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Statement:

The US Department of Energy uses Earned Value Management as a performance management tool that measures actual performance of work scope, and the associated cost and schedule, compared to the approved baseline plan for that work scope. An Earned Value Management System has been proven to be a valuable tool for project managers and is currently being used on many government contracts and in the private sector as well. The use of EVMS is a requirement for most DOE EM contracts, including capital asset projects and operational activities.

This bulletin provides a short description of EM's history of using earned value, past issues associated with its use, benefits of using the method, and current requirements and guidelines to implement an EVM system. General lessons learned are presented organized by the five phases of project management: initiation, planning, execution, control and closeout.

Discussion:

Background

One of the most important parts of program management involves understanding if a project or activity is on schedule, if the technical scope and objectives are being met, if the work is costing more than planned, and what can be done if the performance shows deviation from its plan. An Earned Value Management System can provide the processes and information to assist in effectively managing the project or activity.

DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, requires that an EVMS is used on all projects (except firm fixed price contracts) with a Total Project Cost (TPC) greater than or equal to \$50M, although projects with a TPC less than \$100M may request an exemption from the Project Management Support Office (PMSO) from using EVMS. For projects with a TPC between \$50M and \$100M, the contractor shall maintain EVMS compliant with the EIA-748C Standard, *Earned Value Management Systems*, or as required by the contract. For projects with a TPC greater than \$100M, the Office of Project Management Oversight and Accountability (PM) must conduct the review process to certify the contractor's EVMS compliance with EIA-748C. In addition, for projects with TPC greater than \$100M, PM will conduct a risk-based, data driven surveillance against some or all of the EIA-748C requirements. More information on projects less than \$50M will be available via a new DOE EM policy, "*Office of Environmental Management Policy for Management of Capital Asset Projects with Total Project Cost equal to or less than \$50 Million*" which is under review.

On October 1, 2017, DOE EM rolled out implementation of the "Requirements for Management of the Office of Environmental Management's Cleanup Program." This Cleanup Policy defines the requirements for organizing, decision making, execution, performance measurement and reporting for the EM portfolio. The policy outlines principles that are tailored to address the unique aspects of the EM Cleanup Program, including use of EVMS as a performance measurement tool, if required by the contract. The "H" Clause of EM contracts will state whether EVMS is required or not, and whether the system can use tailored approaches to the requirements while maintaining compliance with EIA-748C Standard.

Discussion

The concept of Earned Value Management was developed initially for use in the defense industry by the Department of Defense. Analysis of variances from the plan, when conducted properly, can be a valuable tool for a program manager to effectively control and address cost, scope and schedule problems as they arise.

The key to an effective earned value system is disciplined execution and management with proper planning. The EIA Standard 748 provides a number of criteria and attributes to have an effective EVM system. The EVMS Standard has two primary objectives: (1) Establish and use contractors' integrated management processes and (2) Utilize systems that provide timely and meaningful data for use by both contractor and Government management.

The EIA-748 standard lists 32 criteria or guidelines than an EVMS system must comply with. The guidelines are organized into the following five major project management activities:

- Organization – includes five guidelines that focus on organizing the work. A Work Breakdown Structure (WBS) must be established to a level that details the scope into specific tasks as well as identifies the task's relationship to a deliverable. Also critical, is the organizational breakdown structure (OBS) that identifies who is responsible for each WBS scope element. At the level of WBS and OBS intersection, a control or cost account manager (CAM) is identified who is responsible for scope, schedule and cost of that particular WBS element.
- Planning and Budgeting – includes ten guidelines that cover requirements for planning, scheduling and establishing the time phased budget for each task. An integrated master schedule, which is resource loaded, is developed to provide logic-tied activities toward achieving the project's objectives. The resulting time phased budget and integrated master schedule comprise the performance measurement baseline (PMB) for the project. The total budget that includes all tasks is then defined as the budget at completion (BAC), along with some level of reserve set aside for project uncertainty, management reserve (MR). The addition of MR and BAC results in the contract budget base (CBB).
- Accounting – includes six guidelines that focus on capturing the actual costs that are expended for the project. Costs are captured in such a way that is consistent with the manner in which the tasks are executed.
- Analysis and Management Reports– includes six guidelines that include how management reviews cost and schedule variances, and the documentation of the root cause, impact and corrective action to correct them. Issues are identified at the cost account level so that specific actions can be taken to correct issues. A new estimate at completion (EAC) may be determined as warranted.
- Revisions – includes five guidelines that include incorporation of customer directed changes and how the project baseline is affected. This includes the need to perform analysis and potential re-planning of the project, and its performance baseline, as needed.

In the 1990's the Department of Defense conducted a series of studies following the cancellation of U.S. Navy's A-12 program, a major aircraft acquisition, and the subsequent audit that followed. Their studies indicated that focusing primarily on the stringent application of the criteria had resulted in a higher cost of using the system than the benefit received from using the system. Surveys indicated that some of the EVMS cost was due to over-implementation of the 32 criteria resulting in excessive documentation that may have diverted attention of the project manager away from real issues. To refocus attention, the original criteria were replaced with industry standards in 1996.

Despite its shortcomings, for use on large, cost-reimbursable contracts where the government bears the brunt of the project risks, it was found that there are ten benefits for using EVMS. They are:

1. It is a single management control system that provides reliable data.
2. It integrates work, schedule, and cost using a work breakdown structure.
3. The associated database of completed projects is useful for comparative analysis.
4. The cumulative cost performance index (CPI) provides an early warning signal.
5. The schedule performance index provides an early warning signal.
6. The CPI is a predictor for the final cost of the project.

7. It uses an index-based method to forecast the final cost of the project.
8. The “to-complete” performance index allows evaluation of the forecasted final cost.
9. The periodic (e.g., weekly or monthly) CPI is a benchmark.
10. The management by exception principle can reduce information overload.

Conclusion

The concept of earned value management was first established and used by the Department of Defense in the 1960's. Over the decades, although the title evolved, the concept and the basic tenets have not changed. The current standard for implementing earned value is described in EIA-748, *Standard for Earned Value Management Systems (EVMS)*, and includes 32 guidelines organized into five discipline areas.

EVMS, if properly implemented, provides customer and contractor with benefits. The contractor will have visibility into issues that might arise with schedule, cost and technical issues. It will allow project managers to have a tool that can identify schedule and cost variances at appropriate levels within a project structure to allow changes to be made to correct rising issues. The customer will have an increased confidence that the contractor can properly manage their project and have the ability to take corrective actions quickly as problems arise. Earned value is now used world-wide on a variety of projects including construction, production, research & development, etc. The objectives of using EVMS can be summarized into five areas:

- Related time phased budgets to specific scope or tasks
- Provide a basis to capture work progress against an established baseline
- Relate cost, schedule and technical performance
- Provide effective and valid performance data for managers to use to assess status of their projects
- Provide managers with an effective level of summarization to be able to make proper decisions

Recommended Actions:

The following are lessons learned from the use of an Earned Value Management System organized by the five phases of Project Management:

- Project Initiation Phase
 - Establish the baseline early
 - Have EMVS staffing identified during contract negotiations
 - Project Management should execute the project like it was proposed
 - Ensure PM, Cost Account Managers (CAMs), EVMS staff are properly trained
 - Develop clear understanding of any variances in scope or differences in assumptions
 - Define variance thresholds for reporting by percent and/or dollar value
 - Agree to variance analysis at a specific level of WBS, documentation, root cause identification and corrective actions required
- Project Planning Phase
 - Establish an EVMS implementation schedule
 - Ensure Integrated Project Teams are working to the same schedule
 - Establish and approve a performance baseline
 - Have established change control procedures in place
 - Define use of reserve and undistributed budget
 - Customer must approve baseline changes as required by DOE Orders
- Execution Phase
 - Establish schedule for EVMS status and reporting
 - Agree upon EV method and completion criterial for defined tasks
 - Establish approach for vendor/subcontractor accruals and receipts
 - Define reconciliation process to validate ACWP reported and variances

- Incorporate EV results in monthly review deliverable and status reports
- Report number of late work package starts and completions
- Identify and budget MR for unrealized risks
- Control Phase
 - Involve the IPT in determination of definition and cost of changes
 - Should use timely EVMS variance root cause analysis to be effective
 - Have IPT validate labor report charges and responsibilities
 - Establish an over target baseline plan as needed
 - Close incomplete tasks and re-plan them as new tasks in a timely fashion
 - Be aware that small unapproved changes can cause scope creep and drive variances
 - Review EVMS on a periodic basis to show proper usage
- Closeout Phase
 - End of project (last 5-10%) incorrect data can cause dramatic changes
 - Ensure final EACs include remaining commitments and labor suspense
 - Ensure all charge accounts are closed and suspense/bad charges are cleared
 - Understand contractor financial calendar so rate adjustments are clear
 - Ensure final EVMS report matches current invoice totals

Critical Decision(s): CD-0 to CD-4

Facility Type(s): All

Work Functions(s): Project/Program Management, Project Control

Technical Discipline(s): All

References:

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2. EIA-748-C, www.humphreys-assoc.com/evms/EIR-748.php
3. Pennington, Jim, Business Operations Director, "PROJECT MANAGEMENT USING EARNED VALUE (and the Problems & Lessons Learned from it)", https://ocio.nih.gov/PM/PMC/.../NIH_EVM_Primary_Presentation_11-07-07.ppt, National Institute of Health, November 2007
4. "EVMS Education Center – Basic Concepts of Earned Value Management (EVM)", <https://www.humphreys-assoc.com/evms/basic-concepts-earned-value-management-evm-ta-a-74.html>.