The Basics of Earned Value Management

BACKGROUND

Earned Value Management (EVM), which has been a mainstay of major government project management, has now caught the imagination of government IT professionals as well as those in the private sector. This has happened because EVM offers, for the first time, an “apples to apples” methodology for understanding how projects are progressing in relation to the original funding and scope.

EVM is now a requirement for all major capital-funded IT programs in the U.S. Government. In June 2002, the Office of Management and Budget mandated the use of EVM systems for all major IT service and acquisition contracts. DOD requires EVM on contracts worth more than $50 million and the application of at least some EVM principles on contracts worth more than $20 million. The purpose of this white paper is to describe the basics of an Earned Value Management approach to project management, with a particular emphasis on its use by the U.S. Federal Government.

INTRODUCTION

Earned Value Management (EVM) is a valuable tool in the Project Manager’s arsenal of tracking measures. EVM is now a requirement for all major capital-funded IT programs in the U.S. Federal Government. Over a decade ago, the Secretary of Defense decided to cancel the Navy A-12 Avenger II Program because of performance problems detected by EVM. This proved conclusively that EVM mattered to secretary-level leaders. In an era of enormous government IT spend (estimated to be around $65B per year), fluency in EVM concepts and methods is a prerequisite to progressive project management.

How is EVM pertinent in the Federal arena? Generally, most projects are reviewed and evaluated based on how much money has been spent to date compared to the project budget. However, as most project managers and analysts know, expenditure is not always an accurate assessment of the amount of work completed.

It is therefore a common practice to look at the percent complete data around a given project. This presents the challenge of looking at two different measurements – dollars and percent complete. This leaves questions like “If I am 50% complete and have spent $250,000, is that good or bad? Was the percent complete subjectively or objectively determined?”
Earned Value (EV) is an evaluation of accomplished work (in dollars) and is the foundation of EVM. Pre-defined earning rules are used to measure EV, which is then compared to the planned value (PV) and actual costs (AC) of a project. What makes this information more useful than just multiplying the percent complete by the budget, is that the earned value is based on a time-phased budget baseline so all values (planned, actual, and earned) are related to time. This baseline is used for all performance measurements and is called the Performance Measurement Baseline (PMB).

Since the PMB represents the planned budget for the approved scope of work, it only changes with approved scope changes. EVM therefore enforces planning and change control while limiting scope creep. With a fixed PMB, performance-to-plan can be used to indicate trends that allow accurate forecasts of cost and schedule performance to that baseline. This forecasting ability is a significant improvement for both project managers and customers trying to assess project performance.

**SUMMARY OF INTRODUCTION TO EARNED VALUE MANAGEMENT**

- EVM is critical for project management in the public sector.
- EVM is founded on a dollar-based baseline for evaluating planned vs. earned vs. actual project work.
- EVM provides a reliable and accurate forecasting ability, which greatly increases the accuracy of project assessment for project managers and federal customers.

**WHAT IS EARNED VALUE MANAGEMENT?**

EVM is a project management technique that objectively tracks physical accomplishment of work by:

- Relating resource planning to schedules and to technical performance requirements
- Integrating project cost, schedule, technical effort, and risk in a realistic and executable plan called the Performance Measurement Baseline (PMB)
  - Tracks performance and progress to the plan
  - Provides early warning of developing problems and opportunities
  - Enables early corrective action when deviating from the plan
- Representing a repeatable process
  - Provides standard and consistent methods for progress measurement
  - Facilitates consistent use of performance metrics on all projects
  - Enables management to easily assess health of the enterprise
  - Provides project past-performance data and lessons learned, which are useful for improving performance and preparing future estimates for similar work
- Providing an early warning of performance problems while there is time for corrective action

In addition, EVM improves the definition of project scope, prevents “scope creep,” communicates objective progress to stakeholders, and keeps the project team focused on achieving progress.

Earned Value Management encompasses a great deal of project management functionality.

**WHAT EARNED VALUE MANAGEMENT IS NOT**

EVM is not a financial system or accounting system. Although many organizations require detailed financial budgeting and cost collection and all information must be reported in dollars, EVM is not a financial system or accounting system. EVM is a specific project management and reporting technique that has enjoyed wide acceptance in the U.S. Government.

EVM is not a reporting requirement. EVM enables detailed reports, which enhance its project tracking capability. Since EVM has certain data that is unique, the reports are unique, but it is not just a reporting requirement.

EVM is not just a government requirement. Although the federal governments in several countries require the use of EVM on major projects, EVM is also used by many commercial companies to manage projects. Use of EVM algorithms and metrics have a broad application; therefore, companies are using EVM as a means of managing work more effectively.
BASIC PRINCIPLES OF EARNED VALUE MANAGEMENT
Earned Value Management originated in industry as a best practice and was turned into a requirement by the U.S. Department of Defense. The concept spread throughout the U.S. Government, industry, and other countries because this management concept embodies fundamentally sound principles for managing performance of projects and programs. These principles are:

- All project work is defined and planned.
- The work is broken down into finite product-oriented components and assigned to a single organization.
- The scope, schedule, and cost objectives are integrated into a plan by which progress can be measured.
- Actual costs are recorded at the same level where the work is planned, but may be collected at a lower level.
- Performance is objectively measured on a regular basis.
- Variances and deviations are analyzed, impacts are forecasted, and estimates at completion are based on the actual performance to date and the remaining effort.
- Changes to the performance measurement baseline are controlled.
- Earned Value information is employed in the organization’s management processes.

What follows is more in-depth discussion on additional principles of Earned Value Management.

PLANS ARE TIME-PHASED
A time-phased plan schedules both work and budget. A familiar part of project management, this is commonly done as a critical path management (CPM) schedule, but time-phased planning also works.

Time units can vary. For instance, when doing monthly reporting, one should have at least weekly schedules; however, most project managers (PMs) plan in days.

Figure 1 shows a plot of the planned value for a project that is estimated at $18,000 in 10 months. It is planned as a level-loaded project.

![EVM Concepts](image)

Figure 1: The Planned Value of a Level-Loaded Project
THE PLAN IS SAVED AS THE BASELINE
An approved plan is documented and saved as the baseline. Changes are only made to the baseline when there is an approved scope change. The baseline is the foundation for the earning of value that is based on accomplishment. For example, when a project is 50% complete, the value earned is 50% of the baseline. This is called the Performance Measurement Baseline (PMB). Re-estimates of the plan may be maintained as the current plan, but do not change the baseline.

Because the baseline is time-phased, the total Budget At Completion (BAC) of the work is the sum of the entire budget in the PMB. This allows a budget to be considered with respect to time. Therefore, the planned value (PV) is the budget planned to date as opposed to the BAC, which is the total budget.

EARNED VALUE IS CALCULATED FROM THE BASELINE
There are many ways to calculate Earned Value (EV) based on physical accomplishment. The following simple example uses the percent complete without considering how it is measured.

If at the end of the fourth month, the project is 26.7% complete with a BAC of $18,000, the EV is $4,806 (.267 x $18,000). The planned value at the end of the fourth month was $7,200. Graphically, that data looks like what is depicted in Figure 2.

It is easy to reach two conclusions from this graph. First, the project is behind schedule; second, at this rate, the project will finish very late. The last piece of the puzzle is the actual costs to date.

ACTUAL COSTS ARE COLLECTED FROM THE FINANCIAL SYSTEM
Whether you collect costs directly (time and material), allocate costs, or do any combination of the two, the costs of the project need to be reviewed against the information already collected. When the actual cost data is added to the chart, it looks like Figure 3.

This indicates that at the end of four months, the plan was to accomplish $7,200 worth of work; $4,800 worth of work was actually accomplished, and $5,600 was spent to do it.

GETTING INFORMATION FROM THE DATA
Spending Variance of $1,200 – This example shows that project costs were less than planned costs by $1,200.

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\text{Planned Value (PV)} - \text{Actual Costs (AC)} = 7,200 - 5,600 = 1,200
\]

Cost Variance of $800 – Even though the project is under spent to the plan, it is overrun by $800 based on the work accomplished.

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\text{Earned Value (EV)} - \text{Actual Costs (AC)} = 4,800 - 5,600 = 800
\]
Schedule Variance of $2,400 – If $7,200 worth of work was planned to date and only $4,800 worth of work was accomplished, then the project is $2,400 behind schedule.

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\text{Earned Value (EV) - Planned Value (PV)} = \$4,800 - \$7,200 = -\$2,400
\]

This also correlates to approximately 1.3 months behind schedule (10 months for $18,000 is an average of $1,800 per month, making $2,400 equal to 1.3 months.)

Variance at Completion – By forecasting the remaining costs to complete the work – Estimate To Complete (ETC) – and adding that to the Actual Costs (AC), the sum is the Estimate At Completion (EAC).

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\text{EAC} = \text{AC} + \text{ETC}
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Comparing that EAC to the Budget At Completion (BAC) provides a forecast of the overrun or under run at the completion of the project, called the Variance at Completion (VAC).

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\text{VAC} = \text{BAC} - \text{EAC}
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In addition to the calculations showing current status, there are a series of calculations that may provide additional insight into the future performance of the project. These and all the other calculations are defined in the Glossary of Terms.

**ESSENTIAL CHARACTERISTICS**

The guidelines contained in the ANSI standard do not describe a system; rather, they state the qualities and operational considerations of an integrated management system without mandating detailed system characteristics. The standard and its guidelines do not address all of an organization’s needs for day-to-day or week-to-week internal control such as status reports, reviews, and formal and informal communications.
In designing and implementing an Earned Value Management System, the objective should be effective management and control. A system that meets the letter of the guidelines but not their intent does not support management needs. Earned Value Management Systems that meet the intent of the guidelines feature:

- Thorough planning
- Timely baseline establishment and control
- Information broken down by deliverable product and by organization or function
- Objective measures of progress and performance against the plan at levels where the work is being performed
- Consistent reporting to higher management for use in decision making
- Analysis of significant variance
- The implementation of management actions to mitigate risk, manage cost, and schedule performance

These are also characteristics of good management and should be used in conjunction with Earned Value Management to provide the insight and information necessary to make informed decisions.

**THE VALUE OF EARNED VALUE MANAGEMENT**

All projects need effective management. Projects that are complex, on the leading edge of technology, or that have other parameters that make them difficult and risky must have greater insight, control, and performance indicators to be successful. These projects can benefit the most from Earned Value Management.

An Earned Value Management System that implements the ANSI/EIA 748 standard EVMS guidelines provides control and insight because it:

- Relates time-phased budgets to specific tasks to requirements contained in a statement of work
- Provides accurate, reliable, and timely data
- Measures project progress and performance with related costs, schedule, and technical accomplishments
• Provides Federal managers with information based on data that originates from the systems used by the contractor to manage the project.

With the ability to evaluate accomplished work in dollars at a point in time against what was planned, it is no wonder that project managers and IT professionals in both the private sector and in the government are deploying Earned Value Management. These managers get a visual depiction of discrepancies and can implement immediate course corrections to stay on budget and on time in meeting the goals of the organization.

INDUSTRY-LEADING EVMS
Deltek offers the industry’s most comprehensive solutions to help manage earned value. Our leading earned value management and analysis systems help both Government Contractors and Government Agencies control costs, schedules and resources and easily analyze earned value data. For more information on Deltek’s Earned Value Management Systems, visit www.deltek.com/evm.
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