The Earned Value Management Maturity Model®

(EVM³®)

Version 0.0
Initial Public Draft

September 2000
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Introduction

Rapid and widespread acceptance of Earned Value as a “best practice” has encouraged an increasing number of institutions, both in private and public sectors, to include Earned Value in their project management process. The five step model Earned Value Management Maturity Model™, or EVM™, is a maturity model for organizations to use in implementing and improving Earned Value. Firms with an EIA/ANSI 748 compliant Earned Value Management System (EVMS) can use the EVM™ to establish Earned Value process metrics and create Earned Value improvement plans.

This is the first draft of the EVM™. Readers are encouraged to comment upon this version and offer recommendations and improvements for future versions. Through the cooperative efforts of readers throughout industry and government, Management Technologies hopes to create a document that can be used to define a path, and provide a staged standard for organizations to create and improve their Earned Value Management practices. Please address your comments to support@mgmt-technologies.com.

The current version of this document may be downloaded free of charge from www.mgmt-technologies.com.

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Background

How do you measure an organization’s capability in applying Earned Value Management (EVM)? What is the subset of ANSI/EIA 748 requirements which are sufficient to get started in EVM? How do you know that your potential teammate or contractor has a competent EVM system in place? When the US DoD published their Earned Value Management standard (Cost/Schedule Control Systems Criteria, or C/SCSC) over twenty-five years ago, a formal validation process was established. This process evaluated a DoD contractor’s Earned Value Management system using an on site review and “validation” process. For subsequent use on new contracts the proper application of the “validated” Earned Value Management system was assured through a Subsequent Application Review or SAR.

A similar situation existed in the world of software development in the 70’s and early 80’s. There was no way of knowing if one company or organization was better than another at software development. Yet some firms seemed, on average, to be more successful. With the rising cost and risk of failed DoD software projects the Software Engineering Institute (SEI) was created. The SEI undertook an effort to determine the processes used in firms with a better than average track record. From these efforts a series of “best practices” was documented as a goal for software organizations to attain. Although not an ANSI standard, attaining these best practices is now sought after by both developers and customers as attributes of sound software development. Known as the SEI Software Capability Maturity Model (SW-CMM™), this set of practices is known to take years for organizations to meet all requirements. The SW-CMM is built around five levels of maturity, with the fifth being the highest capability. This industry standard has resulted in customers and industry knowing the skills and practices of software developers through both internal and external assessments of their software capability using the SW-CMM.

Both software development and application of Earned Value Management are process intensive efforts. Therefore it seems that the basic five level CMM model may be applicable to the development of a maturity model for Earned Value, an Earned Value Management Maturity Model, or EVM³.

Establishment of ANSI/EIA 748 Earned Value Management standard, and the cancellation of the U.S. DoD standard have left a void where the formal validation process once existed. Thus customers, teammates, and senior management are left unsure about the real quality and usage of EVM within an organization.

This document defines a five step Earned Value Management Maturity Model or EVM³. This maturity model follows the concepts of other maturity models in (a) providing the user a step-by-step means to evolve a Earned Value Management Systems (EVMS) within their organization, and (b) a common
The Earned Value Management Maturity Model™

framework for firms and industry to discuss the relative strengths of various EVMS applications

**Fundamental Concepts**

The EVM³ is intended to provide users with a defined means of establishing and improving their Earned Value Management Systems (EVMS). It can also provide industry and government with a standardized means of evaluating an EVMS. The EVM³ is tied to the ANSI/EIA standard 748 by establishing compliance with 748 as a necessary condition for achieving EVM³ Level III. Thus EVM³ complements the ANSI standard in providing means to achieve compliance by prescribing a growth path from little or no Earned Value to a ANSI compliant implementation to a continually improving Earned Value system.

A EVMS can be defined as a set of activities, methods, and practices, that people use to develop and maintain a Earned Value baseline, measure project performance, produce performance variances reports, predict program outcomes, and revise baselines when justified. As an organization matures, the EVMS process becomes better defined and more consistently implemented throughout the organization.

EVMS process capability describes the range of expected results that can be achieved by following a defined EVMS process. The EVMS process capability provides one means of predicting the value of EVMS to the organization.

EVMS process performance represents the actual results achieved by following a defined process. Thus, EVMS process performance focuses on the results achieved, while process capability focuses on results expected.

EVMS process maturity is the extent to which a specific process is explicitly defined, managed, measured, controlled, and effective. Maturity implies a potential for growth in capability and indicates both the richness of an organization's EVMS process and the consistency with which it is applied in projects throughout the organization. The EVMS process is well-understood throughout a mature organization, usually through documentation and training, and the process is continually being monitored and improved by its users. The capability of a mature EVMS process is known. Process maturity implies that the productivity and quality resulting from an organization’s process can be improved over time through consistent gains in the discipline achieved by using its software process.

As an organization gains in EVMS process maturity, it institutionalizes its process via policies, standards, and organizational structures. Institutionalization entails building an infrastructure and a corporate culture that

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supports the methods, practices, and procedures of the business so that they endure after those who originally defined them have gone.

**Overview of the EVM³**

**Level 1 Initial Level**
Level 1 is the level of organizations with no or limited EVM implementation in place. This level provides a defined starting point for an initial implementation of EVM.

**Level 2 Localized Level**
Level 2 defines an EVM implementation which is less than fully compliant with ANSI 748, but may be sufficient for smaller projects or teams. Earned Value Management may only be applied to certain teams or functional areas within a project. Use of Earned Value Management may be initiated by team leads for their areas and not by the project manager. Earned Value Management is used to varying degrees and to various project limitations. These teams meet five simplified criteria (Fleming and Koppelman) of (a) defining and decomposing the scope with a Work Breakdown Structure like structure, (WBS) (b) planning and schedule the scope, (c) budgeting cost accounts to functions, (d) maintaining a performance baseline, and (e) monitoring project performance and forecasting outcome. The resulting initial benefits of a Level 2 EVM implementation are consistent with the modest investment, thus creating a positive “first use” of EVM. This encourages further use of EVM, further investment in EVM, and a goal of attaining higher levels of EVM³. Further, Level 2 allows for a defined, but less than full, implementation which should provide valuable project insight with a minimum of administrative cost passed to the [Government] customer.

**Level 3 ANSI/EIA 748 Compliant**
Level 3 is an ANSI/EIA 748 compliant implementation. In addition a training program and an organizational repository of Earned Value historical data, best practices, and reference material exists.

**Level 4 Managed**
Level 4 adds guidelines for measuring the quality of EVM data and introduces metrics for measuring the health of an Earned Value Management system. This Level allows an organization to measure and put in place process improvement in their Earned Value Management System. The goal is an increased awareness of areas where improvement in their EVMS would provide more timely decision making data, reduction in EVMS implementation cost, and improved fidelity between the Earned Value data and the actual project cost and schedule condition.

Project technical performance is addressed using Earned Value as part of a Level 4 organization.
Level 5 Optimizing
The highest level of the EVM³, Level V, requires monitoring the efforts to improve an Earned Value Management system. This level used the Earned Value Management process data to establish and track efforts to implement process changes. Organizations with an ANSI or DOD compliant EVM implementation can use Levels IV and V as goals for improving the utility, timeliness, accuracy, and cost effectiveness of their EVM systems.

Framework of the EVM³

Internal Structure of the Maturity Levels (CMM™ definition)
Each maturity level is decomposed into constituent parts. With the exception of Level 1, the decomposition of each maturity level ranges from abstract summaries of each level down to their operational definition in the key practices. Each maturity level is composed of several key process areas. Each key process area is organized into TBD sections called common features. The common features specify the key practices that, when collectively addressed, accomplish the goals of the key process area.

Key Process Areas
Except for Level 1, each maturity level is decomposed into several key process areas that indicate the areas an organization should focus on to improve its EVMS process. Key process areas identify the issues that must be addressed to achieve a maturity level.

Each key process area identifies a set of goals considered important for enhancing process capability. The path to achieving the goals of a key process area may differ across projects based on differences within industry segments or environments. Nevertheless, all the goals of a key process area must be achieved for the organization to satisfy that key process area. When the goals of a key process area are accomplished on a continuing basis across projects, the organization can be said to have institutionalized the process capability characterized by the key process area.

Certain key process areas appear in more than one level. This represents processes which have additional goals at higher EVM³ Levels. Typically these are related to partial (Level 2) and complete (Level 3) fulfillment of the EIA/ANSI 748 Standards.
The Five Levels of the EVM³

Level 1 Initial Level

Definition of Level 1
Level 1 is the Initial level and represents the level of most organizations that have not used Earned Value. Use of Earned Value, if any, is spotty and only though the support of individual efforts and interest.

With little management support, any Earned Value use is abandon in times of project crisis, and Earned Value baselines are lost as frequent replans occur to attempt to show current project condition as the planned condition.

Understanding Level 1
Level 1 represents organizations with no or very little Earned Value management in use. Any use of Earned Value is limited to individuals or small projects where an Earned Value advocate uses its principles in attempting to calculate SPI and CPI even though precise planning and cost data is missing. The work packages may be only at high levels, or possibly only one lengthy work package exists. BCWS (Budgeted Cost of Work Scheduled) is the project’s original spend plan, without regard to use of short duration work packages. The Budgeted Cost of Work Performed (BCWP) is subjectively estimated. A formal means of accounting dollars or hours spent on the project may be missing. The user may be forced to simply estimate the hours used per week for the Actual Cost of Work Performed (ACWP). A WBS may not exist and data is not easily rolled up, nor is there a capability to drill down to problem areas. The user appreciates the importance of Earned Value but finds their project or organization does not appreciate nor encourage Earned Value Management.

In addition, with Earned Value unrecognized for its utility there are no organizational procedures in place to define the rules and expectations. The Earned Value reports may be present but lack credibility as Schedule and Cost data looks good but overruns and late deliveries still occur. Earned Value performance depends on the Individual capabilities and varies with their skills, knowledge, and motivations. There are few stable EVMS processes in evidence.

Level 2 Localized Level

Definition of Level 2
EVM³ Level 2 represents organizations with an interest in the use of Earned Value Management and a reasonable attempt to meet some of the good practices found in the ANSI standard. These organization meet five simplified criteria (Fleming and Koppelman) of (a) defining and decomposing the scope with a WBS-like structure, (b) planning and schedule the scope, (c) budgeting cost
accounts to functions, (d) maintaining a performance baseline, and (e) monitoring project performance and forecasting outcome.

Understanding Level 2

Level 2 organizations realize the value of assigning work to teams via a WBS. They use a WBS to break the project work into meaningful, manageable portions, and formally assigned it to a person or department at each lowest WBS element. At each WBS level the elements are considered to have a ‘contract’ with defined values for the triple constraint (cost, schedule, performance or scope). The budget may be stated in dollars, or hours for labor intensive efforts. It is a time-phased budget. The means of determining work completed is likely subjective and rely on estimated percent complete. There may not be an easy ability to roll-up data through the Work Breakdown Structure and no project-wide rolled up baseline may exist. Earned Value Management may occur only at the lowest level of the Work Breakdown Structure. A performance baseline is established at least for each control cell, and only altered through a formal change process. Variance from cost and schedule are determined and analyzed at the cost account level, but not necessarily at the total project level. The baseline is kept up-to-date with formal changes to the project scope and funding.

Implementation costs are minimized. Formal training on Earned Value may not exist, using one-on-one on the job training instead. Spreadsheets may be used to capture the plan and performance data, perform Earned Value calculations, and provide graphs.

The accounting system may not have rigorous detail at the lowest level, but an effort is made to estimate the ACWP. Lacking formal timekeeping, ACWP estimates are made based on recollections of team size, competing tasks, available time, travel, and vacation time away. Likewise BCWP is based more on subjective measures than objective measures. Variance thresholds may not exist, but a periodic reviews of variances, Schedule Performance Index (SPI) , and Cost Performance Index (CPI) are formally done.

Application of Earned Value may not be wide-spread or uniform throughout the enterprise. There may be projects or Program Management Offices (PMOs) who use Earned Value, and others who do not. Where Earned Value is used, there will likely be some inconsistency in application since no formal Earned Value directive system exists.

For smaller projects and small organizations Level 2 may be sufficient. It is certainly an improvement over non-EV project management. Level 2 provides some of the basic functionality of an EVMS, at little cost. It can be viewed as entry level Earned Value for firms with a goal of full ANSI compliant systems. This modest list of project planning and control accomplishments can illustrate the value of EVMS to a reluctant workforce and skeptical management. With its low cost and relaxed requirements Level 2 can help overcome cultural resistance to EVMS. The benefits of Earned Value will outweigh the modest cost, leading to a positive first use of Earned Value. Level 2 can educate the
organization on the principles of Earned Value and help define the policies for a future, enterprise-wide, ANSI compliant “system description”. Finally, EVM³ Level 2 will help define the requirements for the selection of formal EVMS tools (software) for deploying Earned Value throughout the organization.

Key Process Areas for Level 2

The Key Process Areas (KPAs) for level 2 are listed below. To provide ease of migration to Level 3 the level two KPAs are a subset of the ANSI 748 Standard stated as key processes. A reference to the Standard’s paragraph is in parentheses.

**Organizational Process Area**

Goal 1  Work is defined, typically using a WBS (2.1a)

Goal 2  Who does the work is defined (2.1b)

**Planning Process Area**

Goal 1  A time-phased budget is established and maintained (2.2c)

Goal 2  Budgets (dollars, hours, or other measurable units) are established for control accounts and work packages. Planning packages may be used for far term efforts. (2.2e)

Goal 3  Work package budgets sum to the control account budget (2.2f)

**Accounting Process Area**

Goal 1  Costs are recorded in a manner consistent with budgeting (2.3a)

**Analysis Process Area**

Goal 1  Cost and Schedule Variances are calculated (2.4a)

Goal 2  Reasons (root causes) for Cost Variances and Schedule Variances are provided to project management (2.4b)

Goal 3  Managerial actions are implemented based upon earned value information. (2.4e)

**Revisions Process Area**

Goal 1  The performance baseline is maintained and changed consistent with authorized changes to the project scope, budget or schedule (2.5a)

Goal 2  A traceable history of revisions to the baseline is retained (2.5b)

Goal 3  Changes to the baseline require appropriate approval (2.5d)

Goal 4  Changes to the baseline are documented (2.5e)
Level 3 ANSI 748-98 Compliant

Definition of Level 3
EVM3 Level 3 describes an EVMS that meets the requirement of the ANSI standard. In addition the organization has established an organizational process focus (group) for defining the organizational EVMS process definition (an Earned Value Process Group or EVPG). Further, a formalized employee training program is created for addressing their EVMS process, tools, and implementation guidelines. An EVMS library is established to capture EVMS lessons and history and reference material. Changes to the organization’s project planning, project organization, scheduling, and funding processes are integrated with the EVMS process and required changes in the EVMS are made.

Understanding Level 3
An EVMS System Description approved by management and published. A uniform application of Earned Value is found throughout the organization, subject to the projects’ approved tailoring of the System Description requirements. Those organizations maintaining a previously validated EVMS that met the DoD C/SCSC may be least at Level 3. Note that the EVM3 Level 3 requires a formalized training program and centralized EVMS library which may not have previously existed.

Key Process Areas for Level 3
The KPAs for Level 3 include the remaining requirements of the ANSI standard that were not stated in Level 2. Additional goals include a System Description document, training, an Earned Value Process Group, and an organizational Earned Value library.

Organizational Process Area
Goal 1 The company’s planning, scheduling, budgeting, work authorization and cost accumulation processes are integrated with each other using the project work breakdown structure and the project organizational structure.(2.1c)

Goal 2 The company organization or function responsible for controlling overhead (indirect costs) is identified. (2.1d)

Goal 3 The project work breakdown structure and the project organizational structure are integrated such that cost and schedule performance can both be measured for either or both structures. (2.1e)

Goal 4 Earned Value process development and improvement activities are coordinated across the organization. (An EVPG or similar body exists and is funded by the organization.)

Goal 5 Organization-level process development and improvement activities are planned.
Planning Process Area

Goal 1  The authorized work is scheduled and the sequence of work and significant task interdependencies are shown. (2.2a)

Goal 2  Physical products, milestones, technical performance goals, or other indicators are used to measure progress. (2.2b)

Goal 3  Significant cost elements (labor, material, etc.) are identified as needed for internal management, and for control of subcontractors. (2.2d)

Goal 4  Level of effort (LOE) activity is identified and its use is minimized, and used only for efforts which are unmeasurable or for which measurement is impractical. (2.2g)

Goal 5  Overhead budgets are established for each significant organizational component for indirect expenses. The amounts in overhead pools that are planned to be allocated to the program as indirect costs should be budgeted and identified. (2.2h)

Goal 6  Management financial reserves and undistributed budget should be identified and continuously monitored. (2.2i)

Goal 7  The project budget is reconciled with the sum of all internal project budgets and management reserves. (2.2j)

Accounting Process Area

Goal 1  Control account’s direct costs are summarized to the work breakdown structure without a single control account being allocated to more than one work breakdown structure element. (2.3b)

Goal 2  Control account’s direct costs are summarized to the contractor’s organizational elements without a single control account being allocated to more than one work breakdown structure element. (2.3c)

Goal 3  All contract allocated indirect costs are recorded. (2.3d)

Goal 4  Unit costs, equivalent unit costs, or lot costs are identified when needed. (2.3e)

Goal 5  Material accounting system sub-goals are:

  Subgoal a. Control account’s material accounting is summarized and assigned consistent with the budgets using recognized, acceptable, costing techniques.

  Subgoal b. Control account cost performance measurement is done at the most suitable point in time for the each category of material, but not before progress payments or actual receipt of material

  Subgoal c. All material purchased for the program including the residual inventory is accounted for (2.3f).
Analysis Process Area
Goal 1  Cost account’s (and other required level’s ) cost and schedule variance are computed at least monthly using actual cost data, or reconcilable cost data, from the accounting system: (2.4a)

Goal 2  Reasons for significant differences between planned and actual schedule performance (Schedule Variance), and between planned and actual cost performance (Cost Variance) are provided at least monthly and in sufficient detail for program management. (2.4b)

Goal 3  Budgeted and applied (or actual) indirect costs are identified, and reasons for significant variances are provided at the level and frequency needed by management for effective control. (2.4c)

Goal 4  Data elements and associated variances are summarized throughout the program organization and/or work breakdown structure as needed to support management and any required contractual customer reports. (2.4d)

Goal 5  Revised cost-at-complete estimates are developed based on performance-to-date, commitment values for material, and estimates of future conditions. Cost-at-complete estimates are compared with the performance measurement baseline and important variances at completion are identified to company management and included in any applicable customer reporting requirements.(2.4f)

Revisions Process Area
Goal 1  Retroactive changes to work performed records that would change previously reported actual costs, earned value, or budgets are controlled. Adjustments should be limited to corrections of errors, routine accounting adjustments, directed changes from the customer or management, and changes to improve the baseline integrity and accuracy of performance measurement data (2.5c).

Standardization Process Area
Goal 1  A standard organizational Earned Value (System Description) process is developed and maintained.

Goal 2  A repository of Earned Value information is maintained by the organization through collecting, reviewing, and cataloging project data and experiences.

Training Process Area
Goal 1  Training activities are planned.

Goal 2  Training for developing the skills and knowledge needed to perform Earned Value management is provided.
Level 4 Managed

Definition of Level 4
At EVM³ Level 4 the organization begins to collect metrics on the EVMS itself. This is a separate activity from reporting project performance using Earned Value.

Understanding Level 4
The Level 4 organization has established a robust EVMS and now seeks to improve the EVMS. The important feature of EVM³ Level 4 is that the organization has moved from simply collecting Earned Value data for project performance, to collecting data on the Earned Value process itself. Like any process improvement initiative, the first step is to obtain metrics on the process.

The metric data is retained in an organizational database for analysis and trending. Meaningful variation in performance can be distinguished from random variation. This effort is used to determine how the Earned Value Management System is functioning and improving as a process. These metrics measure the quality and timeliness of the Earned Value data gathered via the Earned Value process.

Specific metrics are not required. A list of potential metrics includes:

- Number of work packages per CAM
- Data latency
- Number of re-plans and budget changes
- Number of retroactive adjustments
- Planning package lead time
- Percent non-discrete work packages
- Value of re-plans per re-plan

Level 4 also addresses advanced applications of Earned Value. In addition to the conventional Earned Value calculations, these organizations adjust BCWP for technical performance factors to provide an alternate, technical view of the project health. Thus, Earned Value at Level 4 addresses the scope (performance) and cost and schedule (Triple Constraint).

Key Process Areas for Level 4

Planning Process Area
Goal 1 The technical scope of the project is considering in planning and an appropriate means of measuring each technical accomplishment to its technical baseline is defined.
Accounting Process Area
Goal 1  The technical accomplishment is measured at appropriate technical events and, based upon the budget, a “technical” value of work completed is computed.

Analysis Process Area
Goal 1  The technical accomplishment is compared to the technical baseline and a technical variance is computed measured at appropriate technical events and adjustments are made to the value of work completed (BCWP) based upon technical achievements.
Goal 2  Reasons (root causes) for Technical Variances are provided to project management
Goal 3  Technical actions are implemented based upon earned value information.

Revisions Process Area
Goal 1  The technical baseline is maintained and changed consistent with authorized changes to the project technical objectives.
Goal 2  A traceable history of technical revisions is retained
Goal 3  Changes to the technical baseline require appropriate approval
Goal 4  Changes to the technical baseline are documented

Measurement Process Area
Goal 1  The measurement processes are planned
Goal 2  The organization’s Earned Value Management System’s process is known in quantitative terms.

Level 5 Optimizing
Definition of Level 5
Level 5 represents the highest level of achievement in implementing Earned Value. At this level plans are put in place, with budgets and champions, to improve the quality and usefulness of the Earned Value data. Goals are set for improving the EVMS, for example: reducing re-plans, data latency, and retroactive changes. Facilitators may be made available to help project planning using less LOE. Metrics are used to track Earned Value Management Systems improvements.

Understanding Level 5
The Level 5 organization recognizes the importance of continuously improving their EVMS. Through their EVPG and senior management support the EVMS
process is made more accurate in instrumenting project cost schedule and technical status. The Earned Value process becomes more standardized, less costly, and more responsive to management needs. Data is available more quickly for decision making. A formal long term plan is established and tracked for incorporating new tools and techniques.

Key Process Areas for Level 5

**Defect Prevention (CMM)**
Goal 1 Defect prevention activities are planned.
Goal 2 Common causes of defects are sought out and identified.
Goal 3 Common causes of defects are prioritized and systematically eliminated.

**Improvement Process**
Goal 1 Continuous process improvement is planned.
Goal 2 Participation in the organization's Earned Value Management process improvement activities is organization wide.
## Revision History

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