

**AWIPS Evolution and Transformation
Management Plan**
Created: 11/29/2005
Final: 3/9/2006

Table of Contents

Introduction	1
Scope Definition of AWIPS Evolution Project	2
Organization Descriptions	3
Management Processes	6
<i>OSIP Overview</i>	7
<i>Mission Assurance Manager’s Gate Process</i>	8
<i>Blended Process for AWIPS Evolution</i>	8
<i>Implementation Examples</i>	9
a. Product Improvements – Scientific Enhancement	10
b. Product Improvements – Infrastructure Service Enhancement	11
c. Adaptive Maintenance	12
Roles and Responsibilities	13
Risk Reduction/Prototyping Activities	15
Conclusion	18
Appendix 1 – Acronym List	19
Appendix 2 – Individual Roles	20

Table of Figures

Figure 1 - OS&T Organization	4
Figure 2 - Portion of the AWIPS Program Office Structure.....	4
Figure 3 - Raytheon AWIPS Program Organization	5
Figure 4 - AWIPS Evolution Integrate Product Team.....	5
Figure 5 - IPT Members.....	6
Figure 6 - OSIP Stages and Gates.....	7
Figure 7 - Blending Mission Assurance Manager's Gate Process with OSIP	9
Figure 8 - Decision Assistance Application Example	10
Figure 9 - Generalize Process for Adding New Science to AWIPS	11
Figure 10 - Infrastructure Service Process Example.....	11
Figure 11 - Generalized Process for Adding Infrastructure Service.....	12
Figure 12 - Organizational RAM for New Science	14
Figure 13 - Organizational RAM for Infrastructure Service	15
Figure 14 - Prototype Decision Tree.....	16
Figure 15 - OSIP/Raytheon Software Development Relationship	17

AWIPS Evolution and Transformation Management Plan

Introduction

The evolution of Advanced Weather Interactive Processing System (AWIPS) is a recognized need of the NOAA National Weather Service (NWS) (See Statement of Need (SON) #04-005). AWIPS must evolve so that the NWS is able to rapidly infuse new science into operations. The NWS recognized this need during the recent contract award by offering a continuous technology refresh (CTR) option. This option, when exercised, allows the adjustment of the underlying AWIPS infrastructure thus positioning the NWS to meet new requirements in the years ahead.

This project, AWIPS Evolution, requires the coordination of multiple processes and organizations in order to be successful. This document defines the overall management approach for the oversight and execution of this project. Conversely, this document is not designed to solve technical issues dealing with evolution of the software in the upcoming years but to provide a set of guidelines that can be used to address questions and conflicts that arise during the execution.

The following core beliefs shape the approach to the management and implementation of new technologies within AWIPS:

- Certain aspects of the target architecture will require prototyping and evaluation in an operational setting to insure an implementation that will meet the operational needs of NWS,
- Certain critical components of the current operational baseline will have to be migrated into the target architecture to support the evaluation defined above,
- Business cases will have to be developed in order to determine the most cost effective and timely method to enhance application functionality in conjunction with migration to the new target architecture, and
- It is more effective to have a standardize set of tools (e.g., configuration management and architectural tools) and processes.

AWIPS Evolution will be executed according to the following principles:

- Use Open Source standards and software where possible,
- Use spiral development and prototyping when appropriate for meteorological and hydrological development,
- Use spiral development and prototyping as risk reduction mechanisms to insure that target architecture meets the operational needs (e.g., performance) of NWS,
- The Government will work with Raytheon in the generation of the Software Product Improvement Plan (PIP) and AWIPS Development Environment (ADE) specification, and
- AWIPS Evolution will be executed within Operations and Services Improvement Process (OSIP).

In order to insure that these core beliefs and principles are applied appropriately, this document focuses on the following areas:

- Scope Definition of AWIPS Evolution Project
- Organization Descriptions
- Management Processes
- Roles and Responsibilities

To assist with the use of this document, Appendix 1 contains an acronym list.

Scope Definition of AWIPS Evolution Project

The NWS recognizes that AWIPS currently has several shortcomings that limit its ability to meet evolving requirements that support the mission of NWS and NOAA. These shortcomings have been briefed to NWS leadership and documented within SONs via OSIP. As stated in the SON, some of the limitations are as follows:

- “Software architecture is unreliable and prohibits seamless integration of new science,
- Numerous outstanding field requirements are not being met (driven by software, hardware, and communication limitations),
- Takes too long to get new data added to Satellite Broadcast Network,
- Current database architecture creates redundancies and inefficiencies,
- Process for defining, validating and prioritizing software and data (product) requirements is deficient. Lack of clear management-endorsed requirements leads to a range of problems during the development lifecycle, and
- Support for the development of AWIPS software architecture documentation needed for maintenance and evolution.”

In order to address these shortcomings, a management process must be defined that will enable new technology, developed within the private sector, to be implemented within the system.

These shortcomings are divided into two major areas: implementation of new operational service enhancements and infrastructure adjustments. The new operational services enhancements can be implemented in several different ways, but ultimately depend on how the AWIPS infrastructure will be revamped in the coming years. It is these infrastructure changes that make up the significant portion of the CTR option. These infrastructure changes are necessary but not sufficient to correct all of the existing shortcomings.

Within AWIPS Evolution documentation, the operational service enhancements are divided into four categories: 1) Data Delivery (SON #05-040); 2) Visualization (SON #05-021); 3) Collaboration (SON #05-042); and 4) Information Generation (SON #05-041). Within these four categories, the collaboration and information generation tasks clearly are requesting the implementation of new requirements within AWIPS. The other two tasks (i.e., data delivery and visualization) cross the line between new operational service enhancements and infrastructure adjustments in that these areas could be defined as ser-

VICES under a Service Orientated Architecture (SOA). These service definitions may or may not completely address the shortcomings described within the SONs. Some of the components of implementing these two tasks are associated with the infrastructure changes and some are associated with enhanced functionality.

The scope of the CTR option is another management issue. The NWS wants an infrastructure and architecture that supports both AWIPS and National Centers AWIPS (N-AWIPS), yielding a more integrated enterprise. The Government proposes that an assessment be conducted to determine how the elements of the AWIPS SOA are applied to the N-AWIPS infrastructure. The assessment would evaluate at least the following:

- Include National Centers for Environmental Prediction (NCEP) technical and procedural requirements in the workflow analysis and
- Determine a rough order of magnitude (ROM) estimate of costs and impacts of adapting NCEP applications to utilize SOA service components.

If the assessment indicates that it is cost effective for NCEP to utilize SOA service components, then the roles and responsibilities between NCEP and Raytheon must be clearly defined. To ensure that NCEP can continue to meet its technical and procedural requirements, the following are preliminary recommendations: 1) NCEP continues to develop, maintain and be responsible for the N-AWIPS baseline and 2) Raytheon is responsible for the development and maintenance of SOA components utilized by N-AWIPS.

These issues must be resolved within the drafting of a detailed PIP and associated task orders. Raytheon is responsible for the drafting of this PIP but it is in the Government's interest to be involved in the process in order to ensure that the proposed task orders contribute towards the satisfaction of the items documented in the various SONs. This PIP provides the roadmap for implementing a new architecture in AWIPS. This PIP should only be adjusted when either the contractor or the Government can provide a clear requirement supporting the change. An example, would be finding out that an assumption is incorrect such as the impact of a change in the Concept of Operations for the NWS. Any proposed change in the PIP needs to be considered carefully by all parties involved in order to make the best decision for the NWS and AWIPS.

Organization Descriptions

The organizational structure must be defined prior to the execution of the CTR. This section defines the Government-Raytheon partnership. Red is used to indicate Raytheon, blue the Government in the figures in this section.

The Programming Branch provides the Government lead for the AWIPS Evolution project, including technical understanding of proposed solutions and project management. This branch is composed of individuals from SEC and the development laboratories of Global Systems Division (GSD), Meteorological Development Laboratory (MDL), Office of Hydrological Development (OHD), and NCEP. This branch is governed by two

structures. Figure 1 show the organizational structure where the branch is located within the System Engineering Center (SEC).

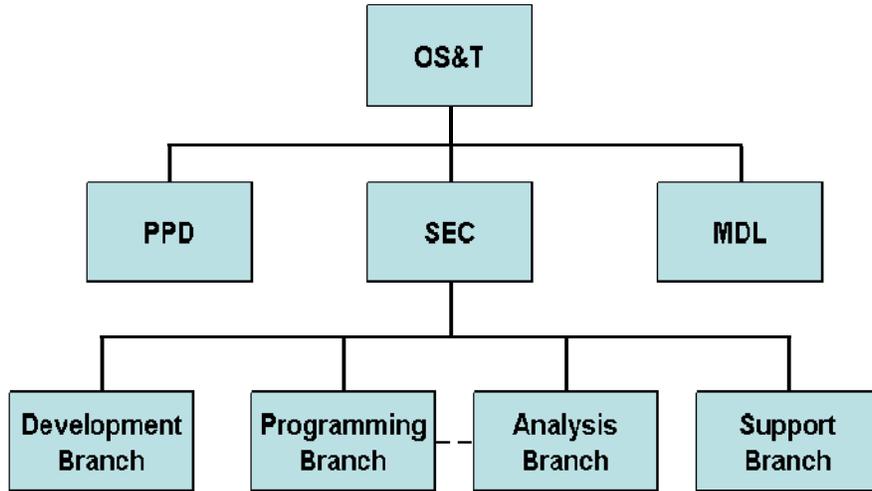


Figure 1 - OS&T Organization

The second structure is the AWIPS Program Office Structure (see Figure 2). In this organization, the activities of AWIPS Programming Branch are directed by the AWIPS Product Improvement (API) Manager.

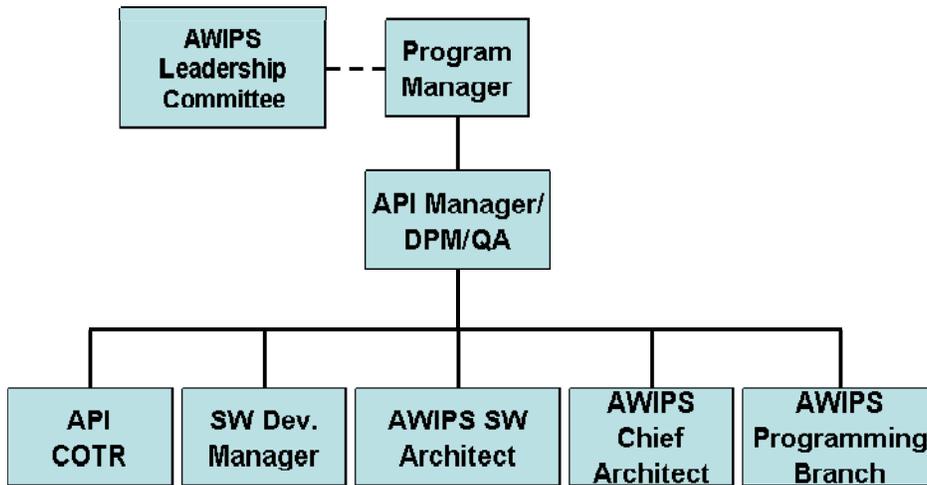


Figure 2 - Portion of the AWIPS Program Office Structure

As illustrated in the Raytheon *Statement of Work/Technical Proposal*, Figure 3 provides the program structure for the AWIPS contract. The Raytheon contract indicates that the three areas of Mission Assurance, Software Maintenance and Support, and AWIPS Evolution all work through the Program Management aspect in order to accomplish their respective tasks.

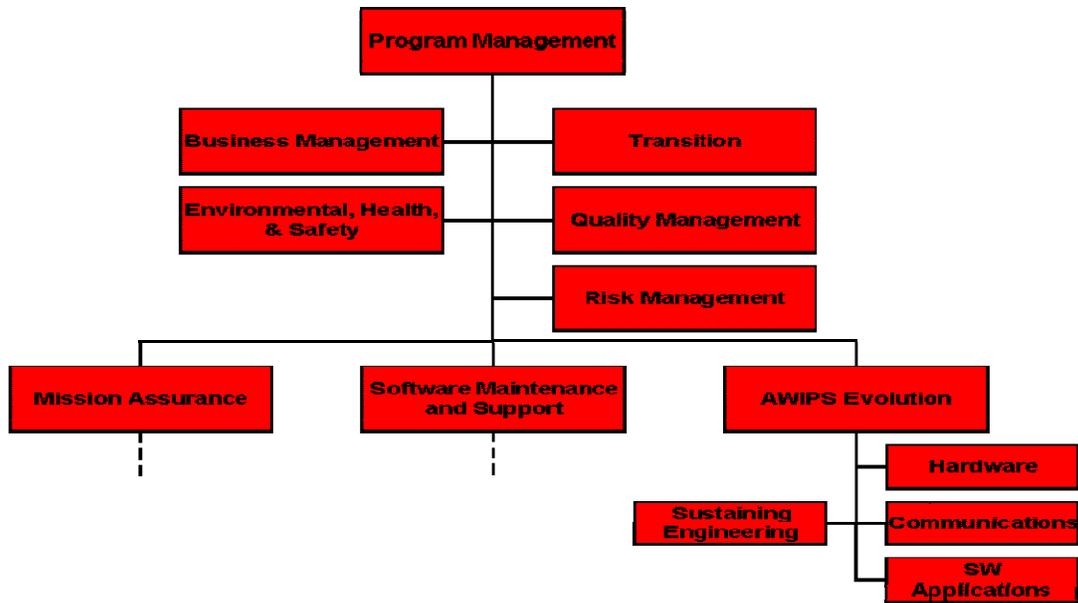


Figure 3 - Raytheon AWIPS Program Organization

The Raytheon AWIPS contract proposes that the work associated with the CTR option be accomplished by establishing an Integrated Product Team (IPT). The Government agrees with this concept and proposes that the initial IPT include the Programming Branch from the NWS and the AWIPS Evolution structure from Raytheon (see Figure 4). Once the CTR option is exercised, the IPT must establish the specific rules of engagement in order to accomplish the activities necessary to provide product improvements in AWIPS.

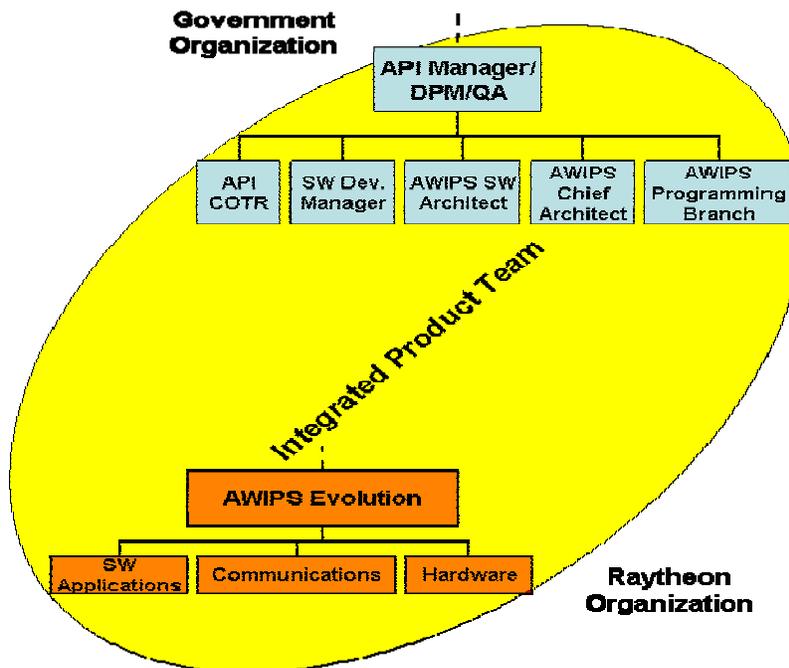


Figure 4 - AWIPS Evolution Integrate Product Team

This IPT is the same as the OSIP Integrated Work Team (IWT) for the AWIPS Evolution SON¹. The IPT is augmented with additional individuals from other areas within the NWS and Raytheon as this project moves through the OSI stages and gates. This provides the team with the appropriate expertise in order to carry out the OSI Process and conduct the necessary development and/or testing for a particular stage. Figure 5 shows the organizations expected to contribute to the AWIPS Evolution project as it traverses the OSIP stages and gates. Depending on the stage of the task, Raytheon leads the team and has members on the OSIP Gate Review Boards.

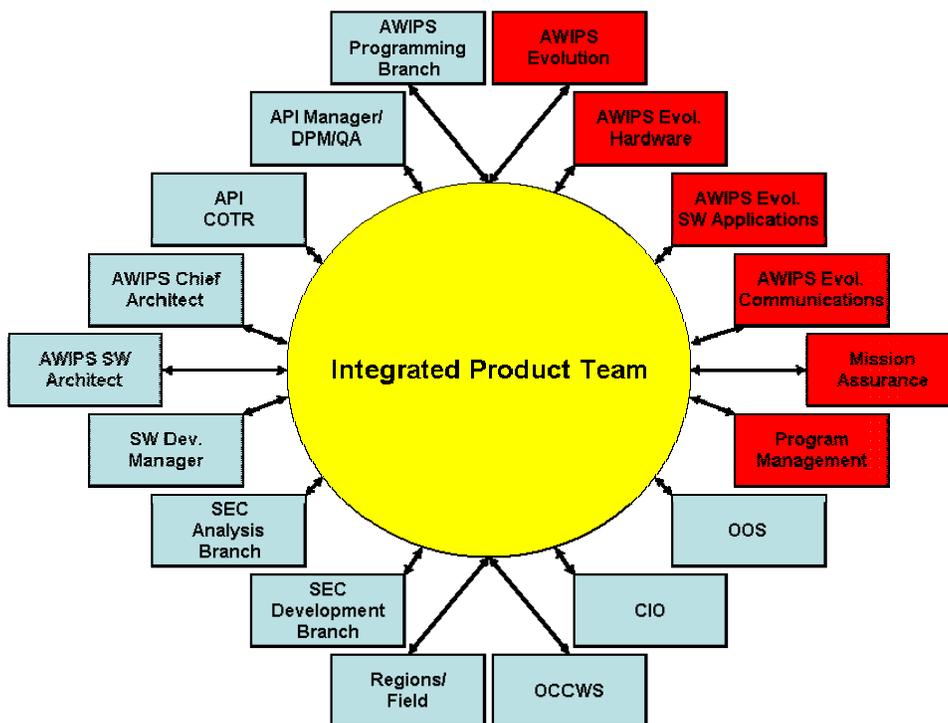


Figure 5 - IPT Members

Management Processes

Both the NWS and Raytheon have processes governing the implementation of software within operational environments. This section describes the associated processes and provides an idea of how to blend them into a single process for the AWIPS Evolution project. Following the process descriptions are a few examples of how this process can be applied. By looking at these examples, a framework is created to address the issues and concerns from the various implementations to be faced during the execution of the CTR option.

¹ Note: IWT and IPT are interchangeable terms.

OSIP Overview

OSIP has been referred to within this document several times. The NWS uses this process to identify needs and scientific opportunities, perform research, evaluate solutions, and implement scientific and technical solutions for existing needs. This process is composed of 5 stages and 4 gate reviews. At the gate reviews, members from all organizations within the NWS decide whether or not the task moves to the next stage. Figure 6 shows the stages and gates associated with OSIP.

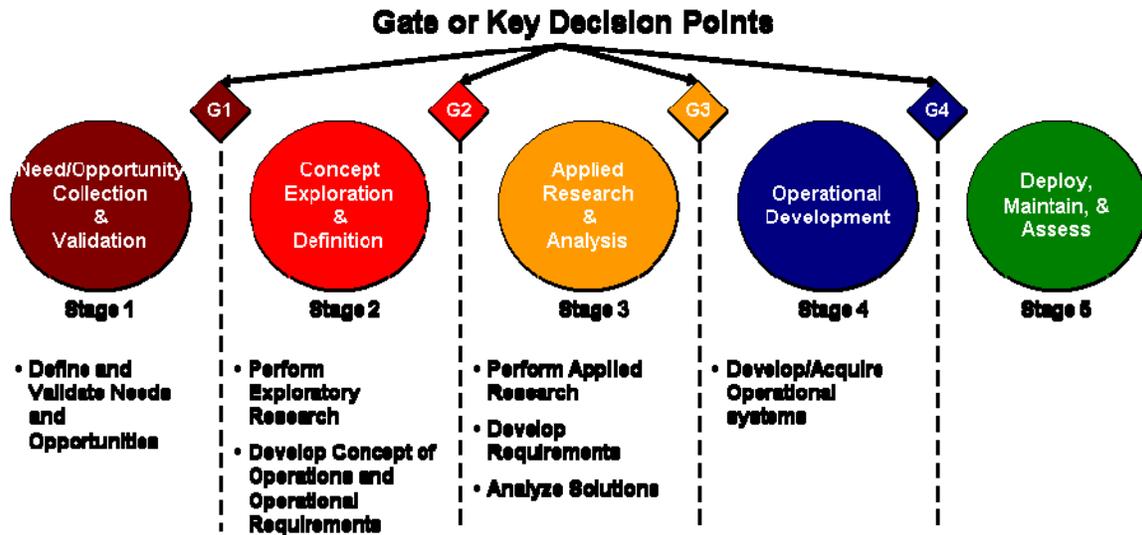


Figure 6 - OSIP Stages and Gates

During Stage 1, a specific need/opportunity of the NWS is presented and validated. The presenter must complete a SON and start developing the initial Project Plan. After this need/opportunity has been validated at the Gate 1 review, the concept of operations and the associated operational requirements are documented. Any necessary exploratory research is conducted and evaluated to determine whether or not a particular technology and/or solution will satisfy these requirements. Spiral development and prototyping are vital in order to assist in the evaluation of the appropriate solution. These solutions are documented in a report describing the results. These documents along with an updated project plan are presented to the gate members for the 2nd gate review. Once the task/project proceeds through Gate 2, the potential solutions (e.g., the viable technologies identified in Stage 2) are analyzed in order to determine the best solution for the need. During this stage, the technical requirements are developed and implemented. Operational prototype is used to obtain necessary user feedback in order to narrow the scope of the technical requirements. In order to support the decision, a business case is developed. Based on this business case, additional research evaluation, production of technical requirements, and an updated project plan, the Gate 3 members determine whether or not this task/project can proceed to be prepared for operations. During Stage 4, the final design, development, and testing of the code is accomplished. This final production of software is tested against the operational and technical requirements which were established and refined during Stages 2 and 3. It is during this stage that training plans and materials are developed. The final decision for deployment is made at the Gate 4 review. This decision is based on the results of the operational testing and a final update to the

project plan. The 5th stage is the deployment and the beginning of the Operations and Maintenance of the task/project.

Mission Assurance Manager's Gate Process

The Raytheon Mission Assurance Manager's Gate Process is an internal process that is used to ensure that approved enhancements meet Raytheon quality standards, meet all applicable operational requirements, and are complete, tested, and ready for incorporation into the baseline. This process also ensures that the Raytheon team is prepared to conduct and support the deployment of the enhancement(s) and all documentation is updated appropriately. Raytheon states within the *Statement of Work/Technical Proposal* that this process is a parallel process that integrates with existing NWS processes.

In this process, the Mission Assurance Manager makes a recommendation on whether or not a given enhancement is ready to move into the baseline. This recommendation is based on whether or not the

- Enhancement meets design and operational requirements,
- Enhancement causes no unintended harm to other parts of the system,
- Maintenance impact has accounted for its impact on other mission assurance tasks,
- Staff has been appropriately trained, and
- Standard Operating Procedures are adhered to or updated as necessary.

The general steps used within this process are outlined within the *Statement of Work/Technical Proposal*. Those steps are summarized below

- Mission Assurance Manager cognizant of the development of the candidate improvement,
- Candidate improvement shown to be an improvement to AWIPS via testing,
- Test results are provided to the Mission Assurance Manager,
- Candidate improvement approved by the Mission Assurance Manager,
- Candidate improvement is reviewed by Raytheon Gate Review Team who makes a recommendation to the Raytheon Program Manager about whether or not this improvement should be incorporated into the baseline,
- Raytheon Program Manager provides a recommendation to the Contracting Officer's Technical Representative (COTR) for subsequent NWS acceptance or rejection, and
- If approved by the COTR, accepted change is deployed to the sites via an appropriate means (e.g., operational build, maintenance upgrade, emergency upgrade, etc.).

Blended Process for AWIPS Evolution

The process applied to AWIPS Evolution should satisfy the review processes described above (e.g., OSIP and Raytheon Mission Assurance Manager's Gate Process) as well as remain efficient. The production of high priority and quality enhancements that do not have negative impact on the overall system are central goals of both of these processes. OSIP provides the documentation structure necessary to support the various decision points as a

new requirement goes from concept to deployment. Figure 7 shows how the Raytheon Mission Assurance Manager's Gate Process can be blended with OSIP

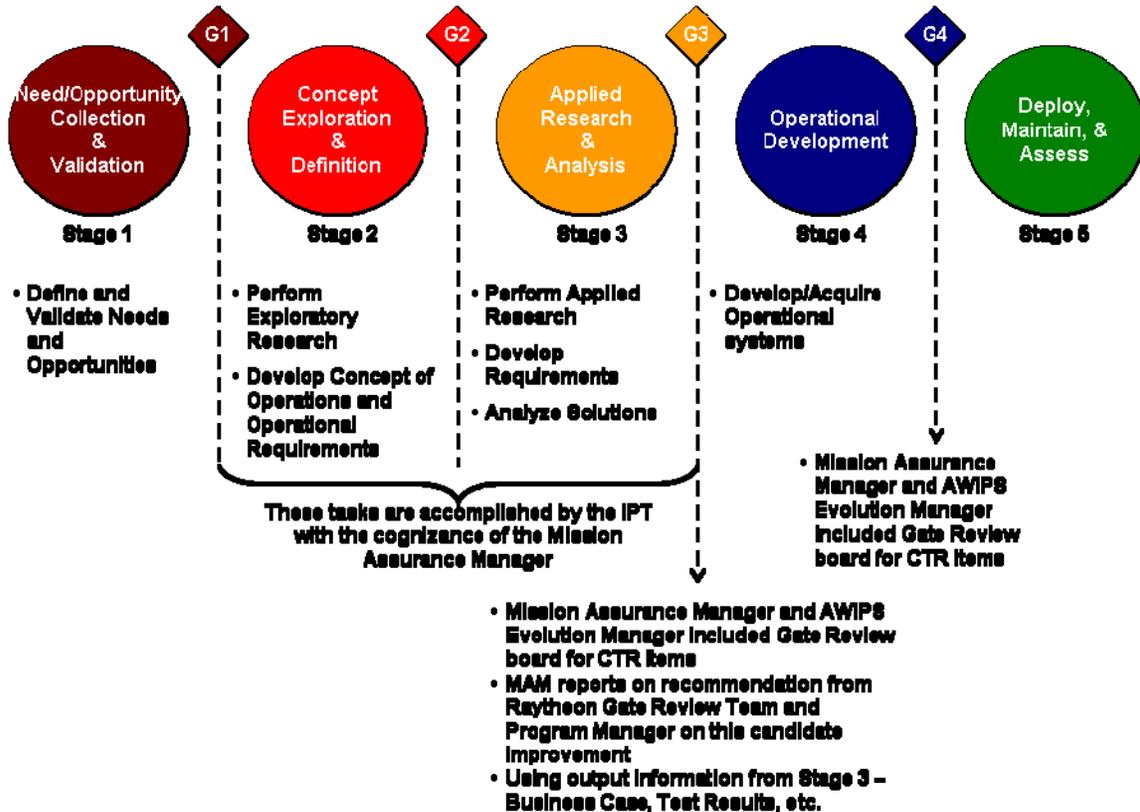


Figure 7 - Blending Mission Assurance Manager's Gate Process with OSIP

As these two processes are blended, Stages 2 and 3 are executed with the cognizance of the Mission Assurance Manager. This manager along with the API Manager and the Operations and Maintenance Manager from the NWS participate in the OSIP Gate 3 and 4 Review Boards. At these reviews, the Gate members evaluate software testing results, training plans, and OSIP documentation in order to determine whether or not a project moves to the next OSIP stage. If a particular enhancement is determined not to be ready for the next stage, then it will not be presented until it is acceptable. Blending these two processes allows for the most efficient achievement of the stated goal which is to provide high priority and high quality enhancements in the AWIPS baseline.

Implementation Examples

This section defines three scenarios and their respective Government-Raytheon interactions. These examples deal with the introduction of new science into the AWIPS enterprise, with the introduction and/or modification of the AWIPS infrastructure, and AWIPS adaptive maintenance. These examples are illustrated with diagrams that blend OSIP with responsibility profiles for the Government and Raytheon. Within these diagrams (i.e., Figures 8 – 11), the blue background represents Government responsibility whereas the red background shows the areas where Raytheon is responsible. The yellowish circle represents responsibilities associated with the IPT. Within each stage, it is envisioned

that Raytheon and the Government will work together in order to successfully incorporate the new science into the AWIPS baseline. Any software development complete during this process is accomplished within the ADE and the Software Development Kit (SDK) provided by Raytheon.

a. Product Improvements – Scientific Enhancement

The first case deals with the introduction of a new scientific algorithm or application within the baseline. In the case, the Government has the lead role in developing and evaluating the algorithm(s) or application(s). Figure 8 shows how the OSIP process interacts with the Integrated Product Team concept proposed by Raytheon.

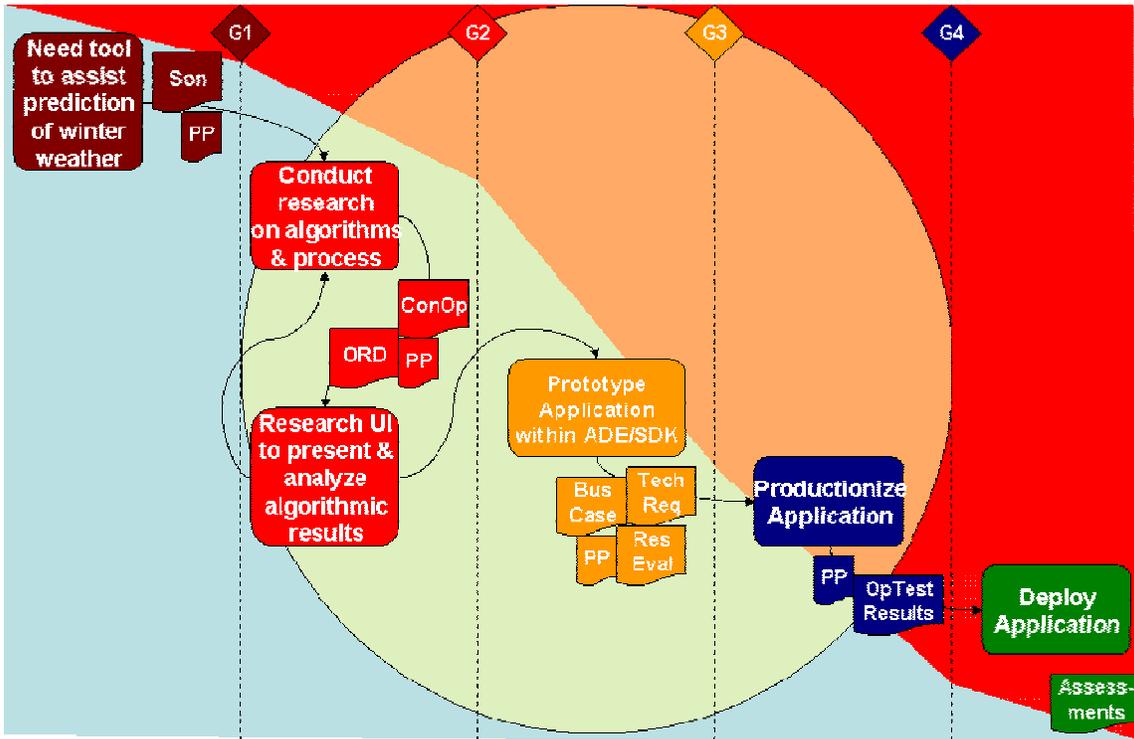


Figure 8 - Decision Assistance Application Example

Since Figure 8 represents a specific example of a decision assistance application, it is helpful to generalize this concept. This generalized version is depicted in Figure 9. This diagram is split into 3 parts: OSIP Stages, Activities, and Responsibility Profile. As a reminder the spiral development occurs within Stages 2 and 3. It is during these stages that specific requirements are being determined for the new application. As a result, it is necessary to “build a little and test a little” to validate whether or not certain assumptions are correct. The IPT determines the appropriate time to present the information to the gate review board for approval to start the next stage.

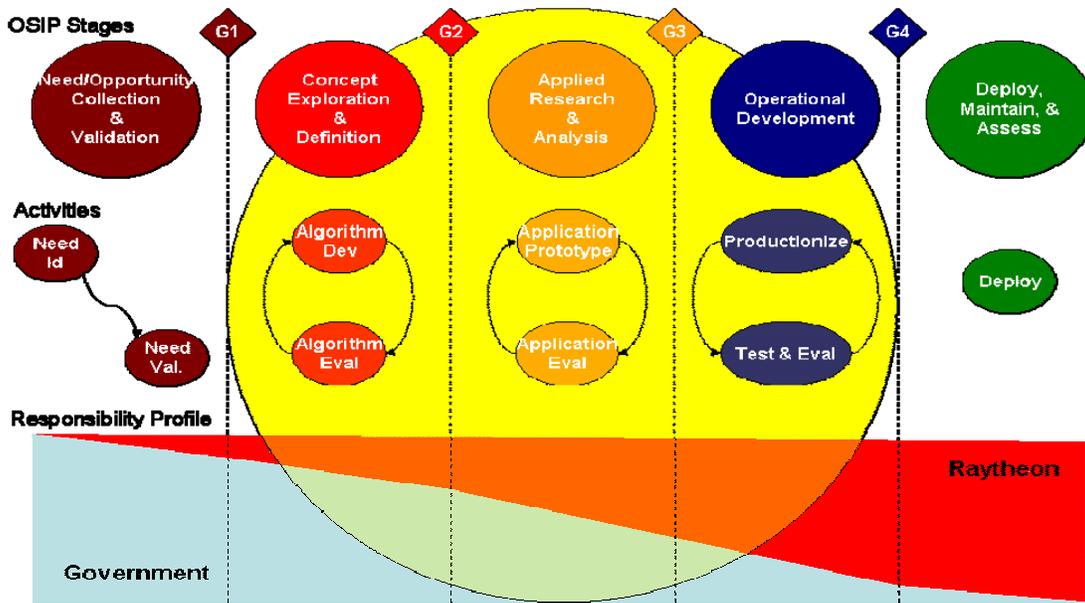


Figure 9 - Generalize Process for Adding New Science to AWIPS

b. Product Improvements – Infrastructure Service Enhancement

A significant portion of the AWIPS Evolution project deals with enhancement of the underlying infrastructure. These enhancements have a different responsibility profile between the Government and Raytheon. Figure 10 shows this responsibility profile. When comparing this diagram to the one in Figure 8, Raytheon has a larger responsibility profile for Stages 1, 2, and 3). The profile is consistent between these examples for Stages 4 and 5. The Government assists in defining infrastructure service requirements and evaluating the proposed solutions and implementations. The Government may also provide support prototyping infrastructure services.

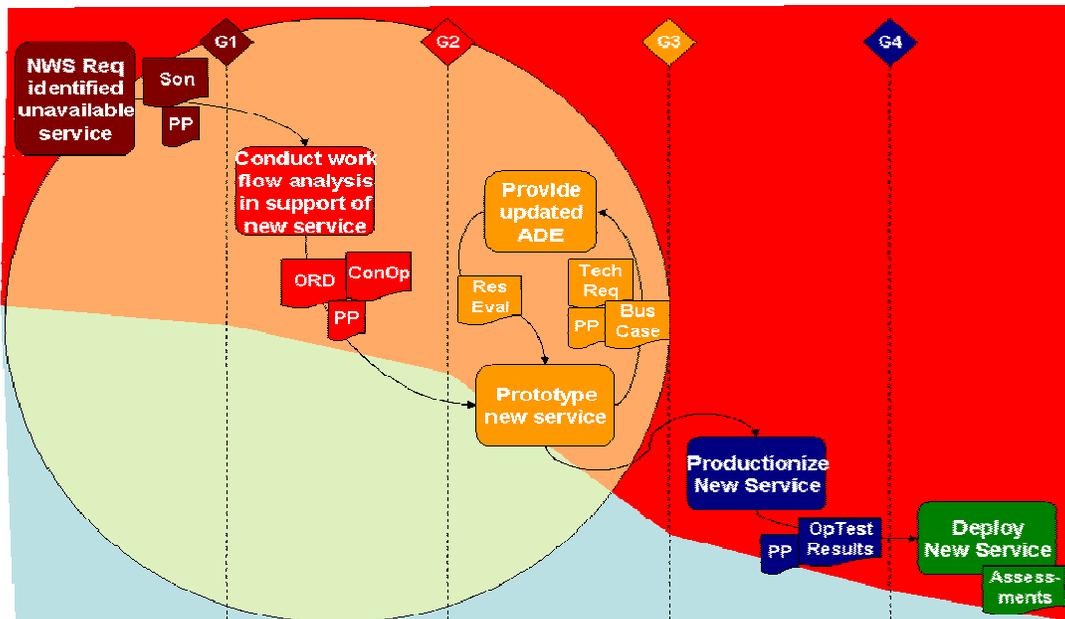


Figure 10 - Infrastructure Service Process Example

Figure 11 shows the generalized version of this diagram. Once again, spiral development and appropriate prototyping must be conducted in support of risk reduction activities during OSIP Stages 2 and 3.

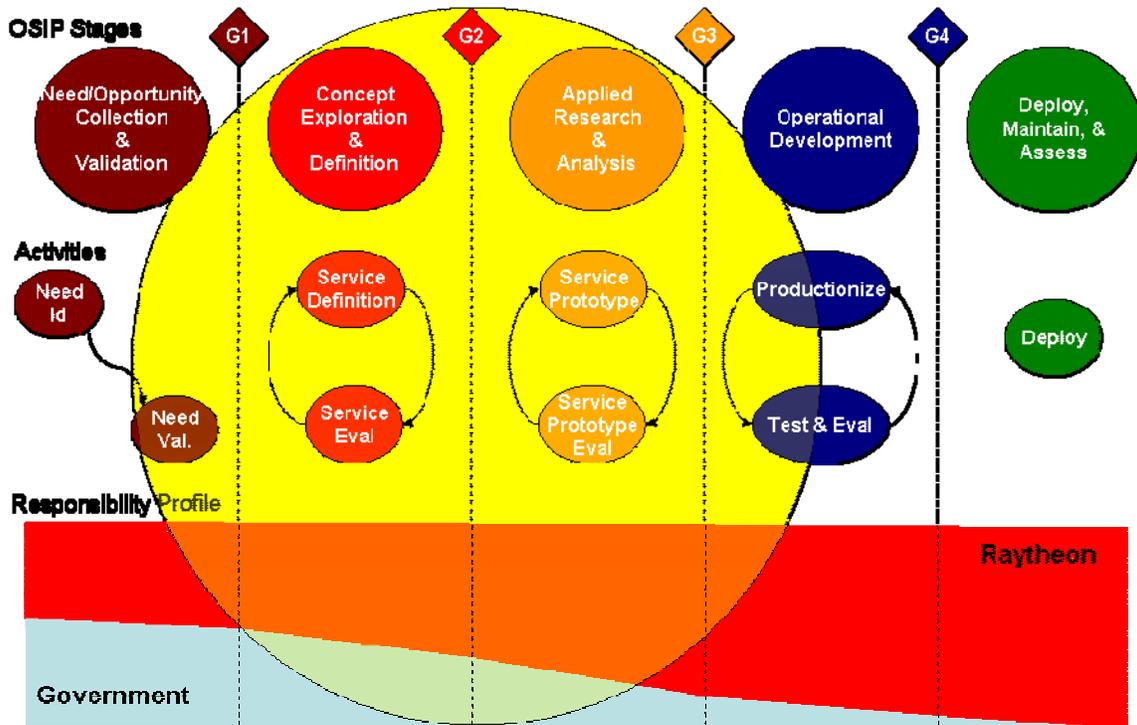


Figure 11 - Generalized Process for Adding Infrastructure Service

When looking at these types of enhancements the Government and Raytheon must work together and within the supplied ADE/SDK in order to develop and implement these changes successfully in the AWIPS baseline.

c. Adaptive Maintenance

Looking at the processes in the area of adaptive maintenance is a bit different than the processes involved when undertaking product improvements. Adaptive maintenance falls into two categories: adding additional, but similar capabilities, or updating algorithms or existing capabilities.

When adding additional, but similar capabilities, the process is essentially a modification of an existing functionality. The example typically used to describe this situation is the addition of new model data. In this situation, the infrastructure to process model data is already in place. There is little to no research necessary to implement this enhancement. This type of adaptive maintenance is in the realm of the AWIPS contractor to accomplish. This category does not use the OSIP since typically this type of development does not require a significant investment of resources. This type of development is prioritized via the Software Recommendation and Evaluation Committee (SREC) for inclusion in the appropriate AWIPS build.

The other area of adaptive maintenance involves updating scientific algorithms or enhancing existing capabilities. In this situation, research is often required to understand and validate the change. The Government is responsible for the research portion and the contractor is responsible for the implementation within the AWIPS baseline. OSIP may or may not be required in this situation depending on the level of research required to identify and update the algorithm or enhance the capability. If a significant amount of research is required, then OSIP is used to determine the allocation of resources and the priority of the change. Otherwise, SREC is used to determine the overall priority of the change. In the situation where OSIP is involved, then this process will mirror the description of a new scientific application described above (see Figures 8 and 9).

These examples represent the situations likely to be encountered during the execution of the CTR option. Each situation is slightly different and how these processes are combined could vary. In each case, the process does not govern the implementation but is used to insure that the goals of the NWS and AWIPS are implemented in an effective manner.

Roles and Responsibilities

Within the AWIPS Evolution project, there are clear roles and responsibilities for both the contractor and the Government. Raytheon is responsible for the definition and implementation of the target architecture and the development of the PIP, ADE, and SDK. As a result, Raytheon is wholly responsible for the AWIPS infrastructure. The Government's responsibilities are participating and supporting all IPTs, verifying that the design and implementation meet the operational needs of the NWS, and participating collaboratively with Raytheon in technology exploration and risk reduction activities. Ideally, the Government laboratories (e.g., SEC, GSD, MDL, NCEP, and OHD) have expertise that is encapsulated entirely within applications that reside within the new architecture. When the Government laboratories collaborate on a solution to a particular SON, OSIP defines the interactions between these entities.

A more detailed understanding of the roles of both the contractor and Government can be obtained by looking at Responsibility Assignment Matrices (RAM) for the introduction of new science enhancement and infrastructure service enhancement examples provided in the Management Processes section. The RAM shows for each process activity (e.g., testing, Concept of Operations development, etc.) which group/individual is participant, accountable, lead, reviewer, provides input to the process, and/or provides sign-off authority. The table is setup using the following key:

- Participant (P) – this group/individual is involved with the production of documentation, reports, software, etc. necessary to support the assigned task(s) as part of the IPT.
- Accountable (A) – this group/individual leads the IPT and has the overall accountability to complete the assigned task(s).
- Lead (L) – this group/individual provides the corresponding accountable authority opposite the “Accountable” responsibility. For example, if Raytheon is account-

able for a particular task, then “L” is assigned to the Government group/individual that is responsible for insuring that the task(s) are completed. This group/individual is a member of the IPT.

- Reviewer (R) – this group/individual reviews the documentation and/or results at the completion of a task.
- Input (I) required – this group/individual provides input to the IPT in order to improve the software development and/or documents. These group/individuals also serve as experts that are not directly represented on the IPT.
- Sign-off (S) required – this group/individual has the final authority to approve a particular task to proceed to the next stage of the process. There is sign-off authority for both the Government and contractor.

Figure 12 presents the RAM for the introduction of new science enhancement example as described in the previous section. As shown in Figure 9, the Government has a significant responsibility in the initial stages of OSIP. This is indicated in RAM diagram by the assignment of “Accountable” to the Government. It should be noted that this RAM diagram is done from the perspective of the AWIPS Evolution Project. The “Accountable” responsibility could move to other entities within the Government depending on the need that has been addressed. For example, the “Accountable” responsibility could reside with OHD if the requested enhancement involves the science of hydrology. The main point is that the Government leads the IPT to develop the enhancement within the framework of the ADE/SDK. Once the application is proven, the information is handed over to Raytheon to prepare the software for operational deployment.

Organization Responsibility	Raytheon				Government										
	Program Mgr	Mission Assurance	SAW Main & Support	AWIPS Eval	Program Manager	O&M Manager	API Manager	SEC				OSIP Gates	NCEP/Labs	OCCWS	Field/Regions
								PB	SAW Architect	AB	CB				
Need Identification				P			A	P	R			R,I,S	R	R	R
Project Plan	R	R	R	L,P			A	P	R	R	R	R,I,S	P	P	P
Algorithm Development				L,P			I	P	I	I			A		
Algorithm Evaluation				L,P			A	P					P	P	P
ConCps/ORD	R	R	R	L,P		R	A	P	R	R	R	R,I,S	P	P	P
Technical Requirements	R	R	R	L,P			A	P	R,I	R,I	R,I	R,I,S	P	R,I	R,I
Application Prototype				L,P			I	P					A		
Application Evaluation	I	I	I	L,P			A	P					P	P	P
Results Evaluation	R,S	R,S	R,S	L,P	R,S	R,S	A	P	R			R,I,S	P	R,I	R,I
Business Case	R,S	R,S	R,S	L,P	R,S	R,S	A	P	R,I			R,I,S	R,I	R,I	R,I
Productionization			A	P			I	P			L		P		
Test & Evaluation			A	P			I	P			L		P	P	P
Operational Test Results	R,S	R,S	A	P	R,S	R,S	I	P			L	R,I,S	R,I	R,I	R,I
Deployment		A	P			L								P	P
Assessment	R,I,S	A	P		R,I,S	L						R,I,S		P	P
O&M		A	P			L									

Figure 12 - Organizational RAM for New Science

Figure 13 illustrates the RAM for the example of adding a new infrastructure service enhancement to the AWIPS baseline. In this case, Raytheon has the “Accountable” responsibility and the Government performs a supporting role.

Organization	Raytheon				Government										
	Program Mgmt	Mission Assurance	SW Main & Support	AWIPS Env	Program Manager	O&M Manager	AFI Manager	SEC				OSIP Gates	NCEP/LaIs	OCCWS	Field/Regions
								PB	SW Architect	AB	DB				
Need Identification				A			L	P	R			R,I,S	R	R	R
Projac Plan	R	R	R	A			L	P	R	R	R	R,I,S	P	P	P
Service Development				A			L	P					I		
Service Evaluation				A			L	P					I	P	P
CanOps/ORD	R	R	R	A		R	L	P	R	R	R	R,I,S	I	P	P
Technical Requirements	R	R	R	A			L	P	R,I	R,I	R,I	R,I,S	I	R,I	R,I
Service Prototype				A			L	P					I		
Service Prototype Eval	I	P	I	A			I	P					I	P	P
Results Evaluation	R,S	R,S	R,S	A	R,S	R,S	L	P	R			R,I,S	R,I	R,I	R,I
Business Cond	R,S	R,S	R,S	A	R,S	R,S	L	P	R,I			R,I,S	R,I	R,I	R,I
Productionization			A	P			I	P			L		I		
Test & Evaluation			A	P			I	P			L		I	P	P
Operational Test Results	R,S	R,S	A	P	R,S	R,S	I	P			L	R,I,S	R,I	R,I	R,I
Deployment		A	P			L								P	P
Assessment	R,I,S	A	P		R,I,S	L						R,I,S		P	P
O&M		A	P			L									

Figure 13 - Organizational RAM for Infrastructure Service

The role and responsibility matrix varies based on the type of enhancement is being incorporated into AWIPS. The significant point of these matrices is that no single entity has complete responsibility for introducing items into the AWIPS baseline. The management process sets up a “checks and balance” situation in which Raytheon and the Government must successfully partner together in order to prepare AWIPS for future requirements.

Risk Reduction/Prototyping Activities

The use of prototyping as a risk reduction activity is proven within the NWS. Based on previous experience, the NWS believes that applications and/or infrastructure enhancements that affect critical NWS operations (e.g., warning mission, data access, etc.) should be prototyped in an operational setting. There is practical limit to the amount of prototyping that can be accomplished. As a result, potential enhancements need to be evaluated to determine whether or not they will benefit from prototyping. Potential enhancements may not need to be prototyped if requirements are sufficiently defined and/or the operational impact is a low risk. Figure 14 shows a decision tree to assist in this determination. The concept associated with this decision tree is to acknowledge that not all changes are created equal. So, the decision tree starts out by asking whether or not the change is significant? If so, then what is the impact on critical NWS operations? For example, in the

area of applications, a significant change to Warngen requires operational prototyping whereas a significant change to the Climate application most likely does not. In a similar manner, a significant change to the data access service requires operational prototyping when a significant change to the logging service does not. These questions are arbitrary; the point of the exercise is to evaluate whether or not the successful implementation of the enhancement will benefit from operational prototyping versus other testing methods.

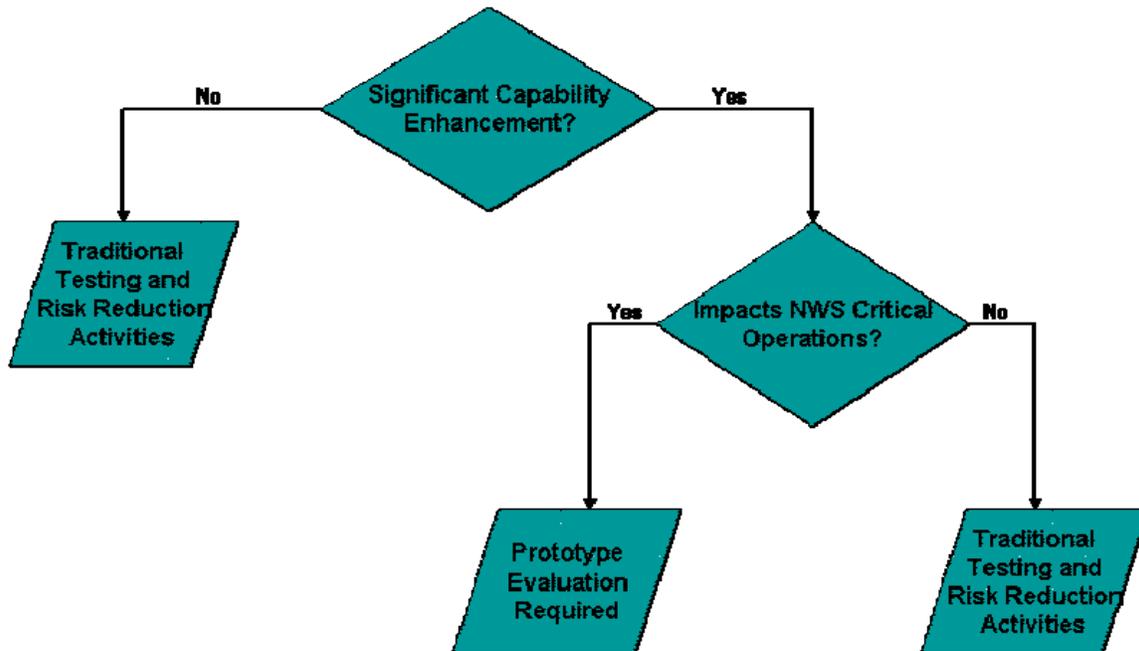


Figure 14 - Prototype Decision Tree

As a result of previous operational prototyping, the NWS has observed the following benefits:

1. Assists in identifying and evaluating viable technologies,
2. Refines and clarifies operational requirements,
3. Reduces overall costs when accomplished early in the process, and
4. Improves resultant implementation of the enhancement due to user feedback.

The first item, assists in evaluating viable technologies, is associated with OSIP Stage 2 where as the item of refining and clarifying operational requirements is consistent with OSIP Stage 3. Figure 15 maps the OSIP stages with the Raytheon Software Development process. These two OSIP stages map to the model, prototype, and refine effort defined within the proposed process.

During these early stages of enhancement development (e.g., algorithm, infrastructure service, etc.), OSIP defines the establishment of operational and technical requirements. These requirements define the criteria against which the final product will be tested to determine whether or not it can be deployed. Thus, the operational and functional requirements are of utmost importance in this process. If the requirements are incomplete or incorrect, then the final product will not satisfy the needs of the NWS. As a result, it is essential that the contractor and Government, including field personal, be involved in the

establishment of these requirements. These requirements must define the technical, functional, look & feel, performance, etc. needs of the new/enhanced application or service. Via the operational prototyping of critical enhancements, the NWS is assured that these requirements are being satisfied. The development laboratories within the NWS have critical intuitional and functional expertise with respect to hydrological and meteorological applications, algorithms, and operations. Also, the development laboratories have established a web of relationships with the regional and field personal that facilitates operational testing. This expertise and established relationships should be utilized to facilitate successful operational prototyping of critical enhancements.

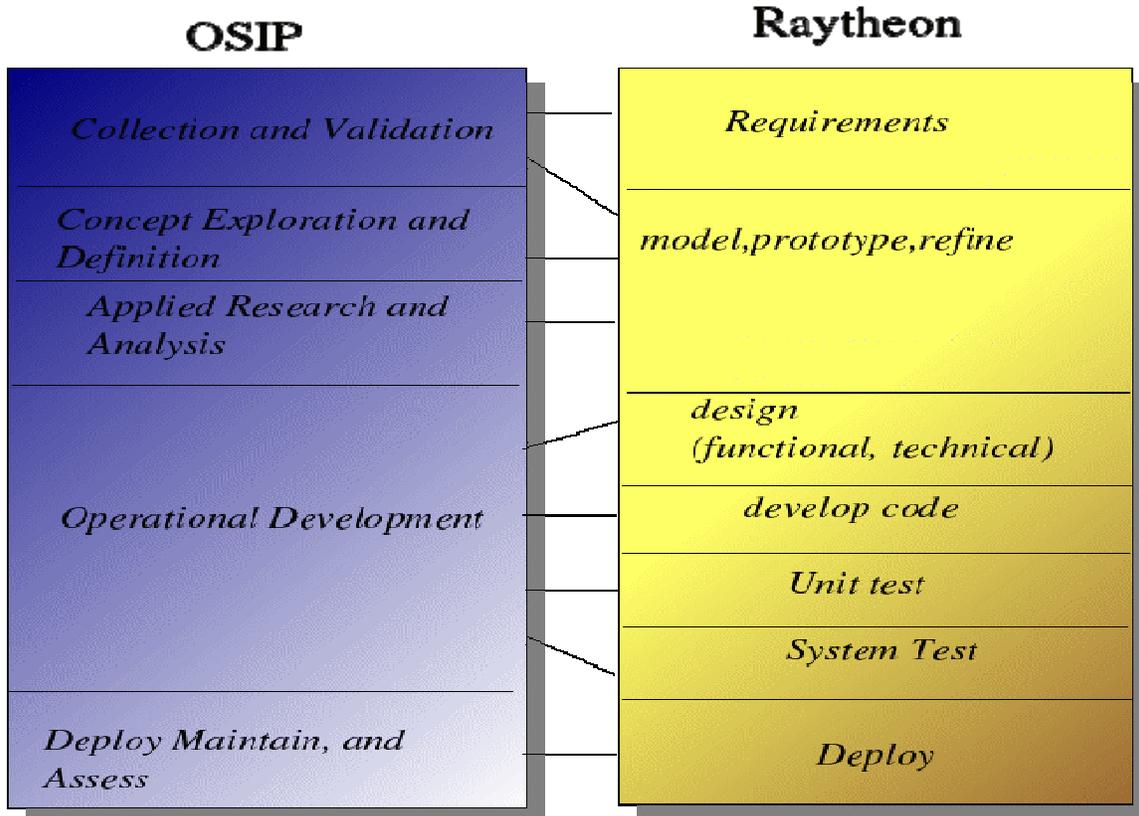


Figure 15 - OSIP/Raytheon Software Development Relationship

Operational prototyping means different things depending on the situation. Typically, the prototype software is used within a laboratory setting initially. This initial use is followed by testing in structured and controlled environment. Once the software passes this testing, then it is evaluated within an environment that mimics an operational setting (e.g., Regional Headquarters test bed). Even with all of this testing, it is often necessary to prototype the software in an actual operational environment. In this situation, a prototyping structure needs to be implemented to allow this type of software evaluation but reduce the risk on the operational system.

Technical issues will arise in any operational prototyping. These technical issues associated with the prototyping effort need to be evaluated and resolved within the Project Plan(s), as updated for each OSIP Stage, associated with AWIPS Evolution. These technical issues include requirement evaluation and impact on the operational mission of the

Weather Forecast Offices (WFO), River Forecast Centers (RFC), and National Centers (NC).

The NWS will continue to fund strategic development aimed at improving operational services at the WFOs, RFCs, and NCs. With the development laboratories of the NWS being subject matter experts, Raytheon has the option to contract with these laboratories in order to accomplish prototyping work. The exact roles and responsibilities are governed by OSIP and the associated funding profile.

It is the belief of the NWS that the only way to ensure that a critical NWS needs are satisfied within the operational environment is to work with the end users and other stakeholders to establish requirements and evaluate the software at various stages against these requirements.

Conclusion

This AWIPS Evolution and Transformation Management Plan provide a high level framework for resolving issues associated with the execution of the AWIPS Evolution project. This plan focuses on the organizational and structural processes established to facilitate the enhancement of operational services and the underlying infrastructure.

Operational prototyping is established as a necessary activity for the evaluation of critical enhancements. Both the Government and Raytheon can make significant contributions to these enhancements and it is only by working together via an IPT and within the ADE/SDK that the changes associated with AWIPS Evolution will be successfully implemented.

Appendix 1 – Acronym List

- ADE – AWIPS Development Environment
- API Manager– AWIPS Product Improvement Manager
- AWIPS – Advanced Weather Interactive Processing System
- COTR – Contracting Officer's Technical Representative
- CTR – Continuous Technology Refresh
- GSD – Global Systems Division
- IPT – Integrate Product Team (same as IWT in the context of this document)
- IWT – Integrated Work Team (same as IPT in the context of this document)
- MDL – Meteorological Development Laboratory
- N-AWIPS – National Centers AWIPS
- NC – National Centers
- NCEP – National Centers for Environmental Prediction
- NWS – NOAA National Weather Service
- OHD – Office of Hydrological Development
- OSIP – Operations and Service Improvement Process
- PIP – Product Improvement Plan
- RAM – Responsibility Assignment Matrices
- RFC – River Forecast Centers
- ROM – Rough Order of Magnitude
- SEC – System Engineering Center
- SDK – Software Development Kit
- SOA – Service Oriented Architecture
- SON – Statement of Need
- SREC – Software Recommendation and Evaluation Committee
- WFO – Weather Forecast Offices

Appendix 2 – Individual Roles

Government Roles –

- API Manager/DPM/QA: Jim Christman
- API COTR: Walter Scott
- Software Development Manager: Edwin Welles
- AWIPS Software Architect: Jason Tuell
- AWIPS Chief Architect: Tim Hopkins
- AWIPS Programming Branch: Jason Tuell