

IBM Software Development Platform Helps U.S. Nuclear Regulatory Commission Comply with OMB Regulations and Manage Outsourced Development

Overview

■ **The Challenge**

Like all federal agencies, the U.S. Nuclear Regulatory Commission (NRC) must comply with Office of Management and Budget (OMB) requirements to receive funding for major IT projects. The NRC also must manage complex projects often outsourced to Commercial-off-the-shelf (COTS) vendors and integrators. To accomplish both of these objectives effectively and efficiently, the NRC needed to advance program management practices by replacing manual, stovepiped methods with a comprehensive, integrated approach, implemented enterprise-wide.

■ **The Solution**

The NRC adopted the IBM® Software Development Platform, including integrated tools for requirements management and automated reporting of project status. The agency also applied a use case driven approach to project management, enabling improved stakeholder collaboration and more predictable system delivery.

■ **The Benefit**

The IBM Software Development Platform has enabled the NRC to meet OMB requirements more efficiently with integrated processes and tools for program management. Project managers now have a clear roadmap to manage outsourced projects and the information they need to take corrective action and mitigate risk. At the same time, the NRC has implemented a solution that supports improved portfolio management and operationalizes the agency's Enterprise Architecture efforts.

The NRC regulates civilian use of nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. One of the agency's key responsibilities is overseeing licensing and reporting of nuclear materials. The Office of Nuclear Material Safety and Safeguards has overall responsibility for NRC's materials program, and NRC's Regional Offices implement these programs in the states for which they are responsible. Of the over 20,000 active source, byproduct, and special

nuclear materials licenses in place in the United States, about a quarter are administered by NRC; the rest are administered by 32 Agreement States that have established programs to assume NRC regulatory authority.

The mission critical IT systems and applications for nuclear materials licensing must enable data sharing between NRC and Agreement States. In addition, like all US federal agencies these development projects are subject to evaluation by the OMB to ensure they are cost effective, aligned with the organization's mission, and truly meet the needs of end users. OMB requires submission of an annual progress report (Exhibit 300), on major information technology projects in order to obtain funding approval. The NRC also needed to establish an effective approach for managing outsourced development projects based on COTS applications or packaged applications.

While on the surface these two issues may be loosely linked, in practice at the NRC they are closely related. A key performance measure required by OMB is *Earned Value* -- an industry standard method to objectively measure the progress of a project

through its entire lifecycle. Earned value analysis integrates the project scope of work with schedule and cost elements for optimum project planning and control. Decision making in project management depends on the kind of performance metrics made possible by earned value analysis. Likewise, accurate earned value analysis relies heavily on the ability to establish and follow a clear project plan. At the NRC, project managers needed to monitor and manage both of these core issues in a way that could be institutionalized and implemented across the organization.

Pat Smith, Senior IT Specialist at the NRC, explains, "All of our major IT projects are required to submit to the OMB an Exhibit 300 or Capital Asset Plan and Business Case. This is essentially a collection of information that covers a wide range of areas. In addition to enterprise architecture, one of the areas is earned value reporting. We are expected to be doing earned value analysis on a monthly basis so we can get early warnings on deviations from the schedule. If you deviate more than 10 percent on cost or schedule you will have problems with the OMB. So it is very important to be able to not only manage projects, but also to be able to report that you are managing them to the OMB. It is a critical measure of the success of your project. And as a project manager, you have to be able to show that you are on top of this because your funding depends on your OMB 300 submission. This is a problem that is shared agency-wide across the NRC; it is institutional."

The Program Management Process is as Important as the Data

The difficulties of reporting earned value and developing an Exhibit 300 that the OMB would accept became apparent to Smith on an IT project to develop a digital data management system. This courtroom-based system was designed to integrate IT with audio/visual capturing for recording and playback of legal proceedings. Smith recalls, "Throughout the project I reported earned value in a monthly status report to the agency's commissioners. When it came time to submit an OMB 300 on that project, I discovered that the same reports I had been submitting to the agency chairman and the commissioners on a monthly basis were not acceptable to OMB. I fed data from Microsoft® Project into a simple Excel spreadsheet, from which I created graphs. But the OMB was looking for an integrated project management process. The process was actually as important as the data points. In addition, we were managing the effort in a stovepiped manner – for example, I did not report into a common database where others could see what we were doing or provide oversight. Moving forward I knew we had to have an integrated, holistic approach that was going to be acceptable to OMB."

While the NRC had limited experience with earned value reporting prior to this project, the agency recognized its value as a project management tool for controlling costs and managing schedules, and began looking for Earned Value Management System

(EVMS) tools. Early candidates considered by the NRC, however, were rejected because they would have required considerable upfront expense and would require the agency to retool by replacing Microsoft Project, a tool which it had standardized on.

Addressing Broader Development Needs

As the issue of earned value reporting began to become more apparent, IT teams within the agency were also finding that there was room for improvement in their approach to managing requirements. In the past, NRC project requirements were frequently described using a series of bulleted items. In addition, requirements traceability was maintained manually and business rules were maintained manually in a separate matrix. As a result, project management efforts across the organization were likely to benefit significantly from an automated, integrated, uniform and ultimately more predictable requirements management solution.

To address these needs and to establish an integrated Enterprise Architecture for software development, the NRC acquired tools from the IBM Rational® Software Development Platform, including:

- IBM Rational RequisitePro® for requirements management
- IBM Rational ProjectConsole™ for automated project status reporting

- IBM Rational Rose® for model-driven development
- IBM Rational ClearQuest® for defect and change tracking
- IBM Rational TestManager for test management

As these tools are rolled out, the NRC is also phasing in use of the IBM Rational Unified Process®, or RUP®, across the agency. RUP is a configurable software development process platform that provides the NRC with proven best practices and process guidance. Smith notes, “The NRC recognized the power of having multiple capabilities in one integrated solution.”

Now, the NRC develops use cases to describe system behavior and requirements from the user’s point-of-view in terms of actors and series of actions. By linking all development activities to use cases in Rational RequisitePro, the NRC has implemented a methodology, supported by an integrated toolset that significantly enhances its teams’ requirements management and project management capabilities. At the NRC, the IBM Software Development Platform is not a solution solely for software developers; it provides an integrated solution for project managers as well. Smith explains, “For the NRC, the key is to tie all activities back to the use cases, which then serve as a vital mechanism for documenting requirements. Every requirement is defined in a use case in Rational RequisitePro.

And every project activity – including requirements validation, design, test plan development, and testing – relates back to those use cases. The entire project is clearly laid out and well-defined.”

A Valuable Realization

It was during on-site training for IBM Rational Software Development Platform tools that Smith came to an unexpected realization. During a briefing on Rational ProjectConsole, she heard that Rational ProjectConsole automates reporting on project status and dynamically creates a project Web site with a graphical dashboard based on data collected from IBM Rational tools and third-party products. Smith immediately saw an opportunity to apply these capabilities to the NRC’s pressing earned value reporting concerns, without any additional costs to the agency.

She recalls, “The training conducted by IBM Rational was invaluable. When I saw the Rational ProjectConsole dashboard, I thought ‘That’s it!’ Here is our EVMS -- and not only that, but it is an integrated solution.”

Working together, Smith and a contractor implemented an EVMS that is founded on Rational ProjectConsole and Microsoft Project – the agency’s standard software for tracking schedules and milestones. “We completed it very quickly. In a few days, we had a solution that enables the NRC to effectively and efficiently perform earned value reporting

for software development projects through the integration of Rational ProjectConsole with Microsoft Project. This solution has now been institutionalized across the NRC,” says Smith.

Meeting OMB Requirements for EVMS with IBM Rational ProjectConsole

According to Smith, Rational ProjectConsole provides the NRC with a wide range of capabilities that are essential to effective earned value analysis and reporting, including:

- Automated periodic data collection of project information
- Automatic calculation of earned value metrics
- Automatic generation of earned value reports
- A consolidated metrics database for all NRC projects for portfolio management
- Consolidated reporting from other Rational tools including Rational RequisitePro, Rational ClearQuest, and Rational TestManager

The OMB’s earned value guidelines require an analysis of how a project is progressing over time – a trend analysis -- presented in graphical chart form. In addition to the trend analysis charts, OMB also requires periodic tracking of key earned value metrics. To satisfy these requirements, Rational ProjectConsole first periodically collects information from the NRC’s project plan. Rational

ProjectConsole uses that information to enable project managers to perform historical trend analysis and to generate the OMB-ready HTML report using Rational ProjectConsole Template Builder. Using the IBM Rational ProjectConsole Template Builder, the NRC can define a template that describes what information to extract from the source, and exactly how it is to be formatted to meet OMB requirements.

“Being able to supply the OMB with what they need using IBM Rational ProjectConsole is big. It was a huge hurdle, it was agency wide, and it was critical – everybody needed it. We found a solution that required no additional purchases or training and that supports portfolio management. In very short periods of time we can get incredibly informative results. Most importantly, our OMB submissions were complete,” Smith says.

She notes that while it is preferable to use EVMS from the start of projects, the NRC’s implementation also has provided benefits for post-completion analysis. She explains, “We are replacing a legacy system, and we weren’t able to complete the implementation before the OMB filing deadline. But I was able to back fill data on the costs of maintaining the legacy system. Through the graphs we could show details and provide additional justification of how the costs were excessive and why we needed to implement the new system. Using Rational ProjectConsole, I just dropped it all right into the OMB 300 format, and then submitted it to the OMB.”

Use Cases Drives Project Success

After finding a solution for effective and efficient OMB compliance, Smith and other project managers at the NRC turned their attention to applying IBM Rational tools to improve requirements management and project management. Smith saw that use cases could be leveraged throughout every stage of the project lifecycle to tie development activities together for more effective project management. Use cases describe system behavior from a user’s perspective in a way that is understandable to a wide range of stakeholders, including senior leadership, end users, designers, developers and testers.

Smith reports, “After we completed the EVMS, we started thinking about how we could utilize use cases as the project management tool. We decided that at each stage of the system development life cycle we would have traceability to the use cases. For example, during requirements validation, when the contractors say they have completed 50 percent of the validation effort then I know we should be at 50 percent of the cost; we should have 50 percent of the schedule and we should have 50 percent of the use cases completed. When we get into design, it is the same thing, when we are at 50 percent completion and 50 percent of the money then I want to know that we have addressed 50 percent of the use cases. And the same thing will happen when we go into development and then testing. The use case, to me, is key in conveying the requirements and

where you stand at every step of the development process. Even very early on in the project, I have a road map for the entire remainder of the project.”

Building Stakeholder Consensus, Streamlining the Proposal Process

Smith managed the first project at the NRC to use IBM Rational tools from the start. The construction of the system, which will track nuclear materials and licensing, is being outsourced to a system integrator --a common practice for government projects. As the agency project manager, Smith is using IBM Rational ProjectConsole, IBM Rational RequisitePro and a focus on use cases to better manage the project from start to finish.

One of the first challenges was to incorporate input from the many stakeholders involved in the project. “We brought in working group members that represented all the stakeholders – which were in the thousands. We had a lot of buy-in and a lot of oversight on this project. Building consensus through use cases has been considerably easier than it would have been, had I not had a good, uniform tool like Rational RequisitePro,” says Smith.

With approximately 50 use cases defining the new system, the NRC began eliciting proposals from COTS vendors. Smith explains, “We developed the use cases independently, before contacting any vendors. As we went ahead with our acquisition we shared all the requirements and the use cases with the vendors. They used the use cases

to identify the gaps between their COTS solution and our specification as part of their proposal process. I think it gave us a higher-quality vendor response, lowered our risk, and resulted in a more predictable proposal process. The vendor we selected, who was relatively unfamiliar with this approach, subsequently told us they had never had a customer who had the requirements as well defined as ours.”

In addition to defining use case specification in Rational RequisitePro, the NRC also models use cases in Rational Rose. This provides greater clarity and a shared framework for understanding how actors and the system relate to one another. Smith notes, “We have our textual use cases in Rational RequisitePro and our use case diagrams in Rational Rose. We shared both with the winning vendor. Use case models are valuable because they enable us to have everything clearly laid out for ourselves. For example, if we start talking about a new administrative role, I immediately picture a new actor and where that actor will fit in the use case model.”

Managing Outsourced Development

After selecting a vendor, Smith realized further advantages of focusing on use cases throughout the project. Assuming relatively equal weighting of use cases, she could track the vendor’s progress as the percentage of use cases completed for any particular phase of the

project. And she could correlate that percentage at any point to the time and costs consumed to date on the project. “As a result of using the use cases and tying everything back to them, we have this very clear road map for the future. It is extremely important to us to be able to manage this project and to know where we stand at any point in time. It gives you that additional measure and confidence; and it reduces your risk as a project manager.”

Smith cites a number of advantages of leveraging use cases in outsourced development. The NRC’s use cases:

- required no rework prior to handing over to vendors
- helped identify gaps in COTS solutions
- contributed to a more predictable acquisition process
- resulted in a higher-quality vendor response
- provided a clear roadmap and unambiguous basis for validating development progress
- lowered risk

Smith’s team at NRC has added custom attributes to each use case that will enable vendors to indicate when they have completed validation, design, development and testing of the use case. “When the contractor is in the design phase, for example, he will be able to check off each one. We’ll do that at every stage. I think it

is going to be especially critical for testing, because it is easy for testers to lose their place in an iterative development process. And, when the earned value report shows that half of the resources are expended for the activity and it is the mid-point of the schedule, there is a way to ensure that half of the requirements are tested.”

Raised Expectations for Accelerated Project Delivery

In the past a development effort of the scope of the nuclear materials licensing project would typically require 18 to 24 months to complete. With the anticipated boost in efficiency expected from the IBM Software Development Platform and Rational Unified Process, the project is scheduled to be completed in little over a year. Despite being on an aggressive schedule, Smith is confident that the project will be delivered on time. “The fact that we are able to even envision a project with such a rapid development schedule, is truly attributable to the fact we have such clearly defined requirements and a methodology that helps us,” she says.

Smith adds, “In the beginning of the project, we needed a little extra time, because we had a learning curve. But we are really seeing the benefits of spending that time upfront. I think the benefits are going to increase exponentially from here on out. We focus on quality, and I know I am going to have a quality product. Everything is fully documented. We have the

ability to do much more informed management and analysis. And each project we work on, we will do a little bit better of a job.”

Moving from Reporting to Analysis

Smith notes that by using IBM Rational tools and RUP, project managers and others at NRC have been able to get a comprehensive view of IT projects and the IT project portfolio. The success and consistency that Smith has achieved on early projects is being extended enterprise-wide to improve efficiency and information sharing both within NRC and with other agencies. “There will be follow-on efforts where other agencies such as the Department of Energy will be accessing some of our resources. We now have a common methodology that is in use by other agencies; I see IBM Rational tools and RUP becoming such a standard throughout the IT field. I think they have given us a common foundation for communicating, not only internally but with contractors and other agencies,” she says.

The adoption of IBM Rational tools and processes has helped the NRC move from a predominantly manual process that relied on Excel spreadsheets and subjective data to a more automated process with a graphical project-level dashboard. In a broader sense, this is a move from reporting to analysis -- that has provided the ability to improve tracking, better control and schedules, take a more strategic approach to project management, and provide the enterprise with a clear view of the entire effort.

Smith concludes, “Getting the reporting right was critical for OMB and critical for us internally. But equally important is what you can do with that information once you have it. With the IBM Rational Software Development Platform, I now have a road map; because I can analyze this information I have a clear line towards the future. I can take corrective actions earlier, when they are less expensive. Whereas the OMB emphasizes an integrated project management approach and process, I know that we now have an integrated and holistic project management process and approach. We are truly operationalizing enterprise architecture by focusing on delivering systems that meet stakeholder needs. Applying project portfolio management best practices is an important part of that. Through objective data and simplified reporting on program metrics we can effectively look across the entire enterprise at other places we can use it.”



© Copyright IBM Corporation 2005

IBM Corporation
Route 100
Somers, NY 10589
U.S.A.

Produced in the United States of America
02-05
All Rights Reserved.

IBM, the IBM logo, ClearQuest, ProjectConsole, Rational, Rational Rose, Rational Unified Process, RequisitePro, and RUP are trademarks of International Business Machines Corporation in the United States, other countries or both.

Microsoft and Windows are trademarks of Microsoft Corporation in the United States, other countries, or both.

Other company, product and service names may be trademarks or service marks of others.