

# Project Management in Government: An Introduction to Earned Value Management (EVM)

By Young Hoon Kwak and Frank T. Anbari

*This article is adapted from Young Hoon Kwak and Frank T. Anbari, “Project Management in Government: An Introduction to Earned Value Management (EVM)” (Washington, DC: IBM Center for The Business of Government, 2010).*

Management of government projects, programs, and portfolios—and the related expenditures of public funds—are major, visible areas of interest and concern. Emphasis on performance improvement in government continues to increase steadily, supported by mandates imposed by government laws and public pressure. Despite a growing understanding of the determinants of success, increasing maturity, and a stream of successful programs and projects, project failures continue at an alarming rate.

## Why Is Project Management Needed in Government?

There are visible examples of failure in major public programs and projects. *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2008* points out that, of the 840 major information technology (IT) investments (about \$65 billion) in the U.S. federal IT portfolio in fiscal year (FY) 2008, there were 346 major IT investments (about \$27 billion) that were not well planned and managed, reflecting investments on the Management Watch List as well as those rated “Unacceptable.”

Earned Value Management (EVM) is a powerful methodology that gives the executive, program manager, project manager, and other stakeholders the ability to visualize a project’s status at various points during the project life cycle and consequently manage projects, programs, and portfolios more effectively. EVM helps provide objective project assessments when applied appropriately, and clearly quantifies the opportunities to maintain control over cost, schedule, and specifications of various types of projects. EVM gives managers greater confidence in making evidence-based decisions about project scope, schedule, cost, resources, and risks; hence, it allows more effective control and project oversight.

## Key Legislation and Regulations Related to EVM

**Title V of the Federal Acquisition Streamlining Act** (FASA; U.S. Congress, 1994) requires that agency heads must define and approve the cost, performance, and schedule goals for major acquisitions and achieve, on average, 90 percent of the cost, performance, and schedule goals established.

**The Clinger-Cohen Act** (U.S. Congress, 1996) requires the Director of the Office of Management and Budget (OMB) to develop, as part of the budget process, a process—for analyzing, tracking, and evaluating the risks and results of all major capital investments for information systems—that encompasses the entire life of each system.

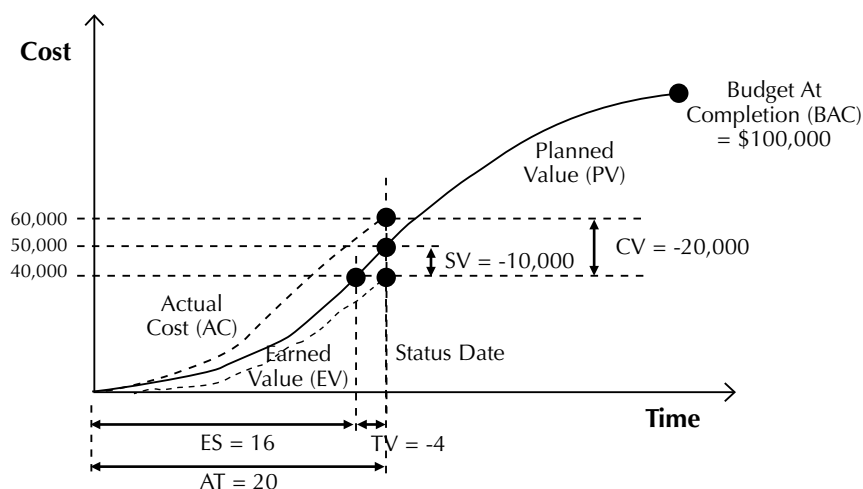
**The OMB Circular A-11, Part 7 – Planning, Budgeting, Acquisition and Management of Capital Assets** (OMB, 2008) and **the Capital Programming Guide** (OMB, 2006) were written to meet the requirements of FASA and the Clinger-Cohen Act. These documents set the policy, budget justifications, and reporting requirements that apply to all agencies of the executive branch of government that are subject to executive branch review. They address capital acquisition, require the use of EVM consistent with the American National Standards Institute ANSI/EIA 748 for both government and contractor work, and are the genesis for the EVM system (EVMS) requirements for the Federal Acquisition Regulation.

NASA is one of the leading federal agencies in the U.S. government applying project management principles consistently by implementing the use of EVM. Its mandated use through detailed, specifically delineated organizational protocols; the commitment of resources to assist in the implementation of EVM use; the standardized data analysis capabilities; and formalized reporting requirements—as well as providing the training needed to ensure meaningful use of EVM across

## A Comprehensive Example

Consider a project that has a baseline Budget at Completion (BAC) of \$100,000 and a baseline schedule of 40 weeks. The baseline indicates that, by the end of week 20, the project is planned to be 50 percent complete. At the end of week 20, it is reported that 40 percent of the project work has been completed at a cost of \$60,000. The main components of this example are shown in the figure below.

From the example, we can conclude that this project is in serious trouble in terms of both cost and schedule performance. Corrective actions should have already been taken. It is critical to conduct an immediate review of this project, evaluate the underlying causes of the problems facing it, and make appropriate decisions promptly.



### Using the EVM method:

$$\text{BAC} = \$100,000$$

$$\text{AT} = 20 \text{ weeks}$$

$$\text{AC} = \$60,000$$

$$\text{PV} = 50\% \times \$100,000 = \$50,000$$

$$\text{EV} = 40\% \times \$100,000 = \$40,000$$

### Therefore:

$$\% \text{ Complete} = \text{EV} \div \text{BAC} = \$40,000 \div \$100,000 = 40\%$$

$$\% \text{ Spent} = \text{AC} \div \text{BAC} = \$60,000 \div \$100,000 = 60\%$$

### Cost and Schedule Variances:

$$\text{CV} = \text{EV} - \text{AC} = \$40,000 - \$60,000 = -\$20,000$$

$$\text{SV} = \text{EV} - \text{PV} = \$40,000 - \$50,000 = -\$10,000$$

### Time Variance:

$$\text{PV Rate} = \$100,000 \div 40 \text{ weeks} = \$2,500 \text{ per week}$$

$$\text{TV} = \text{SV} \div \text{PV Rate} = -\$10,000 \div \$2,500 \text{ per week} = -4 \text{ weeks}$$

### Performance Indices:

$$\text{CPI} = \text{EV} \div \text{AC} = \$40,000 \div \$60,000 = 0.67$$

$$\text{SPI} = \text{EV} \div \text{PV} = \$40,000 \div \$50,000 = 0.80$$

### Estimate at Completion and Variance at Completion:

$$\text{EAC} = \text{BAC} \div \text{CPI} = \$100,000 \div 0.67 = \$150,000$$

$$\text{VAC} = \text{BAC} - \text{EAC} = \$100,000 - \$150,000 = -\$50,000$$

Source: Adapted from Anbari, 2003.



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the agency—all clearly show how NASA is committed to incorporating EVM into its management processes. NASA adopts and applies sound project management processes in initiating, planning, executing, monitoring, controlling, and closing its programs and projects, within which the comprehensive incorporation and use of EVM techniques is one small, yet critical aspect.

## Steps in EVM Implementation at NASA

NASA uses a five-step approach to implement EVM, as outlined below.

### Step 1: NASA's Integrated Baseline Review

This aspect specifies standardized guidance for the NASA Integrated Baseline Review (IBR) process by providing project managers, project staff, and EVM experts with a standard guide for conducting the IBR as a technical review, ensuring that the project manager has ownership of the process, and defines IBR responsibilities.

### Step 2: Schedule Health Assessment

This process allows the project manager to conduct a project schedule review, internally referred to as a schedule health assessment, that evaluates the soundness and validity of project schedules. The schedule health assessment is a quantitative, evaluative methodology that helps determine the credibility and practicality of the schedule for project management purposes. It improves the EVM process by evaluating life cycle plans.

### Step 3: Integrated Information System

This information system is used to apply project review concepts through the use of an in-house EVMS. By utilizing an enhanced EVM server and database configuration, NASA provides its project managers with a practical, in-house EVMS that enhances the planning, execution, and performance management of NASA programs and projects.

## Critical Success Factors in the Implementation of EVM at NASA

The following highlights areas of strength in the implementation of EVM at NASA—as a public organization that has been utilizing EVM effectively to monitor and control its projects:

- NASA invested in the use of EVM, as demonstrated by its comprehensive policies and procedures.
- The NASA EVM website (<http://evm.nasa.gov>) provides a detailed clearinghouse for training, policies, and procedures.
- A dedicated team to monitor EVM deployment and use is funded.
- A single IT system for tracking and reporting exists, synchronizing cost and schedule data into a consolidated repository.
- Trend analysis is performed from day one and throughout the life cycle of the project.
- Consistent reporting structures are required, with linkages to requirements documentation as a standard operating procedure.
- EVM analysis is used to make organizational-level decisions, schedule modifications, and funding allocations, and to document lessons learned.

### Step 4: Automated Data Analysis

This capability allows for continuous review of data through the use of an automated data analysis system. Through the automated analytical capability that performs EVM calculations by utilizing the above-mentioned integrated information system, timely and routine analyses of EVM data are facilitated that enable real-time, project-related decision making.



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### Step 5: Organizational Investiture

Overall, the directives that NASA uses are adopted with flexibility depending on the size and complexity of specific projects. The degree of alignment to NASA project management practices is generally left up to the project manager. It is vital to NASA that viable results are achieved within budgetary constraints and that public perceptions are maintained. An entire department has been created for the use of EVM at NASA, which clearly delineates the level of investiture in this best practice.

## Assessing the EVM Experience at NASA

### Findings Related to the Value of Project Management and EVM at NASA

Major findings related to the value of project management and EVM at NASA are presented below.

- **Finding One:** With a project success rate of 97 percent, NASA personnel we interviewed indicated that no justification is needed for doing project management, but justification is needed if it is NOT done.
- **Finding Two:** It can be inferred that the assessment of the level of stakeholder satisfaction with project management at NASA is directly related to the tone of media coverage and public perception of NASA missions.
- **Finding Three:** NASA's leadership stressed that the degree of alignment with NASA project management practices is generally left up to the project manager.
- **Finding Four:** When discussing the ability of a project management group to be successful, one of NASA's leaders suggested that some senior government executives tend to speak about project management in terms of overall mission and obligations, and do not discuss project management on a program or portfolio level.
- **Finding Five:** Project results are well documented at NASA.
- **Finding Six:** NASA demonstrated that it had satisfactorily addressed issues related to its leadership commitment;

the quality of its corrective action plan; and its capacity to implement the plan, including program/project office involvement, validation of its accomplishments, and demonstrated progress in the timely accomplishment of its milestones.

- **Finding Seven:** NASA has an extensive, thorough "lessons learned" process.
- **Finding Eight:** Project management principles at NASA are defined as working as a team, measuring performance through the use of quantitative data, collaborating extensively with global stakeholders and contractors, implementing efficient change management practices, and allocating priorities to programs and projects using portfolio management concepts.



## Recommendations for Improving EVM at NASA

The following recommendations highlight potential opportunities for improvement in the implementation of EVM at NASA.

**Recommendation One: NASA should apply EVM use to projects of \$20 million or less.** NASA stipulates the use of EVM for projects over \$20M, and requires the approval of the Chief Engineer to deviate from this mandate. By developing methods to use EVM for smaller-cost projects that may not be considered as high-visibility projects, NASA would have standardized processes and procedures for all of its projects.

**Recommendation Two: NASA should apply EVM to firm fixed price projects.** Applications of EVM are usually conducted within cost-plus or incentive-type contracts. Typically, firm fixed price contracts are not managed using EVM because these types of contracts are seen as a risk transfer to the contractor and not to NASA.

In reality, NASA is still exposed to risk in terms of quality, schedule, and the ability to complete the project—which ultimately can impact the agency's objectives. Therefore, a modified EVM approach may have meaningful applications to protect NASA from this exposure.

**Recommendation Three: NASA should develop a scope management indicator as part of EVM.** Currently, NASA EVM measures only cost and schedule constraints. It may be possible to incorporate a scope management indicator to capture information on the stability of this important constraint.

**Recommendation Four: NASA EVM should include a variance in time.** Current EVM metrics are expressed in terms of dollar cost and not in terms of the actual time. While schedule variances need to be stated in terms of dollar cost, it may be useful to express these variances in terms of time, or represent them in terms of duration as well. The schedule variance in terms of dollars may not effectively highlight the true requirement to realign the schedule.

## Recommendation for Other Government Agencies

**Recommendation: EVM should be widely adopted by agencies across government.** EVM is a powerful methodology that gives the manager the ability to visualize a project's status at various points during the project life cycle and consequently manage risks more effectively. EVM has given managers greater confidence in making evidence-based inferences about project resources and scope management; hence, it has

allowed more project control and oversight. EVM also brings other innovations into projects. It calls for a project-oriented management structure, a learning culture in the organization, the recognition of specialized skills and expertise, and more interface and interdependence within reporting lines.

EVM has been instrumental in supporting stronger cash flow management capacity, improving transparency and governance, facilitating prevention or mitigation of conflicts, and above all helping bring several large-scope projects to completion on time and within budget. EVM is an effective management methodology that helps provide objective project assessments when applied appropriately, and clearly quantifies the opportunities to maintain control over cost and schedule aspects of various projects and programs.

EVM as a methodology has proven merits and continues to expand to several sectors. It advocates for more rigor in project planning and implementation, which are undeniably prerequisites for any successful project. Using EVM or parts of it, and tailoring it to specific situations has allowed managers to enjoy its benefits, including better cash flow management, improved relationships with clients, and successful management of project constraints. Knowledge, skills, applications, and maturity in EVM continue to grow as this powerful method is being used more widely. EVM will continue to grow as long as more of its weaknesses are known and turned into opportunities for improvement. ■

### TO LEARN MORE

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The report can be obtained:

- In .pdf (Acrobat) format at the Center website, [www.businessofgovernment.org](http://www.businessofgovernment.org)
- By e-mailing the Center at [businessofgovernment@us.ibm.com](mailto:businessofgovernment@us.ibm.com)
- By calling the Center at (202) 551-9342