



Raytheon

**Task Order Proposal to
Continue Migration of AWIPS Functionality in
Support of the AWIPS Software Continuous
Technology Refresh Re-Architecture Under
Task Order 11 of the AWIPS Software
CTR Re-Architecture Initiative**

Technical Approach

Submitted Under
Contract DG133W-05-CQ-1067
Advanced Weather Interactive Processing System (AWIPS)
Operations and Maintenance

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Acronyms and Abbreviations Used in This Proposal

AFP	Application Focal Point
AWIPS	Advanced Weather Interactive Processing System
CAVE	Common AWIPS Visualization Environment
CTR	Continuous Technology Refresh
D2D	Display-Two Dimensional
DR	Deficiency Report
DTP	Deployment and Transition Planning
EDEX	Enterprise Data Exchange
GFE	Graphical Forecast Editor
GHG	Gridded Hazard Generator
ISC	Inter-Site Coordination
IV&V	Independent Validation and Verification
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
O&M	Operations and Maintenance
OB	Operational Build
OTE	Operational Test and Evaluation
PIP	Product Improvement Plan
RHEL	Red Hat Enterprise LINUX
SIT	Software Integration Test
SME	Subject Matter Expert
SMM	AWIPS System Manager's Manual
SMS	Software Maintenance and Support
SSDD	System/Subsystem Design Description for AWIPS
SW	Software
TBD	To Be Determined
TIM	Technical Interchange Meeting
TO	Task Order
TTR	Test Trouble Report
UFE	User Functional Evaluation
UM	AWIPS D-2D User's Manual

1. Introduction

In June 2007, Raytheon launched a series of software migration Task Orders to be performed under the Advanced Weather Interactive Processing System (AWIPS) Software Continuous Technology Refresh (SW CTR) Re-Architecture initiative. This Task Order (TO11) is the final AWIPS Baseline *Software Migration* Task Order. OTE and Site Migration, or deployment, will follow this Task Order culminating in AWIPS II becoming operational across the NWS. The roadmap and more detailed discussion of the migration and O&M transition to AWIPS II is in the SW CTR Product Improvement Plan (SWPIP), currently at version 4.0 (delivered with the Deployment and Transition Planning TO). The SWPIP v4.0 provides the background and context for this task order.

In this proposal, we present Raytheon's technical approach to completing Task Order 11. Also included in the proposal are the assumptions on which we based our approach, an itemized list of proposed Task Order deliverables, a recommended work schedule, and a summary of projected labor hours required to complete the task.

A Pricing Summary of the costs associated with completing TO11 is presented under separate cover.

2. Assumptions

- A. All conditions and assumptions noted in the Raytheon AWIPS proposal remain in effect.
- B. Raytheon travel is Firm Fixed Price.
- C. Government travel is assumed for Technical Interchange Meetings and as required for project reviews and support.
- D. The performance schedule outlined in Section 5 of this proposal is to be finalized by mutual agreement between Raytheon and NOAA/NWS.
- E. Task order schedule assumes timely support by the NWS for:
 - a. Scheduling and conducting TIMs with Government Labs or NWS organizations, including TIMs convened in Omaha with Raytheon developers,
 - b. Providing technical information requested by Raytheon development and test teams,
 - c. Timely detection and communication of critical software DRs to Raytheon,
 - d. Establishing appropriate TTR priorities to match labor availability to resolve software issues.
- F. Completeness and accuracy of SW implementation is directly related to information received in the process of AWIPS migration; issues arising from missing, outdated, or incorrect information will be addressed following the standard TTR/DR process described in Section 3 of this document.
- G. Due to undocumented features, varying usage, significant local customization / applications / over writes, and other operational nuances of AWIPS software, some User Functional Evaluation (UFE) and Independent Validation and Verification (IV&V) feedback (similar to feedback on WarnGen after TO8) will be required to ensure effective

completion of AWIPS migration (feedback and revisions to be made as mutually agreed upon between Raytheon and the NWS).

- H. A central server (TBD) will be used to store local data required to support ISC, Service Backup, and Site specific configuration data. Design to be by Raytheon; equipment currently in use by NWS assumed to be sufficient for AWIPS II (i.e. no new hardware anticipated at this time).
- I. The Government is responsible for the planning, execution, and reporting of government “pre-OTE” testing.
- J. Cost and schedule updates required by baseline changes in post OB9.1 releases will be assessed after the applicable readiness review. Incorporation of these changes will be made according to mutually agreed upon schedules though it may be impractical to complete these revisions prior to the start of OTE.

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3. Description of Approach

In recognition of the need to revise our approach for this last remaining migration task order, and in response to requests from the NWS for earlier and more frequent software deliveries, as well as incorporation of activities previously included in later task orders, Raytheon is proposing the following for TO11:

Major differences from previous approach (TO 8, 9, 10)

Referring to Figure 1^a:

- Raytheon will provide six interim deliveries (D1, D2, D3, D4, D5, and D6) of software functionality to allow the government more time for testing prior to OTE.
- The Task Order period of performance has been extended to accommodate additional testing.
- There will be more frequent project specific coordination meetings between RTS and the Government.
- There will be no “Delivery Testing” as with TO 8, 9, 10. Rather, Task Order completion will be modeled to follow the more familiar AWIPS I release process and criteria. Given that OB9.1 is (in fact) operational it will provide the baseline for defining “completion” of TO11. Successful completion of OB9.1 SIT procedures using AWIPS I criteria will define completion of the task order.

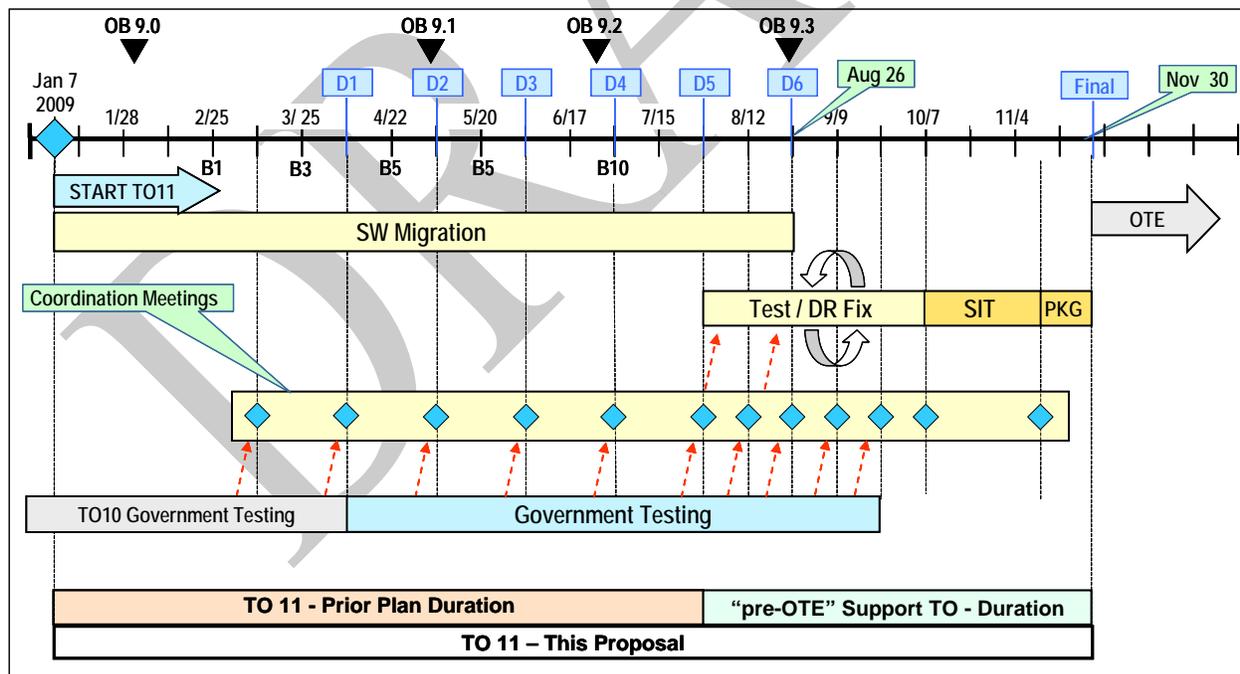


Figure 1. Task Order Conceptual Approach

RTS/Government Project Coordination Meetings

^a OB milestones appearing in Figure 1 refer to the Readiness Review for the given build.

Referring to Figure 1, Coordination Meetings will be held between Raytheon and the Government per the following:

1. Initial meeting held on or about March 11, 2009
 - a. Task Order Overview
 - b. Testing / TTR / DR process review
 - c. Detailed Review of Delivery 1 content
 - d. Review and initial disposition of TTRs (TO10, or before)
2. Recurring monthly on or about the day of Interim Deliveries beginning with Delivery 1 and continuing through Delivery 5, addressing:
 - a. Detailed review of Delivery content, including issues (if any)
 - b. Planned content for the next delivery, and beyond if changing
 - c. Raytheon SIT results, what is ready for government “pre-OTE” testing, and any DRs ready for Government retest
 - d. Review of DR *backlog* with overall labor estimates^b of DR additions from previous meeting
 - e. Review and *initial* disposition of *new* TTRs
3. Recurring bi-weekly beginning after Delivery 5 until the start of the final SIT, addressing
 - a. Test Progress
 - b. New TTRs, DRs
 - c. Fixed DRs
 - d. Review of DR *backlog* with overall labor estimates of DR additions from previous meetings
 - e. Review and *initial* disposition of *new* TTRs
 - f. DR priorities
 - g. New build availability and coordination^c
4. Completion of SIT, addressing
 - a. Final Test Results Review
 - b. State of DR backlog
 - c. Issues, if any
 - d. Final Delivery Contents (DVD contents)
 - e. Readiness for OTE entry

Interim Software Deliveries

1. Interim Deliveries will be provided per the timetable shown in Section 5.
2. The attached TO11 Delivery Checklist (v9) spreadsheet provides detailed information of functionality delivered with each Interim Delivery.

^b The purpose of this estimate is to track DR fix requirements against the DR labor and time budget. Since the approach to fixing DRs often includes addressing several as a batch, the labor required to fix individual DRs may not be provided unless a major effort is anticipated.

^c We anticipate more frequent builds after Delivery 6. Providing the NWS with the new builds during this period will be coordinated between Raytheon and the NWS during the cycle.

3. Delivered functionality is expected to be ready for “pre-OTE” *functional* testing. The *functions* delivered are considered to be complete as shown on the Delivery Checklist. Product dissemination will be emulated via a practice mode for WarnGen and GHG so that life-cycle testing can be performed, but the actual ability for dissemination via the WAN will occur after Delivery 6.
4. In order to save time and avoid unnecessary cost, Interim Delivery content will not include complete “packaging” as provided with TO 8,9, and 10. Details on what is included in each interim delivery are shown in the “Readme 1st Tab” of the TO11 Delivery Checklist (v9) spreadsheet.
5. Software Deliveries will be tested by Raytheon prior to Delivery using duplicate AWIPS OB9.1 SIT procedures, where possible^d. Where using duplicate procedures isn’t feasible Raytheon will develop an equivalent test for AWIPS II. Test results will be reported at the Project Coordination meetings discussed previously.
6. Test Procedures for DR fixes will be provided with each Interim Delivery.
7. Interim Deliveries will include the supported system configuration specification for the delivery; all NWS testing will be conducted on test platforms configured as specified.
8. Raytheon will install Interim Deliveries on Raytheon Test Beds to confirm installation procedures. Verified Interim Deliveries will be via FTP from (TBD) server. The Government may witness the installation to aid in their understanding of the installation/configuration. The Government is responsible for distribution and installation on Government systems, as needed, for testing. Modifications required to execute the Interim Delivery on government test equipment will be made by the Government.
9. TO11 deliveries will be based on RHEL 5.2.
10. There will be three supported configurations for Interim Deliveries. The first will be based on a complete AWIPS I Test Bed (servers and workstations), the second on a workstation with CAVE and a server with EDEX (similar to Omaha configuration), and the third on a single AWIPS workstation running CAVE and EDEX.

Final TO11 Software Delivery

1. As previously agreed upon between the NWS and Raytheon, successful completion of SIT procedures will constitute successful completion of the Task Order and mark the “end” of the AWIPS I *Baseline Software Migration* Phase of the project. For TO11, Raytheon will use the OB9.1 SIT procedures.
2. Packaging of final TO11 delivery will include the material similar to previous Task Orders plus:
 - a. The Final Regression Test Report
 - b. SIT Procedures (incorporating DR test procedures as appropriate)
 - c. DTP related documentation listed in the “Documentation” Section below

^d SIT testing in Omaha prior to delivery will be on Omaha development systems and not Baseline System Test Beds.

Raytheon Testing

1. SIT testing of interim deliveries will be conducted in Omaha.
2. Stability testing of AWIPS II using the same approach as previous Task orders (i.e. deploy and monitor bi-weekly builds on a separate, non-development server running continuously during the two week cycle; monitor and report results).
3. Performance testing and related tuning will be done on a Silver Spring test bed.
4. Raytheon will begin a “Test / DR Fix” cycle immediately after Interim Delivery 5 that will last 10 weeks. This cycle will be highly iterative with Builds occurring more frequently than bi-weekly. Disposition of Government TTRs from D5, D6, or from earlier deliveries will be addressed during this cycle at bi-weekly coordination meetings.
5. A final SIT regression test will be performed on a Raytheon Test Bed at Silver Spring following the cycle discussed in item 3.

Raytheon DTP related testing

1. Configuration, installation (“start-up”), rollback, and roll-forward will be done on a Silver Spring test bed; includes regional variations and RFCs.
2. Localization, customization, and configurability
3. AWIPS II / AWIPS I Interoperability testing
 - a. ISC
 - b. Service Backup for GFE, Warngen, RiverPro, AvnFPS
 - c. ESB / MHS

Government Testing

The following is assumed:

1. The Government will develop and execute any test procedures they require beyond the SIT and DR procedures provided with the Interim Deliveries.
2. The Government will distribute and support Interim Deliveries to Regions and field sites.
3. The Government will manage the government TTR processing.

TTR/DR Processing

1. Coordination of TTR / DR processing will follow the process described in this section.
2. Definitions: “TTRs” are Government generated reports and “DRs” are items in the Raytheon Omaha TRAC system.
3. Raytheon DRs generated during SIT pre-delivery testing are reported to the Government with each Interim Delivery. The government will use this list to avoid generating TTRs for known problems.
4. NWS and RTS will jointly disposition TTRs resulting from government testing.
 - a. TTRs will be consolidated and culled of duplicates, AWIPS I defects, non-SW defects, editorial comments, enhancements, and acceptable variances by the Government prior to review with Raytheon.
 - b. TTRs that remain after this process are compared to existing Omaha DRs and duplicates culled.

- c. Remaining TTRs are combined with Raytheon DRs for the delivery and are assigned “fix prior to start of OTE” or “fix afterwards” priorities.
5. TTRs or DRs identified during AWIPS II testing will be checked against AWIPS I DRs to verify that they are unique to AWIPS II. A test causing a DR in AWIPS II where there is no corresponding DR documented with AWIPS I is run against AWIPS I to ensure that pass/fail is the same for AWIPS I and AWIPS II. AWIPS II DRs that are not duplicated in AWIPS I are assigned DR numbers by Omaha and classified per step 4.c above).
6. While labor is allocated to fix many of the known DRs before starting TO11, defects discovered or reported after the start of TO11 will be addressed after Interim Delivery 5^e.
7. Due to the TO11 schedule and Firm Fixed Price contract, resources to address DRs are finite and determined by the budget. Therefore, it may become necessary to triage the DR list for final TO11 delivery. Resources are planned to be available in the next task order to support fixing DRs discovered during OTE. The NWS can decide to include a portion of the remaining backlog of TO11 DRs in that task order.
8. To allow time for final regression testing and packaging, a cutoff prior to the end of SIT will be established (date is TBD).

Technical Interchange Meetings

Raytheon proposes several Technical Interchange Meetings with the NWS during TO11. These include:

1. Face-to-face Technical Interchange Meetings (TIMs) with NWS SMEs to provide Raytheon developers with detailed implementation information and feedback necessary for applications migration (e.g. undocumented features, varying usage, significant local customization / applications / over writes, and other operational nuances of AWIPS which impact software implementation). Raytheon plans to conduct those meetings at our facilities in Omaha, Nebraska. The tentative dates and topics for the sessions follow.
 - a. Hydro
 - i. 12-13 Mar. Evaluate PDC Timestep; adhoc. Evaluate Gage Table, edit precip by drawing polygons. Answer developer questions and provide guidance on application functionality.
 - ii. 16-17 Apr. Evaluate TimeSeries Forecast and Precip functionality. Evaluate SHEF decoder functionality. Assess MPE changes to data period displays, single site radars, new GUI development. Answer developer questions and provide guidance on application functionality.
 - iii. 21-22 May. Evaluate full functionality of the PDC and TimeSeries functions. Test MPE QC functionality. Answer developer questions and provide technical guidance.
 - iv. 25-26 Jun. Evaluate RiverPro GUI functionality. Evaluate Satellite precip and edit precipitation functionality. Answer developer questions and provide technical guidance.
 - v. 30-31 Jul. Evaluate full MPE and RiverPro functionality.

b. WarnGen

^e A new TTR may be fixed prior to D5 if the situation warrants.

- i. 26-27 Feb. Evaluate software development efforts to include Special Marine Warnings and round trip test mode of products ("Send" button); DRs worked since TO10. Work with developer.
 - ii. 19-20 Mar. Evaluate site backup capabilities, site templates and Line of Storms. Work with developer; provide feedback.
 - iii. 23-24 Apr. Evaluate full WarnGen capability.
- c. GFE/IFPS
- i. 26-26 Mar. Evaluate initial cut of IFPS and GFE Daily Forecast critique. Provide feedback to developer; answer questions.
 - ii. 28-29 May. Evaluate GFE DR fixes; evaluate IFPS. Provide feedback to developer
 - iii. 25-26 Jun. Complete end-to-end test of GFE. Identify discrepancies; work with software engineer to understand DR fixes.
 - iv. 23-24 Jul. End to evaluation of GFE.
2. One (1), one day long face-to-face TIM with the National Core Local Application Development Team (NCLADT) addressing any technical issues regarding Local Applications.
 3. One (1), face-to-face TIM at the NWSTD facility in Kansas City NWSTC instructors addressing site data migration (e.g. localization and configuration) where it is different than AWIPS I. This TIM will be 1 or 2 days long.
 4. Additional remote TIMs needing less than three hours will be scheduled as needed and as resource allow ("best effort"). We expect NCEP, WES, and SMS TIMs will occur and others that might arise.

Documentation

In addition to the typical software documentation, drafts of the following DTP related documentation will be provided. Drafts are provided since multiple revisions are expected to occur during OTE.

1. AWIPS SMM, AWIPS UM, AWIPS SSDD updates
2. Supported deployment system configuration specification per DTP material
3. Installation procedures (install AWIPS II on AWIPS I baseline system)
4. Cut-over, rollback procedures
5. AWIPS I removal procedures
6. Site system configuration procedures (e.g. localization, customization, configuration)

Support

1. Support for the Application Focal Point (AFP) trainers will be provided via the TIM(s) mentioned earlier and consulting for AFP courseware.

2. Provide Support to the O&M Transition effort.

4. Deliverables

Deliverables for this Task Order are identified in **Table 1**.

Table 1. Task Order 11 Deliverables

Item	Description	Comments
1	Six Interim Deliveries	SW capabilities as defined in the attached "TO11 Delivery Checklist (v9)" Spreadsheet
2	Final Delivery	Final TO11 Software build
		Consolidated SIT Procedures, DR Test Procedures, Raytheon Test Report
		Documentation for Final TO11 Delivery <ul style="list-style-type: none"> - JavaDoc Library - Typical Packaging and contents as with TO8, 9, 10 - Installation Flow Lines - Release Notes - Architecture Briefing Update - Programmers Update for changes affecting government SW development
3	Contractual Documentation	UM, SMM, SSDD update drafts
4	DTP Related documentation	<ul style="list-style-type: none"> - Supported System Configuration specification for OTE and deployment - "How to" configure systems/applications for site and user specific use for delivered applications - Interoperability process / procedures for Service Backup and ISC between A1 and A2 systems

5. Schedule and Milestones

Key milestones in the Task Order 11 performance schedule follow in Table 2. All proposed milestone dates will be finalized with the Government after Task Order Award.

Table 2. Task Order 11: Project Milestones

Item	Description	Date
1	Start Technical Activity	01/07/09
2	Task Order Award	TDB
3	TIM: SME visit Omaha, WarnGen	2/26 - 27
4	Kickoff With NWS (combine with coordination meeting 1)	3/11/2009
5	TIM: SME visit Omaha, Hydro	03/12 - 13
6	TIM: SME visit Omaha, WarnGen	03/19 - 20
7	TIM: SME visit Omaha, GFE / IFPS	03/26 - 27
8	Initial Coordination Meeting	03/11/2009
9	Interim Software Delivery 1	04/08/09
10	Delivery 1 Coordination Meeting	04/08/09
11	TIM: SME visit Omaha, Hydro	04/16 - 17

Item	Description	Date
12	TIM: SME visit Omaha, Warngen	04/23 - 24
13	Interim Software Delivery 2	05/08/09
14	Delivery 2 Coordination Meeting	05/08/09
15	TIM: SME visit Omaha, Hydro	05/21 - 22
16	TIM: SME visit Omaha, GFE / IFPS	05/28 - 29
17	TIM: NCLADT, NWSTD @ Kansas City*	May or June TBD
18	Interim Software Delivery 3	06/03/09
19	Delivery 3 Coordination Meeting	06/03/09
20	TIM: SME visit Omaha, AvnFPS	06/2 - 3
21	TIM: SME visit Omaha, Hydro	06/25 - 26
22	TIM: SME visit Omaha, GFE / IFPS	06/25 - 26
23	Interim Software Delivery 4	07/01/09
24	Delivery 4 Coordination Meeting	07/01/09
25	TIM: SME visit Omaha, GFE / IFPS	07/23 - 24
26	TIM: SME visit Omaha, Hydro	07/30 -31
27	Interim Software Delivery 5	07/29/09
28	Delivery 5 Coordination Meeting	07/29/09
29	TIM: Application Focal Points @ Kansas City?*	08/ TBD
30	TIM: SME visit Omaha, Hydro	08/ TBD
31	TIM: SME visit Omaha, GFE / IFPS	08 / TBD
32	Biweekly Coordination Meeting 1	08/12/2009
33	Interim Software Delivery 6	08/26/09
34	Delivery 6 Coordination Meeting	08/26/09
35	Biweekly Coordination Meeting 2	09/09/2009
36	Biweekly Coordination Meeting 3	09/23/2009
37	Biweekly Coordination Meeting 4	10/07/2009
38	Post SIT Review	11/11/2009
39	AWIPS II TO11 Delivery	11/30/09
* Travel required for Raytheon Team		

6. Labor Estimate

Table 3 presents the estimated labor required to complete Task Order 11.

OB9.2 and OB9.3 are not defined as of this proposal. Therefore, the labor to sync to these OB releases is not included in this Proposal.

Labor Category	Labor Hours
AWIPS Evolution Manager	
Principal Subject Matter Expert	
Senior Contracts Administrator	
Business Manager	
Procurement Specialist	
Quality Assurance Specialist	
Senior Documentation Specialist	
Total Raytheon Hours	
Junior Engineer (Subcontract)	
Senior Engineer (Subcontract)	
Principal Subject Matter Expert (Subcontract)	
Total Subcontractor Hours	
Total Hours	
*Hours may differ slightly from the Pricing Summary due to rounding.	

Table 3. Estimated Labor Required to Complete Task Order 11