



**National Defense Industrial Association (NDIA)
Program Management Systems Committee (PMSC)
Earned Value Management Systems
Application Guide**

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CONTENTS

1	INTRODUCTION.....	1
2	DEFINITIONS	2
3	ACQUISITION PROCESS AND EARNED VALUE MANAGEMENT	4
3.1	ACQUISITION LIFE CYCLE.....	4
	3.1.1 <i>Acquisition Planning</i>	6
	3.1.2 <i>Acquisition Management</i>	7
3.2	EARNED VALUE MANAGEMENT.....	11
3.3	INTEGRATING RISK MANAGEMENT WITH EARNED VALUE MANAGEMENT	12
4	EVM APPLICATION PLANNING.....	14
4.1	ORGANIZING FOR EVM	14
	4.1.1 <i>Governance</i>	14
	4.1.2 <i>Risk-Based Application</i>	15
	4.1.3 <i>Scalability</i>	16
4.2	DEVELOPING THE PROGRAM BUDGETS	17
4.3	CONTRACTING FOR EVM.....	21
	4.3.1 <i>Contract Types</i>	21
	4.3.2 <i>Incentives</i>	22
	4.3.3 <i>Pre-Systems Acquisition Planning</i>	23
	4.3.4 <i>Systems Acquisition</i>	24
	4.3.5 <i>Integrated Baseline Review</i>	24
	4.3.6 <i>Surveillance</i>	25
5	PERFORMANCE MANAGEMENT AND MEASUREMENT	26
5.1	MEASURING PERFORMANCE PROGRESS	26
5.2	MANAGEMENT ANALYSIS	28
5.3	PROGRAM PROGRESS COMMUNICATION	29
5.4	CHANGE MANAGEMENT	30
6	EVM APPLICATION GUIDANCE	33
6.1	EVM APPLICATION FRAMEWORK.....	33
6.2	ANSI/EIA-748 STANDARD EARNED VALUE MANAGEMENT SYSTEMS	34
6.3	NDIA PMSC EARNED VALUE MANAGEMENT SYSTEMS APPLICATION GUIDE	35
6.4	NDIA PMSC EARNED VALUE MANAGEMENT SYSTEMS INTENT GUIDE	35
6.5	NDIA PMSC EARNED VALUE MANAGEMENT SYSTEMS ACCEPTANCE GUIDE	35
6.6	NDIA PMSC THE PROGRAM MANAGERS’ GUIDE TO THE INTEGRATED BASELINE REVIEW PROCESS.....	36
6.7	NDIA PMSC EARNED VALUE MANAGEMENT SYSTEMS SURVEILLANCE GUIDE ...	37

ACRONYMS.....38

1 INTRODUCTION

The primary objective of this guide is to describe for all organizations implementing the American National Standards Institute/Electronic Industry Alliance's (ANSI/EIA-748-A), Earned Value Management Systems (Current Version) the importance of planning the Earned Value Management (EVM) application through all phases of the acquisition life cycle. Throughout the remainder of this guide ANSI/EIA-748-A will be referred to as "ANSI/EIA-748."

ANSI/EIA-748 provides a scalable approach for EVM that can be adapted to any size program, project, or enterprise. It is through the program planning process that the program risk adjusted budget is authorized in terms of scope, schedule, and resources. The successful execution of the program within its performance objectives depends to a large degree on the quality of the planning effort for the application of EVM.

EVM is an effective integrator of the work scope, schedule, and resources for program management when applied consistently with the program complexity, size and risk. Hence, it is recommended for all programs where delivery of a product or other objectively measurable outcome is the intended objective.

This guide elaborates on the performance-based management requirements defined by the Office of Management and Budget (OMB) and contained in OMB Circular No. A-11, Part 7, "Planning, Budgeting, Acquisition and Management of Capital Assets". This guide also provides the context for the application of EVM within a notional Federal Government agency acquisition life cycle, and therefore contains government acquisition terminology.

In addition insight into the use of other NDIA Program Management Systems Committee (PMSC) guides is provided. This helps an organization's program and senior management within government, commercial, or industry customer and supplier organizations to establish a high confidence that an Earned Value Management System (EVMS) meets and complies with the organization's implementation of ANSI/EIA-748. Neither these guides nor ANSI/EIA 748 should be interpreted as specific requirements for an EVMS; rather they are intended to define and explain EVMS guidelines in sufficient detail to allow an organization to implement an effective EVMS.

This Guide will assist in:

- Applying EVM throughout the acquisition life cycle including EVM application planning, contracting for EVM, implementation and use of EVM, and EVMS review and acceptance, where multiple government agencies can accept an EVMS without imposing unnecessary duplication of acceptance reviews.
- Planning for a program risk based EVM application by incorporating systems engineering, cost estimating, risk management and contracting activities to develop and manage the cost, schedule and performance goals and objectives for a program.
- Organizing to facilitate EVM governance and systems compliance.
- Measuring performance progress and managing change.

Users of this guide are encouraged to submit recommended revisions to the NDIA PMSC.

2 DEFINITIONS

Acceptance Authority (EVM System Acceptance Authority) - An organization or party within a Government Agency or contractor organization responsible for recognizing that a supplier's EVM system proposed for use on a prime or subcontract, or for in-house work, meets the guidelines in ANSI/EIA-748.

Cost Risk - The likelihood that the program will not accomplish planned tasks within the planned budget and may consist of inaccurate/unreasonable cost estimates or failure to manage to cost, schedule, or performance objectives.

Earned Value (EV) - The value of completed work expressed in terms of the budget assigned to that work, also referred to as Budgeted Cost for Work Performed (BCWP). It provides an objective measure of the value of completed work expressed in terms of the budget assigned to that work.

Earned Value Management (EVM) - A management methodology that integrates a program's technical scope, schedule and resources with program risk in a baseline plan against which progress is measured to produce metrics that highlight variances and performance trends, thereby providing program managers, as well as higher level management, with objective visibility into program progress and enable more effective management.

Earned Value Management System (EVMS) - The integrated set of policies, processes, procedures, systems, and practices that meet an organization's implementation of ANSI/EIA-748.

Integrated Baseline Review (IBR) - A risk-based review conducted by Program Management to ensure mutual understanding between the customer and the supplier of the risks inherent in the supplier's Performance Measurement Baseline (PMB) and to ensure the PMB is realistic for accomplishing all the authorized work within the authorized schedule.

Integrated Project Team - means a multi-disciplinary team of acquisition professionals led by a program/project manager that is responsible and accountable for planning, budgeting, procurement and life-cycle management of an investment to achieve its cost, schedule, and performance goals. This definition expands on the "Integrated Product Team" concept used by some agencies in order to emphasize that participation by all management disciplines is essential to a project's successful planning and execution.

Management Reserve (MR) - An amount of the total budget withheld for management control purposes rather than being designated for the accomplishment of a specific task or set of tasks.

Performance budget - A budget presentation that clearly links performance goals with costs for achieving a target level of performance. In general, a performance budget links strategic goals with related long-term and annual performance goals (outcomes) with the costs of specific activities to influence these outcomes about which budget decisions are made.

Performance Measurement - A method of determining progress and a means for evaluating efficiency, effectiveness, and results. Performance measurement should include program accomplishments in terms of outputs (quantity of products or services provided) and outcomes (results of providing outputs in terms of effectively meeting intended agency mission objectives), indicators, statistics or metrics used to gauge program performance.

Performance Measurement Baseline (PMB) - The total time-phased budget plan (Budget at Completion) against which program performance is measured. It is the schedule for expenditure of the resources allocated to accomplish program scope and schedule objectives, and is formed by the budgets assigned to control accounts and applicable indirect budgets. The PMB also includes budget for future effort assigned to higher level accounts, also referred to as summary level planning packages, plus any undistributed budget. Management Reserve is not included in the PMB, as it is not yet designated for specific work scope.

Program - A major, independent part of a capital asset or system that involves a planned effort to achieve an outcome, the progress toward which is discretely measurable. A program may be comprised of multiple projects, delivery orders, task orders, or other recognized terms indicating a bilateral agreement between contracting parties.

Program Manager - The individual designated with responsibility for and authority to accomplish program objectives for planning, budgeting, acquisition, and management to meet the user's operational needs. Also may be identified as Project Manager or Product Manager.

Program Budget (PB) - The total budget for the program including all allocated budget, management reserve, and undistributed budget. In this context, "program" includes all government and contracted resources used to perform all contracts and projects. It does not include program funding and schedule risk-adjusted contingencies.

Program Risk-Adjusted Budget (PRB) - The total program budget that includes an additional amount of funding and schedule above the PB that customer management determines may be necessary to ensure project/program success. The PRB for a government program should be established at a level of probability sufficient to provide acceptable confidence that a program can achieve 90% of its performance, cost and schedule objectives within the approved budget as required by statute. The amount above the PB covers risk that was not identifiable through the IBR and other risk management approaches, but that history on similar programs or the amount of total risk on the particular program indicates will likely be needed to ensure sufficient funding and schedule will be budgeted for project/program success. The difference between the PB and PRB is held at a level above the program level to be released to the program when justified to fund cost and schedule overruns from the PMB that happen through no fault of the program management process.

Project - A temporary (generally several years) endeavor undertaken to create a unique product or service. A program is a group of projects managed in a coordinated way to obtain benefits not obtained from managing them individually. The terms "project" and "program" are used interchangeably in this guide because the management principles are the same.

Risk - An uncertain future event or situation that could impact the ability to achieve overall program requirements within defined cost, schedule, and technical objectives. Risk has two components: 1) the probability (or likelihood) of a particular outcome and 2) the consequences (or impact) of that outcome. The consequences of risks are typically thought of as negative; a risk event with positive consequences is referred to as an opportunity.

Schedule Risk - The likelihood that the program actions cannot be accomplished in the planned program timing and may result from unrealistic schedule estimates or problems with program execution.

Technical Risk - The likelihood that the program, as planned, will be unable to deliver a product to satisfy the technical/operational requirements.

Undistributed Budget - Budget associated with specific work scope or contract changes that have not been assigned to a control account or summary level planning package.

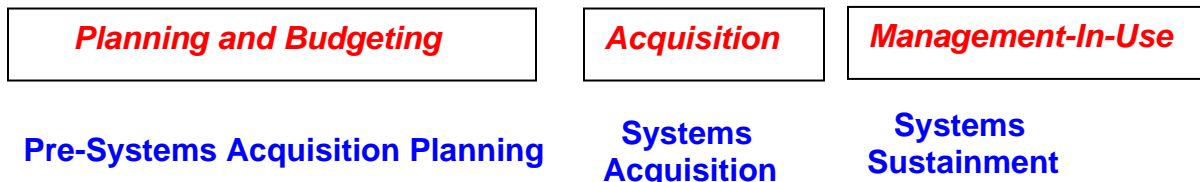
Work Breakdown Structure (WBS) - A product-oriented division of program tasks depicting the breakdown of work scope for work authorization, tracking, and reporting purposes.

3 ACQUISITION PROCESS AND EARNED VALUE MANAGEMENT

3.1 Acquisition Life Cycle

- Several acquisition disciplines are essential to establishing and operating an integrated EVM process within the acquisition life cycle, especially Program Management, Systems Engineering, Cost Estimating, Risk Management and Procurement.
- Integrated Project Teams should devote the planning time needed to create an adequate Work Breakdown Structure at program initiation and to keep it current throughout program execution.

The program or project acquisition life cycle starts with concept analysis progressing through technology definition, requirements planning, acquisition and finally through operations or management. Although the terminology may differ throughout government and industry, the processes are generally the same. These processes typically include decision points where executive boards review and approve a program’s entry into the next phase or stage, based on satisfactory completion of exit criteria from the prior phase or stage. The Capital Programming Guide supplement to the OMB Circular A-11, Part 7 reflects three lifecycle phases of the capital programming process: Planning and Budgeting, Acquisition, and Management-In-Use.



These three phases when viewed from a systems perspective may be identified as Pre-Systems Acquisition Planning, Systems Acquisition and Systems Sustainment as shown above.

Pre-Systems Acquisition Planning, for purpose of this Guide, includes linking planning and budgeting for long-range planning of capital assets in a strategic annual plan that describe an organization’s incremental progress toward achieving its strategic goals and objectives.

The Systems Acquisition Phase begins after the agency has received funding for a segment, module, or the entire asset and ends when the asset is delivered and fully operational. It includes both in-house organization work as well as contracted work. The in-house work must be managed with the same rigor as contract work. In-house operations are expected to achieve the cost, schedule, and performance goals to ensure success of the project, just as with contracted work.

The Systems Sustainment Phase begins after completion of the Systems Acquisition Phase. The Systems Sustainment phase is generally the longest phase of the investment or systems life cycle and represents the operations and management of the system as deployed.

In order to understand the application of EVM it is necessary to view the requirement in context of the federal capital asset planning or investment lifecycle as defined in OMB Circular A-11 Part 7 and the Capital Programming Guide and the activity flow between the key functions displayed in Figure 1.

FUNCTIONAL ACTIVITY FLOW

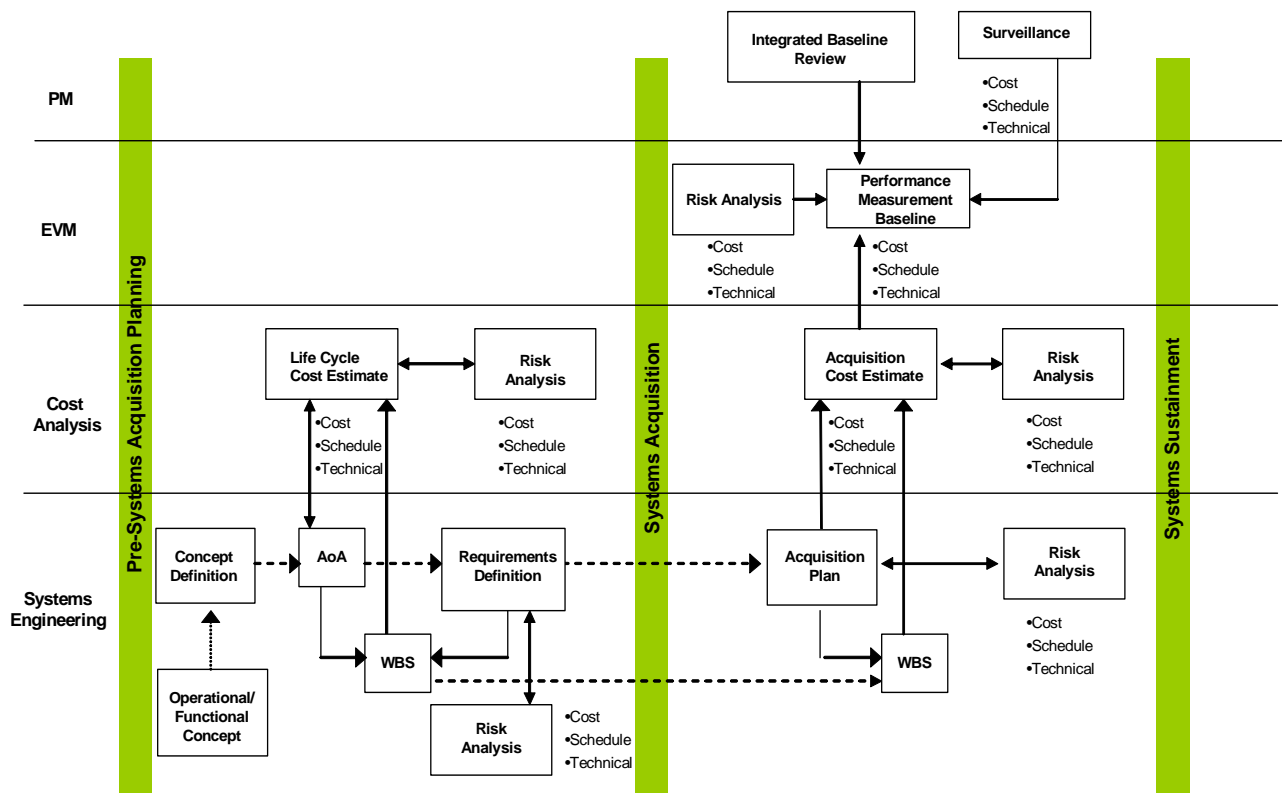


Figure 1. Note: AoA means Analysis of Alternatives

Figure 1. Key Functional Activity Flow

3.1.1 Acquisition Planning

Several acquisition disciplines are essential to planning an acquisition through its life cycle. At initiation of a major acquisition the team should include individuals with skills in the following areas: Project Management, Contract Oversight, Cost Estimating, Risk Management, Sustainability, Scheduling, Users, Budget, Technical Experts, Information Resource Management, Value Management, and EVM. Staff with other appropriate skill sets should also participate. Control Account Managers (CAMs) or integrated project teams are an integral part of the acquisition process. They support the Program Manager (PM) and operate in a spirit of teamwork with participants empowered to make commitments for their organizations enabling decision-makers to make the right decisions at the right time.

Planning for EVM and risk management begins at program inception with the definition of the work and extends through the assignment of the work to the performing organizations. Work is defined using a Work Breakdown Structure (WBS) that displays and defines the product(s) and relates the elements of work to each other and to the end products that completely define the program. Risks identified in the planning should be assigned to specific elements of the WBS. Risks should be identified in the risk register and referenced to the WBS Dictionary to serve as the basis for the development of the risk-adjusted baselines.

Department of Defense (DoD) Military Handbook 881A (MIL-HDBK-881) “Work Breakdown Structures for Defense Materiel Items” is a widely used WBS reference, which many non-defense organizations have adapted for use on their programs. Although the Handbook is DoD oriented, the concepts and approaches of good WBS development are applicable regardless of the defined end-item.

The evolution of a WBS during a program life cycle is illustrated in Figure 2. As the program planning proceeds, all affected organizations – especially systems engineering, cost estimating, contracting and program management – should work together to establish the program WBS, refine it as the definition firms up, and extend it to individual projects and contracts.

Organizations that have similar programs should consider using a standard WBS template to support consistent program definition and to facilitate an integrated program management process.

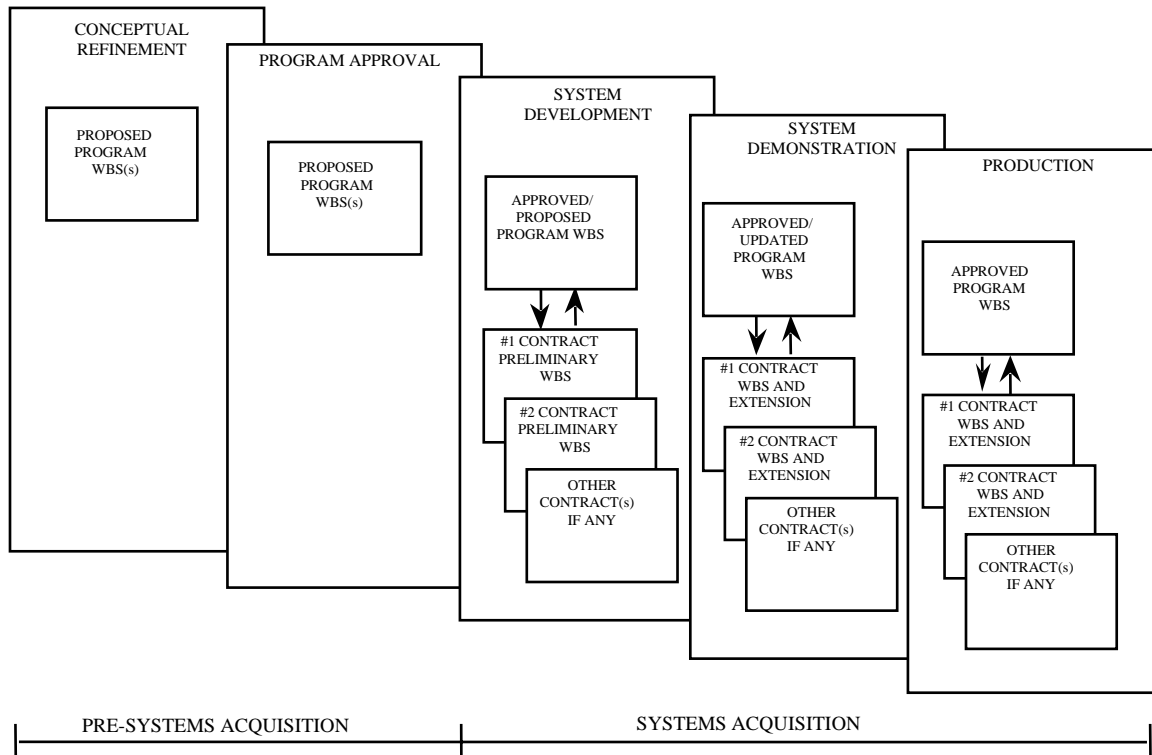


Figure 2. WBS Evolution

Even if the preferred solution has not been determined, it is essential that program WBS planning begin promptly upon program initiation during the earliest stage of the planning phase. The importance of devoting adequate time to “up front” planning to create a well-developed WBS and to keep it current throughout program execution cannot be overstated.

Program management’s use of EVM depends on a well-developed WBS to ensure that a program is completely defined. Program experts in collaboration with experts in the areas of Systems Engineering, Cost Estimating, Procurement, Risk Management, Scheduling, and EVM need to develop a WBS as a common framework within a given program, among related programs and across an organization’s portfolio. For example, the program WBS established during concept definition will provide the framework for estimating the program’s cost and risk during the pre-systems acquisition planning and for developing the program schedule. The cost estimate and program WBS provide the basis for suppliers to extend the WBS to achieve integrated cost, schedule and technical performance management using EVM during systems acquisition.

3.1.2 Acquisition Management

Integration of work and performing organizations is achieved by identifying the organizational levels where responsibility for work scope, schedule and resource management for each WBS elements is assigned. This management control point, known as a “control account,” is unique to each organization and varies depending on how the organization operates as illustrated in Figure 3. For example, an organization that is functionally oriented may have more control accounts than an organization that manages with integrated product teams because these teams frequently have a broader span of control. Control accounts should be established at a level high enough to

provide sufficient management flexibility, yet low enough to ensure that all significant variances are identified early enough to take corrective action. The level selected for control accounts may vary among programs and even within programs, for example, when a decision is made to manage a high risk WBS element at a relatively low level.

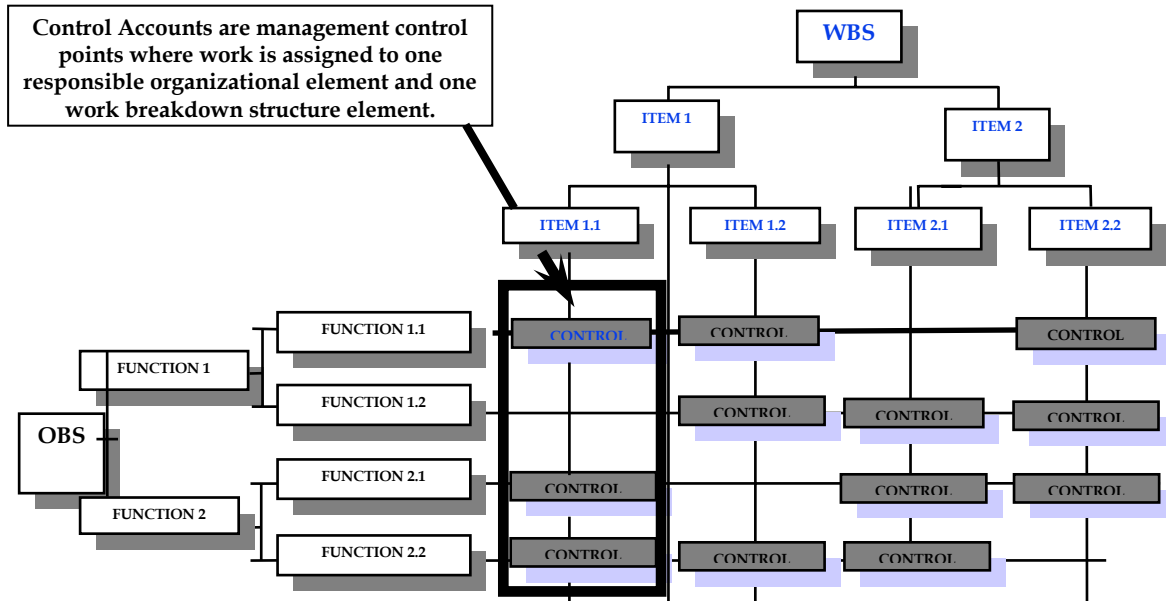


Figure 3. WBS/Organization Matrix

Managing a major investment takes a dedicated integrated project team of acquisition professionals along with personnel with other skills such as legal, budget, finance, personnel, and others that may be needed to achieve a successful program. The size of the dedicated staff assigned to the integrated project team and their location will vary depending on the phase of the investment, but individuals with acquisition skill sets must be assigned to the team and they should be co-located during the planning phase and available when needed throughout the remainder of the investment's life cycle. The entire team needs to be together to the extent possible during the planning phase so that all disciplines participate in the development of the statement of work and the cost estimates to ensure they address the concerns of all disciplines.

Once the program requirements and end products are defined the cost estimator can use this information to project the program cost and schedule estimates. This cannot be accomplished without first establishing an estimating structure and WBS, identifying cost drivers, and collecting cost, schedule, technical and programmatic information to form the estimating methodology. Throughout this process, risk must be identified to ensure the range of possible outcomes is considered. This concept (illustrated in Figure 4) shows the life cycle and its relationship to program management and risk assessment. Managing these costs can be accomplished by ensuring the program has a clear integrated program execution plan and schedule as illustrated in Figure 5. This must include the probability of success associated with

the total program with each element in the WBS if the program technical, schedule and cost objectives are to be met.

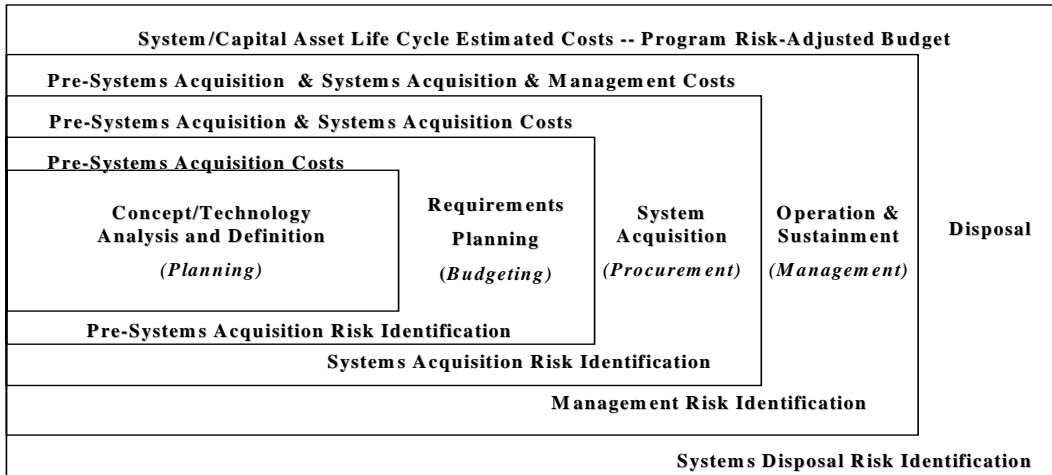


Figure 4. Capital Asset Life Cycle Cost and Risk Application

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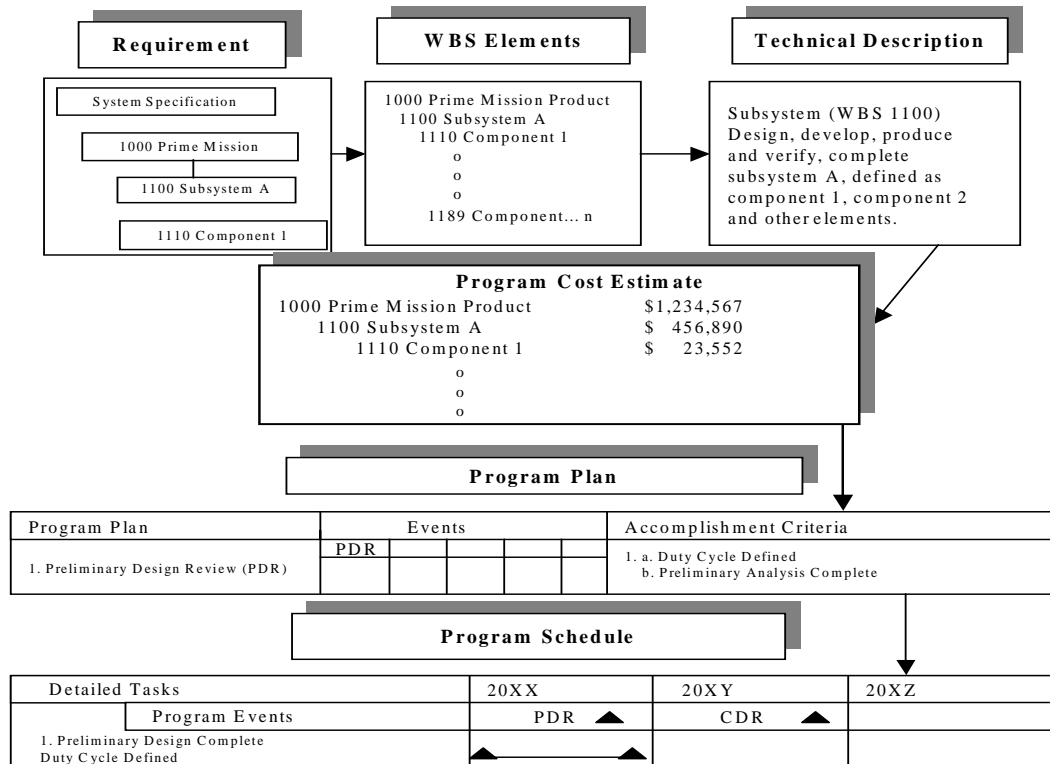


Figure 5. Relationship of Program Plan and Schedule with WBS

3.2 Earned Value Management

- Earned Value (EV) is the value of completed work expressed in terms of the budget assigned to that work, also referred to as Budgeted Cost for Work Performed (BCWP).
- Earned Value Management (EVM) is a management methodology that integrates a program's technical scope, schedule and resources with program risk in a baseline plan against which progress is measured to produce metrics that highlight variances and performance trends, thereby providing program managers, as well as, higher level management with objective visibility into program progress and enable more effective management.
- Earned Value Management System (EVMS) is the integrated set of policies, processes, procedures, systems, and practices that meet an organization's implementation of ANSI/EIA-748.

EVM provides program management with a capability to integrate the work scope with the schedule and cost elements for effective program planning and control through the following principles.

- Planning all work scope for the program to completion
- Defining the work scope in logical components for which the responsibility for control of technical, schedule, and cost objectives, including risks, can be assigned
- Integrating of work scope, schedule, and cost objectives into a performance measurement baseline plan from which accomplishments may be measured and baseline changes controlled
- Recording of actual (or estimated) costs incurred in accomplishing the work performed
- Objectively assessing the accomplished work at the work performance level
- Analyzing variances from the performance measurement baseline, forecast of impacts, and estimates at completion for schedule and cost

Effective application of EVM provides customer and supplier program managers timely, accurate and integrated cost, schedule and technical performance information, for both the total capital investment program and the individual supporting projects or contracts.

- The nature of the work (e.g. inherent complexity, external dependencies, schedule and/or cost risks, high management visibility) is a key consideration in establishing a performance management approach.
- Where the work is discrete, EVM can be effectively employed. Where the work is level-of effort, performance must be evaluated using other means that are not related to schedule milestones or measures of progress.

For the benefits of EVM to be fully achieved, comprehensive planning at the outset, combined with the establishment and disciplined maintenance of a performance measurement baseline, are required. The combination of comprehensive planning, baseline maintenance, and earned value yields earlier visibility into program performance and estimated completion projections than is provided by non-integrated management tools or methods of planning and control. Systematic implementation of EVM throughout the organization facilitates comparison of program performance, enabling managers to make better-informed decisions.

3.3 Integrating Risk Management with Earned Value Management

Because of the differences in the nature of the work and the objectives for each phase of the defined acquisition lifecycle, methodologies for executing, managing, and evaluating performance must be used that are appropriate to each phase and the type of work being accomplished. Identifying the deliverable, whether a product or service, provides useful information on structuring a system. This facilitates delivery of the product. EVM is not necessarily appropriate for all phases but is applicable where significant risks (uncertainty) in cost, schedule and scope objectives are thought to exist.

Successful project management requires proactive identification and assessment of potential risks in the Planning and Budgeting phase, plus the planning of actions necessary to respond to them. The objective of the risk management process is to identify risks and opportunities, develop handling plans or responses, allocate program resources for risk handling activities, and manage them effectively to minimize cost, schedule, and performance impacts to the program acquisition. The risk management process relies on inputs from program personnel, customers, and other sources, as well as program management and analysis tools utilized on the program.

Risk is integrated with EVM processes during the planning and execution phases of the program to improve performance and enable more reliable predictions of program outcomes as illustrated in Figure 6. During the planning phase, the PM must decide, given the risks and opportunities identified, how much budget to allocate and how much to hold in management reserve. Budget for risk handling is allocated to the control accounts based on their significance and where in the WBS they exist. Schedule risk assessments are performed to identify schedule risks. As the baseline plan is executed, EVM metrics provide insight into the success of risk/opportunity handling plans, the realization of risks and the capture of opportunities. Management reserve is issued or returned to replan future work as needed to address realized risk or take advantage of captured opportunities. Quantified risks and opportunities are to be taken into account in the Estimate to Complete (ETC) for each control account and the overall baseline best, worst, and most likely EACs.

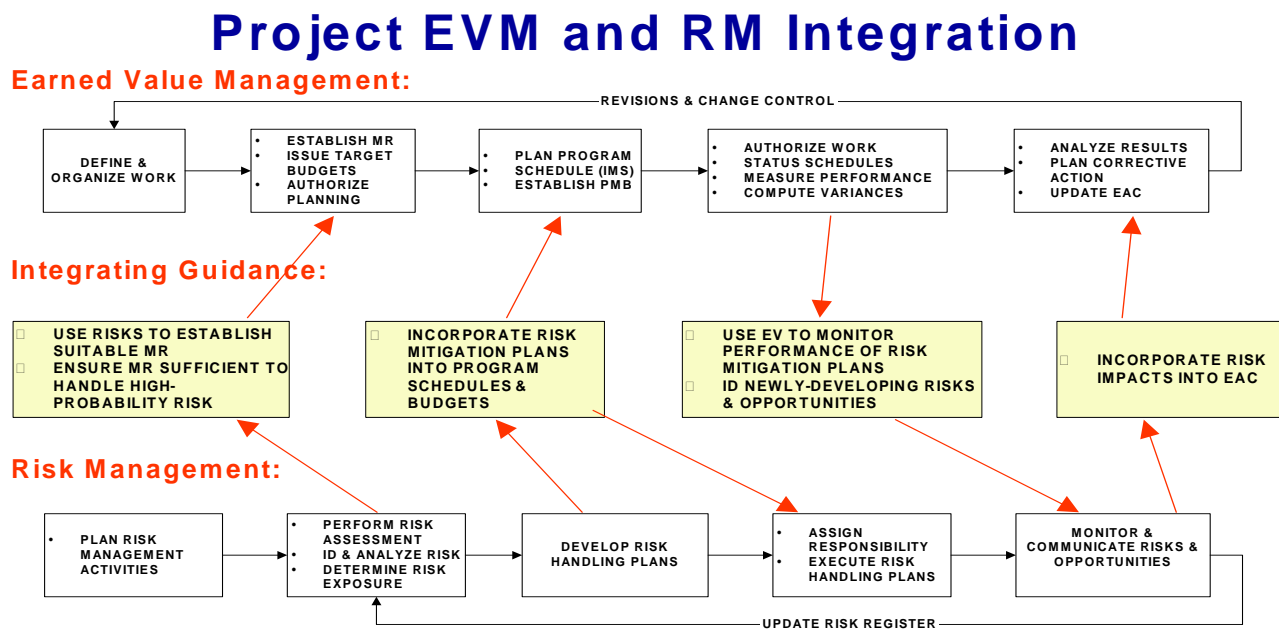


Figure 6. Project Level Earned Value Management (EVM) and Risk Management (RM) Integration

4 EVM APPLICATION PLANNING

4.1 Organizing for EVM

- EVM application is a process that begins at program inception with the definition of program work and extends through the assignment of the work to the performing organizations.
- Integration of work and performing organizations is achieved by identifying the WBS and organizational level where work scope, schedule, resource and risk management occurs.

EVM applies to the total program effort, including both customer resources and contracted work, to better manage complex, high-risk programs. In other words, EVM is applicable to the in-house (customer) portion of the program effort as well. All program work activities performed by any organization are derived from the program and extended WBS, which should be managed using EVM.

- Customer Organizations. Customer organizations and personnel, while commonly used to perform program management and oversight, also may perform engineering, testing, deployment and logistics support functions. Customer organizations may act as the systems integrator.
- Major Suppliers. Major suppliers are commonly employed in the areas of design, engineering, development, deployment and support functions.
- Support Suppliers. Support suppliers commonly perform support roles in one or more areas of program management, engineering, configuration management, test and logistics. Support suppliers may provide services and logistics support functions.

4.1.1 Governance

Effective EVM implementations depend on several management disciplines. Typical EVM responsibilities performed by the PM, Contracting Officer and EVM System Owner includes those listed below.

Program Manager

- Leads development of the program's technical approach, cost estimates, schedule, risk/opportunity management plans and PMB;
- Determines the management approach for a program and applicable contracts based on program size, complexity and risk;
- Manages the program budget and provides PMB performance information to management, including corrective actions and/or baseline change requests;

- In consultation with the contracting officer, develops the acquisition strategy for obtaining the selected solution and establishes the appropriate EVMS and reporting applications for each contract;
- In coordination with the contracting officer, conducts the Integrated Baseline Review (IBR);
- Prepares the program for an EVM System Compliance Evaluation Review, if required;
- Ensures the integrated product teams are adequately trained in program management, EVM, risk management and other program management disciplines;
- Incorporates supplier contract performance and risk/opportunity data into the program performance information using the program WBS;
- Estimates cost and schedule at completion based on performance data.

Contracting Officer

- In consultation with the PM, develops the acquisition strategy for obtaining the selected solution and establishes the appropriate EVM and performance data for each contract and project;
- In coordination with the PM establishes contractual requirements for the IBR;
- Advises the team preparing the contract solicitation on the proper use of contract clauses and supporting documentation for EVM;
- Formally receives, delivers comments and accepts contract deliverables;
- Coordinates with the EVM System Owner to ensure that supplier EVM system meets the ANSI/EIA-748.

EVM System Owner

- Assists PMs and business managers to apply EVMS requirements to programs and contracts;
- Coordinates EVM activities with other government agencies and with industry;
- Develops policy and guidance for EVM;
- Consults with teams on EVM issues during planning and implementation phases;
- Advises and assists programs with IBR;
- Coordinates EVMS surveillance and maintains information about acceptance of suppliers' EVMS;
- Coordinates EVMS reviews;
- Manages EVM training.

4.1.2 Risk-Based Application

Significant investments require a clearly understood process for ensuring that the program budget, expected outcomes and cost/schedule performance measurements are integrated with

risk management. Risk management begins with evaluating the WBS for cost, schedule and technical risk. Risks in each of these areas for each WBS element should be identified, analyzed, and quantified in terms of potential cost or other impact to the program. Risk identification involves identifying and analyzing program areas and critical technical elements to identify and document the associated risk. Assumptions and constraints also need to be identified and analyzed for cost impact. Risk analysis involves examining each risk issue to determine the probability of the risk occurring and the cost, schedule and technical consequences if the risk occurs. To a degree acceptable to management, the cost of the risk occurrence is added to the program budget and the result of this analysis is a risk-adjusted cost estimate.

The program's milestone schedule should also be adjusted for risk. Measurable WBS elements significant to a project milestone should be analyzed for most optimistic, most pessimistic and most likely duration. A risk-adjusted schedule will have finish dates that reflect the likelihood of a risk event occurring and its associated schedule impact. If schedule delays will affect cost, this information should be reflected in a risk adjusted cost estimate.

A significant program investment demands a mechanism to ensure that the expected program schedule and cost outcomes and cost/schedule performance measurements are integrated with risk management. Without this integration, budget may be expended without regard to specific events, products or other deliverables. The decision to apply EVM should be based on the nature and characteristics of the work to be performed on the contracts and projects. Careful evaluation of the size, complexity and estimated risk will influence decisions such as the type of contract(s) awarded as well as the application requirements for an EVMS.

EVM lends itself most readily to work that can be defined in terms of cost, schedule and technical performance objectives. Such work occurs primarily in a program's development and production phase. However, the primary consideration should be the nature of the work. For example, work done during a planning phase to develop a prototype or test article lends itself to performance management using EVM. Similarly, maintenance, repair and overhaul work done during a program's operational or management-in-use phase is measurable using EVM techniques.

A program's planned duration should also be considered. For less complex projects (generally considered to be less than a year), it is still important that appropriate cost, schedule and risk management processes be applied for effective monitoring and control. Their implementation may be less detailed than required on more complex projects.

4.1.3 Scalability

Aligned with the principles, the guidelines in ANSI/EIA-748 are "scalable". That is, they describe the attributes of an effectively integrated management system. They do not prescribe a specific method of implementation. In addition, one or more of the 32 guidelines may not apply to a given program or organization. This inherent flexibility is the strength of EVMS that has contributed to its continued effectiveness. The following are examples of scalability in the application of the guidelines and in implementation of an EVMS.

- **Applicability.** Some guidelines are unique to certain types of programs. For example, "Identify unit costs, equivalent unit costs, or lot costs when needed" refers

to a manufacturing environment or to deliverables priced on a unit, equivalent unit or lot basis. Another guideline requires that all indirect costs allocated to the contract be recorded. If indirect costs are not identifiable or do not exist, the guideline would not apply.

- **Frequency.** Progress is statused at least monthly. A best practice is to link the EVMS to an organization's normal management business rhythm, which may be as frequent as weekly. Although actual cost information may not be available from an accounting system, the EVMS may use actual or estimated costs. Estimated costs should be based on labor hours, units or similar measurable basis for management and reconciled with the actual cost accounting data when they become available.
- **Accounting Systems.** The guidelines per se do not include requirements for accounting systems. Major federal suppliers meet well-established government accounting system requirements (Cost Accounting Standards). These major suppliers use "estimated costs" to align cost with budget and earned value data where vendor billing and payments lag the earned value data. Most government organizations and many small and medium suppliers do not have equivalent systems and must use alternative approaches for estimates of the actual costs to provide timely actual cost information for EVMS.
- **Program Size.** Small contracts and projects may be no less critical to an organization than larger, more complex ones. In using EVM for such contracts and projects, organizations must consider the depth of implementation detail. For example, ANSI/EIA-748 does not define a specific decomposition level for the WBS.
- **Reporting.** Customer reporting requirements should be limited to that essential for program oversight and contract administration. Electronic reporting or direct access to supplier data is preferable because they shorten the delivery cycle time. When integrated product teams use EVM data routinely to manage the program and record the actions taken, reporting may be seen as a by-product of the implemented management process.

4.2 Developing the Program Budgets

When programs, projects and contracts contain cost and schedule risk, the risks are managed by selecting the appropriate contract type and by establishing cost and schedule reserves at all management levels.

Many programs will need to develop two budgets, the Program Budget and the Program Risk-Adjusted Budget. The first budget is the program budget, which is developed using the traditional EVM and Risk integration techniques to develop the PMB along with management reserve and undistributed budget. The process is described below under the heading "Program Budget."

The second budget, the PRB, is formed after determining the PB. It may be necessary when significant potential unknown risk to the cost and schedule goals is identified in the PB. If an estimate establishes to senior leadership's satisfaction that cost and schedule goals for a program/project can be achieved within the statutory requirement that at least 90 percent of the cost, schedule and performance goals be achieved, then a separate PRB is not necessary. If on the other hand, supported by good systems engineering and cost estimating, management believes there likely will be requests for additional funding and schedule, then additional budget should be available for allocation to the program/project.

Experience shows that moving funding from program to program is a very inefficient budgeting technique and can mean that all the affected programs will incur cost increases and schedule delays. Historically the number of programs that experience significant overruns is enormous and they are very disruptive of good budget discipline. The development of a PRB allows senior management at all levels to have a more realistic idea of what a program is likely to cost. Management can then make a more informed decision on whether the program has a better return on investment than other competing programs and should be funded.

OMB's Capital Programming Guide allows the use of a PRB, when necessary, because of the discipline it brings to the budgeting process. A PRB allows managers to manage for success, rather than managing to an optimistic budget that has little chance of being met. OMB must approve the PRB and programs must ensure that OMB fully understands the rationale for the additional funding and schedule requested in excess of the PB.

If a PRB is approved, the funding above the PB is retained at a level above the program for use only when fully justified. The funding above the PB should not be released to the suppliers as the PB represents the expected target for the program to achieve. Bonuses for government personnel and incentives for suppliers are based on achieving the program goals at or below the PB. However, completing the program within the PRB is by definition a successful program. Not meeting the PRB would be considered a failed program. The following sections discuss the development of the PB and use of PRB contingencies necessary when EVM indicates the PB will be breached.

Program Budget

Measuring the progress of a program cannot be accomplished without understanding the PB and PMB. The PMB should represent the entire program based on judgments concerning cost, schedule, and technical risk and is described in terms of the entire technical requirements (size, weight, capability, performance, etc.). These requirements are defined through the systems engineering process that determine how the program will be conceived, developed, produced, and managed through its life cycle. This process provides a clear understanding of the program by defining the end products.

Figure 7 illustrates the result of a program planning phase, incorporating the results of systems engineering, cost estimating, and risk planning to develop the overall cost, schedule and performance goals for a program. It also illustrates how EVM supports the overall program cost and schedule risk management consistent with industry and government needs for capital asset management.

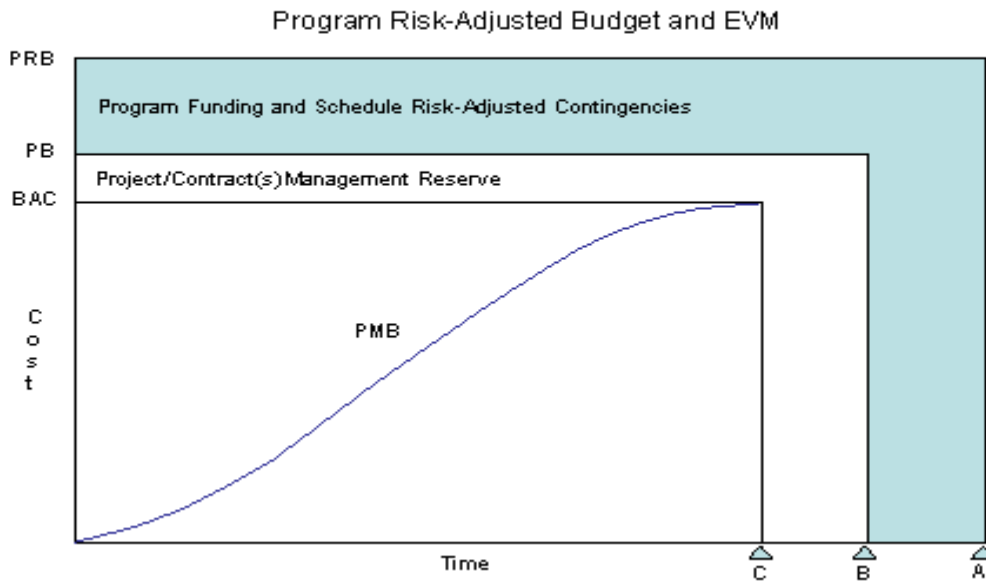


Figure 7. Planning Phase

The line labeled PB, “Program Budget”, represents “the total budget for the program including all allocated budget, management reserve and undistributed budget”. In this context, “program” includes all organization resources and contracted supplier resources used to perform all contracts and projects. Organizations allocate budgets to their PMBs that include allowances for schedule and cost uncertainty, which provide challenging but achievable targets. Some of this allocated budget may be assigned for risk handling activities that have been incorporated into the schedule and PMB. By implementing EVM at the program level, agencies can summarize in one PB all resources required to execute the program, whether performed by an organization or supplier. The schedule milestone “B” represents the required completion date for those projects and contracts.

Contracts and projects also include cost and schedule management reserves appropriate to the level of risk and contract type. Management reserves are established at appropriate confidence levels based on risk tolerance and represent the difference between the PB and the Budget at Completion (BAC). When time phased, the BAC establishes the PMB. Budget allocated to the PMB should reflect the PM’s assessment of the potential for under runs or over runs due to the opportunities and risks. Cost management reserve is not time-phased. The time between schedule milestones “B” and “C” in the above illustrates the project/contract schedule reserve and milestone C represents an early finish or “challenge” schedule for the performing organizations.

Program Risk-Adjusted Budget

The shaded area labeled “Program Funding and Schedule Risk-Adjusted Contingencies” represents funding and schedule contingencies in the program’s approved risk adjusted budget earmarked to cover the risk of cost and schedule overruns on the program’s contracts and projects.

OMB approval of a program’s risk-adjusted budget establishes the goals for reporting to OMB on program performance and is represented by the Program Risk-Adjusted Budget (PRB) and Schedule milestone “A.” The Federal Acquisition Streamlining Act (FASA) Title V requires that programs be managed within 10% of the budget goals. In this context, “program” means the approved capital investment or useful segment approved by OMB.

By establishing PMBs that reflect challenging cost and schedule goals and adequate reserves, organizations can utilize EVM’s ability to provide early visibility into program cost and schedule performance problems, allowing time to take corrective action and enhancing the probability of achieving cost, schedule and performance goals within the PRB.

Conversely, organizations that do not establish reserves increase performance risk because nearly all programs contain some degree of cost and schedule uncertainty. Reserves held within a PM’s authority should be related to approved work scope risk and opportunity; reserves held above the program permit senior management to balance resources as required among programs.

Organizations that do not allow for reserves at both levels may inadvertently encourage managers to “bury” the reserves within their programs, effectively denying objective visibility into performance and limiting senior management flexibility.

4.3 Contracting for EVM

- Both the customer and supplier need EVM data and the appropriate contract type must be chosen.
- Regardless of the type of contract, it is incumbent upon the customer to ensure not only that satisfactory progress is being made against the defined plan (PMB), but also that the trend will continue for future work.
- Placing incentives on achieving a Schedule Performance Index (SPI) or Cost Performance Index (CPI) of 1.0 often results in the reported data being managed to those objectives and diminishes the value of the process by removing early warning signals.
- An Advance Agreement specifies the organization will maintain and use the accepted EVMS as an integral management process on current as well as future contracts.
- PMs conduct IBRs on contracts with EVM contract requirements. IBRs are an essential element of a PM's risk management approach.
- As part of their overall management strategy, PMs should use EVM to assure effective management of cost, schedule, and technical performance and risk to identify newly emerging risks/opportunities.
- EVMS surveillance approach is usually documented in a surveillance plan that is approved by appropriate internal management and recognized by customer management.

4.3.1 Contract Types

EVM may apply to all contract types regardless of the system or capital asset being acquired. However, for contracts issued in support of a program where the supplier does not control and manage the work scope and schedule (such as a staff augmentation contract), EVMS requirements should not be applied to the contract itself but at the program level where scope, schedule, and cost data are present. Applying EVM at the program level presents new challenges for the performing organizations to include Firm Fixed Price (FFP) contracts and organization resources in their program EVMS. For example:

- FFP contracts normally do not provide for access to suppliers' actual cost data
- Government accounting systems normally accumulate costs by performing organization, making it difficult to allocate actual cost data to individual programs

The customer and supplier must manage for program success, this means both the customer and supplier need the appropriate contract type to be chosen and EVM data supplied.

When the nature of the work is complex, management using an EVMS is critical to controlling and managing the effort. Where the external or internal risks are great the ability to plan and respond to those risks, including managing change, is essential to increase the likelihood of achieving the program objectives.

Flexibly priced (cost-type or fixed price incentive) contracts are used when the nature of the work is complex and costs cannot be estimated with sufficient confidence to use an FFP contract. Application of EVM to these contracts is well documented in ANSI/EIA-748 and the NDIA PMSC EVMS Intent Guide. (See paragraphs 6.2 and 6.4 of this guide)

A Time and Material (T&M) contract should be used only when it is not possible at the time of placing the contract to estimate accurately the extent or duration of the work or to anticipate costs with any reasonable degree of confidence. The visibility into actual costs in a T&M environment is accomplished by exploiting the standard component of T&M contracts, the labor hours. If desired the hours delivered can be translated into financial terms by using the established labor hour rates. In this manner the customer and supplier can provide program EVM information to their senior management and external organizations.

FFP contracts are suitable when cost risk is low. Even though FFP contracts may not provide visibility into the supplier's actual costs, EVM provides the means to objectively assess schedule progress and correlate the performance achieved with the program objectives.

4.3.2 Incentives

EVM supports contract incentives in two ways. First, EVM provides objective information to determine over run or under run status on flexibly priced contracts where the customer shares cost risk with the supplier. Second, EVM provides a means to assess the ability of the supplier's management team to achieve the desired technical, schedule and cost objectives.

CAMs assess the performance to date, analyze variances from the PMB, estimate the contract cost at completion, and implement actions required to achieve technical, schedule, and cost objectives. Variances are an important element of the EVM process and need to be recognized as early warnings of deviations from the PMB. A desirable outcome may be compromised if the contract includes incentives for reporting a monthly Schedule Performance Index (SPI) and Cost Performance Index (CPI) near 1.0 (no variance). If the customer believes the contract is executable within such narrow bounds, the appropriate contract type would be FFP to reflect the low risk as opposed to cost type or fixed price incentive.

If EVM reporting incentives are desired, a customer may elect to use award fees to "look back" at key milestones, such as preliminary design reviews/critical design review and the end of contract, to determine if reports depicted contract status objectively and if estimated contract outcomes were reasonable based on performance to date. Such "performance-based reporting" would support performance-based contracting and reward contractors for managing effectively, thus reducing the need for oversight.

Performance-based incentives are recommended as they encourage early visibility into problems and management actions that in turn support the objectives of performance-based acquisition. When incentives are used in this way, it is possible – indeed likely – that a project could overrun a flexibly-priced contract, incurring a reduction in profit, while at the same time earning a maximum award fee for program reporting.

Earned value may be used as the basis for contract payments. Earned value data reflect the value of completed work in the terms of the budget assigned, which presents an attractive rationale for paying on that basis, especially on FFP contracts that incorporate performance based milestone payments. The completion of a payment milestone is objectively reflected by the earned value; in effect, performance based payment milestones and earned value is synonymous since both are characterized by demonstrable performance or completion criteria such as delivery. All contract activity must be included in the payment milestone value (i.e. the sum of all the payment milestones should equal the contract value).

4.3.3 Pre-Systems Acquisition Planning

EVMS documentation should be established in the standard form or forms used by the organization for process documentation, policies, and procedures. ANSI/EIA-748 does not require or suggest that descriptive documentation be created outside the normal organizational requirements, nor does it restrict the ability to effectively implement desired system changes.

Organizations will normally evaluate their internal management systems in accordance with their policies and good business practices to assure they meet the guidelines in ANSI/EIA-748. The guidelines are high-level and goal-oriented. They state the qualities and operational considerations of an integrated management system using earned value methods without mandating detailed system characteristics. They also enable implementation on large and small programs, projects, or contracts. EVM System Owners have sufficient flexibility within the Guidelines to implement EVM in a manner that employs the most effective and efficient performance management methods and techniques.

The NDIA PMSC EVMS Intent Guide is meant to be used by the EVM System Owner to complete a compliance map of the EVMS to the ANSI/EIA-748. Prior to receiving system acceptance, an organizational entity should prepare a compliance map documenting how its business processes meet the Guidelines in order to satisfy a contractual requirement that its system meets the intent of ANSI/EIA-748. This compliance map verifies for both internal management and external customers or reviewers that the organization has done a comprehensive job of describing an EVMS that meets the intent of the ANSI/EIA-748.

An Advance Agreement or other EVMS acceptance or recognition document between an organization and suppliers specifies the EVMS will be maintained and used as an integral management process on current as well as future contracts. When an Advance Agreement or other acceptance or recognition document has not been provided, an organization should document its EVMS using the NDIA PMSC EVMS Intent Guide Compliance Map and provide the Map in its proposal to convey the EVMS to be applied during performance.

A Compliance Evaluation Review (CER) is conducted following the design and implementation of the EVMS to verify that the system being reviewed meets the intent of ANSI/EIA-748. The CER may occur prior to program approval or contractual authorization to proceed or may occur after these events. When the CER occurs prior to a project approval or contract authority to proceed, a viable alternative process is to complete the Intent Guide Templates mapping the EVMS with ANSI/EIA-748. It would then be reviewed and recognized as meeting the ANSI/EIA-748 guidelines by the organization requiring compliance. Implementation of the approved EVMS is verified and accepted by the contract or project customer through the ANSI/EIA-748 EVMS guideline joint surveillance process defined in the NDIA PMSC

Surveillance Guide. The organization requiring compliance would issue a formal acceptance of the process at the conclusion of the joint surveillance.

Cross-agency acceptance is best accomplished through the establishment of reciprocal agreements between agencies and organizations to mutually recognize an EVM System ANSI/EIA-748 acceptance or recognition documents. Alternative acceptance methods could be for an agency to accept another agency's EVMS acceptance with surveillance based on the standards described in the NDIA PMSC Surveillance Guide, or for an agency to review the documentation from the EVM System Owner's compliance evaluation review as the basis for acceptance.

4.3.4 Systems Acquisition

EVM System Acceptance is a process that involves the reviewing and approval of an EVMS that meets the intent of the 32 EVMS Guidelines embodied in ANSI/EIA-748. A summary of the purpose, scope, applicability and location of the NDIA PMSC EVMS System Acceptance Guide is provided in paragraph 6.5 of this guide.

Once the project selected for compliance evaluation has implemented the EVM process, the system evaluation process begins. The EVM System Owner may elect to conduct or may have conducted a simulation of the EVMS Compliance Evaluation Review, referred to as a Progress Assessment Review (PAR). The PAR affords an opportunity for the EVM System Owner to address any shortfalls in the design and/or implementation prior to the actual CER. The purpose of the EVMS CER is to determine if the implementation of a documented EVMS meets the ANSI/EIA-748 guidelines. The CER may occur prior to project approval or contract authority to proceed or may occur after these events. When the CER occurs prior to a project approval or contractual authorization to proceed an alternative process is to complete the Intent Guide Templates mapping the EVMS with ANSI/EIA-748 and have the EVMS recognized as meeting the ANSI/EIA-748 guidelines. Implementation of the recognized EVMS is verified and accepted by the contract or project customer through the ANSI/EIA-748 EVMS guideline joint surveillance process defined in the NDIA PMSC Surveillance Guide. A separate acceptance for realigned organizations applying a compliant EVMS is not required. For example, a corporate level EVMS could be flowed to an organization within the corporation without an additional CER. However, implementation is specific to each contract or project and should be verified through surveillance.

4.3.5 Integrated Baseline Review

The Integrated Baseline Review (IBR) process provides an invaluable opportunity to compare PMs' expectations and to address differences before problems arise. It provides project management teams with a thorough understanding of the contract or project plan and its risks and opportunities, allowing early intervention and application of resources to address project challenges. As a result both PMs increase their confidence in the PMB. Following the IBR, the initial risk register and risk/opportunity handling plans should be updated, if necessary, including additions or changes to the original list of risks/opportunities or their attributes, based on the results of the IBR.

The objective of the IBR is to confirm implementation of the following business practices.

- The technical scope of work is fully included and consistent with authorizing documents;
- Key schedule milestones are identified;
- Supporting schedules reflect a logical flow to accomplish the technical work scope;
- Resources (budgets, facilities, personnel, skills, etc.) are adequate and available for the assigned tasks;
- Tasks are planned and can be measured objectively, relative to technical progress;
- Underlying PMB rationales are reasonable; and
- Managers have appropriately implemented required management processes.

Additionally, the adequacy of management reserve is assessed with respect to project risk not accounted for in the PMB.

A summary of the purpose, scope, applicability and location of the NDIA Program Manager's Guide to the IBR Process is provided in paragraph 6.6 of this guide.

4.3.6 Surveillance

The purpose of surveillance is to focus on using EVMS effectively to manage cost, schedule, and technical performance. It ensures that the supplier processes and procedures are being followed appropriately and it confirms they continue to meet the ANSI/EIA-748 guidelines.

Program surveillance results are summarized to determine overall compliance and identify areas in need of corrective action. Systemic issues are based on the frequency of findings in surveillance of individual programs. Prime suppliers are responsible for surveillance of subcontractors.

The customer should consider the effectiveness of the supplier's surveillance process when deciding whether to observe, review the findings of internal surveillance, or engage in joint surveillance. When joint surveillance is conducted the customers are members of the surveillance team and assigned responsibilities. Objectives of this process are identical between the customer and prime suppliers, and between prime suppliers and subcontractors.

Joint surveillance is an approach usually documented in a surveillance plan that is approved by appropriate supplier and customer management. The plan typically spans multiple years and is supplemented by an annual schedule containing the programs selected for surveillance in that year.

Management's objective in surveillance should be to select EVMS processes based upon the risk associated with the remaining work and content that is specific to the programs being reviewed. The selection of EVM guidelines and processes reviewed should be relevant to the program phase and should provide an opportunity for coaching or mentoring during the surveillance process. Factors influencing the need for contract/project selection include: risk, maturity of implementation, size and complexity, and the independence of the company's surveillance team.

Summarized metrics are used to identify and characterize process and systemic problems across multiple programs. These are subsequently addressed by updating training and/or EVMS process improvements. This is also known as system surveillance.

A summary of the purpose, scope, applicability and location of the NDIA PMSC Surveillance Guide is provided in paragraph 6.7 of this guide.

5 PERFORMANCE MANAGEMENT AND MEASUREMENT

5.1 Measuring Performance Progress

Variations are neither “good” nor “bad;” they are the early warning indicators of emerging problems and quantifiers of deviations from the plan useful for managing complex projects.

The strength of EVM as a management tool lies in obtaining objective measurements of work accomplished at the level of the organization where integration of work scope, schedule and cost and risk management occurs (the control account). Schedules are statused with progress based on work accomplished in accordance with technical completion (or exit) criteria. EVM information is statused at least monthly, but may be done more frequently to coincide with the organization’s business process (for example, when schedules are statused weekly or biweekly). Program performance against the schedule provides a means to determine and evaluate potential program schedule risks.

Schedule progress should coincide with EVM status to provide meaningful performance data. Programs should consider statusing weekly for early warning indications of schedule variations. The CAM provides the task progress accomplished, remaining task duration or estimated completion dates for any tasks in progress but not yet complete and revises as necessary the start and completion dates for work not yet started.

EVM provides visibility into key performance measurement data at time now as illustrated in Figure 8. The EVM data at time now includes the planned budget in the PMB, the work completed expressed in terms of the PMB budget assigned to that work, and the actual cost incurred for completing that work.

The EVM data provides insight into these management questions.

- How much of the work in the budget plan (planned value) has been accomplished or “earned” (EV)?
- How much did the work accomplished actually cost (actual cost)?
- How does the actual cost of the work accomplished compare with its earned value?
- When will the contract or project be finished and how much will it cost?

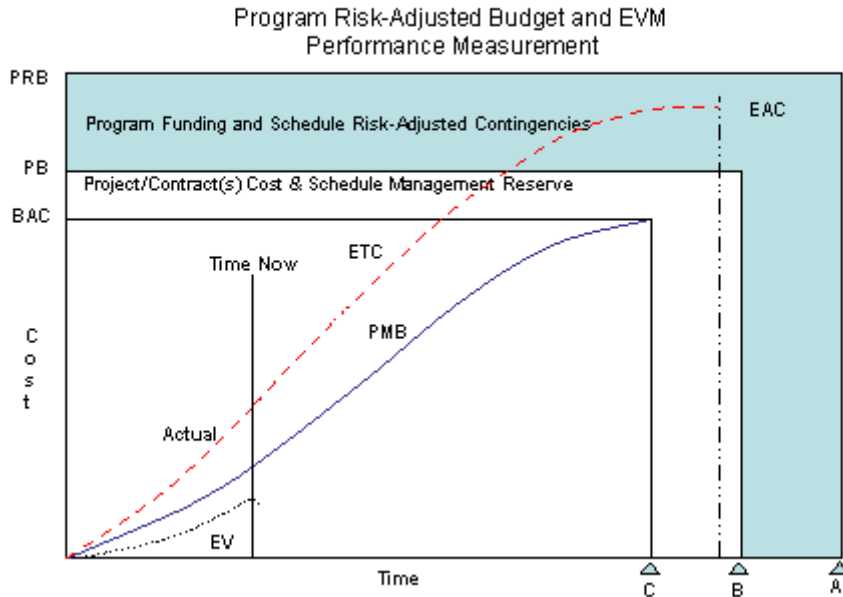


Figure 8. Earned Value Management Data

Variations may be favorable or unfavorable. Favorable variations may represent opportunities (the flip side of risk), while unfavorable variations may quantify the effect of realized risk on cost and schedule performance. PMs should be alert to the possibility that favorable variations may offset overruns. Also, while ANSI/EIA-748 emphasizes strict controls on PMB changes that erase current period or historical variations, it does not prohibit replanning future work to enable the capture and return to MR of excess budget associated with identified opportunities.

5.2 Management Analysis

- Performance data provides PMs the answer to the question “Where am I?” and the planned work remaining.
- Estimate to Complete (ETC) reflected in the schedule tasks and budget for the work remaining addresses the “When will I complete and how much will it cost” to complete the contract or project.
- The analysis of variances informs the PM about risks and opportunities (realized, retired, and identified) in the remaining work scope, schedule and cost.
- Program management team must implement actions to achieve program technical, schedule and cost objectives.

At each management review point (typically monthly), CAMs review the control account cost and schedule data and assess the ETC and EAC for their control accounts. CAMs make an assessment based on the historical performance of the accounts, current performance metrics, and future work scope remaining to be completed. These projections should consider potential process improvements, risk assessments, risk and opportunity handling plans, and other applicable factors that may affect remaining work. Schedule performance is analyzed with respect to “behind schedule,” “on schedule” or “ahead-of-schedule” conditions and projections.

When integrated product team members identify needed corrective actions that cannot be immediately taken, they should be assigned to a responsible team member for planning and execution.

Variance Analysis provides CAMs the ability to communicate deviations from the plan in terms of schedule, cost and at completion variances. The analysis should summarize significant schedule and cost problems and their causes, actions needed to achieve the projected outcomes, and major challenges to achieving project performance objectives. As control account trends become evident, any risks or opportunities identified should be incorporated into the project risk management process.

PMs should review control account schedule and cost variances periodically for the total contract or project impacts and to provide to management indications of the overall performance. Risk and opportunity potentials may be identified at any WBS level. Once accepted by management they are tracked along with their estimated technical, schedule, and cost impacts. If the PM determines a risk (or opportunity) handling task should be included in the PMB, necessary resources may be authorized through the use of MR. EVM is then used to manage and measure performance on the task as needed to achieve project objectives.

5.3 Program Progress Communication

- Communicating program status is an essential activity for all projects.
- Its two primary purposes are to provide essential control account information facilitating informed management decisions and to communicate performance status to senior leadership and stakeholders.

Performance or progress assessment using EVM information is most useful when the EV data are provided by CAMs who are actively managing cost, schedule and scope within the project or contract. It provides the details at the control account level where progress is achieved and actions are taken when variances from the PMB occur. Timeliness in communicating the integrated performance information among the program CAMs and the PM is essential in establishing confidence in the actions proposed as a result of performance analysis and risk monitoring.

Monitoring progress on risk handling plans is required to ensure the plan is being effectively implemented and is in fact reducing the risk. Corrective action plans should be implemented if the handling plan is not effective in reducing the risk. Analysis may also result in additional risk mitigation measures, identify new risk, or revise the risk management plan.

The customer can benefit most when they are engaged in the program reviews where the team addresses the performance data, variance analysis, risk tracking, and corrective action plans taken to achieve program objectives. Even though there are provisions for formal preparation and delivery of variance analysis, fundamentally analysis is a continuous program management activity. Waiting for information from a supplier's reports does not promote timely and effective project management. The performance reports should reflect the management analysis and actions identified in the program management reviews.

Organizations should establish a capability for contract and project performance status that includes technical, schedule, cost, performance (EVM) data, and risk that is consistently summarized for use in decision making at all levels of program management and the stakeholder organizations. The use of Contract Performance Report (CPR) or other EVM reports does not constitute the entire universe of available contract or project information. Daily and weekly reports, meetings, design and program reviews, risk review boards, and other avenues for obtaining accurate information, including technical performance, should be used as appropriate.

For reporting to senior decision makers, EVM facilitates timely, accurate and integrated schedule, cost and technical performance information. It is important that EVM and risk measurement data be available from a single source and that the data provide insight to support decision-making at the program-level as well as for higher organizational levels.

5.4 Change Management

- Changes in all programs are inevitable.
- The integrity of the PMB is maintained through a change management process that ensures the PMB accurately represents only the authorized work to be accomplished.

The primary objective of change management is to maintain the integrity of the PMB and performance information. Because the change management process is intended to control replanning of the remaining future work, PMB changes must not be used as a means to modify actual performance and progress information. Changes to performance and progress information may sometimes be necessary to correct accounting and other errors significant to the accuracy of the EVM information. Acceptable retroactive changes are those that correct errors, make routine accounting adjustments, or improve the accuracy of the performance measurement data and all such changes must be justified, explained and documented.

Corrections should always be made if incorrect data are eroding the management value of the system, but management reports will be compromised if current plans or program history (performance to date information) are constantly being changed. If the objective of replanning becomes a routine to eliminate variances or to attain a specific performance index (e.g., SPI and/or CPI), then EVMS will not only lose its value for objective performance measurement, but it will also compromise organizational compliance with its implementation of ANSI/EIA-748. Regardless of the scope of the replanning effort, a complete historical record of the original PMB and all changes must be maintained for analytical, reporting, and lessons learned purposes.

The change management process must be able to accommodate routine “replanning” (changes within the PMB), customer-directed changes (normally contract modifications) and “reprogramming” (changes that do not amend the contract but that result in an over-target baseline).

The objective of replanning within the PMB is to reflect a revised program plan for in-scope changes to future budgets. Some examples of appropriate replanning (i.e., within the project target cost or approved total allocated budget) include:

- Changes resulting from a design review that modify requirements;
- A major shift in the resource profile to accomplish the remaining effort;
- Funding restrictions or modifications that affect future resource availability;
- Rate changes (including overhead rates), which are significant enough to warrant replanning;
- Changes to increase MR by recovering budgets that will not be required due to the realization of opportunities;
- Changes to allocated MR for the purpose of planning a risk handling activity resulting from the identification of a new risk or one whose consequences or impact has become elevated.

Figure 9 illustrates the use of management reserve applied to the PMB where the BAC increased but the program schedule completion, Point C, remains unchanged.

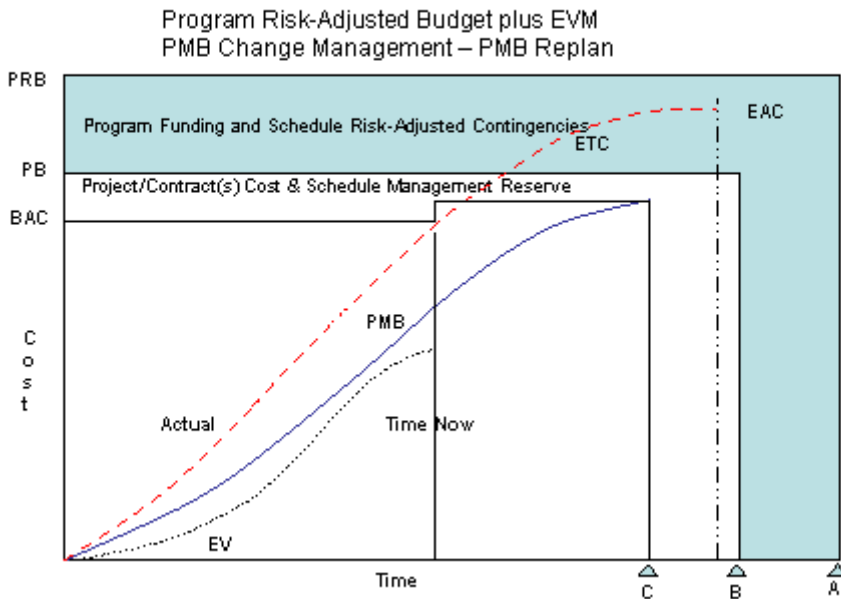


Figure 9. PMB Replan

When a program is unable to stay within the threshold objectives, scope, schedule and budget defined in the PB (the intersection of the PB and Point B illustrated in Figure 9) the agency may decide to change the technical objectives, extend the schedule and/or make additional funding available to the program (for example, by reprioritizing its missions). This is effectively reprogramming the scope, schedule and/or budget and may result in a modification to the PMB. When additional scope, schedule, or budget is applied to the program PMB it must only be done through the change management process. Figure 10 illustrates a reprogramming where program funding and schedule contingencies are utilized. The schedule completion date is extended beyond the program management reserve, Point B but remains within the program risk-adjusted schedule contingency, Point A. The PMB is increased by the use of the program management reserve up to the PB. The EAC now extends above the PB due to performance overruns prior to time now but remains within the program funding risk-adjusted contingency of the PRB.

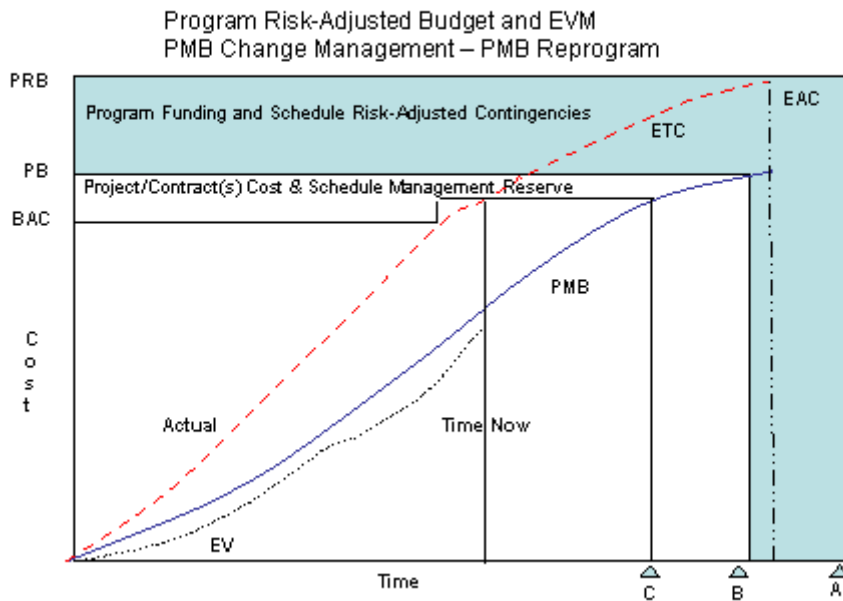


Figure 10. PMB Reprogram

6 EVM APPLICATION GUIDANCE

6.1 EVM Application Framework

The purpose of this section is to provide a high-level relationship framework for EVM application using applicable NDIA PMSC guides within the acquisition life cycle. It is very important to recognize that EVMS requirements should be implemented to provide the management information needed by program management for effective management of the contract or project. In addition, it is important to recognize that no single EVMS application can meet every management need for performance measurement due to variations in organizations, products, processes, and working relationships.

During Pre-Systems Acquisition, organizations should plan for the EVM application to work performed by both supplier and in house organizations. Both organizations should ensure EVM is integrated within their documented management processes and understood by those who will implement EVM. Supplier and organization internal data may be integrated using a common integrated program process for effective and efficient program performance analysis and reporting.

EVM application should be approached in these aspects as illustrated in Figure 11.

- Documented business processes
- EVMS Implementation for a contract or project
- EVMS Surveillance on a contract or project EVMS implementation

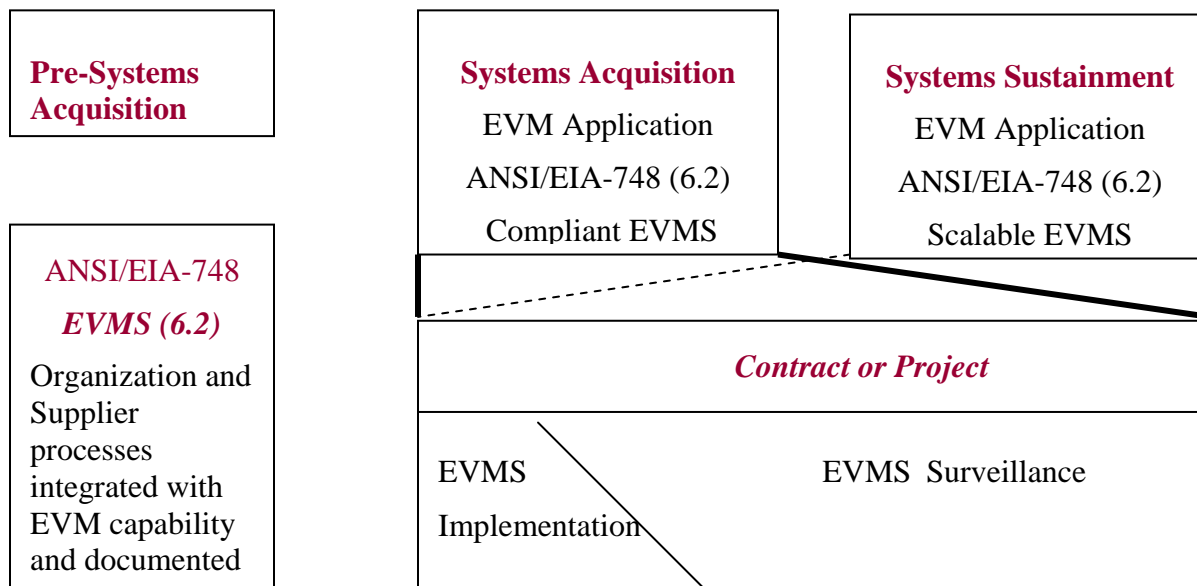


Figure 11. EVM Application in the Systems Acquisition Life Cycle

Typically implementation requires 60 to 90 days after contract or project authorization where documented business processes integrating EVM capability are institutionalized. Surveillance

begins after completion of implementation and continues through the contract or project life cycle.

NDIA PMSC Guides supporting EVMS application in accordance with ANSI/EIA-748 are identified with the applicable acquisition life cycle for the customer and supplier organizations in Figure 12. The number in parentheses after each guide name identifies the section below explaining its use in the application of EVM on a contract or project. Paragraph 6.2 provides insight into ANSI/EIA-748 that is essential for effectively applying EVM.

Acquisition Life Cycle	Acceptance Authority or Customer	EVM System Owner or Supplier
Pre-Systems Acquisition Approval or Award	Recognize: <i>Application Guide (6.3)</i> <i>System Acceptance Guide (6.5)</i>	Document and Assessment: <i>Application Guide (6.3)</i> <i>Intent Guide (6.4)</i>
Systems Acquisition Approval or Award	Accept: <i>Intent Guide (6.4) & Surveillance Guide (6.7)</i>	Implement: <i>Intent Guide (6.4) & Surveillance Guide (6.7)</i>
	IBR Review: <i>IBR Guide (6.6)</i>	IBR Review: <i>IBR Guide (6.6)</i>
	Surveillance: <i>Surveillance Guide (6.7)</i>	Execution and Surveillance: <i>Surveillance Guide (6.7)</i>

Figure 12. NDIA Guide Applicability

6.2 ANSI/EIA-748 Standard Earned Value Management Systems

ANSI/EIA-748 provides two concepts important to EVM application. The Introduction explains that the principles of an EVMS are simply good program management practice. It also recognizes that scalability in employing the principles of EVMS is fundamental to its successful application on any program and that the EVMS guidelines which are applicable to large complex and/or high risk programs can be scaled as appropriate to enable any program regardless of its size and complexity to realize the benefits of earned value management.

The EVMS guidelines in Section 2 of ANSI/EIA-748 are purposely-high level and goal oriented as they are intended to state the qualities and operational considerations of an integrated management system using earned value analysis methods without mandating detail system characteristics. Different organizations establish and apply a management system that best suits their management styles and business environments.

Organization business processes must include the integration of program scope, schedule, and cost objectives, establishment of a baseline plan for accomplishment of program objectives, with appropriate consideration of risks, and use of earned value techniques for performance measurement during the execution of a program.

When these activities are done in the Pre-Systems Acquisition planning and budgeting phases of the capital asset programming process the EVMS may be implemented and provide a PMB for management of the contract or project within the shortest possible timeframe following authorization.

6.3 NDIA PMSC Earned Value Management Systems Application Guide

The purpose is to provide guidance for the application and use of EVM during all phases of the acquisition lifecycle. In addition, it provides users with insight into the use of the NDIA PMSC Guides to ensure that an organization's program and senior management whether within a government, commercial, or industry customer, or a supplier organization can have a high confidence in its Earned Value Management System (EVMS), its ongoing meeting the ANSI/EIA-748, and its continuing ability to meet the organization's need for reliable information on program performance and progress.

6.4 NDIA PMSC Earned Value Management Systems Intent Guide

The primary purpose of the Intent Guide is to define the management value and intent for each of the guidelines listed in Section 2 of the ANSI/EIA-748 standard. Each intent guideline is numbered for reference purposes. Accompanying the management value and intent definitions is a list of typical attributes and a list of typical outputs that can provide objective evidence that a management system meets a given guideline.

The Intent Guide is applicable for use by either a government organization or supplier whenever the documentation, implementation and use of an EVMS meeting the guidelines in ANSI/EIA-748 are a program requirement. It is recommended for use in performing an initial compliance assessment by the implementing organization preparatory to providing system acceptance.

An organization that needs to demonstrate that its system meets the intent of the ANSI/EIA-748 standard should use the Intent Guide to prepare a compliance map, which documents how its business processes meet the ANSI/EIA-748 EVMS Guidelines. The objective of the compliance map is to demonstrate that the EVMS Owner has thought through each guideline and can describe how its business process meets the intent of the guideline. Section 3 of the Intent Guide provides an example of a process description compliance map and Appendix A of the Intent Guide provides compliance map templates that can be used to develop a company, organization, or program compliance map.

A customer or independent reviewer may use the compliance map as the basis for verifying that the EVMS meets the intent of the guidelines.

To be most effective, the EVM process should be documented and implemented on an organization basis rather than program by program. Contract or project implementation of a company or organization documented EVMS may be accomplished through scalability.

6.5 NDIA PMSC Earned Value Management Systems Acceptance Guide

The System Acceptance Guide defines a process whereby an EVM System Owner (government or industry) with a first-time requirement to meet the ANSI/EIA-748 guidelines accomplish the following:

- (a) Understand the need for and effectively design an EVMS;
- (b) Evaluate whether the EVMS is capable of meeting the intent of ANSI/EIA-748;
- (c) Implement successfully the EVMS on the requiring acquisition;
- (d) Prepare and provide documentation that substantiates implementation;
- (e) Obtain EVMS recognition that will satisfy the current and future requirements for an approved EVMS.

6.6 NDIA PMSC The Program Managers' Guide to the Integrated Baseline Review Process

The Program Managers' Guide to the Integrated Baseline Review Process was developed to improve the consistency of the overall IBR Process. It integrates the IBR with risk management, within the framework of the IBR Process.

The IBR Guide describes the attributes of an effective IBR and discusses a baseline review process that will lead to a better understanding of program risks. The IBR Process enables managers to effectively utilize the project PMB to assess performance, and to better understand inherent risks. The IBR Process should continue throughout the life of a project and consists of the following jointly executed project management activities:

- PMB Assessment,
- IBR Preparation,
- IBR Execution, and
- Management Processes.

The key elements in the IBR Process are the following:

- The IBR Process establishes and maintains a mutual understanding of the PMB and mitigates program risk.
- Preparation for the IBR should begin as soon as practical.
- Before executing the IBR, ensure the PMB reflects the entire scope of work, documented at the appropriate level of detail.
- Preparation includes planning that identifies key responsibilities, required technical expertise, training, review dates, review scope, risk evaluation criteria, documentation needs, disposition of findings, and procedures for risk identification, documentation, and incorporation into project risk management planning.
- The intent of the IBR is to provide the PMs with a mutual understanding of the project PMB and to attain agreement on a plan of action to handle the identified risks.
- Anything that does not support the intent of the IBR should be moved outside the review.
- Technical, Schedule, Cost, Resource, and Management Processes risks identified during the IBR should be reviewed; action risks should be incorporated into the project risk management planning.

- Management processes provide the PMs with a continuous source of project information that enables mutual understanding and the reduction or elimination of the need for future IBRs.

The IBR Guide is the principal IBR reference and should be used to implement an integrated baseline management discipline on an acquisition program. PMs are strongly encouraged to use this guide during IBR training, when preparing for an IBR, and then again during the actual execution and conduct of the IBR.

6.7 NDIA PMSC Earned Value Management Systems Surveillance Guide

The Surveillance Guide defines a standard surveillance approach for all parties because it ensures a common understanding of expectations, encourages efficiencies through the use of a uniform process, and gives consistent guidance for all stakeholders in the EVMS process.

Surveillance is the process of reviewing the health of the EVMS applied to one or more contracts or projects. Surveillance focuses on ensuring that the key elements of the EVMS process are maintained over time and on subsequent applications to effectively manage cost, schedule, and technical performance.

An organization working in an EVMS environment should use this guide as a model for establishing a cost-effective EVMS surveillance process. It can also be used by organizations with existing EVMS processes seeking to make surveillance more effective and to standardize approaches on all programs.

ACRONYMS

ANSI/EIA	American National Standards Institute/Electronic Industries Alliance
BAC	Budget at Completion
BC	Business Case
BCWP	Budgeted Cost for Work Performed
CAP	Capital Asset Plan
CAM	Control Account Manager
CPR	Contract Performance Report
CPI	Cost Performance Index
EAC	Estimate at Completion
ETC	Estimate to Complete
EV	Earned Value
EVM	Earned Value Management
EVMS	Earned Value Management System
FASA	Federal Acquisition Streamlining Act
FFP	Firm Fixed Price
IBR	Integrated Baseline Review
ICR	Initial Compliance Review
IMS	Integrated Master Schedule
LOE	Level of Effort
MR	Management Reserve
NDIA	National Defense Industrial Association
OMB	Office of Management and Budget
PB	Program (or Project) Budget
PM	Program (or Project) Manager
PMB	Performance Measurement Baseline
PMSC	Program Management Systems Committee
PRB	Program Risk-Adjusted Budget
RM	Risk Management
SPI	Schedule Performance Index
T&M	Time and Material
UB	Undistributed Budget
WBS	Work Breakdown Structure