing.

During the TO11 development and test period, four Key Decision Points (KDP) will take place. If at any of those KDPs it is apparent that it will be impossible to pass the OT&E Readiness Review, a decision will be made by the government to reject the TO11 delivery (i.e., AWIPS Migration software deployment will be delayed).

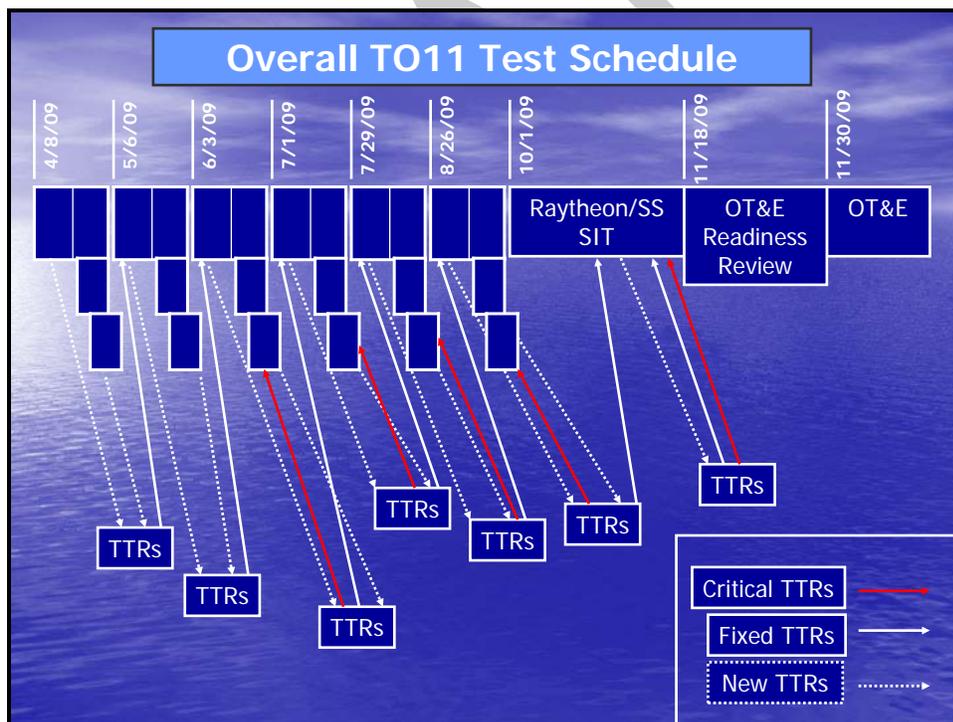


Fig. 3-2 TO11 Test Methodology

Details of each phase of TO11 testing can be found in sections 3.2 through 3.4.

3.2 **SWIT Testing**

3.2.1 Entrance Criteria

TO11 slices contain COMPLETE functionality for a “vertical slice” of AWIPS (e.g., AvnFPS, AWIPS communication infrastructure, Service Backup). The vertical slice shall be delivered with documentation sufficient enough to completely describe the contents of the slice. The vertical slice shall also be delivered with complete and reliable installation instructions.

3.2.2 Test Procedures/Contents

Raytheon/Silver Spring (ASM) will be responsible for performing SWIT tests on all functionality delivered in each slice. The SWIT tests shall be selected such that any test that contains any steps related to the slice shall be executed. This includes SWIT tests that have been executed in previous TO releases (i.e. regression testing).

The MDM will be used to determine which AWIPS functions have been delivered, and thus, need to be tested. It is expected that ALL delivered functionality will be tested by executing this set of test cases.

3.2.3 Test Environment

The testing shall take place at Raytheon/Silver Spring on TBW3, TBW4, and/or TBDW as appropriate for the particular vertical slice. Raytheon and/or ASM personnel will execute the test procedures with government witnesses and Subject Matter Experts (SMEs) present (government option). The Raytheon/Silver Spring testbed for each vertical slice may also be selected based on system availability.

3.2.4 Defect Reporting

The government will have a minimum of one laptop per each testing workstations present during the SWIT testing. The laptops shall have network access, allowing for immediate entry of defects into the TTR database.

3.2.5 Roles and Responsibilities

Raytheon/Omaha will be responsible for delivery of each slice, along with supporting documentation containing a detailed description of the slice contents. Installation instructions shall also be provided with each slice.

Raytheon/Silver Spring shall provide the testbed(s) and test personnel necessary to execute the SWIT tests for each vertical slice.

Comment [JEC6]: It's not clear to me how much interaction the gov't wants to have during this test period. We've done nothing for the first two slices. Do we want to start this effort with slice 3? Slice 4? Or do we want to abandon the SME/witness concept in the interest of allocating resources elsewhere?

SEC shall (optionally) arrange for the presence of one or more SMEs for each SWIT test period. SEC shall also (optionally) arrange for the presence of one or more government witnesses for each SWIT test procedure. The SMEs will observe the SWIT tests and provide expert feedback, analysis, and defect identification. The government witnesses will combine the information received from the SMEs with their own observations, entering any defects into the TTR database.

The government will review the TTRs and assign a level of criticality to each TTR. These reviews will occur no less than 3 times per full workweek.

3.2.6 Schedule

The SWIT testing will take place over a period of 3 working days. Since it is expected that Raytheon/Omaha will deliver a vertical slice every 4 weeks, it follows that SWIT testing will occur every like period.

3.2.7 Exit Criteria

All documentation is complete and accurate. The installation of the slice occurs with no critical errors. All SWIT tests for the vertical slice being tested pass with no critical defects.

3.3 Independent Verification and Validation (IV&V) and User Functional Evaluation (UFE)/Side-By-Side (SxS) Testing

After the vertical slice passes SWIT, SEC will install the software on the NHDA system at NWS Headquarters. Upon successful installation, the software will be posted to the NCLADT website and be made available to all of the IV&V participants, UFE/SxS sites, and other NOAA personnel that wish to test and/or develop with the software.

For further details regarding IV&V, please see the individual IV&V TO11 slice Test Plans. For further details regarding UFE/SxS, please see the Overall UFE Plan.

3.3.1 Entrance Criteria

The vertical slice shall be deemed ready for IV&V if it has successfully passed SWIT Exit Criteria, been successfully installed by SEC on the NHDA system as well as at least one standalone system, and passed a basic ad-hoc checkout.

The vertical slice shall be deemed ready for UFE/SxS 2 weeks after the software is released by Raytheon. The UFE/SxS sites will be able to install the software and test the software after they receive and set up the Standardized Configuration for AWIPS II Testing (SCAT) testbeds.

3.3.2 Test Procedures/Contents

The IV&V Team will perform pre-existing test cases as compiled by the government prior to the start of TO11, supplemented with additional new and/or modified test cases provided by Raytheon with each slice. The IV&V Team will also perform test cases designed to provide performance-based metrics for the AWIPS I and AWIPS II software.

The MDM will be used to determine which AWIPS functions have been delivered, and thus, need to be tested. It is expected that ALL delivered functionality will be tested by executing this set of test cases. The IV&V Test cases will consist of those that are identified by the MDM as well as any relevant regression test cases and any automated test cases. The IV&V Team will also test all TTRs/DRs that Raytheon indicates are resolved by the vertical slice.

The UFE Team will execute Use Cases and Ad-hoc testing. The focus of these tests will be defined by the delivered functionality as defined in the MDM.

3.3.3 Test Environment

The IV&V Team will perform its testing on national headquarters, national centers, and development organization AWIPS platforms. The UFE/SxS Team will perform its testing on Regional and WFO AWIPS systems known as Standardized Configuration for AWIPS II Testing (SCAT) testbeds. The specifications for these SCAT testbeds can be found in “Local Apps and Side-by-Side AWIPS Configuration.doc.”

3.3.4 Defect Reporting

TTR reporting will vary depending on the tester’s location, but in all cases there will be immediate access to the TTR database, allowing for immediate entry of defects. The TTRs will be discussed along with all other TTRs during frequent TTR meetings with Raytheon (see section 3.1).

3.3.5 Roles and Responsibilities

The IV&V Team members are responsible for testing each slice’s contents by running through pre-existing test procedures that will fully test the functionality in each slice. It is expected that this testing will largely duplicate the testing performed by Raytheon during their own acceptance testing and SwIT testing. The IV&V testing will serve to *independently* verify the success of those tests.

The UFE/SxS Team members are responsible for testing each slice’s contents by performing generalized Use Cases and Test Scenarios in an effort to perform the same tasks using multiple (e.g. regional/local) methodologies.

3.3.6 Schedule

All IV&V and UFE/SxS testing will occur for approximately 4 weeks following the SwIT test for each delivered slice. The IV&V and UFE/SxS testing is largely expected

to end after the testing of the final slice, however some assistance may be required when testing the post-SIT delivered DRs/TTRs.

3.3.7 Exit Criteria

Since each TO11 slice is being treated as a new release, the IV&V and UFE/SxS efforts will provide metrics and milestones associated with each slice. Both IV&V and UFE/SxS will provide reports at the conclusion of each slice's test period. These reports will contain clear and specific assessments of TO11 to date. The data contained in these reports will be a major factor in determining if TO11 OT&E will begin on time.

3.4 Local Application Porting & Testing, Site Migration, NCLADT activities

The National Core Local Application Development Team (NCLADT) is comprised of a group of NWS headquarters and field personnel that are working to help define common local application migration techniques to the entire NWS.

<Site Migration details here>

Comment [JEC7]: Detail Raytheon assistance expected.

3.4.1 Entrance Criteria

Sites will be able to begin porting local applications as soon as they receive AWIPS software from Raytheon with sufficient architecture that allows for local application migration. As of this writing, local application porting has already begun with varying levels of success.

3.4.2 Test Procedures/Contents

Not applicable.

3.4.3 Test Environment

Any machine or clustered environment with hardware sufficient enough to run AWIPS II software may be used. In order to minimize hardware incompatibilities, it is suggested that sites use the SCAT hardware mentioned in section 3.3.

3.4.4 Defect Reporting

Defects in the software discovered as a result of NCLADT and Site Migration activities will be defined in TTRs. These include general software defects found during the course of general software usage and missing/incomplete infrastructure components that are needed by the local application developers/users.

3.4.5 Roles and Responsibilities

NCLADT members are responsible for porting some of the most commonly used local applications and GFE “Smart” methods/procedures/tools. NCLADT members are also responsible for reporting defects in the delivered software.

Raytheon is responsible for...

3.4.6 Schedule

Local application migration has already begun and will continue through the start of System OT&E.

Site Migration activities will...

3.4.7 Exit Criteria

All “critical” local applications must be migrated and in working order before the start of the “Site” phase of OT&E. Please refer to the OT&E Plan for specific schedule information.

3.5 External Interface Testing

Several external interfaces have been identified that may be affected by the migration from the AWIPS I software. These are listed below, along with the stakeholder. This test plan does not detail the specifics associated with testing these interfaces. It simply serves as a list of interfaces that must be tested prior to the OT&E Readiness Review.

Comment [JEC8]: Did I miss any?

3.5.1 NMAP – National Centers for Environmental Prediction (NCEP)

3.5.2 NEXRAD – Radar Operations Center (ROC)

3.5.3 FXnet – GSD

3.5.4 FXC – GSD

3.5.5 LAPS – GSD

3.5.6 MSAS – GSD

4. Delivery Acceptance

4.1 Overview

Starting on 10/1/09 and continuing for 20 working days (ending 10/29/09), a System Integration Test (SIT) will be performed at Raytheon/Silver Spring. At the start of SIT, AWIPS Migration software will have all functional areas substantially complete. The only software updates after this point will consist of DR/TTR fixes. The government will have witnesses present for all SIT testing and any new TTRs will be written as soon as possible to facilitate their rapid resolution.

In addition, the performance of the AWIPS Migration software must meet or exceed the AWIPS I software's performance. Details of performance testing and associated metrics may be found in section 9, Testing Categories.

After the SIT, there will be an opportunity for DR fixes to be delivered and tested although it is expected that Raytheon will be working on these DRs long before the official end of SIT. The final DR delivery before the OT&E Readiness Review will be on 11/4/09. DR and Regression testing will occur from that point through 11/16/09.

Upon delivery of these TTR/DR fixes, the code will be considered "frozen" for purposes of determining if the software is ready for OT&E. This is the software that will be considered at the OT&E Readiness Review.

11/17/09 will be reserved for compiling results and preparing for the OT&E Readiness Review.

4.2 Acceptance Criteria

On 11/18/09 the Government will conduct an OT&E Readiness Review. At this review, the SIT test results will be reviewed along with input from all of the government stakeholders. If the attendees reach a consensus that all OT&E Entrance Criteria have been met, OT&E will begin on 11/30/09.

Input to the OT&E Readiness Review will include, but is not limited to:

- IV&V Slice/Delivery reports, including performance metrics
- UFE/SxS Slice/Delivery reports
- MDM metrics including
 - Tested vs. Untested Function Map (FM) items
 - Test Cases passed vs. failed
- Total number of TTRs/DRs
- Total number of CRITICAL TTRs/DRs

Simply put, the OT&E Entrance criteria are the TO11 Acceptance Criteria.

4.3 Failure Contingency

In the event of a TO11 failure, it seems prudent to continue the development and testing of TO11. However, there must be a contingency plan in the event that the government declares that TO11 will not be accepted, it becomes clear that the OT&E Entrance Criteria will not be met, and/or Raytheon declares that TO11 will not be ready on schedule. There are two viable options if any of these situations occur – the GSD Risk Mitigation and a new AWIPS-I build (OB10).

4.3.1 AWIPS-I OB10

As soon as possible after a declaration of TO11 failure/delay occurs, the SREC shall meet to discuss items for inclusion in an additional AWIPS-I release, OB10. The content and number of point releases for OB10 will largely depend on the length of delay in the TO11 entrance into OT&E.

Any additions to the AWIPS-I baseline in OB10 shall also be delivered with the rest of TO11.

5. Problem Reporting, Escalation, and Issue Resolution

5.1 TTR Reporting

The Official Witness/Documenter (government personnel), will sign off/approve (on paper or digitally/softcopy) on each test case as completed with either a Pass or Fail result and will document any problems encountered and the SME(s) will initial. All problems documented during testing will generate a government Test Trouble Report (TTR). The TTR generation software will be the mechanism by which problems are documented, at the time of testing. The SME's will make an initial determination of the criticality of the TTR, in collaboration with the other members of the Test Team (Raytheon tester and Government Witness/Documenter).

Comment [JEC9]: Is this true? Or do we want this decision to be solely by the gov't?

5.2 TTR Escalation

As soon as possible after a test case has been completed, TTRs documented by the Official Witness/Documenter(s), will be passed to the TTR Review Team (TTRT) for analysis and validation. The Test Teams will be available by telephone (and/or other convenient means), at each Test Station, to answer questions from the TTRT. The TTRT will have the final say as to criticality of each TTR but will not overrule the Test Team without consultation. As TTR's are generated, they will be passed to Raytheon for resolution, as expeditiously as possible via electronic means. Preferably, the electronic means of generating the initial TTR's and their criticality and Raytheon's reported resolution, will be integrated and networked in such a way as to make the process seamless, rapid and cost effective.

5.3 TTR Resolution

DRs/TTRs, if delivered, are to be tested with each slice. Raytheon will provide explicit testing instructions for each DR/TTR. After the final slice is delivered, DRs/TTRs will be tested as quickly as possible after delivery from Raytheon.

Testing of the DRs/TTRs will be performed by members of the IV&V Team, UFE Team or the NCLADT Team as appropriate. Reports of these tests, pass or fail, shall be forwarded to the TTRT. The TTRT will have the final word whether the DRs/TTRs can be closed.

TTRs that are declared as Variances will be forwarded to the SREC. The SREC will vote on whether the Variance is acceptable. If acceptable, the TTR will be closed and test cases/scenarios will be updated as appropriate to reflect the new functionality. If unacceptable, the TTR will be reclassified based on its criticality.

6. Test Team and Environment/Concept of Operations

6.1 Test Environment

Testing shall be performed using one or more of the following configurations/systems:

- Single AWIPS workstation (keyboard, mouse, three monitors) & single XT (keyboard, mouse, one monitor)
- Multiple AWIPS workstation/XTs (performance, stress testing)
- RFC AWIPS configuration
- OCONUS (multi-domain) AWIPS configuration (TBW4 at Raytheon/SS)
- Multiple AWIPS system testing (ISC traffic, IFPS Service Backup)

6.2 Testbeds

Testbeds include RTS/SS, NHDA, UFE/SxS sites (WFOs/RFCs), NCEP, GSD, NWSTC(?), and NSSL(?)

Comment [JEC10]: Do we need specifics here? Is a list of UFE/SxS sites sufficient? Do we need to describe each testbed's hardware and software?

7. TO11 Delivery Testing Resource Needs

7.1 Initial Testing

Target Work Days to complete SIT: **20**

Target Total Number of test cases to be executed: 2340

All A1 Swit test cases: 1820

Additional test cases: 520

Total Number of Test Steps Executed: 93060

Target Number of test cases executed, per day: 117

Number of Test Stations and Test Teams needed, per day: **8**

Total Government test personnel needed per day: **16**

Total Raytheon test personnel needed per day: **8**

Total test personnel needed per day: **24**

Average Test Cases Executed Per Day, per Test Station: 14.6

Average Total Test Cases Executed Per Day(all stations): 117

Practical total Government labor LOE for test personnel: 2560 hours

Practical total Raytheon labor LOE for test personnel: 1280 hours

Comment [JEC11]: Tim's original estimate was for 40 days of initial testing. This estimate was based on a single TO11 deliverable from Raytheon. Due to schedule constraints, we appear to be limited to 20 days. I doubled or halved the values in this section where appropriate. If this is unrealistic (quite possible), we'll have to throw more bodies at this, include more testbeds, and/or work longer hours.

7.2 Automated Testing

It is strongly suggested that a complete suite of regression tests be conducted to mitigate the risk of DR/TTR corrections introducing new problems. The regression tests should be automated in order to limit the effort and time needed to execute them. The government has been developing an automated testing tool called RCP Application Test System (RATS) and has made that code available to Raytheon. Raytheon is free to use that code in any way they see fit to help develop such a regression testing tool. Such a tool would be utilized by the SWIT, SIT, Syat, and IV&V testing teams, as needed and as possible. Raytheon may also elect to develop their own tool from scratch, or in any way they see fit that best meets this need.

Given the limited time and resources available to test the entire AWIPS system, it seems critical that many of the MDM items with no current test case coverage be tested by new RATS or RATS-like systems. Existing test cases may be also be converted to RATS if the nature of the test case lends itself to automated verification.

7.3 Post-SIT DR/TTR and Regression Testing

After the SIT, there will likely be some number of DRs/TTRs that must be fixed prior to OT&E. The schedule has development and deployment time built in after the SIT, although it is expected that Raytheon will be fixing these DRs/TTRs well before the end of SIT. After delivery of these TTR/DR fixes, the Government will have 7 working days to retest them, also allowing for any Regression testing deemed necessary.

Resource allocation for this activity is very difficult to estimate. What follows appears to be an upper limit on the number of DRs/TTRs that can be tested during this period. This assumes that by this point, most DRs/TTRs are for minor issues that can be tested more quickly than DRs/TTRs discovered early in the TO11 cycle. If that assumption is incorrect, the upper limit of DRs/TTRs that can be tested will be much lower than represented here.

Target Work Days to complete Post-SIT DR/TTR/Regression Testing: 7
Number of Test Stations and Test Teams needed, per day: 8
Total Government test personnel needed per day: 16
Total Raytheon test personnel needed per day: 8
Total test personnel needed per day: 24
Average DRs tested per hour: 2
Average DRs tested Per Day, per Test Station: 16
Average Total Test Cases Executed Per Day(all stations): 128
Target Total DRs tested during Post-SIT DR/TTR/Regression Testing: 896

8. Schedule

8.1 Summary of Vertical Slice Activities (repeated for each slice)

Vertical Slice delivery from Raytheon/Omaha: Working Day 1
SWIT Start: Working Day 2
SWIT End: Working Day 4
SEC/IV&V/UFE Start: Working Day 5
SEC/IV&V/UFE End: Working Day 25

Total elapsed time per vertical slice: ~20 working days

Vertical Slice cycles will overlap somewhat. Using the above example, Vertical Slice 2 will be delivered from Raytheon/Omaha on Working Day 21. Vertical Slice 2 SWIT will take place on Working Days 22-24, allowing Vertical Slice 2 to enter SEC/IV&V/UFE the day after Vertical Slice 1 exits SEC/IV&V/UFE.

Key Decision Point #1 (after Slice 4 receipt): Monday, July 13, 2009
Key Decision Point #2 (after Slice 5 receipt): Monday, August 10, 2009
Key Decision Point #3 (after Slice 6 receipt): Wednesday, September 9, 2009
Code Freeze: Wednesday, September 30, 2009
Key Decision Point #4: Wednesday, September 30, 2009

SIT Begins: Thursday, October 1, 2009
SIT Ends: Thursday, October 29, 2009
Duration: 20 working days

Raytheon Final Pre OT&E DR delivery: Wednesday, November 4, 2009

Final Pre OT&E DR Test/Regression Test Begins: Thursday, November 5, 2009
Final Pre OT&E DR Test/Regression Test Ends: Monday, November 16, 2009

OT&E Readiness Review: Wednesday, November 18, 2009
OT&E Start: Nov. 30, 2009
OT&E End: Start + 6 months

8.2 Detailed Schedule

Vertical Slice 1 delivery from Raytheon/Omaha: Wednesday, April 8, 2009
Vertical Slice 1 SWIT Start: Thursday, April 9, 2009
Vertical Slice 1 SWIT End: Monday, April 13, 2009
Vertical Slice 1 SEC/IV&V/UFE Start: Tuesday, April 14, 2009
Vertical Slice 1 SEC/IV&V/UFE End: Monday, May 11, 2009

Comment [JEC12]: These dates are wrong. They're also in the past. How should we address this? Should we?

Vertical Slice 2 delivery from Raytheon/Omaha: Wednesday, May 6, 2009
Vertical Slice 2 SWIT Start: Thursday, May 7, 2009
Vertical Slice 2 SWIT End: Monday, May 11, 2009
Vertical Slice 2 SEC/IV&V/UFE Start: Tuesday, May 12, 2009
Vertical Slice 2 SEC/IV&V/UFE End: Monday, June 8, 2009

Comment [JEC13]: These dates are wrong. They're also in the past. How should we address this? Should we?

Vertical Slice 3 delivery from Raytheon/Omaha: Wednesday, June 3, 2009
Vertical Slice 3 SWIT Start: Thursday, June 4, 2009
Vertical Slice 3 SWIT End: Monday, June 8, 2009
Vertical Slice 3 SEC/IV&V/UFE Start: Tuesday, June 9, 2009
Vertical Slice 3 SEC/IV&V/UFE End: Tuesday, July 7, 2009

Vertical Slice 4 delivery from Raytheon/Omaha: Wednesday, July 1, 2009
Vertical Slice 4 SWIT Start: Thursday, July 2, 2009
Vertical Slice 4 SWIT End: Tuesday, July 7, 2009
Vertical Slice 4 SEC/IV&V/UFE Start: Wednesday, July 8, 2009
Key Decision Point #1 (KDP#1): Monday, July 13, 2009
Vertical Slice 4 SEC/IV&V/UFE End: Monday, August 3, 2009

Vertical Slice 5 delivery from Raytheon/Omaha: Wednesday, July 29, 2009
Vertical Slice 5 SWIT Start: Thursday, July 30, 2009
Vertical Slice 5 SWIT End: Monday, August 3, 2009
Vertical Slice 5 SEC/IV&V/UFE Start: Tuesday, August 4, 2009
Key Decision Point #2 (KDP#2): Monday, August 10, 2009
Vertical Slice 5 SEC/IV&V/UFE End: Monday, August 31, 2009

Vertical Slice 6 delivery from Raytheon/Omaha: Wednesday, August 26, 2009
Vertical Slice 6 SWIT Start: Thursday, August 27, 2009
Vertical Slice 6 SWIT End: Monday, August 31, 2009
Vertical Slice 6 SEC/IV&V/UFE Start: Tuesday, September 1, 2009
Key Decision Point #3 (KDP#3): Wednesday, September 9, 2009
Vertical Slice 6 SEC/IV&V/UFE End: Monday, September 28, 2009

Key Decision Point #4 (KDP#4): Wednesday September 30, 2009

TO11 Code Freeze: Wednesday, September 30, 2009

SIT Begins: Thursday, October 1, 2009
SIT Ends: Monday, October 29, 2009

Raytheon Final pre-OT&E DR delivery: Wednesday, November 4, 2009

Final Pre OT&E DR Test/Regression Test Begins: Thursday, November 5, 2009
Final Pre OT&E DR Test/Regression Test Ends: Monday, November 16, 2009

OT&E Readiness Review Preparation: Tuesday, November 17, 2009
OT&E Readiness Review: Wednesday, November 18, 2009

OT&E Begins: Monday, November 30, 2009

<insert xls or mpp figure depicting schedule (when finalized)>

9. Testing Categories

The number and content of the AWIPS Migration software test cases will be somewhat dynamic. Existing test cases will be modified and new test cases will be written as each slice is delivered. These new/modified test cases will address gaps in the current functional testing and will address the testing of any variances accepted into the AWIPS Migration software.

As of this writing, the government has identified 920 test cases and use cases that need to be executed by the end of TO11. This number is expected to increase significantly as the test case gap is closed before the start of SIT.

9.1 MDM Test Categories & Metrics

The MDM will be used by the government to track which test cases have been executed, which pieces of AWIPS have been tested, and which test cases pass/fail. The following metrics will be included in each TO11 slice's IV&V Report:

- Number of MDM Test Cases executed
- Number of MDM Test Cases which pass/fail
- Number of MDM Function Map items that pass/fail testing
- Number of MDM Function Map items untested (i.e., missing test cases)
- Overall MDM Function Map progress (items delivered vs. scheduled)
- Percentages of expected values listed above (e.g., 98% pass, etc.)
- Number of new TTRs/DRs (critical and non-critical) written based on the slice

9.2 AWIPS Migration Software Performance

As part of the IV&V Testing, the government will perform tests to determine the performance of the AWIPS Migration software. AWIPS Migration software must perform at least as well as the AWIPS I software. This section details the performance testing that will take place with each TO11 Slice.

9.2.1 RCP Application Test System (RATS)

At a minimum, the following RATS tests will be performed:

autotest_001.pl – Measure time to load & loop IR Satellite
autotest_002.pl – Measure time to load & loop model data, radar, and satellite to all panes
autotest_003.pl – Measure time to load & loop model data, satellite, and observations to all panes

Results of the RATS tests will be compared to baseline results from AWIPS I (OB9) to ensure there is no significant performance degradation. Information regarding RATS and

Comment [JEC14]: Comments? Any I missed that would be useful?

the individual test scripts may be found at the AWIPS Evolution Test Website, under “Tools” in the “AWIPS 2 Testing” section:

<http://www.nws.noaa.gov/ost/SEC/AE/Testing.htm>

9.2.2 Other Performance Testing

9.2.2.1 Data Ingest Performance Testing

The government will compile Data Ingest and Product Notification metrics for both AWIPS I (OB9) and TO11:

- Total number of products
- Average storage time
- Maximum storage time

The rate of data ingest (i.e., volume) will be overlaid on a graphical representation of the storage time to determine if larger products significantly degrade the metrics.

A successful test will occur if both the average storage time and maximum storage time of both the Data Ingest and Product Notification in TO10 are at least as fast as in OB9.

9.2.2.2 Graphical User Interface (GUI) Testing

The government will compile Performance Metrics for D2D menu items using the AWIPS I (OB9) software. These metrics, gathered by using a stopwatch, will be performed by repeating the tests using one set of canned data and two sets of live data. The response time for each of the D2D menu items will be logged in an Excel spreadsheet. Averages will be calculated to smooth out spikes and valleys in system performance.

These tests will be repeated using each TO11 slice’s software. The detailed results will be summarized and compared to the baseline (AWIPS I) results.

A successful GUI performance test in TO11 will occur if:

- The overall average response time of the GUI is not worse than AWIPS I (OB9)
- There is no “significant” degradation for any of the individual menu items as compared to AWIPS I (OB9).

9.2.2.3 Data Dissemination Testing

Because TO11D6 contains the communications software for AWIPS Migration, Data Dissemination Performance metrics will not be of much value in the early slices of TO11. When the communications software has been delivered, data dissemination metrics will be calculated that show the amount of time between when an application signals its intent

to disseminate a product/message and when the communications software actually sends the product/message to an external addressee. Timing will stop once the product/message leaves the testbed so network traffic will not skew the test results.

These results will be compared to similar tests using AWIPS I software. A successful test will occur if the AWIPS Migration software average dissemination time is equal to or less than it is using AWIPS I software.

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APPENDIX A -- Basis of Estimate of Resource Needs

TO9 Delivery Test Statistics

Number of Workstations used: 1 (no XT)
Number of test cases: 26
Number of Steps Executed: 1034
Elapsed time (in hours) to complete (not including lunch, breaks etc.): 28
Calendar/Working Time (in days) to complete: 3 (long days)
Total Person Hours To Complete: 91
Average Test Cases Per Day: 8.7
Average Steps Executed Per Test Case: 40 (39.8)
Average Steps Executed Per Hour: 36.9
Average Person Hours Per Test Case: 3.5
Average Person Hours Per Step Executed: .088 (5.3 minutes)

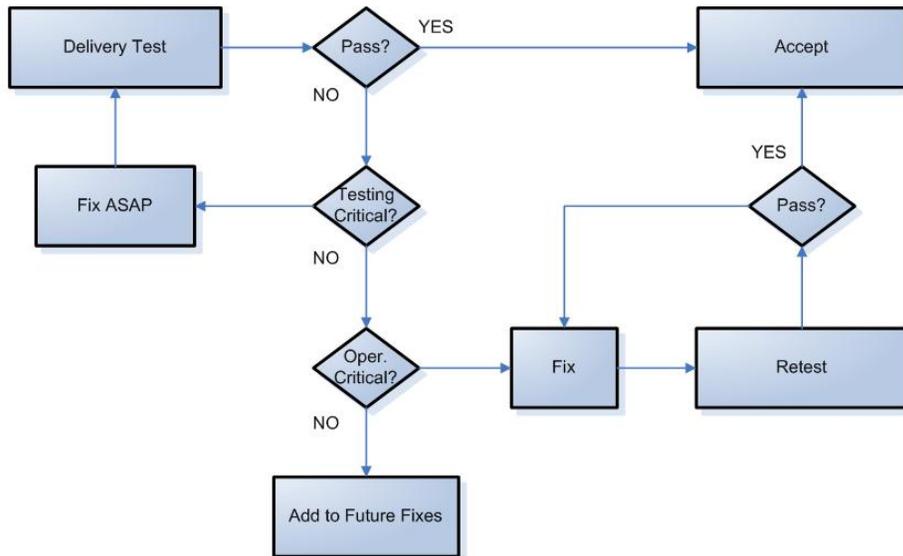
Problem Summary

Total Number of problems documented: 79
Items identified as **Critical DR's**: 3 (#'s 29, 33 and 44)
Items identified as potential **Non-Critical DR's** for Raytheon: 57
Items identified as **Variations**: 5
Items identified as **Notes** (of interest): 14
Non-Critical DR's likely to be operationally critical: 35
Likely operationally critical DR's per test case: 1.46

Raytheon Disposition Summary

Total Number of problems documented: 79
Items written up by Raytheon as **Critical DR's**: 3
Items written up by Raytheon as **Non-Critical DR's**: 44
Items identified as known problems, previously written up as Raytheon DR's: 12
Items identified by Raytheon as "N/A": 8
Items identified as duplicative of a previous TO9DT DR already written up: 3
Items identified as documentation issues: 2
Items identified as "Tasks for a future TO": 3
Items identified with individual explanations, not in any other category: 4

Diagram 1 – Testing Flow Chart



Testing Critical: Prevents further execution of the Test Case
Operationally Critical: Prevents start of OT&E

Comment [JEC15]: This chart makes no attempt to limit the number of defects. This conflicts with the OT&E entrance criteria. Should we modify the flow chart or scrap it altogether?