

# Lockheed Martin Develops Enhanced Airspace Security System with IBM Rational XDE and IBM Business Integration Tools

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## Overview

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### ■ The Challenge

*Lockheed Martin began an enterprise integration initiative to link the air traffic monitoring systems of four federal agencies. The project's distributed development team needed tools to facilitate model-driven development and legacy system integration.*

### ■ The Solution

*The team adopted IBM Rational XDE to build an effective architecture, document use case requirements, and communicate the requirements and architecture clearly. In addition, the team is using IBM Rational Application Developer for WebSphere Software and tools from the WebSphere Business Integration portfolio to accelerate integration efforts.*

### ■ The Benefit

*The advanced capabilities and tight integration between IBM solutions are enabling a relatively small engineering team to proactively address risk, minimize costs and maintain an aggressive schedule of delivering customer demonstratable functionality every 90 days.*

As a lead systems integrator and information technology company, Lockheed Martin is one of the world's premier technology companies and is principally engaged in the research, design, development, manufacture and integration of advanced technology systems, products and services. Recently, engineering teams from Lockheed Martin Transportation and Security Solutions (TSS) and Lockheed Martin Integrated Systems & Solutions (IS&S) began work on an Enhanced Airspace Security system (EAS). The system will serve the Federal Aviation Administration (FAA), the Department of Defense (DoD), the U.S. Secret Service, and the Bureau of Immigration and Customs Enforcement. When completed, the system will enable operators at multiple agencies to efficiently collaborate as they monitor, track, and coordinate prompt responses to non-cooperative or potentially threatening aircraft.

TSS, which specializes in advanced aviation management, security and other mission-critical information technology solutions is working together on the project with IS&S, which builds transformational

solutions for intelligence, surveillance and reconnaissance; command and control; communications; and combat support to the DoD and the intelligence community. The Enhanced Airspace Security project, or EAS, requires the integration of multiple disparate legacy systems to enable automated data exchange and enhance interaction, communication and coordination between agencies.

### Addressing a multi-agency need

John Pritchard, Chief Architect for the EAS project at Lockheed Martin, reports, "Each agency historically developed its own system to accomplish its air surveillance mission. EAS is an enterprise integration project that will enable the agencies to share information. Frequently, one of the agencies will start monitoring an aircraft and then need to pass the information to another agency. Before EAS, there was really no automated way for them to exchange data."

To accomplish the goals of the project, the team needed to integrate the agencies' various systems and keep costs down while aggressively managing risk. They needed to

define a flexible, sound architecture for the entire system; define requirements and system functionality clearly; and communicate the architecture and requirements to their customers and everyone on the distributed team.

### **IBM tools, processes and service all play a role**

Based on successes with IBM Rational® tools on earlier projects, Pritchard and his colleagues began using IBM Rational Rose® XDE™ Developer for Java®, to develop the system architecture. The team is also using IBM Rational Application Developer for WebSphere® Software as their IDE along with tools from the IBM WebSphere Business Integration portfolio to streamline development and accelerate the integration of legacy systems. In addition, consultants from IBM Rational brand services are assisting in tool deployment and architecture design.

Pritchard notes, “From an architecture and project execution perspective we are using Rational XDE in all of our modeling activities and Rational Application Developer for WebSphere Software in our development activities. We are using the WebSphere Business Integration tools to help us in the areas of service oriented architectures, Web services, and enterprise integration. We have an integrated development environment because WebSphere Business Integration capabilities are an integrated part of Rational Application Developer for

WebSphere Software. And we will be running EAS on an IBM WebSphere Application Server. We are not fundamentally changing the legacy systems; we are leveraging the power of IBM tools to allow these legacy systems to interoperate.”

He adds that IBM technical assistance helped to accelerate the early stages of the project. “We had IBM consultants come in to work with us on tool integration and architecture design to help kick-start the program.” The consultants assisted in setting up the EAS development environment which includes IBM eServers™ running POWER5™ processors and AIX®.

On the project, the development team is also applying an iterative software development approach and other principles of the IBM Rational Unified Process®, or RUP®, methodology. “We are following a RUP-based methodology. We are going through multiple iterations and employing all the tenets of RUP. We will have three month iterative cycles in which we add more use cases and more functionality to the system in each iteration.” says Pritchard.

### **Responding information sharing initiatives**

There are two key government initiatives that are driving the two major agencies involved in EAS in the direction of service oriented architecture. The DoD’s Defense Information Systems Agency (DISA) has an initiative called Net-Centric

Enterprise Services (NCES), which will provide DoD organizations with access to reliable information through net-based services infrastructure and applications. The FAA’s initiative is System-wide Information Management (SWIM), which will also provide an information sharing infrastructure.

Pritchard reports, “These are government mandates which are behind the move to service oriented architectures to allow government systems to interoperate. EAS is going to be among the first that uses Web services to do that for these two agencies, and it will demonstrate how they can share data with each other.”

### **Modeling a service oriented architecture**

A key step in the project was developing a model of the legacy system integration. The model serves not only as a foundation for future development efforts but also as a key deliverable to Lockheed Martin’s customers. “Our iterations are demonstration based, and the first iteration is an architectural release focused on data exchange. As we complete the elaboration phase of development, we will have a demonstrable architecture that we will show to our customers. Included in that will be the design work we did in Rational XDE using the Unified Modeling Language (UML). We used UML to model legacy application integration using Web services. We defined a service oriented architecture that allows legacy

applications to expose functionality as a service that other applications can then find, bind and invoke,” explains Pritchard.

### **Support for a distributed development team**

At this stage, the EAS development group is relatively small – but its 18 team members are spread out in four locations across the country. With a geographically distributed team, clear communication is essential, but not always easy to achieve. Rational XDE and UML provide the EAS team with an effective way to communicate the architecture and other elements of the system. Pritchard notes, “We have people in Minnesota, California, Washington D.C. and Colorado. Communication is a big challenge. We are using UML diagrams as a mode of communication, and Rational XDE is facilitating that. UML is the de facto standard in the industry and it provides essential support for distributed teams that share information off a single model.”

He continues, “A developer on one coast can create a design that developers on the other coast are going to understand because they are all speaking this common modeling language. Our team has legacy developers using IBM Rational Apex® and developers who are doing the enterprise architecture and J2EE infrastructure work using Rational Application Developer for WebSphere Software. They all use UML. We are introducing our legacy application

developers to UML to add an integration perspective to their legacy development.”

### **Use case-based requirements management**

UML models in Rational XDE also serve as the EAS team’s primary means of managing requirements on the project. EAS project requirements are defined in terms of use cases and modeled in Rational XDE. “Because this started as an unsolicited proposal to the government, we did not get a set of formal requirements from them. All of the requirements we define were use case-based and modeled in Rational XDE. We went through RUP’s use case realization process. And when we made our proposal to the government we had not only defined their challenge but we had modeled the requirements needed to address it.”

For Pritchard, Rational XDE’s ability to generate code and integrate UML modeling and development activities reflects an important capability for development teams moving forward. He notes, “I think that Rational XDE, which is bringing modeling and development closer together, is where we are seeing the software development culture move. As teams grow larger, we are seeing the concepts of modeling—even modeling of application architectures—being applied by developers. More and more they are going to need tools that can provide both modeling and code generation.”

### **Minimizing legacy development**

One of the goals of the project was to minimize changes to existing systems already in use by the FAA, DoD and other agencies. The EAS team is using WebSphere Business Integration tools to simplify this effort. IBM WebSphere Business Integration Message Broker transforms in-transit information to provide a level of intermediation between applications that use different message structures and formats.

Pritchard explains, “The WebSphere Business Integration tools do two key things for us. First, as a message broker they determine what systems are interested in data published by another system, and then get the data there. Second, they do message translations. The FAA has a different message format from the DoD, for example, to define a flying aircraft. Each legacy system publishes XML messages. The WebSphere Business Integration tools will transform those messages into whatever format the receiving system needs. Those systems will receive the message in the same format that they have always gotten data. That enables us to have a really small footprint on the legacy side.”

### **Minimizing risk, reducing costs**

Identifying and reducing risks has been part of the EAS project’s success to date. Pritchard notes, “Use case-based requirements management and an iterative life cycle have helped us with risk reduction. We identified the technical



risks in the program, and we planned those in the early iterations. Because the iterations are demonstration-based, we are getting early feedback from our customers—and that is important to us and to them.”

From modeling, development and business integration tools, to technical consulting and infrastructure, IBM has provided a broad foundation to support the EAS initiative. Pritchard reports that leveraging this wide range of solutions has been an advantage for the EAS team. He concludes, “There are a number of benefits to using the IBM solutions on this project. First and foremost is cost savings. By leveraging the off-the-shelf capabilities that the IBM products offer we can do a lot more with a relatively small team. In that regard, productivity is another key benefit. We have to show the customer demonstratable capability every 90 days, and accomplishing that is a function of what the IBM tools provide us in terms of modeling and developing in an integrated environment.”

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