

**OFFICE OF PROJECT MANAGEMENT
EVMS COMPLIANCE REVIEW
STANDARD OPERATING PROCEDURE
(ECRSOP) – APPENDIX A:
COMPLIANCE ASSESSMENT
GUIDANCE (CAG)**

**Issued by:
Office of Project Management (PM)
Project Controls Division**

November 28, 2018

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1. PREFACE

The EIA-748 Earned Value Management System (EVMS) standard contains 32 guidelines, that concern management practices, business processes, management control systems, and organizational culture. The Department of Energy (DOE) Office of Project Management (PM) recognizes the 32 EIA-748 EVMS Guidelines as the basis for determining the compliance (e.g., worthiness) of the management tools used to plan and control capital asset acquisitions each year. The EIA-748 EVMS Standard references the National Defense Industrial Association (NDIA) EVMS Intent Guide and other NDIA related documents to further clarify the summary compliance requirements of the 32 EVMS Guidelines.

According to the Standard, a compliant contractor EVMS provides for the generation of timely, reliable, and verifiable contract performance data, permitting government program managers to evaluate a contractor's progress and likelihood of meeting programmatic and contractual requirements for cost, schedule and technical viability. EVMS is founded on the idea that program managers and their teams make the best decisions when they have the best data and information.

This Appendix to the Office of Project Management (PM) Earned Value Management Systems Compliance Review Standard Operating Procedure (ECRSOP) provides Compliance Assessment Guidance based upon the EIA-748 EVMS Standard and its references. This is to ensure PM review teams consistently assess the compliance of a contractor's EVMS.

The assessment tools used in conjunction with this document include:

1. The PM-30 EVMS CRC Excel file for use in documenting the review of the contractor's EVM System Description and supporting procedures under configuration control
2. The Guideline (GL) Attributes and Tests Excel file for use in identifying and documenting the results of the automated and manual tests required for each attribute.

This Appendix also provides information for stakeholders and other interested parties, to more fully understand the principles and elements of EIA-748 EVMS Standard. It also assists with assuring customers and stakeholders and other mission partners that DOE O 413.3B (latest version) capital asset programs and projects are planned and managed using sound practices.

Frequently Asked Questions (FAQ) about EIA-748 EVMS Compliance:

1. Product/Deliverable Oriented Work Breakdown Structure (WBS) – Pg. 8, 9
2. Work Scope, Cost, and Schedule Integration – Pg. 15, 16
3. Control Account Manager Span of Control – Pg. 18, 21
4. Network Logic Driven Critical Path – Pg. 22, 23
5. Schedule Detail – Pg. 22, 30-38
6. Planning Horizons (Rolling Wave) – Pg. 37, 58, 61
7. Early Date, Late Date Baselineing – Pg. 39
8. ETC Activities – Pg. 41
9. Zero Budget Work Package Activities – Pg. 53-55, 68, 69
10. Total Project Cost Work Authorization @ CD-2 – Pg. 56

11. Material and Procurement Baseline – Pg. 28, 34, 62-63, 83, 87
12. Material Progressing – Pg. 62
13. Authorized Unpriced Work, Not to Exceed Value Planning – Pg. 56, 72-74, 104-106, 120, 121
14. Freeze Period – Pg. 103-109
15. Title III Engineering Construction Support – Pg. 68, 69
16. Funds v. Budget Concept – Pg. 112
17. Management Reserve Usage – Pg. 113
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2. INTRODUCTION

































This PM ECRSOP Appendix has been developed for use by PM in its oversight on capital asset programs and projects executed under contracts with DOE O 413.3B (latest version) and FAR 52.234-4, Earned Value Management System requirements necessitating the contractor to use an EVMS that has been determined by the Cognizant Federal Agency (CFA) to be compliant with EIA-748. It provides the narrative to identify and clarify the required management attributes of EIA-748 compliance and the applicable automated and/or manual tests intended to establish the quality, performance, and reliability of a contractor's EVMS. This Appendix, while solely applicable to PM, is also available, at their discretion, for use by regulators, project managers, project controls personnel, project sponsors and others involved in determining EIA-748 compliance in support of applicable DOE O 413.3B (latest version) capital asset programs and projects.

This Appendix provides detailed guidance based on recognized leading sources for establishing, employing, and maintaining a compliant EVMS, and referenced in the EIA-748 and DOE O 413.3B, including the DOE G 413.3-10A EVMS Guide, the EIA-748 EVMS Standard, multiple National Defense and Industry Association (NDIA) Integrated Program Management Division (IPMD) Guides including the EVMS Intent Guide, EVMS Surveillance Guide, EVMS Acceptance Guide, EVMS Application Guide, EVMS Scalability Guide, and the Planning and Scheduling Excellence Guide (PASEG), the Government Accountability Office (GAO) Cost Estimating & Assessment Guide, and the GAO Schedule Assessment Guide.


Given that the details contained in these numerous resources have been distilled and coordinated to reflect a comprehensive and holistic EVMS compliance framework based on DOE's project management governance and contracting approaches as well as the type of work DOE performs and manner in which it is performed, users of this Appendix should be careful to not take discrete elements or statements in one reference document that may appear on the surface to be contradictory, out of context to or misconstrued with the whole of this Appendix. In short, use of singular guidance by itself outside the PM ECRSOP – Appendix A: Compliance Assessment

Guidance (CAG) should not be construed as EVMS compliant by PM. Thus, this synthesized and uniform approach to evaluate the performance of a contractor's EVMS in the manner described herein ensures fairness and consistency of EVMS compliance proceedings by PM in performance of its responsibilities.

Figure 1 displays the traditional five EIA-748 management areas with a sixth for Indirect Cost Management (see EIA-748 EVMS Guidelines 4, 13, 19, and 24) separated to accommodate the PM-30 EVMS compliance process. This places proper emphasis on the classification and management of indirect costs which can be a substantial cost to a project. The division of EIA-748 EVMS Guidelines into management areas and processes facilitates a common understanding of EIA-748 EVMS compliance requirements and their application towards the practice of project management. The hierarchical structure used to define the qualities and operating characteristics of an EIA-748 compliant EVMS includes a definition of the guideline, a brief discussion on the purpose of the guideline, and the attributes of the guideline. Typical attributes (as defined by the NDIA EVMS EIA-748 Intent Guide and other cited references) provide the strategic intent behind each guideline, structured by a detailed discussion section and the impact of non-compliance. The tests developed for each guideline are threshold-based to identify areas requiring further review.

| TABLE OF EIA-748 MANAGEMENT AREAS | | | | | |
|--|---|--|---|--|---|
| 1. | 2. | 3. | 4. | 5. | 6. |
| Organization | Planning, Sch, & Budget | Accounting | Analysis | Revisions | Indirect Cost Mgmt. |
| (1) Define WBS  | (6) Establish Schedules  | (16) Cost Budget Consistent  | (22) Calculate Variances  | (28) Timely Changes  | (4) Indirect Cost Manager  |
| (2) Define OBS  | (7) Planning & Progress Pts  | (17) Collect Cost by WBS  | (23) Variance Analysis  | (29) Reconcile Budgets  | (13) OH Budgets  |
| (3) Systems Integration  | (8) Create Time Phased PMB  | (18) Collect Cost by OBS  | (25) Summarize Variances  | (30) Retroactive Changes  | (19) Collect OH Costs  |
| (5) WBS OBS Intersection  | (9) Authorize & EOC Budgets  | (20) Identify Unit Lot Costs  | (26) Management Use of EVMS  | (31) Authorized Changes  | (24) Indirect Cost VAR Analysis  |
| | (10) Work Package & Measures  | (21) Material Performance  | (27) Timely & Valid EAC  | (32) Document Changes  | |
| | (11) WP & CA Budgets Equal  | | | | |
| | (12) Identify Control LOE  | | | | |
| | (14) Identify MR & UB  | | | | |
| | (15) Reconcile Project Budget  | | | | |

EIA-748 Guideline

(1) Define WBS 

EIA-748 Guideline Description

Number of Attributes

Figure 1. EIA-748 EVMS Management Areas

This Appendix uses standard terminology as defined in the PM ECRSOP, Appendix E: Definitions and Sources. It is understood that contractors may employ different terms that better facilitate

EVMS implementation within their particular operating environment. The EIA-748 EVMS Guidelines are broad enough to allow for practical application but are specific enough to assure the government of timely and reliable performance data. The responsibility for developing and applying the specific procedures for complying with the guidelines is vested in the contractor. As such, contractors have flexibility to develop an EVMS most suited to their management needs provided they meet the intent of the guidelines. In addition, contractors are encouraged to establish and maintain innovative, cost effective systems and processes, and to improve them continuously.

3. ORGANIZATION

This section focuses on preparing to successfully execute the project using effective management controls. The primary objectives of the four EIA-748 EVMS Guidelines (1, 2, 3, and 5) that comprise this category are to establish the basic framework for organizing all contractually authorized work to be accomplished, identifying the functional organization hierarchy responsible for accomplishing that work, and creating an integrated structure that allows for controlling all efforts.

A structured approach for decomposing the project work scope into manageable segments creates the Work Breakdown Structure (WBS) wherein each WBS element contains a specific scope of work. The work is defined in the WBS Dictionary and includes a description of the technical scope for each element. The WBS also provides the basic structure for planning, budgeting, scheduling, cost accumulation, work authorization, measuring progress, data collection, reporting project status, and management control (EIA-748 EVMS Guideline 1). The establishment of an organizational structure (i.e., Organization Breakdown Structure (OBS)) is to assign organizational responsibility, accountability, and authority for all the project work. It identifies which organizations in the corporate structure, to include major subcontractors, have responsibility for work accomplishment (EIA-748 EVMS Guideline 2) and must be supported by organizational hierarchy identifying the responsible managers.

The Organization Guidelines require the use of a fully integrated management and control system to execute the project. The planning, scheduling, budgeting, work authorization, and cost accumulation management subsystems must integrate in the EVMS such that the data derived from one system is relatable to and consistent with the data of each of the other systems. The integration provides the capability for establishing the Performance Measurement Baseline (PMB), identifying work progress, collecting actual costs, facilitating management analysis, and corrective actions. The proper integration of the contractor's EVMS and associated processes ensures the information and performance data retrieved from the EVMS is traceable and auditable (EIA-748 EVMS Guideline 3).

The assignment of organizational elements to specific WBS elements where work scope management occurs establishes the Control Accounts (CA). These are the primary management control points for work authorization, planning, budgeting, cost accumulation, and performance measurement (EIA-748 EVMS Guideline 5). The WBS level at which a CA is established is primarily a function of the size of the project and the type of product. CAs do not all have to be established at the same level within the WBS as each product and/or deliverable branch within the WBS should be subdivided as far as needed to allow for adequate management, insight, and control. Through the creation of a CA, the Project Manager identifies who in the organization is given authority and responsibility to manage, control, and facilitate the allocation of resources to accomplish a specific scope of work. The CAM is ultimately responsible for the schedule, cost and technical performance associated with accomplishing the scope of work within a CA. The CAM is also responsible for planning the resources necessary to accomplish that scope of work. In some cases, particularly in a construction environment, other functional organizations (e.g., Planning & Controls, etc.) may assume a more active role in the planning and management of resources in support of the CAM's responsibilities. In this scenario, effective internal bilateral communication between the CAM and the functional organization is essential to ensure accomplishment of the CAM's responsibility for managing the execution of the CA scope of work.

Guideline 1

Define the WBS

Define the authorized work elements for the project. A WBS, tailored for effective internal management control, is commonly used in this process.

Purpose of the Guideline

The Work Breakdown Structure (WBS) provides the framework for technical scope, schedule, and budget planning and control through the life of the project. Of foremost importance in organizing any project is the establishment of all the work parameters that are required to accomplish the project. This EIA-748 compliance requirement necessitates that this be done, and that a product/deliverable oriented WBS be used as the vehicle for this work and resource definition. When completed, the WBS will provide a framework for various and extensive management and control purposes. The WBS breaks down all authorized work scope into appropriate elements and will be used as the beginning point for all work scope planning, the assignment of work scope to responsible organizations, authorizing work scope, scheduling, budgeting, cost accumulation, performance analysis, and revisions to the baseline plan. Also, the WBS will provide the framework for data collection and reporting.

The product/deliverable oriented WBS establishes a common frame of reference for relating work scope activities to each other and relating project costs at summary levels of detail. This provides a sound basis for cost and schedule control. The WBS is a numerical, graphic representation that

completely defines a project by relating elements of work in that project to each other and to the end product. The WBS is comprised of elements that describe a specific item of hardware, service, or data. Descending levels of the WBS provide elements of greater detail. The number of levels of a WBS depends on the size and complexity of the project.

Early in the project planning process, project management should develop the WBS that will best describe the product/deliverable oriented work scope in the way it will be executed. All elements of the WBS should be defined in an accompanying WBS Dictionary. The WBS elements are added or changed to reflect the changes and refinements of the scope as the design and project execution are being developed. As levels are added to the WBS, they should be checked across the project to ensure that they remain consistent.

Management Value of the Guideline

Defining scope is an essential first step to the success of any project. It ensures that project deliverables and all other project requirements are clear and well defined. The WBS and associated WBS Dictionary help in identifying and describing detailed information about each control account and work package (WP) to the lowest level of WBS. Because the WBS is used as a management tool throughout the life cycle of a project to identify, assign, track, and accomplish the complete scope of work, it must be managed under formal change control with higher level of organizational approvals required for higher levels of the WBS. Customer approval should be required for the highest level of the WBS. The WBS must also remain current to the requirements of the project. The WBS Dictionary, in addition to expanding on the simple one-line description of the WBS elements, should include a brief definition of the scope or statement of work and defined deliverable(s) that will comprise the element resources and cost. If there are important or unique aspects of the element to particular phases of the project, these should be referenced. It may also provide a link to detailed technical definition documents (reference WBS Handbook dated 8-16-12, section 3.6). The WBS dictionary is an important part of the scope baseline process.

Because of ever-changing circumstances, the WBS and associated WBS Dictionary are under constant revision. Therefore, project management should frequently review the contents of the WBS dictionary to assure its contents are current and relevant. With each proposed change to the baseline the Contractor should include a markup to the WBS Dictionary reflecting any impacts to the WBS with the proposed change. This WBS markup should accompany the schedule and cost backup that supports the requested baseline change.

Impact of Noncompliance

The benefit of a WBS and associated WBS Dictionary is to ensure the project team clearly identifies all authorized work to facilitate their ability to plan and schedule the work and produce quality deliverables that meet project requirements and organization standards. Failure to link scope with the WBS may result in required work being omitted or unauthorized work being

performed. Without a single WBS that contains all authorized project work, the project cannot be properly planned, managed, and executed. Failure to include all authorized project work including the identification of work scope to be performed by subcontractors and any revisions resulting from authorized changes and modifications with the WBS and associated WBS Dictionary could result in required work being omitted or unauthorized work being improperly performed.

Typical Attributes

1. Is the product-oriented WBS used for a given project extended to the control account level as a minimum?
2. Does the WBS include all authorized project work and any revisions resulting from authorized changes and modifications?
3. Are all WBS elements specified for external reporting?
4. Is the WBS arranged in a hierarchy and constructed to allow for clear and logical groupings, including identification of subcontractors?

Discussion

A key aspect of this Guideline is a single, product/deliverable-oriented WBS extended to the CA level at a minimum to plan and budget, control and accomplish the complete authorized scope of work. In all cases, the contractor must extend the WBS to levels needed for effective management control. These levels should allow for the definition of the authorized scope of work into manageable segments that a project team can understand; as each level of the work breakdown structure provides further definition and detail.

The authorized scope of work is contained within the Contract Budget Base/Project Budget Base¹ (CBB/PBB), the budget value in terms of dollars. Additionally, the PMB includes control accounts and WPs that contain detailed information about each control account and WP to the lowest level of a single WBS ensuring that project deliverables and all other project requirements are clear and well-defined. For instance, a test uses a comparison of the WBS and associated WBS Dictionary to the contractor's cost tool to assess whether the full technical content of the WBS aligns to the budgeted dollar values recorded in the cost tool at the various levels of the WBS. Hence, alignment confirms a single product-oriented WBS is extended to the appropriate levels. The WBS level at which a CA is established is primarily a function of the size of the project and the type of product. All CAs do not have to be established at the same level within the WBS as each product and/or

¹ Project Budget Base (PBB) is the sum of the PMB + MR and is the same as the Contract Budget Base (CBB) when there is a one to one relationship (one project per contract). Because DOE often has many projects to one contract, the term PBB applies and is not to be confused with the Performance Baseline (PB) which is the entire project budget (Total Project Cost (TPC) including fee and contingency. and represents DOE's commitment to Congress. Throughout this document, CBB/PBB will be used.

deliverable branch within the WBS need only to be subdivided as far as needed to allow for adequate management, insight, and control. Another test uses a comparison of the Integrated Master Schedule (IMS) to the cost tool to assess if the complete scope of all authorized work and the associated dollarized budget values at the same levels of the WBS are accounted for using the IMS (or project schedule), thus confirming that a single product-oriented WBS is being used. The testing concludes by comparing the WBS nomenclature in the baseline and forecast IMS (or project schedules) to ensure the same WBS is being utilized, and taken the first two tests, the complete scope of work is considered.

The WBS Dictionary describes in detail each component in the WBS hierarchy to allow for clear and logical groupings, by product and/or deliverable. The WBS and associated WBS Dictionary should represent the complete scope of work identified in the approved Project Execution Plan (PEP) or other scope definition document like the Conceptual Design Report. While other performing entities (e.g. other direct government contracts and/or other prime contractors funded by the program or project) may, or may not have standard contractual arrangements, they are nonetheless responsible for specified WBS elements through some type of directed agreement with the DOE. This work content must also be subdivided to an appropriate level of product-oriented detail for project planning, control, and reporting. The resulting work elements must be clearly identified and included within the project WBS under the correct hierarchical branches in just the same manner as prime contractor WBS elements. For instance, another test uses a manual check of the PEP or other scope definition documentation to verify products and/or deliverables are readily found in the WBS and associated WBS Dictionary, and consequently reflected in the IMS (or project schedule) and associated budgets in the cost tool.

The complete and proper identification of all contractually authorized work following a WBS hierarchy provides the project team with a framework that represents the complete authorized scope of work. This includes the identification of work scope to be performed by subcontractors and any revisions resulting from authorized changes and modifications. The WBS clearly documents the project requirements, milestones, deliverables, end products, documents and reports that are expected to be provided by the contractor. One of the functions of this EIA-748 compliance criteria is to limit out-of-scope work is being performed. A test uses a comparison of the IMS (or project schedule) to the Integrated Project Management Report / Contract Performance Report (IMPR/CPR) Format 1 to assess if subcontracted work, if any, is included as part of the WBS hierarchy, and if out of scope work is being prematurely performed because of a change or modification to the project. Another test, a semi-automated test, by comparing the contents of the WBS and associated WBS Dictionary with that of the contractor's work authorization process, typically using the Work Authorization Document (WAD). Any differences between the WBS and the contractor's work authorization process would suggest that unauthorized work is being performed.

Subcontracted work should also be included. For projects with a TPC of \$50M or more², the prime contractor is responsible for flowing down to subcontractors the requirements for reporting cost and schedule data for the prime to incorporate into the monthly reporting into PARS and to enable the prime's EVMS to be compliant with EIA-748. The prime is responsible for identifying the authorized scope of work in the WBS hierarchy for major subcontractors as well as subcontractors for Critical Items (CI) and/or High Dollar Value (HDV) material³. For example, the subcontracted effort may provide for delivery of a single lower-level WBS element, such as a vendor-fabricated module. In other cases, the subcontract scope of work may provide for efforts within several lower-level WBS elements, such as design work for a core mechanical system or instrumentation to be installed in a new facility. In either case, the WBS and associated WBS Dictionary must be capable of uniquely distinguishing the subcontractor responsibilities from each other, and from the work retained in-house by the prime contractor. Refer to the prime contractor's EVM System Description for the criteria the prime uses for determining a major subcontractor, critical items, and high dollar value material.

Figure 2 provides a WBS example consistent with the standard DOE classification for building elements and related sitework. Buildings include office spaces, factories, green houses, processing plants, towers, pads, and other structures used for a DOE project. The WBS hierarchy can be viewed as either an individual entity or a group of buildings (complex), including building structure and utilities, equipment in the facility related to its primary mission(s), support equipment, furniture, and fixtures.

² DOE Order 413.3B Attachment 1, Contractor Requirements Document states: "The Contractor shall: (1) comply with the requirements of this CRD to include subcontractor(s), and (2) flow down the appropriate requirements of the CRD to a subcontractor, when the total project cost to the prime contractor are greater than \$50 million." For EVMS purposes within DOE, this in practice means that the prime contractor is solely responsible for fielding an EVMS that is certified by PM as compliant with EIA-748. To the extent that the prime contractor issues subcontracts for resources or material in performance of the contracted project scope of work, the prime is responsible for flow down of the appropriate cost and schedule reporting requirements to subcontractor(s) that will enable the prime contractor to report cost and schedule data from and manage with an EIA-748 compliant EVMS.

³ Depending on a prime contractor's make or buy decision, the prime contractor and/or the subcontractor(s) may have High Dollar Value (HDV) material and/or Critical Items (CI). A CI is high risk material, which it may or may not be considered high dollar, but if not tracked, could impact the critical path.

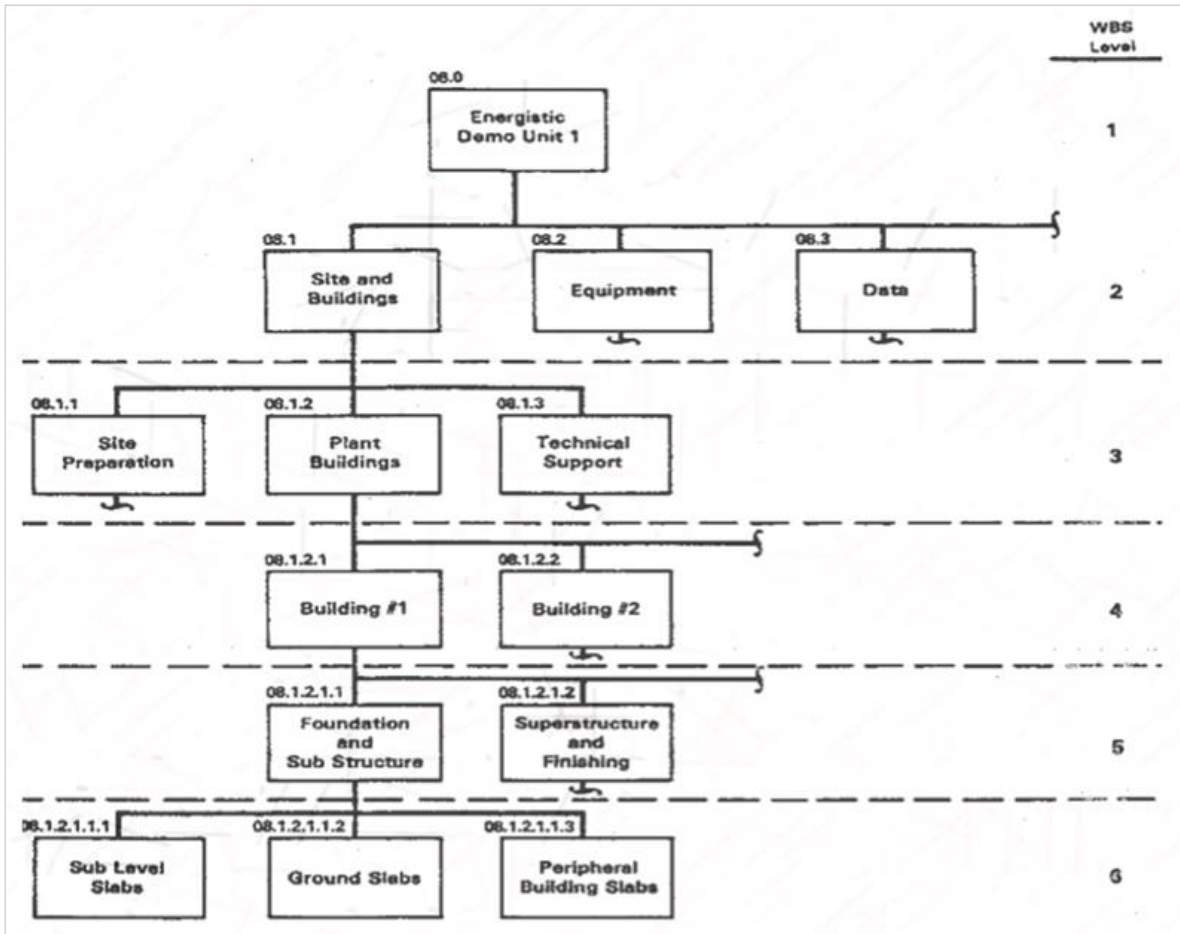


Figure 2. Construction Sample WBS Hierarchy

Guideline 2

Define the Project OBS

Identify the project organizational structure, including the major subcontractors, responsible for accomplishing the authorized work, and define the organizational elements in which work will be planned and controlled.

Purpose of the Guideline

Once the scope of work has been adequately defined via the WBS it is important to assign responsibility for accomplishing the complete scope of work. This EIA-748 compliance criteria requirement not only requires the assignment of organizational responsibility but also serves to ensure that the contractor reviews resource availability and the availability of managerial personnel under the assigned organizations to identify the personnel with the time and the capability to assume responsibility for additional contract work. The undertaking of composing an

organizational structure (or Organization Breakdown Structure - OBS) to identify which specific resources in the corporate structure will have responsibility for work accomplishment must ensure that full management and technical capability exist for accomplishing the complete scope of work. The WBS represents WHAT work will be accomplished and the OBS represents WHO will accomplish (manage/perform) the effort.

Management Value of the Guideline

Good management mandates the establishment of clear effort/activity responsibility within an organization. Since the definition process of the WBS establishes a common framework for schedule, cost and technical performance measurement, and for communicating data and reporting, the OBS provides a clear and definitive assignment of organizational responsibility for accomplishing the complete scope of work and establishes a single-point manager who can be held accountable for that work accomplishment. This is especially important at the control account level. Where management, resources, or technical capacity is not sufficient, project management must choose between the options of subcontracting for this additional capability or trying to hire additional personnel as a means of increasing capacity. The necessity to identify organizational responsibility cannot be minimized. When clear responsibility is not established, unsatisfactory performance is less likely to be corrected. Decisive, effective management, particularly corrective action, results from clear (and formal) assignment of responsibility.

Impact of Noncompliance

Failure to define the responsible organization and effectively assign the authorized scope of work to responsible managers prevents the project manager from maintaining visibility, accountability, and control of project cost, schedule, and technical performance and hinders project execution. If identification of organizational responsibility is done improperly or insufficiently at the onset of a project, it almost always results in lack of management control, scheduled accomplishments, and cost overruns

Typical Attributes

1. Are all authorized activities assigned to organizational elements?
2. Are major subcontractors, HDV and/or CI subcontractors and inter-organizational work efforts identified and integrated into the project OBS?

Discussion

The organizational structure to execute the project determines how the roles, authorities and responsibilities are assigned, controlled, and coordinated, and how information flows between the different levels of the management structure. The type of structure depends on the organization's objectives and strategy. In a centralized structure, the top layer of management has most of the decision-making authority and has tight control over departments and divisions. In a decentralized structure, the decision-making authority is distributed, and the departments and divisions may have

different degrees of independence. For example, the CAM may be a direct report to the project manager, or there may be intermediate level functional managers who report to the project manager as part of a multi-tiered structure. The OBS identifies those resources in the contractor's organizational structure that are responsible for accomplishing the complete scope of work with the organizational structure of departments, units, teams, and/or major and HDV/CI subcontractors. When designating the organization responsible for managing the project, the contractor must assign resources with sufficient authority and responsibility to execute the scope, schedule, cost, and technical objectives.

Many contractors have an OBS that is either functionally aligned, product aligned, or a combination of both. Regardless of the structure used, the OBS and associated organizational charts must reflect the contractor's organizational structure that is responsible for accomplishing the complete scope of work. Each month, the OBS should be reviewed for currency and adjusted as necessary. Where a contractor does not develop a graphical or tabular representation of the project organization, the contractor at a minimum, must institute an organizational coding structure that provides the hierarchical relationships of resources assigned to various management or organizational levels within the project consistent with internal/external summary management analysis and reporting levels. To facilitate the automation of testing, one test compares the Resource Assignment Matrix (RAM) (or comparable document) to the IPMR/CPR Format 2 to assess whether dollarized budget values assigned to CA and WP levels have an association to the contractor's organizational structure. The other test examines the OBS to determine if effort being performed exclusively by an HDV/CI subcontractor is separately identified and assigned to the appropriate WBS elements and responsible project organization.

Guideline 3

Integrate Management Processes

Provide for the integration of the planning, scheduling, budgeting, work authorization and cost accumulation processes with each other, and, as appropriate, the project WBS and the project OBS.

Purpose of the Guideline

It is imperative that, at any time, a contractor EVMS can provide a complete audit trail for any increment of work through the various management subsystems. The EVMS must demonstrate traceability from the assignment of authorized work scope to the WBS where the work is formally identified and defined. It must be able to trace the assignment of resources to the OBS where the chain of command is assigned, and it must be able to trace the work scope to the scheduling system so one can identify when, in time, this effort fits into the total contract plan. The contractor must be able to provide and explain the detailed plans for getting the work scope accomplished, along with providing a definition of type of effort required.

The EVMS should be able to break the effort down by element of cost/resource (labor, material, etc.), and substantiate that efforts' budget construction, demonstrate how the work plan is translated into action in the work authorization system and how actual costs are accumulated to the work plan as that work is accomplished. Through this type of audit trail an alpha-numeric work designation system pervades; it is by this system that data is collected and flowed through the various levels of the WBS and the OBS to the point of summarization and reporting.

Management Value of the Guideline

The success of any project depends heavily on the effectiveness of its managers. Project managers depend on reliable data that is consistent throughout the planning, scheduling, budgeting, work authorization, and cost accumulation subsystems to make decisions involving cost, schedule, and technical performance to ensure the viability of the project such as exploring opportunities and avoiding risks. The work scope, schedule, and cost elements of the project are coordinated according to an integrated and defined set of standard processes.

Impact of Noncompliance

The existence of a fragmented and misaligned management control system produces inconsistent and unreliable data between subsystems that weaken project management's ability to effectively use core management processes. Whenever integration of scope, schedule, cost and technical parameters is not well established, it calls into question the usefulness of the EVMS data and information, and effectiveness of decision-making.

Typical Attributes

1. Are the planning, scheduling, budgeting, work authorization, and cost accumulation systems integrated with each as other as appropriate, via common data elements and a common coding structure through the WBS and the OBS at the control account level (at a minimum) through the total project level?
2. Is the subcontractor cost and schedule data integrated into the prime EVMS?

Discussion

The integration of documented EVMS processes and operating procedures will enable consistent and reliable performance data across the enterprise management. This integration is obtained through the development and consistent use of a unique coding structure (i.e., work orders, job orders, activity code charge number structure, etc.) that facilitates the linkage among and between the EVMS and specifically management subsystems including organization, planning and scheduling, work authorization and budgeting, cost accumulation, performance measurement, and change control processes.

A fundamental requirement for the EVMS is consistency between separate and interdependent financial and management subsystems. Unique coding structures typically taken from a

combination of WBS and OBS alpha-numeric designators will support the transfer of data and allow the performance data derived from one management subsystem and process to relate to, and be consistent with, the performance data of other management subsystems and processes. This data simultaneously flows through each of the management subsystems, the WBS, and the OBS to the reporting level and the total contract level, where actual work scope management and control occurs, and where performance measurement is conducted. For example, if a discrete WP is behind schedule in the IMS (or project schedule), it must reflect a behind schedule status in the cost tool. Additionally, date reconciliation between the baseline and forecast IMS (or project schedule), and cost tool are also a primary consideration of the requirement for integration. Baseline and forecast dates in the IMS (or project schedule) must be within the same accounting month of the resources in the cost tool. The same budget in the work authorization process should be consistent with the Budget at Complete (BAC) and PMB total budget values. For instance, the automated and data driven strategy for a Guideline 3 test uses a comparison of the IMS (or project schedule) to the cost tool for active WPs to assess the consistency of the physical percent complete being generated from each management system and process. Likewise, all remaining Guideline 3 tests use a comparison of data to assess the complete audit trail for any increment of work scope through the various management subsystems.

Significant subcontracted effort must be clearly recognizable within the WBS and the OBS. Prime contractors will define the parameters of a "Major Subcontractor" in their EVM System Description. It is necessary to be able to identify each major and HDV/CI subcontractor's effort, and to be able to separate this performance from that of every other performer. This is typically accomplished by creating separate WBS elements (at the WP level) for each of the subcontracted products/services. The prime contractor must ensure that subcontractor performance data is accurate and consistent with the actual performance to date whether that data comes from a flow down of EIA-748 EVMS requirements or is obtained through monthly cost and schedule reporting.

This does not imply that the prime contractor is required to report the same performance data submitted by the subcontractor, but that the prime contractor take the necessary steps towards ensuring the incorporated performance data is consistent and reflective of actual performance to date. Hence, special steps must be taken to minimize performance data differences caused by accounting month differences. If prime contractor and subcontractor accounting calendars are significantly different, then the following steps apply:

- The subcontractor must provide schedule status monthly to the prime to facilitate the determination of project progress and the calculation of the project critical path that is reconcilable to subcontracted work;
- The subcontractor must report costs to the prime for the week ending that corresponds closest to the prime's accounting month-end and IMS date; and
- The subcontractor then carries the remaining period until their month-end as a part of next month's reporting.

As part of their responsibilities, the prime contractor must perform periodic assessments of all or portions of the subcontractor's work efforts, including monthly Budgeted Cost for Work Scheduled (BCWS), Budgeted Cost for Work Performed (BCWP), and Estimate at Completion (EAC) values. Occasionally, the prime contractor may need to eliminate an inappropriate retroactive change reported by the subcontractor, or the subcontractor EAC may need to be adjusted higher because of some potential Requests for Equitable Adjustments (REAs). In all cases, these changes must be documented and justified in the IPMR/CPR Format 5. Typically, the prime contractor will assign one or more CAMs to manage the subcontracted efforts, and these efforts may be part or all the work scope of a CA. Depending on the contractual requirements between the prime and the subcontractor, performance is assessed by the prime or subcontractor, and incorporated into the IPMR/CPR (or monthly reports) to DOE. In either case, the prime's CAM is responsible for ensuring that the schedule, budget, performance, analysis, and EAC are current and accurate. If not, then the issues should be documented and communicated to the subcontractor and the DOE.

For instance, the automated and data-driven strategy for assessment compares subcontractor performance data from a flow down of EIA-748 EVMS requirements or obtained through monthly cost and schedule reporting with that reported by the prime contractor. These series of tests range from a comparison of core performance data BCWS, BCWP, Actual Cost of Work Performed (ACWP), BAC and EAC, to a comparison of the IMS (or project schedule) baseline and forecast start and finish dates alignment.

Guideline 5

Integrate WBS/OBS to Create Control Accounts

Provide for integration of the project WBS structure and the project organizational structure in a manner that permits cost and schedule performance measurement by elements of either or both structures as needed.

Purpose of the Guideline

The control account is a management control point where the WBS and OBS intersect. Control accounts are placed at various strategic points of the project's WBS where technical scope, schedule, and cost parameters are integrated. At a minimum, the control account is the point where work progress is analyzed and compared with actual costs, where variance analysis occurs, and where corrective action is initiated. The selection of the appropriate WBS level within the WBS hierarchy for establishing the control accounts should consider the span of control and level of detail for managing cost and schedule performance. The person responsible for the work effort (scope, schedule, and budget) is the control account manager (CAM). This is the foundation for ensuring the contractor's planning, scheduling, budgeting, work authorization, and cost accumulation processes are fully integrated.

Management Value of the Guideline

The control account represents the level where the contractor's management organization is able to assign responsibility for performance to individual managers. These responsibility assignments must relate directly to the functional capability of the manager, and to the WBS element's product or service. The control account is the focal point of control within the EVMS. Control accounts can be scaled to include a manageable number of deliverables or even all of the deliverables that an organization is providing. A Project Manager and CAM will jointly track the deliverables by the organizational unit to maintain responsibility for the deliverables. The selection of the appropriate level within the WBS hierarchy, and level of detail for the control account, allows for management by exception. This is done by examining the performance and operational results of a control account, and only bringing issues to the attention of management, if results represent substantial differences from the budgeted or expected amount.

Impact of Noncompliance

Failure to establish the proper responsibility, authority, and accountability for the control account and prompt assignment of the CAM could have an adverse effect on the successful performance of the project. Control accounts established at inappropriate WBS levels could impede a CAM's ability to effectively manage the scope, schedule, cost, and technical parameters of the project. Failure to define CAs properly (scope, schedule and budget) can create ineffective management or increased cost. The assignment of more than one control account manager for each control account indicates a lack of sole managerial authority over the control account resulting in the operational inefficiencies and potential conflict in the control of resources and direction of effort to be accomplished.

Typical Attributes

1. Is each control account assigned to a single organizational element directly responsible for the work and identifiable to a single element of the WBS?
2. Does the CAM have responsibility, authority, and accountability for the work scope and performance of the control account?
3. Is there only one CAM assigned to each control account?
4. Are control accounts established at appropriate levels based on the complexity of the work and the control and analysis needed to manage the work effectively?

Discussion

The intersection of the WBS and the OBS represents where the CA is established. That intersection is necessary to understand the assigned responsibility for managing, controlling, and facilitating the allocation of resources to the work scope and permits cost accumulation and performance measurement. There may be one or more responsible organizations supporting a single WBS or multiple CAs within one OBS element. Generally, this occurs when the work within a WBS

element must be segregated for management control purposes that are driven by scope and exit criteria (i.e., completion of the effort). Figure 3 reflects multiple CAs assigned to one OBS element. Managers need to consider the complexity of the work and the efficiency of the organization in establishing the CAs. This structured approach assists the contractor project manager with assigning responsibility and authority for performing the work scope contained in the WBS. Labor, HDV/CI, major subcontractors, and LOE may be managed in separate CAs as appropriate within the intersection of the WBS and OBS responsibility. For instance, Guideline 5 verify that the necessary intersection is established to assign responsibility for managing the CA, and that each CA is assigned only one WBS element and one OBS element. These tests are accomplished by looking for duplicative or non-existent nomenclature for each CA recorded in the cost tool.

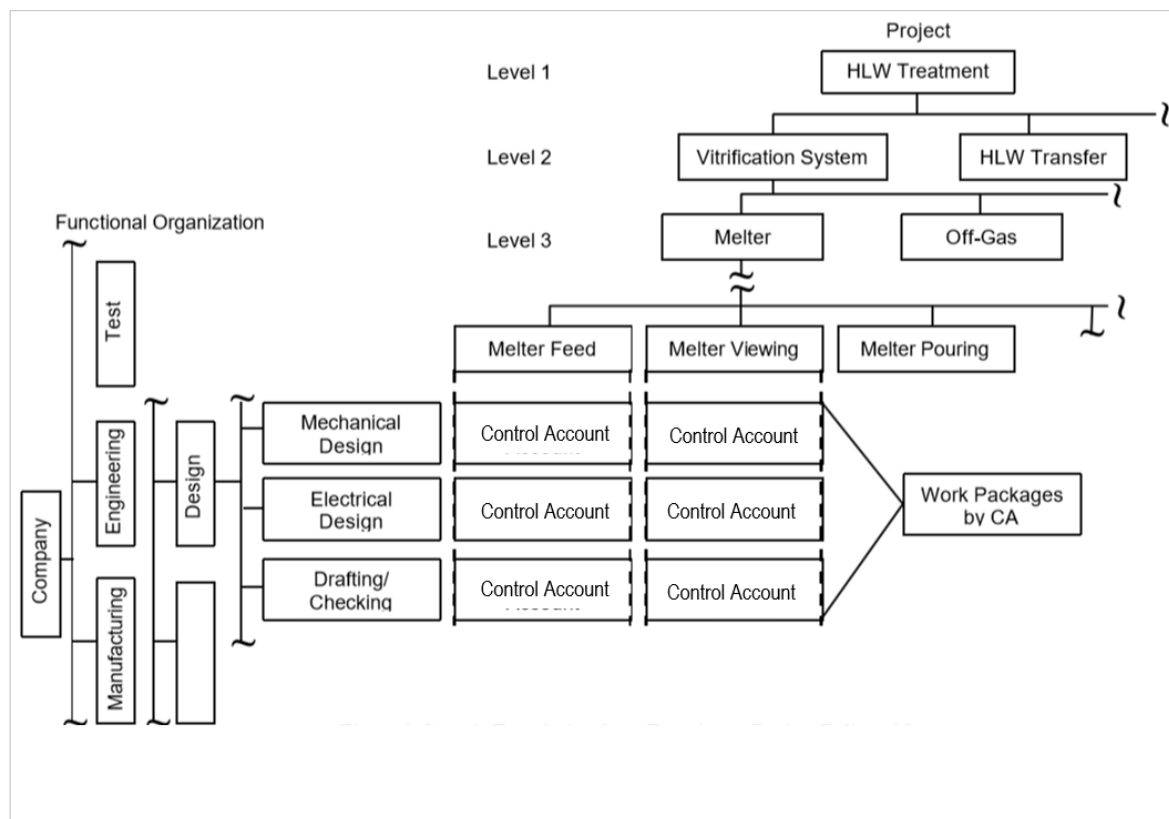


Figure 3. WBS and OBS Integration and Control Account

Because the control account is a logical subdivision of a higher level WBS element, it must be identifiable to only one WBS element. This ensures that schedule, cost and technical performance data can be summarized directly through the WBS without subdivision or dual allocation. EIA-748 EVMS compliance criteria require that only one control account manager be assigned to the control account. Many contractors construct a Responsibility Assignment Matrix (RAM) with the control account managers listed on one axis and the WBS element control accounts listed on the other axis. This singular responsibility criteria verifies that each control account is assigned only

one control account manager. The RAM (or like document) becomes a cross check to ensure singular responsibility for each control account. It is not uncommon for a control account manager to be given responsibility for more than one control account.

EIA-748 EVMS compliance criteria requires that the control account manager be in a position recognized for having the responsibility, authority, and accountability for the planning and performance of the control account. It is important that the control account manager know his/her managerial responsibilities and authorities within the context of the contractor's EVM System Description. It is not unusual for a control account manager to delegate authority to lower levels of the organizational structure to assist him/her with managing the control account. For example, the control account manager may have a technical manager assisting him/her who in turn may have responsibility for other personnel assigned to the control account. Regardless of any delegated authorities, the control account manager must have a thorough working knowledge of the control account details, including an understanding for the technical scope, planning and schedule, work authorization and budgeting, work status, forecasting, and revisions of the control account. This automated series of tests use a comparison of work authorization documentation, baseline change documentation, and the organizational hierarchy to assess if the control account manager has been delegated the proper authority for assigning resources and making the necessary changes to the control account in a timely manner in accordance with EVM System Description requirements.

EIA-748 EVMS compliance criteria requires that the control account manager be able to demonstrate effective control of the control account(s) for which they are responsible. The size and complexity of the technical scope, and the number of resources working the efforts simultaneously naturally increases a control account manager's span of control and responsibilities. While there are no dollar or management span of control thresholds limiting a control account manager's responsibility, his/her technical background, experience, and the time needed to comply with the many responsibilities of the contractor's EVMS should be taken into consideration by the project manager before the assignment is made. For instance, the automated and data driven strategy for assessment looks for possible span of control issues for open control accounts greater than 7% of the project budget (i.e., BAC) and greater than 10% of the period BCWS with three consecutive status periods of Schedule Variance (SV) or Cost Variance (CV) at +/- 10%.

4. PLANNING, SCHEDULING, AND BUDGETING

The focus of the Planning, Scheduling, and Budgeting category is to develop plans and strategies to achieve the desired program/project cost, schedule, and technical objectives. This includes the identification of short- and long-term resource needs. The ten guidelines (6–15) that comprise this category set the foundation for integrating scope, schedule, and budgets into a baseline against which accomplishments will be measured. This baseline, called the Performance Measurement Baseline

(PMB), is managed primarily at the control account level and consists of a dollarized time-phased plan established at the WP or activity level that reflects how the contractor intends to use its resources, including subcontractors, to accomplish all the authorized work (Guidelines 8 and 9). The PMB provides the government and the contractor a common reference point for discussing program/project progress and status (Guideline 15).

Integral to establishing the PMB and critical to the success of any program/project is the use of a fully integrated, networked schedule (Guidelines 6 and 7) that establishes and maintains a relationship between technical achievement and cost and schedule progress status. The schedule provides visibility into the accomplishment of the activities required for execution of the contractual scope of work and is the basis for creating the PMB. The schedule structure should also correlate with the information in the Integrated Master Plan (IMP), when the IMP is contractually required. The IMP is an event-based plan consisting of a hierarchy of project events with each event being supported by specific accomplishments, and each accomplishment associated with specific criteria to be satisfied for its completion. The IMP is normally part of the contract and thus contractually binding.

The IMS is required for any EVMS contract/project. The IMS is an integrated, resource loaded, time-based schedule containing the logical network of activities required to accomplish the project scope. All levels of schedule hierarchy, i.e., summary master schedules, intermediate schedules, and detailed schedules come from IMS. The summary master and intermediate level schedules are summarized roll-ups of the detailed IMS. Supplemental schedules, such as subcontractor schedules or Material Requirements Planning (MRP) or like systems should be integrated into or be consistent with the IMS at the detailed level. The building of predecessor and successor logic relationships at the working level, i.e., a networked schedule, are necessary for planning activities and events, logically sequenced for progressive development and implementation, providing a road map for timely completion of contractual/project requirements. Whatever approach to scheduling is chosen, there must be both vertical integration (from detailed activities to top level) and horizontal integration (across activities at the same level). In general, the IMP can be thought of as the top-down planning tool and the IMS as the bottom-up execution tool for those plans.

Developing a baseline schedule, measuring performance against it, and estimating when remaining activities will start and/or finish are essential elements of good schedule management. Equally important is the meaningful analysis of project schedules that provides the project team with a rational basis for decision making in order to meet project objectives. Schedule analysis is the process of assessing the magnitude, impact and significance of actual and forecast variations to the baseline schedule and/or current operating schedule. It begins with the calculation of the project's critical path and determination of any change in the completion date of the project. Schedule analysis also includes diagnosing the reliability of the project schedule and its direction by examining elements including schedule accuracy, integration, realism, performance, variances, trends, forecasts, "what-ifs," risk and relationship to resources.

For the schedule risk assessment to be successful, the network schedule must be developed and maintained appropriately. A thorough examination of the network should be done to ensure that the schedule is functional. This requires the identification and characterization the full range of schedule issues. The contractor should demonstrate that the scheduling technique meets the minimum requirements of scheduling as defined in EIA-748 and is consistent with the contractor's written EVM System Description and operating procedures. EIA-748 employs a networked scheduling technique to verify attainability of project schedule objectives, and to integrate the project schedule among all related components. The network should link all project milestones, events, WPs and activities in logical cause and effect sequences to determine the required time needed to complete the project. Strings of linked predecessor and successor activities constitute 'paths' through the network. The Critical Path Method (CPM) of scheduling is traditional and well accepted by industry for developing the logic (or execution strategy) of the schedule. The contractor may modify the strategy continually through execution ensuring the network is sound and the sequence of work flow is correct.

The DOE G 413.3-7, Risk Management Guide, states the purpose of the quantitative risk analysis is to provide budget and completion date estimates that include the effects of the project risks and other project uncertainties using statistical modeling techniques such as Monte Carlo analyses or other similar methodologies. Schedule Risk Analysis (SRA) is a recognized industry best practice which identifies the high-risk areas of the project, determine the likelihood of risk materializing, and assess the impact of possible risk. The inclusion of uncertainty provides more complete information to evaluate the likelihood of finishing work on time and within budget. The initial assessment should begin as soon as the project baseline is implemented. A well-executed SRA process can provide the essential strategies for recognizing, reducing and/or eliminating possible risks, with the specific emphasis on project schedule risks. The SRA uses statistical techniques in the form of Monte Carlo simulations to identify technical, programmatic and schedule risk in a project and quantifies the impact of those risks on the project's schedule. Risk analysis determines the likelihood of risk materializing, assess the impact of possible risk, and more importantly, compiling the information and opportunity to mitigate risk long before it impacts the project. Standard output reports, products, and threat / opportunity correlation information is followed by action strategies for risk mitigation and tracking.

The EIA-748 EVMS Guidelines further establish the planning parameters associated with the PMB including:

- Establishing the CBB/PBB, including authorized unpriced work. (Guideline 8). An allowance is made for a portion of the CBB/PBB to be withheld outside of the PMB as Management Reserve (MR) for internal management control purposes.
- Using MR to provide the contractor with a budget to manage risk within the established contract scope (Guideline 14).

- Using Summary Level PPs (SLPPs) for effort that cannot yet be detail planned at the CA level (Guideline 8).
- Authorizing work and identifying significant elements of cost (labor, material, other direct costs) (Guideline 9).
- Partitioning CA work scope into WPs for near-term effort and/or PPs for effort outside the current planning window (Guideline 10).
- Applying the most appropriate earned value measurement technique to ensure progress reported against the PMB provides reliable performance data (Guidelines 10 and 12).
- Ensuring the budgets of WPs and PPs sum to the total budget authorized for that CA (Guideline 11).
- Ensuring the PMB includes overhead budgets (Guideline 13).
- Using Undistributed Budget (UB) as a holding account for contractually authorized work scope and budget that has not yet been assigned to an organizational element at or below the Work Breakdown Structure reporting level, either directly to CAs or SLPPs. Because UB is budget tied to specific work scope, it is part of the PMB (Guideline 14).
- Lastly, the guidelines emphasize maintaining the integrity of the PMB by ensuring the sum of lower level budgets does not exceed the total time-phased PMB and that all internal project budgets and management reserve reconcile to the CBB/PBB (Guideline 15).

Guideline 6

Scheduling Work

Schedule the authorized work in a manner, which describes the sequence of work and identifies significant activity interdependencies required to meet the requirements of the program.

Purpose of the Guideline

To provide project management with a fully integrated, networked, and time-phased plan that provides visibility into the detailed progress and accomplishment of the milestones and activities required for execution of the authorized scope of work.

Management Value of the Guideline

A fully-integrated schedule facilitates the establishment of a valid PMB. Scheduling authorized work facilitates effective planning, statusing, and forecasting, which are critical to the success of a project. This is accomplished through a fully networked and resource loaded IMS, a foundational component of a valid PMB. This provides the ability to produce a critical and driving paths and allows project management to evaluate and implement actions designed to ultimately complete the project within contractual parameters. An IMS provides project management a comprehensive status of authorized work scope and facilitates the timely tracking and communication of project performance.

Impact of Noncompliance

Noncompliance with this guideline can impact a project manager's ability to communicate the project timeline necessary to accomplish the technical scope, establish the PMB, evaluate progress, and provide reliable schedule forecasts for remaining work. Avoiding delays is a top priority for contractor Project Managers; without exception, a poorly conceived project leads to crippling delays, consuming thousands of labor-hours and millions of dollars.

- Without having all the authorized scope included in the IMS, work scope may not be tracked within the schedule and the critical path may be inaccurate and not useful as a management tool.
- If schedule margin (SM) is used in the schedule, its use must follow strict protocols to ensure it does not impact the validity of the critical path and provides a realistic measure of schedule risk. Without schedule margin in the baseline schedule, management may not have the tools necessary to address and mitigate risks to the schedule.
- Risk mitigation activities in the project schedule that are not in alignment with the Risk Register means that the risk management process has not been fully integrated into the IMS and therefore those risks may not be correctly quantified and/or effectively managed.
- Incorrect, excessive, or missing logic links may invalidate the usefulness of the critical path. This would cause artificial time-based variances and the validity of EVMS reporting would be suspect. Failure to link the schedule to all required milestones and external dependencies means the IMS will not provide accurate dates needed to develop a useable critical path for managerial analysis and decisions.
- If lower level schedules do not support the WPs, PPs and project goals and deliverables in the IMS, the project team is working to different schedules, defeating the usefulness of the IMS as a management tool.
- Excessive lags or use of leads impact the creditability of the validity of the critical path. Hard constraints and excessive use of soft constraints do not allow the schedule network to accurately represent the impacts of schedule slips.
- The lack of near-term detail planning creates a baseline schedule that will not provide sufficient information for determining actual progress, developing reliable forecasts based on performance to date, and managing priorities to accomplish project cost and schedule objectives.
- Lack of a detail plan inhibits the usefulness of the IMS and PMB for providing program management situational awareness of schedule activity and resource details required for effective program execution and management's ability to assess progress for proactive resolution of issues impacting cost, schedule, and technical achievement of program objectives. Too much detail in the future leads to inefficiencies in the effort required to maintain a realistic baseline to effectively manage dynamic projects.
- Activities designated as LOE on the critical path conceal project performance.

- If the status date is not consistent with the status period, the schedule is not in sync with PMB accounting period information. If activity progress is not consistent with the status date, and status is out of sequence, the schedule is not providing accurate or reliable information for decision making.
- A baseline schedule without traceability to the original will not provide management visibility into reasons for the change, nor the impact of the change to understand how the original plan evolved into current plan.
- Negative or excessive float may be an indication of a schedule network that is not adequately defined or does not have accurate precedence relationships between activities. This condition produces a resource plan and work flow that may not be feasible and result in an inaccurate project critical path.
- Negative float indicates an unachievable schedule, and should be reassessed with new activity sequencing, or work arounds to avoid schedule delays. A project schedule that is not based on resource availability is incomplete, and undoubtedly not executable or realistic.

Typical Attributes

1. Does the IMS reflect all authorized, time-phased work scope to be accomplished, including details for any significant subcontracted effort and High Dollar Value (HDV) materials/critical items that could affect the critical path of the IMS?
2. Does the current schedule provide actual status including forecast start and completion dates consistent with the month end status (data) date for all authorized work?
3. Does the network schedule/IMS describe the sequence of work (horizontal integration) and clearly identify significant interdependencies that are indicative of the actual way the work is planned and accomplished at the level of detail to support project critical path development?
4. Is there vertical schedule integration, (i.e., consistency of data between various levels of schedules including subcontractor and field level schedules) and do all levels of schedules align with the EVMS and schedule of record?
5. Does the IMS assign resources to all activities (non-SVT, non-milestone and non- schedule margin)?
6. Does the IMS establish reasonable durations for all activities?
7. Is total float reasonable?
8. Is schedule margin (if any) identified, logically and appropriately planning the baseline and forecast IMS?
9. Are significant and probable risk mitigation steps included in the baseline and forecast IMS and do these steps align with applicable mitigation activities defined in the risk registry?

Discussion

In accordance with DOE O 413.3B, the IMS must be developed and maintained for the project. As a minimum, a resource loaded IMS must contain all labor, material and equipment costs to include unit prices and quantities, and both discrete and LOE activities. The IMS is an integrated, networked schedule containing all the detailed WPs and planning packages (or lower level activities or activities) necessary to support the events, accomplishments and criteria of the IMP (when the IMP is contractually required).

The IMS represents a model of the activities planned to execute the project work scope. To obtain a logical assembly of events and activities or activities, the scheduling process should be designed to permit the evaluation of both the sequence and the interrelationships of contractually specified work. The activities are time phased and sequenced, accurately reflecting how the work is to be performed. Predecessor and successor relationships link the activities together to facilitate the timing and order in which the activities are conducted. The IMS contains project milestones, events, decision points as well as external dependencies. External interfaces that may impact the project schedule must be shown as predecessors or successors to activities in the project. Following the completion of the IMP, the scheduling process is further expanded using a top down, bottom-up iterative approach to increase the number of events and activities or activities by members of the project team, who retain the highest level of knowledge needed to appraise the time horizons for the completion of the work. This approach is especially effective at the WP or activity level where more extensive planning and observation of work is necessary.

The traceability between the various levels of schedules are designed to ensure that technical milestones, activities, or activities represent the completion of either all or part of a WP, are time integrated at ascending schedule levels, and terminate at a corresponding next higher-level schedule critical decision or major milestone.

Subcontracts should be incorporated at a level necessary to support the calculation of a realistic critical path and float values. The level of subcontract integration should be at the same level as if the work was performed internally.

Once the project schedule is completed and approved, it becomes a formal control document. Consequently, any changes to the project schedule's baseline must be formally documented and approved following the contractor's internal operating procedures. The IMS should be directly traceable to the IMP and should include all the elements associated with development, production or modification, and delivery of the total product and project high-level plan. If contractor schedule margin is used, it should only be used immediately preceding a DOE Critical Decision milestone such as CD-4 and should (scope issue) be reflected in the baseline as well as the forecast schedules. DOE schedule contingency is optional and if used should be represented as an activity, clearly defined in the activity name as 'DOE SCHEDULE CONTINGENCY' and placed after the contractor final

delivery. During the execution of the project, activities are created as required to mitigate known or discovered risks. As part of the risk management process these mitigation activities are incorporated into the baseline and forecast schedules and documented via formal change control process or ETC/EAC forecast process.

The IMS is the project plan for accomplishment of all project goals and deliverables. All the discretely measurable work scope found in project documentation, including subcontracted effort and HDV/CI, as well as LOE activities must be accounted for in the IMS. The work breakdown and coding structures enable a project to be divided by level into groups of activities, resources, costs, and materials for planning and control purposes.

This IMS ensures that the relationships between activities in WPs, PPs and SLPPs have been thought out and represent the way the project will be executed. There may be different documents representing the scope of work contractually required on the project. The work scope may be found in a Project Execution Plan (PEP), Statement of Work (SOW), Performance Work Statement (PWS), Conceptual Design Report, or other ancillary documents depending on the practices of the DOE customer organization. Level of effort activities are included to achieve related resource planning requirements. When material procurement is in the detail planning period and negotiations are pending, HDV/CI is initially planned and baselined in the IMS based on the material need date. After negotiations, HDV/CI are adjusted to match the purchase order date. This level of detail is not required for PPs; however, PPs for HDV/CI should be unique so they can still be visible in the IMS.

While a project schedule defines the scope of the work to be undertaken and the timetable for completion, it is the WBS coding structure schema that ensures the planning, scheduling, budgeting, work authorization, and cost accumulation management subsystems are integrated such that the data derived from one system is relatable to and consistent with the data of each of the other systems. The proper integration of the contractor's management subsystems and processes ensures the information and performance data retrieved from the EVMS is accurate, reliable, timely, and auditable (Guideline 3). In addition to having descriptive names, other activity identifiers within the project schedule must be consistent with the project work scope. Activity names that describe the effort and completion criteria help the contractor's PM/CAM easily identify the work scope, identify the scope to be performed, and provide an accurate status.

SM is used to mitigate schedule risk. The amount of SM established is directly related to management's estimation of schedule risk inherent to accomplishing the project goals and deliverables. The relationship between SM and risk in the schedule must be documented and available for review. SM may be established based upon the results of a Schedule Risk Assessment, for example. A risk register is a common repository for the project to document risks and the relationship to the amount of SM planned and baselined in the project schedule. The contractor EVM System Description should establish the policy for the development and maintenance of SM. If SM is used, it must be

located in the IMS as a single activity or gap between the last discrete activity in a critical decision phase, and a critical decision milestone (such as CD-3 or CD-4). This placement will allow management to evaluate the impact of realized risks on the schedule to the next CD milestone and act to address possible to the project. The schedule margin should not drive (be a predecessor to) discrete activities. If schedule margin is used in the IMS, whether modeled using a Schedule Visibility Activity (SVT), or constrained milestones creating a duration gap, it must be clearly identified in the IMS. To ensure clarity, the activity name should contain the text “SCHEDULE MARGIN”, and a code field should be assigned to support filtering requirements of schedule analysis.

SM may be established during the planning stages of the project to address the impacts of risk to the contractor’s ability to complete the work on time and to meet contractual deadlines. Therefore, SM in the IMS represents the project’s schedule reserve to meet the project completion date. The duration of the SM in the baseline and forecast schedule should be equal at the start of the project, or the start of the CD phase it supports. However, as time progresses and the IMS forecast is updated, the SM may be changed at the direction of the contractor PM. SM may be consumed (over time) in the forecast schedule with monthly changes documented in the IPMR/CPR Format 5 report. This analysis should consider the rate of consumption of SM compared to the percent complete of the project. If the percentage of the SM consumption is higher than the project percent complete, it may be an indication that the risks to the project are greater than anticipated, schedule performance is impacted due to technical issues, or the baseline schedule was unrealistic. When SM is totally consumed, it should be reflected in the schedule with a zero duration, indicating the project has no remaining schedule reserve. The duration of the SM activity may be reduced at the discretion of the contractor PM over the course of the project based on risk impacts and managerial actions. The SM activity listed on the baseline schedule is under change control requirements; however, changing the duration of the SM activity in the forecast is not subject to change control.

Once the PMB has been established it is essential that contractor PMs take the appropriate steps to identify, examine, and assess potential risks in the baseline schedule. The creation of a networked-based schedule is an important feature of a contractor PM’s ability to visualize the number, kind, and sequence of activities or activities needed to execute a complex project. Risks that require mitigation are documented in the Risk Register and, and when applicable, include those activities chosen to mitigate the risk in the baseline and forecast schedule. Because the probability and impact of some risks are greater than others, it is up to the contractor PM to establish thresholds that determine which risks are significant enough to have risk mitigation. All significant and authorized risk mitigation activities added to the baseline (and associated forecast) schedule must be processed through a formal change control process. Once included in the project baseline schedule, the risk mitigation activities in both the risk register and schedule must align. However, there may be risks found in the risk register that are neither practical nor significant enough to be planned in the project baseline schedule.

The IMS is based on a hierarchical structure with the discrete and LOE activities found at the lowest level being summarized to a Work/Planning Package level through the CA and then to the total project level. The IMS is expected to have more granularity in the near term with less detail moving towards the future.

The traceability between the various levels of schedules is designed to ensure that milestones and activities occurring at or below the WP level that represent the completion of either all or part of a WP are time integrated at ascending schedule levels and terminate at a corresponding next higher-level schedule milestone. The number of schedule levels (or tiers) is a function of project complexity and size. See Figure 4.

Typically, there are essentially four levels that make up the project schedule. They are: (1) Milestone, (2) Summary, (3) Intermediate, and (4) Detailed.

- Milestone Schedule - A high-level schedule that displays key events of major importance defined both by the contractor and the PM. Programmatic events are typically indicated using a solid [black] diamond symbol. Milestones are major events consuming zero calendar days.
- Summary Schedule - The master schedule depicts top-level key events and milestones at the summary level of the WBS (for example, levels 1-3 of the WBS). It should be an integrated roll-up of the intermediate schedules (i.e., Vertical Integration).
- Intermediate Schedule - Intermediate schedules include mid-level project activities and key milestones, which include all associated accomplishments of the project summary master, schedule, traceable to the WBS element as necessary to display work effort at the intermediate level of summarization (for example; levels 3-5 of the WBS as appropriately tailored). There may be several intermediate schedules that depict varying levels of detail of the WBS. The intermediate schedule should be an integrated roll-up of the detailed schedules (i.e., Vertical Integration).
- Detailed Schedule - The lowest level of the network schedule and the foundation of horizontal and vertical schedule integration. It should include the detailed activities and milestones that depict the work scope that represent all WPs and planning packages identified in the contract Performance Measurement Baseline (PMB). It is developed and used as the blueprint for the day-to-day management and control of work by the CAM. Detailed schedules must contain activity start and finish dates that are based on physical accomplishment and are clearly integrated with project level time constraints. Detailed schedules must consider all horizontal and vertical interdependencies between and among control accounts, WPs, planning packages, activities, and supporting schedules, e.g. engineering, production, and subcontractor. Dependencies fall into one of two categories: (1) 'Internal' dependencies are generally referred to as dependencies between separate work scope activities entirely within the boundaries of the WBS element, and (2) 'External' dependencies are generally referred

to as dependencies to work scope outside the control of the project team, or interfaces to external sources.

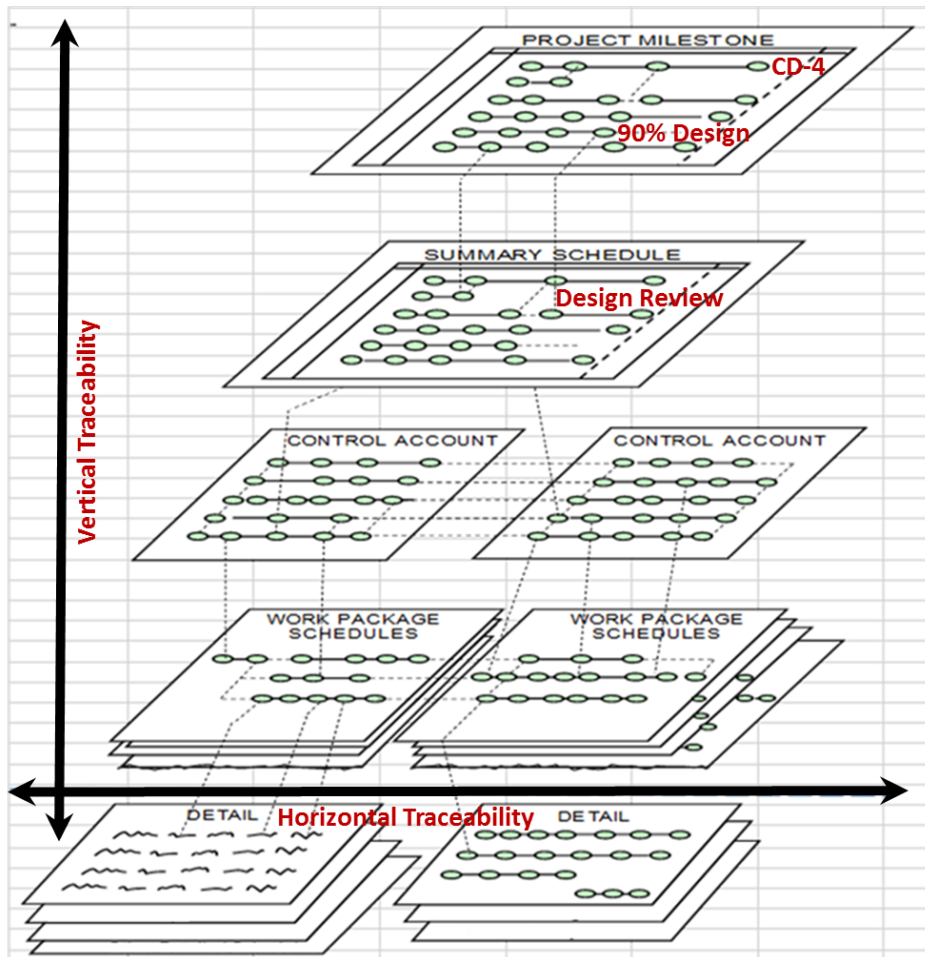


Figure 4. Integrated Master Schedule Hierarchy

The contractor should demonstrate that the scheduling technique meets the minimum requirements of network scheduling to verify attainability of project schedule objectives and to integrate the project schedule among all related components. Significant project events, external dependencies, and decision points must be reflected in the IMS to facilitate the planning and execution of work scope. The network should link all project milestones, events, and activities in logical cause and effect sequences to determine the required time needed to complete work. This technique facilitates the calculation of the project critical path. The critical path is the longest path of related incomplete activities in the logic network from ‘time-now’ whose total duration determines the earliest project completion. A review of the calculated critical path reveals those activities that are causing delays in accomplishing work and those activities that jeopardize the project timeline. This analysis helps management focus on these activities to develop workaround plans and seize opportunities. When

activities in the project schedule are statused out of sequence, logic relationships may be broken and established with new or existing activities to best reflect the execution of work moving forward.

While the IMS contains LOE activities, this type of work should not be associated with driving paths to an intermediate milestone or the project critical path. The critical path is considered reasonable when discrete work activities are tied together in a sequence that makes sense from a workflow standpoint. Activities in the detailed schedule must contain sufficient detail and consider work calendars and the availability and allocation of resources. While the project schedule defines the scope of the work to be undertaken and the timetable for completion, it is the coding structure schema that includes the WBS that ensures the planning, scheduling, budgeting, work authorization, and cost accumulation management subsystems are integrated such that the data derived from one system is relatable to and consistent with the data of each of the other systems.

Subcontracted work is typically significant portions of project scope assign to another contractor to perform. The subcontracted effort may be fixed price; however, this does not affect how the subcontract should be integrated within the IMS. Subcontractors should be integrated at the level at which interfaces to support the development of the critical path and performance measurement are required (with or without an EIA-748 EVMS flow down requirement).

SVTs represent the work in the IMS that does not have resource requirements or scope and therefore is not included as part of the contractor's PMB cost but is related to and may potentially impact the project schedule activities. Examples include customer review of documents, site work performed by other contractors before work can begin, wait times for RFP responses, and material shipping durations. SVTs must be identified in the schedule with "SVT" in the activity name, along with a description of the SVT activity. The inclusion of a value in an activity code field is not required but is helpful in separating out SVTs from other activities during filtering, grouping and schedule health assessment exercises. SVTs should have a contractor activity owner and have their status updated as required, generally with outside consultation (as they represent outside project effort). When employed correctly, SVTs provide the reason for a delay in an IMS. They also provide the expected (Baselined), updated forecast and actual durations as the schedule forecast moves in time. The impacts of the SVTs are based on logical predecessor and successor relationships in the IMS. Because they are visible and contain activity names, SVTs are a preferred alternative to lags in the IMS, where documentation on the rationale for the lag is usually hidden from view if it exists at all.

A comprehensive IMS plays a crucial role in ensuring that a project scope, time, and cost can be tracked and monitored. To ensure success, scope of work must be clear, activity durations realistic, resources assigned for accomplishing the work must be appropriate, and dependencies and logic between activities must be assigned that model the sequence of work that represent how delays in one activity could impact future activities. Without the identification of dependencies and subsequent logic relationships, it is difficult to know how delays on individual activities will ultimately affect

other related activities in later stages of the project. The IMS network establishes a logical sequence of work that leads through key milestones, events, and/or decision points to completion of project objectives. Milestones that could influence the IMS calculations have the appropriate predecessors and successor links established in the baseline and in the forecast schedule to provide management with the correct dates and paths.

The schedule network is a model of how the project will accomplish the goals and deliverable reflected in the contract. The granularity of both the baseline and forecast schedule must be sufficient to promote a clear understanding of the work scope at the work performance level. This means the detailed activities must be planned in a sequence the way they will be worked. All activities in the schedule should have both predecessor and successor relationships, with the exception of logical external receipts or deliveries including the project start and end. These relationships define in what order work will be performed. The logical sequence of design and construction WP activities and planning packages in the project schedule from start to finish must reflect a strategy capable of meeting the scope specifications and requirements and indicative of how the project will be built and cost. Additionally, all activities and milestones should be baselined to provide the ability to measure changes in time from the plan to the current forecast schedule. All activities and milestones in the baseline schedule should also be contained in the forecast schedule.

The IMS should identify the project critical path—the path of longest duration through the sequence of activities with the least amount of total float. It is also defined as the longest path of related incomplete activities in the logic network from ‘time-now’ whose total duration determines the earliest project completion. Establishing a valid critical path is necessary for examining the effects of any activity’s slipping along this path. The project critical path determines the project’s earliest completion date and focuses the team’s energy and management’s attention on the activities that will lead to the project’s success. The baseline schedule is subject to formal change control which could impact a major project milestone and the critical paths. Changes to forecasted major project milestones and the forecasted critical paths shall be documented and explained from one month to the next. The schedule delivered to the customer must be consistent with that utilized by the contractor.

The logical sequence of design, construction, Decontamination and Decommissioning (D&D), and remediation type capital asset projects must reflect how the site will be improved and success is measured. Activity level relationship and interdependencies (i.e., key hand-offs) must be indicative of the actual way the work is planned and accomplished at the level of detail to confirm that the critical path is valid. For example, work regarding an electrical system cannot be concealed or covered until such work has been inspected and approved before drywall work is initiated. In this example, a Finish to Start (FS) relationship must be used to accurately reflect the actual way the work is accomplished.

The traceability between the various levels of schedules is designed to ensure that milestones and activities occurring at or below the WP level, which represent the completion of either all or part of a WP, are time integrated at ascending schedule levels and terminate at a corresponding next higher-level schedule milestone. The number of schedule levels (or tiers) is a function of project complexity and size.

The detailed schedule is the lowest level of formal scheduling and is developed and used as the blueprint for the day-to-day management and control of work by the CAM. Each schedule level must support the next higher level. There may be additional levels that must also be vertically integrated. Detail schedules such as field level and supplemental schedules are not required to be in the IMS but must also vertically trace to the IMS. Subcontractor schedules must align vertically, regardless of the implementation method chosen to represent them in the IMS. HDV material procurement and delivery information in the IMS must align with information in other sources, such as a material tracking database.

Horizontal and vertical traceability demonstrates:

- The schedule is rational;
- Has been planned in a logical sequence;
- Accounts for the interdependence of detailed activities; and
- Provides a way to evaluate current status.

Relationships with excessive lead or lag time should be avoided in the IMS. If relationships with large lead or lag times cannot be avoided, they must be explained. A lead is the amount of time of the overlap between where a successor activity begins, and a predecessor activity completes. A lag is the amount of time between the end of a predecessor activity and the beginning of a successor activity. The classic example is a three-day lag between pouring the concrete and ability to be able to build upon it. The three-day lag is a missing activity of the concrete curing. Typically lags represent fixed relationship based on laws of nature, or an external event outside the scope of the project. In all cases, lags can be modeled using an SVT activity. Lags >22 days require justification. Neither leads nor lags should never be used to manipulate or manage dates within the IMS.

Date constraints are anything that limits or restricts movement of a WP activity, or group of WP activities. Hard constraints, for example prevent logic in the network from driving the schedule. An activity may slip, but the impact of the slip will not be accurately reflected if a hard constraint is restricting the movement of other dependent activities in the schedule network. The project end date requires a hard constraint to calculate float values and run a critical path.

All use of hard constraints, if any, should be justified in a text field in the IMS and defined in the IMS Data Dictionary. Of special note is the mandatory constraint type. This constraint is designed to break

logic to achieve its assigned date. It is recommended to avoid the use of mandatory constraints in the IMS. The following are considered hard constraints:

- Mandatory Start or Finish
- Finish or Start On or Before
- Start or Finish On

Soft constraints, for example are defined as constraints that affect the early pass of the schedule. In other words, they inhibit activities from moving closer in time based on status. Soft constraints are most commonly used to model resource restrictions or provide material or subcontractor delivery dates. Normally they should be justified and less than or equal to 15% of the incomplete activities. Soft constraints are defined as:

- Start and Finish After
- As Late as Possible

The natural subdivisions of the control account furnish both the contractor's PM and CAM a blueprint according to the way the work will be accomplished.

The control account is broken down as much as possible into short-term units of work called WPs. Work packages are the basic building blocks developed and used by the CAM for detailed planning and control of contract performance. A WP is normally defined further into activities. From a network-based scheduling and performance measurement perspective, it is important to keep the activities that make up a WP homogeneous and either relatively short in duration (i.e., no more than 44 working days), or assigning interim measures using Quantifiable Backup Data (QBD) to a WP to reduce the problems associated with calculating the network and determining the amount and value of completed in-process work. While all contractual effort is planned and controlled through the control account, most contractors recognize that it may not be practicable or possible to do grassroots planning for an entire contract. Taking this limitation into account, budgets may be detailed and planned to the next key or critical milestone, or within a period of time that is practical for the effort involved, referred to as a planning horizon using the control account WP. Budgets beyond this time frame are recorded on the control account planning package where information may not be available for CAMs to plan activities in more detail. For example, a PM may require CAMs to detail plan, or convert PPs to WPs that are within a six-month planning window to their natural completion.

Planning beyond the near term may be less detailed, usually assigned to PPs, but still in support of project milestones and deliverables. For many projects, the fiscal year may be the planning horizon. Scope that has not yet been authorized to a CA (SLPPs) may also be in the schedule farther beyond must be in support of project milestones and deliverables just like PPs. Activities, including those assigned to PPs and SLPPs must have predecessor /successor relationships as they are part of the schedule network and potentially on the critical path.

The goal of limiting discrete schedule activities to no longer than 44 working days within WPs is to enhance the schedule's capability to provide fidelity required for early schedule warning capability and focus management attention to schedule work arounds. Earned value techniques should be captured at the activity level to further substantiate QBD for long duration WPs. These earned value techniques imply discrete work efforts and must be appropriate for the length of the WP and the type of work being accomplished. Under no circumstances should the length of an activity or the combination of activities be longer than their parent WP. Because QBDs are associated with performance measurement, they are required to be identified and reported at either the WP or activity level.

Actual progress of an activity from its start to its finish is determined using earned value measurement principles with time elapse consideration. The relationship between the amount of budgeted cost for work accomplished (or BCWP) and the amount of budgeted cost for work planned (or BCWS) for the activity must be weighed against the time for doing so. For activities that are of relatively short duration, it is less important to track progress in such detail; but for activities of an extended duration, indicating the technical percentage of the activity that is complete helps track actual progress against the baseline plan.

Note: For schedule activity duration, WP duration, and float, exceeding the established thresholds does not result in an automatic Corrective Action Request (CAR), but would rather trigger an assessment of the magnitude and any provided rationale and justification issues.

- At or below the stated threshold: Compliant and no further related questions
- Within a factor of two times greater than the stated threshold (i.e., if threshold 10% then > 20%): CAM follow-up discussions will be required to see if reasonable.
- Beyond a factor of three times greater than the stated threshold: This is likely a systemic issue and may result in stopping a review and requiring the contractor to fix these issues before the review can continue. This is typically a significant and non-justifiable issue that affects the overall integrity of the IMS.

A reliable and efficient planning and scheduling process is essential to manage the project effectively. Maintaining a realistic baseline schedule in view of changing customer requirements and unforeseen supplier or construction problems is a real and challenging proposition for many projects. To increase the relevance of the project baseline schedule and PMB, a planning and scheduling process that uses a detailed planning horizon strategy is an effective approach for actively managing changes.

In a planning horizon setting, the frequency with which the project schedule is updated can have a significant impact on the project's stability, productivity, and costs. Hence, one of the important decisions in the design of a planning horizon strategy is the frequency of planning future work efforts. The planning and scheduling of work is often performed on some regular basis e.g., 6

months, year, next major milestone or event, etc. Thus, the baseline schedule most useful for the purposes of project management and performance measurement is one that is incrementally developed with detailed plans following a rolling horizon basis. In practice, the far-term project schedule would be based upon the aggregated workflow execution strategy plans and then, as those plans enter the near-term planning horizon, would be decomposed to greater level of detail to reflect current project circumstances.

A rolling wave or block planning approach as a planning horizon methodology is defined as cycles of detail planning. These cycles are typically 6 months; although when practicable, instead of time-based, the cycles should rather be based on the period between project technical milestones within CD phases that are between 6-12 months apart. Within the rolling wave/block planning window, detailed WPs and their associated activities are planned with greater fidelity to allow for execution level detail. Beyond the rolling wave and block plan spans there are typically planning packages and/or SLPPs. LOE WPs are not required to follow the rolling wave cycles. To avoid needless work efforts and costs, the DOE FPD and other feds should be cautious to promote or require detail planning beyond the near-term rolling wave/block planning period. In dynamic projects, it can be ineffective to detail plan for periods beyond that, since detail plans beyond one year may become obsolete before they start.

Advantages of a Planning Horizon Strategy:

- Ensures an execution plan that can be used by the entire project team to manage the work;
- Provides detail only for a short period that is well known;
- Ensures that the detail always exists into the future; and
- Is cost effective as compared to the detail planning of the entire project.

Rolling Wave Technique: While all project effort is planned and controlled through the control account, most contractors recognize that it may not be practicable or possible to do grassroots planning for an entire project. Taking this limitation into account, budgets are typically detail planned for activities that are scheduled to start within planning horizons of three to six months using the control account WPs. Budgets beyond this time frame are recorded on the control account-planning package. The conversion of planning package (or far-term) budgets into precise WP (or short-term) budgets typically start 30 days prior to the when planning packages enter the planning horizon.

Block Planning Technique: For Block Planning, budgets are typically detailed and planned to the next major project technical milestone or event. Typically, planning blocks range from between six and twelve months. Budgets beyond this time frame are recorded on the control account-planning package. The transfer of planning package (or far-term) budgets into precise WP (or short-term) budgets typically start 30 to 60 days prior to the beginning of the block. This process is followed until all planning package budgets have been incorporated into a detailed plan. Prior to the completion of each block the CAM, together with functional team members prepare a detailed

schedule (or blueprint) for the use of staff-hours (or labor-dollars) needed to complete all activities within a block of time.

The scheduling system must be initially constructed to ensure that there are technical and other milestones (goals or other concrete evidence of work activity completion) which can be used to measure how much work has been accomplished at any point in time throughout the life of a project. Given this capacity for accurate and meaningful work statusing, the ability to forecast work completion dates is enhanced. CAMs must forecast completion dates for work which has departed from the original plan to ensure that projected schedule slippages are surfaced for management action in a timely manner. The following characteristics define a well-maintained IMS.

- Completeness
 - Project schedule must reflect the entire scope of work including critical subcontract efforts.
- Realism
 - Project schedule must account for work calendars, the chronological order of workflow, logical activity interdependencies, duration estimates that consider resource allocation and availability, and delivery points.
 - Ground rules and assumptions for developing the schedule are clearly defined and documented.
 - Project schedule is properly updated, is current and relevant.
- Reasonableness
 - Schedule specified for a project must present a feasible or reasonable plan for the sequence and duration of the work.

The baseline schedule is a plan that represents the way the work scope will be executed at the time it is established. The forecast schedule is statused (typically monthly) to report current progress against the baseline and to forecast the schedule status of incomplete activities up to and including project completion.

When maintained properly, the IMS provides project management insight into the program's progress and its planned and forecasted duration. To accomplish this, the baseline schedule must be maintained to continually enable a comparison of planned and actual status of technical accomplishment based on milestones or other indicators used by the contractor for control purposes. Furthermore, as the PMB is maintained to reflect a realistic plan in terms of resource requirements, the baseline schedule must also reflect a realistic plan in terms of activity durations. When the PMB and schedule baseline are realistic with meaningful performance measures and/or interim milestones representative of technical accomplishment, time-based analysis of planned and actual status of completed work can be used to provide reliable forecasts of completion dates for scheduled work. The schedule should be baselined to the actual way in which work will be performed. This is

typically done using the calculated early dates from the network logic. If the contractor elects to baseline the schedule using the calculated late dates from the network logic special attention and justification will be needed to validate the use of late dates are not for reasons of having the EVMS generate positive metrics.

For the IMS to produce meaningful results, the schedule must represent all work required to perform the scope of the project, the activities must have durations based upon the scope and resources required to perform the work, and all logical relationships must have assigned predecessors and successors to complete the integrity of the network of activities. To help model the schedule to real life impacts, several options are available in the scheduling toolset. One option, lags, is available to offset time between activities and milestones in the schedule network. However, lags, especially negative lags that are counter to the flow of time, are strongly discouraged as they may impact the accuracy of the critical path. Constraints place restrictions on either start or finish dates of activities and may impact the critical path accuracy as well. The schedule should be relatively free from constraints allowing the network to reflect accurate schedule impacts. Constraints are useful to hold the project end date in place, but when used elsewhere, the critical path may be distorted. A single constraint placed on the end item DOE deliverable will facilitate the development of a critical path and allow accurate calculations of dates and float in the schedule.

After a project is baselined, routine updates occur to both resource and schedule information. In addition to confirming start and finish dates, updates should be made to an activity's duration length and modifications to relationships (i.e., links) between activities as and when necessary. The impacts of these changes should be immediately visible throughout the area of the network affected. Schedules are typically updated at the close of each monthly accounting period and are the responsibility of the CAM and Project Manager. The purpose of schedule float is to prioritize the resources. The critical path may change on the project as near critical paths slip more than the critical path; schedule float is that indicator. Schedule float that is the least (positive or negative) indicates the activities, based on status, that are now the most critical to complete in order to maintain the overall critical path. Project managers should look at the schedule float changes weekly or monthly as appropriate to understand the work prioritization. Also changes in excessive positive schedule float may indicate a broken link that needs to be fixed.

Total float is the amount of time an activity can slip before the project end deliverable is impacted. Generally, float greater than 10% of remaining duration in the calendar year is considered high and raises the question whether the activity is linked to an appropriate successor. Float management is the number one tool to managing priorities. If the float is reasonable, then an early warning indicator is degradation of schedule float. It is of particular importance to identify and substantiate the sequences and relationships among activities necessary to complete the critical and near-critical (or low float) paths. Because schedule float is the slack in the project schedule that represents the total amount of time a discrete, non-LOE activity can be delayed without causing a delay to the project.

The objective tests for any activity within a specified 12-month period with a total float equal to or greater than 10 percent of the project’s remaining duration. If an activity is found to have a disproportionate amount of total float, it indicates possible issues with the project schedule’s precedence logic, and the efficiency of resource distribution and work flow. The test is purposefully dynamic to consider the latitude of a project schedule during the early stages of execution and progressively tightens leading to the constrained completion date (or another end point).

Figure 5 illustrates total float being a proportionate measurement to the risk of completing work within the project’s remaining duration. In this example, a three-year project with a total (remaining) duration of 792 days would result in a maximum total float of 79 days (i.e. 10% of remaining duration) for the first 12-month period; a maximum total float of 53 days for period two (i.e. 10% of remaining duration of 530 days); and 25 days (i.e. 10% of remaining duration of 250 days) of total float maximum for all remaining activities in the third and final period.

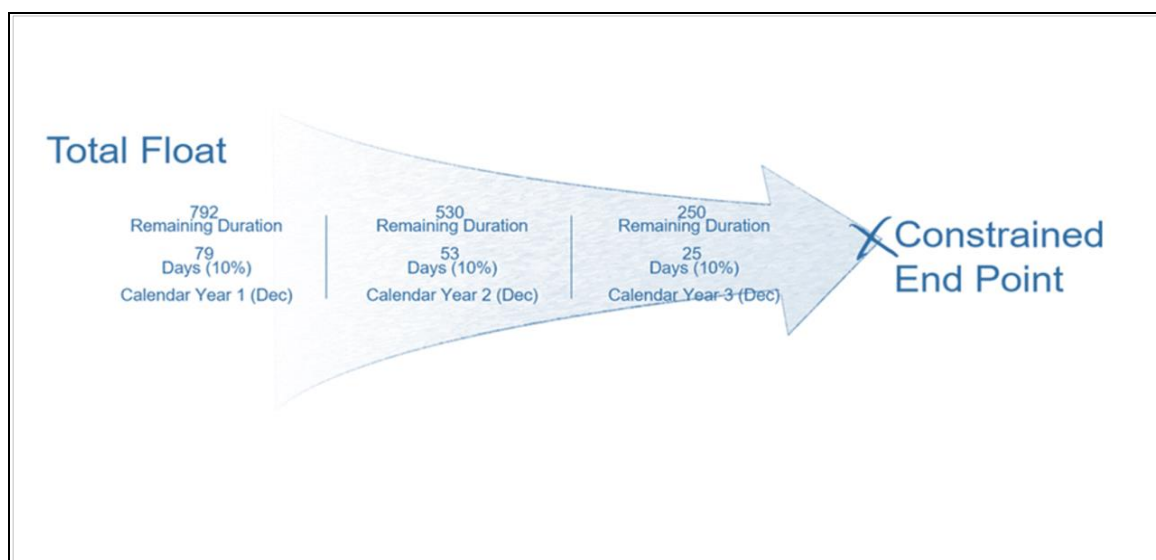


Figure 5. Total Float Proportionate to Risk of Completion Within Remaining Duration

Schedules are statused monthly. This process provides a consistent reporting period that the contractor submits to the DOE. The status date reflects when the status was determined and is the departure point for the schedule forecast. The baseline and forecast schedules are closely related as the status schedule was first derived from the baseline schedule. Project status must be easily reconciled to the baseline schedule to measure progress to the baseline. If there are significant differences between the two schedules, the accuracy of the forecast and baseline schedule become questionable. The forecast schedule becomes questionable if CAM status and forecasts to activities and milestones significantly change from month to month.

Activities associated with work as part of a REA, emerging work, workarounds with new risk mitigation activities, and emergency efforts not already in the baseline schedule may be added to

the schedule within the freeze period or beyond through the Baseline Change Proposal (BCP) process as defined in the contractor's EVM System Description. See Revisions section for baseline change details and Figure 14. Example of Revisions and Data Maintenance Process.

Occasionally, however, it may be necessary to add activities in the forecast schedule that are not reflected in the baseline schedule.⁴ These activities should contain all the attributes expected in the IMS, including code field assignments, work descriptions reflective of scope, durations, interdependencies with other activities, and the resources required to perform the work scope.

Activities not already in the baseline schedule may be added in the forecast schedule under the above circumstances as either an Estimate-to-Complete (ETC) Non-Variance at Completion (VAC) activity or ETC VAC activity. It must be associated with and aligned to the work scope already in the performance measurement baseline. The difference between the two is that:

- ETC Non-VAC activity
 - Non-variance means that no additional costs will be incurred; however, the existing resources are re-spread to provide greater visibility and schedule fidelity.
 - An example: Because of a work-around, instead of two activities over the three months, the forecast respreads the effort to three activities over the course of four months. Resources remain the same so there is no cost impact, however, the duration has changed.
 - The contractor will provide adequate justification where resources are not assigned to these additional activities.
 - The contractor will ensure for the vertical traceability (alignment) between the time-phasing of the resources/costs for added ETC activities and the parent forecast activity they are further defining.
- ETC VAC activity
 - VAC means that there will be an associated cost variance to complete the additional work scope, e.g. emergency effort, emerging work, or REA.
 - Additional costs must be considered in the EAC.

In either situation, the existing IMS network must be expanded (and calculated) to consider ETC activities. Additionally, it is important that the use of either activity type in the forecast schedule be limited in use and is not a substitute for the absence of an adequate level of detail and fidelity in the baseline schedule.

⁴ ETC Non-VAC and ETC VAC activities in excess of their associated baseline activity should not exceed 5% of the total number of activities for the reporting month (freeze period) and 1% of the total number of activities in the forecast schedule.

When the IMS is statused, float values may change and significant changes alert management to areas that may require attention. To ensure integration between the baseline schedule and the PMB for both cost and schedule analysis, consistent reporting of progress (BCWP) and actual costs (ACWP), the month-end accounting period (commonly referred to as the cost processor date) must coincide with the schedule reporting period (schedule status date or data date). Completion criteria must be very clear. An example of this would be using activity names to describe completion criteria such as: "complete soil compaction test number one." Frequently, subcontractors represent a significant portion of the project. If this were the case, subcontractor schedules must be an integral part of an IMS. The accuracy of these schedules is critical and the CAM or manager responsible for oversight of the subcontractor must review and approve these schedules.

The contractor PM must ensure that the LOE relationships are appropriate. LOE activities are never linked as a predecessor directly or indirectly to discrete activities. Ensure the relationships are appropriate and not tied to discrete activities in a way that would allow LOE activities to impact discrete effort date calculations, contractual event date calculations or place LOE activities on the critical path.

An important factor in determining the time required to complete the project schedule, and EIA-748 requirement, is identifying the critical path. If an activity is delayed on the critical path, by definition, the project is delayed. Total Float is the amount of time that an activity can be delayed from its early start date without delaying the project finish date.

Precedence logic defines the sequencing order of work, and how activities are related to one another in the project schedule. If an activity is to be completed before the next activity can be started, the preceding activity has precedence over the latter activity. Excessive float may indicate that there are missing activities, or that the schedule contains incomplete or inaccurate precedence logic. Often times excessive float occurs when activities are connected to the project completion milestone which can be years away. While convenient, this constrained successor is not likely to be the most appropriate logic tie and can invalidate the identification of the project critical path. The test examines the degree of schedule flexibility at the project level and at the activity level, were schedule flexibility is gradually reduced through elapsed time.

Negative float in a schedule indicates that activities and milestones cannot meet their required finish dates based on precedence logic, duration, and status. The more negative the float value, the larger the issue is for the elements of the schedule that must be recovered to meet their finish date requirements. Negative float in the baseline schedule indicates an unachievable plan and should be addressed whenever present. Negative float in the forecast schedule is more common and represents a call for action. As such, a recovery plan should be developed and implemented to address that condition. Persistent, unaddressed large negative float in the forecast schedule is an early indication of violating a schedule constraint, and the potential for missed project deliveries or events.

Project managers need to ensure that the information reported is accurate and consistent with the status period. When the IMS is statused in accordance with the business cycle (no less than monthly), the process includes setting the status date (also known as the data date) to be the end of the reporting period. This will move the forecast of the remaining work to be completed to the right of the status date. There should not be activities that have not been started prior to the data date, nor should there be actual start and/or actual finish dates after the data date. Additionally, activities should not be statused out of sequence based on the status of their predecessors. For example, a predecessor should be completed before a successor activity can start with a FS relationship. If the successor does start out of sequence, then the relationship is overcome by events and should be deleted in the status file and replaced with a meaningful predecessor and successor for each activity. An activity is zero percent complete when it has not yet begun, and it is 100 percent complete when it is finished. The contractor's scheduling system should also indicate the remaining duration (i.e., time) the activity will consume for the determination of expected completion of technical objectives.

An IMS enables project management to perform time-based analyses and schedule risk assessments (SRA), both of which are critical to the success of meeting project commitments. Time-based analysis is enhanced by a properly maintained baseline schedule used for comparisons between planned and actual status. Comparisons are made possible through the schedule status process which involves a determination of physical progress that correlates with technical accomplishment against the baseline schedule, and an assessment of remaining work at the activity level that should provide reliable estimates of projected start dates, remaining duration (expected finish dates), and resources required within the projected time frames. A properly maintained forecast schedule is essential to provide management early warning of critical deviations from the baseline plan in sufficient time to develop work around plans, or determine if technical, cost, or other trades are required to meet the project's objectives.

Problems will occur over the life of the project. Some of the problems will require workaround planning. To maintain the forecast schedule, workaround plans must be incorporated into the project forecast IMS and support the applicable WP and CA schedules (meaning they should be associated with the effort causing the workaround). This includes rework and alternative sequencing. The activities and revised logic ties representing workaround plans must be incorporated into the schedule network to ensure the revised critical path, near-critical paths, and driving paths are properly established. In effect, the workaround, when complete, is the path forward to mitigate a current problem within the forecast schedule. Workaround plans in the IMS typically result in more activities in the forecast schedule than the baseline. However, any differences need to be clearly linked back to the same control account and WP that the work around is supporting.

Before implementation, the potential workaround plans are examined for realism in terms of timing (what are the impacts downstream to work based on these changes), resources (are the needed

resources available based on the new demands of the potential plan) and technical content (will these changes alter the technical goals or requirements). As such, the CAM is a significant partner to analyze realism in any workaround planning. A part of the workaround plan implementation involves changing the logical relationships between activities. While forecast logic changes are not normally subject to change control using internal budget change documentation (e.g., BCR), the CAM is still responsible for verifying the realism of the changes. The analysis should explain changes to critical path or near critical path WPs and PPs (or lower level activities) from submission to submission as well as any changes to the IMP, if required. The impact of critical path changes on major project milestones or other major schedule risk areas should also be discussed. Workaround and/or recovery plans, and associated impacts caused by project changes should also be provided. The schedule narrative should address progress to date and discuss any significant schedule changes such as added/deleted WP(s), planning package(s) or activity(s), any significant logic revisions, and any/all changes in programmatic schedule assumptions. Finally, the analysis should, if required, be able to forecast future potential delays and/or potential problems. This type of analysis should be done as needed and provided to the customer and the project team to assist in the schedule risk management process.

In a dynamic environment with constantly shifting circumstances, it is crucial to control changes or revisions that impact the baseline. After a project is baselined, routine updates occur to scope, schedule and resource information. In addition to confirming changes to baseline start and finish dates, updates should be made to an activity's remaining duration and relationships (i.e., logic links) with other activities when necessary. The impacts of these changes should be immediately visible throughout the area of the network affected. Schedules are typically updated at the close of each monthly accounting period and are the responsibility of the CAM. The CAM must control the changes or revisions that impact the baseline. The baseline represents the foundation on which actual accomplishments are measured. Any changes or revisions to the baseline are made only at the direction of the Project Manager, typically with concurrence from the government. Schedule changes must follow a formal baseline change control process that requires transparency regarding exactly what is changing. Documentation is required to reflect the schedule condition before the requested change and after the change, and rationale providing management sufficient visibility when reviewing and approving the change. This topic will be further discussed in the Revision and Data Maintenance section of this Appendix.

Resources are how work is accomplished. For the IMS to be achievable, resources must drive WP, PP, and activity level durations. The EVMS process must consider the availability of personnel, facilities, and equipment to perform the defined work needed to execute the project successfully. Resource risk must be considered in the development of the IMS, including the effect of external factors such as loss of availability to competing work efforts or unexpected downtime that could preclude or otherwise limit the availability of the resources needed to complete planned work. It is vitally important to recognize that the quality of resource estimates affects the schedule risk, which

includes the assumptions used for resource allocation for work items. See Figure 6. Resource requirements, availability, and hours should be considered in the determination of WP activity and planning package durations. It is important to ensure the type (i.e., trade group) and quantity of resources are identified and understood and not over/under allocated. For example, two plumbers for ten days, or ten plumbers for two days. Resource conflicts (over/under allocations) influences the project critical path and near critical path(s).

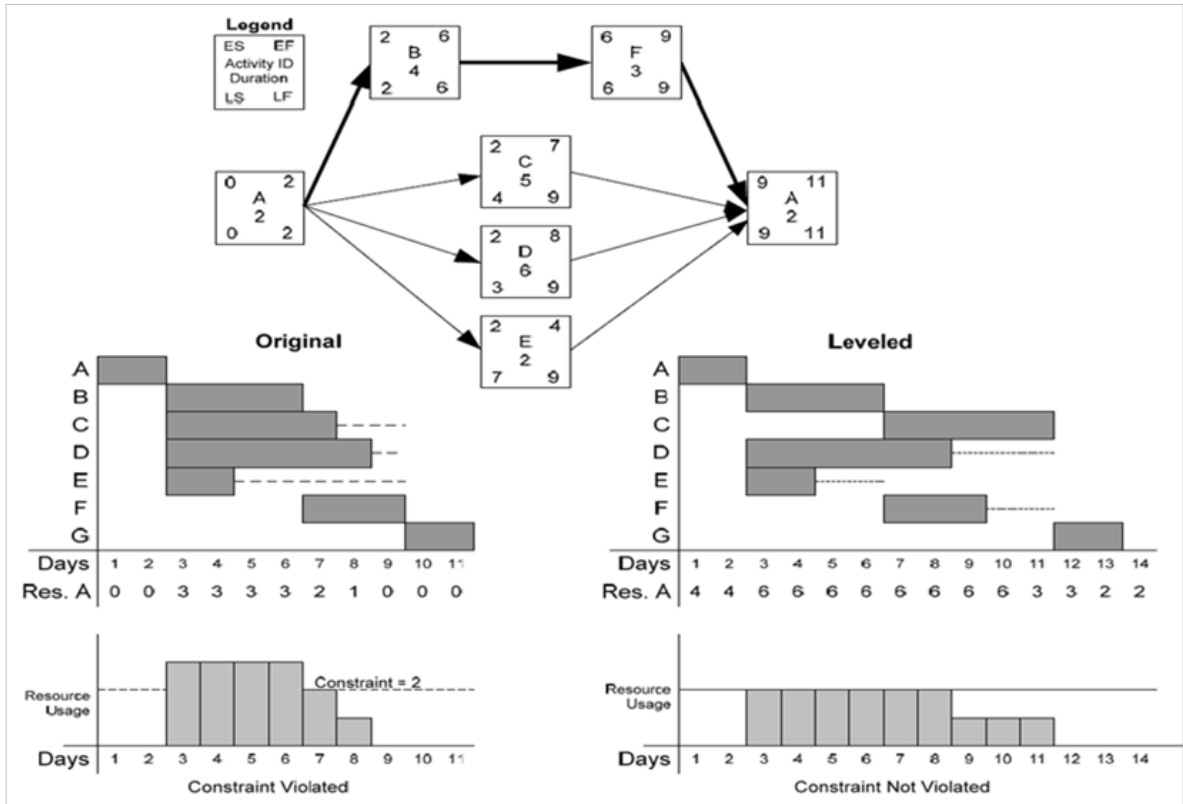


Figure 6. Resource Allocation

Guideline 7

Identify products and milestones for progress assessment

Identify physical products, milestones, technical performance goals, or other indicators that will be used to measure progress.

Purpose of the Guideline

To ensure project schedules establish and maintain a relationship between technical achievement and the objective measurement of performance to accurately report the progress of the work. The

identification of milestones, deliverables, and significant accomplishments within the schedule will make it possible to place an objective value on the amount of work required to meet performance goals, and as work can be proven to have been accomplished, proceed to the next set of activities in the schedule.

Management Value of the Guideline

There is considerable dependence between EIA-748 EVMS Guidelines 6 and 7. For example, Guideline 6 requires sequential scheduling that will identify activity level interdependencies, while Guideline 7 requires identification of interim goals by which to measure the progress of the project. To avoid subjectivity in the assessment of work accomplishment and progress, the contractor should ensure that interim performance goals have been identified and used for developing the project schedule. The project schedule must consider objective product or milestone completion criteria that are meaningful indicators of progress and address the physical or tangible completion of work.

Completion criteria for WPs and activities must clearly indicate what constitutes completion. Naming conventions of activities play an important role in providing clarity to “what complete looks like”. The detailed activities in the project schedule, as well as interim milestones for longer duration WPs, provide objective indicators of progress that correlate with technical achievement, and not just the accomplishment of work. The use of redundant names for activities in the schedule is highly discouraged as clarity is greatly reduced, and it creates confusions during the status cycle.

Impact of Noncompliance

Without identifying objective products and milestones in the schedule that are meaningful interim indicators of progress, the project team will not be able to rely on the schedule to track actual technical accomplishment and provide an accurate assessment of progress toward meeting key event and milestone goals. Missing technical performance goals in the IMS leaves management without visibility into the progress towards achieving project goals and completing on time.

Typical Attributes

1. Are meaningful and objective completion criteria aligned with technical performance goals and used for measuring the progress of milestones, events, and other indicators?

Discussion

The traceability between the various levels of project schedule are designed to ensure that milestones and activities that represent the completion of either all or part of a WP are time integrated at the ascending schedule levels and terminate at a corresponding higher-level schedule milestone.

For the establishment of higher-level milestones, as part of the contract between contractor and the DOE, key events, delivery dates and other milestones are negotiated and bound by the agreement

between the two parties. The most visible of these goals are the Critical Decision (CD) milestones 1–4 on the project. As indicated in the following graphic (Figure 7), the CD milestones help define the boundary points between project initiation, definition, execution, and operations. The contract, PEP, SOW, Work Statement, Conceptual Design Report, and other documents also identify milestones and control points that require effort to perform and therefore influence the IMS. These items may include document deliveries, reports, and other closure items signaling the completion of work. The IMP, when required, or other event-based plan and the IMS are used to track project technical and schedule status, including all significant mitigation efforts that support the risk management process.

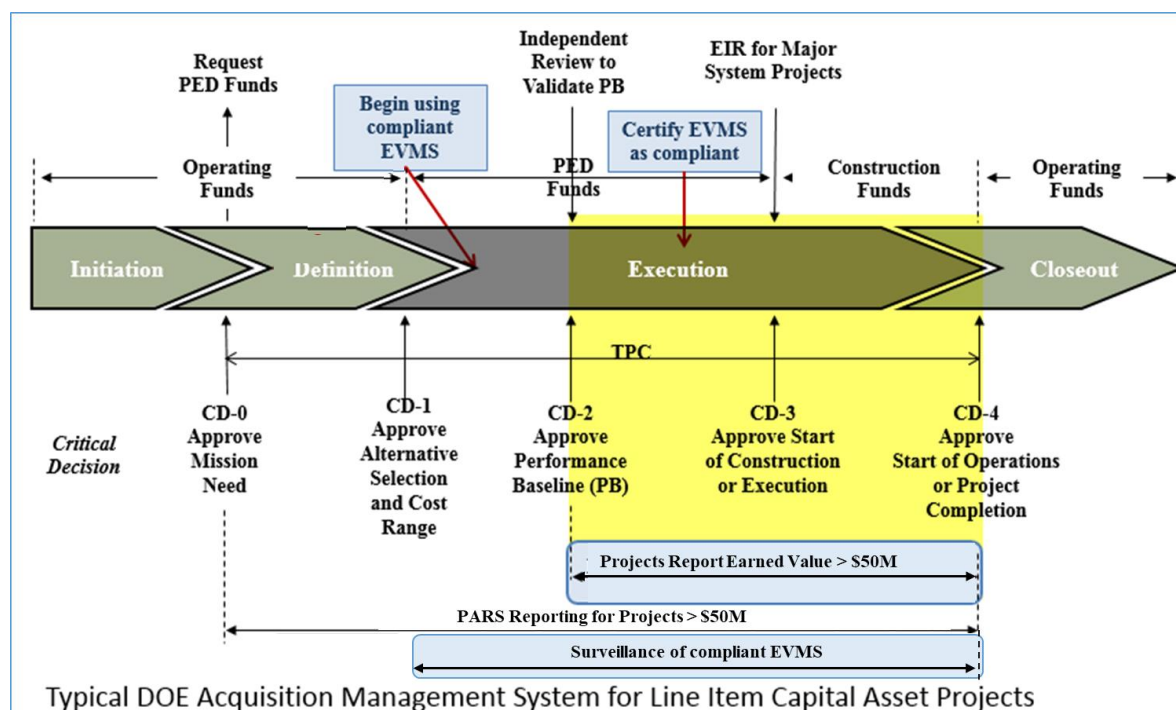


Figure 7. DOE O 413.3B Critical Decision (CD) process and EVMS requirements

The IMP is comprised of a hierarchy of project events, in which each event is supported by specific accomplishments, and each accomplishment is based on satisfying specific criteria to be considered complete. The IMS is an integrated, networked schedule containing all the detailed WPs and planning packages (or lower level activities) necessary to support the events, accomplishments, and criteria of the IMP. From a schedule perspective, the time-based impact of technical performance progress measured using QBDs at the WP activity level must be considered in the IMS calculation. QBDs are discussed in EIA-748 EVMS Guideline 10.

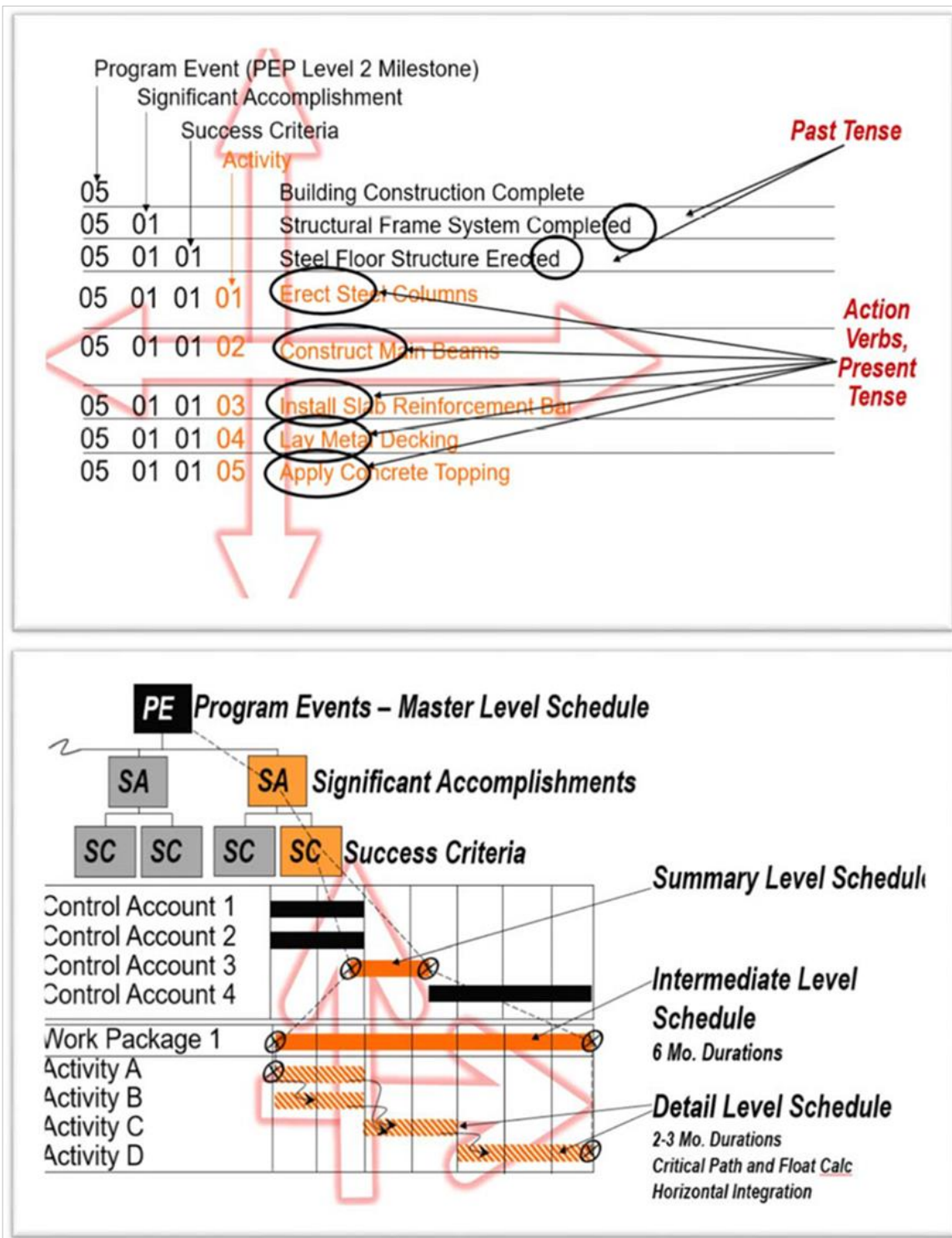
The IMP depicts the overall structure of the project including critical milestones and events. It should define accomplishments and criteria for the successful completion of each critical milestone

or event. The IMP is the contractor's event-based plan for accomplishing the SOW or PEP. The IMS is a networked, multi-layered schedule generated by the contractor that begins with all identified IMP events. The IMP events, accomplishments, and criteria are duplicated in the IMS and detailed activities are added to depict the steps required to satisfy each criterion.

In the event an IMP is not contractually required, the principles should be implemented. In the absence of an IMP, QBDs or interim milestones and control points should be utilized for planning and as indicators of progress to provide close correlation to the accomplishment of technical work scope. An 'event' is defined as high level maturity point. This is typically CD-1, CD-2, CD-3, and CD-4. Accomplishments are generally the 5-10 things at a high level that when complete indicate the event is complete. The criteria are the steps that prove the accomplishment has been finished. By having the schedule hierarchy in this fashion, it shows the schedule is based on accomplishing the technical objectives of the project. The IMS should be directly traceable to the IMP, or to the CD milestone structure more commonly employed in DOE contracts. The result is a fully networked, "bottom-up" schedule that supports critical path analysis. It is always calculated through the end milestone of the project, typically CD-4. Driving paths may use different project events, deliverables, or the project end item (such as CD-3) depending on the reason for calculating and identifying the path(s) with the least amount of float. For more on critical path analysis see EIA-748 EVMS Guideline 6.

Figure 8 shows the single numbering schema that enables traceability through the project schedule. Each activity should be associated with a unique alpha-numeric code used to organize and filter the activities into categories as necessary to confirm a complete scope of work to requirements documents. For example, Significant Accomplishment and Success Criteria is typically written in past tense to signify what accomplishment at complete, i.e. structure erected. Activities are typically written using action verbs, present tense to signify what actions are required to achieve the Success Criteria. Work package activities pertaining to the Success Criteria 'Steel Floor Structure Erected' for the start of the Project Event 'Building Construction Complete' with a WBS identifier '5.1.1' would contribute to a single numbering code that would be reflected in the contract (C0000). The alpha-numeric code would read 'C0000-5.1.1'.

This coding scheme can be expanded to reflect the organization or trade group 'AA' that has been given the responsibility for the work and would read 'C0000-AA-5.1.1'. Combining the IMP alpha-numeric numbering system with the WBS creates a single numbering schema that enables traceability through the IMS.



Guideline 8

Establish the Performance Measurement Baseline (PMB)

Establish and maintain a time-phased budget baseline, at the control account level, against which program performance can be measured. Initial budgets established for performance measurement will be based on either internal management goals or the external customer negotiated target cost including estimates for authorized but undefinitized work. Budget for far-term efforts may be held in higher level accounts until an appropriate time for allocation at the control account level. If an over-target baseline is used for performance measurement reporting purposes, prior notification must be provided to the customer.

Purpose of the Guideline

The purpose of Guideline 8 is to create a time-phased, resourced plan against which the accomplishment of authorized work is measured.

Management Value of the Guideline

This plan must ensure resources for accomplishing the work are time-phased consistent with the planned work scope for all authorized work. This time-phased relationship between authorized work, time, and resources is referred to as the Performance Measurement Baseline (PMB). The government and the contractor have that common reference point, the PMB, for discussing project progress and success.

The accurate reporting of progress against a mutually recognized plan facilitates the implementation of actions by management to maintain or bring the project back on plan. The establishment of realistic budgets, directly tied to the authorized scope of work, is essential for each organization responsible for performing project effort. Also, the establishment and use of the PMB is indispensable to effective performance measurement and it should be in place as early as possible after contract award or Authorization to Proceed (ATP).

Impact of Noncompliance

An inaccurate PMB impacts government and contractor management's ability to use the PMB as a common reference point for analyzing and discussing cost and schedule progress.

Without the timely establishment of realistic budgets directly tied to the authorized scope of work, and time-phased consistent with the project schedule, management cannot rely upon performance measurement information for effective implementation of actions to maintain or bring the program back on plan. To support project management, direct costs must be charged to a program consistent with the corresponding budgets. If charges are not carefully controlled, costs may be misallocated and impact effective performance measurement.

Failure to obtain requisite customer approval for an OTB/OTS, or adequately incorporate changes via the work authorization process impacts management's ability to establish realistic cost and schedule targets and effectively use performance measurement information to manage the project.

Typical Attributes

1. Are all of the elements of the PMB (Scope, Schedule, and Budget) aligned?
2. Does the time-phased PMB represent a reasonable plan for completing the project?
3. If an OTB/OTS has been approved, does the PMB reflect the total allocated budget (TAB) value?
4. Are summary level planning packages established above the control account level for far-term effort that identifies scope, schedule, and associated budget?

Discussion

The PMB is an integrated time-phased budget plan for the accomplishment of work scope requirements on a project having full alignment to resource planning and the project schedule (Figure 9). The PMB includes any UB value that is not yet time-phased (see EIA-748 EVMS Guideline 14) prior to its distribution. The PMB's time-phased budget is more commonly referred to as the Budgeted Cost for Work Scheduled (BCWS).

The PMB is the time-phased budget plan against which actual performance is assessed. The CBB/PBB value used to establish the PMB is tied to the current value of the contract, including any Authorized, Unpriced Work (AUW). The contractor must ensure that the resource plan is executable within budget and schedule constraints and is realistic to achieve the work scope. Additionally, the contractor must use current rates (i.e., approved, provisional, or proposed) when establishing the PMB. Control account budgets to include material and subcontract budgets are time-phased consistent with the project schedule.

The PMB, exempting UB, is the time-phased budget plan that is comprised of SLPPs and CAs. SLPPs are for future effort that cannot be realistically identified to a CA. They are higher level planning accounts above the CA level that identify scope, schedule and associated budget, but have not been assigned to CAs. CAs are detail planned in WPs for the near-term effort and planned in PPs for the far term effort (see EIA-748 EVMS Guideline 6 and 10). The PMB must be planned consistent with the baseline schedule dates and durations in the IMS for authorized work. See Figure 10.

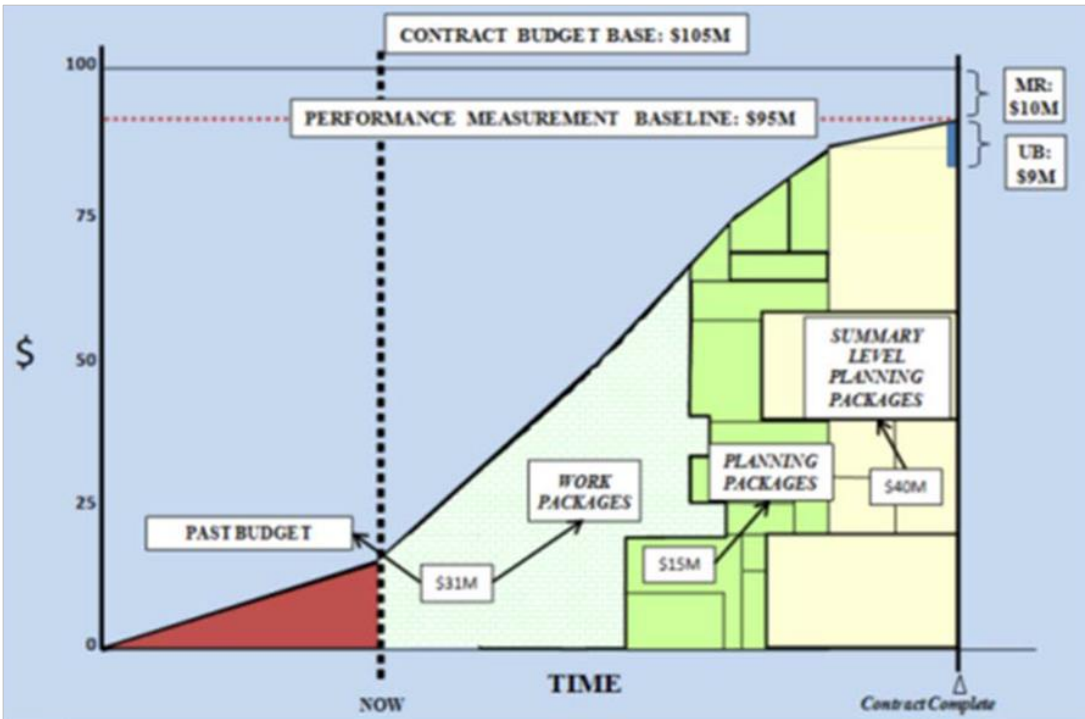


Figure 9. Time Phasing the PMB

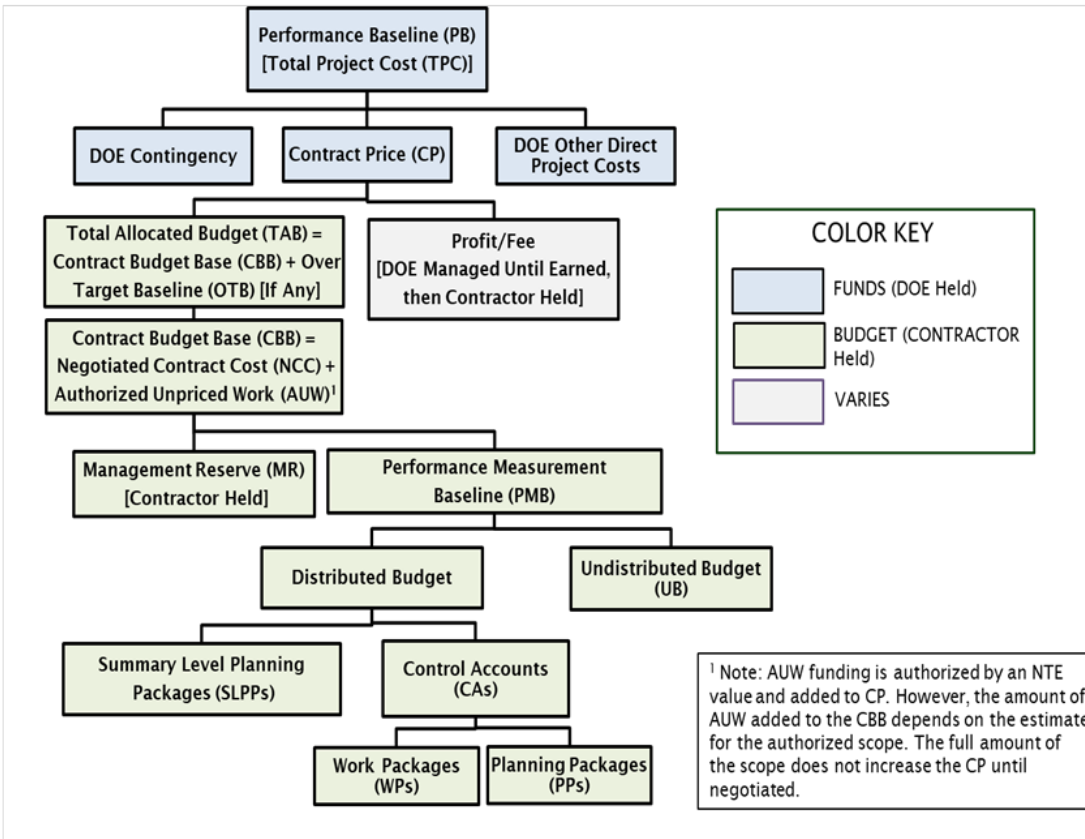


Figure 10. Baseline Hierarchy

As CAs and WPs are scheduled to begin, the CA scope, budget, and baseline schedule are authorized as documented in the work authorization. At a minimum, charges must be collected at the CA level. If charges are at the CA level, concurrent with the start of the first WP, charge numbers are opened and after the completion of the last WP, charges are closed. If charges are at the WP level, opening and closing of charge numbers occurs at the WP level. When work is statused 100% complete, the applicable charge numbers for that labor scope should be closed (it is recognized the charge number may need to remain open for lagging costs ((estimated actuals reported) and/or rate changes for final year-end reconciliation). The CAM remains responsible for the current EAC until final closure.

In cases where remaining budget is insufficient to complete the work scope of the project, the use of zero budget WP activities is not allowed. They provide no performance measurement value, even though they represent discrete work that the contractor must perform. If the contractor recognizes that additional budget is necessary to accomplish the project goals and DOE approves, the budget may be added to the baseline to create an OTB. The primary purpose for implementing an OTB is that it improves managerial control over the remaining project. While it results in a new baseline that is over the CBB/PBB, it improves control of the remaining contract work. Indications that an OTB should be considered include:

- The original baseline is no longer realistic, and managers cease to recognize it as an achievable goal.
- The performance measurement information from an unrealistic baseline is not valid so should not be used for decision making.
- All attention is directed toward the ever-increasing Estimate at Completion with little interest or sensitivity to the schedule or newly developing, potentially correctible cost and schedule problems.

The purpose of an OTS is to facilitate continued sound management practices to complete all work beyond the contract / project completion date. When an OTB/OTS has been approved and implemented, the work authorization documentation for the affected CAs must be changed and approved to reflect the amount of the over target budget. Note: An OTB/OTS must be approved by the DOE Federal Project Director (FPD) in coordination with the designated DOE EVMS focal point and contracting officer before implementation. Refer to Figure 11.

non-resource baseline activities is permissible on a limited basis for scheduling subcontract fixed-price procurements only⁵. The goal is to enhance the planning and scheduling of subcontract work to increase the effectiveness and usefulness of the project schedule. The zero budget non-resource activities should be linked to the subcontractor progress payment milestone for which the work is intended.

Guideline 9

Authorize and budget by cost elements

Establish budgets for authorized work with identification of significant cost elements (labor, material, etc.) as needed for internal management and for control of subcontractors.

Purpose of the Guideline

Through a formal work authorization process, resources required to execute the control account's scope of work are identified, planned and budgeted by element of cost (EOC).

Management Value of the Guideline

Approved work authorization must precede the baseline start and actual start of work. No work shall begin before work is authorized by an initial work authorization. Formally authorizing the work ensures the assignment of project work scope to the responsible organization is clearly documented and the resources required for completing the work are budgeted and acknowledged by the management team prior to commencement of work. Budget is established for work scope that is then further planned by the EOCs for labor, material, subcontractor, and other direct charges required to accomplish it.

Impact of Noncompliance

Lack of planning and establishing budget by EOC impacts management's ability to allocate resources effectively and ensure all required resources are committed and available to the project. This, in turn, affects the execution of the control account work scope within schedule and budget constraints. Ensuring control account budgets are authorized and planned by EOCs facilitates management insight into program performance at the resource level. Inadequate work authorization increases the risk of performing unauthorized work and cost overruns. Unauthorized expenditures, budgets, and scheduled activities prior to formal work authorization may be an indicator of lack of program management attention and control over resources, baseline plans, and schedule resulting in poor execution of contract

⁵ Additional guidance is contained in the DOE-PM (PM-30) Position Paper "Application of the Schedule of Values (SOV) Method with Zero Budget Activities, 10/25/2018".

requirements. Failure to be able to rollup costs by dollars will prohibit reconciliation with the PMB and impact visibility and analysis of dollarized cost performance at key management control levels.

Typical Attributes

1. Do Work Authorization documents identify scope of work, budget by element of cost, and period of performance?
2. Does the contractor require that work scope, schedule, and budget are authorized before the work is allowed to begin and actual costs are incurred?
3. Within control accounts, are budgets segregated and planned by element of cost (e.g., labor, material, subcontract, and other direct costs)?

Discussion

Work authorization includes the control account relationship to the WBS element and responsible organization. An approved control account by way of the work authorization process is the contractor Project Manager's vehicle to delegate responsibility for budget, schedule, and technical scope requirements to a designated CAM. A budget is established for work scope that is then further planned by EOCs for labor, material, subcontractor, and other direct charges required to accomplish it. For the purposes of EIA-748 EVMS planning and budgeting, work authorization for the entire TPC value begins with the establishment of the Performance Baseline (PB) at CD-2.

Approved WADs must precede the baseline start and actual start of work. No work shall begin before work scope, schedule, and budget are formally authorized by WADs. This process is a both a planning and control function to ensure that the assignment of program work scope to the responsible organization is clearly documented and the resources required for completing the work are budgeted by EOC within the baseline schedule period of performance and acknowledged by the management team prior to commencement of work.

For emerging work associated with Authorized Unpriced Work (AUW), at least partial authorization is required before work is performed, and actuals are incurred. This authorization may be a week, a month, or longer as long as it has scope, schedule, and budget consistent with the interim authorization. Interim authorization may be approved by the contractor PM through a directive as long as it is replaced within several months with a formal work authorization that is also approved by the CAM. This process is to allow for authorization of emergency work consistent with the intent of earned value. However, no work may proceed without formal DOE authorization verbal or written if new project scope is the result. See EIA-748 EVMS Guideline 28.

EOCs are a subset of the CA and WP budgets. Initially, the Basis of Estimate (BOE) was developed and broken out by EOC to provide enough detail for resource planning. EOC budgets found in the

WAD are direct descendants from the BOE. EOCs may vary by contractor as they are controlled by company accounting practices.

Budgets for direct costs are those chargeable to a specific WP and include labor, materials, equipment, and any other resources defined by the project. The time-phasing of material budgets should be consistent when the material is expected to be received and consumed (See EIA-748 EVMS Guideline 21 for acceptable points for planning and measuring material). Budgets for subcontractors are time-phased to support project schedule requirements (See EIA-748 EVMS Guideline 21 for acceptable points for planning and measuring subcontracts to vendors). (See EIA-748 EVMS Guideline 13 for establishing indirect budgets). Budgets may be stated in dollars, hours, or other measurable units consistent with the budget values reflected in the CAPs and the latest WADs. Figure 12 depicts the segregation by cost element.

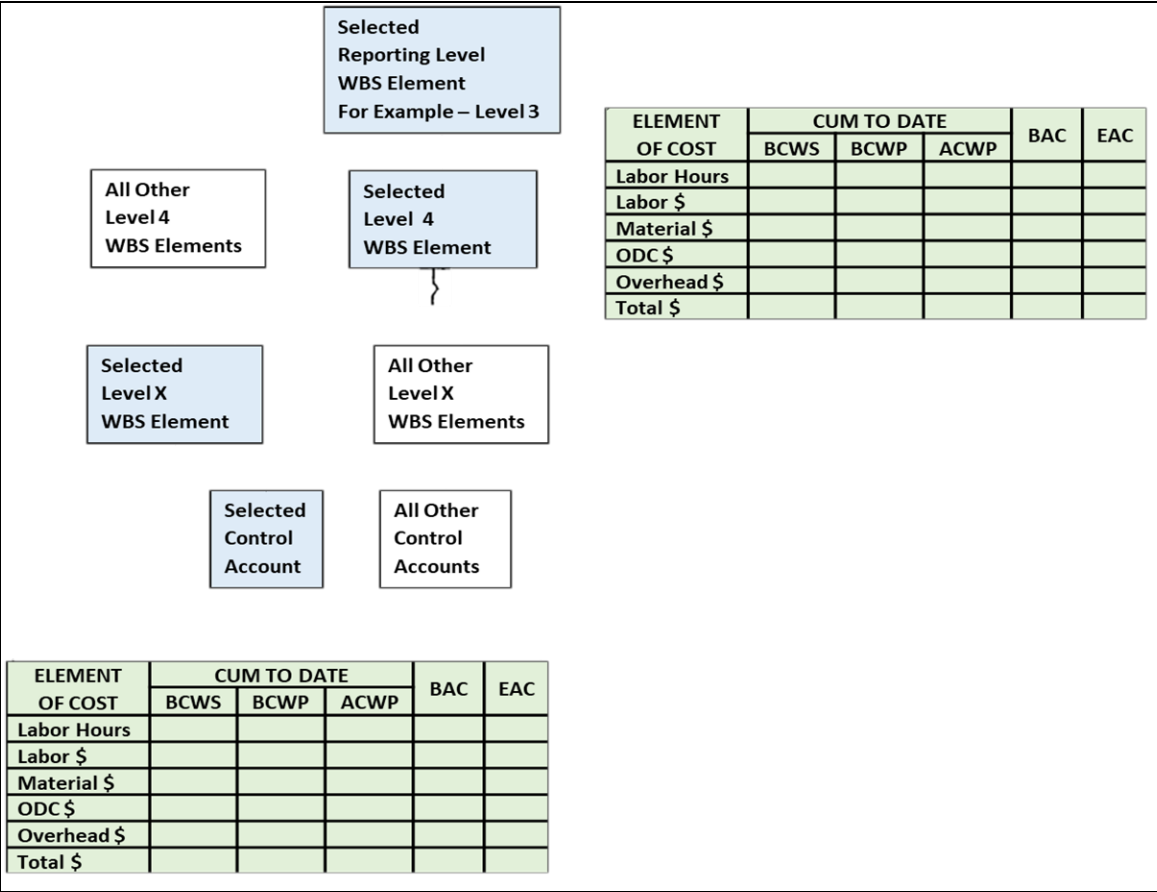


Figure 12. Element of Cost Vertical Alignment

The formal work authorization process extends from the project level to the CA. Budgets for WPs within the CA are the responsibility of the CAM. The BOE developed for the project during the proposal phase is typically used as the basis for development of the WP budgets as details by EOC are found in this document. The WP budgets plus planning package budgets (if any) must sum to

equal the CA budget. Material and installed equipment budgets should be based on the defined and expected quantities needed to meet the requirement and scheduled using the negotiated delivery date (the Bill of Material (BOM) is typically the basis of the budgets). Materials can range from major procured subsystems and fixtures to things such as structural steel, concrete, asphalt, and lumber. Installed equipment includes any custom or mass-produced assemblies that become part of the project, such as generators, pumps, chillers and other similar equipment. Budget for authorized subcontractor work is based initially on the prime contractor's estimated value and must be updated to reflect final negotiations. Authorized subcontracted work must be integrated into the prime contractor's PMB.

Budgets are typically planned in hours for labor elements, dollars for other direct costs, and quantities for material elements. Material WPs may be initially planned as yards of concrete, tons of steel, etc. However, all WP budgets must be converted to dollars through the application of standard labor rates, material unit prices, etc. Current overhead and other indirect rates (approved, provisional, or proposed) are also applied as appropriate for the establishment of indirect budget components of WPs. WP budgets are then rolled up to the CA level and included in performance reports.

Guideline 10

Determine Discrete Work and Objective Measures

To the extent it is practicable to identify the authorized work in discrete WPs, establish budgets for this work in terms of dollars, hours, or other measurable units. Where the entire control account is not subdivided into WPs, identify the far-term effort in larger planning packages for budget and scheduling purposes.

Purpose of the Guideline

Ensure control account work scope is partitioned into executable and measurable segments of work that are accomplished within the authorized control account period of performance (POP).

Management Value of the Guideline

Because it may not be practicable to do grassroots planning for an entire project for which there is insufficient information to make detail planning practical, planning packages (or far-term/aggregate scope) budgets are decomposed into precise WPs (or short-term/detailed scope) through the rolling wave planning or block planning process. This process is followed from the beginning of the contract through its end until all planning package budgets have been detailed planned. The selection of an appropriate WP Earned Value Technique (EVT) allows for accurate and objective performance measurement. The selection of EVT that best reflect the activity being performed can provide accurate status and situational awareness for proactive resolution of issues impacting cost, schedule, and technical achievement of project objectives.

Impact of Noncompliance

The selection of inappropriate EVT's would not allow for accurate and objective performance measurement. This could result in inaccurate status and impact management's ability to use performance measurement information to identify and resolve issues impacting project schedule, cost and technical objectives.

WPs that are not limited to short spans of time, and not supported by objective QBDs, could impact the accuracy of progress assessments and impact management's ability to use performance measurement information to identify and resolve issues impacting project schedule, cost and technical achievement of project objectives. In a dynamic or uncertain work environment, the longer the WP, the greater the risk over time that the active plan will vary from the baseline plan. Long duration WPs (greater than 6 months) run a higher risk of developing cost and schedule variances that can be attributed to challenges in keeping to a plan that is likely to change. Additionally, long duration WPs may impact the CAM's flexibility in planning once the effort has started, cause inefficiencies if there is a change in approach that requires replanning or require needless reporting of variances if the approach changes and replanning is not accomplished.

Failure to separately identify a single EVT at the point where performance is taken can result in an ineffective baseline for performance measurement. Unless every WP or its activities can be identified to its end-result with clear exit criteria that aligns to the CA's technical scope objectives, there can be no assurance that progress assessments are meaningful indicators of technical accomplishment in meeting the project's objectives. Subjective assessments of progress could impact management's ability to rely upon and use performance measurement information to identify and resolve issues impacting project schedule, cost and technical achievement of project objectives.

Confusion in identifying specific and unique WP title descriptions can lead to planning errors, and inaccurate performance measurement. This may also result in invalid EACs reported to the DOE. Additionally, EVT's that are inconsistent with the way material is planned would not provide accurate status and situational awareness for proactive resolution of issues impacting cost, schedule, and technical achievement of project objectives. If the IMS and the EVMS cost tool are out of alignment with reporting progress, management and customer are deprived of sufficient reliable information to make competent management decisions.

SLPPs and PPs without distinct scope, schedule, and budget defined by EOC impacts management's visibility into remaining far-term effort. Indistinct PP work scope, resource requirements, and misaligned scheduled start and finish dates can impact PP conversion to WPs due to insufficient controls to prevent budgets allocated to future work from being used in the near-term. This would deflect management attention from taking actions on current problems and delaying visibility of impending variances due to insufficient budget left for remaining work. The long-term effect would

place the project at risk for not meeting goals and deliverables because of ineffective baseline maintenance planning and controls.

Inability to convert technical progress into a measure of performance (i.e., BCWP) invalidates the EVMS reporting of the project, impacts the accuracy of cost, schedule, and technical progress assessments and impact management's ability to use performance measurement information to identify and resolve issues impacting project schedule, cost and technical achievement.

Typical Attributes

1. Are discrete WPs relatively short in time or do they have objective interim measures or milestones, such as points of technical achievement to minimize the subjectivity of in-process evaluation and enable accurate performance assessment?
2. Is future work which cannot be planned in detail subdivided to the extent practicable for budgeting and scheduling purposes?
3. Do all WPs and planning packages have a budget or assigned value expressed in terms of dollars, labor hours, or other measurable units?
4. Is a single EVT (Discrete, LOE, or Apportioned) assigned per WP?
5. Are WPs clearly distinguishable from all other WPs including the titles being unique and consistent with the scope of the WP?
6. Are WP or activity (where performance is taken) EVTs consistent with the manner in which the resource budgets (all elements of cost) are planned to be performed and progress measured?
7. Are detailed WPs planned as far in advance as practicable and is work progressively subdivided into detailed WPs as requirements are defined?
8. Can the WP and planning package budgets be substantiated?

Discussion

Effort contained within a CA is distributed into either WPs or PPs. WPs are the manageable units of work that must be accomplished in order to fulfill the contractual goals and deliverables on the project. The resources assigned to WPs are to be time-phased the way the detail work is to be accomplished. The selection of appropriate EVTs will allow for accurate and objective performance measurement. WP descriptions and titles must clearly distinguish one WP effort from another. The schedule may have more detail below the WP/planning package level to support the development of a realistic critical path, as applicable.

The objective of a WP is to plan the work in small, manageable segments using objective measurements of progress at the activity level to effectively manage and execute the project's scope, schedule, and technical objectives. It is important that the earned value for work completed (or BCWP) is calculated in a manner consistent with the way work is planned (or BCWS). Discrete work is defined as a specific product or service with distinct and measurable outputs that are

relatable to the project's technical objectives. These measurable outputs are where project status can be measured objectively by planning the work in small, manageable segments at the activity working level. WP and planning package quantities, sizes and durations within a control account will vary subject to scope, internal management needs, and the size and complexity of the contract. Examples of measurable products or outputs include design efforts, a tool design package, a build-to-package, a shop order, a part number, a purchase order, or any other definable product.

The expectation is that WP activities with an EVT of 0/100 should be 22 working days or less in accordance with GAO-16-89G which states:

“In general, estimated detail activity durations for near-term effort should be no longer than the reporting period established by the program. For example, if the reporting period for a construction project is weekly, then near-term activity durations should be one working week or less. If management requires monthly updates, then near-term activity durations should be about 22 working days or less. If activities are longer than the reporting period, activities should have at least one quantitative measurable event within the reporting period.”

A WP with an EVT of 50/50 should be 44 working days or less in duration to support quantitative earned value assessment and to have executable detail for the current periods. The 44 working days represents two accounting months according to most accounting calendars. Discrete WPs may be longer than 44 working days (up to six months, i.e. 132 working days) when supported by short duration activities or QBDs with technical progress points. There is no intent to artificially break up a WP. Each WP is unique and has exit criteria. The intent is that what is defined as a WP is at a certain level of fidelity. Excessively long WPs should not be allowed when they do not support a rolling wave or block planning process.

The selection of an appropriate Earned Value Technique (EVT) allows for accurate and objective performance measurement. The selection of EVT that best reflect the activity being performed can provide accurate status and situational awareness for proactive resolution of issues impacting cost, schedule, and technical achievement of project objectives. A single EVT is required at the point where performance is taken. Contractors often do this at the WP level; however, it is optional for a contractor to support WPs with single EVTs designated at the activity level when performance is taken at the activity level.

The contractor must have a good workable definition (in its EVM System Description and in practice) of what constitutes a WP. Each WP must also be identified as to its end-result (i.e., what part it has to play in accomplishing the scope of work of the CA).

Additionally, and of most importance, is the requirement to identifying appropriate, objective completion criteria that will align how technical performance will be accomplished is essential for

accurate measurement of progress (or BCWP). The completion criteria must answer the question: “What does ‘done’ look like, rather than what work has been done?” Completion criteria is typically found and defined in the titles of WPs or its activities in the IMS.

At a minimum, WPs should reflect the actual way the work is to be done and should be a clearly distinguishable subdivision of a CA. Each WP must be distinct from other WPs, with each WP containing mutually exclusive work scope and a unique WP title/ID in the cost tool. Similarly, when EV progress is determined at the activity level and summarized to the WP level, activities should be a clearly and distinguishable subdivision of a WP. Each activity must be distinct from other activities, with each activity containing mutually exclusive work scope and a unique title/ID in the IMS. The reviewer should look for WPs with duplicate names (titles) in the EVMS cost tool and, when applicable, activities containing duplicate names (titles) in the IMS.

The selection of an EVT that best reflects the activity being performed can provide accurate status and situational awareness for proactive resolution of issues impacting cost, schedule, and technical achievement of project objectives. Material is planned based upon when it is needed. The point of performance must be established no earlier than the actual receipt of the material items in lieu of preferred receipt (with inspection and acceptance). More suitable representation of material progress are points in time that are closer to the point of usage or consumption such as release from inventory to work-in-progress, and delivery to the user when applicable (i.e., for direct delivery material). Material items that are subcontracted to vendors to develop, build, fabricate or manufacture may be planned (or BCWS), and performance taken (or BCWP), using progress payment milestones that are supported by a plan detailing technical or physical accomplishment.

HDV materials are planned discretely using objective milestones or other rational basis to measure the amount of material received. If there is no guidance to differentiate between low and HDV material, all material must be planned as discrete HDV material requirements. For some low value material items, LOE may be the appropriate EVT provided there is company guidance.

Another technique called PERT cost (EAC based, see Appendix B for Formula) is preferred to LOE for low value material but may only be used for low value material. The planned budget must be consistent with the point in the material cycle when performance is expected to be claimed. For example, if milestones were set up to claim performance for critical or high value material upon receipt and acceptance, then the budget must be planned against these milestones and scheduled accordingly. This alignment ensures a valid measurement of schedule variance. Procurement activities are part of the construction process and must be scheduled as such.

Material must be segregated from other elements of cost into separate WPs as performance is earned differently. It must be planned and scheduled according to material need dates to support of the negotiated delivery dates of final products. Leading up to final negotiations the need date should be

used for planning and scheduling purposes. If a negotiated delivery date occurs prior to the actual need date, the baseline project schedule should reflect the negotiated delivery date. This will ensure for the accurate assessment of material performance measurement to align with the procurement system. Enough detail on HDV/CI must be included in the project schedule for timely identification of problems and delays on the procurement of key materials and equipment which can have a domino effect on successor construction activities. Material is time-phased by dollar amount based on the type of material. Contractors must conduct an analysis to identify and differentiate categories of material, appropriate planning method, and the associated EVT. This analysis must distinguish between material and subcontracted effort. (See EIA-748 EVMS Guideline 21 for further information on material EVTs and HDV definitions).

PPs represent the portion of a control account that has not yet been detail planned. They must have distinguishable general scope descriptions, scheduled start and completion dates, and associated budget time-phased within the scheduled time frame consistent with resource estimates by EOC, but do not have established methods of earning performance. SLPPs are work efforts at a higher level not assigned to control accounts, but still have scope, schedule and budget by element of cost.

The selection of an appropriate WP EVT allows for accurate and objective performance measurement. Objective accomplishments and completion criteria are determined in advance and used to measure progress to determine achievement of milestones/events or other indicators. To achieve the EIA-748 requirement for the objective measurement of project progress indicative of a specific quantity installed or other technical achievement, the integration of work scope, cost, and schedule must always be maintained. The CAM must establish interim milestones and WPs (or lower level activities) that serve as indicators of progress. Control account planning must interface and align directly with critical milestones and events, accomplishments, and criteria or other progress indicators listed in supplemental schedules. Performance metrics ensure that maximum time is allowed though early warnings of developing problems for management action to keep the project on plan. The intent of earned value as it relates to objective criteria and EVTs is that the work is statused consistent with the technical progress. Said a different way, if the work is on schedule, it should not have a schedule variance, and if it is behind or ahead of schedule, it should have a negative or positive schedule variance. This evaluation is accomplished with objective indicators that reflect technical accomplishment in the BCWP for all discrete work consistent with progress achieved towards each of the goals of the project's key events, decision points, and milestones. This process provides managers with accurate schedule status and credible early indications of project problems where there is a need to take corrective action.

The objective indicators required at the WP level depend on the EVT used. For example:

- 0/100 is limited to WPs that will be complete within the same accounting month as the start. They should not exceed 22 work days in duration. The objective indicator is the WP exit criteria.

- 50/50 is limited to WP with durations of two accounting periods (i.e., 44 work days or less). The objective indicator is the WP exit criteria.
- Milestones or Milestone weights with percent complete. The objective indicators are the milestone definitions/definitions of completion. This technique allows partial completion for milestones when an objective estimate of completed portions of a given milestone is possible. The milestone weights with percent complete require at least one technically-based milestone every other month to prevent artificial schedule and cost variances.
- Percent Complete WPs requires objective indicators. These are typically WPs that exceed two accounting periods in duration and should be supported by activities and milestones within a WP, QBDs, or rules of performance that restrict the percentage completion to predetermined measures of technical progress. These QBDs are subject to change control once the WP has started and should also have enough technically-based QBDs so at least one can be completed every month, preventing artificial schedule and cost variances.
- LOE is not an objective EVT and therefore has no objective indicators. LOE performance is claimed solely by the passage of time and will be claimed regardless whether any actual work was performed. For this reason, the use of LOE as an EVT should be limited solely to work that is not measurable.
- Apportioned effort is work associated with other discrete work and therefore has no specific unique objective indicators; however, the methods of the apportionment must be documented, logical and demonstrable. Apportioned effort must have a direct relationship to discrete work whereby the percent complete reported by the discrete effort is appropriate for the percent complete to be reported by the apportioned effort.

WP EVTs may be assigned at the WP level or to the activities within the WP supported by EVTs at the schedule activity level. The EVT WP percent complete is determined by the sum of activity percent complete BCWP of WP activities reported in the EVMS cost tool. While the % complete from the cost tool is reported in PARS, it should also agree with the schedule tool. When supported by activity level EVTs the following aspects are required:

- WPs should not commingle discrete and LOE activities. If LOE activities are contained within a predominantly discrete CA, the LOE work should not exceed 10 percent and the cost performance of the discrete work must be clearly discernable.
- LOE comingling with discrete work at the activity level follows the comingling restrictions in Guideline 12 discussion.
- Discrete activities must be associated with EVTs (follow the EVT duration guidelines).
- BCWP is calculated by activity and summarized to the WP level in the EVMS cost tool to calculate the percent complete.

The IMS is the source for dates and progress of effort to the EVMS cost tool. The technical basis of progress is reported to the EVMS cost tool, summarized if necessary and produces BCWP for

analytical use to support managerial decisions. The pathway from schedule baseline to schedule forecast, to status, to BCWP must be documented, consistent and accurate.

When the CAM provides status to the schedule, at least on a monthly basis, the same information must be accurately reflected in the products from the EVMS cost tool without adjustments from outside departments or individuals. The progress status reported by the CAM is based on technical achievement, not on elapsed activity duration. Therefore, progress is reported and transmitted to the EVMS cost tool based on physical % complete or other fields, and not on a percent complete based on elapsed planned duration. With these processes in place, many issues that are identified in the EVMS data can easily be traced back to the IMS for cause, impact and corrective action.

Guideline 11

Sum WP/PP Budgets to CA

Provide that the sum of all WP budgets plus planning package budgets within a control account equals the control account budget.

Purpose of the Guideline

In order to ensure that the PMB is valid the budgets of all CAs which comprise it must be valid. In all cases, the value of the budget assigned to individual WPs and PPs within the CA must sum to the total value authorized for the CA.

Management Value of the Guideline

To maintain the integrity of the PMB, the WP and PP BACs must sum to the associated CA's authorized BAC. The sum of the CA's WP and PP BACs must also equal the sum of the time-phased budgets in WPs and PPs. The benefit of proper summarization results in a project plan that establishes a valid budgetary basis for the PMB at the CA level.

Impact of Noncompliance

Failure to ensure the sum of the budgets of the WPs and PPs sum to their associated CA's authorized BAC would result in an over or under allocation of project budgets inconsistent with contract requirements and a PMB that is not valid at the CA level. This impacts the accuracy of performance measurement data and would not provide a common reference point for government-contractor discussions for accurate progress assessments. An EVMS that has WPs and PPs that exceed the CA's authorized budget is an indicator of an undisciplined work authorization system that does not have proper checks and balances. This calls into question the validity of the PMB and can affect the accuracy of performance measurement information. Budget without scope at the CA level constitutes MR, which if present in CAs, could impact the CAM's ability to accurately status the progress of work and produce reliable EACs.

Typical Attributes

1. Does the sum of all WP budgets plus planning packages within control accounts equal the budgets authorized to those control accounts?

Discussion

The purpose of this guideline is to ensure a discipline check over the WP and PP budgets assigned to the CAs. All CAs contain the budget that represents the work scope assigned to the responsible organization for that specific effort. This includes WPs and PPs. The sum of the budgets assigned to individual WPs and PPs within the CA must sum to the total budget authorized for that CA. The system reviewer and the CAM should always be able to verify that the sum of the EOCs making up the CA budget authorized for that CA scope of work is equal to the sum of the WP budgets plus the sum of the PP budgets. At no time should a CAM have an amount of budget that is not assigned to a segment of work. Such an amount would constitute MR and MR should never exist at the CA level. The system reviewer should ensure that the contractor's EVM System Description gives adequate attention to this requirement and should ensure that the CAs do adhere to this summation principle in actual practice.

Guideline 12

Level of Effort (LOE) Planning and Control

Identify and control level of effort activity by time-phased budgets established for this purpose. Only that effort which is not measurable or for which measurement is impracticable may be classified as level of effort.

Purpose of the Guideline

The purpose of this Guideline is to ensure LOE is limited only to those activities that should not or cannot be discretely planned.

Management Value of the Guideline

Classification of work scope as LOE is limited to activities that have no practicable, measurable output or product associated with technical effort that can be discretely planned and objectively measured at the WP level. Their progress measurement is based simply on the passage of time; they will always get credit for doing what they planned ($BCWP = BCWS$). A schedule variance will never be possible, then, in an LOE activity. In every project, there are activities accomplished that by their nature are unmeasurable or not practical to measure because the end item deliveries are not dependent on the work. Prudent use of LOE is necessary to minimize the distortion of performance data for effective project management.

Impact of Noncompliance

Failure to ensure LOE is limited only to those activities that should not or cannot be discretely planned would inhibit visibility into the progress the contractor is making towards accomplishing cost, schedule, and technical objectives. If LOE activities are not tracked separately from discrete and apportioned WPs, the LOE would distort performance data required for effective project management. Inappropriately coding measurable work using the LOE EVT limits the ability to measure the performance of that work and would mask the performance of other measurable work in the WP, CA and the project.

The schedule performance (or BCWP) or even the cost performance of discrete work of the CA may be masked by the comingling LOE and discrete or apportioned effort. This could result in an inaccurate overall progress assessment for the project, and impact management's insight into developing cost, schedule, and technical problems through variance analysis.

Typical Attributes

1. Is the LOE EVT only used for effort where measurement is impractical or supportive in nature? (Impractical refers to effort that would not affect discrete major end-item deliverables, if slippage occurs.)
2. Is the co-mingling of LOE and discrete effort within a control account minimized, and when co-mingled within a control account is performance of the discrete effort separately evaluated?
3. Is the amount of LOE activity in the plan appropriate for the performing organizations utilizing it, and is it limited?

Discussion

LOE is work defined as having no practicable, measurable output or product that can be discretely planned and objectively measured. LOE scope is typically administrative or supportive in nature and may include work in areas such as project management, contract administration, financial management, security, field support, help desk support, clerical support, etc. Because of this relative ease of working with LOE, it is often selected as the category of effort for WPs that should actually be measured discretely. When determining whether LOE as an EVT is appropriate, an understanding of the nature of the work is imperative rather than setting a threshold for the amount of LOE allowed. The contractor should provide a documented methodology (i.e., process flow) for how LOE work is distinguishable from that of discrete and apportioned work.

A primary deciding factor on whether LOE can be used is whether it can be delayed without impacting discrete work end products. A true LOE can slip years without impacting other discrete work. For example, project controls may produce monthly reports and be responsible for uploads to PARS each month. Although these functions are DOE requirements, the slippage would not affect discrete work major end-item deliverables and so it could be tracked as level of effort. Staffing of

level of effort is also an indication. Management level activities are typically planned by headcount (hours will peak in longer accounting months) and also typically LOE.

While LOE effort is included in the IMS, LOE WPs/activities must not be a predecessor to discrete work activities, as that would potentially distort the calculation of the critical path. However, LOE could be a successor from a discrete activity with no harm to the critical path calculation.

If LOE WPs and discrete WPs are contained within a CA, there must be a means of separately measuring the performance of the discrete work, i.e., actual costs are either accumulated at the WP level, or within the CA, actual costs are accumulated separately for LOE and discrete work. As a general rule, the amount of LOE WP budget at complete (BAC) within a predominately discrete CA should not exceed 15 percent of the CA BAC to keep from masking the performance of the discrete work. If exceeded, a separate CA for the LOE should be considered.

Because LOE accrues BCWP equal to BCWS by the passage of time, there is no objectivity in measuring progress. The SV is always = 0, which tends to mask SV's applicability to discrete effort, if LOE and discrete EVT types are comingled within a single CA. When a CA contains WPs planned with both discrete and LOE, care must be taken to minimize any potential distortion of CA performance.

It is optional for a contractor to support WPs with EVTs at the activity level. However, a single EVT is required at the WP level. One of the basic tenants is that WPs are uniquely discrete, apportioned effort, or LOE. Therefore, if WP level EVTs are supported by EVTs at the activity level, then discrete WPs may only be supported by discrete activity level EVTs.

Construction support Title III Engineering⁶ work scope (T3) and other similar support efforts should be budgeted using the LOE method. If a significant technical/design issue arises during construction, zero budget ETC activities should be added to the forecast schedule and sequenced using precedence logic with the discrete construction work it is impacting. The resultant effect should show the slip/downstream impact to related activity start/finish dates and necessitate the update of cost ETCs. Earned value (or BCWP) for the baseline discrete construction activities shown in the top part of the graphic below can only be claimed when each are successfully completed as shown in the bottom part of the graphic. The associated baseline construction support LOE activity (long bar) should be extended to align with the forecasted finish date of the last discrete construction activity with its remaining budget re-time phased in a linear fashion. The EAC value for the construction support LOE

⁶ Additional guidance is contained in the DOE-PM (PM-30) Position Paper "Construction Support (e.g., Title III) as LOE, 9/14/2018".

should also be updated. Full earned value (or BCWP) for the baseline construction support LOE activity can only be claimed when the last discrete activity has been completed. The handling of Title III Engineering work scope will need to be fully addressed in the Earned Value Management System Description, including the establishment of a threshold level for when ETC activities (aka, zero budget activities) should be added to the forecast schedule. The current compliance thresholds of 5% and 1% for the use of ETC activities in the current month and for the total project respectively will continue to be used as a flag for further assessment.

Guideline 14

Identify MR and UB

Identify management reserves and undistributed budget.

Purpose of the Guideline

The use MR and UB facilitates the planning, communication, coordination, control, motivation, and performance of the project. It is important that controls are in place to ensure budgets that are established for MR and UB are separately identified and controlled.

Management Value of the Guideline

The ability to establish MR allows project management to react to unforeseen in-scope situations that arise during the life of a project. MR is budget for handling project risk and in-scope unanticipated events. EIA-748 is clear in that MR is not a source of funding for additional work scope or for the elimination of performance variances. In doing so, it jeopardizes the legitimacy of the PMB.

UB is budget that is applicable to specific contractual effort that has not yet been distributed to control accounts or SLPPs. UB may also contain scope subject to removal from the distributed baseline due to contractual changes. Identification of the project's UB, facilitates project management's ability to account for and report on all authorized scope and budget. UB is a transitional budget that should be distributed in a timely manner.

Impact of Noncompliance

Without MR the project management team would not be able to budget for, and measure the performance of, unplanned or unforeseen in-scope work. Without UB project management's ability to account for and report on all contractually authorized scope and budget would be minimized.

Failure to segregate MR from PMB overstates PMB and impacts the system's capability to provide visibility into contract cost, schedule, and technical performance through project completion. Failure to adequately use MR for effort in-scope to contract can impact the accuracy of the contract's status using performance measurement information. It may also limit management's effectiveness for using

the system to provide early warning of cost, schedule, and technical objectives and developing reliable EACs.

UB that is not reconcilable to contractual actions is indicative of a PMB that may be inconsistent with contract requirements. Inconsistencies between the PMB and contract requirements can indicate budgets have been over or under allocated, which can impact the capability of EVMS to provide accurate project cost, schedule, and technical performance and produce reliable estimates of contract completion.

Typical Attributes

1. Is MR held outside the PMB?
2. Is MR use controlled and are records maintained that show how MR is used (sources, uses, control account affected, current value)?
3. Is UB part of the PMB, have defined scope traceable to contractual actions, and is it controlled and limited to newly authorized effort which cannot yet be distributed to WBS and OBS elements at or below the reporting level?

Discussion

MR is budget set aside allowing the contractor PM, not the customer, and provides the contractor with a budget for unplanned activities within the current program scope. Throughout the life of the project, MR enables the PM to respond to future unanticipated events within the contract's work scope, by distributing budget to track and mitigate project risks. MR is not associated with a specific scope of work until it is allocated to a CA and therefore, is not included in the PMB. The distribution into and application out of MR must be formally allocated through the change control process. Through this process, the MR budget is transferred to/from WPs within the PMB. MR is not a source of budget for additional work scope (out of scope of the contract/project) or for the elimination of performance variances. MR belonging to a major subcontractor must be incorporated into the prime contractor's EVMS with traceability to the subcontractor's reported MR. The establishment of MR budget by the contractor PM should be commensurate with the level of risks identified by project management.

MR is set aside, from the Negotiated Contract Cost (NCC), by the contractor's PM during the initial establishment of the baseline. This is normally done through an analysis of risk to establish budget for in-scope unanticipated events to handle realized project risks and contingencies throughout the life of the contract. This creates a motivational "budget challenge" for CAMs. MR is not to be associated with a specific scope of work and is not included in the PMB. MR budget is controlled by the contractor PM. It is distributed to the CAMs only when properly authorized. Once distributed, the MR budget becomes part of the PMB.

MR is not a source of funding for additional work scope or for the elimination of performance variances. Using MR budget solely to adjust cost variances is not a legitimate reason for distributing MR budget. MR must not be allocated to offset accumulated overruns or underruns.

Because MR is budget that is not yet tied to work, it does not form part of the PMB. While this definition applies to a prime contractor's MR, when EVMS requirements are flowed down to subcontractors, a common industry practice is to allocate the subcontractor's MR to the prime's PMB, normally as a PP in the last period of a CA containing subcontractor effort. As such, the subcontractor's MR is identified to the scope of the subcontracted effort and subcontractor MR transactions are recorded as adjustments to the PP where it resides in the prime's PMB. The effort within a CA is considered complete when there are no PPs present within the control account, and the sum of its WP BCWP is equal to the sum of its WP BAC. Therefore, when a subcontractor's MR is contained in the prime's PMB within a control account, the control account close-out action includes converting the PP reflecting the subcontractor's MR to a WP and then making the WP BCWP equal to its BAC.

MR is the contractor's budget set aside for management control purposes and used at the discretion of the contractor's PM; the government should not direct contractor use of MR. The contractor's customer should not view or require the contractor's MR to be used for work that has not yet been formally authorized. MR is also not a contingency that can be eliminated from prices during subsequent negotiations or used to absorb the cost of program changes. The budget being held in reserve must not be viewed by a customer as a source for added work scope. Because the use of MR is at the discretion of the PM (prime PM for prime effort, and subcontract PM for subcontract effort), it is possible for MR to remain after all work is completed under the contract or subcontract.

Examples where MR budget has improperly defined scope may include, but is not limited to, instances where either the contractor's MR is fenced off for use a specific CLIN, or broken down and identified to specific risk items, or even found in the PMB (not associated with Subcontractor's MR) within SLPPs or CAs as PPs without definitive scope. Presence of these examples in a contractor's EVMS can limit the effectiveness of using the EVMS to provide early warning of developing cost, schedule, and technical objectives and developing reliable EACs. The substantiation of risks for the establishment of MR should not be confused with the intent to expend MR for that purpose. That would essentially inhibit the use of MR for other unplanned work when needed for performance measurement purposes. The same applies to CLIN related MR. It should not be limited for use to a specific CLIN as MR has nothing to do with scope or funding when it is established. When MR is broken down and identified to specific risks, the system reviewer should check to see if the Most-Likely EAC being reported in the contractor's IPMR has included those identified risks and their corresponding estimates. If not, the EAC is not accounting for all relevant risks on the contract. The EAC should also address all identified risks, opportunities, and their corresponding estimates rather than merely project the expenditure of the remaining MR. If budget is found within the PMB that is

set aside for risk, the system reviewer should check to see if the budget is being used to eliminate cost variances.

DOE contingency budgets are budgets that are available for risk associated with technical uncertainty or programmatic risks owned by the Government. Contingency budgets are controlled by the Federal staff. While contingency is included in the Total Project Cost (TPC), it is not part of the CBB/PBB.

UB is budget that is applicable to specific contractual effort that has not yet been distributed to control accounts or SLPPs. Identification of the project's UB, facilitates project/project management's ability to account for and report on all authorized scope and budget. UB is a transitional budget that should be distributed in a timely manner as work scope is finalized and distributed to CAs or to SLPPs. UB may also contain scope subject to removal from the distributed baseline because of contractual changes. Budgets for the near-term portion of scope should be allocated commensurate with when the work is authorized.

UB is part of the PMB and has budget associated with contractually authorized work scope that has not yet been distributed to an organizational element at or below the WBS reporting level.

The key is that UB, unlike MR, always has scope. Each project change must be tracked within UB until totally allocated to the time-phased PMB or MR. Changes are documented in a log detailing the monthly transactions and providing current values. The Format 5 of the IPMR/CPR must discuss the composition of the UB balance in terms of the project authorization. Scope and associated budgets that may reside in UB include:

- Authorized Unpriced Work (AUW),
- Newly definitized work scope, and
- Work that has been de-scoped but not yet contractually removed from the project.

UB is a short-term holding account where the budget is expected to be distributed into the PMB or removed from the contract. Delays in contract direction may impact the timely distribution of UB into CAs.

EIA-748, Guideline 29, requires that documentation of the CBB/PBB to which external contractual actions and authorized internal baseline revisions are identified, managed, tracked and reported. The use of a CBB/PBB log to track the PMB, UB, and MR transactions (if not in separate logs) is appropriate. Refer to the contractor's EVM System Description for the documentation process. The CBB/PBB log also serves to identify reporting period (monthly) end values, reporting period changes to/from MR, PMB, and UB, and the current balances.

Guideline 15

Reconcile to Target Costs

Provide that the program target cost goal is reconciled with the sum of all internal program budgets and management reserves.

Purpose of the Guideline

The project's Negotiated Contract Cost (NCC) plus Authorized Unpriced Work (AUW) must reconcile with the CBB/PBB/Total Allocated Budget (TAB).

Management Value of the Guideline

By ensuring that the target cost value is traceable to the sum of the internal budgets comprising the PMB, and MR, a common point of reference is established that is fully understood by all parties and supports both performance assessments and funding requirements.

Reconciling the sum of all internal project budgets (CA budgets, SLPP, and UB) and MR to the contractually authorized cost establishes a valid comparison to the contract target cost. It is essential for project management to account for all budget authorized for the contractual scope of work.

This accounting is demonstrated by reconciling the NCC plus the estimated value of any un-negotiated unpriced-change-orders received to date to the CBB/PBB and to the PMB plus MR to ensure there is consistency. All control account budgets, SLPPs, and UB are summed up to a total value known as the BAC of the PMB. Having validated the sum of the internal budgets, this sum plus MR equals the value known as the CBB/PBB. The CBB/PBB also equals the TAB unless there is a recognized OTB. In that case, the TAB must be reconciled to the CBB/PBB plus any recognized over target budget. (See Guideline 31 for more information related to OTB/OTS.)

Impact of Noncompliance

Failure to ensure that the target cost value is traceable to the sum of the internal budgets and MR, would not provide a common point of reference that is established and fully understood by all parties to support both performance assessments and funding requirements. Inability to reconcile the TAB or CBB/PBB is indicative of a PMB that may be inconsistent with contract requirements. Irreconcilable differences between the authorized values for the TAB (including OTB, if approved), CBB/PBB, PMB, and the value of the NCC plus the estimated value of AUW (if any) can indicate budgets have been over or under allocated which can impact the capability of EVMS to provide accurate project cost, schedule, and technical performance and produce reliable estimates of contract completion. Inconsistencies between authorized contract cost targets and

corresponding project budget allocations causes performance reporting to be unreliable, subject to challenge and suspect for use in making sound decisions.

Typical Attributes

1. Is there a reconciliation of the CBB/PBB to the NCC plus AUW, the CBB/PBB to the TAB, and does the sum of the control account budgets for higher level WBS elements, UB, and MR reconcile with the TAB?

Discussion

Reconciling the sum of all internal project budgets (CA budgets, SLPPs, indirect budgets (if not applied at the CA level), UB, and MR) to the contractually authorized contract target cost establishes a valid comparison to the contract target cost.

It is essential for project management to account for all budget authorized for the contractual scope of work. This is demonstrated by reconciling the NCC plus the estimated cost of AUW received to date to the CBB/PBB and to the PMB plus MR to ensure there is consistency. The CBB/PBB also equals the TAB, unless there is a recognized OTB. In that case, the TAB must be reconciled to the CBB/PBB plus any recognized over-target budget. All CA budgets, SLPPs, and UB are summed up to a total value known as the BAC of the PMB. Having validated the sum of the internal budgets, this sum plus MR equals the TAB or CBB/PBB (if no recognized OTB exists).

5. ACCOUNTING CONSIDERATIONS

The Accounting Considerations category focuses on ensuring that all direct and indirect costs associated with accomplishing the complete scope of work contained in the contract are properly transferred to the EVMS cost tool at the level of detail required for performance analysis and reconcilable to contract performance reports. All financial transactions must be documented, approved, and recorded properly in the financial accounting system on a consistent and timely basis in accordance with Generally Accepted Accounting Principles (GAAP) and applicable Cost Accounting Standards (CAS). As the EVMS cost tool uses direct cost data from the contractor's accounting system to accurately report project costs and to conduct EVMS performance and variance analysis, the accounting system is critical to ensuring EVMS performance data is reliable and auditable. The primary objective of the six EVMS Guidelines (16–21) that comprise this category is to ensure cost data is accurately collected for a valid comparison to budgets and performance.

The Accounting Considerations guidelines require that the direct costs recorded in a formal and accepted accounting system are reconcilable to the ACWP reported in the EVMS cost tool. Direct costs are accumulated and charged to CAs consistent with planned budgets and acceptable costing techniques (EVMS Guideline 16). The guidelines also require actual costs to be accurately

accumulated and summarized within the EVMS cost tool by the project's WBS and OBS elements (EVMS Guidelines 17 and 18). All indirect costs allocable to a project must be properly recorded and correctly allocated (EVMS Guideline 19 – see Section 7.0 Indirect Guidelines). As applicable, the accounting system must be able to identify unit costs, equivalent unit costs, or lot costs, and distinguish between recurring and non-recurring costs (EVMS Guideline 20). Identifying unit costs is typically applicable to production contracts. Acceptable points for measuring material performance are specified and material costs are required to be reported in the same accounting period that performance is claimed. In the event direct costs for work accomplished have not yet been formally recorded in the accounting system, accruals and/or estimated actuals are used for EVMS performance reporting and assessment. This ensures that any cost variances accurately represent the cost status of the work accomplished (EVMS Guidelines 16 and 21). Records showing full accountability for all material purchased for the contract, including residual inventory must be maintained (EVMS Guideline 21).

Guideline 16

Record Direct Costs

Record direct costs in a manner consistent with the budgets in a formal system controlled by the general books of account.

Purpose of the Guideline

The reconciliation section primary deals with the project reconciliation of ACWP. It also seeks to maintain overall consistency with the disclosure statement.

Management Value of the Guideline

The Reconciliation with Source Systems section deals with how the accounting system is integrated with purchasing, labor, and other inputs to the accounting system. The accounting system is the book of record for ACWP and is updated from other source records. The Accounting Documentation subsection addresses the integration of open and closed charge numbers consistent with the work requirement.

Impact of Noncompliance

- Failure to reconcile actuals between the accounting and cost systems invalidates the cost variance and prevents accurate and effective performance management.
- Inconsistency of direct costs to the disclosure statement means the contractor is not compliant with contract requirements approved by the DOE Chief Financial Officer (CFO).

- Failure to collect and record actual costs (or ACWP) in the same period the work is accomplished (or BCWP) negates the validity of the cost variance and prevents accurate and effective performance management.
- Failure to accrue cost by EOC in the same WP/activity as budget would invalidate variance analysis and inhibit the EAC generation.
- Failure to reconcile the purchasing system, the accounting system and the EVMS cost tool could understate the EAC reported to DOE and impact contractor funding requirements.
- Inability to reconcile the EVMS cost tool ACWP with the accounting system actuals compromises the accuracy of ACWP reported to DOE.

Typical Attributes

1. Is the ACWP in the EVMS cost tool formally reconciled each month with the actual costs in the accounting system?
2. Is the manner in which the contractor classifies its direct cost (direct labor, material, other direct costs) and credits consistent with their approved disclosure statement?
3. Are direct costs recorded in the control account on the same basis as budgets were established and, at a minimum, by EOC?
4. Control accounts or WPs opened and closed based for cost collection on the start and completion of work contained therein?

Discussion

Record the direct costs in a manner consistent with the budgets in a formal system controlled by the general books of account. This is the responsibility of the Project Controls Organization. The primary assumptions are that the EVMS reported actuals reconcile with the accounting systems and are supported, if required, by estimated actuals. The calculation of ACWP is also consistent with the disclosure statement.

The accounting system is the book of record for ACWP and is updated from other source records. Actuals from the accounting system and the ACWP reported in required EVMS reports must be reconciled at the end of each accounting period and the results of the reconciliation should be documented. There are a couple of aspects that need to be considered:

- Reconciliation is required for ACWP reported as of the accounting month-end date. (Reconciliation does not mean that actuals from the accounting system and those reported in EVMS equal each other. For example, estimated actuals may be needed for labor, material, or subcontractor payment lags).
- ACWP must be consistent with BCWP in terms of the reporting period.
- Reconciliation is required at the project level by EOC.
- Estimated actuals must be justified at the level applied.
- Reconciliation is both monthly and cumulative to date.

- Control accounts and WPs are opened and closed based on the actual start and actual completion of work contained therein for the purposes of cost collection.

The EIA-748 EVMS accounting system compliance requirements seek to maintain overall consistency with the disclosure statement. EOC such as labor, material and Other Direct Costs (ODC) defined in the contractor's disclosure statement for the project must be consistent with the accounting system tracking of EOCs for direct cost elements. Actual resources expended in accomplishing the work must be recorded on the same basis resource budgets were assigned if meaningful comparisons are to be made.

In the event direct costs for subcontracted effort and/or material have not yet been formally recorded in the accounting system, estimated costs (estimated actuals) will be used for EVMS performance reporting and assessment in the EVMS. This is to address timing differences between the accounting system and performance reports. Once direct costs have been recorded, they will replace the estimated costs (estimated actuals) recorded in the EVMS. This process may be used to remove project direct costs from the EVMS, such as cost transfers, where the accounting process lags behind the identification of the need.

BCWP is the budgeted cost for what was accomplished. ACWP is what was spent to accomplish the work. BCWP minus ACWP is the cost variance. For the validity of the cost variance both BCWP and ACWP must be reported in the same accounting period. However, some common reasons why they may be recorded in the accounting system in different months follow:

- Labor can be distorted because of significant errors that may be in process of correction. The primary sources for correction of labor errors are cost transfers or an individual justification.
- HDV Material (see EVMS Guideline 21) typically has payment terms that may not coincide with calendar month-ends. By definition, HDV material is significant and tracked discretely. HDV material requires assessment of estimated actuals monthly, if actuals have not been accrued. The source for the estimated actuals is typically the receipt record/purchase order cost.
- Subcontractors typically are required to status activities consistent with the prime's month-end date. Actuals may be delayed because of lagging invoices/payments. The source for estimated actuals is typically the subcontractor ACWP or invoice.

In all cases, the ACWP must be recorded in the same month as the BCWP is recorded. There should not be months with significant BCWP without ACWP or vice versa. As general rule of thumb, "significant" is when BCWP is greater than \$2K. The term accrual may be used instead of estimated actuals. Accruals are typically done directly in the accounting system and based on a purchase order, journal transfer or other verifiable record. If they are done in the accounting system, this may be met since the reconciliation is between the accounting system and the EVMS cost tool. All estimated

costs (estimated actuals) used for performance reporting will be reconcilable between the accounting general ledger and the EVMS cost tool.

Another intent of this EIA-748 Guideline is to determine if actuals are recorded consistent with corresponding budget and performance. This means that the effort should be charged to where it is budgeted. It does not require that the EOCs in the accounting system match the EOCs in the EVMS cost tool. However, in no case must the accounting EOCs be changed when input into the EVMS cost tool. EOCs will typically vary over time. There is no expectation that the budget be changed if an EOC is not charged or charged differently. The CAM should understand the charges by EOC and be able to explain the differences in variance analysis. The CAM has the option to change the future plan beyond the freeze period, if the variances by EOC are significantly distorting the performance. EOCs are very relevant to how ETCs and EACs are calculated.

The accounting system is the book of record for actual cost collection. It typically produces or is integrated with the pay system and has employee salary information. There are various source records that are inputs such as time cards, material purchase orders, payments that are inputs or cost source put into the accounting system. For EVMS cost tool actuals (ACWP) to be credible, these source records must be valid, approved, reconciled, and auditable.

The purchasing system typically has separate approvals. There are a number of basic documents from the accounting system that influence the EVMS cost tool and the forecasting process.

- Purchase Request— an engineering document that specifies the technical requirement. If the purchase request is significantly different than the BOM costs, then the CAM should identify an EAC impact for the anticipated value in the EVMS cost tool.
- Purchase Order – this acquisition document to be sent to the source, is generated by the purchasing office and needs to be compliant with all federal laws regarding sources. At this point, an evaluation should be made to determine the commitment amount that should be accrued in the accounting system with respect to the terms and conditions of any multi-year contracts and their impact on the execution year. This analysis must be done to identify the appropriate value to be represented in the EVMS cost tool. The EAC should also be updated for the difference, if any, between the BOM or estimated price and the final acquisition price.
- Purchase Receipt – This document includes inspection and is the receipt documenting acceptance. Generally, this acceptance is the point in which BCWP is claimed for HDV material. At this point, the obligation to pay should be accrued in the accounting system or as an estimated actual based on the quantity received multiplied by the purchase order price.
- Vendor Invoice – This document is needed before accounts payable can write a check and actuals hit the accounting book of record. Accounts payable usually requires the purchase

order, the purchase request and the vendor invoice to verify material, quantity and dollar amount in order to make an accurate payment to the vendor.

- Inventory Usage Documentation – The accounting system must account for the cost of material used to include scrap, rework, test rejections and unanticipated test quantities. Also see EIA-748 EVMS Guideline 20 for usage requirement.

At all times, these source records must be traceable and reconcile with the accounting commitment, obligations, actual values, and the EVMS cost tool earned value (or BCWP) assessments, and ACWP values (with estimated actuals if required).

The labor tracking system typically starts with the manual or automated time keeping system that records performance by charge number. This is then costed in the accounting system where actual employee labor rates are kept. There are several aspects of this process that are critical:

- The timing of labor costing should support weekly labor reports and month-end reconciliation.
- Labor is typically a significant cost component.
- Labor hours charged should directly reconcile with ACWP hours. Typically, estimated actuals are reported in dollars.
- CAMs should receive labor name reports of actual charges weekly to verify accuracy.
- The CAM should be able to submit adjustments for errors and corrections on a routine basis.

Guideline 17

Summarize Direct Costs by WBS Elements

When a work breakdown structure is used, summarize direct costs from control accounts into the work breakdown structure without allocation of a single control account to two or more work breakdown structure elements.

Purpose of the Guideline

To assure that accurate cost data is being reported throughout the various levels of the WBS and provides project management with the confidence that the data is reliable.

Management Value of the Guideline

Accurate cost summarization by WBS element provides management visibility into the current cost of products and services being procured. Accurate accumulation and summarization of direct costs support effective analysis of performance measurement information and forecasting of potential future costs.

At a minimum, direct costs are collected at the control account level and summarized to successively higher WBS levels for reporting and performance measurement purposes. To prevent distorting the data and the related assessments of performance, internal controls are put in place to ensure that direct costs collected within control accounts are accurately summarized up through the WBS without being allocated to two or more higher level WBS elements. The charge number structure uniquely relates direct costs to control accounts and facilitates the summarization of costs by the WBS. This practice assures direct costs will be summarized and reported only within a single WBS element. Validity of the resulting performance metrics enhances management's ability to make programmatic decisions and properly forecast future costs for the remaining work.

Impact of Noncompliance

Failure to summarize direct costs by WBS prevents the system from ensuring the direct costs reflect the costs associated with accomplishing the scope of work and would result in inaccurate reporting at various WBS levels. If direct costs are not required to be allocated to only one WBS element, the costs in a WBS element would not be directly related to the work performed and performance assessments would be distorted.

Typical Attributes

1. Can direct costs be summarized by element of cost, from the Control Account or Work Package charge number level through the WBS hierarchy without allocation of a single control account to two or more higher-level WBS elements?

Discussion

The intent of this EIA-748 Guideline is to verify that actual direct costs are summarized through the WBS to the total project level while preserving the EOC integrity. Direct costs are collected, at a minimum, at the CA level and summarized to successively higher WBS level for reporting and performance measurement purposes. To prevent distorting data and related assessments of performance, internal controls are in place to ensure that direct costs collected within CAs are accurately summarized up through the WBS without being allocated to two or more higher level WBS elements. Assurance that accurate cost data is being reported throughout the various levels of the WBS provides project management with the confidence that the data is reliable. Validity of the resulting performance metrics enhances management's ability to make programmatic decisions and properly forecast future costs for the remaining work.

As defined in EIA-748 EVMS Guideline 5, the CA is at the intersection of the WBS and OBS. Charge numbers are required in EIA-748 EVMS Guideline 16 at the CA level and recommended at the WP level. Regardless, actual costs (ACWP) should summarize successfully so that actual charge number traceability is maintained in the summarization of EOCs. The contractor's charge number structure should uniquely relate the direct costs of the CAs' work performed (and WPs within the

CAs if costs are collected at that level) in order to facilitate the summarization of those costs to the applicable WBS element. This practice assures direct costs will be summarized and reported only within a single WBS element and the costs are directly related to the work performed.

Guideline 18

Summarize Direct Cost by OBS Elements

Summarize direct costs from the control accounts into the organizational elements without allocation of a single control account to two or more organizational elements.

Purpose of the Guideline

To prevent distorting data and related assessments of performance, internal controls are in place to ensure that direct costs collected within control accounts are accurately summarized up through the OBS without being allocated to two or more higher level OBS elements.

Management Value of the Guideline

Accurate cost summarization by OBS element provides management visibility into current costs incurred by organizational elements in production of the products and/or services. Confirmation that direct costs are accurately accumulated and summarized supports management's effective analysis of performance measurement information and forecasting of potential future resource requirements and their costs. Direct costs are collected, at a minimum, at the control account and summarized to successively higher OBS levels for reporting and performance measurement purposes. The charge number structure uniquely relates direct costs to control accounts and facilitates the summarization of costs by the OBS. This practice assures direct costs will be summarized and reported only within a single OBS element. Assurance that accurate cost data is being reported throughout the various levels of the OBS provides project management with the confidence that the data is reliable. Validity of the resulting performance metrics enhances management's ability to make programmatic decisions and properly forecast future costs for the remaining work.

Impact of Noncompliance

Failure to ensure that direct costs are accurately accumulated and summarized would not support management's effective analysis of performance measurement information and forecasting of potential future resource requirements and their costs.

Typical Attributes

1. Can direct costs be summarized by element of cost, from the Control Account or Work Package charge number level through the OBS hierarchy without allocation of a single control account to two or more higher-level work breakdown structure elements?

Discussion

The contractor's charge number structure uniquely relates direct costs to CAs/WPs and facilitates the summarization by the OBS from the accounting system, to the EVMS cost tool/CAPs, through the IMS, to the WAD, the RAM and OBS. This practice assures direct costs are summarized and reported only within a single OBS element from CA to the project level.

Actual costs need to be available at all levels of the OBS. As stated in EIA-748 EVMS Guideline 17 and defined in EIA-748 EVMS Guideline 5, the CA is established at the intersection of the WBS and OBS. The WBS identifies the work and the OBS identifies who is responsible for the work. This EIA-748 Guideline is similar to EIA-748 EVMS Guideline 17 except that it verifies that actual direct costs are summarized through the OBS to the total project level while preserving the integrity of the EOC. In either case the intent is the same—actual cost collected at the CA level may not be rolled up (i.e., summarized) to multiple higher-level elements. This process is accomplished by ensuring the direct costs reported and analyzed at higher levels of the OBS only reflect the costs associated with the authorized resources to accomplish work. Assurance that direct costs are accurately accumulated and summarized to provide valid data supports management's effective assessment of performance management information and forecasting of potential future resource requirements and their costs. Also see EIA-748 EVMS Guideline 3 – System Integration.

Guideline 20

Identify Unit and Lot Costs

Identify unit costs, equivalent unit costs, or lot costs when needed.

Purpose of the Guideline

The purpose of the Guideline is to ensure contractor accounting systems are capable of determining the unit or lot costs of items developed or produced.

Management Value of the Guideline

This determination is done for cost reporting purposes and to provide visibility into the factors driving project cost growth. The contractor's accounting system must have the capability to produce unit, equivalent unit, or lot costs for cost reporting purposes. Deriving and analyzing changes in unit cost data, especially during production or manufacturing, provides project management insight into the reasons for cost growth or efficiency, and highlights the need for potential changes in how the project is managing cost and schedule. The accounting system must be able to segregate the costs of production units, lots, or equivalent units by elements of cost (i.e., labor, materials, other direct costs, and indirect costs). Additionally, it must distinguish between recurring and nonrecurring costs as required by internal/external reporting requirements. This process will provide project management flexibility to plan, measure performance, and forecast in a more efficient way when there are multiple projects in the production line. Where it is not practical to determine the individual unit costs of items produced, "lot" costs may be accumulated

wherein a “lot” represents an aggregate of a specified and consistent number of units. On production contracts where, multiple similar units are produced and delivered to different customers, or when units are randomly removed from the production line to support various customer delivery agreements, “equivalent unit costs” (i.e., all things being equal, each unit’s cost is approximately equivalent to every other unit’s cost) may be established.

Impact of Noncompliance

The inability of the contractor’s accounting system to be able to identify unit costs, equivalent unit or lot costs by EOC (in terms of labor, material, other direct, and indirect costs (as required by the contract)) limits DOE’s ability to ensure there is sufficient funding for contracted units and predict the cost of future procurements.

Typical Attributes

1. Does the contractor’s system have the capability to provide unit costs, equivalent unit or lot costs in terms of labor, material, other direct, and indirect costs as required by the project?

Discussion

In a production or manufacturing environment, the contractor’s accounting system must have the capability to produce unit, equivalent unit, or lot costs for cost reporting purposes. Just as a contractor acquires materials, vended items, and subcontracted components by unit of cost so also is the contractor expected to produce his contracted items in a manner that facilitates derivation of unit cost. Future pricing efforts are intimately concerned with the cost per unit of previous acquisitions. Current negotiation postures are established based upon historical unit costing as well. This Guideline may not be applicable in a pure construction, engineering design or similar type of project. It is normally required when (a) there are multiple customers funding individual units or lots or (b) there are future procurements of the same items pending and the information will be used to estimate the costs of those units or lots.

Deriving and analyzing changes in unit cost data, especially during production or manufacturing, provides project management insight into the reasons for cost overruns or underruns, and highlights the need for potential changes in how the project is managing cost and schedule.

The accounting system must also be able to segregate the costs of production units, lots, or equivalent units by EOC, (i.e., labor, materials, other direct costs, and indirect costs). If a given unit’s cost was determined to be \$100,000, it is important to know, for current negotiation postures and future acquisitions, how much of this cost was because of labor, materials, overhead, and other direct charges. When multiple units of the same design are being produced in a manufacturing assemble line environment, it is usually sufficient that the accounting system be able to provide “equivalent” unit costs: i.e., the total cost of all the units divided by the number of units produced.

Guideline 21

Track and Report Material Cost/Quantities

For EVMS, the material accounting system will provide for:

- 1) Accurate cost accumulation and assignment of costs to control accounts in a manner consistent with the budgets using recognized, acceptable, costing techniques.
- 2) Cost recorded for accomplishing work performed in the same period that earned value is measured and at the point most suitable for the category of material involved, but no earlier than the time of actual receipt of material.
- 3) Full accountability of all material purchased for the program including the residual inventory.

Purpose of the Guideline

The purpose of Guideline 21 is to ensure that material costs are accurately collected from the accounting system and transferred to the EVMS in order to compare those costs with corresponding budgets and completed work. It is also to ensure reliable performance measurement suitable to the material category and to ensure that all material items purchased for the contract are accounted for through contract completion and final disposition.

Management Value of the Guideline

The establishment of accurate cost accumulation, performance measurement, and identification of residual inventory is essential since material may comprise a large portion of a contract's costs. Material management must be accomplished in a manner that provides maximum identification of HDV/CI for effective management visibility. To support project management, direct costs for material items must be assigned to a project consistent with the corresponding budgets for that material. This assignment provides the basis for realistic evaluation of cost variances and ultimately facilitates EAC projections. (See EIA-748 EVMS Guidelines 23 and 27.)

Impact of Noncompliance

If material costs are not accurately collected from the accounting system and transferred to the EVMS, the project team would not be able to compare those costs with corresponding budgets and completed work. The EVMS would not produce reliable performance measurement data suitable for the material category and would not ensure that all material items purchased for the contract would be accounted for.

The direct costs for material items are not assigned to a CA/WP consistent with the corresponding budgets for that material and do not provide a valid basis for realistic evaluation of cost variances and realistic EAC projections to DOE. Material cost variances should be analyzed and evaluated in terms of both price and usage variances to assist estimate at complete projections. Failure to track material

may cause overall project delays. Without full material accountability, requirements may increase material cost.

Typical Attributes

1. Are material actual costs recorded on the same basis in which budgets were planned and performance is claimed?
2. Is material performance (or BCWP) recorded in one of the following ways: 1) upon receipt of material but no earlier, 2) issue from inventory, or 3) consumption of the material?
3. Does the material or other system provide for the accountability for material purchased to include residual inventory for the project?
4. Does the Contractor's system provide for determination of price variance usage material analysis where applicable?

Discussion

The intent of this Guideline is that actuals for material are recorded on the same basis as budget and performance are recorded. Material costs must be accurately accumulated within charge numbers and charged to the CA level, at a minimum, using recognized and accepted costing techniques. (Also see EIA-748 EVMS Guideline 16). These techniques may vary based upon the way material is brought into CAs. For example, material received directly for work that is in process is normally costed to the CA at the invoice amount.

Materials issued from an inventory storeroom/warehouse may be costed to the CA in several different ways:

- On a Last In, First Out (LIFO) basis in which the most recently received units of each type of material are issued first. In inflationary times this process allows the contractor to cost the higher priced materials (just received) to the contracts in-house while retaining the less inflated priced units in inventory as surplus or back-up commodities. If a LIFO material accountability system is used for warehoused materials, then the original CA budgets should be estimated with the LIFO concept in mind. The way materials are budgeted in CAs is dependent upon the contractor's methodology for accounting for those materials.
- On a First In, First Out (FIFO) basis in which the first units received of each type of material are also the first units issued for usage. This method is most beneficial when there are large quantities of materials being used that have a short, specific shelf-life of guaranteed usability.
- On an Average Unit Cost (AUC) basis wherein the units being issued for use are taken from the warehouse in a random order with no regard to their time of receipt. An average cost of each unit of each type of material is maintained and updated as each new shipment of materials is received. Then when a unit of material is issued, the CA receiving the distribution is charged with the average unit cost of that material.

Still other materials may be furnished by the customer. In this case, the Government Furnished Materials (GFM) would be costed at no charge when placed into work that is in process. Regardless of the costing method used, the same basis must be used for both budgeting and applying actual costs for materials. If material is supplied as GFM it should be identified as an SVT with no resources/budget applied.

Budgets for HDV/CI must be planned discretely using objective milestones or other rational basis for measuring the amount of material consumed. This process would include multiple deliveries of the same item for which a series of sequential milestones would be listed. For inventory material, the contractor may choose a percent complete, a milestone for each “kit” of material issued to work in progress (WIP), or another EV technique that accurately reflects the issuance to this type of material. For material that will be released in kits, determine how BCWP and ACWP are determined at the time of partial kit releases.

To be compliant with EIA-748 EVMS compliance requirements for this guideline, performance for materials are expected to be planned (or BCWS) and claimed (or BCWP) based upon receipt, inspection, and acceptance, provided the material items are placed into use within a reasonable time or are specifically identified to a serially numbered end item. Pending negotiations HDV/CI are planned and scheduled according to material need dates. At the conclusion of negotiations, the baseline schedule is revised to reflect negotiated delivery dates (reference GL10). Using the negotiated receipt date prevents the early assessment of progress for material that may ultimately be cancelled and cause adjustments for previously claimed earned value.

When progress payments are made based on proof of physical/technical accomplishment, then they form the basis for earned value. In this process, it is important that the documentation related to proof of physical accomplishment be examined. Hence, subcontractor progress payments and/or schedule of values should be used as the documented technical and/or quantifiable backup data to verify and report performance.

There may be situations where the contractor may offset the planning of material budgets (or BCWS) to coincide with the payment of the vendor’s invoice. This offset is done primarily to ensure that BCWP for the material and the costs for that material are reported within the same accounting period. This approach is acceptable only if (a) the actual consumption of the material occurs within a reasonable time frame of the payment (usually 30 days or one accounting period), and (b) it is not used as an across-the-board approach to material BCWP management for all categories of material. While this is generally acceptable, the contractor must be vigilant about not claiming performance without recording invoiced costs to avoid a false positive cost variance. Should the invoice lag the material delivery, the contractor must account for these costs using estimated actuals.

All material purchased or furnished as GFM/GFE must be fully accounted for on a particular project. In contractor material control systems previously approved by DOE and in good standing, the intent may be met, and additional verification may not be required. If this is not met, then records must be kept providing for full and complete accountability of all materials purchased for the project or furnished as GFM/GFE. This material does not include usually trivial scrap such as excess concrete from a pour. Security may prohibit return of residual material. Unused, scrap, and residual is interpreted within normal construction process. Not included as residual are items not useful for future projects and excess normally.

These records must reflect the acquisition, issue to CAs, return of unused materials from CAs, valuable scrap quantity and disposition, and residual material inventory. Normally, any unused material should be returned to stores/warehouse for disposition. Actual direct material costs include the materials in the final product, scrap, damaged materials, and so forth, plus any material purchased for the contract but not used, for which an alternate use cannot be found, and any residual inventory. However, unit cost projections for follow-on procurements must include material consumed plus material requirements for schedule assurance based on waste and spoilage trends determined from an appropriate phase of the contract performance.

6. ANALYSIS AND MANAGEMENT REPORTS

The Analysis and Management Reporting category focuses on management use of the EVMS performance data to detect and act upon early technical, schedule, and/or cost deviations from the PMB. The six guidelines (22–27) that comprise this category establish the minimum requirements for generating and analyzing cost and schedule variances (Guidelines 22 and 23), establishing and implementing corrective action plans (Guideline 26), and maintaining credible EACs at both the control account and total project levels (Guideline 27). The performance data used for variance analysis must be generated from the EVMS. To ensure cost and schedule variances are valid, the EVMS method used to derive the BCWP must be consistent with the method used to plan and resource the associated work. (See EIA-748 EVMS Guidelines 10 and 12.) The applicable actual direct costs must map or trace to the accounting system. (See EIA-748 EVMS Guidelines 16 and 21.) These minimum requirements facilitate the CAM's ability to identify significant cost and schedule performance drivers and use that information to make informed programmatic decisions that will optimize the use of resources to accomplish the remaining work.

Consideration of the impact of indirect cost performance on the overall cost of the project is also included in this category. The guidelines require analysis of indirect cost performance and their impacts to the ETC for the remaining work (see EIA-748 EVMS Guideline 24 — Section 7.0 Indirect Guidelines). The guidelines further require the performance data to be accurately summarized from the control account level to the contractually mandated reporting level so that the same data being used to internally manage and execute the project is being communicated externally to the

government (Guideline 25.) This level of reporting ensures that all project stakeholders are informed of progress and allows for management action to address problems identified through variance analysis and/or risks to project execution (Guideline 26). Lastly, the guidelines require the contractor to periodically evaluate and update ETCs and derive control account and project level EACs that reflect a valid projection of project cost.

Timely and reliable EACs provide the contractor PM visibility into future resource needs and support the government's ability to provide sufficient funding to the project (see EIA-748 EVMS Guideline 27).

Guideline 22

Calculate Schedule Variance and Cost Variance

At least on a monthly basis, generate the following information at the control account and other levels as necessary for management control using actual cost data from, or reconcilable with, the accounting system:

- Comparison of the amount of planned budget and the amount of budget earned for work accomplished. This comparison provides the schedule variance.
- Comparison of the amount of the budget earned and the actual (applied where appropriate) direct costs for the same work. This comparison provides the cost variance.

Purpose of the Guideline

The emphasis of this Guideline depends on accurate cost and schedule performance data generated on a routine basis. In order for project management to assess both progress and variances as compared to the baseline, reliable and auditable data must be generated in a timely manner, on a monthly basis at a minimum in alignment with the contractor's accounting reporting periods.

Management Value of the Guideline

For analysis and variance reporting, the following data elements must be identified, on a periodic basis, at the CA level:

- BCWS represents the amount of work planned.
- BCWP represents the amount of work actually accomplished.
- ACWP represents the actual cost of the work accomplished traceable through the accounting system.
- The comparisons of BCWP versus BCWS, and BCWP versus ACWP, results in two variances:
 - BCWP minus BCWS results in the CA's Schedule Variance (SV).
 - BCWP minus ACWP results in the CA's Cost Variance (CV).

Impact of Noncompliance

Project management would not be able to assess schedule and cost performance and provide valid, reliable information to make timely and accurate management decisions. Use of analysis based on variances generated by non-standard formulas will result in a lack of standardized reporting, resulting in management being compromised in their ability to accurately identify and report areas in need of attention.

Typical Attributes

1. Are the formulas to calculate SV, CV, and VAC consistent with IPMR/CPR and DOE Gold Card instructions?
2. Is BCWP calculated in a manner consistent with the way work is planned?

Discussion

The DOE Gold Card includes standard formulas for calculating CVs, SVs and VACs which must be followed to ensure accurate variances are being reported. The formulas follow:

- $CV = BCWP - ACWP$
- $SV = BCWP - BCWS$
- $VAC = BAC - EAC$

The contractor must ensure it uses the same method for calculating both BCWS and BCWP. Monthly BCWS values should be planned by an objective method commensurate with the way BCWP values will be earned so that comparisons between BCWS and BCWP have a minimum amount of distortion. The objective methods used to calculate BCWS and BCWP should be chosen so that when BCWS is calculated it matches the monthly resource plan as closely as possible. The method used should also depend upon the type of effort involved in each WP, i.e., discrete, LOE, and apportioned. Regardless of the type of effort involved or the method chosen by which to measure earned value, BCWS must be calculated by the same method. It is not allowable, for example, to plan work by a factoring method such as with an apportioned method if earned value is to be calculated by one of the discrete measurement methods. Nor is it allowable to plan work by the Interim Milestone method if earned value is to be calculated by the 50-50 method. Absolute consistency is mandatory between the planning method used and the earned value method chosen for measuring performance. They must be the same.

Guideline 23

Analyze Significant Variances

Identify, at least monthly, the significant differences between both planned and actual schedule performance and planned and actual cost performance and provide the reasons for the variances in the detail needed by program management.

Purpose of the Guideline

The ability to analyze deviations from the established plan permits management at all levels to rapidly and effectively implement corrective actions in an effort to regain project/contract objectives. Because the majority of contractor accounting and budgeting systems are based on synchronized accounting calendar, unless an alternate reporting frequency is mandated, variance analysis should be conducted per this same cadence. The collection and analysis of CVs, SVs, and VACs are required to be completed in accordance with external IPMR/CPR reporting requirements (see EIA-748 EVMS Guideline 27 for additional information on the VAC process).

Performance measurement data, by element of cost, is used to identify trends in cost, schedule, and technical performance. By using this information to determine the root causes of variances, management is better able to address specific problems, and move forward to focus on mitigation as well as cost and schedule projections. This process, like all other parts of the contractor's management system, must be documented in formal operating procedures.

In those cases where no EIA-748 EVMS flow down requirement exists for a major subcontractor, it is necessary for the prime to evaluate subcontractor performance. Formal procedures should document the establishment of subcontractor reporting requirements, as well as validation and review of the subcontractors' performance measurement data submissions by the prime contractor.

Management Value of the Guideline

Without this visibility into and the understanding of plan deviations, the success of the project can be jeopardized. Additionally, insight into future cost and schedule performance, based on the analysis of variances, will be facilitated. The purpose of this guideline is to ensure both significant SVs and CVs are analyzed, at least monthly, at a level of detail required to manage the effort; i.e., to enable management decision-making and corrective action.

Impact of Noncompliance

Without monthly/routine data and variance analysis, management is unable to use the EVMS information to make timely decisions or to properly assess project performance. Without the establishment of an appropriate variance analysis process from the prime and the subcontractor, the lack of a standardized performance assessment may result in undetected deviations from the plan. Management would not be able to analyze deviations from the established plan nor effectively implement corrective actions in an effort to regain project/contract objectives. The success of the project can be jeopardized.

Typical Attributes

1. Monthly, are all significant cost, schedule, and technical impacts to the control account with regard to the contractor's internal thresholds discussed and documented?
2. Are variances addressed in the detail needed by program management?

3. Do variance analysis thresholds exist, and are they appropriate for the project(s)?

Discussion

Analysis of cost and schedule variances and VACs are conducted at the control account level on a monthly basis. Once notified that established thresholds have been breached, the CAM is responsible to document and approve formal variance analysis. Normally, the specific dollar or percentage thresholds are not specified directly in the analysis system description/operating procedures because they must vary based upon the type, size, and risk associated with each individual contract. However, the requirement for such thresholds should exist in the procedures and the thresholds used on a given project/contract should be documented in a project/program directive. This analysis provides an early insight into the root causes, impacts, and corrective actions related to cost and schedule challenges. It also highlights the potential need for management action to mitigate potential or realized project risks. Analyzing variances at the control account and summary levels enables project management to understand the impact of cost and schedule performance drivers at the point where budget, scope, and resources are actively managed.

In this context, root cause is defined as the issue that if addressed would either mitigate the impact on future variances or prevent the variance from reoccurring. Impacts are defined as the impact to the control account and project. Corrective action is how the variance will be mitigated or the EAC updated.

Narrative Section: The narrative should identify quantitatively the cause of the variance and then identify the root cause(s). The expectation is that the majority of the variance exceeding the threshold is addressed. Current variances should be addressed separately from cumulative variances.

- **Cost variance (CV):** An example is a \$100K cumulative cost variance for a labor account may be attributable to \$20K indirect rates, \$50K to widget technical problems, and \$30K to labor rate variances. Analysis discussion should also address elements of cost if significant and whether the CV will continue. For cumulative and current period HDV material CV analysis, refer to EIA-748 EVMS Guideline 21 for formulas used to calculate PV and/or UV.
- **Schedule variance (SV):** Analysis of schedule variance should also address the float impact from the IMS. Schedule variance is typically a dollarized representation of schedule performance that does not provide visibility into detailed progress and accomplishment of the milestones and activities required for execution reflected in the IMS. Concurrent analysis of the integrated network schedule(s) is done to determine the status of specific activities, milestones, and critical events and to identify the factors contributing to the dollarized and time-based schedule variance.
- **Variance at Completion (VAC):** Analysis should relate the impact of the ongoing cost variance to the projected VAC. For analysis of VAC HDV material, refer to EIA-748

EVMS Guideline 21 for formulas used to calculate PV and/or UV. (See EIA-748 EVMS Guideline 27 for more information.)

Impact: This section should describe the cost and schedule impacts to the control account as well as any impact to programmatic events or other CAs. For schedule variances, the following should be described: the impact to the critical path (i.e., a delay in a critical activity's completion effects the project completion), float, schedule margin (where applicable), contractual milestones and/or delivery dates. This section should also address the impact to the ETC.

Variance analysis of the subcontractor's cost and schedule performance must be conducted regardless of whether the EVMS requirement was flowed down to the subcontractor. A subcontractor with an EIA-748 EVMS flow down must formally implement the EVMS and conduct variance analysis for any variances exceeding stated thresholds. These VARs are then submitted to the prime contractor's CAM for review, concurrence, and incorporation into the prime's IPMR/CPR that is subsequently reported to the DOE. If there are no EIA-748 EVMS flow down requirements, the responsible prime contractor CAM must analyze the subcontractor's performance using data such as technical status reports, schedules, invoices, formal and informal communications, etc. as part of the CAM's VAR process. The contractor's EVM System Description and documented processes/procedures must define and explain the analysis process for subcontractor performance when there is no EIA-748 EVMS flow down requirement.

Guideline 25

Summarize Performance Data and Variances for Management Reporting

Summarize the data elements and associated variances through the program organization and/or work breakdown structure to support management needs and any customer reporting specified in the project.

Purpose of the Guideline

This Guideline requirement stipulates that EVMS data used for internal management reporting and external customer reporting emanates from the same source, ensuring both the contractor and the Government are using the same database to manage the project.

Management Value of the Guideline

All the data elements (BCWS, BCWP, ACWP, BAC, and EAC) are calculated at the CA level and must summarize from the CA level up through the through the WBS and across the OBS to the total contract level without being divided among two or more higher level WBS elements. The success of the summarization process promotes accurate management insight as well as budget integrity and reconciliation. Variance thresholds internal to the Contractor, if specified, may be tighter than the thresholds identified for external reporting.

Impact of Noncompliance

If the contractor and DOE are not using the same data from the same database to manage the project, the project could be jeopardized. Inconsistent analysis between CA and project levels masks performance and increases project costs.

Typical Attributes

1. Is performance measurement information summarized from the control account to the project level through the WBS and OBS for project management analysis purposes and customer reporting?

Discussion

Projects are structured using a WBS and OBS that define the CAs. These subdivisions of the WBS and OBS ensure an understanding of responsibility for managing and controlling the allocation of resources to the work scope, and provide for consistent analysis from the CA through the WBS and OBS. The WBS and OBS also serve as the structure for summarizing cost accumulation and for reporting the EVMS performance measurement data aligned to scope to the appropriate responsible person. While summary level variance analysis, if required, may differ depending on project requirements, the summary level managers or Project Managers have the same responsibility as CAMs, just at a higher level in the WBS or OBS. While a summary level manager may rely on CAMs to provide the detailed variance analysis applicable to their CAs, they should be cognizant of the cost and schedule performance for their area of their responsibility.

In a compliant implementation, there is only one set of data. Project management must have the same goals, objectives, and deliverables as DOE has placed on the contract. This alignment allows everyone to progress through project execution with the same plans and expectations.

Guideline 26

Implement Corrective Actions

Implement managerial action taken as the result of earned value information.

Purpose of the Guideline

The availability of timely and accurate EVMS data for variance analysis provides management early insight into the magnitude of potential problems. Subsequent management response, by all levels, is required to mitigate the impacts on project objectives.

Management Value of the Guideline

Earned value information must be incorporated into project management reviews with internal manager and the customer and used in the decision-making of corporate leadership. Sound project management embraces a consistent and repeatable process that involves monitoring the project, addressing problems, implementing solutions, and following up on effective corrective actions until closure. Implementing corrective actions and assessing the effect is critical to ensuring the success of the project. As a result of the routine performance and progress evaluation, the cost, schedule, and technical status provided to the customer must align with the contractor's EVMS data and information in order to identify the progress made towards meeting the overall technical, schedule, and cost objectives of the project. For effective management control to proceed, root cause analysis, impacts, and resulting corrective actions must be identified at the appropriate level and then formally tracked to resolution and closure.

Impact of Noncompliance

If the PM and CAMs are not using the EVMS data and information, and specifically the IMS to prioritize work scope, resource conflicts are likely to ensue, performance inefficiencies may increase, and project goals may be missed. Significant changes in float values between periods left unattended may indicate issues with the integrity of the schedule and the final costs to complete remaining work. If managers do not use the EVMS data and information for daily management and decision making the resultant inaction may result in a project with poor cost and schedule performance.

Corrective actions should be assigned to a responsible manager with the appropriate authority to implement the necessary corrective actions and risk mitigation efforts required. Without this daily attention and authority, corrective actions and risk avoidance measures may not be fully understood, appreciated, and completed. An underutilized EVMS can result in uncontrolled cost overruns and schedule slips where managers do not identify problems and take immediate corrective action and ignore the magnitude of problems. The consequences are:

- Inaccurate status information
- Misleading cost and schedule performance trends
- Delayed visibility of problems
- EAC jumps and schedule slips (unwelcome surprises)

Typical Attributes

1. Is there evidence the contractor's management uses and analyzes earned value information (at least on a monthly basis) as a part of their decision-making?
2. Are corrective actions identified, including activities to reduce cost/schedule impacts? Do corrective actions include a completion schedule and the identification of person(s) responsible for executing the corrective action plans?

Discussion

The project maintains a monthly cadence or EVMS cycle that uses performance measurement data to manage issues that arise during execution. This monthly rhythm lends itself to reviewing the earned value data, finding variances, determining root causes and the appropriate corrective actions and tracking these actions to closure through a corrective action log. Typically, contractor PMs conduct status meetings, critical path and risk meetings, all using data and information from the EVMS.

Corrective Action Plans should identify risks, specific actions, mitigation steps, completion schedules, and the responsible managers. These plans should be developed in the EVMS. Once corrective action plans are developed, they are documented in the VAR. These plans should identify specific actions that are required, risk mitigation steps, a completion schedule, and identification of the responsible person(s). The plans are documented, implemented, and monitored until resolution of the problem. An effective project management approach should ensure that the individuals responsible for implementing corrective actions have sufficient authority and control over the required resources used to resolve or recover from the performance deviation. Identified cost, schedule and technical risks should be incorporated into a formal risk management process. If variances are unrecoverable, an explanation of the impact on the project should be provided. If corrective action is not taken, then explain how the impact will not adversely affect accomplishment of project objectives.

While there is no requirement for a corrective action log in the guidelines, the corrective actions must be tracked and reflect the problem/cause, the corrective action, the responsible person, estimated completion date and the actual completion date. A corrective action log is typically used.

Part of the VAR is documenting corrective action plans to reduce or mitigate the variance. The VAR corrective action must identify the activities, responsible person for implementation, and the estimated completion date. A corrective action log is a best practice that documents and facilitates follow up on the actions through completion (see EIA-748 EVMS Guideline 26).

Guideline 27

Maintain Estimate at Completion

Develop revised estimates of cost at completion based on performance to date, commitment values for material, and estimates of future conditions. Compare this information with the performance measurement baseline to identify variances at completion that are important to company management and any applicable customer reporting requirements including statements of funding requirements.

Purpose of the Guideline

Ensure that the estimates of the cost to complete the remaining work scope on a project are periodically reassessed. A most likely estimate of the total costs for completing all work scope is maintained and reflects the future impacts and risks/opportunities not yet captured in performance. The development of WP level time-phased ETCs for all remaining work scope are the basis for completion dates and funding requirements.

Management Value of the Guideline

A properly established and maintained EAC ensures continuing visibility into the cost, schedule, risks and opportunities, as well as the resource requirements (e.g., funding, labor resources, facilities, etc.) and contributes to project success for both the government and the contractor. The contractor PM's and CAM's ability to defend project level and control account level EACs for remaining work scope. Timely, accurate, reliable, and auditable cost estimates support the government's ability to sufficiently fund the project and enhance management's visibility into critical resource requirements (labor resources, facilities, etc.).

Impact of Noncompliance

When the EAC is not properly maintained, the project will not have visibility into cost and schedule risks and opportunities, as well as the resource requirements (e.g., funding, labor resources, facilities, etc.) that could jeopardize the success of the project. Failure to base EACs on a realistic assessment of the resources required to complete remaining work scope, including material purchases and subcontract efforts, creates uncertainty and increases the risk of EAC jumps and schedule slips (e.g., unwelcome surprises).

Typical Attributes

1. Are estimates of cost at completion generated with sufficient frequency to provide identification of future cost problems in time for possible corrective or preventive actions?
2. Are estimates of cost at completion generated at the level where resources are planned, and actuals cost are collected by CAMs? And are estimates coordinated with those responsible for resource availabilities?
3. Are estimates of costs at completion an accurate, detailed, unembellished depiction of the cost of a project, control account or WP/planning package? The cost estimate has a single total value and may have identifiable component values including:
 - (1) Performance to date
 - (2) Material commitments
 - (3) Actual costs to date
 - (4) Knowledgeable projections of future performance
 - (5) Estimates of the cost for contract work remaining (including known risks and/or opportunities) to be accomplished
 - (6) Applicable direct and indirect rates

4. Are annual comprehensive estimates of costs prepared with increasing degrees of information including the establishment of ground rules and assumptions for each cycle and future cost estimates by elements of cost?
5. Are the contractor's estimates of costs at completion reconcilable with cost data reported to the Government?

Discussion

Developing the EAC is a crucial part of the project management plan as it provides insight into future resource requirements. The EAC is based on the ACWP to date plus the ETC for the remaining incomplete work. EACs are not constrained by funding or negotiated contract costs but focus on the total projected cost of the project work scope.

The ETC is developed by element of cost at the WP, planning package and SLPP levels (or lower depending on where resources are identified) for the remaining effort and are added to the cumulative ACWP to calculate the EAC. This calculation includes evaluating the type and quantity of resources required to complete project objectives. At a minimum, direct costs are collected at the control account level so the calculation of ETC is based on time-phased resources corresponding to the scheduled forecast dates, and is accurately summarized through the WBS and the OBS. On a monthly basis, the CAMs review the status of the expended effort and the viability of the forecast. Subcontractor EACs are included in the prime EAC.

Judicious maintenance of the CA level EAC by the CAM ensures that the EAC reflects a valid projection of project costs. When updates are made to existing forecasts, significant changes are briefed to project management. Internal and external reporting includes the same updates and reflects the same risk and opportunity evaluations.

Annually at a minimum, a comprehensive EAC must be prepared by the CAM assigned responsibility for the work using all available information to formulate the most accurate EAC. A properly established and maintained EAC will ensure continuing visibility into resource needs (resources, materials, etc.) and lead to project success for both the DOE and the contractor. Using the management assigned responsibility for the work scope, accurate estimates by element of cost enhance the contractors' visibility into critical resource requirements.

The To-Complete Performance Index (TCPI) metric must be evaluated to gauge realism of the EAC against the cumulative Cost Performance Index (CPI_{cum}).

- $TCPI_{EAC} = (BAC - BCWP_{cum}) / (EAC - ACWP_{cum}) = \text{EAC-based To-Complete Performance Index}$
- $TCPI_{EAC}$ index is compared to the CPI_{cum} index and should be within +/- .10 of the CPI for the EAC to be considered realistic. An accurate well maintained EAC supports the customer's ability to provide sufficient funding to the project.

In projects, during the monthly review cycle, CAMs review the accuracy and currency of the CA EAC at the same EOC levels and, if necessary, generate a revised CA EAC for PM approval.

The PM is responsible for reporting the most likely EAC each month as well as the best and worst case EACs. Also, EACs are reported by WBS in Format 1 and by OBS in Format 2 of the IPMR/CPR. The EACs by WBS and OBS should tie with internal reports. There also needs to be reconciliation between the summarization of EAC from the WBS/OBS and the PM's most likely addressed in Format 5 of the IPMR/CPR. This reconciles the internal and externally reported EACs.

The review of ETCs must always include a review of the latest schedule forecast dates, as the schedule forecast will drive costs and must be continually evaluated. Because resource allocation and availability drive the schedule forecast dates, resources included in the ETC must be planned consistently with the schedule forecast and timing. Said a different way, the ETC and the forecast schedule must demonstrate cost and schedule traceability. This traceability also means that the resource spread in the schedule should be the same as the resource spread for entire work scope in the EVMS cost tool. The EAC forms the basis for future resource requirements such as specific labor by category, equipment, facilities, etc. There may be conflicting requirements at the facility or company level for these resources. Shortages and overages must be coordinated with functional management to ensure the EAC is achievable. The EACs must be the result of a fully staffed effort including top management participation to ensure that needed resources (budget, staffing, special skills, etc.) are available for the remaining effort.

It is the responsibility of the prime to ensure all project work scope is reviewed in the development of the EAC. Depending on the contractual relationship, either the subcontractor or the prime may be responsible for developing the EAC. If the subcontractor develops the EAC, the prime is still responsible to review the subcontractor's submission to ensure they have followed the ground rules and assumptions and assessed the reasonableness of the total EAC. The prime CAM is also responsible to plan the subcontractor fee, if any, in separate WP, to ensure that the EAC incorporates the subcontractor fee.

On a monthly basis, the CAM must review the status of the expended effort and viability of the forecast. This analysis must focus on performance to date within the CA, an assessment of the effort on work scope not yet completed, and an evaluation of the type and quantity of resources required to complete the remaining effort by element of cost. The CAM evaluation of EAC metrics by TCPI, Independent EAC (IEAC) formulas, and correction of any data anomalies at the CA and WP level, can be used for comparative analysis and to check for the reasonableness of the EAC. This will help ensure a more accurate projection of project costs. When updates are made to existing forecasts, these significant changes are briefed to project management.

CAMs have the responsibility to review for currency their control account EACs every month during the variance analysis process. Thresholds do not have to be exceeded to change an EAC, just knowledge that the current ETC is no longer realistic and does not represent the work remaining. An update to the EAC may be because of schedule delays, cost variances, degrading performance indices, technical performance issues, realized risks, and/or scope changes.

The ETC is prepared by resource based on variances that occur by EOC. Monthly EAC analysis should focus on performance to date within the control account, an assessment of the effort to complete the remaining work, and an evaluation of the type and quantity of resources required to complete the effort. It is probable that the EAC may require updating based on technical trends that may precede significant schedule and/or cost impacts. Generally, a 5% overrun or underrun to the EAC is considered significant enough to trigger a review of the EAC to determine if the EAC should be updated. A 10% overrun or underrun to the EAC requires an EAC review and update (if applicable).

The PM and CAMs need to approve any ETC/EAC update. Effectively maintaining the control account EACs provides project management with the assurance that projected costs for completing the work are credible and that any decisions regarding the allocation of future resources is based on valid data.

$TCPI_{EAC}$ to CPI is the most common metric used to check for the reasonableness of the CAM EACs. The formula for $TCPI_{EAC}$ is $(BAC - BCWP_{cum}) / (EAC - ACWP_{cum})$. The other way to look at this formula is left to earn divided by left to spend. When the control account percent complete is greater than 15%, then a .05 and .1 difference is mathematically significant. This difference has been proven out with 1,500 large projects at DOD. The EAC at the CA level should be reviewed for currency at a .05 difference between $TCPI_{EAC}$ and CPI_{cum} . At a .1 difference the EAC must be evaluated and updated, if it cannot be justified. In calculation of this metric a .1 or higher number indicates the EAC is understated. A value equal or less than (.1) indicates the EAC is overstated.

Reviewing an EAC for achievability or reasonableness is a good practice at the project level. There are two checks of EAC realism that should be performed: comparison of the CPI_{cum} to the $TCPI_{EAC}$, and comparison of the EAC to two independent EACs (IEAC).

- Comparison of CPI_{cum} to $TCPI_{EAC}$: The TCPI measures how efficient one must be to achieve the EAC being forecast. The formula is: $(BAC - BCWP_{cum}) / (EAC - ACWP_{cum})$. The TCPI should be within 10% of the CPI to be considered achievable or justified.

- Comparison of EAC to the best case/worst case IEACs to provide a range:
 - Cum CPI Method — The Cost Performance Index (CPI) measures the historical efficiency for performing the work. The formula is: $BCWP_{cum} / ACWP_{cum} = CPI$. The IEAC based on this past performance is calculated as $IEAC = BAC / CPI_{cum}$. This provides an EAC solely based on historical cost performance.
 - $CPI_{cum} \times SPI_{cum}$ Method — This formula includes cost and schedule performance. The formula is: $ACWP_{cum} + ((BAC - BCWP) / (CPI_{cum} * SPI_{cum})) = IEAC$.
 - The two EACs should be within 10% of each other. Should there be larger differences, the contractor PM should review the EAC for CAs that may have driven the EAC higher than necessary.

These comparisons are valuable in determining the credibility of an EAC. Note that some of the tests overlap; for example, all may indicate an understated EAC. For the purpose of testing, they all are considered one integrated test. Depending on the phase of the project, certain EACs may not be relevant. For example, the cumulative CPI method is typically only reliable in the first phases of the project to 50% complete. The CPI/SPI method is only reliable between 35% and 75% complete. The $TCPI_{EAC}$ formula is accurate for most of the project phases. Typically, none of the calculations are reliable below 15% complete.

The Comprehensive EAC (or bottom up EAC) is conducted at least annually, or more frequently as stipulated in the contractor's EVM System Description. This process will need to be repeated more frequently if project performance deems the current EAC is no longer valid. This process must include, but not be limited to, ground rules and assumptions, an overall schedule for completing the comprehensive EAC, identification of templates used to update the EAC, and the final approval process. The customer also needs notification if a funding constraint is breached per guidance in the contract or DOE O 413.3B.

While the monthly EAC is a routine assessment, the comprehensive EAC process addresses all facets of the project. This process must include, but not be limited to, ground rules and assumptions, an overall schedule for completing the comprehensive EAC, identification of templates used to update the EAC, and the final approval process. The customer also needs notification if a funding constraint is breached per guidance in the contract or DOE O 413.3B. Resources are planned within WPs at the EOC level, therefore resources are updated annually within the WP to prepare the comprehensive EAC. The comprehensive EAC also must be accompanied by a BOE.

A comprehensive EAC is often prepared at the start of a major project phase, such as the start of design or construction. Consequently, it can reflect the reduced uncertainty resulting from a design release and/or a released bill of material, which enables the contractor to answer these questions:

- Are the remaining authorized funds sufficient to complete the project?
- Is prior cost experience a predictor of future cost performance?

- Should the remaining project be modified based upon the performance to date?
- Will the project cost performance impact the corporate financial condition?

The earned value guidelines define the EAC as the sum of the contract cumulative- to-date ACWP plus the contractor PM's best estimate of the time-phased resources (funds) required to complete the remaining authorized work, the ETC. This relationship is often expressed by the formula $EAC = ACWP + ETC$. Thus, the EAC is a forecast of the project's final cost. The contractor may revise work priorities, replan remaining activities on the project schedule, and/or adjust the technical approach to complete the project's goals within the estimated remaining resources. The goal is to complete all of the contract work scope within the Contract Target Cost (budget) and Contract Completion Date (schedule).

As with all estimates, the level of uncertainty of an EAC will vary with the type of remaining work, the available information, and the perceived remaining risks. Prudent management needs to know how valid an EAC is, especially when the EAC varies significantly from the project's authorized budget (or BAC). Thus, the objectives of project management include the identification of the level of uncertainty associated with the remaining schedule, establishing the cost estimate for the remaining work, and managing the impact of the uncertainty upon the project cost goals.

For these reasons, the CPR and the IPMR require three separate EACs in an attempt to capture information regarding the level of cost uncertainty or the magnitude of the known project risks. These reports require EACs that represent the best case, the worst case and the most likely EAC. The best-case estimate is the one that results in the lowest cost to the Government. This estimate is based on the outcome of the most favorable set of circumstances that consider opportunities and factored best-case assumptions of risk. The worst-case estimate is the one that results in the highest cost to the Government. This estimate is based on the outcome of the least favorable set of circumstances. The most likely EAC is the contractor's official EAC and represents the contractor's commitment to DOE. As such, the most likely EAC takes precedence over the estimates presented in the IPMR/CPR Column (15) of Formats 1 and 2 and Blocks 6.a.1 and 6.b.1. This EAC is the value that the contractor's management believes is the most likely outcome based on a knowledgeable estimate of all authorized work, known risks, unknown risks, and probable future conditions.

As the actual cost to date is a known value, EAC uncertainty is a function of the ETC. The ETC is prepared by re-estimating the resources required to complete the remaining authorized work using the cost experience to date and then applying a number of other factors; such as current direct and overhead rates, SRA, Monte Carlo simulations, and root cause analysis. A well-conceived ETC also considers purchase order commitments, anticipated labor efficiency and rate, material price and usage, ODC price and usage performance, risk and opportunities, resources by type, and other factors identified by higher management. Additionally, as the ETC is being developed it should be mapped to the current schedule consistent with the Estimated Completion Date (ECD).

As a means to cross check the EAC, a mathematical or independent estimate of the EAC is typically prepared using performance indices based upon the cost and schedule experience to date. For example, the CPI (cumulative BCWP / ACWP) can be used to complete the EAC by dividing the project BAC by the CPI. The resulting EAC is often referred to as the Independent EAC (IEAC) to distinguish it from a formal or grass roots EAC. The IEAC can be quickly prepared and then used to test the reasonableness of the current cost estimate and to indicate when a comprehensive EAC should be undertaken. It is important to note that these calculations do not consider any “thinking” about the considerations mentioned above with respect to anticipated labor efficiency and rate, risk and opportunities, SRA, etc. It is often said that they are independent of sanity, logic, and judgment. They are calculated for comparative analysis, which is an important purpose.

Timely and realistic EACs and completion date estimates should be an integral part of project management and corporate financial management practices. Both practices require routine comparison of project EACs and completion date estimates with contract targets to forecast and report the financial performance of the project to customers and stockholders.

7. REVISIONS AND DATA MAINTENANCE

The Revisions and Data Maintenance category focuses on maintaining an accurate and reliable CBB/PBB and PMB throughout its POP. The objective of the five guidelines (28–32) that comprise this category is to establish the requirements for implementing a formal change control process that will preserve the integrity of the PMB and corresponding EVMS data and information. These guidelines ensure that the PMB reflects the most current plan for accomplishing the effort thus providing credible performance measurement data that management can rely on to make project-related decisions.

As the PMB represents the agreed-upon plan between the contractor and government for how contractually authorized work is accomplished and measured, any changes to the plan must be formally controlled and properly documented using a systematic approach. Ensuring authorized contractual changes are incorporated into all affected budgets, schedules, work authorizations, and other project documentation in a timely manner prior to the commencement of that work ensures the PMB reflects all authorized work scope (Guideline 28). Implementation of the Revisions and Data Maintenance guidelines requires the contractor to use a disciplined change control process that maintains the integrity of cost and schedule data when incorporating authorized revisions to the project’s scope, schedule, and/or budgets (Guideline 29). To maintain the accuracy/validity of performance measurement data, and its use for making reliable cost/schedule projections, retroactive changes to the data must be controlled and limited to certain circumstances only (Guideline 30).

The freeze period first discussed under Guideline 6, applies further to the Revisions Guidelines as shown in Figure 13. This figure shows the pertinent guidelines for the periods prior to, during, and after the freeze period.

| Oct | Nov | Dec | Jan | Feb |
|---|------------------------------|------------------------------|------------------------------|--|
| Earlier Periods (Time Now -2...n) ← | Prior Period (Time Now-1) | Current Period (Time Now) | Next Period (Time Now +1) | Future Periods (Time Now +2...n) → |
| RETROACTIVE CHANGE PERIOD (GL 30) | | FREEZE PERIOD (GL 28 & 29) | | PLANNING PERIOD (GL 28 & 29) |
| | | | | |

Figure 13. Revisions EIA-748 Guidelines Applicable to Freeze Period Changes

The source of revisions to the PMB can be either internally or externally driven and may affect all categories of an EVMS. Consistent and systematic use of a baseline change control process prevents unauthorized revisions to the CBB/PBB and PMB (Guideline 31). It is important that authorized baseline revisions are documented, managed, tracked and reported to the contractor PM and the government in a timely manner (Guideline 32). Examples of changes to the baseline are depicted in Figure 14.

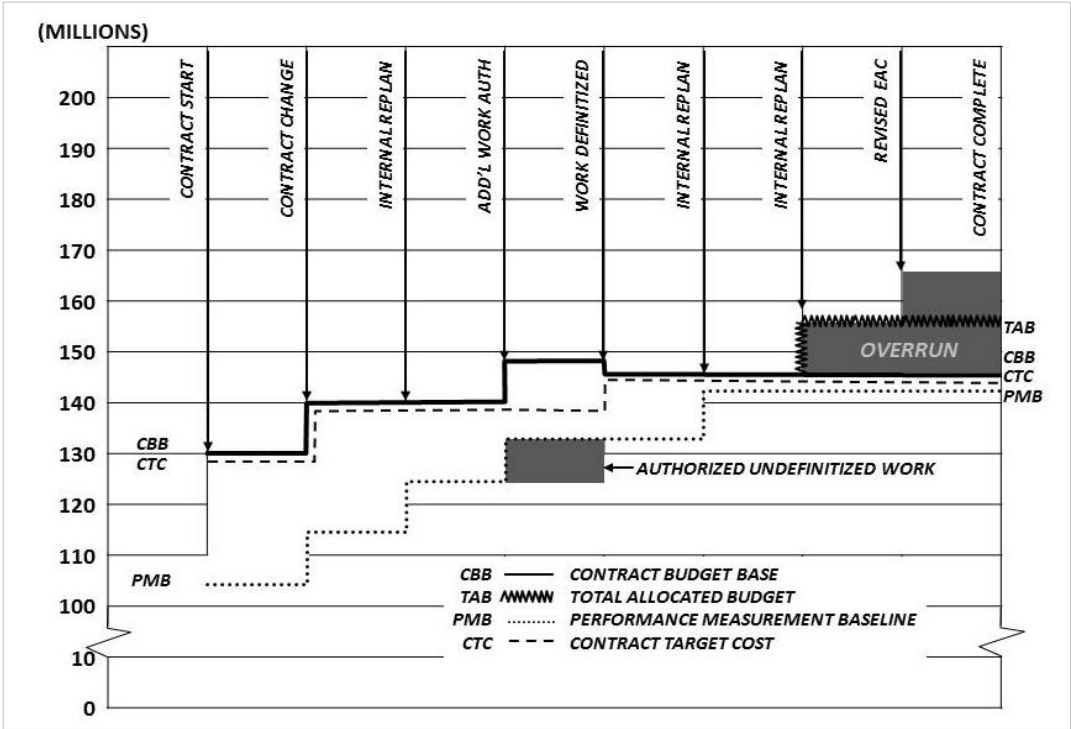


Figure 14. Example of Revisions and Data Maintenance Process

Guideline 28

Incorporate Changes in a Timely Manner

Incorporate authorized changes in a timely manner, recording the effects of such changes in budgets and schedules. In the directed effort, prior to negotiation of a change, base such revisions on the amount estimated and budgeted to the project organizations.

Purpose of the Guideline

To ensure authorized changes are accurately incorporated into the CBB/PBB and project schedule in a timely and systematic manner. Implementing a disciplined change control process assures that the CBB/PBB (PMB + MR) is up to date and that performance measurement data reflects all authorized work scope.

Management Value of the Guideline

A properly maintained CBB/PBB is crucial to effective project management. The timely and accurate incorporation of contractual changes ensures that the information generated from the execution of the baseline plan provides an accurate picture of progress and facilitates appropriate management actions and decisions.

This guideline addresses changes to the baseline in one of two ways: 1) Incorporate Negotiated Changes: The requirements for handling the incorporation of DOE directed changes, or 2) AUW: A unique aspect of implementation is reacting to formal changes. This section sets the minimum expectation for handling AUW.

Impact of Noncompliance

Without timely incorporation of authorized changes, the CBB/PBB (PMB + MR) will not be up-to-date and the baseline may not reflect the current authorized work scope from contractual changes, which prevents the proper execution of authorized work. Failure to distribute scope and budget in a timely manner after a stop work order may result in delays in detailed planning and work execution. Failure to reclaim budget (in the event of a stop work) in a timely manner may result in work being performed after a stop work order has been issued. Failure to incorporate the full, estimated budget for all newly authorized work results in a baseline that does not fully represent the work scope of the changed contract.

Typical Attributes

1. Are authorized changes incorporated in the PMB in a timely manner?
2. For unpriced change orders, detailed planning is maintained for near-term work. After definitization, any budget remaining in UB will be planned and budgeted within control accounts, SLPP, or MR.

3. Incorporating changes must not arbitrarily eliminate existing cost and schedule variances.

Management must ensure that DOE-directed changes are incorporated into the project plan. Change is inevitable and as projects progress, new concepts or opportunities surface, and risks are realized impacting the original plan that may now need revision.

Incorporating negotiated changes is conducted in a controlled manner. This controlled process preserves the integrity of the original plan, allowing a clear understanding of what is changing. Authorized changes are processed in a timely manner, incorporating such changes into the PMB within two accounting periods after the DOE approved change document and subsequently, for internal changes, within one accounting period after the approval of the contractor baseline change documentation (e.g., Budget Change Request (BCR)). Project documentation is revised consistent with the authorized contractual change ensuring the new project direction is supported by revised budgets, schedules and forecasts. Maintaining up-to-date project documentation is also important to ensure the most recent negotiated changes are incorporated into the EVMS.

The baseline must reflect the current authorized work scope with contractual changes. A properly maintained and up-to-date PMB and IMS are crucial to effective project management. The timely and accurate incorporation of contractual changes ensures that the information generated from the execution of the baseline plan provides an accurate picture of progress and facilitates appropriate management actions and decisions. New scope and/or contingency must be authorized by the customer.

UB is budget that is applicable to specific contractual effort that has not yet been distributed to CAs or SLPPs. Identification of the project's UB, facilitates project management's ability to account for and report on all authorized scope and budget. UB is a holding account for new authorized work or AUW. Once a DOE approved change document has been approved, the UB budget and scope must be distributed to CAs and/or SLPPs no later than two full accounting periods. For unpriced change orders (or AUW), the contractor's best estimate of the cost of the new work scope is developed for planning and budgeting purposes. This value is used to establish initial budgets in the PMB. Until the effort is definitized and priced, scope and budget for near term efforts are established in CAs with the remaining scope and budget held in UB until negotiations are complete. After definitization, the scope and budget remaining in UB will be planned and budgeted in CAs and/or SLPPs as soon as practical, typically within 44 working days, but no later than one full accounting period after the baseline change documentation is approved (also see EIA-748 EVMS Guidelines 9 and 14).

UB may also contain scope removed from the distributed baseline. If the government issues a stop work order or DOE required scope reductions, the work must be immediately stopped with the budget associated with the budgeted cost of remaining work returned to UB to await final definitization and removal from the contract/project. This distribution is required within one full accounting period

after the stop work order is received to keep project scope and time-phased PMB in synch. Contract scope reductions are removed from UB within one month after the baseline change documentation approval taking the scope out of the project for the work stopped.

AUW accommodates the need for additional scope and budget and provides a controlled process to allow work to begin and negotiations to follow. There are times when the contractor and DOE agree that additional scope was not in the original work statement but is understood to be required and is necessary to accomplish the project objectives. It may be that the work must be started immediately, preceding negotiations to definitize the final budget. (See the discussion of planning emerging work under GL9). While UB distributions to accommodate AUW in the near-term may be limited by the not-to-exceed (NTE) funding authorizations, the full estimate for AUW should be placed in UB at the time the AUW is authorized until distributed.

AUW must be incorporated into the PMB at its estimated value for the entire work scope and therefore not be limited to a contractual funding limitation such as an NTE. Because these funding limitations are typically at 50%, 75% if deemed a qualified proposal, or at some amount less than the anticipated total value of the effort, it is simply a partial amount to encourage negotiations. The entire estimate for the newly authorized work scope is then placed into UB. The contractor is encouraged to distribute only the amount of budget necessary for near-term work until the entire effort can be definitized. Once the definitization has occurred, the AUW can then be more easily adjusted to the negotiated amount, and then the UB amount remaining distributed to CAs and SLPPs (see EIA-748 EVMS Guideline 28).

The contractor determines the full value of the change to incorporate into the baseline from one of several sources. This number is provided to DOE before implementation. As the estimate matures, the revised forecast is reconciled with the remaining UB as applicable. In order of preference the sources could be

- A number with full scope provided by DOE. This number does not include an NTE that is not based on the total scope.
- A proposal with Certified Cost and Pricing.
- Any written proposal.
- A Rough Order of Magnitude (ROM) estimate.

The changes to the CBB/PBB in the form of AUW must accurately identify all authorized work scope on contract. AUW scope and associated budgets are identified without the constraint of funding or NTE limitations but are related to the value of the proposal. Just as incrementally funded contracts should establish a CBB/PBB for the entire scope of work, the budget established for AUW must represent all authorized scope. The contractor responds to the AUW authorization by placing the near-term budget into the applicable CAs and the remainder in UB until negotiation and incorporation into the contract (and removal from AUW). After definitization of a contract modification, any AUW

budget remaining in UB is allocated appropriately, i.e., either planned and budgeted into control account(s), SLPP(s), or MR as soon as practical or removed from the CBB/PBB.

Guideline 29

Maintain Baseline and Reconcile Budgets

Reconcile current budgets to prior budgets in terms of changes to the authorized work and internal replanning in the detail needed by management for effective control.

Purpose of the Guideline

To ensure the ongoing integrity of the CBB/PBB, budget traceability throughout the lifecycle of a project must be maintained. Current budgets must reconcile to prior budgets in terms of changes to work scope, resources, schedule, and rates so that the impact of contract changes and internal replanning on overall project growth is visible to all stakeholders.

Management Value of the Guideline

The need for accurate performance measurement requires that the CBB/PBB maintain a traceable relationship to the contract. As changes are made to the contract, the CB/CBB/PBB must be adjusted by the amount of change in order for the communication between the customer and contractor to remain valid. Change control for internal replanning ensures a realistic and valid baseline that maintains its relevancy when different engineering or construction approaches or reorganization of work or people are necessary to increase the efficiency of operations.

Impact of Noncompliance

Without maintaining the baseline and reconciling budgets, the impact of contract changes and internal replanning on overall project growth would not be visible to all stakeholders. Frequent or continuing adjustments to the baseline or accounting data within the freeze period may result in an unstable baseline from which cost and schedule variances are dependent upon to provide insight into performance trends. Failure to properly document the supporting details for proposed baseline changes invalidates the integrity of the PMB. Inability to trace the changes leading to the current budget baseline results in a lack of confidence that the baseline changes were properly authorized and implemented. It also provides a lack of confidence in the validity of the baseline. Inappropriate or improperly tracked baseline changes result in an unstable and invalid baseline, causing bad information for decision making by the contractor PM. Baseline changes that are poorly justified may lead to poor work execution and scope creep.

Failure to record offsetting and equal entries against UB and the distributed budget will result in erroneous values for the budgets and an inaccurate baseline. Failure to record offsetting and equal

entries against MR and the PMB will result in erroneous values for the budgets and an inaccurate baseline.

Failure to have effective baseline controls in place for open WPs will result in an unstable baseline, unauthorized changes, and lack of insight into the true performance of the project. When LOE WPs are not replanned to align with expected actual costs, BCWP will be still be automatically recorded, resulting in a false cost variance.

Typical Attributes

1. Are baseline changes reconcilable to the prior baseline and does the baseline change documentation include all necessary information for effective control?
2. Are changes to BCWS in open WPs limited to time phasing the remaining future budget outside the documented freeze period or provide additional detail (not new scope) without a change in BAC? Are BCWS changes to future time phasing approved?
3. Is MR limited to authorized work that is in-scope to the contract, but out of scope to a control account?

This restricted period encourages detailed control account planning to be in place beyond the freeze period to facilitate efficient execution of the near-term work scope and to allow valid performance measurement. The freeze period is a term used to indicate a restrictive period for baseline changes. Several definitions are crucial to understanding this concept. Typically, contractors will follow an accounting calendar rather than the monthly calendar, so the freeze period is referenced in terms of the calendar used for EVMS. Contractors will use this accounting calendar for all aspects of EVMS planning, execution, and reporting. The intent of the freeze period is that there must be no ability to adjust the budgets or budget time phasing based on actual performance in order to mask variances. Baseline changes are highly restricted during this defined freeze period in order to maintain a stable and measurable work plan for ongoing work. See Figure 15.

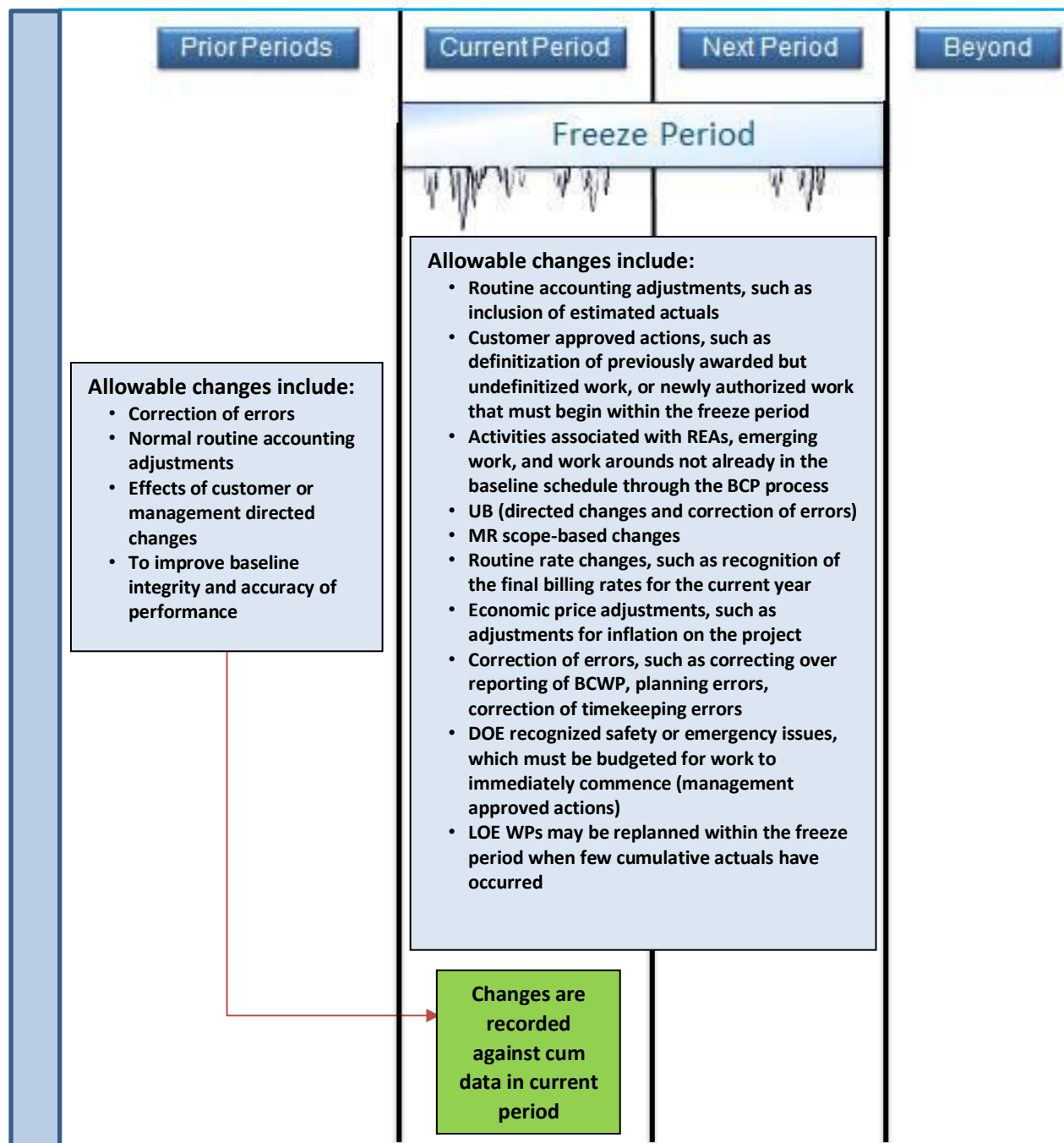


Figure 15. Freeze Period Changes

The freeze period must be at least two reporting periods, i.e., current plus one. At the beginning of the month it is the longest and the end of the month the shortest. It rotates at the contractor accounting calendar month-end date to the next following month-end date to the next following month-end.

Managers must restrict any baseline and accounting changes during a defined freeze period. Baseline and accounting changes are highly restricted during the defined freeze period in order to maintain a stable work plan for ongoing work, allow meaningful variances, and to ensure that planned resources will be available as scheduled.

Changes permitted within the freeze period are limited to:

- Routine accounting adjustments, such as inclusion of estimated actuals;
- Customer approved actions, such as definitization of previously awarded but undefinitized work, or newly authorized work that must begin within the freeze period;
- Activities associated with REAs, emerging work, and work arounds not already in the baseline schedule through the BCP process;
- UB (directed changes and correction of errors);
- MR scope-based changes;
- Routine rate changes, such as recognition of the final billing rates for the current year;
- Economic price adjustments, such as adjustments for inflation on the project;
- Correction of errors, such as correcting over reporting of BCWP, planning errors, correction of timekeeping errors;
- DOE recognized safety or emergency issues, which must be budgeted for work to immediately commence (management approved actions); or,
- LOE WPs may be replanned within the freeze period when few cumulative actuals have occurred.

The IPMR/CPR Format 5 must identify the reasons for MR transactions and these must agree with the reasons provided in the contractor's change control documentation. Review freeze period budget change documents to ensure adherence to the process. Verify cost and schedule explanation of impacts to the IMS and CBB/PBB are documented. Compare all documentation to ensure internal changes match what is reported to the Government.

Managers must ensure that all baseline change documentation is reconciled throughout the EVMS.

The source documents may vary between contractors depending on the EVMS, but will include:

- Baseline schedule durations (baseline start and finish dates);
- Baseline schedule links, showing any updated or new logic;
- Earned value techniques for new WPs;
- Proposed new earned value technique process for changing WPs before and after EVT is revised;
- Baseline budgets by element of cost;
- Baseline rates used for planning (may refer to date and name of approved set)'
- Justification for proposed baseline changes within freeze period.

Note that the contractor's system may also require submission of any proposed QBD as back up for the earned value technique. When a change is required from one budgeted element of cost to another, the change is driven by either a change in the work scope or how the work will be performed. For example, work was previously budgeted as labor meaning it would be performed by in house (prime contractor) labor resources. If a subcontractor was now performing the work, the budget element must change from labor to subcontract/material. In all cases, this item represents a change in the work scope and how it will be done and must be approved and documented in a baseline change request.

Additionally, the EVT may not be changed in an open WP where direct costs have already been incurred unless the EVT chosen was proven to be a planning error. The preferred method is to close the existing open WP by setting cumulative BCWS and BAC equal to cumulative BCWP and planning a new WP with the different technique. Again, ACWP is not changed when the existing WP is closed, and any CV will remain with the closed WP.

If the preferred method for revising the EVT by closing the existing WP and opening a new one is not used, and the contractor chooses to revise the existing WP, then the contractor must:

- Adjust the cumulative BCWP for performance using the new EVT. The issue here is that the percent complete could change using a different EVT. This issue includes QBDs, if applicable.
- Update the IMS and the EV cost tool.
- Provide the justification and documentation for changing the EVTs in open WPs in the IPMR/CPR Format 5.

The integration of scope, schedule and budget during the change process is crucial to baseline integrity. Following a controlled and consistent change process is vital to maintaining accurate EVMS reporting. The change process requires that there be a clear understanding of what is being changed and reconciliation between the current plan and the revised plan facilitates this understanding. Project documentation such as work authorizations, schedules, and project logs provides and demonstrates this reconciliation.

Current budgets and schedules must reflect the current levels of authorized work and be based on resources needed to complete that work. The budgets must be traceable to original authorized budgets and scope.

It may be necessary to perform internal replanning actions within scope of the authorized contract (CBB/PBB or TAB) to compensate for cost, schedule, and technical problems which have caused the original plan to become unrealistic; or which require a reorganization of work or people to increase efficiency of operations; or which require different engineering or manufacturing

approaches. Internal replanning is intended to maintain an executable baseline for the remaining in-scope work on the contract.

Schedules must support the project milestones and deliverables. The ability to track budget values and schedules for both internal and external changes is necessary to properly maintain the CBB/PBB from contract start to completion. This process also ensures that the CBB/PBB maintains a traceable relationship to the contract. As changes are made to the contract, the CBB/PBB must be adjusted by the amount of change in order for the communication between the DOE and contractor to remain valid.

Management must ensure that if a change involves UB, it is reconciled with the CAs, SLPPs, or MR. As UB is a temporary holding account for work scope and budget, any baseline change that involves a transaction from UB to CAs and/or SLPPs or vice versa must be offset by a reverse change to the affected accounts. For example, if a change was recorded to UB to move \$1M to the distributed budget, UB would be decremented by \$1M, and the distributed budget would be incremented by \$1M. The sum of the budget changes to the CAs/PPs or MR must always be equal to the amount distributed from UB. These offsetting entries would be recorded in the CBB/PBB log against the appropriate budget elements (see EIA-748 EVMS Guideline 29).

Most changes will involve movement from UB, but there may be occasions when budget (and the corresponding work scope) is moved from the CAs/WPs into UB. This process is typically done during major re-baselining, movement across CAs, between CAMs, or during stop work situations. UB should be available by change authorization so when work is distributed in part, the remaining budget in UB is still tied to the scope not yet distributed to "CAs". UB may never be negative.

MR transactions used for the sole purpose of eliminating cost variances inhibit early warning signals to identify and correct problems before they worsen. Budget allocations to/from MR through baseline changes that offset cost overruns or underruns, impacts the accuracy of performance indices such as the CPI as a measure of cost efficiency which is also used by contractors and its customers alike to forecast EACs.

The distinct concepts of budget and funds are often confused and may result in a non-compliant EVMS. While funds are a monetary resource provided to pay for completing a statement of work as agreed to contractually, budgets are time-phased estimates to establish the PMB. The EVMS provides visibility into performance based on the time-phased budget so that future costs can be projected. Since most contracts to which EVMS is applicable are cost reimbursable, tracking actual costs and estimating the cost to complete the effort is essential to funds management. The government is responsible to manage the funding to ensure adequate funds are available to cover the allowable costs incurred in completing the project, including cost overruns against the original plan. If the measurement of the work indicates that the total cost will exceed the budget, the budget

does not need to be re-planned. Cost and schedule overruns are used to assist in making projections based on past efficiencies to future efficiencies. Continually replanning the baseline can distort the EVMS data used to make projections which again, are critical in arriving at an accurate EAC.

The contractor must include a clear definition of in the EVM System Description. For clarity and consistency, the EVM System Description must define the process and list allowable conditions under which MR may be approved and allocated to the PMB. The process must ensure that the use of MR meets the stated criteria in the EVM System Description. MR cannot be used to offset accumulated overruns and/or under runs.

Typical authorized uses of MR include:

- Previously unrecognized activities or realized risks consistent with the general scope of work of the contract;
- Change in execution strategy (e.g., make/buy decisions);
- Unexpected future internal scope growth within the currently authorized scope of the project;
- Direct and indirect rate changes and currency fluctuations;
- Risk and opportunity handling (not for cost or schedule variance-based risks);
- Work that needs to be repeated (not the result of inaccurately reported progress);
- Changes to the future budget of work not yet started (e.g., subcontractor activities that are negotiated post project award).

Management must ensure that if MR is authorized, it correctly reconciles with the CAs or SLPPs. Conversely, if an authorized change results in a transfer to MR, as in a make or buy decision where the alternative requires less budget, then the increase to MR must reconcile. These offsetting entries would be recorded in the CBB/PBB log against the appropriate budget elements (see EIA-748 EVMS Guideline 29).

Changes may impact work scope currently being executed. While changes to open WPs are permitted under specific conditions, it is important to follow a controlled process to ensure the previously reported EVMS data is not compromised. In order to further control near term changes, freeze period restrictions may limit changes to open WPs.

The only permissible change to open WPs is a change in the time phasing of the existing budget by EOC beyond the freeze period without DOE approval/direction. This is to ensure baseline stability and a continuing valid measurement of reported BCWP. When new scope-related changes drive a change to an open WP, the preferred method is the WP must be closed by setting cumulative BCWS equal to cumulative BCWP. A new WP would then be planned with the revised scope and budget. ACWP is not changed when the existing WP is closed, and any CV will remain with the closed WP.

If the preferred method for implementing new scope is not used and the contractor chooses to revise the existing WP, then the contractor must:

- Add the additional budget using current planning rates.
- Update the IMS and link/relink activities as required and realistic.
- Adjust cumulative BCWP for performance within the earned value technique. The issue is that the BAC has changed, so the prior cumulative percent complete will change the current BCWP. This includes QBDs, if applicable.
- Provide justification and documentation for changing open WPs in the IPMR/CPR Format 5.

LOE WPs may be replanned to align the budget with the expected start and completion dates for work to be executed. LOE WPs may even be replanned within the freeze period when few cumulative actuals have occurred, to ensure that BCWP will be recorded at the proper time to align with the time frame when actual costs are expected to occur. The interpretation of few is less than 10% actuals to date as compared with the cumulative budget. However, if significant actual costs have already been recorded, these baseline changes are prohibited except for the controlled purposes.

When LOE WPs are not replanned to align with expected actual costs, BCWP will be still be automatically recorded, resulting in a false cost variance.

Project logs provide a method of tracking changes to budgets on the project. The logs typically keep a running balance of the current budget reflecting each change impacting the specific account, such as MR or UB. Each entry made in an account reconciles to other project documentation such as the MR or UB logs, work authorizations, change control documentation, schedules, and control account planning, PMB, and CBB/PBB. The logs provide a significant portion of the data required in the monthly EVMS reporting for the IPMR/CPR and PARS submissions.

Every transaction for MR or UB must be thoroughly documented with the appropriate supporting details in change control documentation. The documentation must specify the affected control account(s) and contain a good justification for the proposed change. Requests for MR must justify the budget request for the control account. Every transaction must follow the guidance and restrictions established in the contractor's EVM System Description.

Typically, an entry is made in the project's applicable budget log (CBB/PBB, MR, UB, etc.) when the CAM requests a number to begin preparation of the change. After approval, the approval date is noted in the log, and the appropriate adjustments are made to MR or UB, and to the distributed budget. These adjustments must track directly to the approved change on the change documentation, with a single entry in the log. After approval, the changes are incorporated into the baseline IMS and budget as appropriate and the work authorization document is created or updated to reflect the new baseline. The revised baseline is also reflected in the EVMS cost tool output for CAPs and also incorporated in the month-end IPMR/CPR.

Guideline 30

Control Retroactive Changes

Control retroactive changes to records pertaining to work performed that would change previously reported amounts for actual costs, earned value, or budgets. Adjustments should be made only for correction of errors, routine accounting adjustments, effects of customer or management directed changes, or to improve the baseline integrity and accuracy of performance measurement data.

Purpose of the Guideline

Control retroactive changes to records pertaining to work performed that would change previously reported amounts for actual costs, earned value, or budgets. Adjustments must be made only for correction of errors, routine accounting adjustments, effects of customer or management directed changes, or to improve the baseline integrity and accuracy of performance measurement data.

Management Value of the Guideline

This Guideline is intended for the active performance period and it provides general guidelines for the types of changes, (i.e., correction of errors, routine accounting adjustments, effects of customer or management directed changes, or to improve the baseline integrity and accuracy of performance measurement data.”

One of the most important EVMS tests is used to find out if there have been unauthorized retroactive changes to the baseline. In practice, this test is done by examining whether a contractor has a change control process that controls retroactive changes to previously reported amounts for actual costs (or ACWP), earned value (or BCWP), or budgets (or BCWS) through a process that includes management approval. Authorized changes to previously report amounts must be made in the current reporting period. Another important test compares the contractor’s current period data on the IPMR/CPR formats 1 and 3 (which reflect any retroactive changes) to the related explanations on format 5. This examination helps to ensure that a realistic PMB is maintained and there is continuous and consistently credible visibility into past performance. Some contractors might be tempted to eliminate the favorable cost variances from past performance in order to allocate the remaining (unused) budget to future effort. This tendency is usually based on the contractor not making the distinction between financial funding and EVMS budgeting standards. The intention of an EVMS budget baseline is to maintain visibility of past performance for the purpose of forecasting future performance. It is important to remember that the BCWP is allowed to change for the correction of errors and for the examples of acceptable changes listed below to improve the accuracy of earned value. If other changes are made, then the integrity of the BCWP value becomes suspect.

BCWP is the cornerstone of a performance measurement system and it should be based on the accomplishment of discrete activities that are representative of true progress. The objective is to minimize any subjectivity in the BCWP calculation. One type of allowable routine accounting adjustment to BCWS stems from negotiating an unpriced change order that results in a differential between the distributed budget of the change and its negotiated value. Please note that the BCWP value should not be impacted by this type of adjustment.

Replanning, or the realignment of scope, schedule, and budget within the CBB/PBB, must be limited to preserve a stable baseline upon which performance is measured. Replanning is generally intended for future plans (in the next accounting period, or outside the freeze period e.g., current period plus 'x' number of months) that significantly vary from the original baseline, but it may also affect budgets in past or current periods within strict controls. Cost, schedule, and technical problems often cause the original plan to become unrealistic; they may require a different engineering or manufacturing approach, or reorganization to increase efficiency of operations. Changes to improve baseline integrity or the accuracy of performance measurement are acceptable, even though they may appear primarily to offset cost overruns or underruns.

Examples of acceptable changes to previously reported amounts for actual costs, earned value, or budgets during the active performance period are the following:

- De-earning BCWP when a material item is returned to vendor for repairs;
- De-earning BCWP when rework is required;
- Change in approach due to make or buy decisions;
- Adding budget in the active performance period for risk mitigation activities; and
- Rate adjustments (limited to ACWP only).

Conversely, an example of an unacceptable change is when a contractor retroactively reduces a performance value previously reported to equal the actual costs incurred, and then transfers the resulting budget for the effort to other activities that are overrunning. Even though this transfer may be undertaken at the prompting of the project office, it translates to mean a budget underrun (placed against the next emerging issue) rather than a measure of performance. As a result, these changes often have a material impact on reported values and go uncontrolled as negative BCWS, BCWP and ACWP.

Any mass retroactive change as an across-the-board single point adjustment can have drastic effects on the project and its progress reports. A retroactive change to monthly data will not only cause management to question the work that was previously thought to have been accomplished, but it will also impact the cumulative trend that was previously reflected.

The contractor's adjustment method for the effects of a customer-directed change is critical. Changing a control account budget value during a freeze period for customer directed changes is a

legitimate necessity and should be considered as part of a contractor's internal controls process. Furthermore, the contractor's work authorization process needs to accommodate such changes prior to the start of work during the active performance period. Otherwise, the authorization process will lag behind, and it could lead to establishment of zero-budget accounts or WPs that would result in negative performance values (see EIA-748 EVMS Guideline 8).

Impact of Noncompliance

Failure to control and restrict retroactive changes may result in a significant number of retroactive changes to previously reported data, thereby invalidating the monthly analysis and management decisions by the contractor's management and by the DOE. Frequent and uncontrolled use of SPA techniques results in performance variances being continually eliminated, with the result that performance data is useless for analysis and predictive forecasting.

Typical Attributes

1. Does the contractor limit retroactive changes to routine accounting adjustments, definitization of contract actions, customer or management directed changes, or to improve the baseline integrity and accuracy of performance measurement data?

Discussion

Management controls and limits the number of retroactive changes to previously reported data and ensures authorized changes are made in the current reporting period, not in the period in which it occurred, to provide visibility.

Retroactive changes must be limited to the following conditions:

- Routine accounting adjustments, such as clerical errors, cost transfers, calculation errors, prior period omissions, and prior period adjustments to actual overhead rates;
- Customer or management approved actions, such as definitization of previously awarded but undefinitized work;
- Routine rate changes to ACWP only, such as recognition of the final billing rates for the current year;
- Data entry corrections, such as correcting the reporting of BCWP, correction of timekeeping errors, etc.;
- Recording the impact of closing a WP by setting cumulative BCWS to the value for cumulative BCWP; or,
- Economic price adjustments, such as adjustments for inflation on the contract
- Does the contractor prevent future budget from being used to change the budget of current work or to and offset schedule/cost variances?

A SPA is the process that sets existing contract cost and/or schedule variances to zero and typically accompanies a replan of remaining effort with the goal of completing the project on schedule and

within budget. If a contractor applies the concept of a SPA, then proper controls need to be defined and practiced. Following the implementation of a SPA, the goal should be to develop a new PMB that completes all the remaining work using the remaining budget from the original PMB.

Variances may be reset according to Figure 16. It should be noted that all adjustments are recorded in the current reporting period; in other words, historical reporting is unchanged. Also, note that the ACWP is never changed and must always reconcile to the actual accounting records.

| Approaches | Method |
|--|--------------------------------|
| Eliminate Schedule Variances only (most preferred) | Set cum BCWS equal to cum BCWP |
| Eliminate Cost and Schedule Variances (least preferred) | Set cum BCWS and BCWP = ACWP |
| Eliminate Cost Variances only (rare) | Set cum BCWP = ACWP |

Figure 16. Single Point Adjustment (SPA) Approaches

There are three different approaches for adjusting variances (Figure 16). The preferred approach, when deemed necessary and approved, is the option that only eliminates the schedule variance. The remaining BCWS is then available for replanning into future periods as part of the replanning exercise. This procedure is a logical approach as the budget corresponds to the revised scope of work, provides a valid basis for measuring performance on the revised work, and historical records of actual costs associated with work performed have not been lost.

The least preferred is to eliminate both cost and schedule variances. The BCWS and BCWP are set equal to ACWP. It is discouraged because it does not accurately reflect the work performed at closeout and invalidates the use of productivity measures used in evaluating revised EAC. A rare approach is where only the cost variances are eliminated. This is done when the schedule information is considered valid.

SPAs must be implemented sparingly, as resetting variances to zero restricts any insight into performance for several months. The contractor must provide advance notification and request for approval to the contracting officer prior to implementation of a SPA. If the contractor also adds additional budget during this process that exceeds the target cost, it is known as an OTB. (Refer to EIA-748 EVMS Guideline 8).

Guideline 31

Prevent Unauthorized Revisions

Prevent revisions to the project budget except for authorized changes.

Purpose of the Guideline

Prevent the incorporation of unauthorized revisions into the CBB/PBB.

Management Value of the Guideline

The consistent and systematic use of a baseline change control process to implement changes prevents unauthorized revisions to the time-phased PMB. Unauthorized revisions could inadvertently result in baseline budgets or schedules that exceed the CBB/PBB. The CBB/PBB is a controlled value and cannot be changed by the contractor except as a result of customer contract actions.

There may be situations when available budgets for the remaining work are insufficient for successful execution of the current plan and result in unrealistic or inexecutable assessments of project performance. In these situations, contractor PMs may conclude that the PMB no longer provides meaningful cost and/or schedule performance data. It may be necessary for the TAB for the work to exceed the CBB/PBB, a condition known as an OTB, and/or for the baseline schedule to exceed contract milestones, a condition known as an OTS. The process of establishing either an OTB and/or OTS is called formal reprogramming and may be considered where improved insight and management control would result.

A thorough analysis of project status is necessary before the consideration of the implementation of an OTB and/or OTS. Requests for establishing an OTB or an OTS must be initiated by the contractor and approved by the customer contracting authority. Subcontractor flow-down, where it relates to formal reprogramming, is the prime contractor's responsibility to approve and manage. Implementing an OTB and/or OTS does not change the terms and conditions of the contract but merely serves to improve management of the remaining work. For special considerations to reset variances or implement a SPA for an OTB/OTS, refer to Guideline 30.

Impact of Noncompliance

Unauthorized revisions could inadvertently result in baseline budgets or schedules that exceed the CBB/PBB. The CBB/PBB is a controlled value and cannot be changed by the contractor except as a result of customer contract actions. Failure to maintain this one-to-one relationship between the CBB/PBB and the project value may also result in authorized work not being approved and budgeted if the CBB/PBB target cost does not reconcile with the value of the project that includes profit and/or fee. Improper summing of the PMB and MR to the CBB/PBB and/or the TAB in an OTB causes loss of visibility in budget management. Failure to properly implement an approved OTB will result in

a poorly integrated plan for performance measurement and an increased risk of failure in project execution.

Typical Attributes

1. Are project budgets (CBB/PBB or TAB) only revised through project authorization from DOE?

Discussion

Disciplined baseline change control helps maintain the relationship between the CBB/PBB at target cost and the project value (includes profit and/or fee). This ensures that the contractor PM is managing with performance measurement data that accurately reflects only the authorized scope of work.

Unauthorized revisions could inadvertently result in baseline budgets or schedules that exceed the CBB/PBB. The CBB/PBB is a controlled value and cannot be changed by the contractor except as a result of customer contract actions.

Typically, the contractor will issue a project authorization document at the total project level, at project award, and at subsequent revisions to the project value through modifications. These documents must track directly to the project value. The project authorization document is issued to the contractor PM, giving him the authority to plan the new work scope within the new or revised project budget and plan the CBB/PBB at target cost.

Authorization of budgets in excess of the CBB/PBB is known as an OTB. This OTB is also known as reprogramming and is a significant undertaking by the contractor to replan the remaining baseline. When the amount of the over target budget is added to the CBB/PBB, an OTB results. This new value is known as the TAB.

In order to prevent unauthorized increases to the TAB and causing it to exceed the CBB/PBB value, prior approval is required between the contractor and the government for implementation of an OTB. This approval process reinforces the mutual management of the project. Additionally, recognition of the OTB on cost reimbursement contracts notifies the DOE customer that additional funding will be required to complete the contract.

One of the basic EVMS requirements is that the PMB plus MR equals the CBB/PBB (the project/contract value at cost). Once the PMB is established, changes to the scope, schedule and/or budget usually occur.

For most contract changes, the need for the change is often time critical. When this occurs, the contracting officer may issue an undefinitized change order or AUW. This order allows the

contractor to start the work while a proposal and contract modification are being negotiated. At this point in time, the TAB is equal to the CBB/PBB, which is now equal to the NCC plus the AUW. Once the modification is negotiated, the NCC, CBB/PBB, and TAB will all once again be equal.

During the life of a project, situations may arise whereby available budgets for the remaining work are insufficient to ensure valid performance measurement. Under these circumstances, a requirement may exist for the TAB for work to exceed the CBB/PBB. The resulting value is referred to as an OTB. The TAB is now equal to the OTB. The establishment of an OTB does not change the CBB/PBB or NCC.

If the contractor recognizes that additional budget is necessary to accomplish the project goals and DOE approves, this budget may be added to the baseline to create the OTB. Note that it is the responsibility of the contractor to notify DOE via a request for an OTB and DOE must approve it before an OTB can be implemented. Prior to approving the revised PMB, it should be jointly reviewed by the contractor and the government to verify that it represents an achievable budget and schedule that can be successfully executed. If DOE does not approve the OTB, the contractor must reflect the additional costs as overruns without adjusting the CA budgets within the PMB. It should also be noted that an OTB is not a contractual action and the CBB/PBB value is not changed. Subcontractor EIA-748 EVMS flow down, where it relates to formal reprogramming, is the prime contractor's responsibility to approve and manage.

When the contractor and DOE are satisfied that the new baseline represents a reasonable plan for completing the work, the new baseline becomes the basis for future performance measurement. With an approved OTB the formula for the TAB is $TAB = CBB/PBB + OTB$, where OTB represents the value of the forecast overrun. The revised PMB would consist of the value of the original PMB plus the over target budget allocated to each CA. That value plus the MR should equal the new TAB. See Figure 17.

Guideline 32

Document PMB Changes

Document changes to the PMB.

Purpose of the Guideline

Documented changes to the PMB must always reflect the most current plan for accomplishing the effort.

Management Value of the Guideline

Authorized changes must be incorporated into the PMB and authorization documents updated accordingly prior to the commencement of work. Documented changes made to the PMB must be traceable and substantiated. A baseline change control process governs authorized changes to work scope, period of performance, and budget in the CBB/PBB.

Impact of Noncompliance

Failure to properly document baseline changes results in a poor baseline that will be difficult to execute. This will also result in difficulty when implementing subsequent baseline changes.

Typical Attributes

1. Are authorized changes to the PMB documented and traceable?

Discussion

Using a disciplined, systematic change control process to document PMB changes provides assurance that everyone on the project team is using the same technical scope, schedule, and budget baselines to measure and manage performance. This enhances internal and external management confidence in the performance data that is used to make programmatic decisions. The PMB should always reflect the most current plan for accomplishing the effort. Authorized changes must be incorporated into the PMB and authorization documents updated accordingly prior to the commencement of work. Documented changes made to the PMB must be traceable and substantiated. The contractor's EVM System Description must describe a process for proper documentation of baseline changes.

It is essential for baseline change requests to have supporting detail that shows, by control account, the time-phased budgets by element of cost for the current baseline and the proposed baseline. This process allows for a proper review and approval of the proposed change, and subsequent incorporation into the baseline. The intent is to ensure the change documentation provides a clear description of what is changing. A "before and after" picture is often used to fully describe the change.

8. INDIRECT CONSIDERATIONS

Indirect costs are a broad category that typically represents a majority of project costs and are defined as costs that cannot be directly charged to only one project but must be allocated. The term indirect includes all of the project burdens on direct work. Examples include overhead, General and Administrative (G&A), Cost of Money, and types of supervision that allocate their time.

Because indirect costs are significant when compared with total project costs, the earned value guidelines require that the indirect cost structure is defined, and the company organization or function is identified for the responsibility for controlling indirect (overhead) costs (see EIA-748 EVMS Guideline 4), indirect costs are budgeted (see EIA-748 EVMS Guideline 13), indirect actuals are accrued (see EIA-748 EVMS Guideline 19), and indirect analysis is performed (see EIA-748 EVMS Guideline 24). Although this process parallels at a high level the traditional application of earned value, there are differences that warrant this appendix:

- Indirect costs are grouped into indirect pools, which are then allocated against the appropriate bases to yield the planned indirect rates.
- Indirect costs are typically annually based as planned rates, with adjustments at year end to actual rates.
- Indirect costs are not managed with a project schedule or IMS.
- The goal of indirect cost management is stability of overhead rates and control of indirect costs. Management of indirect costs may include scope reduction (example no 4th quarter overhead training).
- The CFO typically has overall responsibility for indirect management.
- Indirect costs are not managed through EVMS CAs but rather through assignment of responsibility to the managers who are most directly responsible for supplying indirect services. Such authorization responsibility is often placed separately at each overhead pool or category.
- Indirect analysis is performed by the responsible indirect cost manager but must also be considered by the project's CAMs during control account analysis.
- Change control management is not as relevant to indirect pools because of the annual planning and allocation of final costs for the year, however it is relevant to preventing retroactive changes to overhead budgets and determining whether to change overhead budgets for work remaining.

The contractor identifies the indirect pools and application bases in their disclosure statement and indirect policy. Each contractor may define pools and application bases differently to meet their respective corporate structures and business situations. However, each contractor must document who has responsibility for budgeting, charging, and analysis of major components in each

significant pool in their accounting policy, procedures, authorization memos and/or their EVM System Description.

DOE's interpretation of the intent of each of the four Indirect Considerations guidelines and expectations for implementing each guideline are below.

Guideline 4

Identify Overhead Management

Identify the organization or function responsible for controlling overhead (indirect costs).

Purpose of the Guideline

Ensure the contractor has an organization that is responsible for establishing, approving, managing, controlling, and assigning resources to overhead (indirect costs) budgets.

Management Value of the Guideline

Visibility into indirect costs is essential for successful management of a project. The impact of indirect costs on any project must be accounted for and managed. It is important to have processes documented and organizations established specifically to manage and control indirect costs. This will help the contractor effectively manage and control execution of overall project objectives.

Impact of Noncompliance

Since indirect costs account for a major portion of the project costs, the contractor PM will not be able to effectively manage and control execution of the overall project objectives. Failure to provide written procedures that clearly define the indirect cost processes could lead to ineffective management and control of indirect costs – leading to significant cost overruns for the project.

Typical Attributes

1. Is there a process that clearly defines the indirect account structure, indirect manager's assignment, responsibility, and authority, and how indirect budgets are established, and indirect cost expenditures controlled?

Discussion

The contractor must clearly identify the management position that is assigned the responsibility and authority for controlling indirect costs and that has the authority to approve the expenditure of resources. It is necessary to have an indirect budgeting and forecasting process since indirect costs account for a major portion of the cost on any project. As indirect costs can significantly impact the cost of a project, it is important for the contractor PM to know who is responsible for authorizing and controlling overhead (indirect) budgets and expenditures.

Indirect costs are for common activities that cannot be identified specifically with a particular project or activity and should typically be budgeted and controlled separately at the functional or organizational manager level. Typical indirect costs include overhead, burden, cost of money and G&A.

The EVM System Description and/or indirect procedures must clearly identify managers who are assigned responsibility and authority for controlling indirect costs and who have the authority to approve expenditure of resources. The process for management and control of indirect costs, including assignment of responsibility, is documented in the contractor's disclosure statement, the responsible organization's approved accounting procedures, and the EVM System Description at various levels.

The management process for indirect rate pools including both the base and numerator aspects should be documented to ensure responsibility is clear. Those designated should be consistent with company organization structures and indirect procedures. Those responsible should also have documented authority, within limits, over charges within the pools.

It is expected that contractors will define those responsible for development and control of indirect budgets and expenditures. Additionally, the contractor should define thresholds and a process for management by exception for indirect performance and analysis. It is also expected that the SD, indirect policies and disclosure statement will be consistent with all of the defined indirect responsibility and implementation.

Guideline 13

Establish Overhead Budgets

Establish overhead budgets for each significant organizational component for expenses which will become indirect costs. Reflect in the program budgets, at the appropriate level, the amounts in overhead pools that are planned to be allocated to the program as indirect costs.

Purpose of the Guideline

Ensure indirect budgets (e.g., overhead, G&A, and cost of money) are established and included in the PMB at the appropriate level for visibility.

Management Value of the Guideline

Indirect budgets play an important role in budgetary control and management and can account for a major portion of the cost of any project. The overall value of establishing indirect budgets lies with the ability of the contractor to manage cost elements that cannot be directly assigned to individual projects or project activities and ensures that indirect costs are applied fairly and appropriately. By comparing actual indirect expenses to established indirect budgets, the company can determine if the

absorption of indirect expenses based on existing documented allocation schemes is on track or if allocation rates will need to be adjusted. Contractor recurring rate performance reviews should be conducted on a regular basis (i.e. monthly, quarterly, etc.) to ensure effective control and management of the indirect expenses and indirect budgets. The accurate assignment of indirect expenses assures each project will receive the appropriate allocation of indirect costs.

Impact of Noncompliance

Indirect budgets play an important role in budgetary control and management and can account for a major portion of the cost of any project. Without this budgeting requirement, the PMB would not accurately measure total cost to the government based on contractor performance/progress and would invalidate the PMB as a realistic baseline plan.

Typical Attributes

1. Are indirect budgets managed and incorporated into the PMB in concert with documented processes and current rates (i.e., approved, provisional, proposed)?

Discussion

Project indirect costs are for common activities that cannot be identified specifically with a particular project or activity and are budgeted and controlled separately at the functional or organizational manager level. (See EIA-748 EVMS Guideline 4.) Just as with direct budgets, indirect budgets must be included in the PMB using the current rates to ensure the PMB represents a realistic baseline plan as specified in the Contractor's EVM System Description.

The contractor must establish indirect (i.e., overhead, burden, cost of money, and G&A expense) budgets at the appropriate organizational level for each pool and cost sub-element. Project-specific budgets for indirect costs are developed and planned in conjunction with the direct budgets and must be consistent with the contractor's documented procedures for how indirect costs are approved and allocated to the project. This methodology is normally described in the organization's accounting procedures.

The most current set of rates must be used when planning the initial baseline and subsequent baseline changes related to contractual changes, or for internal replanning, if MR is available for increases in indirect rates. These rates may be either forward pricing rate proposed (FPRP), forward pricing rate provisional, or forward pricing rate approved (FPRA). Should these rates not cover the entire duration of the project, the contractor must extend the rates to the out years on the same basis, using a sound estimate for the indirect pools and potential business base. Note that these are the budgeted rates and applied to budgeted direct costs (or BCWS) and also used in BCWP calculations. The "applied" rates are updated for actual costs over the course of a year and are applied to the actual direct costs for ACWP reporting. (See EIA-748 EVMS Guideline 19)

Guideline 19

Record/Allocate Indirect Costs

Record all indirect costs that will be allocated to the project.

Purpose of the Guideline

Ensure all indirect costs are properly and correctly allocated in a consistent manner to the contract(s) that apply and at the level where overhead budgets are established.

Management Value of the Guideline

The potential negative cost impact of poor indirect cost performance to a project mandates that the contractor manage these costs as effectively as possible. The availability of auditable actual indirect costs supports management's efforts in this critical area. A documented process established specifically to provide visibility into the management/control of indirect costs is essential for successful project management.

Allocating indirect costs to a project consistent with the level where overhead budgets have been established, facilitates analysis of overhead variances (i.e., budgeted values for indirect costs versus the actual indirect costs allocated) and potential management action(s) to control costs.

Impact of Noncompliance

Failure to establish a process specifically to provide visibility into the management/control of indirect costs could distort contractor data being generated by the EVMS and could impact the project EAC. The lack of clear definition of organizational assignments and authority level for each indirect pool/category can lead to a lack of indirect cost control and to serious cost overrun problems for projects.

Typical Attributes

1. Are indirect costs charged to the appropriate indirect pools?

Discussion

Policies and procedures should ensure that the allocation of cost to a product, contract, or other cost objective is the same for all similar objectives. Indirect costs are allocated per the contractor's documented procedures to ensure that all projects benefiting from the expenditure of indirect costs are allocated their portion of those costs. If incurred indirect costs vary significantly from budgets, periodic adjustments should be made to prevent the need for a significant year-end adjustment. (See EIA-748 EVMS Guidelines 27 and 29). Indirect Cost allocation processes must ensure management responsibility for indirect cost management is aligned with the authority to manage indirect costs to support effective cost control.

Indirect costs are for common activities that cannot be identified specifically with a particular project or activity and must typically be budgeted and controlled separately at the functional or organization managerial level. The CAS disclosure statement must identify the allocation base and indirect cost pools by functional element of cost.

The following activities are associated with the recording and allocation of indirect costs:

- Record all incurred indirect costs for the project in the accounting system.
- Allocate them to the recorded direct costs per the documented procedure to ensure that all projects benefiting from the indirect costs receive the appropriate allocation.
- If incurred indirect costs vary significantly from budgets, periodic adjustments must be made to prevent the need for a significant year-end adjustment. (See EIA-748 EVMS Guideline 13).
- Indirect cost allocation processes must ensure management responsibility for indirect cost management is aligned with the authority to manage indirect costs to support effective cost control.

The contractor has the responsibility through internal audits to assure that indirect charges are properly recorded throughout the accounting structure. The contractor also has the responsibility to assure that such costs are not duplicated (i.e., that they are neither charged to more than one pool nor charged to both an indirect pool and a direct/allowable cost element at the same time).

Because of the nature of pooled costs, entry errors are more difficult to detect than with direct costs. Periodically, reviews must be made to assure that indirect costs are being charged to the appropriate indirect pools and by the appropriate incurring organization. Typical overhead categories may include custodial, security, computing equipment. A contractor should insure that custodial only has custodial type charges.

Guideline 24

Analyze Indirect Cost Variances

Identify budgeted and applied (or actual) indirect costs at the level and frequency needed by management for effective control, along with the reasons for any significant variances.

Purpose of the Guideline

Indirect cost variances are regularly identified and reviewed for insight into their impact on overall project cost performance. This will facilitate project management's ability to forecast future indirect cost performance as well as develop corrective action plans intended to regain project objectives. Ongoing indirect cost analysis provides visibility into potential indirect cost overruns and the opportunity to develop and implement management action plans to meet project objectives.

Management Value of the Guideline

The overall value to the contractor is visibility into the absorption of indirect costs that cannot be directly applied to a contract. Managing indirect costs on a continuing basis enables the contractor to adjust rates in a timely manner so as to complete an accurate EAC for individual projects/contracts. Project management must understand that ongoing indirect cost analysis provides visibility into potential indirect cost overruns or underruns and the opportunity to develop and implement management action plans. This effect must be considered when developing and analyzing the ETC. Indirect costs are allocated to a contract consistent with the procedures described in the contractor's Cost Accounting Standards Board (CASB) Disclosure Statement.

Impact of Noncompliance

Failure to integrate indirect analysis with project level EAC analysis can significantly understate total project costs. Management would not have visibility into potential indirect cost overruns and the opportunity to develop and implement management action plans to meet project objectives.

Typical Attributes

1. Are the variances between budgeted and actual indirect costs identified and analyzed routinely consistent with the budget authority in GL 4? If significant variances occur, are management corrective actions taken to reduce indirect costs and is project management notified?
2. Are there indirect analysis thresholds established by each budget category?

Discussion

Indirect variance analysis is provided to the capital asset projects to support the EAC update process. From the project perspective, one of the benefits of indirect analysis is gaining an understanding of the potential impacts. Rates can be significant drivers of overall project costs. Typically, the appropriate level of management would be the contractor PM and/or project controls analyst.

Indirect rate management is crucial to meeting project cost objectives. This guideline requires a monthly indirect cost analysis to be performed by those assigned responsibility, comparing indirect budgets to indirect actual costs and explaining the cause of resultant variance(s). The importance of analyzing indirect cost performance requires the exercise of maximum discipline in following the established indirect cost control procedures. The results of indirect analysis are provided to project and business managers for their use in forecasting the impact to the project EAC.

Threshold identification and analysis of indirect cost variances are conducted at the level where overhead budgets have been established and where ongoing, periodic reviews of indirect cost performance are conducted. The results of the analysis of indirect cost variances must be documented. This analysis provides project management visibility into the reasons for potential or realized indirect cost performance deviations that contribute to the contract's overall cost and impacts to the ETC.

The analysis also enables the management team to take corrective actions to mitigate their impact. If significant differences between budgeted and actual indirect costs occur, periodic adjustments should be made to prevent the need for a significant year-end adjustment.