Extending use of Earned Value Management

EFCOG Project Management Working Group
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Introduction

Significant attention and effort has been focused on the development and delivery of capital assets within the DOE. As new guidance has been implemented through orders such as DOE O 413.3 the processes have matured and become sustainable. Recently there are increased efforts to expand the use of project management tools and techniques to other programs and deliverables throughout the department. Additionally, the President's Management Agenda has placed emphasis on the use of Earned Value Management (EVM) as an effective tool to be used across the Federal Government in the delivery of major projects including Information Technology (IT) investments. Expanded guidance has been set forth in documents such as the Office of Management and Budget (OMB) Circulars A-11 Exhibit 300, A-109, A-123, A-127 and A-130. The EFCOG Project Management Working Group recognized a need to provide some resources to the contractor community that could be helpful in applying EVM to areas that have not traditionally applied this project management tool. Most of the body of knowledge in EVM application within the DOE has been centered in the acquisition of capital assets primarily through Line Item construction projects. The guidelines and criteria relating to use of EVM have not changed significantly over the last 30 years though have evolved from the Cost and Schedule Control System Criteria into a more broadly applied ANSI Standard 748 with similar specific criteria. The focus of this white paper is to provide helpful information on the application of EVM to the following three areas:

Environmental Management (EM) projects
Deactivation and Demolition (D&D) projects
Information Technology (IT) projects

Each of these unique categories has different requirements that govern their successful delivery. EVM as a tool can be applied to all though there are distinct challenges within each business line. There are different acquisition methods, limitations, budgeting processes, funding mechanisms, and terminology. The goal of this paper is to examine each category individually through the use of case studies and benefit from our collective experience in ways to expand the effective application of EVM within the DOE complex.

Discussion

For each category, the case studies will include a brief description of the project, a discussion of what is unique about the project, a view of how the category of projects differs from construction projects, insight into the approach to applying a certified EVM System, and a discussion of lessons learned and recommendations for implementing EVM tool in the most efficient and effective way.

All projects typically follow a similar lifecycle at a high level, starting with initiation and progressing through planning, execution and closeout. DOE Order 413.3 describes Critical Decision (CD) points through the project lifecycle that provide stage gate control in the project delivery process. There is a requirement to use EVM on capital acquisition projects greater than $5M and the system must be certified in conformance with ANSI Std. 748 for projects greater than $20M. The EVM system must be in place by the time the performance baseline is established with CD- 2. EM, D&D and IT projects utilize the critical decision process although the planning and documentation requirements for the critical decision differ by project category. Additional guidance for IT investments is becoming more available in documents such as NNSA's draft Project Execution Model for IT Investments. Common to all is a requirement for EVM, the application and certification of which is discussed in the case studies below.

Environmental Management and D&D Projects Case Study

Savannah River Site (SRS)

EVMS Implementation and Certification

On 11/28/05, SRS received their EMVS letter of compliance from the Department of Energy (signed by Bruce M. Carnes, Director, Office of Management/Chief Acquisition Officer). The formal SRS Site EVMS Certification was conducted by the Defense Contract Management Agency (DCMA) from February 28, thru March 4, 2005. The joint DCMA/DOE team conducted over 40 interviews ranging from a diverse crosscut of WSRC senior management and staff, program and project personnel, down to individual Control Account Managers (CAMs). The DCMA outbrief cited nine exemplary SRS practices:

- Senior Management commitment and involvement in certification effort
- Continued senior management involvement
- EVM Web-site –Easy access to data-
- Indirect cost control
- Robust scheduling system
- 247-F Project very clear/straightforward EV progress metrics –Good model for future D&D projects
- Change control consistency (trend program-BCP)
- Monthly Forecast at Completion (FAC) process
- Accruals process supports EV reporting

Significant focus by SRS management has facilitated the application of a projectized tailored approach to applying EVM on nontraditional construction type projects in addition to full implementation of the 32 criteria on traditional projects. The projects selected for certification included two Capital Line Item projects, four Environmental Restoration projects, and one D&D project. The following paper focuses on the non-traditional, non-capital projects assessed during the certification effort. These projects include:

- D&D project 247F Project– ($75M)

- Four Soils and Groundwater projects (varying between $25M to $75M in size)

D&D PROJECT – 247F PROJECT

Project Description

The 247F Project takes the facility from cold shutdown with chemically and radiologically contaminated equipment to a decommissioned end state of a clean concrete slab. Federal and State environmental regulations are being met. All equipment, components, and structures are being properly disposed as wastes.

What is unique about the D&D Project?

The presence of very hazardous chemicals and acids, and radiological contamination in the process lines and equipment required extensive characterization, work planning, careful work methods, and radiological contamination control.

The main process building is a 97,600 ft^2, two-story building of standard steel construction, with a reinforced concrete section. The purpose of the facility was to convert Uranium feedstock into a useable fuel form to support the Navy's Nuclear Propulsion Program. From 1990 to 2003, radiological materials were removed, small auxiliary structures were removed, and process lines flushed. Hazardous chemical and radiological fluids remained in process lines and equipment due to piping and equipment configuration

Surveillance and maintenance (S&M) for the facility was performed in accordance with documented S&M procedures, which included entries to ensure facility structural integrity, and to monitor process areas for migration of radioactivity.

How are D&D Projects different from a construction project?

During the recent evaluation for compliance with the 32 Guidelines of ANSI/EIA 748, the DCMA EVMS Certification Team highlighted the 247F project in their out brief. DCMA cited the project as utilizing a "very clear/straightforward EV progress metrics – Good model for future D&D projects".

DOE Manual 413.3-1 (Section 1.3.2 Projects) defines a project as "specific undertakings that support a program mission; are undertaken to create a product, facility or system; and have defined beginning and endpoints." Per DOE M 413.3-1, projects also include developing and installing software systems, remediation and disposition of contaminated site and facilities, and restoration or modernization of existing facilities and infrastructure. Construction projects typically seek to build or modify an existing structure. A D&D type project seeks to modify the structure to a suspended state and/or eliminate the structure. The D&D project follows a reverse process from the construction phases defined in the DOE-M-413.3-1, in order to render the structure in-operable.

The deactivation and demolition of this capital asset will reduce the facility hazards and remove hazardous materials and contaminated equipment and components. The goal of

deactivation is to render the facility in a condition ready to achieve the final decommissioning end state vision (i.e. demolition). Contaminated items will be removed from the facility and areas of contamination will be decontaminated to the extent necessary to be cost effective.

Risks associated with a construction project typically deal with availability of resources, funding, weather conditions, permits, etc. D&D projects deal with similar risks, plus a host of issues in dealing with legacy materials, and legacy construction and environmental issues. Several major project risks have been identified for the 247F Project that could delay project schedule and increase costs. The following risks have the greatest potential negative impact to the project cost and schedule. The risks identified include:

- Hazardous material abatement (e.g. asbestos and Poly-chlorinated Biphenyls [PCBs]) and significant mold abatement
- Non-Destructive Assay (NDA) measurements required for removal and disposal of contaminated equipment components
- Increased radiological loading for waste containers and the solid waste slit trench not realized
- Inability to achieve clean concrete slab or <20% fixed contamination for the facility shell
- Free release of waste requiring an item-by-item radiological evaluation.
- Approval of direct disposal of classified equipment
- Adequate drum characterization or process knowledge for release/disposal of 501 legacy shipping containers
- Residual acids in piping and equipment
- Potential for inaccurate facility as built drawings, especially for electrical distribution systems

As with construction projects in the government arena, other primary constraints to the project are contingent on:

- Congressional funding for SRS
- Decrease in project funding levels, based on SRS or DOE priorities
- Permit approvals from federal or state authorities
- Availability of resources (personnel and equipment) each of which could cause significant schedule delays and, possibly, cost impacts to the project baseline

Any of the above issues could result in an impact to scope or schedule and result in change control actions.

The work execution strategy organized the building into zones for deactivation. The work execution strategy considered that many of the large contaminated pieces of equipment located in the center of the building could not be removed until the outer zones were cleared of obstacles impeding their removal. In addition, the outer zones were often the zones of least contamination and thus provided the greatest opportunity for

training, work methods development, and implementation of crew logistical support methods for the safe deactivation of equipment and components.

The scope and estimate for each Work Package (zone) was based on three generic tasks: Characterization, Deactivation, and Waste Disposition. The discrete earned value technique utilized for each zone was physical percent complete. The three generic tasks within each zone were further detailed by several standardized schedule activities in the Integrated Schedule. The EV subsystem for determining the physical percent complete of each task was based on weighting the baseline hours of these schedule activities. The three generic tasks were also weighted to the Work Package (zone) utilizing the baseline hours.

The Deactivation and Waste Disposition tasks represented the bulk of the work in each zone. The generic Deactivation task model had identified 14 discrete schedule activities within 5 steps. These scheduled activities were assigned a weighting based on their contribution to the entire Deactivation task baseline. Thus, based on their pre-defined weighted value, the physical percent complete update for each schedule activity translated into the percent complete for each task, which in turn determined the physical percent complete of each work package (zone).

Use of the Apportioned EV technique was very applicable for this D&D project (i.e.: the main waste removal activity of the Waste Disposition task was apportioned to the removal of piping and equipment within each zone). Consumable tools (saw blades, etc.) as well as plastic suits, laundry, and radcon support for each Control Account were apportioned to the physical percent complete of all zones (work packages) within the Control Account. This allowed the Level of Effort (LOE) EV technique to apply only to supervision and some support functions.

Field quantities were not tracked for EVMS performance, a key difference from routine Construction Projects. The granularity of 100 zones, which were further subdivided to about 120 zones and subzones for work planning and schedule purposes, provided the basis for objective performance measurement. This resulted in over 300 relatively small tasks (number zones * 3 generic tasks) with relatively short durations and objective 100% complete points.

Representative Story Board examples with actual documents were used during the EVMS certification review, to explain the Work Authorization, BCWS, BCWP, and ACWP processes. The project Work Authorization process was traced from the project value stated in the M&O contract through any approved BCP's to the current project baseline. The project baseline was in turn traced to authorized Control Account Plans and the multi-signature approval of the scope and execution strategy for each Zone's Work Package (required prior to starting work). Trace Packages (for BCWS, BCWP, and ACWP) containing the same example documents were prepared for each Control Account and Work Package. This allowed the auditors to verify the integration of scope, cost, and schedule; as well as verify the EVM system was sound and auditable.

ENVIRONMENTAL RESTORATION PROGRAMS

Project Descriptions

The Environmental Restoration Programs are responsible for the investigation, assessment, remediation, and closure of inactive areas, units and associated groundwater plumes at the SRS. The Program ensures that all remediation activities from initial investigations and characterizations through final remediation and closure have been fully documented. Remedial Investigation (RI)/Characterization reports clearly define the nature, extent, fate, and transport of contaminants and the level of risk that these contaminants present. Subsequent analyses are then performed to examine potential remedial alternatives, ensuring due consideration of appropriate technologies, in arriving at the selected remedy.

The SRS EVMS Certification effort included four Soil and Groundwater Closure projects ranging in size from $25M to $75M.

What is unique about Environmental Restoration Projects?

All Environmental Restoration project activities are governed by the Resource Conservation Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and other state and federal agreements and regulations, including United States Department of Energy (USDOE) orders and guidance.

RCRA/CERCLA – regulated units (waste or groundwater) are identified in the *Federal Facility Agreement (FFA) for the Savannah River Site* (SRS) that directs the comprehensive remediation at the site. The FFA delineates the relationship between the FFA requirements and the requirements for corrective measures conducted under Sections 3004(u) and 30054(v) according to conditions of the SRS RCRA permit and a State of South Carolina hazardous waste permit.

The FFA governs the corrective/remedial action (RA) process from unit investigation/assessment through unit remediation/closure. It describes the process for the South Carolina Department of Health and Environmental Control (SCDHEC), the United States Environmental Protection Agency (USEPA), and the USDOE to set annual work priorities (including schedules and milestones) for the corrective/RA process. The SCDHEC, USEPA, and USDOE, coordinate the administrative and public participation process prescribed by the various statues (i.e., RCRA and CERCLA) governing the corrective/RA process at the SRS. The Project Execution Plan (PEP) and the project-specific information contained in the project files support implementation of the FFA and the *SRS FFA Implementation Plan (FIP)* in establishing a graded approach for meeting project requirements. These requirements include those identified in the USDOE Order 413.3, “Program and Project Management for the Acquisition of Capital assets” and

guidance in the USDOE Program and Project Management Manual and Project Management Practices.

How are the Environmental Restoration Projects different from a construction project?

The requirements for Critical Decisions in the Soil and Groundwater Closure projects are handled in accordance with DOE Order 413.3. DOE Order 413.3 defines a Critical Decision (CD) as the formal determination or decision at a specific point in a project that allows the project to proceed to the next phase and commit resources.

Critical Decisions for Soil and Groundwater Closure Projects (SGCP) work require decisions that fit the regulatory and remediation processes based on RCRA, CERCLA, or other regulatory direction. CD authorizations with supporting documentation require review and validation from the US DOE Acquisition Executive (AE). Critical Decision steps CD-0 and CD-1 are combined for SGCP projects and the information is submitted at the same time supporting the regulatory process for SGCP work activities. CD-2 and CD-3 are combined to facilitate the regulatory requirement of Remedial Action start within 15 months of the signed Record of Decision (ROD).

The current SRS Contract requires CDs on non-Line Item projects. Once DOE approved and validated the contract baseline described in Project Baseline Summaries (PBS), CD 2/3 was granted for each PBS for the contract period. Since the contract period is typically much shorter than the project duration, this resulted in a mixture of DOE Order 413.3 requirements being imposed at the project level and at the PBS Level. This also created significant funding and schedule "management challenges", which makes implementation of a "typical" ANSI Standard EVMS system difficult. The current contract also utilizes SPI as a basis for fee calculation. Prior contracts used both CPI and SPI as performance based incentives.

As with construction projects in the government arena, other primary constraints to the project, as well as regulatory considerations, are subject to:

- Congressional funding for SRS
- Decrease in project funding levels, based on SRS or DOE priorities
- Availability of resources (personnel and equipment) each of which could cause significant schedule delays and, possibly, cost impacts to the project baseline

APPROACH TO SRS SITE EVMS CERTIFICATION

During the week of February 28, 2005, a DOD-DCMA (DCMA) and DOE-OECM (DOE) team began the WSRC EVMS Compliance Evaluation for DOE Order 413.3 projects. The review identified one Major Corrective Action Request (CAR) finding on "Work Authorization"; three minor CARs (WBS Dictionary; EAC policies/procedures and Earned Value control account traces). DCMA was on-site on June 14, 2005, to closeout all the CARs. They agreed to closeout all the CARs during that visit however, the sign-off of the Site level procedures was required to receive EVMS Certification. SRS completed revisions and sign-off of all outstanding site procedures during July, thus

clearing the way for DOE SR to close their action with DCMA. On 11/28/05, SRS received their EMVS letter of compliance from the Department of Energy (signed by Bruce M. Carnes, Director, Office of Management/Chief Acquisition Officer).

Several months of preparation took place prior to the arrival of the Certification review team. WSRC formulated a projectized approach focused on the systematic preparation and assessment of the existing EVM process prior to the certification. Preparation activities included the following:

1. Identified the list of potential projects for certification review.
2. Assigned a senior management champion who issued a site memo communicating the background and importance of the effort. This helped eliminate perceived barriers, ensured a cooperative team effort, and gained site and project support for the initiative.
3. Established an EVMS Project Team headed by a Project Manager to lead the preparation effort. The EVMS Project Team was comprised of Subject Matter Experts (SMEs) from various site/project disciplines. Other SMEs were added to the team as needed. The EVMS Project Manager and EVMS Project Team:
   - Created a schedule for the entire validation effort and set the schedule baseline with aggressive milestones.
   - Scheduled weekly meetings and monitored progress
   - Identified Action Items, Responsible Individual(s), and assigned task due dates. Measured progress against these action items to ensure the completion as scheduled.
4. Developed and implemented EVMS System Description and Site EVMS Policy.
5. Completed a Gap Analysis
   - Between ANSI/EIA 748 (32 Criteria) and existing procedures/guidance documents
   - Benchmarked the individual Project Teams' knowledge and expertise by administering an EVMS Test.
   - Defined and documented "tailoring" concept
6. Revised/upgraded Procedures and Guides as required to meet EVMS criteria
7. Prepared CAMs for interviews and provided EVMS tools
   - Assigned mentors with strong EVMS backgrounds to each project to coach and prepare the CAMs for the interviews.
   - Developed and distributed additional EVM reference material
     - EVMS Pocket Guides
     - Suggested specific responses to all 32 criteria
   - Procured and provided the CAM the opportunity to view a video of an example CAM interview.
   - Ensured all CAM Notebooks were up-to-date and consistent in format.
   - Conducted dry-run interviews with each CAM. Interview questions were designed to train the CAM to answer the questions using the CAM Notebooks and project documentation.
   - Provided additional training as required
   - Developed document trace boards (poster-sized story boards) and work flow process charts (vertical and horizontal traces of schedules and baseline data)

to use as a training aid and as a means to define the work process during the CAM interviews.

8. Conducted an Independent Readiness Assessment
   - Assembled a team of corporate SMEs and DOE personnel.
   - Conducted the independent assessment about 3 weeks prior to validation.
   - Identified corrective actions and resolved prior to DCMA/DOE team's arrival.
9. Made the DCMA/DOE interview process as relaxed and easy as possible.
   - Provided all review data on CD's in advance with hard-copy available during the interviews.
   - Made sure all logistics, facilities, equipment, etc. are available and ready to go.
   - Prepared to meet with the team at the end of each day and be ready to take any action necessary to address issues, concerns, and misconceptions early in the process. (Helped to minimize misunderstandings, misconceptions, and miscommunications each day.)
10. Responded with Corrective Action Plan to DCMA as quickly as possible following the DCMA Outbrief.
11. Implemented Corrective Actions and close-out CARs as quickly as possible.

LESSONS LEARNED

WSRC lessons learned include the following:

1. Internal and external cultural, political and language barriers, are common problems found when designing and implementing any new process. Both perceived and real issues need to be minimized or resolved in order to complete the process with any degree of success.

   - The SRS culture and project type is different from typical projects. The SRS Maintenance & Operations (M&O) Contract has applied EVM against traditionally non-project type work. M&O contracts typically carry a much higher ratio of on-going Level of Effort or "hotel load" activities that are very difficult to quantify and measure as a project.

   - M&O type projects typically extend 30-40-50 years. This makes it very difficult to apply traditional EVM criteria for extended periods of time. SRS has bounded it's project schedule to the contract period of performance for purposes of setting the performance measurement baseline.

   - Funding constraints for an M&O type contract makes the performance measurement baseline extremely volatile and subject to constrained scope definitions on a continual basis. In addition, the DOE complex is typically challenged to accomplish more scope for less money, within fiscal year constraints.

   - Site specific processes, software, phases, etc., as well as acronyms, are often confusing to the assessment team if they are not familiar with the site terminology. Avoid acronyms; use specific full terminology. Minimize site specific terminology where practical or use with clear definitions.

- The SRS contract and probably most site contracts contain contractual project reporting requirements and/or fee calculations based on CPI/SPI which may conflict with the ANSI EVMS Standards or traditional project management/controls practices. The ANSI standard does not address using CPI or SPI for fee calculations, but it does strongly suggest not to report against two project baselines. These conflicting contractual requirements should be clearly communicated with the assessment team prior to and during the assessment. For the WSRC Certification review, this distinction was discussed at length during the training and planning meetings. The review focused on the execution plan baseline, which is utilized as the project performance measurement baseline and is managed consistently with standard EVMS practices.

2. Schedule your activities and run the preparation effort like a project with a strong project manager in the lead. Target to get several activities rolling as soon as possible.
   - Get local DOE support and agreement early in the process.
   - Get a champion (senior management, preferably). Issue a site memo by the champion communicating the effort and continue to maintain communication during the process. The identification of an effective champion will help eliminate perceived or real barriers, will ensure cooperative certification team effort, and will rally site/project support for the initiative.
   - Establish a corporate EVM policy early in the process if one does not already exist. Draft and agree on the System Description and process early in the effort. This will help establish a common set of acronyms, and gain consensus on what the EVM process includes and how it operates. Diagramming the process was very revealing and helped identify issues and misconceptions. (If you can't draw the process, then you can't write about it.) Strive to resolve issues (there will be several….) as quickly as possible.
   - Do a self assessment against the 32 criteria vs your policies, procedures, and guidelines. Identify the gaps and issues promptly and assign point of contacts/responsible individuals and teams responsible for resolving the issues. Set target dates for completion and hold people accountable to completion dates.
   - Communication is vital to the effort's success. Keep the site/project support informed of all decisions and schedule status. Use Electronic/Shared Folder accessible by all team members. This ensures that all the team members see meeting minutes, actions items, resource data, and the most recent drafts of the system description and other documents.
   - Identify and use success stories and lessons learned from other certification efforts – try to emulate their success and avoid their failures.
3. Keep everything simple and to the point – Make it as easy as possible for the DCMA/DOE review team to follow the information and data trails. Mountains of

convoluted data may result in DCMA/DOE team misinterpretation of the data or give the perception that the CAM does not really understand the system or process.

- Diagrams and Process Flow Charts should be easy to understand - A picture is worth a 1,000 words. Prepare at least two (BCWS, BCWP and ACWP) sample data traces (poster sized story boards) for each project and prepare one in presentation format Develop document traces as a means to define the work process and as a training aid. (You will be surprised at how many people think they know how the process works but really don't when required to demonstrate their knowledge of the overall process.)
- Also develop a flow chart for the Work Authorization Process and Accounting Process (Indirect and Direct charges-how actuals get to the project). In addition, a Reporting flowchart - depicting internal project reports, project reporting to client and senior management, and Site reporting to senior management and client.

4. Practice makes perfect. Assign EVMS SME mentors to work with each identified project.

- DRY RUN *ALL* presentations prior to presenting to the DCMA/DOE certification team. Make sure everyone presenting understands and that the overall presentation is cohesive and portrays a united project management image.
- A lot of CAMs will insist that they already know everything and that they do not need to practice. Training and mentoring was extremely beneficial in stressing consistency and preparing the CAM for the unexpected. Establish a common list of typical interview questions for the CAMs, Project Controls, and Project Managers. Use the CAM notebooks when conducting the interviews. Make sure all CAM Notebooks are up to date and consistently formated between projects. (Set up the CAM notebooks well in advance of the review and use the notebooks as a key part of the monthly variance analysis process. This will get the CAM used to using the notebook, and familiar with the reports.). Train the CAM's to answer interview questions by showing the information on a project document or a trace board, rather than just providing the answer. This shows that the CAM's are using the reports. Preliminary training should be required for CAMs and PMs - to get them familiar with the terminology.
- The dry-run interviews, if possible, should be performed by personnel who have been interviewed in prior validation efforts. All potential interviewees (CAMs, PCEs, PMs, etc.) should be interviewed, even if it involves scheduling a makeup session. Assessment should be performed by individual having no prior project influence - Objectivity is diminished when this occurs.
- Conduct dry-run interviews using off project personnel to perform the interviews. We saw a big difference in the CAM's level of preparedness. It will also demonstrate how the CAM will come across in the real interviews and give you time to conduct additional training. Assessors should have working knowledge of project management and project controls in addition to EVMS.

5. Gap analysis, interviews, and general preparation should also be performed against the finance groups (site and project).

6. Make the site visits for DCMA/DOE personnel as relaxed as possible:
   - Go to their hotels and escort them on site the first day
   - Make sure they have all the facilities, equipment, etc needed. (Get your logistics set up early. Make sure you have allocated space and conference rooms, phones, internet, printer and copier access. Have PC's available, even if the team brings their own laptops.)
   - Set the interview schedule as early as possible. Coordinate with the team lead in advance to determine which CAM's/PM's and project controls personnel will be interviewed and when.
   - Let them know that you care about their success as much as your success
   - Introduce them to senior management, include senior management in the review process up front
7. Prepare to meet with the DCMA review team at the end of each day and take action to close any confirmed CAR's before the team writes their report on Thursday afternoon. Attempt to address issues, concerns, and misconceptions (this will help minimize misunderstandings and/or miscommunications each day).
8. Don't let the CAM's be interviewed alone, have a Project Controls person in the room with them but make sure it is the CAM answering the question. This will also give you feedback paths to address any shortcomings before the next round of interviews. You may also consider having the interviewed CAM debrief the CAM's to be interviewed next
9. Respond immediately with corrective actions while corrective action requirements are fresh in the DCMA/DOE team's minds. Once they move onto the next site their priorities will change.

CONCLUSION

SRS has successfully demonstrated the application of a tailored EVM approach to projectized non-traditional, non-construction, scopes of work. The SRS cadre of EVM knowledgeable and trained personnel have developed and implemented the processes, tools and expertise to apply a tailored EVM approach through formal documented policies, procedures, and guidelines. The success of the recent DCMA certification and the SRS receipt of a DOE letter of EVMS compliance are attributed to the EVM culture driven expectations and focus from the SRS senior management team down through the program and project teams. SRS plans to continue the surveillance of existing EVM implementation as well as exploring opportunities, methods and process improvements in applying the intent of the EVM process to future SRS missions and programs.

Information Technology Project Case Study

EVMS Implementation and Certification

IT Projects

GENERAL

Implementation of Earned Value Management (EVM) presents a unique set of requirements requiring special actions. The requirements become more complex if G&A Funds finance the project. The challenges inherent in the EVMS process when applied to IT projects were clearly evident at Los Alamos National Laboratory (LANL) during the certification process for the Enterprise Project (EP). This paper presents the actions taken by the Laboratory to implement EVMS for a G&A funded IT project and the lessons learned during the implementation process. This project, the Enterprise Project, was one of 4 projects presented by the Laboratory for review by the DOE EVMS Certification Team.

ENTERPRISE PROJECT DESCRIPTION

The purpose of the Enterprise Project (EP) is to implement an Enterprise Resource Planning (ERP) system at LANL. ERP systems are commercial, computer-based systems developed to provide administrative business and computing services for a host organization, private or public. Typically, ERP systems support services such as accounts management, general ledger, supply chain management, employee information tracking, benefits tracking, compensation, payroll, required training, and safety and health. Commercial Project Management systems are also now available as enterprise systems.

The objectives of the project are to have:

- More effective integration of LANL business systems
- •Greater consistency with U. S. Department of Energy (DOE) business systems and with the business systems of other University of California (UC) Laboratories
- A simpler business systems support structure
- Streamlined business processes

Ultimately, developing a sustainable institutional business architecture will enable all levels of Laboratory personnel to manage effectively and competently as measured by DOE and industry standards. The ERP system will provide managers with necessary, accurate, and timely information that will help them make the best possible decisions. This, in turn, will help the Laboratory become more efficient, cost effective, and modern in its approach to business. These objectives will eventually reduce the overall cost of supplying and maintaining business systems as the existing mix of proprietary and best-of-breed human resources and financial systems are replaced.

The project is scheduled to be completed in FY 06 and cost $ 80M. An integrated project team of more than 120 people was assembled to execute the work. The Project Manager installed an EVMS to manage the project.

How is an IT project different from a construction project?

DOE Manual 413.3-1 (Section 1.3.2 Projects) defines a project as "specific undertakings that support a program mission; are undertaken to create a product, facility or system; and have defined beginning and endpoints." Per DOE M 413.3-1, projects also include developing and installing software systems, remediation and disposition of contaminated site and facilities, and restoration or modernization of existing facilities and infrastructure. Construction projects typically seek to build or modify an existing structure. An IT type project seeks to develop or change an information management system. The IT project follows a modified process from the construction phases defined in the DOE-M-413.3-1, to create the desired information system.

The original baseline was established based on the waterfall process for the Critical Decisions (CD). That process did not work very well for an IT type project and a spiral reiterative review process was established as a risk mitigation or corrective action approach midway through the project. Following the CD process is not the industry standard in ERPs. Most scholars/experts do not recommend the CD process or the waterfall approach for IT type projects. They recommend the spiral review process or a RAD (Rapid Application Development) based on the assumption that an 80% solution can be accomplished in 20% of the time it would be required to produce the total solution. Scope is traded off to meet schedule assuming that the product will never be perfect when the release goes live. This approach is a modification of traditional project management, but recognizes that an IT project is different from is traditional construction work.

Risk in an IT Project is different from risk in a standard construction project. Skyrme's (1999) research indicates that IT projects such as LANL's Enterprise Project fail, not because of technological impediments, but because of: (1) failure to identify all the stakeholders; (2) lack of a driving force, failure to align missions and goals and the lack of mutual commitment; (3) lack of collaborative relationships, or the converse, a predominance of competitive or pressure relationships; and (4) organizational cultures and management processes that do not support the new ways of working.

Risks associated with a construction project deal with availability of resources, funding, weather conditions, permits, etc. IT projects also deal with similar risks with issues unique to information management. The following risks have the greatest potential negative impact to the project cost and schedule.

- Identification of the correct scope
- Clarification of user needs
- Selection of the appropriate technologies
- Providing for user acceptance
- G&A funding from LANL
- Availability of resources (personnel and equipment) each of which could cause significant schedule delays and cost impacts to the project baseline

LANL APPROACH TO SITE EVMS CERTIFICATION

During the week of May 23, 2005, a DOD-DCMA (DCMA) and DOE-OECM (DOE) team began the LANL EVMS Compliance Evaluation. The review identified two Major Corrective Action Request (CAR) findings on Contingency and Change Control for the EP. DCMA and laboratory personnel met in Washington, DC on Nov 1, 2005, to closeout all the CARs. They agreed on actions to closeout all the CARs during that visit.

Preparation for certification is similar to other projects with modifications for IT-unique activities. The following actions have associated unique EP activities and are critical to good preparation for certification.

- Schedule your activities and run the preparation effort like a project with a strong project manager in the lead. LANL had a PM assigned for the EVMS Certification effort who coordinated the activities of the EP PM in preparing for the EVMS review.
- Get local DOE support and agreement early in the process. Strong support for the EP EVMS was provided from a project director at the Los Alamos Site Office.
- Get a champion. At LANL, a well-respected Deputy Associate Director championed the EP aspects of the certification process. The champion explained the effort to other key individuals at the Laboratory and maintained communication during the process. The identification of an effective champion helped eliminate perceived or real barriers, ensured a cooperative certification team effort, and rallied site/project support for the initiative.
- Establish a corporate EVM policy early in the process if one does not already exist. Draft and agree on the System Description and process early in the effort. Assure that the policy and the process allow for the unique needs of an EP. This will help establish a common set of acronyms, and gain consensus on what the EVM process includes and how it operates. Diagramming the process was very revealing and helped identify issues and misconceptions.
- Do a self-assessment against the 32 criteria vs. your policies, procedures, and guidelines. Ensure aspects unique to EP are included. Identify the gaps and issues promptly and assign point of contacts/responsible individuals and teams responsible for resolving the issues. Set target dates for completion and hold people accountable to completion dates.
- Communication is vital to the effort's success. Keep the site/project support informed of all decisions and schedule status. Use Electronic/Shared Folder accessible by all team members. This ensures that all the EP team members see meeting minutes, actions items, resource data, and the most recent drafts of the system description and other documents.
- Identify and use success stories and lessons learned from other IT certification efforts
- Keep everything simple and to the point – Make it as easy as possible for the Certification review team to follow the information and data trails. Do not

assume that outside reviewers are knowledgeable in IT-specific terminology, equipment or procedures. Mountains of convoluted data may result in Certification review team misinterpretation of the data or give the perception that the CAM does not really understand the system or process.

- Diagrams and Process Flow Charts should be easy to understand. Simplicity and clarity are particularly critical when presenting complicated, unfamiliar IT concepts. Prepare at least two (BCWS, BCWP and ACWP) sample data traces (poster sized story boards) for the EP and prepare one in presentation format. Develop document traces as a means to define the work process and as a training aid. Develop a flow chart for the EP Work Authorization Process and Accounting Process (Indirect and Direct charges-how actuals get to the project). In addition, a Reporting flowchart - depicting internal project reports, project reporting to client and senior management, and site reporting to senior management and client.
- Dry run all presentations prior to presenting to the Certification team. The EP process is different from what people are used to hearing and miscommunication at the beginning of a review takes major effort to undo. Make sure everyone presenting understands and that the overall presentation is cohesive and portrays a united project management image.
- Many EP CAMs will be performing the job for the first time. Training and mentoring was extremely beneficial in stressing consistency and preparing the CAM for the unexpected. Establish a common list of typical interview questions for the CAMs, Project Controls, and Project Managers. Use the CAM notebooks when conducting the interviews. Make sure all CAM Notebooks are up to date and consistently formatted between projects. (Set up the CAM notebooks well in advance of the review and use the notebooks as a key part of the monthly variance analysis process. This will get the CAM used to using the notebook, and familiar with the reports.). Train the CAM's to answer interview questions by showing the information on a project document or a trace board, rather than just providing the answer. This shows that the CAM's are using the reports. Preliminary training should be required for CAMs and PMs - to get them familiar with the terminology. The EP project did formal training in this area.

LESSONS LEARNED

LANL lessons learned include the following:

1. Internal and external cultural, political and language barriers are common when designing and implementation any new process. This is particularly true when IT is involved. Both perceived and real issues must be minimized or resolved in order to complete the process with any degree of success.
   - The IT culture and project type is different from many typical projects. IT projects are more difficult to fully scope, the rate of technical change is extremely rapid and customer acceptance of the end product crucial.

- An EP involves extensive verbal communication and terminologies that are not standard from application to application (Oracle, SAP, JD Edwards, People Soft) and from Implementer to Implementer (Oracle vs. IBM vs. all of the independent consultants that we have that support the project).
- There are no clear design drawings similar to those found in construction so that others can clearly see what, where, why, and design a plan on how to and when by. True progress is not often immediately obvious; the PM must rely on what a software developer has done in the system. That makes it very difficult to quantify progress.
- Site specific processes, software, phases, etc., as well as acronyms, are often confusing to the assessment team if they are not familiar with the site terminology. Avoid acronyms; use specific full terminology. Minimize site-specific terminology where practical or use with clear definitions.

2. Scope is extremely difficult to define. Once defined, maintaining stability of the scope is equally difficult. Scope is partially based on the software that we choose and their "marketing or sales or employees" telling the customers what they can and cannot do. Sometimes customers are surprised that the software cannot do what we think it can and require a custom fix late into the project. In some cases, it does more than we think it can do. The IT project environment is not as simple as a green grass field.
3. LANL relies on consultants for IT work because its core competency is not ERPs. This work involves interfaces or conversions to the legacy applications that are built in very old languages. The code performed in these legacy applications is often not documented. Training these consultants in EVMS techniques is essential to success.
4. Much of the technical work is experimental. An approach is chosen which might work; project technicians keep working with code to make it work. All of the specifications are then revised like "as builts" which takes the same developer to do code and revise the specification. This effort diverts them from their next task. The construction manager cannot just hand the task back to the engineer for modification like a construction project; the same person does both functions. The work is very linear and iterative.
5. The EVMS system must be built at a relatively high level to facilitate making quick changes. ERPs don't have a detailed capital estimate, but work in "orders of magnitude". It is important to make sure that a meaningful WBS driven by work product is established. Budget categories must be established quickly so EVMS data can be accessed. For example, a detailed resource loaded schedule is usually required early in the project and resources must be assigned to every activity to develop the estimate. This is a time consuming process and would take 3-4 months to set up, then 3-4 months more before the EVMS data would start trending and providing meaningful information. In the EP case, the project built the resources at the work package level, but after 3 months the data was providing information that could be acted upon. Quicker is better in this case rather than using the traditional approach of having finer detail in the PMB.

6. Funding constraints for a G&A funded contract makes execution of the performance measurement baseline extremely volatile. Inability to predict funding year to year makes efficient project execution difficult.

7. A similar major challenge was trying to create a project within the rules of G&A. For example, there were difficulties in applying contingency. The project was directed by the Laboratory CFO not to put contingency in project plans as all of the G&A funds had to be spent within the FY with no carryover, or the project might not get funding the following year. This direction was in violation of the guidelines and resulted in a major CAR for the project.

8. Creation of a new Enterprise system must take place while the existing system remains operational. The old system cannot be discarded until the new one is fully functional. In critical people areas such as Payroll, the transition must be seamless and completely accurate. Close coordination with users is critical to this process.

9. The CAM notebook is an extremely valuable tool for management.
    a. Notebooks should included sections of:
        i. Overall Project Schedule
        ii. RAM
        iii. WBS
        iv. Individual Work Package Documentation with detailed basis of estimate and baseline schedule for each assigned WP
        v. Approved BCP's
        vi. Performance Reports (last 3 months worth
        vii. Detailed Variance Analysis as provided by CAM
        viii. Current Period Actual report
        ix. Issues Tracking Log
        x. Current Critical Path Schedule (summarized)
        xi. Copy of the PMP or PEP
        xii. Copy of PM 109
        xiii. Copy of the System Description Document
    b. The CAM with support and QA provided by Project Controls should maintain CAM notebooks. Each CAM can have their own personal notes and highlighted areas on the documents to show that these items are used and referred to on a regular basis.
    c. CAM's have effectively used the RAM and WBS diagram to show how their sections of the project fit into the overall project.

10. It is critical that a Legacy Decommissioning Plan go hand-in-hand with the development of the new systems. Often, the new system is not designed to entirely replace the old system. In this case, the site will have to support both the old and new systems simultaneously at increased cost. Any interfaces to or from external systems require support from the legacy system (and any system that works with that system) for as long as the interface is required. Many outdated systems will require support for years even though it was intended to decommission them.

11. IT and/or process requirements are very difficult to decompose or quantify. Because many things in the IT world cannot be seen or touched, and because the

industry is very young, most people have a difficult time communicating what the complete requirements are. Also, in the IT world, requirements can be satisfied by many different technical solutions and depending on the technical solution chosen, additional requirements may have to be modified, added, or even dropped.

12. Scope creep is very difficult to discern on a large project using e-data that you cannot see. Customers, after testing, often say, "That is not what I meant when I wrote the spec"; requiring expedient fixes to attain acceptance. Those changes are managed as cost variances. During the build stage, systems were thought to be 100% complete only to find out during the testing stage that the customer wanted something different. Valuable money and time was spent in testing unwanted scope. The customer's requirements should have been more clearly defined during the spiral design reviews and during the build stage.
13. A major issue with G&A funding is managing the "carry over". If G&A funding is not used each year, it is lost. As a result, it is difficult to manage variances that swing across FY boundaries. Often the Laboratory treats G&A as more of an accounting pool and will move funds at will at a programs manager's request. Under this system, it can be difficult to keep up with change control, life cycle management and impact on future years

CONCLUSION

LANL has successfully demonstrated the application of a tailored EVM approach to projectized IT type scopes of work. The LANL cadre of EVM knowledgeable and trained personnel have developed and implemented the processes, tools and expertise to apply a tailored EVM approach through formal documented policies, procedures, and guidelines. The success of the recent DCMA certification and pending closure report is attributed to the EVM culture driven expectations and focus from the LANL senior management team down through the program and project teams. LANL plans to continue the surveillance of existing EVM implementation as well as exploring opportunities, methods and process improvements in applying the intent of the EVM process to future LANL missions and programs.

OVERALL CONCLUSION

EVM is a powerful tool for evaluating performance of project work in progress and helpful in projecting the estimate at completion. Appropriate implementation facilitates timely evaluation of potential problems and opportunities. Diligent follow-through of corrective actions supports successful project completion. The basic concept is simple and application is relatively straightforward for projects where one project is governed by one contract. Significant complexities can arise when projects are embedded within Management and Operations contracts especially when the projects span beyond the term of the M&O contract such as with EM type projects. Fiscal year end constraints and cross year funding uncertainties associated with utilizing operating funds tend to create discontinuities, baseline changes and contingency management challenges.

Specific EVM training and mentoring for project personnel is of particular importance for IT projects as this business line is relatively unaccustomed to using this tool. IT scope is difficult to define, control and assess true progress. Though the application is cumbersome, it is possible to conform to the standard and provide a helpful measure of control in the execution of IT projects. Additional guidance is being published to facilitate EV implementation on IT projects with documents such as NNSA's Project Execution Model for IT investments.

Sharing lessons learned and best practices is an effective way to foster continuous improvement as the application of EVM is extended to a wider variety of projects within the DOE complex. This type of activity should be encouraged to leverage the existing skills and expertise within the federal and contractor community. Methods to facilitate the exchange of information, such as the EVMS Clearinghouse website, should be considered as a resource to allow access to this information.

Application of EVM is sufficiently adaptable to make it a useful tool in delivering EM, D&D and IT projects. Ongoing surveillance with an eye toward process improvement and tailoring will help to secure this method as an essential consideration in successful projects.

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