



Raytheon

**Task Order Proposal to
Continue Migration of AWIPS Functionality in
Support of the AWIPS Software Continuous
Technology Refresh Re-Architecture Under
Task Order 9 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

ADE	AWIPS Development Environment
AELC	AWIPS Evolution Leadership Committee
AWIPS	Advanced Weather Interactive Processing System
CAVE	Common AWIPS Visualization Environment
CSCI	Computer Software Configuration Item
CTR	Continuous Technology Refresh
D2D	Display-Two Dimensional
DR	Deficiency Report
EDEX	Enterprise Data Exchange
GFE	Graphical Forecast Editor
IV&V	Independent Validation and Verification
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
NWSHQ	National Weather Service Headquarters
O&M	Operations and Maintenance
PIP	Product Improvement Plan
RRD	Risk Reduction Demonstration
SMM	AWIPS System Manager's Manual
SOA	Service Oriented Architecture
SSDD	System/Subsystem Design Description for AWIPS
SW	Software
TIM	Technical Interchange Meeting
UFE	User Functional Evaluation
UM	AWIPS D-2D User's Manual
VTEC	Valid Time Event Code

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 over the course of two years. Under each Task Order in the series, we will deliver specific migrated end-user functions to the National Oceanic and Atmospheric Administration, National Weather Service (NOAA/NWS). The series will culminate in AWIPS II Release 1.0.

In this proposal, we present Raytheon's technical approach to completing Task Order 9, which is the second in the series of planned software migration Task Orders. Also included in the proposal are the assumptions on which we based our approach, a description of our task objectives, 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 Task Order 9 is presented under separate cover.

2. Assumptions

- A. All conditions and assumptions noted in the Raytheon AWIPS proposal remain in effect.
- B. Travel is Firm Fixed Price.
- C. The performance schedule outlined in Section 6 of this proposal is based on the Task Order award date shown in that section. The final schedule is contingent upon the actual date of Task Order award and test bed availability, and will be mutually agreed upon with NOAA/NWS.
- D. Timely access to appropriate Government personnel and organizations will be provided. Scheduled visits with Labs or NWS organizations will occur within the approximate time frames shown in the final Task Order Schedule and will not delay the project.
- E. Government feedback on interim reviews and deliverables will be timely so as not to delay the project.
- F. NWS will provide a detailed checklist of Graphical Forecast Editor (GFE) functions, as they did for D2D, to facilitate closure of migration for GFE.
- G. A one day face-to-face GFE Technical Interchange Meeting (TIM) will be held (see Section 6, Milestone 6) to provide Raytheon Developers with detailed implementation information for use in the GFE migration.
- H. The *Software Continuous Refresh Technology Product Improvement Plan* (ver. 3.0, DCN AWP.PLN.SWPIP-03.00) is incorporated by reference into this proposal.

3. Description of Approach

The SW CTR Re-Architecture initiative entered the Migration Phase with Task Order 8. Software delivered under Task Order 9 builds upon the Task Order 8 delivery, and therefore includes the ADE 1.0 (AWIPS Development Environment 1.0), selected end-user functionality, and extensions to the ADE/infrastructure.^a This will be the second of four planned software migration Task Orders.

The general approach to the software migration effort is described in Section 6 of the *Software Continuous Refresh Technology Product Improvement Plan* (SW PIP) (Ver. 3.0, 22 June 2007). The *SW PIP* provides a more comprehensive overview of the AWIPS II migration and deployment as well as details of the software migration. The *SW PIP* includes a “Software Capabilities Matrix” that cross-references migrated functions to the AWIPS software baseline CSCI (Computer Software Configuration Item) and the various software migration Task Orders.

The Task Order 9 Work Items identified in this proposal are organized into five major categories. The first category, Software, includes six Work Items – Workstation Capabilities (CAVE), SOA Service Capabilities (EDEX), SOA Plug-ins, EDEX Common Library, Data Management, and Advanced Development.^b The other major categories/Work Items are Test, Documentation, Training, and Support. The final Work Item is Briefings, which includes the delivery of briefings prepared as Activities under appropriate Work Items.

Descriptions of the five major categories follow. Table 1, which concludes this section, itemizes the specific Activities to be performed under each Work Item included in this Task Order.

- **Software.** The primary forecaster functionality to be delivered under this Task Order is Graphical Forecast Editor (GFE) functionality.^c Further Hydro plug-in frameworks will be addressed with Advanced Development. Additional D2D Workstation capabilities will also be delivered. A Risk Reduction Demonstration/briefing will be provided showing the results of the advanced development efforts. ADE/infrastructure functionality will be extended. (See Table 1 for more detailed descriptions of this functionality.)
- **Test.** Raytheon will develop a Test Plan, Test Procedures, and a Test Report for this Task Order; copies will be provided at the conclusion of the Task Order. To the extent possible, we will reuse existing AWIPS I test procedures. We expect to reuse more end-user functionality test procedures than system-level, infrastructure test procedures. Developer testing will be performed at Raytheon’s Omaha facility, and Delivery Testing will be performed either at the Raytheon AWIPS Program Management Office/Test Facility in Silver Spring or at NWS Headquarters, depending on availability of test beds. Delivery Testing and acceptance is described Section 5.
- **Documentation.** Raytheon will update the AWIPS II JavaDoc and Architecture briefing material as we did with previous ADE releases, and Release Notes will be provided. Raytheon will “red-line” affected areas of existing O&M (Operations & Maintenance) documentation that Raytheon is responsible for maintaining in preparation for reissue of this

^a AWIPS II refers to the total environment and includes the ADE, end-user functionality, and the execution environment.

^b An Advanced Development effort results in a demonstration and/or briefing, and may be composed of demonstration/prototype quality code.

^c Not all of GFE will be delivered with this Task Order; some functions will be delivered in later Task Orders.

documentation with Release 1.0. The specific documentation referenced here are the affected user manual sections/pages, the *AWIPS System Manager’s Manual (SMM)*, and the *AWIPS System/Subsystem Design Description (SSDD)*. [Note: “Red-line” documentation will not be provided as a deliverable until after Release 1.0 of AWIPS II.]

- **Training.** Although training and training support will be addressed in a separate Task Order, Raytheon will prepare a Technical Update Briefing of ADE changes under Task Order 9 for delivery to the developers previously “trained” in Task Orders 3 through 6. The objective of this briefing is to provide a bridge to the formal training to be offered in the future. The briefing will highlight changes to the ADE affecting creation of end-user applications software. A Smart Tool conversion example will be included.

Under Task Order 9, Raytheon will also update previously developed Software Architecture Briefing material to reflect changes to the environment. A briefing describing those changes will be delivered as part of the Out Brief identified in the schedule of milestones in Section 6.

- **Support.**
 - **User Functional Evaluations and NWS Testing.** Raytheon will support these efforts by responding to and resolving critical defects, as defined in Section 5, as quickly as possible. NWS will screen and consolidate DRs that are generated from the User Functional Evaluations (UFE) or other testing prior to forwarding to Raytheon. Raytheon will disposition all DRs received. Disposition may result in a software correction or in a written response such as “no software correction required” or “correction deferred to subsequent TO.” Corrections will be applied to the system during any appropriate Task Order prior to the AWIPS II Release 1.0.
 - **Customer Technical Interchange Meetings.** TIMs will be conducted to provide direct interaction between the Raytheon development team and field operations personnel. The intent of the TIMs is to discuss existing Local Applications and the techniques available to replace, convert, or interface them to the AWIPS II software environment. As with Task Order 8, we propose to conduct one face-to-face TIM and two remote TIMs via teleconference. The face-to-face TIM will include software demonstrations.

The major work items and activities of this Task Order are shown in **Table 1**.

Table 1. Task Order 9 Work Items/Activities

Work Item	Description/Activity
Work Station Capabilities	Implement the following: <ul style="list-style-type: none"> ● GFE Perspective: GFE Menus, tool bar, GFE edit preferences, Legend Pop Ups, Status Bar, Intersite coordinate GUI. ● Spatial Editor: Animation, Edit Areas, Pencil Tool, Sample Tool, Move/Copy Tool and Contour Tools. ● Grid Manager: Primary Widget, Select Wx Element and Time range, Copy/Paste/Stretch/Compress, and Interpolate Grids Dialog. ● Graphical Hazards: GHG Viewer, GHG Monitor, and VTEC interface. ● Formatter Launcher + Data Interface. ● Smart Tool Widgets + Interface (create a set of GUI widgets that are accessible from a Smart Tool script). ● AvnFPS for TAFs. ● Redbook Vector Rendering.

Work Item	Description/Activity
SOA Service Capabilities (EDEX)	Implement the following: <ul style="list-style-type: none"> • GFE Plug-In and Server Messages for : grid management, grid lock management, reference data management, and control. • GFE UtilitySrv Messages for color tables, maps, topo, and VTEC. • Web Based Forecast Products Interface. • Text Product Generation Interface including the data sampler and histogram.
SOA Plug-ins	Implement the following: <ul style="list-style-type: none"> • BUFR Decoder {Profiler, Model Soundings, Satellite Soundings}. • Red Book Vector Products Plug-In to support products viewable from D2D menus. • AFOS parser and formatter for TextWX support. • LDAR Lighting plug-in with decoder. • Text Product Decoder for warnings.
EDEX Common Library	Implement the following: <ul style="list-style-type: none"> • Meteo Library Extension for access by uEngine Tasks. • Derived Parameters for grid and point data. • GFE Interpolation Functions for scalar, vector, and discrete(Wx) data types. • Smart Init Interface to enable initializing from model data and create the desired parameters. • Smart Tool Interface with a library of functions for use by smart tools.
Data Management	Implement the following: <ul style="list-style-type: none"> • GFE Data Model for scalar, vector, discrete(Wx), with interpolation. • Text QC and Business Rules.
Advanced Development	Prototype the following: <ul style="list-style-type: none"> • Hydro Visualizations. • Hydro Ingest: DPA Decoder.
Test	<ul style="list-style-type: none"> • Develop and document Test Plan, Test Procedure, and Test Report. • Update Regression Test Procedures. • Perform combined Delivery Test on Silver Spring or NWSHQ Test Bed. • Support User Functional Test as described in Sections 3.
Documentation	<ul style="list-style-type: none"> • Update JavaDoc. • Update Architecture Briefing. • Redline appropriate sections of the D2D and GFE user manuals, SMM, and SSDD for later incorporation into production documentation.
Training	<ul style="list-style-type: none"> • Update existing training materials for currency. • Provide a technical briefing for previous trainees, highlighting ADE changes (includes Example of Smart Tool Porting). <p><i>[Note: Developer training and training support are addressed in a separate Task Order.]</i></p>
Support	<ul style="list-style-type: none"> • Provide DR support for UFE and IV&V as described in the description of the Support Work Item in this Section. • Conduct one face-to-face and two remote TIMs.
Briefings	<ul style="list-style-type: none"> • Provide delivery briefing (Architecture Updates, delivered end-user functions). • Provide Technical ADE update briefing package for previous ADE trainees. • Provide Risk Reduction Demonstration of Advanced Development items.

4. Deliverables

Deliverables for this Task Order are identified in **Table 2**.

Table 2. Task Order 9 Deliverables

Item	Description	Comments	
1	Software		
	1.1	Workstation Capabilities	As described in Section 3.
	1.2	SOA Service Capabilities (EDEX)	
	1.3	SOA Plug-Ins	
	1.4	EDEX Common Library	
	1.5	Data Management	
2	Documentation		
	2.1	Software	<ul style="list-style-type: none"> Javadoc Library for All Developed Code
	2.2	Test	<ul style="list-style-type: none"> Copy of Raytheon Software Test Plan, Test Procedures, associated Requirements Traceability Matrix, and Test Report User Functional Test DR Disposition Report
	2.3	Technical Briefing Material	<ul style="list-style-type: none"> Task Order Out Brief including updates to the Software Architecture Briefing ADE Technical Update Briefing (to be delivered as part of TO8 training) Risk Reduction Demonstration / Briefing
	2.4	Training Material	<ul style="list-style-type: none"> Updates to previous training material for currency with this release
	2.5	Release Notes	
3	Briefings	<ul style="list-style-type: none"> Delivery Out Brief ADE Programmers Briefing (remote) Risk Reduction Demonstration / Briefing 	

5. Delivery Acceptance

In this section, Raytheon describes the acceptance method for TO9 SW deliverables. It is based on the Task Order acceptance approach developed, documented, and agreed to by the Government and Raytheon for TO8, and consists of the following steps. [**Note:** The milestones identified in these steps are taken from the schedule and milestones proposed in Section 6.]

- Raytheon delivers the Draft Test Plan to the Government (Milestone 7).
- The Government reviews the Draft Test Plan to verify that the outlined test plans are sufficient for acceptance of the software. The Government's review of the Test Plan is limited to the Task Order 9 deliverable capabilities described in Table 1. This review is due back to Raytheon not more than 10 working days after the delivery of the Draft Test Plan (Milestone 8). If necessary, Raytheon and the Government will meet to review the results of the Government's review in order to gain clarity and mutual acceptance of the additional tests. The Government will provide a Use Case for any additional tests required for acceptance of Task Order 9 deliverables (Milestone 16).

- Raytheon delivers a draft copy of the Test Procedures defined in the previous step (Milestone 14). This review is due to Raytheon not more than 10 working days after the delivery of the Draft Test Procedures (Milestone 15). If necessary, Raytheon and the Government will meet to review the results of the Government’s review in order to gain clarity and mutual acceptance of the results.
- If it is necessary to test a critical defect fix, the Government and Raytheon will jointly define and thereby agree to the tests and regression tests needed to confirm that the defects have been corrected. This agreement will be reached during the execution of the delivery test. The tests will be demonstrated with the SW delivery (Milestone 18).

Figure 1 illustrates the basic approach. Table 3 defines the steps that comprise the Acceptance Process.

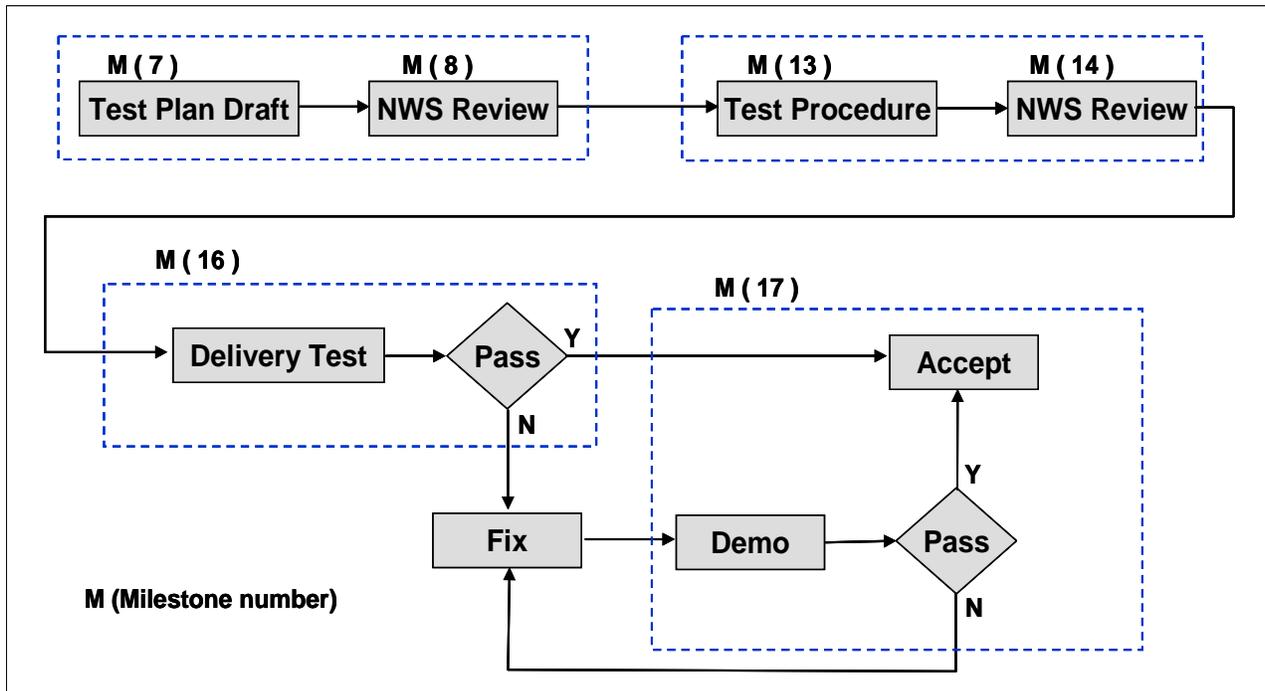


Figure 1. Acceptance Process for Task Order 9

Table 3. Acceptance Method for SW Deliverables: Definitions of Terms

Acceptance Method Term	Definition
AWIPS Baseline Hardware	A predefined configuration that is typical of an operational AWIPS System (e.g., test bed). The predefined configuration will remain unchanged throughout the testing discussed in this section.
Delivery Test	This test is conducted on AWIPS Baseline hardware by Raytheon personnel. Government personnel observe all aspects of this test. This period of time is used to assess the installation and test procedure execution. Any problems will be captured for future resolution. Critical defects must be corrected prior to accepting the software. If delivery testing fails, another test is conducted at the time of delivery of the TO deliverables and consists of a demonstration of those test procedures necessary to confirm the correction of critical defects. This demonstration occurs on AWIPS baseline hardware and includes necessary regression tests to demonstrate that corrected DRs have not negatively impacted other parts of the software deliverable. Acceptance is not reached until all critical defects are corrected.
Critical Defect	Any problem that prevents the system from working for its intended purpose until the Task Order 10 release. Because Task Order 9 is not an operational release, a critical defect would be one that would prevent appropriate testing and evaluation in the coming period before the Task Order 10 release. What constitutes "appropriate" testing and evaluation is as agreed to between NWS and Raytheon.
Non-Critical Defect	A condition for which a reasonable work-around can be provided, or a condition that doesn't prevent subsequent testing (e.g., UFE, IV&V).
Acceptance	The act of agreeing to accept the deliverable and related invoice based on the results from the Delivery Test. Acceptance of Advanced Development deliverables will be via Risk Reduction Demonstrations, as has been done in previous Task Orders.

6. Schedule and Milestones

Key milestones in the Task Order 9 performance schedule follow. **Figure 2** graphically depicts the performance timeline; **Table 4** itemizes all schedule activities. All proposed milestone dates are approximate and subject to Government availability and the date of Task Order award.

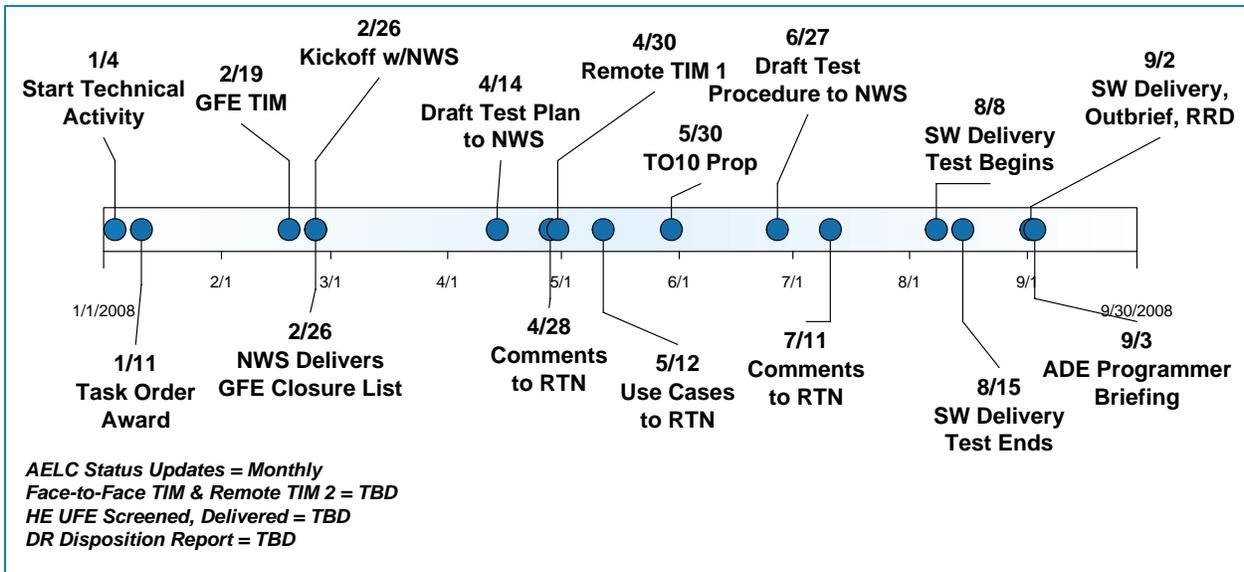


Figure 2. Task Order 9: Project Milestone Chart

Table 4. Task Order 9: Project Schedule and Milestones

Item	Description	Date
1	Start Technical Activity	01/04/08
2	Task Order Award	01/11/08
3	Kickoff With NWS	02/26/08
4	NWS delivery of GFE closure list (<i>NWS milestone</i>)	02/26/08
5	AELC Status Updates	monthly
6	GFE TIM*	02/19/08
7	Draft Test Plan to NWS	04/14/08
8	NWS comments delivered to Raytheon (<i>NWS milestone</i>)	04/28/08
9	Use Cases to Raytheon for new tests (<i>NWS milestone</i>)	05/12/08
10	Remote Customer TIM	04/30/08
11	TO10 Proposal	05/30/08
12	Face-to-Face Customer TIM; Location TBD* (CONUS)	TBD
13	Draft Test Procedures to NWS	6/27/08
14	NWS comments provided to Raytheon (<i>NWS milestone</i>)	7/11/08
15	Remote Customer TIM	TBD
16	TO9 Software Delivery Test*	08/08/08-08/15/08
17	TO9 Software Delivery, Out Brief, and RRD*	09/02/08
18	ADE Programmers Briefing (Remote)	09/03/08
19	All DRs screened, consolidated, and delivered to Raytheon (<i>NWS milestone</i>)	TBD
20	DR Disposition Report	TBD
* Travel required for Raytheon Team		
Key: AELC = AWIPS Evolution Leadership Committee DR = Deficiency Report		RRD = Risk Reduction Demo TIM = Technical Interchange Meeting

7. Labor Estimate

Table 5 presents the estimated labor required to complete Task Order 9.

Table 5. Estimated Labor Required to Complete Task Order 9

Labor Category	Labor Hours
AWIPS Evolution Manager	200
Principal Subject Matter Expert	960
Senior Contracts Administrator	20
Business Manager	82
Procurement Specialist	20
Quality Assurance Specialist	22
Senior Documentation Specialist	40
Total Raytheon Hours	1344
Junior Engineer (Subcontract)	5,103
Senior Engineer (Subcontract)	8,884
Principal Subject Matter Expert (Subcontract)	2,406
Total Subcontractor Hours	16,393
Total Hours	17,737
*Hours may differ slightly from the Pricing Summary due to rounding.	