OFFICE OF PROJECT MANAGEMENT (PM)
EARNED VALUE MANAGEMENT SYSTEM (EVMS)
COMPLIANCE REVIEW STANDARD OPERATING PROCEDURE (ECRSOP)

APPENDIX A
COMPLIANCE ASSESSMENT GOVERNANCE (CAG)
2.0

OFFICE OF PROJECT MANAGEMENT
PROJECT CONTROLS AND POLICY DIVISION (PM-30)

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CHANGE PAGE

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PREFACE

An Earned Value Management (EVM) methodology and the associated Earned Value Management System (EVMS) requirement are designed to ensure that agencies acquire capital assets and major systems in the most effective, economical, and timely manner. Specifically, Federal Acquisition Regulation (FAR) Subpart 34.2 directs that a compliant EVMS be required for major acquisitions in accordance with the Office of Management and Budget's (OMB) Circular A-11. The Department of Energy (DOE)—like other government agencies—sees the use of a disciplined methodology that integrates the work scope, schedule, and budget for high-value, complex projects essential to delivering on its commitments to the Congress and other key stakeholders. A compliant EVMS provides for the generation of valid and verifiable performance data, permits the evaluation of progress, and allows for the calculated probability of meeting programmatic and contractual requirements. A key aspect is the ability to capture physical and technical progress to determine what "done" looks like, rather than what work has been done. EVM is founded on the premise that project teams make the best decisions when they have the best data and information.

The Office of Project Management (PM) is challenged with demonstrating to Department leaders a cost-effective way of implementing an EVMS that consistently provides timely, accurate, and reliable project data and information. The implementation of an automated, data-driven analytics-based EVMS compliance strategy is viewed as key to meeting FAR EVMS requirements and the DOE's strategic goal to improve the efficiency and effectiveness of its contract and project management processes.

For years, government and industry have debated the finer points of EVMS compliance with no real result. To reach common ground, the DOE is actively working with other government agencies and industry partners to reach greater clarity and consistency for the implementation of FAR Subpart 34.2 and the EIA-748 EVMS Standard. In practice, loosely defined requirements have led to long-term inconsistencies in the practice of implementing a compliant EVMS.

The release of DOE PM's Compliance Assessment Governance (CAG) 2.0 rectifies this by providing more precise information and guidance on the necessary actions required of both government and industry for the effective implementation of an integrated project management (IPM) strategy using a compliant EVMS. A fiscally constrained environment demands that projects take the necessary actions to effectively manage Department resources. This will require a fundamental shift in mindset for how a project team thinks about an EVMS.

This is a positive and long overdue first step toward addressing OMB's October 2015 Office of Federal Procurement Policy memorandum, Reducing the Burden of Certifying Earned Value Management Systems. The memorandum's purpose is to encourage agencies to enter into reciprocity agreements to recognize EVMS certification across agencies. Reciprocity would reduce burdens both on the agencies that assess EVMS capabilities and the contractors that are required under FAR Subpart 34.2 to have certified EVMSs. The cost of obtaining EVMS certification can be significant, and, under current practices, contractors sometimes are required to obtain multiple agency EVMS certifications. Providing one face of government to industry by sharing EVMS review results between and among agencies, with each following a standard automated assessment protocol, will reduce waste and promote efficiency. A data-driven approach can also eliminate EVMS compliance barriers that result in some government agencies

and contractors thriving while others fail. Efficiency through automation reduces operating costs, is compatible with smaller staffs, and allows agencies to operate with fewer resident experts.

It has often been observed that if you keep doing the same things you generally get the same results. By extension, if you keep doing the same thing in an environment of shrinking budgets and changing priorities, you probably will suffer worse results. It is time to rethink how we perform EVMS compliance reviews (both initial certification and follow-on surveillance). Big data are at the core of this different thinking—using data sets and algorithms to summarize inputs and outputs, detect patterns, identify areas to assess, and draw conclusions. A data-driven approach is used to efficiently test the reliability of ten core management processes from initial implementation and continually afterward to reduce the risk of failure during a project's life cycle. The capability to remotely test a contractor's EVMS data greatly reduces and may eliminate the need for multiple government assessments, and the labor and travel costs associated with numerous visits to a contractor's site.

To test the idea that EVMS compliance can be best accomplished when collectively considering the maturity of management processes and a project's environment, PM initiated a multi-year academic research study with Arizona State University (ASU), Tempe, AZ, in November 2018. The results of the study[1] supported the research premise – An effective EVMS can position a project for meeting scope, schedule, and budget objectives, and that a project's environment determines the effectiveness of an EVMS. The study's results provide us with a roadmap for defining and determining the maturity of an EVMS and helping us to identify environmental barriers that prevent its full implementation and benefits.

Let us continue to work collaboratively and collectively while traveling off the beaten path as we rethink how to view and implement an EVMS that everyone can benefit from.

Melvin Frank
Director, Project Controls and Policy Division (PM-30)
Office of Project Management
US Dept. of Energy

[1] https://ip2m.engineering.asu.edu/
https://www.energy.gov/projectmanagement/articles/ip2m-metrr-asu-evms-study

FOREWORD

This appendix provides stakeholders and other interested parties the information needed to better understand the principles and elements of the Electronic Industries Alliance (EIA)–748 EVMS standard. It also helps ensure the U.S. Department of Energy (DOE) plans and manages its capital asset programs and projects using sound practices.[2] The Office of Management and Budget (OMB) requires agencies to use a performance-based acquisition management strategy and EVMS based on the EIA-748 EVMS standard to objectively assess whether contractors are performing according to plan and whether the money spent each month is producing value.[3] OMB Circular A-11 requires agency heads to manage their major acquisition portfolio within 90 percent of the investment's cost, schedule, and performance goals.

> The investment cost, schedule, and performance goals established through the planning phase of the investment are the basis for approval to procure the asset and the basis for assessing risk. During the procurement phase, performance-based management systems (earned value or similar system) must be used to provide contractor and Government management visibility on the achievement of, or deviation from, goals until the asset is accepted and operational. If goals are not being met, performance-based management systems allow for early identification of problems, potential corrective actions, and changes to the original goals needed to complete the investment and necessary for agency portfolio analysis decisions. These systems also allow for administration decisions to recommend meaningful modifications for increased funding to Congress, or termination of the investment, based on its revised expected return on investment in comparison to alternative uses of the funds. Agencies must ensure that the necessary acquisition strategies are implemented to reduce the risk of cost escalation and the risk of failure to achieve schedule and performance goals.[4]

The EIA-748 EVMS standard defines the EVMS requirements and governs the EVMS application. Per DOE Order (O) 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, the Office of Project Management (PM) recognizes the EIA-748 EVMS standard as the basis for management controls used to plan, budget, and control capital asset acquisitions. The EIA-748 EVMS standard references the National Defense Industrial Association (NDIA) Integrated Program Management Division (IPMD) EVMS intent guide and other NDIA related documents.[5] PM, the cognizant federal agency (CFA) for DOE projects, takes these documents under advisement in rendering clear guidance for determining compliance with the EIA-748 EVMS standard. Users of this appendix are encouraged to submit questions and recommendations to PM to maintain its currency and relevance.

The EIA-748 EVMS standard describes how to implement an effective EVMS and generate current, accurate, complete, repeatable, and auditable (i.e., compliant)[6] performance data and information. Data quality is essential in setting contractor and government management objectives and accurately assessing the achievement of, or deviation from, goals until the asset is accepted and operational. If goals are not being met, these data identify the cause of problems to enable corrective actions and changes where needed to complete and deliver the investment.

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[2] For the remainder of this appendix, we use the term "project" to refer to either a *project* or *program*.

[3] OMB, Circular No. A–11, *Preparation, Submission, and Execution of the Budget*, "Capital Programming Guide," August 2021.

[4] OMB, Circular No. A-11, Appendix J, p. 5.

[5] NDIA, *Earned Value Management Systems EIA-748-D Intent Guide*, July 19, 2018.

[6] Craig Hewitt, 2019 Department of Energy Project Management Workshop: Trustworthy Data and Information

Knowing the sources of performance data and whether they represent actual project performance is vital. The EIA-748 EVMS standard is founded on the idea that project teams and stakeholders make the best decisions when they have the best data and information.

Self-governance refers to the capacity of a project/program to govern autonomously and, as such, is an important approach to overseeing the effective implementation of the EVMS. When projects/programs instill an integrated project management methodology using the EVMS in a way that benefits both the customer and contractor, the results can often lead to improved execution and the optimal performance of the project/program team. EIA-748 compliance is accomplished through self-governance where both the customer and contractor hold themselves accountable for the oversight and validation of EVMS-generated data. Customer, contractor, and stakeholder active involvement in encouraging and establishing a culture of self-governance is essential to an effective EVMS. Self-governance is a repeatable process in which the contractor (as the EVMS owner) oversees itself and controls its affairs. When a project/program instills an integrated project management methodology and promotes a culture of self-governance and compliance, it positions itself for success.

An objective self-governance approach ensures the long-term sustainability of a continuously improving EVMS and is visible, structured, and genuinely endorsed by customer and contractor organizations. Key characteristics and features include:

- Leadership engagement which encourages continuous improvement and defines and enforces a culture of compliance;
- A chartered authority structure with cross-organizational engagement (e.g., financial office, procurement, quality assurance, etc.) which reports to and interacts routinely with institutional leadership;
- A methodology to routinely assess system health via clearly defined and independently positioned oversight that has a clear line to senior management;
- Effective, consistent, and defined processes that are repeatable and enduring;
- A learning organization capable of maintaining and improving workforce skills via proven techniques such as peer-to-peer mentoring; and
- Above all and incorporated throughout are transparency and openness to feedback.

The PM *Earned Value Management Systems (EVMS) Compliance Review Standard Operating Procedure (ECRSOP)* contains this Compliance Assessment Governance (CAG) based on the EIA-748 EVMS standard and expanded to include the use of an EVMS when the EIA-748 EVMS standard is not required. This promotes the use of performance-based management systems to reduce the risk of cost escalation and failure to achieve schedule, budget, and performance goals. It ensures that DOE projects consistently implement and continuously assess the effectiveness of the EVMS.

This appendix offers detailed guidance based on recognized leading sources for establishing, employing, and maintaining an effective EVMS, including DOE Guide (G) 413.3-10B, *Earned Value Management System*, the EIA-748 EVMS standard, and NDIA IPMD guides:

- *Earned Value Management Systems EIA-748-D Intent Guide*
- *Surveillance Guide*

- *Earned Value Management System Acceptance Guide*
- *Earned Value Management Systems Application Guide*
- *Earned Value Management System Guideline Scalability Guide*
- *Planning & Scheduling Excellence Guide (PASEG)*.

Other sources include the U.S. Government Accountability Office (GAO) Cost Estimating and Assessment Guide and Schedule Assessment Guide.

This appendix distills and summarizes voluminous details in these resources to form a comprehensive, holistic framework for applying their guidance to DOE work. View any apparent contradictions with these references in the context of the whole of this appendix, considering its synthesized, uniform approach to EVMS evaluation, which ensures fairness and consistency.

Other PM-30 EVMS compliance resources used in conjunction with this document include the following:

- The EVMS Compliance Reference Crosswalk (CRC) Excel file for use in documenting the assessment of a contractor's EVM system description and supporting procedures
- The EVMS Testing Specification Sheets for use in identifying and documenting the results of the automated and manual tests required for each attribute.

1. INTRODUCTION

There are many approaches to implementing an EVMS or similar performance-based management system (such as an alternative project control method), including the application of formal, mature systems and robust processes or more informal, less mature systems and processes. Selecting the right approach can mean the difference between project success and failure. Once an approach has been selected, the project team prepares a holistic plan to assess the effectiveness of the EVMS, including frequent and comprehensive surveillance to garner information needed to improve its use.

Historically, the implementation of a "scaled" EVMS has been randomly done to accommodate the immediate needs of the project leadership team. This, unfortunately, often led to the misapplication of the EVMS, causing, among other things, unclear expectations, which in turn kept projects and stakeholders from having adequate insight and the ability to make timely and relevant decisions. Those responsible for enacting, maintaining, and growing the EVMS were buried under the weight of old, manually intensive, and unwieldy tools, leaving them to cope with system ineffectiveness and inefficiencies. A new and better approach was needed.

In November 2018, PM initiated a government-industry joint research study, led by Arizona State University (ASU), to develop a method for improving the relevance and reliability of EVMS implementation.[7] The study found that a common set of EVMS processes and attributes *are* a necessity. It devised a sliding maturity scale to define the optimum (right size) for EVMS implementation. The results showed that projects implementing an effective EVMS had more reliable data with deeper insight into performance issues, which can lead to rational decisions and better outcomes.

The study found that the maturity of an EVMS correlates with the environment in which it operates. The environment is a measure of internal and external factors in which the project functions; for good fiscal stewardship and project success, it prioritizes EVMS compliance similar to quality and safety. The resultant method focuses on establishing and maintaining a healthy project environment, and its primary product is an effective EVMS. For projects of all types and sizes, the better the project environment is, the more likely the EVMS is viewed as a necessity for better outcomes. Unfortunately, when projects believe the EVMS does not matter, they find out too late that it does.

This appendix applies methods and techniques from the study for assessing the effectiveness of an EVMS, which consists of two parts: (1) operating environment and (2) implementation maturity. The study defines an EVMS as a system of systems that comprises multiple subsystems and documented subprocesses that collectively contribute to the operation of the overall system, integrating scope, schedule, and budget. The integrated nature of the subsystems and documented processes codifies the structuring, analysis, decision-making, and communications of a project.

The study created the Integrated Program Project Management (IP2M) Maturity and Environment Total Risk Rating (METRR), a novel method for assessing a spectrum of EVMS environment and implementation maturity factors. The factors center on the EIA-748 EVMS

[7] *Integrated Project Management (IP2M) Maturity and Environment Total Risk Rating (METRR) Using EVMS*

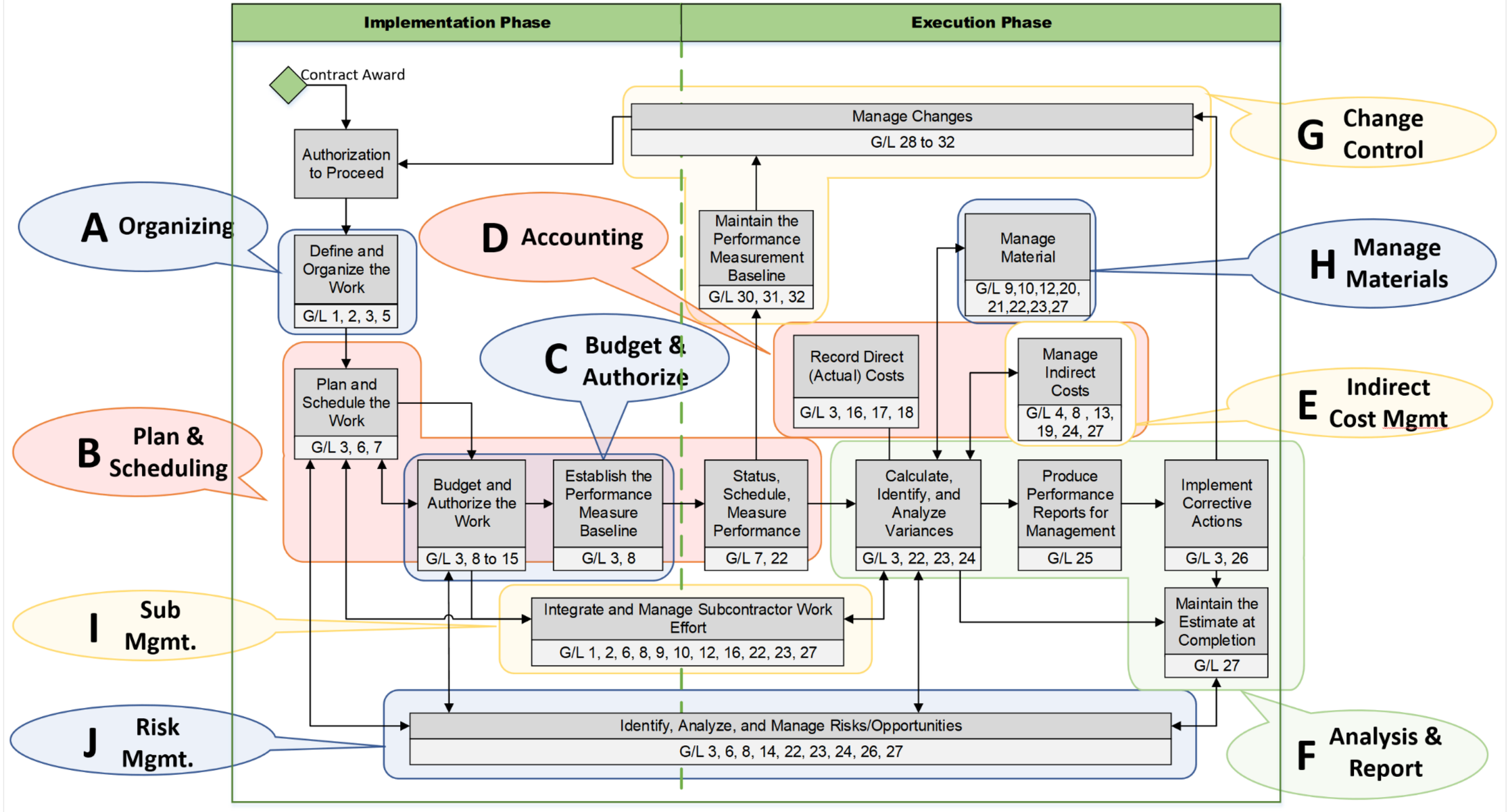
standard but also consider other authoritative sources, including the *Project Management Institute (PMI) PMBOK Guide*, International Organization for Standardization (ISO) Standard 21508, *Department of Defense Earned Value Management System Interpretation Guide (EVMSIG)*, and other evidence-based guidance.

Using IP2M METRR, projects can gauge the efficacy of their management methods and practices in achieving optimum performance and desired outcomes. IP2M METRR helps projects identify the various ways the environment and implementation maturity interact and interdepend to facilitate decision-making, problem-solving, and continuous process improvements. By comparing implementation maturity and environment using a matrix diagram, for example, a reviewer can easily depict the relationship of the project's environment to the maturity of the EVMS side by side. The study found a strong positive correlation (Pearson r=0.83) between the two variables, in which both move in the same direction and the project environment is dominant.

IP2M METRR consists of four environmental categories, each of which is further divided into a total of 27 factors necessary for the effective implementation of the EVMS. These are discussed in Section 2. The reviewer evaluates environment factors on a scale from "not acceptable" and "needs improvement" to "meets some," "meets most," and "high performing." Environment factors that fully meet the criteria defined in the factor descriptions receive a high-performing rating, while those that meet some of the criteria receive a "meets some" rating, and so on. Each environmental factor has an associated relative weight; all factor scores sum to 1,000 points. A point scale helps gauge the environment within which a project is being managed. The study shows that the higher the environment score is, the better chance a project has of achieving desirable schedule and budget outcomes.

The study identified 10 subprocesses necessary for an EVMS: (A) organizing, (B) planning and scheduling, (C) budgeting and work authorization, (D) accounting considerations, (E) indirect cost management, (F) analysis and managerial reporting, (G) change control, (H) material management, (I) subcontract management, and (J) risk management. Each is equally important in contributing to the overall effectiveness of the EVMS implementation. Notably, some are more likely than others to experience high implementation demands, including planning and scheduling, budgeting and work authorization, and change control. Attributes are assigned to each subprocess to describe its inherent quality and characteristics. The adequacy of subprocesses and attributes, individually and collectively, necessitates regular reassessment to gauge their preparedness for meeting the management requirements of the project. Figure 1 shows the interdependency of the 10 subprocesses associated with the 32 EIA-748 EVMS Guidelines that collectively contribute to the operation of the EVMS in the implementation and execution phases of a project as defined by the NDIA scalability guide. The 10 subprocesses are further divided into a total of 56 attributes as detailed in Figure 2.

Figure 1. EVMS Subprocess Flow Diagram[8]



[8] Adapted from NDIA Earned Value Management System Guideline Scalability Guide, current version, www.ndia.org/divisions/ipmd/division-guides-and-resources

Figure 2. 10 Maturity Subprocesses and 56 Attributes of EVMS

A. ORGANIZING
- A.1. Product-Oriented Work Breakdown Structure (WBS)
- A.2. Work Breakdown Structure (WBS) Hierarchy
- A.3. Organizational Breakdown Structure (OBS)
- A.4. Integrated System with Common Structures
- A.5. Control Account (CA) to Organizational Element

B. PLANNING AND SCHEDULING
- B.1. Authorized, Time-Phased Work Scope
- B.2. Schedule Provides Current Status
- B.3. Horizontal Integration
- B.4. Vertical Integration
- B.5. Integrated Master Schedule (IMS) Resources
- B.6. Schedule Detail
- B.7. Critical Path and Float
- B.8. Schedule Margin (SM)
- B.9. Progress Measures and Indicators
- B.10. Time-Phased Performance Measurement Baseline (PMB)

C. BUDGETING AND WORK AUTHORIZATION
- C.1. Scope, Schedule and Budget Alignment
- C.2. Over-Target Baseline (OTB) Authorization
- C.3. Summary Level Planning Packages (SLPPs)
- C.4. Work Authorization Documents (WADs)
- C.5. Work Authorization Prior to Performance
- C.6. Elements of Cost (EOC)
- C.7. Work Package Planning, Distinguishability, and Duration
- C.8. Measurable Units and Budget Substantiation
- C.9. Appropriate Assignment of Earned Value Techniques (EVTs)
- C.10. Identify and Control Level of Effort (LOE) Work Scope
- C.11. Identify Management Reserve (MR) Budget
- C.12. Undistributed Budget (UB)
- C.13. Reconcile to Target Cost Goal

D. ACCOUNTING CONSIDERATIONS
- D.1. Direct Costs
- D.2. Actual Cost Reconciliation
- D.3. Recording Direct Costs to Control Accounts (CAs) and/or Work Packages (WPs)
- D.4. Direct Cost Breakdown Summary

E. INDIRECT BUDGET AND COST MANAGEMENT
- E.1. Indirect Account Organization Structure
- E.2. Indirect Budget Management
- E.3. Record/Allocate Indirect Costs
- E.4. Indirect Variance Analysis

F. ANALYSIS AND MANAGEMENT REPORTING
- F.1. Calculating Variances
- F.2. Variances to Control Accounts (CAs)
- F.3. Performance Measurement Information
- F.4. Management Analysis and Corrective Actions
- F.5. Estimates at Completion (EAC)

G. CHANGE CONTROL
- G.1. Controlling Management Reserve (MR) and Undistributed Budget (UB)
- G.2. Incorporate Customer Directed Changes in a Timely Manner
- G.3. Baseline Changes Reconcilable
- G.4. Control of Retroactive Changes
- G.5. Preventing Unauthorized Revisions to the Contract Budget Base (CBB)

H. MATERIAL MANAGEMENT
- H.1. Recording Actual Material Costs
- H.2. Material Performance
- H.3. Residual Material
- H.4. Material Price/Usage Variance
- H.5. Identification of Unit Costs and Lot Costs

I. SUBCONTRACT MANAGEMENT
- I.1. Subcontract Identification and Requirements Flow Down
- I.2. Subcontractor Integration and Analysis
- I.3. Subcontract Oversight

J. RISK MANAGEMENT
- J.1. Identify, Analyze and Manage Risk
- J.2. Risk Integration

Each attribute is assessed on a 1-to-5 maturity scale: “1” means that work on this attribute has not yet started, and “5” means best in class. Attributes that are mature enough for an EIA-748–compliant EVMS receive a maturity level of “4.” Those that are not yet mature receive scores of “2” or “3,” depending on their levels of maturity as determined by the assessment. The maturity levels for each of the 56 attributes are detailed to enable an informed assessment. The definitions of the maturity levels (1 through 5) are additive, meaning that level 5 includes everything in level 4, level 4 already includes everything in level 3, and so on. Attributes deemed not applicable (N/A) for the project/program under consideration are marked “N/A” and do not affect the final maturity score. A clear justification is added to explain why an attribute is considered N/A. Each attribute has a relative associated weight, and all maturity attribute scores sum to a 1,000-point scale—the higher the score is, the better. For those projects/programs applying less than the nominal 56 attributes, weighted scores are redistributed based on the percentage of all remaining attributes summing to 1,000 points. The score helps quantify the overall level of system maturity for the project being assessed.

This appendix introduces IP2M METRR to help projects and stakeholders execute their roles and responsibilities for meeting their collective goal of completing projects on time and within budget, while achieving quality, safety, and technical performance objectives using the EVMS. Projects are encouraged to implement an EVMS designed for their unique management and reporting needs.

The EVMS comprises multiple management subprocesses that collectively contribute to the structuring, analysis, decision-making, and communication of project performance. As mentioned, these ten management subprocesses - organizing, planning and scheduling, budgeting and work authorization, accounting considerations, indirect cost management, analysis and managerial reporting, change control, material management, subcontract management, and risk management - are essentially an integrated series of management actions taken towards the successful execution of the project/program. The adequacy of subprocesses and attributes, both individually and collectively, serves as the foundation for putting into action the 32 EIA-748 EVMS Guidelines. It is through the assessment of these that EIA-748 EVMS compliance is demonstrated. A crosswalk between the ten subprocesses and 32 EIA-748 Guidelines is provided in Attachment 2.

2. Environment for System Implementation

The notion of environment and human factors refers to all circumstances surrounding the project during its up-front planning and execution. Many factors are conditions directly under the control of the project that influence EVMS implementation. Environment and human factors can vary significantly in type and nature depending on the organization and culture. These factors can be classified as tangible and intangible. Tangible factors are more visible for a project, and intangible factors are often less visible and require constant attention. For example, intangible factors—like team cohesion, the quality of governance, and genuine commitment to EVMS implementation—can be instrumental in success. Intangible factors are not physical per se, like a documented procedure or a management tool set, but they play an important role in EVMS effectiveness.

The study's introduction of environment and human factors and their influence and impact on the maturity (and by default the effectiveness) of an EVMS is a material change from past thinking and approaches. New realities are forcing customers, contractors, and stakeholders to adapt their execution strategies and transform how their organizations use people, processes, and technology to develop capabilities to meet their unique management needs. Users of this document can see how the environment and human factors, both tangible and intangible, become a project's greatest formula for success. Reducing the risk of failing to achieve schedule, budget, and performance goals begins by embracing a culture that fosters trust, honesty, transparency, communication, and shared values.

The environmental and human factors of a project refer to events, factors, people, systems, structures, and conditions, internal and external to organizations, that influence the implementation of the EVMS. The study found that culture, people, practices, and resources are the driving factors most associated with a project's environment, and as such, influence organizations' activities, decisions, behaviors, and attitudes of the people responsible for implementing the EVMS.

The following subsections define and describe environment and human factors for their assessment. The descriptions and definitions are not all-inclusive and may be supplemented when appropriate. The environmental and human factor descriptions are organized in a hierarchy, by category and factor. The assessment rates the level of each factor against its associated description.

2.1. Culture

Culture is, by definition, the display of behaviors. Organizational culture is a system of common assumptions, values, and beliefs (or the lack thereof) which govern how people behave and interact with one another inside of a project. Organizational values and beliefs align with the development and outcomes of a successful EVMS. The project culture can promote or hinder EVMS effectiveness. This category includes seven factors, 1A through 1G (Table 1). The more the project fulfills these factors, the more effective the EVMS.

Table 1. Cultural Factors

Description	Checkpoint
1A The contractor organization supports and is committed to EVMS implementation, including making the necessary investments for regular maintenance and self-governance.	a) The contractor integrated project team (IPT)—including corporate leadership, execution and operations personnel, oversight personnel, and support staff—is in place, and it has a demonstrated belief in the intrinsic value of the EVMS to position the project for success. b) The project follows an integrated project management strategy to identify and manage risks using the EVMS that would otherwise impair a well-formed baseline plan. c) The project has committed resources, including funding, to ensure that effective implementation of the EVMS is a priority, assuring continuous improvement and accountability at every level of the contractor organization. This commitment ensures the availability of key individuals who contribute to implementing the EVMS. Typically, this includes the availability and commitment of other personnel with specialized skills and knowledge of the EVMS, who may or may not be "dedicated" to the project. d) Contractor leadership and team member attitude and discipline, at the corporate office and project levels, lead to the correct use, application, and acceptance of EVMS as an integrated project management tool used in the definition of work scope, planning and scheduling, budgeting and work authorization, managerial analysis, reporting, forecasting, and risk management. e) Contractor leadership actively revisits the most effective ways to evaluate EVMS metrics that support decision-making. f) The contractor organization's policies include incentives and education to foster support and commitment to implementing the EVMS. g) The contractor team does not choose convenience over following the EVMS regulations and procedures that apply to the project. h) Project decision-making, which ultimately drives project results, is collaborative and effectively relies on EVMS-generated data and metrics. i) Governance is enforced and effective at dealing with the project challenges. Self-governance refers to the capacity of a contractor to govern autonomously, an important approach in overseeing effective EVMS implementation. When a contractor instills integrated project management principles using the EVMS in a way that benefits all levels of the organization, the results can guide management decisions, lead to improved project execution, and optimize the performance of the project team.
1B The project culture fosters trust, honesty, transparency, communication, and shared values across functions.	a) Through open communication, the project culture fosters trust, honesty, and shared values, including a realistic portrayal of performance and acceptance of data transparency. Project leadership forms a team culture of trust and honesty, where members can maintain open, synergistic relationships. Open communication enables the team to be more engaged and understand that what they do with the EVMS matters in project success. b) The project culture is a system of common assumptions, values, and beliefs, which governs team member behavior. c) The values and beliefs displayed in the project align with the implementation of the EVMS and project outcomes. d) A shared EVMS implementation plan helps form a common understanding between the customer and contractor, fostering a culture of trust by laying out how things should work. e) The culture is supported by appropriate rewards or incentives for implementation of the EVMS and the execution of EVM (managing with data) for proactive management decision-making. Rewards or incentives are tied to maintaining the integrity of the EVMS as well as meeting project goals. f) The project culture is heavily influenced by the external organizational cultures with which it interacts. If these cultures align, establishing a team culture is much easier than if they are unaligned (where creating shared values may

Table 1. Cultural Factors

Description	Checkpoint
	require more effort). For example, the contractor PM and customer FPD can create bilateral rules of engagement (ROEs) to set expectations up-front. These leaders are visible and accessible. g) Project leadership, and specifically government FPDs and contractor project managers (PMs), ensure trust and honesty are fostered in the project culture, which helps integrate programmatic and technical information across functional areas. This includes sharing accurate data, positive and negative, within and across customer and contractor organizations, with little fear of retribution. h) Realistic status and estimates at completion (EACs) are communicated at all levels and externally. Clear, consistent communication is key.
1C The customer organization supports and is committed to EVMS implementation and usage.	a) The customer organization and its project team have a singular view of and a demonstrated belief in the intrinsic value of EVM and managing with EVMS data to position the project for success. b) The customer supports the project by establishing the topline expectations for EVMS implementation, tailored project size and complexity. c) The customer has committed resources, including funding and personnel, to ensure effective EVMS implementation is a priority. d) Customer commitment ensures guidance, advocacy, and accountability by the PM and functional leadership. This commitment includes a willingness to remove roadblocks that would hinder EVMS implementation and actual work performance. Customer commitment ensures consistent use of and management action from EVMS data and information. e) EVMS knowledge, attitudes, and discipline, at the project office and customer oversight organizations, lead to the correct use, application, and acceptance of the EVMS as a management control tool, including change control, forecasting, and risk management. f) Customer leadership actively revisits the most effective ways to evaluate EVMS metrics that support decision-making and system corrective actions and improvements. The customer institutes a learning organization that actively creates, acquires, and transfers knowledge internally and can modify its behavior to reflect its new knowledge. g) Customer leadership does not choose convenience or preference over following EVMS regulations and procedures. It balances the need to design, produce, and deliver safe and high-quality products and services with the requirement to maintain due diligence using EVM for proactive management action. h) Customer organization policies incentivize and educate to foster continuous support and commitment. i) Formal and timely examination, assessment, and acceptance of EVMS generated data, metrics, and reports enable the project to initiate change, where and when needed. j) If the project has multiple customers or sponsors, they are consistent in their assessment of the contractor's EVMS.

Table 1. Cultural Factors

Description	Checkpoint
1D Project leaders make timely and transparent decisions informed by the EVMS.	a) The contractor and customer consistently demonstrate timely, transparent decisions critical in project success. b) Project leadership and team members have situational awareness of the progress made on programmatic (such as technical, schedule, and budget) objectives that lead to timely, effective decisions. c) The project adequately emphasizes EVMS importance as the means to develop and integrate scope, schedules, and budgets, as well as understand risk and uncertainty. d) The project uses the EVMS to predict and positively influence schedule and cost outcomes using generated data, metrics, and reports in prescribed formats that assist effective management and decision-making. e) Communication platforms disseminate information to enable effective decisions. f) Team members implementing the EVMS are supported by timely decisions and inputs from the sponsors and have corporate support when needed. g) Decisions are shared transparently (for example, scope changes are shared across key stakeholders) and are consistent.
1E Project leadership effectively manages and controls change using the EVMS, including corrective actions and continuous improvement.	a) Project leadership (contractor and customer leadership and their teams) has the authority to manage and respond to changes, implement corrective actions, and employ continuous improvement practices. Every project has changes, including scope, forecasts, personnel, funding, external environment, and EVMS tools. Regardless of the change, project leadership and the team acknowledge and tolerate change as a normal part of the project and are proactive in their response. b) The customer and contractor foster an actionable culture that innovates quickly enough to operate in a rapidly changing environment using the EVMS. c) Project leadership is diligent in ensuring the team follows a closed-loop procedure when responding to change. d) The EVMS offers a solution-based approach to addressing complex project problems. e) The customer and contractor remove obstacles to processing contracts and baseline change management. f) The baseline is proactively managed to ensure it is realistic and preserves the integrity of related metrics. g) Project leadership anticipates change and handles it with a positive attitude, fostering positive stakeholder attitudes and outcomes that lead to effective EVMS implementation and continuous improvement.
1F The project employs effective teamwork, in which team members work synergistically toward common project goals.	a) EVMS stakeholders (including customers and contractors) are working synergistically together toward common project goals using effective teamwork. b) There is a mutual commitment to work together. The project overcomes functional silos through effective teamwork and can organize effectively for integrated project management activities. c) Effective teamwork promotes and welcomes diverse ideas and perspectives that can benefit the EVMS. Formal and informal team-building programs initiate teamwork as early in the project as possible. d) Team building seeks to resolve differences, remove roadblocks, and build and develop trust and commitment, a common mission statement, shared goals, interdependence, accountability among team members, and problem-solving skills. Team building contributes to alignment by helping a group evolve from a collection of individuals into a team. e) Team building between customer and contractor is equally important, but it ensures customer independence for overseeing that the contractor meets applicable regulations and contract terms and conditions. Team building

Table 1. Cultural Factors

Description	Checkpoint
	considers the current stage of team development (forming, storming, norming, or performing). A history of team members and their organizations working together on past efforts using the EVMS supports effective teamwork. (Excessive turnover of team members may hinder effective teamwork because of a lack of continuity. Project leadership addresses team-building activities again to minimize associated impacts.)
1G Alignment and cohesion exist among key team members who implement the EVMS, including common objectives and priorities.	a) Alignment and cohesion among key EVMS stakeholders, including agreement on common programmatic and technical objectives and current priorities, gives the project team the ability to effectively move forward together using the EVMS. When aligned, appropriate participants work within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives. b) Effective alignment promotes direction and the ability to respond to change as needed. (Lack of alignment, conversely, leads to the project team's pursuing conflicting objectives and goals.) Alignment effectively incorporates a diversity of ideas and perspectives that can benefit the EVMS. c) The customer and contractor work cohesively and collectively to implement the EVMS, including working with designated project controls personnel assigned to EVMS implementation. EVMS implementation includes individuals from the entire project (corporate EVMS oversight, consultants, customer, contracts, finance and procurement offices, and so forth). d) In the project environment, alignment has three dimensions: 1. Vertical, top-to-bottom alignment within an organization. Executives, business managers, PMs, and functional specialists within each organization have a common understanding of the plans, schedules, and budgets coming from the EVMS. 2. Horizontal, cross-organizational alignment between functional groups within the organizations represented on the project. Different organizations (including customers, prime contractors, subcontractors, and external stakeholders) with a stake in the project are also well aligned with a common understanding of the plans, schedules, and budgets coming from the EVMS. Any disconnects are understood and addressed to foster alignment. If the project has multiple customers or sponsors, they are considered for alignment and cohesion. 3. Longitudinal alignment of expectations and programmatic objectives throughout the project life cycle. This alignment ensures the project team is working toward common goals.

2.2. People

People denotes the individuals who represent the interests of their respective stakeholders—project business manager, project control analyst, project schedule analyst, acquisitions or subcontracts personnel, control account managers (CAM), IPT or line/resource management, contracting officers, etc.—and are adept in the relevant subject matter to contribute to the implementation of the EVMS to achieve favorable project outcomes. This category includes six factors, 2A through 2F (Table 2). The more the project fulfills these factors, the more effective the EVMS.

Table 2. People Factors

Description	Checkpoint
2A The contractor team is experienced and qualified in implementing the EVMS.	a) The contractor leadership team (including executive management, functional organizational managers, PM, and contracts manager) and the contractor's project team (including PM, project controls managers, and CAMs) are experienced in implementing the EVMS to inform decision-making on a project of similar size, scope, or location. b) The contractor team is qualified to effectively implement the EVMS on the basis of relevant training, education, certification, or experience given the nature of the project, its level of risk, local conditions, schedule constraints, and so on. Experience and qualification may differ. c) The contractor team has the right mixture of experienced personnel to implement the EVMS to ensure it reaches its objectives and desired outcomes. Experience increases the contractor's familiarity with the EVMS for proper project planning, budgeting, and execution. Repetition (through relevant experience) in implementing the EVMS plays a major role in both organizational learning (such as lessons learned, mentoring, and continuous improvement) and in creating routines and capabilities in general. d) A structured method for mentoring and professional development brings contractor leadership and project personnel up to the right level of technical knowledge and skills for the effective implementation of the EVMS given the nature of the project.
2B The customer team is experienced in understanding and using EVM results to inform decision-making.	a) The customer leadership team (such as the sponsor representative and contracting officer) and customer project team (such as the PM, budget officer, contracting official, project controls managers, and engineering lead) have experience using EVM to inform decision-making on a project of similar size, scope, or location. b) The customer has the right mixture of experienced personnel to ensure EVM is used effectively to inform decision-making. Experience with projects of similar size and complexity increases the familiarity and understanding of implementing the EVMS during the project planning, design, and execution phases. Repetition (through relevant experience) plays a major role in both organizational learning (such as lessons learned, mentoring, and continuous improvement) and in creating routines and capabilities in general. c) A structured method for mentoring and professional development brings new individuals up to the right level of technical knowledge and skills, given the nature of this specific project
2C Project leadership is defined, effective, and accountable	a) Customer and contractor project leadership is defined, effective, and accountable, leading to better EVMS implementation and execution. (Project leadership roles can vary across organizations, typically including project sponsor, project director, customer representative, PM, construction manager, operation manager, and others.) b) The organizational structure follows the hierarchy of executive steering committee, project leadership team, and execution team. c) The sponsor and senior leadership enhance the project environment. (They are responsible for the project, have decision-making authority, and ultimately are held accountable for project success; as stewards of the project, their influence enhances or hinders EVM use.) d) Components of good leadership in the project context typically include the following: ▪ General knowledge of contracting strategy, project phases, and delivery systems ▪ Understanding of related business critical success factors ▪ Capacity to determine and align the needs of the key stakeholders ▪ Understanding of manufacturing or construction, start-up, and operations.

Table 2. People Factors

Description	Checkpoint
	e) Components of good leadership in the EVMS context typically include the following: ▪ A demonstrated belief in the value and disciplined use of the EVMS ▪ Clear support of the EVMS as an effective management tool to control the project ▪ Swift action if the EVMS maturity or environment needs improvement, including system certification if needed ▪ Understanding how to assess and manage uncertainties and risks ▪ Implementation of a management governance plan that includes the EVMS ▪ Understanding of the relationships and integration between EVMS and other system metrics- accounting, risk management, quality, safety, Material Requirements Planning System (MRPS), etc. ▪ Striving for far more than minimum expectations.
2D The EVMS implementation appropriately represents project stakeholder interests.	a) Project internal and external stakeholder interests are appropriately represented to provide the right input at the right time during EVMS implementation. (A stakeholder is an individual or entity who can influence, or is influenced by, the project. Appropriate internal stakeholders may include individuals representing the contractor, operations and maintenance, key design or technical leads, CAMs, project management, procurement, accounting, material management, quality management, sponsor, end-user, and manufacturing. External stakeholders may include regulators, Indigenous peoples, local communities, state or provincial governments, or other government agencies.) b) Stakeholders effectively communicate expectations and proactively assist with key decisions. Appropriate stakeholder input helps improve team alignment by providing a sound foundation for a successful EVMS. Proper stakeholder input also gives the leadership and project management teams diverse expertise in the technical and management areas of the project. (For example, EVMS stakeholders, such as CAMs and project management, are represented on the project leadership team and appropriately engaged, offering diverse ideas. In another example, stakeholders are appropriately represented on the EVMS implementation team to ensure an understanding of the project scope.) This diverse expertise facilitates sound judgment of the problems faced by the team, leading to better solutions
2E The professional learning and education of key individuals responsible for EVMS implementation are appropriate to meet project requirements.	a) The professional learning and education of key individuals responsible for EVMS implementation support meeting project requirements. They can adequately apply earned value knowledge, offer professional input and thought leadership, and inform decision-making based on best practices and recognizable standards. b) Implementing the EVMS involves individuals with the necessary technical background, training, EV tools knowledge, qualifications, and certification in the relevant subject matter. c) Effective training on project management practices, procedures, and processes supplements experience, communicating expectations and teaching how to implement the EVMS in the actual operation of work. d) A rigorous, tailored professional development program is maintained as the project progresses, including the development of technical capabilities, exposure to current practices, sharing of lessons learned among PMs, and relevant internal and external training and certification of key EVMS stakeholders as part of lifelong learning principles. e) A proactive, formalized learning and development framework considers succession planning, cross-disciplinary training, team depth, recurring refresh training, and integration across cost and schedule expertise, leading to professional growth and career advancement

Table 2. People Factors

Description	Checkpoint
2F The team members responsible for the EVMS implementation phases are collocated or accessible.	a) Project leadership and team members responsible for the EVMS implementation phases of the project are collocated or accessible, offering an opportunity for closer coordination and interaction. b) Team members are collocated or accessible to develop shared goals, purpose, and culture. (If the team is collocated for general day-to-day execution of the project, by default those responsible for implementing the EVMS, both technical and project controls, are collocated.) c) Collocation facilitates the development of a positive team climate, independent team processes, and maturation of team members and the team itself. (The accessibility of team members, through video conferencing and so on, offers similar benefits to physical collocation. When collocation or accessibility is lacking, time zones and language barriers may necessitate using other communication techniques and technology to support the project.) d) Through collocation, the team regularly and easily meets, converses, and shares ideas, issues, and solutions, improving collaborations. Initiate teamwork as early in the project as possible.

2.3. Practices

Practices are internal and external procedures and processes that can help or hinder desired project outcomes. Internal business practices and methods, including internal standards, requirements, and best practices, are specific to a given organization. External business practices, regulations, requirements, procedures, and methods span organizational boundaries (government to contractor, software provider to contractor, subcontractor to prime, and so forth). This category includes eight factors, 3A through 3H (Table 3). The more the project fulfills these factors, the more effective the EVMS.

Table 3. Practice Factors

Description	Checkpoint
3A The project promotes and follows standard practices to implement the EVMS.	a) Project management documents containing effective practices, procedures, processes, and tools for EVMS implementation are developed and consistently used, tailored where appropriate to the size and complexity of the project. Often referred to as the EVM system description, they define a uniform, consistent, and realistic approach to EVMS implementation. b) The project promotes and follows standard practices, including proper, realistic, and up-front EVMS planning. c) EVMS standard practices govern the organization's project management to integrate a defined set of associated work scopes, schedules, and budgets for effective planning, performance, and management control. d) The project clarifies any variation from the organization's standard procedures for a given contract for all stakeholders to ensure alignment. e) Standard practices facilitate training of all team members, including those less experienced.
3B	a) EVMS requirements definition is in place and agreed upon by key stakeholders and customers, establishing common expectations on the importance of EVMS. b) EVMS project implementation objectives are clear and scaled to the size and complexity of the project. Customer work scope requirements-including the

Table 3. Practice Factors

Description	Checkpoint
The EVMS requirements definition is in place and agreed upon by key stakeholders and customers.	requirement to implement the EVMS-are communicated and documented before work begins. c) EVMS requirements are appropriate to support contractual requirements, leading to more uniform and better-informed decisions.
3C The roles and responsibilities for EVMS implementation are defined, documented, and well understood.	a) Practices, procedures, and processes define and document the roles, responsibilities, accountability, and authority of internal and external stakeholders for both contractor and customer. b) Clearly defined roles and responsibilities align with shared goals and effective EVMS implementation. c) The project's roles, responsibilities, and authorities are well understood, consistent with the contract, followed, and updated as needed, closing gaps to ensure the EVMS runs efficiently. d) Roles, responsibilities, and authorities are documented in a responsibility assignment matrix, making EVMS implementation and execution much smoother and helping meet project expectations.
3D Communication is open and effective, including consistent terminology, metrics, and reports.	a) Constant, open, and effective communication channels transfer EVMS information efficiently and expediently. Communication, including consistent terminology, builds and maintains a productive interface between the project and EVMS stakeholders. b) The project has a communication plan that identifies stakeholders and includes clear milestones involving specific stakeholders as needed. c) The availability of metrics and reports gives customer and contractor management visibility into the project's current state. For example, realistic status and EACs are communicated at all internal and external levels. d) The project identifies and communicates required metrics and reports for the EVMS in meaningful language and terms understandable by all parties. e) Metrics and reports are produced promptly to communicate any significant variances and anomalies to support effective management decision-making. f) Conflict resolution practices and procedures are in place and actively used.
3E Effective oversight, including internal and external surveillance and independent review, is in place and used.	a) Established practices are used for effective oversight of the EVMS by an independent entity throughout the project life cycle to ensure the EVMS benefits the project. (Contract requirements and agreements in place between customer and contractor often drive oversight. An internal, administratively independent oversight team or organization-such as audit, financial, or project controls-can render this input. Conversely, an external organization can perform this type of oversight to effect change. Independent, external assessment and evaluation help remove conflicts of interest and identify other issues not evident to the project team.) b) Evaluations of EVMS practices and subprocesses, including those used to assess EVMS implementation efficacy or compliance with standards, are regularly performed and trends evaluated. These practices include adequate resources and management commitment to support internal and external, data driven surveillance and independent reviews. c) Effective oversight and surveillance practices help the project self-govern and lead to corrective action and continuous improvement.
3F Contractual terms and conditions that hinder the effectiveness of EVMS are known and have been addressed.	a) Contractual terms and conditions-such as contract type and associated risk; use of agile, fast-tracking; many changes; or late requirements for EVMS use-are known, and those that are inappropriate or that conflict with appropriate EVMS implementation have been addressed as early as possible. (In some cases, contract terms and conditions can limit the effectiveness of EVMS applications. For instance, the contractual terms and conditions for EVM may not be appropriate for the contract scope, such as in a case where the contractor

Table 3. Practice Factors

Description	Checkpoint
	must implement a full EVMS on a relatively small, simple maintenance program.) b) The contract award fee or incentives are based on the acceptable implementation and use of the EVMS and current, accurate, and complete performance data for proactive management, in addition to meeting target milestones or deliverables. Contract award fees or incentives are not tied solely to performance thresholds. c) Contractual terms and conditions are actively enforced and strictly interpreted. Contractual terms and conditions are identified, including the responsibility for EVMS implementation, and the project is proactively addressing any limitations within the EVMS structure (such as the overlap of responsibilities, mismatch of business rhythm and capability, contract time not conducive to project objectives, and so forth). d) Contract modifications are reviewed to ensure their impact on the EVMS is addressed, especially changes made late in the project's life
3G Appropriate SME input is adequate and timely.	a) Appropriate SME input is timely, effective, and efficient, supporting the project execution team's needs. (Typically, SMEs are external to the project and have experience and expertise in certain domains of knowledge critical in EVMS success. They can be used for independent assessment or reviews (such as non-advocate reviews or as a "time-shared" resource split between two or more projects. Individual SMEs may cover one or more functional areas, as needed.) b) With the significant input of appropriate SME knowledge, lessons learned are leveraged and obstacles that typically hinder EVMS use are identified well in advance to facilitate timely, consistent use of data, enhancing management decision-making.
3H The key disciplines involved in implementing and executing the EVMS are coordinated.	a) A formal structure of interaction between the key disciplines involved in implementing the EVMS enables them to coordinate and integrate the EVMS effectively with other project management activities. Key disciplines include accounting, engineering, project management, procurement, and supply chain integration. b) Specifically, the project follows a cross-discipline coordination and collaboration plan to assist discipline leads, compliance reporting, audits, etc. This plan, along with a responsibility assignment matrix, is used to coordinate efforts between the customer, contractor, and external stakeholders. c) The coordination and collaboration plan is part of the project execution plan and is updated as changes occur.

2.4. Resources

The resources category addresses the availability of key tools, data, funding, time, personnel, and technology, including software, to support the EVMS subprocesses. This category includes six factors, 4A through 4F (Table 4). The more the project fulfills these factors, the more effective the EVMS.

Table 4. Resource Factors

Description	Checkpoint
4A Adequate technology, including software, and tools are integrated and used for the EVMS.	a) Technology and tools are available, accessible, current, and used appropriately as part of the integrated EVMS. b) The project invests appropriately in technology and infrastructure, including EVMS tools, to assist in the actual operation of work, making decision-making and data sharing more effective. c) The necessary expertise (programmers, systems analysts, etc.) is available to integrate the technology and processes and set up the interfaces between the various systems and tools to ensure smooth integration and minimize the need for major change where possible. d) The choice of technology and processes is periodically assessed for adequacy and other solutions available in the marketplace. (Software products can be "homegrown" internally or part of a commercial system with adequate vendor support. Automated tools are usually better than those needing manual data input.) e) The technology enables the project to completely integrate its EVMS subprocesses with other applicable digital infrastructure systems, creating a met system of connected processes and tools that communicate with each other, preferably automatically. f) Software and tools are in place to generate all of the necessary reports, charts, and data from the summary, total program, and project levels down through the work breakdown structure (WBS) and organization breakdown structure (OBS) to the work package (WP) or task level. They furnish the ability to drill down through the data and summarize the data up to the portfolio level.
4B Sufficient funding is committed and available for implementing and executing the EVMS	a) Sufficient funds are allocated and available to appropriately support the EVMS process for all directly involved in the project, from initiation through final EVMS delivery. (In some cases, the project is sufficiently funded, but the EVMS is not funded sufficiently for implementation. In other cases, generally unacceptable, the project is not sufficiently funded at initiation to meet the project baseline requirements. In still other situations, funding is provided year to year, which can cause continuity concerns. In any of these cases, the EVMS effort may be severely impeded.) b) Sufficient funding enables up-front organizational allocation and commitment to accomplish the EVMS requirements; funding is applied strategically and efficiently, using industry benchmarks or standards where appropriate for comparison. c) Funding is available for non-project-specific external resources to enable the project to support internal and external surveillance, training, lessons learned, corrective action plans, and other needs. d) Resources external to the project can flexibly provide surge capacity, independent assessment, or specialized knowledge as needed for implementing or executing an efficient, effective EVMS.
4C The team that implements and executes the EVMS for the project is adequate in size and composition.	a) The team that implements and executes the project EVMS is adequate in size and composition to efficiently support the project, adjusted as needed. b) The customer and contractor organizations have committed time and resources to efficiently and effectively use EVM results, ensuring that decision-making is timely and informed. c) Customer and contractor organizational staffing levels are in place and adequate to execute scope and workflow, including staffing levels, to effectively implement the EVMS. This includes individuals from the project, corporate EVMS oversight, consultants, customer, project controls, contracts, finance and procurement offices, and so forth. d) Expertise, authority, and experience, having size and composition comparable to industry benchmarks, are appropriate.

Table 4. Resource Factors

Description	Checkpoint
4D Sufficient calendar time and work hours are committed and available for implementing and executing the EVMS.	a) Sufficient working days and hours are committed and available for all, direct and indirect, involved in implementing the EVMS. b) The magnitude of effort to perform the EVMS function is known, and resources to perform the effort are available when needed. This allocation of time and work hours enables adequate effort based on the size and complexity of the project. c) Organizational prioritization and commitment of resources to accomplish EVMS requirements, as well as sufficient notification to assign the resources, is adequate. (For example, this requires the commitment of functional and program-specific managers to have individuals available for the effort and dedicate key personnel time to support the EVMS.)
4E Data are readily available to populate EVMS tools supporting analyses for decision-making.	a) Data are readily available and accessible in a consistent and timely manner according to the business rhythm. b) Data are shared, effectively and efficiently, and support analyses to properly manage the project. c) Data are current, accurate, complete, repeatable, auditable, and contextualized to aid understanding, which leads to effective, timely, and informed decision-making at all levels. d) Data meet applicable EVM reporting requirements, such as file type and format.
4F The project employs an appropriate periodic cycle for executing the EVMS effectively and efficiently	a) The EVMS is implemented in a cycle time appropriate to control the project effectively and efficiently, according to the business rhythm calendar per the contract requirements. The same periodic cycle is followed by subcontractors, accounting, procurement, contracting, and others, as required. b) The appropriate periodic cycle is used to assess and prioritize workflow, ensuring demand is balanced with EVMS capacity, which helps effectively plan, forecast, and allocate resources. c) EVMS personnel and management proactively address any issues that arise

3. Management Processes and Attributes for System Maturity and Effectiveness

EVMS processes ensure the project takes a systematic and disciplined approach to planning, scheduling, budgeting, analysis, change control, decision-making, and communications with customers (see Figure 1). They facilitate the use of a pragmatic and logical approach to meet the objectives of EIA-748:

A. Organizing is based on a structured approach for decomposing the project work scope into manageable segments, creating the WBS, the basic structure for management control.

B. Planning and Scheduling describes the sequence of work scope and identifies activity interdependencies needed to meet the project requirements, including the identification of resource needs.

C. Budgeting and Work Authorization establishes the foundation for integrating authorized work, schedule, and budgets into a baseline against which work accomplishment is measured. This baseline—the performance measurement baseline (PMB)—is managed primarily at the control account (CA) level and consists of a dollarized, time-phased plan established at the work package activity level that reflects how the contractor intends to use its resources, including subcontractors, to complete the project. The PMB gives the government and contractor a common reference point for discussing project progress and status.

D. Accounting Considerations ensures all direct and indirect costs associated with completing authorized work are properly transmitted in the EVMS at the detail required for analysis and decision making. These data are reconcilable to the contractor's financial accounting system.

E. Indirect Cost Management maintains a properly classified indirect cost structure, identifies the contractor organization responsible for controlling indirect costs, properly budgets and accrues indirect costs, and analyzes indirect costs.

F. Analysis and Managerial Reporting focuses on using EVMS performance data and information to detect and act upon early technical, schedule, or cost deviations from the PMB. This requires the contractor to evaluate and update at-completion costs to give the contractor and government visibility into future resource needs sufficient to fund the project.

G. Change Control preserves the integrity of the PMB by formally controlling and properly documenting changes using a systematic approach. It ensures the PMB reflects the most current plan for accomplishing the project, thus providing credible performance measurement data on which the contractor and government can rely to make decisions.

H. Material Management expands on the planning, budgeting, accounting, and performance measurement of material. It is based on the flow of materials, from their initial purchase to their final acceptance, and is a critical function for ensuring identification and accountability of all materials on contract, considering the uniform flow of materials and controlling inventories.

I. Subcontract Management expands on the application of performance measurement to subcontracted efforts, sets management and controls unique to subcontracting, including subcontract certification, to ensure timely delivery of an acceptable product and to notify the government of potential subcontract problems that may detract from delivery, quantity, or

price. (Material Management and Subcontract Management are interdependent in their operations.)

J. Risk Management effectively identifies and manages the technical, schedule, and cost risks to minimize their negative impact on the PMB. Although the project cannot entirely avoid risk due to uncontrollable circumstances, the EVMS anticipates and mitigates risks through an established risk management process.

Hence, as a controlled and coordinated assessment, the qualifications of the 10 core processes are paramount in ascertaining EVMS qualities and operating characteristics.

3.1. EVMS Maturity Template Description and Use

The study created prepopulated maturity model templates and diagrams to represent and measure EVMS maturity. By assigning values to project management attributes, 56 maturity model templates are used to appraise the EVMS maturity.

Similar to how FICO® scores are calculated from many different pieces of credit data in the credit report, the EVMS maturity score reflects how important an attribute and process is for the level of risk and type of work performed. The appropriate EVMS maturity score and associated implementation requirements ensure project resources are appropriately invested in areas that maximize the EVMS value. The templates differentiate between the levels of maturity needed for EIA-748 compliance and those needed only for the practical application of project management. (Level 4 defines the operating characteristics for EIA-748 compliance.) The EVMS maturity score simplifies the project view, rendering an understandable and actionable numeric score.

Figure 3 highlights six sections containing descriptive information for assessing the EVMS effectiveness:

- Template Area ❶ identifies the EVMS subprocess.
- Template Area ❷ identifies the attribute that is part of a larger subprocess.
- Template Area ❸ describes the attribute's essential characteristics.
- Template Area ❹ identifies the attribute's maturity ranges from low, (1) not yet started, to high (5) optimized use.
- Template Area ❺ summarizes the maturity at each level to allow for a quick bracketing of the attribute's maturity during an assessment.
- Template Area ❻ explains each maturity level in greater detail to allow for a more fully informed assessment of maturity. As further described in this document, this area at level 4 maturity contains the individual effectiveness criteria (EC) used to define and substantiate the attribute's overall objective. The EC are used in a "bottom-up" review of the attribute at the most precise detail possible and then aggregated to arrive at the assessment of the overall objective.

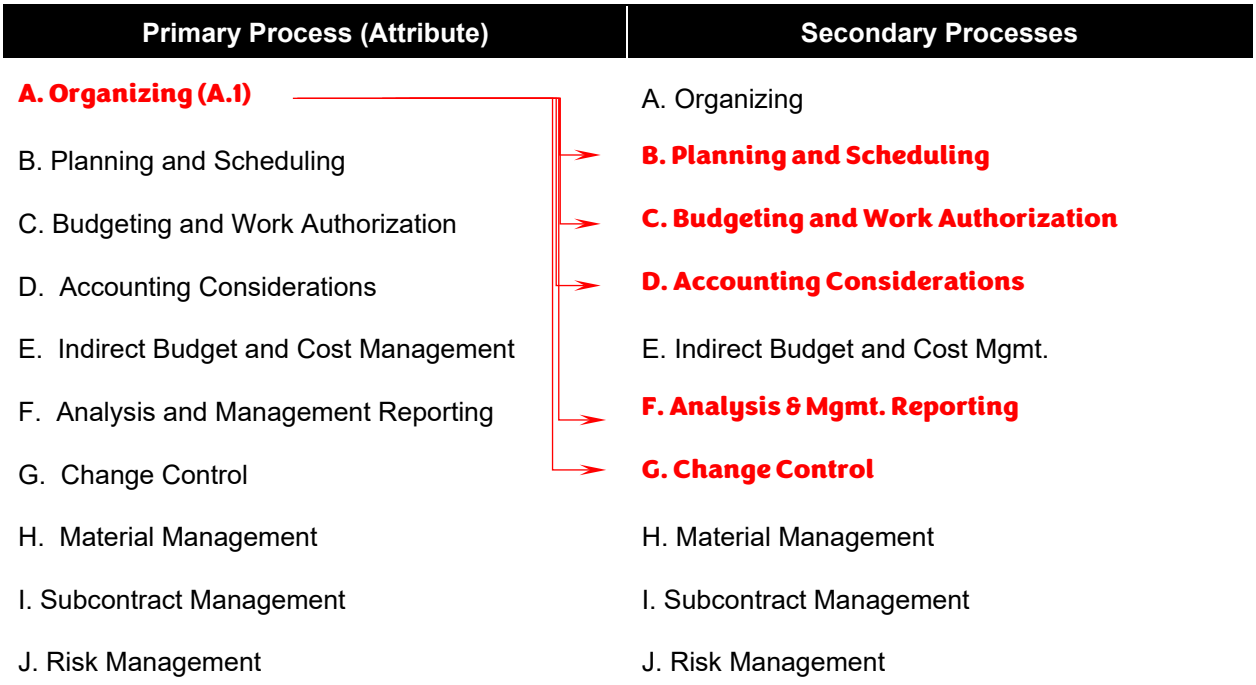
Figure 3. Example EVMS Maturity Template

❶ SUB-PROCESS G: CHANGE CONTROL	❹ Maturity Level				
	LOW	MEDIUM			HIGH
❷ **G.1. Controlling Management Reserve (MR) and Undistributed Budget (UB)**	1	2	3	4	5
❸ The distribution of Management Reserve (MR) and Undistributed Budget (UB) should be accomplished through the use of a formal change control process. MR is controlled by limiting its use exclusively to risk contained within a formal risk register or for in-scope unforeseen efforts not previously identified and budgeted in the Performance Measurement Baseline (PMB). MR is not to be used to offset poor performance (i.e., cost overruns) or cover costs that are out-of-scope to the contract. Conversely, it is to be used to accommodate unforeseen changes that are in-scope to the contract, budgetary changes to future work scope caused by rate adjustments, and other unknowns. To ensure that budgets for newly authorized work remain tied to the associated scope, UB is used to control the distribution of work using a holding account. Once the responsible organization(s) for the new scope has been identified, the budget is transferred from UB to the appropriate Control Account(s) (CAs). This ensures budget and scope will not be transferred independently. Changes to MR and UB budget are formally and separately controlled, tracked, and reported detailing monthly transactions and providing current budget values. A Contract Budget Base/Project Budget Base (CBB/PBB) log is used to track Performance Measurement Baseline (PMB), UB, and MR changes. The CBB/PBB log also serves to identify reporting period (monthly) end-values, reporting period changes to/from MR, PMB, and UB, and current MR and UB budget balances. Items to consider include: ☐ Documentation identifying both MR and UB values. This may include automated or manual records recording initial and, as the program progresses, revised amounts for MR and UB ☐ MR logs, UB logs, PMB logs, and/or CBB logs showing month-end values and changes, monthly sources and applications to/from CAs, and current values ☐ Management performance reports ☐ Other MR and UB changes should be integrated with the Analysis and Management Reporting sub-process. *Comments: This attribute refers to controlling changes to MR and UB. For more information on the identification of MR and UB, see attributes C10 and C11 respectively. PBB is sometimes used when multiple distinct projects make up one contract.* *References:* NDIA EVMS EIA-748-D Intent Guide GL 29; DoD EVMSIG GL 29; DOE CAG GL 29; EIA748-D; NDIA PASEG; ISO 21508:2018(E)	**Not yet started.**	**Some of the processes outlining the steps/actions needed to control MR and UB are in place. MR and UB logs do not exist.** MR and UB Logs do not exist. MR is being misapplied. It is being used to offset poor performance (i.e., cost overruns) or cover costs that are out-of-scope to the contract. UB cannot be identified with defined scope. A process to ensure for the timely clearing of budget and related scope in the UB account does not yet exist.	**Most of the processes outlining the steps/actions needed to control MR and UB are in place and documented. MR and UB logs exist, however are not fully maintained.** MR and UB use and changes are documented in logs, but individual transactions may not be separately reconcilable to internal monthly baseline changes. There may be a few misapplications of MR, including its use to offset poor performance (i.e., cost overruns) or cover costs that are out-of-scope to the contract. UB has defined scope and has been appropriately distributed to the PMB. With some exception, there is timely clearing of budget and related scope in the UB account. MR and UB changes are coordinated with the Analysis and Management Reporting sub-process.	**The documented processes outlining the steps/actions needed to control MR and UB are in place and approved. MR and UB Logs exist and are fully maintained.** All MR and UB changes are documented monthly in logs showing at a minimum the date and title of the change action, associated work package, CA, descriptive title, and reference numbers as needed for tracing back to the originating change documentation. Risk mitigation and/or realization activities are identified with all MR transactions. These transactions are coordinated with the risk management process for re-evaluation of residual risk. MR is used per contractual documentation. New contractual work scope is not budgeted with MR; but instead comes from contingency and is documented via the formal contract change modification process and approved accordingly. UB has defined scope and has been appropriately distributed to the PMB in a timely and effective manner. MR and UB changes are fully integrated with the Analysis and Management Reporting sub-process.	**MR and UB are proactively managed to inform decision-making.** All MR and UB changes are documented and reported in published logs. The control of MR and UB by the project/program manager is proactive and effective. MR and UB are monitored and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Review of MR budget and its distribution is subject to, managed, and controlled by a Change Control Board (CCB) or equivalent. An accurate relationship between the budget amounts in the UB account and the scope of work authorized for each budget value is consistently maintained. Routine surveillance results of MR and UB are fully disclosed with all key stakeholders, who maximize use of these results. MR and UB changes are continuously reviewed and optimized.

3.2. Integrated Nature of the IP2M METRR

IP2M METRR emphasizes the importance and benefits of an integrated EVMS by identifying the relationships between the 10 management subprocesses. To demonstrate the adequacy of these relationships, subprocess integration testing is performed where attributes are logically integrated. Scoring is accomplished primarily through sentiment analysis for each attribute to determine the maturity and effectiveness of subprocess to subprocess(es) integration. As part of each attribute's assessment, the primary subprocess reviewer initiates a discussion with all other secondary and related subprocess reviewers (consistent with the maturity templates). The purpose of this discussion is for the primary subprocess attribute reviewer to determine the level of maturity and scoring impact with respect to the integration with all other related subprocesses as defined by the maturity template. Figure 4 shows the integrated relationship of the organizing subprocess attribute (A.1) with five other subprocesses. (See Attachment 3, Attribute Integration Cross Matrix, for primary to secondary and related subprocess integration across all attributes.)

Figure 4. Relationship of Organizing (A.1) with Other Subprocesses



3.3. IP2M METRR Environment and Maturity Weightings

Of the 10 subprocesses that constitute the EVMS, subprocesses B and C account for 380 points, or 38% of the maximum score of 1,000 points (Figure 5). When combined with subprocesses F and G, these four subprocesses account for 605 points, or 61%, of the maximum score. Thus, emphasizing credible plans, schedules, and budgets with adequate controls and rigorous reporting best positions the EVMS to help the project achieve its objectives.

Within the 10 subprocesses that constitute the EVMS, six attributes list a maturity score of 25 points or higher: J.1, 32 points; J.2, 28 points; B.7, 27 points; F.5, 26 points; F.4, 26 points; and B.10, 25 points (Figure 6). As shown, the risk management attributes (J.1 and J.2) are important and noteworthy. Risk management is an organized method of identifying and measuring risk and developing, selecting, and managing options for handling it. A project considers various types of risk as part of its risk management process. Per OMB, the EVMS is used to mitigate risks in developing capital assets.[9]

[9] OMB, Circular No. A-11, Part 7, "Planning, Budgeting, Acquisition, and Management of Capital Assets."

Figure 5. Weighting of 10 Subprocesses

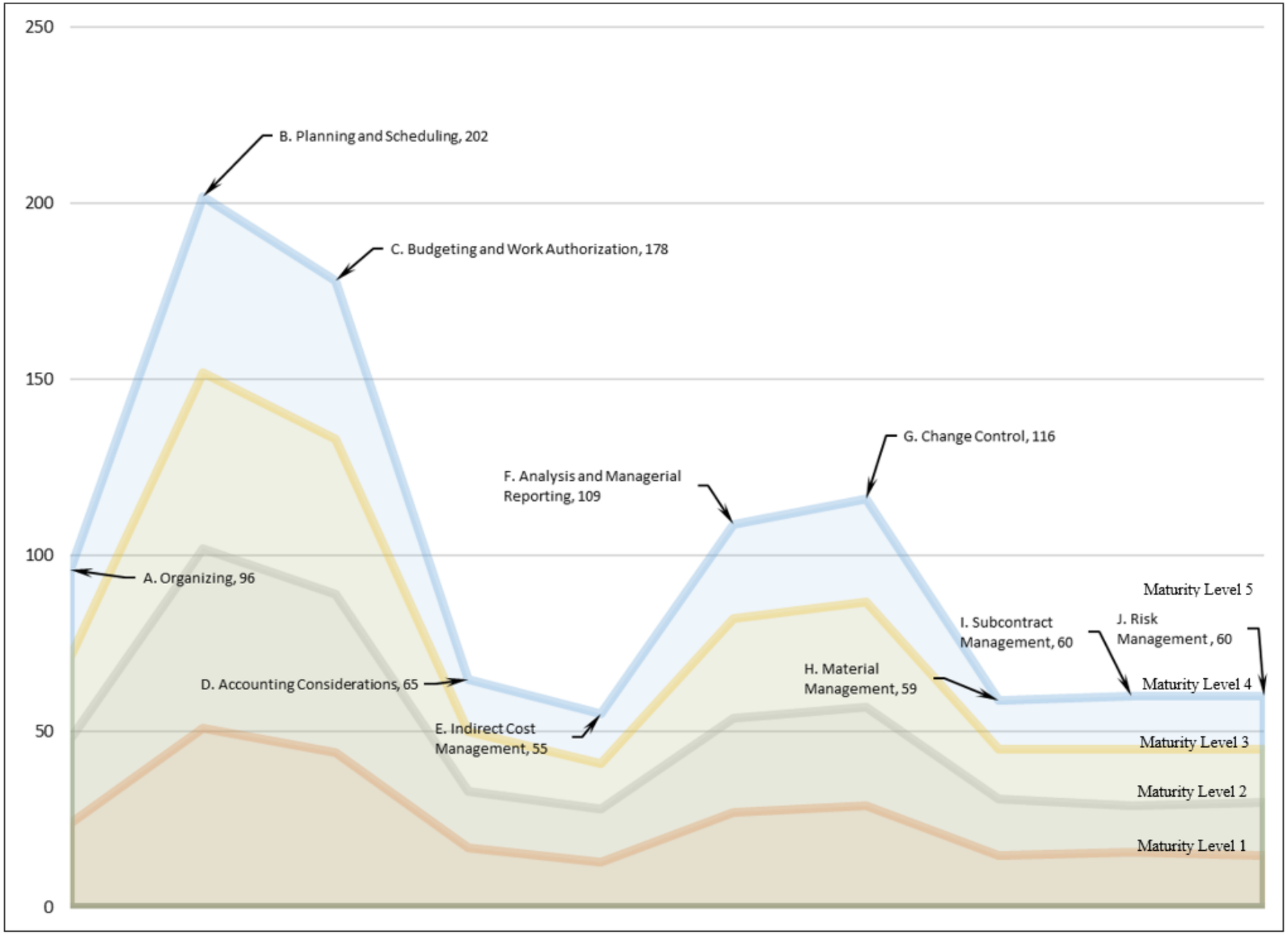
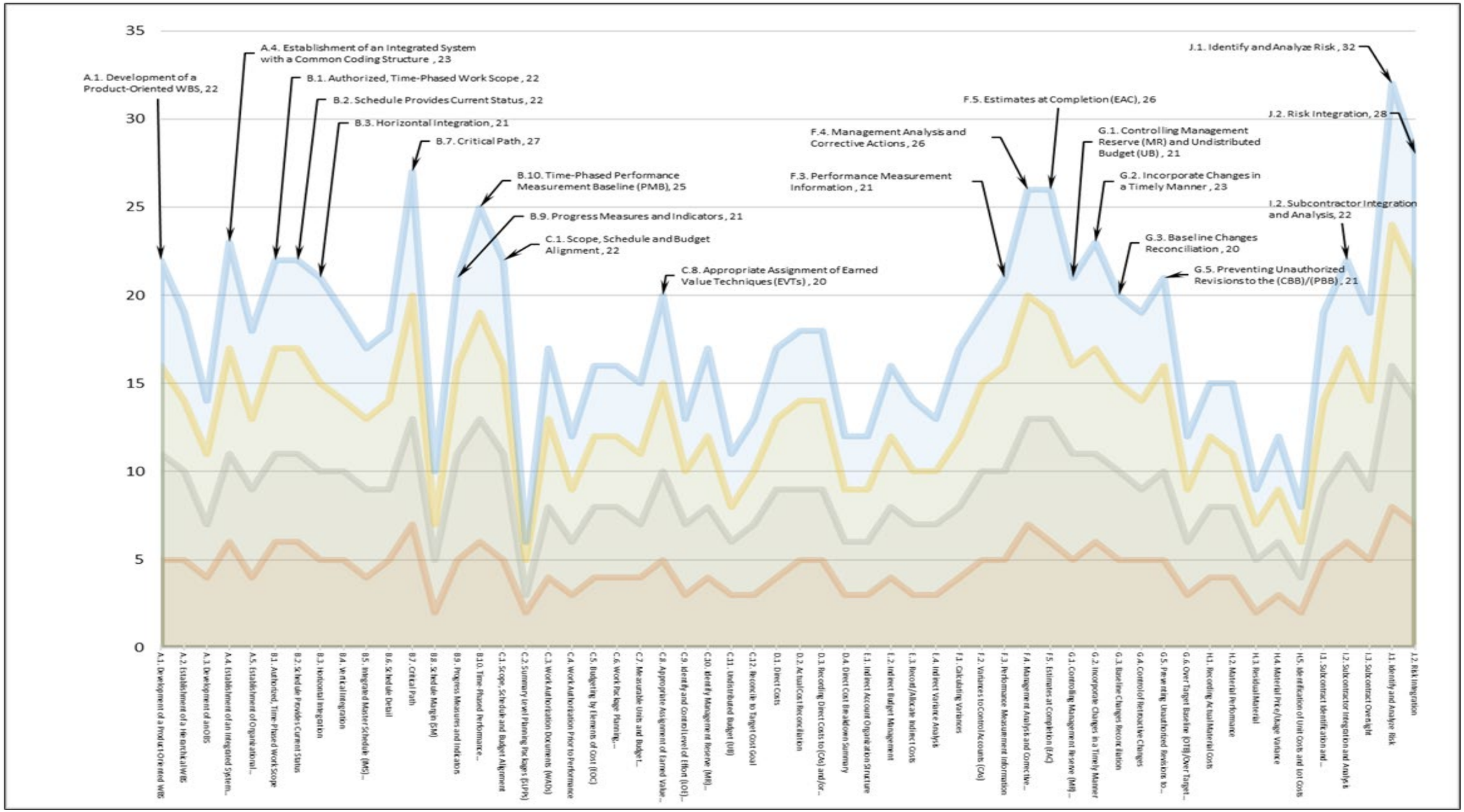


Figure 6. Weighting of 56 Attributes



3.4. EVMS Maturity Scoring Tables

Tables 5 through 60 show the criteria for evaluating attribute maturity levels, ranging from 1 (low) to 5 (high). As noted previously, each attribute is assessed on a 1-to-5 maturity scale: "1" means that work on this attribute has not yet started, and "5" means best in class. Attributes mature enough for an EIA-748–compliant EVMS receive a maturity level of "4" (highlighted in the tables). Those that are not yet mature receive scores of "2" or "3," depending on their levels of maturity as determined by the assessment.

Subprocess A. Organizing

The organizing subprocess ensures a structured approach is taken to establish a product-oriented WBS that furnishes the structure for management control. The primary objective of its five attributes is to establish the basic framework for defining and organizing authorized work scope, identifying the functional organization to establish the organizational breakdown structure (OBS) that serves as the structure for identifying authorities and responsibilities for accomplishing work, creating an integrated and interconnected EVMS to effectively plan and manage all work efforts, and establishing CAs as the primary management control points.

A structured approach for decomposing the project work scope into manageable product-oriented segments creates the WBS, in which each element contains a specific scope of work. Each element is defined in the WBS dictionary (or similar) and includes a description of the technical scope. [10] The OBS identifies the responsibility, accountability, and authority for completing the project. It identifies the organizations and managers in the corporate structure having responsibility for work scope accomplishment, including interdivisional and subcontracted work.

The organizing subprocess requires the use of an integrated EVMS to execute the project. Management subsystems integrate such that the data derived from one system is relatable to and consistent with the data of each of the other systems. This integration promotes establishing the PMB and identifying work progress, collecting actual costs, facilitating management analysis, and implementing corrective actions. The proper integration of management subsystems ensures the performance data retrieved from the EVMS are traceable and reconciled.

The assignment of organizational responsibilities to specific WBS elements for work scope management establishes the CA. The CA is the primary management control point for planning, budgeting, authorizing, accumulating costs, and deriving performance measurements. The WBS level at which a CA is established is a function of the project size and type of product. The number of levels of the WBS is determined by management needs, project risk and complexity, and similar factors. CAs do not have to be established at the same levels within the WBS because each product branch is subdivided as far as needed to enable adequate management, insight, and control. Through the creation of a CA, the PM identifies who in the organization is given authority and responsibility to facilitate the allocation of resources to accomplish work.

[10] For the remainder of this appendix, we use the term *WBS dictionary* to encompass any similar documents that detail the scope in each WBS element, at least to the CA level, in terms of the content of the work to be performed.

CAMs are ultimately responsible for work within schedule and budget targets. They also are responsible for planning the resources necessary to accomplish that scope of work. In some cases, particularly in a construction environment, other functional organizations (such as Engineering and Planning and Controls) may assume a more active role in the planning and management of resources in support of CAM responsibilities. In this scenario, effective internal bilateral communication between the CAMs and functional organizations is essential to ensure the CAMs accomplish their work efforts.

The organizing subprocess considers the following key attributes:

- **A.1.** A single, product-oriented WBS encompasses all authorized work and is decomposed to the appropriate levels for effective management and reporting.
- **A.2.** A hierarchical and incremental decomposition of the WBS (tree structure) shows the subdivision of authorized work required to achieve project objectives.
- **A.3.** An OBS encompasses all authorized work decomposed to the appropriate organizational levels.
- **A.4.** Integration of management control systems uses a common coding structure.
- **A.5.** A natural management point (CA) is designated for planning and control of authorized work assigned to one responsible organizational element (or integrated product teams) for a single WBS element.

As shown in Figure 5, the organizing subprocess considers five management attributes that collectively account for 96 (or 9.6%) of the 1,000 possible points of the maturity model. Of these, A.4 is the highest weighted management attribute (Figure 6).

A.1. Product-Oriented Work Breakdown Structure (WBS)

A product-oriented WBS (Table 5) sets the framework for technical scope, schedule, and budget planning and control throughout the project life cycle. Most important in organizing any project is establishing all the work parameters required to accomplish it. This attribute requires setting these parameters through a product-oriented WBS. When completed, the WBS serves as a framework for extensive management and control purposes. It breaks down all authorized work into appropriate scope elements and is the beginning point for planning, assigning work to responsible organizations, scheduling, budgeting, accumulating costs, analyzing performance, and revising. Also, the WBS provides a framework for data collection and reporting. It extends to the CA level and lower, such as WPs or planning packages (PPs) as necessary for management control. This singular WBS—a product structure, not an organizational one—displays and defines the products to be developed.

The WBS decomposes the work necessary to complete all authorized project scope, including any revisions from authorized changes and modifications. Arranged in a hierarchy, it uses nouns and adjectives to define work. It is constructed to enable clear and logical groupings, either by activities or deliverables. The WBS represents all the work identified in the approved SOW (or equivalent document) and maps to the authorization documentation. Projects typically develop a WBS as a precursor to the PMB. The WBS is accompanied by a WBS dictionary, as required, which lists and defines WBS scope elements.

Table 5. Attribute A.1. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**A singular, high-level product-oriented WBS is established. The WBS does not decompose to capture all work requirements.**	**Processes to require a singular, product-oriented WBS are established. The WBS is traceable and decomposed to the appropriate levels for effective project management. The WBS includes most of the authorized work scope and requirements.**	**Processes requiring a singular, product-oriented WBS are established and approved. The WBS is traceable, encompassing all authorized work, and decomposed to the appropriate levels for effective project management and external reporting. The required WBS is annually validated through internal checks per approved processes.**	**The singular product-oriented WBS is reviewed, revised, and validated annually (or more frequently as needed) with revision history, per approved processes, through in-process internal checks.**
	The process to establish a singular, product-oriented WBS has started but is not documented. The hierarchical WBS is not fully traceable to the SOW and is missing the SOW scope. The WBS is functionally oriented and lacks product orientation. Products often do not fulfill project requirements.	The process to establish a singular, product-oriented WBS that accurately reflects the products, services, and deliverables required to complete the project has been developed. No internal checks are in place to validate that the WBS meets requirements. Most products fulfill project requirements. The WBS hierarchy initially is product-oriented, but when extended to lower levels, the WBS becomes functionally oriented in an organizational or functional orientation. The WBS is coordinated with the planning and scheduling, budgeting and work authorization, change control, accounting consideration, and analysis and management reporting subprocesses.	(A.1.1) The process to establish a singular, product-oriented WBS that accurately reflects the products, services, and deliverables required to complete the project has been developed, documented, and approved. (A.1.2) Internal checks are in place to validate that the WBS meets project requirements. These checks may be outside the WBS process flow. The project ensures that the WBS is verified as product-oriented, and corrections are performed as required during project start-up. Products fulfill all project requirements. If required, WBS descriptive documents, such as a WBS dictionary, index, or similar, have been developed. (A.1.3) The WBS is integrated with the planning and scheduling, budgeting and work authorization, change control, accounting considerations, and analysis and management reporting subprocesses.	The WBS is optimized to streamline the management of the project. Internal checks are in place to validate that the WBS meets project requirements within the WBS process flow. Automated testing ensures that the established WBS is a product-oriented hierarchical decomposition of hardware, software, and services. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of the WBS are fully disclosed to all key stakeholders, who maximize their use. The WBS is continuously improved and optimized.

In developing a WBS, the project team defines the work elements to

- plan the project logically to completion,
- collect the information about work that needs to be done for a project,
- organize activities into manageable components that achieve project objectives,
- facilitate data collection and traceability, and
- establish a control framework for integrated project management.

The WBS integrates with other subprocesses: planning and scheduling, budgeting and work authorization, change control, accounting considerations, and analysis and management reporting.

Objective

This attribute develops a single, product-oriented WBS and WBS dictionary that adequately defines the product. In a mature, high-performing environment, defining work scope is an essential first step in the success of any project. It ensures products and all other project

requirements are clear and well defined. The WBS and WBS dictionary help identify and describe work scope to the lowest levels of the WBS. Because the WBS is used throughout the project life cycle to identify, assign, and track work scope through accomplishment, it is rigorously maintained through a formal change control process. With each proposed contract change to the baseline the contractor includes a markup to the WBS dictionary reflecting any impacts to the WBS with the proposed change. The WBS dictionary includes a definition of the work scope and the deliverables. If aspects of the element are important or unique to particular phases of the project, these are referenced. The WBS dictionary also provides a reference to safety, quality, and technical definition documents.

In summary, the EVMS includes an approved, documented process that requires the development of a single, product-oriented WBS. The WBS is traceable, encompassing all authorized work scope, and decomposed to the appropriate levels for effective project management and external reporting. The WBS is validated through internal checks per the approved processes at least annually. Reporting in the integrated project management report (IPMR) or contract performance report (CPR) Format 1 normally covers WBS level three, but lower levels may be specified for high-cost or -risk items. The government and the contractor periodically review and adjust WBS reporting levels to ensure they continue to render appropriate visibility without requiring excessive information.

Effectiveness Criteria

A.1.1. *The process to establish a singular, product-oriented WBS that accurately defines the products, services, and deliverables required to complete the project has been developed, documented, and approved.*

A.1.2. *Internal checks are in place to validate that the WBS meets project requirements. Checks may be outside the WBS flow. The project ensures the WBS is verified as product-oriented and corrected as required during project start-up. Products fulfill all project requirements.*

A key aspect of this attribute is that a single, product-oriented WBS has been extended—at least to the CA level—to plan, budget, and control the authorized scope of work. The WBS is extended to the levels needed for effective management control. Because WPs have to contain scope, they may extend to the WP level. These levels enable the definition of the work in manageable segments that a project can understand as each level of the WBS provides further definition and detail. The entire budget value of the work sums to the contract budget base/project budget base (CBB/PBB) value. CA and WP/PP plans and budgets extend to the lowest level of the WBS to ensure the work scope and the deliverables are identified and well defined. The WBS level at which a CA is established is a function of the size of the project and the type of product developed. CAs do not have to be established at the same levels in the WBS because each product branch is subdivided as far as needed to enable adequate management, insight, and control. The scope and the product-oriented nature are documented in the WBS dictionary. With each proposed contract change to the baseline the contractor includes a markup to the WBS dictionary reflecting any impacts to the WBS with the proposed change.

A.1.3. *The WBS is integrated with the planning and scheduling, budgeting and work authorization, change control, accounting considerations, and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

Without a single WBS that contains all work, the project cannot be properly executed. Failure to include all authorized project work and any revisions resulting from authorized contract changes in the WBS could result in the omission of required work or performance of unauthorized work.

Special Considerations

As shown in Table 5, A.1 focuses on establishing the type (a product-oriented WBS), whereas A.2 requires the WBS to be integrated (designed to effectively manage the product). Both are required to include all authorized scope intended to meet all project requirements. The contractor requirements document (CRD) or SOW sets forth the requirements of DOE O 413.3B as part of the contract.

A.2. Work Breakdown Structure (WBS) Hierarchy

The WBS scope is arranged in clear and logical groupings and includes all authorized project life-cycle work efforts, regardless of the entity (prime contractor or subcontractor) performing the work (Table 6). The WBS is decomposed from a high-level "structure or building" into subsections and components to form a logical hierarchy. The vertical integration (or traceability) between the WBS hierarchy and entire work scope is clear.

Table 6. Attribute A.2. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Little vertical integration exists between the WBS hierarchy and authorized work scope.**	**Vertical integration exists between the WBS hierarchy and authorizedwork scope, with only minor gaps or errors.**	**Complete vertical integrationexists between the WBS hierarchy and authorized work scope.**	**Vertical integration between the WBS hierarchy and authorized work scope reflects all authorized changes withina reporting period of the change.**
	The process to maintain a logically grouped WBS has started, with hierarchical integration of all authorized scope that accurately reflects the products, services, and deliverables required to complete the program. Many of the WBS elements are missing from external reports. There is little logical grouping of the program scope and how it is arranged in the WBS. Products sometimes meet the project requirements.	Most of the process to develop and maintain a logically grouped WBS has been defined, limited items are open. The process includes hierarchical integration of all authorized scope that accurately reflects the products, services, and deliverables required to complete the program. There is a consistent logical grouping of the program scope and how it is arranged in the WBS. Products mostly meet the project requirements. The WBS hierarchy is coordinated with the analysis and management reporting, accounting considerations, and subcontract management subprocesses.	(A.2.1) The process to develop and maintain a logically grouped WBS has been defined, documented, and approved. (A.2.2) The logic is consistent, and groupings of work scope are arranged with vertical integration throughout the WBS hierarchy. Any issues are minor and not repetitive, and can be quickly and easily corrected. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (A.2.3) WBS descriptive documents such as a WBS dictionary, index, or similar have been developed. (A.2.4) Products meet all project requirements. (A.2.5) The WBS hierarchy is integrated with the analysis and management reporting, accounting considerations, and subcontract management subprocesses.	All authorized WBS elements and groupings are consistent and have clear vertical integration that is 100 percent traceable. They reflect any contractual changes, and this process is repeatable from month to month, including changes and additions to the WBS. WBS elements are specified for external reporting and are traceable to the authorized work scope. The WBS hierarchy is monitored, used for management control, and automatically tested to assess system health and integrity. Necessary corrective actions are implemented and completed, and recurring issues are resolved. Routine surveillance results of the WBS hierarchy are fully disclosed to all key stakeholders, who maximize their use. The WBS hierarchy is continuously improved and optimized.

The WBS hierarchy is a numerical, graphic representation that completely defines a project by relating elements of work in that project to each other and the end product. Descending levels of

the WBS feature elements of greater detail and definition. The number of WBS levels depends on the size and complexity of the project. Early in the project planning process, a WBS hierarchy is established that best describes the product in the way it will be developed and managed. All elements of the WBS hierarchy are defined in an accompanying WBS dictionary. As levels are added to the WBS hierarchy to reflect contract changes, the structure is monitored and maintained to ensure that it remains arranged in clear and logical groupings reflecting the final product.

The WBS hierarchy is integrated with the analysis and management reporting, accounting considerations, and subcontract management subprocesses (Section 3.2).

Objective

This attribute breaks down work scope into smaller components. In a mature, high-performing environment, the WBS is a hierarchical and incremental decomposition of the finished product into segments, deliverables, CAs, WPs, and PPs. It ensures that the product work scope is clearly identified and well defined. The WBS and WBS dictionary detail information on each CA, WP, and PP to the lowest levels of the WBS hierarchy.

Because the WBS is used as a tool for managing work scope requirements throughout the project life cycle, the WBS hierarchy is completely vertically integrated with (or traceable to) all authorized work scopes. (Requirements traceability is the ability to trace product elements and components back to customer requirements and deliverables using the WBS hierarchy.) Product work scope is tracked in all subprocesses from its definition using the WBS hierarchy, to planning and budgeting, to the procurement of raw materials and parts, to fabrication, assembly, and installation to ensure that it can be traced.

Effectiveness Criteria

A.2.1. *The process to develop and maintain a logically grouped WBS has been defined, documented, and approved.*

A.2.2. *The logic is consistent, and groupings of work scope are arranged with vertical integration throughout the WBS hierarchy. Any issues are minor, not repetitive, and can be quickly and easily corrected. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The WBS dictionary details each component in the WBS hierarchy to enable clear and logical groupings. The WBS and associated WBS dictionary represent the complete scope of work identified in the approved project execution plan (PEP) or other scope definition document such as the conceptual design report (CDR). Although other performing entities (outside the project) may or may not have direct contractual requirements, they are nonetheless responsible for acknowledging their association with the project for specified WBS elements. This is typically done through a written memorandum of agreement or similar. This work content is subdivided to an appropriate level of detail for project planning, control, and reporting. The resulting work elements are identified and included in the WBS under the correct hierarchical branches. The project team manually checks the PEP (or other scope definition documentation) to verify products and deliverables are readily identifiable to the appropriate WBS hierarchy and associated WBS dictionary.

Figure 7 shows a WBS example consistent with the standard DOE classification for building elements and related site work. Buildings can include office spaces, factories, laboratories, processing plants, towers, pads, and other structures. The WBS hierarchy can be viewed as either an individual system or a group of buildings (complex), including building structure and utilities, equipment in the facility related to its primary mission, support equipment, furniture, and fixtures.

A.2.3. *WBS descriptive documents—such as a WBS dictionary or index—have been developed.*

The WBS hierarchy and associated WBS dictionary are compared to assess whether the full technical content of the WBS hierarchy aligns with the budgeted dollar values recorded in the planning and budgeting EVMS budgeting tool at the various levels. This alignment confirms that the WBS hierarchy 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 in the WBS because each product or deliverable branch in the WBS is only subdivided as far as needed to enable adequate management, insight, and control. The selection of the appropriate WBS level within the WBS hierarchy for establishing the CA considers the span of control and level of detail needed for managing cost and schedule performance. This is coordinated with attribute A.1, which requires the WBS dictionary for scope, but this attribute focuses on the WBS hierarchy, also a requirement of the dictionary.

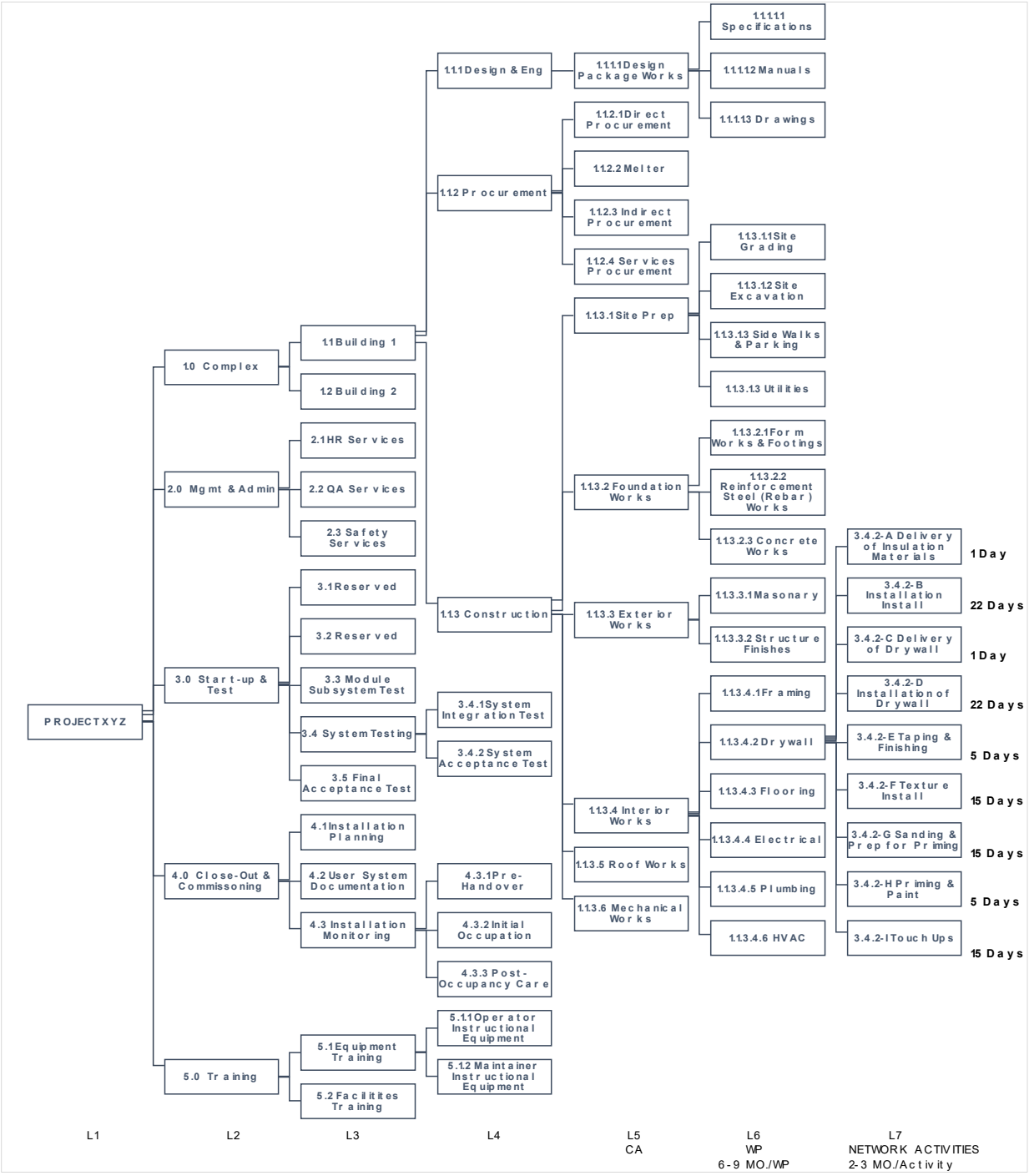
The WBS dictionary describes each WBS element at all levels, from the total project to the WP. Each WBS references the applicable OBS, completion criteria, and key risks and opportunities that apply at the CA level or lower.

A.2.4. *Products meet all project requirements.*

The complete and proper identification of all contractually authorized work using the WBS hierarchy gives the project full accounting for the work scope. This includes the identification of the work scope to be performed by subcontractors and any revisions resulting from contract changes and modifications. The WBS hierarchy captures all project requirements, deliverables, and end products. The WBS hierarchy is used to prevent the performance of out-of-scope work by identifying differences with the work authorization process. This can be done by comparing the contents of the WBS hierarchy and associated WBS dictionary with that of the work authorization process, typically the work authorization document (WAD). Projects use the WBS hierarchy to assess whether the definition of the product accounts for any critical subcontracted work. By comparing the IMS (or project schedule) with the IPMR/CPR Format 1 and other documents at lower WBS hierarchy levels, a project can identify the work scope for each major subcontractor and vendor.

A.2.5. *The WBS hierarchy is integrated with the analysis and management reporting, accounting considerations, and subcontract management subprocesses (Section 3.2).*

Figure 7. Partial Product-Oriented WBS



Impact of Ineffectiveness

Failure to connect all project work scope with the WBS hierarchy typically results in the omission of required work efforts or key procurements, or the performance of unauthorized work. Without a WBS hierarchy that contains all authorized work scope, the project cannot be properly planned, managed, and executed. The failure to include work scope resulting from

contract modifications in the WBS hierarchy and associated WBS dictionary often leads to this undesirable situation.

Special Considerations

The authorized work scope is defined in the project's approved PEP or other related work scope definition document (such as the CRD). The "vertical integration" used in attribute A.2 can be confused with that in attribute B.4, which addresses vertical integration from the schedule perspective. Attribute A.2 addresses vertical integration from the WBS hierarchy perspective, including all authorized work scope. This ensures all authorized scope is consistent with the WBS. This greatly differs from the vertical integration of alignment and consistency of data through all levels of the schedule. Attribute B.4 ensures detailed schedules are consistent with summary level schedules. "Extended consistently" is a better term for this attribute than "vertically integrated."

A.3. Organizational Breakdown Structure (OBS)

The established project organization structure identifies functional organization authorities and responsibilities for accomplishing all work scope, including interdivisional and subcontracted work efforts (Table 7). Once work has been adequately defined by the WBS, an important next step in the organizing subprocess is assigning responsibility for accomplishing that work using a single OBS. This attribute not only requires the assignment of organizational responsibility but also serves to ensure managers review the resource availability of the assigned organizations to identify the availability of qualified personnel to accomplish the work. An organization structure (or OBS) is composed to identify specific resource skills for accomplishing the work. The WBS represents "what" work will be accomplished, and the OBS represents "who" will accomplish (plan, manage, and monitor) the work.

Table 7. Attribute A.3. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**The OBS development process may not require the inclusion of all major subcontractors and other organizations responsible for authorized work. An OBS is established, but not all structure is traceable to all authorized work. The OBS excludes some functions or major subcontractors.**	**Processes require a single OBS to be established, traceable, and encompassing the authorized work. The OBS is decomposed to the appropriate organizational levels, including all major subcontractors, with some gaps.**	**The process to develop and maintain a single OBS is in place and has been approved. The OBS is traceable and encompasses all authorized work. It is decomposed to the appropriate organizational levels for effective project management. The OBS is validated annually at a minimum.**	**The single OBS is established and can accommodate changes in a timely manner. The OBS is validated monthly through in-process internal checks.**
	The process to develop and maintain an OBS that accurately reflects organizational elements required to complete the project has started but may not be documented. Products sometimes meet project requirements.	Most of the process to develop and maintain an OBS that accurately reflects organizational elements required to complete the project has been defined; some items are open. The OBS routinely contains only a few minor issues that are easily corrected and not repetitive. Products meet most project requirements. The OBS is coordinated with the analysis and management reporting and subcontract management subprocesses.	(A.3.1) The process to develop and maintain an OBS is defined, documented, reviewed, and approved. (A.3.2) The OBS is decomposed to the appropriate organizational levels, including all major subcontractors. The required OBS is routinely validated through internal checks per approved processes. (A.3.3) Products meet all project requirements. (A.3.4) The OBS is integrated with the analysis and management reporting and subcontract management subprocesses.	The approved OBS is decomposed to the appropriate organizational levels, tying authorized scope to organizations involved in the project. A new scope is authorized, and the OBS is updated as applicable. OBS data are monitored, used for management control, and are automatically tested to assess errors and integrity. Necessary corrective actions are implemented and completed, and recurring issues are resolved. Routine surveillance results of the OBS are fully disclosed to all key stakeholders, who maximize their use. The OBS is continuously improved and optimized.

A single OBS is used to identify the specific project organization structure elements responsible for accomplishing all authorized work scope. It identifies the project-specific management hierarchy, which may not equate to the functional management and supervision roles on stakeholder organization charts. Organization elements include work teams, functions, or other units used for the execution of project work efforts. These work efforts are identified to the appropriate interdivisional unit and subcontractor.

The OBS is integrated with the analysis and management reporting and subcontract management subprocesses (Section 3.2).

Objective

Good management mandates the establishment of authorities and responsibilities within the organization's structure. In a mature, high-performing environment, the OBS provides a clear and definitive assignment of organizational responsibility to a single-point manager who can be held accountable for the accomplishment of that work. This is especially important at the CA level. The control account manager needs to 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. Although the CAM may not "own" the resources, an agreement is established giving the CAM authority to direct the resources. Wherever resources or technical capacity is not sufficient to

complete work, the project chooses between the options of hiring additional personnel or obtaining interdivisional or subcontracted support as a means of increasing capacity. The necessity to identify authorities and responsibilities for specific work efforts cannot be overstated. The establishment of credible work plans and implementation of timely and effective corrective actions (when necessary) can only result from the clear and formal assignment of authorities and responsibilities within the organization's structure.

Because good management mandates the establishment of authorities and responsibilities within an established organization structure, a documented process to develop and maintain a single OBS is required to be in place and approved. The OBS is traceable to EVMS artifacts, including the WBS dictionary encompassing all authorized project work scope. It is decomposed to the appropriate organization levels for the execution of effective project management. The OBS is validated through internal checks per the approved processes (at a minimum) annually. As noted, the WBS represents "what" work will be accomplished and the OBS represents "who" will accomplish (manage or perform) the effort.

Effectiveness Criteria

A.3.1. *The process to develop and maintain an OBS is defined, documented, reviewed, and approved.*

A.3.2. *The OBS is decomposed to the appropriate organizational levels, including all major subcontractors. The required OBS is routinely validated through internal checks per approved processes.*

The organizational structure to execute the project determines how the roles, authorities, and responsibilities are assigned and how the information flows between the different levels of the structure. The type of structure used depends largely 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 to the departments and divisions, giving them a certain degree of independence. For example, the CAM may be a direct report to the PM, or there may be intermediate-level functional managers who report to the PM as part of a multi-tiered structure. The OBS identifies the resources in the organizational structure that are responsible for accomplishing the complete scope of work, including departments, divisions, units, teams, and major subcontractors that have EVMS flow-down requirements. When designating the organizations responsible for managing the work, the contractor assigns resources with sufficient authority and responsibility to execute the scope, schedule and budget objectives. The control account manager needs to 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. Before CAM assignment is made, his/her technical background, experience, and the time needed to comply with the many responsibilities of the contractor's EVMS are taken into consideration by the project manager. Each month, the OBS is reviewed for currency and adjusted as necessary. When a contractor does not develop a graphical or tabular representation of the project organization, the contractor, at a minimum, institutes an organizational coding structure that provides the hierarchical relationships of the various organizational levels. These are consistent with internal/external summary management analysis and reporting levels, including the IPMR/CPR Format 2.

A.3.3. *Products meet all project requirements.*

Many contractors have an OBS that is either functionally aligned, product aligned, or a combination of both. Regardless of the structure used, the OBS reflects the contractor's organizational structure that is responsible for accomplishing the complete scope of work.

A.3.4. *The OBS is integrated with the analysis and management reporting and subcontract management subprocesses (Section 3.2).*

Impact of Ineffectiveness

If the identification of organizational responsibility is done improperly or insufficiently, it almost always results in poor communications and leads to doing something unintended that could jeopardize the project.

Special Considerations

DOE clarified that a major subcontractor is any subcontracting with EVMS flow-down requirements.

A.4. Integrated System with Common Structures

A fundamental tenet of the EVMS is that the organizing, planning, scheduling, budgeting, work authorization, and cost accumulation systems are integrated with each other (Table 8). At the appropriate WBS level, there is traceability for all work scope through the various management control subsystems. At the forefront of integration, traceability is demonstrated from the assignment of authorized work scope to the WBS element where the work is formally identified and defined. The assignment of resources to complete the authorized work scope is traceable to the OBS where the chain of command is identified. This integration occurs via common data elements and a common coding structure through the WBS and the OBS and ensures the availability of project data and information needed to support all levels of management insight and control. Through alphanumeric work scope designations, subsystem data and information are collected and flowed through the various levels of the WBS and the OBS to the point of summarization and reporting. The intent is to build a framework that integrates management processes to support effective management of the project by accurately integrating schedule, budget, and technical information. Interoperability is an important characteristic of the EVMS to work between and among processes and subsystems. The data or narrative from one process or subsystem are consistent with the data or narrative in other related processes or subsystems.

Table 8. Attribute A.4. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**Integration among planning, scheduling, budgeting, and work authorization elements is lacking. A common coding structure is not in place.**	**Integration of the planning, scheduling, budgeting, and work authorization elements, and a common coding structure throughout the project documentation and reports are mostly in place. Some issues, that are not easily corrected, still exist, but they have minimal impact on the project.**	**Integration of the planning, scheduling, budgeting, and work authorization elements, and a common coding structure throughout the project documentation and reports, are in place.**	**Integration is in place. Internal processes are in place to validate the integration of the structures and data flows and verify accuracy. Changes are readily accommodated to the integrated systems with no impact on the project data integrity.**
	The process to integrate systems has started. A number of significant issues still exist. The WBS or OBS structures are not integrated. WBS and OBS elements are missing or not clearly defined. Little mapping has occurred among the planning, scheduling, budgeting, work authorization, and cost accumulation documents and systems. Key data are not aligned across subsystems.	The process to integrate systems has been defined. Common structures accurately reflect the products, services, and deliverables. A few open items remain. Most WBS and OBS elements are present and linked throughout project documentation and systems. Management reports are traceable to the planning, scheduling, budgeting, work authorization, and cost accumulation documents. There are minor gaps with a few traceability issues throughout the systems or elements that are not mapped to CA levels. Most key data are aligned across subsystems. The integrated system requirement is coordinated with the planning and scheduling, budgeting and work authorization, and accounting considerations subprocesses.	(A.4.1) All WBS and OBS elements are clearly defined and traceable through all project documentation and systems. All key data is aligned across subsystems. (A.4.2) All CAs map to one WBS and one OBS. Management reports are traceable to the planning, scheduling, budgeting, work authorization, and cost accumulation documents and representative systems. (A.4.3) Integration is rigorously monitored by management. Any issues are minor and easily correctable, having no impact on the project. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (A.4.4) The integrated system requirement is integrated with the planning and scheduling, budgeting and work authorization, and accounting considerations subprocesses.	The project is actively checking its WBS and OBS common coding structure for each CA for traceability and accuracy every month, with no errors in deliverables. System integration is monitored, used for management control, and automatically tested to assess system health and integrity. Necessary corrective actions are implemented and completed, and recurring issues are resolved. A storyboard (or like) approach is routinely used to validate data integration and consistency. Surveillance results of system integration are fully disclosed to all key stakeholders, who maximize their use. Manual data entry has been reduced; key data are automatically aligned across systems. System integration is continuously improved and optimized.

The integrated management control system is integrated with the planning and scheduling, budgeting and work authorization, and accounting considerations subprocesses.

Objective

The maturity objective of this attribute is to give projects reliable data and information that is consistent through the various management subprocesses and management subsystems. In a mature, high-performing environment, the integration of management subprocesses and management subsystems and the use of a common coding structure is in place and represented in project documentation and reports. The success of any project depends on the effectiveness of its managers.

Effectiveness Criteria

A.4.1. *All WBS and OBS elements are clearly defined and traceable through all project documentation and systems. All key data align across subsystems.*

The integration of documented processes and operating procedures enables consistent and relatable performance data across the enterprise management. This integration is obtained through the development and consistent use of a unique coding structure (work orders, job

orders, activity code charge number structure, etc.) that facilitates the linkage among and between management subprocesses and management subsystems. 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 support the transfer of data and enable the performance data derived from one management subprocess and management subsystem to relate to, and be consistent with, the performance data of other management subprocesses and management subsystems. These data simultaneously flow through the WBS and the OBS to the reporting levels and the total contract level where actual work scope management and control occurs, and where performance measurement is determined. For example, if a discrete WP is "behind schedule" in the IMS it reflects a "behind schedule" status in the EVMS budgeting tool. Also, date reconciliation between the baseline IMS, the forecast IMS, and the EVMS budgeting tool is also a primary consideration of the requirement for integration. Baseline and forecast dates in the IMS reconcile within the same accounting month of the resources in the EVMS budgeting tool. The budget values used in the work authorization documents are consistent with the budget at complete (BAC) and PMB budget values reported in the EVMS budgeting tool.

A.4.2. *All CAs map to one WBS and one OBS. Management reports are traceable to the planning, scheduling, budgeting, work authorization, and cost accumulation documents and representative systems.*

The use of a common coding structure ensures that integrated data and information are linked (mapped) to the levels where the WBS and OBS intersect. Through alphanumeric work scope designations, performance data and information are traceable through the various management subprocesses. As defined in attribute A.5, the CA is required to have one and only one WBS element and OBS element assigned to ensure this integration.

A.4.3. *Integration is rigorously monitored by management. Any issues are minor and easily correctable with no impact on the project. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

Monitoring is the systematic process of collecting, analyzing, and using the information to track a project's progress toward reaching its objectives and to guide management decisions. Monitoring usually focuses on processes, such as when and where activities occur, who delivers them, and how many people or entities they reach. However, monitoring output may indicate problems with the management subprocesses that need to be addressed.

A.4.4. *The integrated system requirement is integrated with the planning and scheduling, budgeting and work authorization, and accounting considerations subprocesses (Section 3.2).*

Impact of Ineffectiveness

Fragmented and misaligned management subprocesses and management subsystems that produce incomplete, inaccurate, and unreliable data can weaken project management's ability to effectively use core management processes. When integration of the scope, schedule, cost, or technical data or narrative from one management subprocess and management subsystem is inconsistent with the data or narrative in other management subprocesses and management subsystems, it calls into question the usefulness of the EVMS for effective management and decision-making.

Special Considerations

There is a strong correlation between this attribute and the other subprocesses. Integration is critical to the entire EVMS process.

A.5. Control Account (CA) to Organizational Element

The integration of the WBS and OBS enables the identification of who is responsible for which parts of the project work scope (Table 9). Projects identify key management control points called CAs where the WBS and OBS intersect. CAs are established at various levels of the WBS where work scope, schedule, and budget are defined and integrated. At a minimum, the CA is the point where work performance is analyzed and compared with actual costs, where variance is analyzed, and where corrective action is initiated. The person responsible for managing the CA is the CAM. Each CA is designated a single OBS element that is responsible for performing the work and identifiable to a single WBS element. Each CA is designated only one CAM. The CAM has full responsibility, accountability, and authority for performing the CA's work scope within schedule and budget parameters. CAs are established at the appropriate levels on the basis of the complexity of the work and the control and analysis needed to effectively manage.

Table 9. Attribute A.5. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Few CAs are designated to single organizational elements of the OBS and identifiable to single elements of the WBS. CAMs are assigned to a few CAs; they report information but are not technically responsible for the work being performed.**	**Most CAs are designated to single organizational elements of the OBS and identifiable to single elements of the WBS. CAMs are assigned to most CAs at the appropriate levels on the basis of complexity. For each CA, the CAM is responsible for the work and accountable for cost and schedule.**	**All CAs are designated to single organizational elements of the OBS and identifiable to single elements of the WBS. CAMs are assigned to all CAs at the appropriate levels on the basis of complexity.**	**The size, risk, and complexity of each CA are optimized, leading to proactive and effective management and control of the CA. When CA or CAM changes are necessary, the organization can handle the changes with no impact on the project.**
	The process to designate CAs to WBS/OBS, accurately reflecting the products, services, and deliverables required to complete the project, has started. There is no clear OBS/WBS linkage to the CAs or CAMs.	The process to designate CAs to WBS/OBS, accurately reflecting the products, services, and deliverables required to complete the project, is in place with open items. Most CAs are mapped to the WBS and OBS, but some are associated with more than one element or are not mapped. CAMs are assigned but not all consider the accountability and responsibility for the scope of work to be performed. CAs could be broken out to more appropriate levels. The CA and CAM assignments are coordinated with the budgeting and work authorization, analysis and management reporting, and change control subprocesses.	(A.5.1) The process to designate CAs to WBS/OBS is approved and accurately reflects the products, services, and deliverables required to complete the project. (A.5.2) The process is monitored and updated as needed. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (A.5.3) All CAs are clearly aligned with a single WBS and OBS, with appropriate documentation (such as a RAM). (A.5.4) The CA and CAM assignments are integrated with the budgeting and work authorization, analysis and management reporting, and change control subprocesses.	Assignments are monitored periodically (monthly or more often). New CAs and CAMs can be added seamlessly. The project continues to validate and check for consistency and traceability between CAs and the WBS/OBS. CA and CAM assignments are monitored, used for management control, and automatically tested to assess system health and integrity. For example, the realism of forecasting over extended periods may indicate good versus poor CAM selection or span of control. Necessary corrective actions are implemented and completed, and recurring issues are resolved. Routine surveillance results of CA and CAM assignments are fully disclosed to all key stakeholders, who maximize their use. CA and CAM assignments are continuously improved and optimized.

The establishment of CAs and CAM assignments are integrated with the budgeting and work authorization, analysis and management reporting, and change control subprocesses.

Objective

The maturity objective of this attribute is to ensure that the CA represents the level where the contractor's management organization can assign authority and responsibility for performance to individual managers. In a mature, high-performing environment, the responsibilities relate directly to the functional capability of the assigned manager. The CA is the identified focal point of control in the EVMS. CAs are scaled to reflect a manageable workload where the PM and CAM jointly track progress and performance. Further, the appropriate level of detail for the CA allows for "managing by exception" by focusing the attention of the PM and CAM on the things that matter. All CAs are identifiable to a single WBS element and designated to a single OBS element, and each CA is designated a single CAM at the appropriate WBS and OBS levels on the basis of the complexity of the work scope.

Effectiveness Criteria

A.5.1. *The process to designate CAs to WBS/OBS is approved and accurately reflects the products, services, and deliverables required to complete the project.*

A.5.2. *The process is monitored and updated as needed. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

Process monitoring is the activity of reviewing and analyzing the performance of processes to identify successes and problems. Monitoring is an integral part of the EVMS (or like management control system) implementation.

A.5.3. *All CAs are clearly aligned with a single WBS and OBS, with appropriate documentation (such as a RAM).*

Because the CA is a logical subdivision of a higher-level WBS element, it is required to be identifiable to only one WBS element. This ensures that scope, schedule, and budget performance data can be summarized directly through the WBS without subdivision or dual allocation. Each CA is designated a single OBS element that is responsible for performing the work and identifiable to a single WBS element. Only one CAM is assigned to the CA. Many projects construct a RAM with the OBS on one axis and the WBS element listed on the other axis as a documented aid to identify project roles and responsibilities (Figure 8). The RAM (or like document) becomes a cross-check to ensure singular responsibility for each CA. A CAM may be responsible for more than one CA.

As implemented, the CAM can demonstrate effective control of the CAs they are responsible to manage. If the CAM is in the same organization as the resources performing the work, the project organization chart may be adequate to demonstrate authority. The CAM is responsible for a majority of the resources (by org chart or supplemental agreement). In a traditional matrix organization support, agreements are required to ensure CAM authority. Delegated authority needs to include at least a 2-week notice as applicable for resource reassignments by the home organization.

A.5.4. *The CA and CAM assignments are integrated with the budgeting and work authorization, analysis and management reporting, and change control subprocesses.*

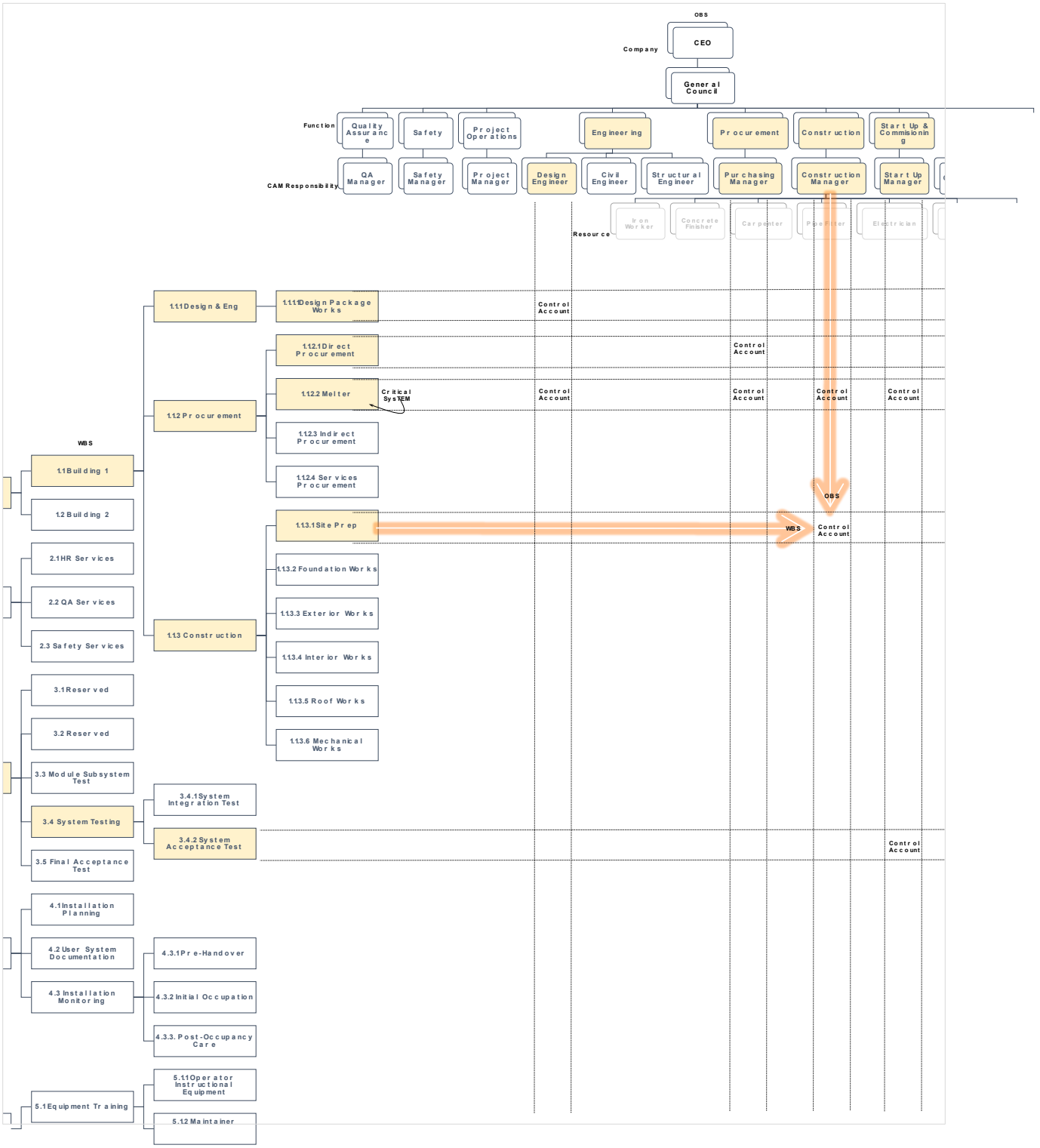
Impact of Ineffectiveness

Failure to establish the proper responsibility, authority, and accountability for the CA and prompt assignment of the CAM can adversely affect project performance. CAs established at inappropriate WBS levels could impede a CAM's ability to effectively manage the work scope, schedule, budget, and technical parameters of the project. Failure to define CAs properly can create an ineffective management approach, leading to schedule delays and increased costs. The assignment of more than one CAM for each CA indicates a lack of the appropriate managerial authority over the CA, resulting in operational inefficiencies and potential conflict in the control of resources and the accomplishment of work.

Special Considerations

None.

Figure 8. Intersecting WBS and OBS Identifying CAs (Partial)



Subprocess B. Planning and Scheduling

Scheduling the authorized work in a manner that describes the sequence of work—and identifies significant activity interdependencies required to execute the project—gives project management an integrated, networked, and time-phased plan and visibility into the detailed progress and accomplishment of the milestones and activities.

The IMS is an integrated, resource-loaded, time-based schedule containing the logical network of activities required to accomplish the project scope required for any EVMS contract or project as the project plan for the accomplishment of all project goals and deliverables. Both vertical integration (from detailed activities to top-level) and horizontal integration (across activities at the same level) are required. The schedule structure correlates with the information in the integrated master plan (IMP) or equivalent when the IMP is contractually required. The IMP is an event-based plan with sufficient definition to enable tracking progress toward the completion of a project. In general, the IMP is the top-down planning tool and the IMS as the bottom-up execution tool for those plans. For the IMS to produce meaningful results, the schedule represents all work required to perform the scope of the project, the activities have durations based on the scope and resources required to perform the work, and all logical relationships have assigned predecessors and successors to complete the integrity of the network of activities. Integral to establishing the PMB and critical in the success of any project is the use of the IMS that establishes and maintains a relationship between technical achievement and cost and schedule progress status. Given this capacity for accurate and meaningful analysis of work progress, the ability to forecast activity and milestone completion dates is enhanced. The schedule renders visibility into the accomplishment of the activities required for the execution of the contractual scope of work and is the basis for creating the PMB. The planning and scheduling subprocess includes the following 10 attributes:

- **B.1.** Authorized, Time-Phased Work Scope
- **B.2.** Schedule Provides Current Status
- **B.3.** Horizontal Integration
- **B.4.** Vertical Integration
- **B.5.** IMS Resources
- **B.6.** Schedule Detail
- **B.7.** Critical Path and Float
- **B.8.** Schedule Margin
- **B.9.** Progress Measures and Indicators
- **B.10.** Time-Phased PMB

The following characteristics define a well-maintained IMS:

- *Completeness.* The project schedule reflects the entire scope of work, including critical subcontract efforts.
- *Realism.* The project schedule accounts 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. The project schedule is properly updated and is current, and relevant.

- *Reasonableness.* The schedule specified for a project presents a feasible or reasonable plan for the sequence and duration of the work.

As shown in Figure 5, the planning and scheduling subprocess considers 10 management attributes that collectively account for 202 (or 20%) of the 1,000 possible points of the maturity model at level 5. Of these, B.7, Critical Path and Float, is the highest weighted management attribute as shown in Figure 6.

B.1. Authorized, Time-Phased Work Scope

The time-phasing of the authorized work scope is a key component of the IMS (Table 10). The IMS is a networked schedule containing all the detailed WPs and PPs or lower-level activities necessary to support the events, accomplishments, and criteria of the IMP or similar high-level planning document.

Table 10. Attribute B.1. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some time-phased work scope within the IMS has been identified.** **Some work scopes in the IMS are traceable by activity to the contract, PEP, SOW/SOO, IMP, WBS, or similar documents.**	**The time-phased work scope in the IMS is mostly defined, and most of the activities and work scope are traceable to the contract, WBS, PEP, SOW/ SOO, IMP, or similar documents.**	**(B.1.1) The IMS is fully defined, with a few minor exceptions, and all of the activities and authorized work scope are traceable to the contract, WBS, PEP, SOW/SOO, IMP, or similar documents**	**All items within the IMS are fully defined and traceable. The time-phased work scope in the IMS is monitored and automatically tested to assess system health and integrity.**
	Internal, subcontractor, and procurement work scope is not identified or discernible in the IMS.	Internal and subcontracted work scope has been identified. Most of the subcontractor and procurement work scope is separately identified and assigned to the appropriate WBS elements. The time-phased work scope is coordinated with the material management and subcontract management subprocesses.	(B.1.2) A defined and approved process and structure are in place to map and trace all activities to the contract, WBS, PEP, SOW/SOO, IMP, or similar documents. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (B.1.3) Internal and subcontracted or procurement work scope has been identified. (B.1.4) Subcontractors or procurements designated as HDV/CI are separately identified and assigned to the appropriate WBS elements. (B.1.5) Subcontractor and procurement work scope are integrated into the project's single IMS at a level to enable accurate reporting and performance measurement. (B.1.6) The time-phased work scope is integrated with the material management and subcontract management subprocesses.	A validation process exists to ensure that all discrete work scope (at a minimum) is authorized and integrated into the IMS. Necessary corrective actions are implemented and completed, and recurring issues are resolved. Routine surveillance results of IMS time-phased work scope traceability are fully disclosed to all key stakeholders, who maximize their use. The traceability of the time-phased work scope in the IMS is continuously improved and optimized.

The IMS reflects all authorized, time-phased work scope to be accomplished, including details for any significant subcontracted effort and high dollar value (HDV) materials/critical items (CI) that could affect the critical path of the IMS. All discrete work scope in the IMS is traceable to the WBS, PEP, and SOW/SOO. A realistic network schedule and time-phased scope are key factors in ensuring the success of the project.

The authorized, time-phased work scope is integrated with the material management and subcontract management subprocesses.

Objective

The maturity objective of this attribute is to define an integrated schedule traceable to all authorized work to facilitate the establishment of a valid PMB. This is accomplished through a fully networked and resource-loaded IMS, a foundational component of a valid PMB, which provides the ability to produce a critical and driving path that enables PMs to evaluate and implement actions designed to ultimately complete the project within contractual parameters.

Effectiveness Criteria

B.1.1. *The IMS is fully defined, with a few minor exceptions, and all the activities and authorized work scope are traceable to the contract, WBS, PEP, SOW/SOO and IMP, or similar documents.*

The entire authorized scope of work is considered in the IMS. Different documents may represent the scope of work contractually required on the project. The work scope may be found in a PEP, SOW, performance work statement (PWS), conceptual design report, or other ancillary documents depending on the practices of the DOE customer organization. The IMS contains all the detailed WPs and PPs (or lower-level activities) necessary to support the events, accomplishments, and criteria of the IMP when the IMP is contractually required. The IMS is directly traceable to the IMP and applicable documents and includes all the elements associated with development, production or modification, and delivery of the total product and project high-level plan. The IMP or equivalent is an event-based plan consisting of a hierarchy of project events with each event 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 contractor defines the following:

- *Key Events*. Typically, these are the DOE CD gates: CD-1, CD-2, CD-3, and CD-4.
- *Key accomplishments*. What are the key activities that prove the event is ready?
- *Key accomplishment criteria*. The proof that the accomplishment has been completed.

B.1.2. *A defined and approved process and structure is in place to map and trace all activities to the contract, WBS, PEP, SOW/SOO, IMP, or similar documents. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

B.1.3. *Internal and subcontract or procurement work scope has been identified.*

All significant subcontracted effort is segregated from internal work scope, separately identified and assigned to appropriate WBS elements, and detailed to the level needed for accurate

reporting and performance measurement. Staff augmentation-type subcontracts are excluded from this requirement.

B.1.4. *Subcontractors or procurements designated as HDV/CI are separately identified and assigned to the appropriate WBS elements.*

All the discretely measurable work scope, including subcontracted effort and procurements designated as HDV/CI, as well as LOE and apportioned activities, are separately identified and accounted for in the IMS. WP/PP for subcontractors or procurements designated as HDV/CI are unique so they can still be visible 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. The IMS ensures that the relationships between activities in WPs, PPs, and summary level planning packages (SLPPs) have been carefully considered and represent the way the project will be executed.

B.1.5. *Subcontractor and procurement work scope are integrated into the project's single IMS at a level to enable accurate reporting and performance measurement.*

Subcontracts are incorporated at a level necessary to support the calculation of a realistic critical path and float values. The level of subcontract integration is required to be at the same level as if the work were performed internally (generally at the detailed level). The subcontracted effort may be firm fixed-price; however, this does not affect how the subcontract is integrated in the IMS. Subcontractors are 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). Frequently, subcontractors represent a significant portion of the project. If this were the case, subcontractor schedules are an integral part of an IMS. The accuracy of these schedules is critical, and the CAM or manager responsible for oversight of the subcontractor reviews and approves these schedules. For these requirements, staff augmentation type subcontracts are planned consistent with labor and not as a subcontract in this section.

Projects are often planned using inputs from a very detailed management system to monitor and track all the items necessary—bill of material (BOM)—to build the final products.

B.1.6. *The time-phased work scope is integrated with the material management and subcontract management subprocesses (Section 3.2).*

Impact of Ineffectiveness

Noncompliance with this attribute can impede a PM'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 PMs as, 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, the work scope may not be tracked within the schedule and the critical path may be inaccurate and not useful as a management tool. Furthermore, if any work scope is not defined, time-phased, and contained in the IMS, the IMS may present inaccurate or incomplete information and cannot be relied upon to make programmatic decisions. This would prevent the program team from utilizing the schedule to determine the status of the project. 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 could result in the omission of required work or improper performance of unauthorized work.

Special Considerations

None.

B.2. Schedule Provides Current Status

The schedule provides the current status, including forecast start and completion dates consistent with the month-end status (data) date for all authorized work (Table 11). The schedule can be updated to report current progress against the baseline and to forecast the schedule status of incomplete activities through project completion. The schedule of the project follows a standardized business rhythm, including a standard "time now" or "data date" that status is reported against. There are no forecast dates before the "time now" date and no actual dates after the "time now" date. The IMS is updated at least as often as the external report is generated (the integrated program management report or other reports). It is time-synchronized per all stakeholder updates/status (vendors, subcontractors, and government activities). The IMS status cycle considers all organizational calendars, and a common status date is established for the integration of schedule data.

Table 11. Attribute B.2. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**The schedule is updated too infrequently to provide current status, or it is not capable of being updated to provide current status in alignment with accounting period information.**	**The schedule is updated to provide current status, mostly in alignment with accounting period information. However, only activities within the status window are updated.**	**The schedule is updated in alignment with the accounting calendar, consistently following an established business rhythm. Schedule forecasts are commensurate with the risk identified on the project.**	**The schedule is updated more frequently than monthly and reviewed in a timely and effective manner to reflect accurate progress of started, completed, and in-progress work and aligns with other earned value data, aiding in reporting and proactive decision-making.**
	Updates are not processed in a manner that ensures consistent reporting of actual progress. Updates to date and durations of activities not yet in progress rarely occur.	Status updates are primarily reserved only for those activities within the current execution window (actual starts, actual finishes, and percent complete). In addition to updates to all activities within the execution window, most activities are reviewed and updates to durations and forecast starts/finishes are made as necessary. A scheduling assessment is available to validate the current status. Schedule forecasting is coordinated with the risk management subprocess.	(B.2.1) The "time now" status date aligns with accounting period information and is updated monthly. (B.2.2) Schedule forecasts consider the schedule risk assessment (SRA). Activity duration estimates represent the most likely time the work should take. (B.2.3) Schedule updates are reviewed monthly with schedule stakeholders, and changes are effectively communicated to inform management decision-making. Schedule status is monitored and tested to assess system health and integrity. Problems are identified, logged, tracked, mitigated, corrected, and closed. (B.2.4) The schedule may be assessed more frequently than monthly, and results in the schedule providing current status and related data used in project planning, re-planning, and decision-making. (B.2.5) Schedule forecasting is integrated with the risk management subprocess.	The schedule is updated weekly during the accounting/reporting period. All activities are reviewed during each status cycle to ensure the accuracy of dates and durations. Full bottom-up revisions to durations and start/finish dates are performed as necessary. Schedule status is monitored and used for management control and is automatically tested to assess system health and integrity. Necessary corrective actions are implemented and completed, and recurring issues are resolved. Scheduling assessment produces accurate updates used to effectively manage the project. EVM and scheduling assessment practices and products/outputs are effectively integrated to produce real-time or near-real-time current project status and informed decision-making. Routine surveillance results of the schedule status are fully disclosed to all key stakeholders, who maximize their use. The schedule status process is continuously improved and optimized.

The WBS hierarchy is integrated with the risk management subprocess.

Objective

The schedule is updated in alignment with the accounting calendar, consistently following an established business rhythm. Schedule forecasts are commensurate with the risk identified on the project.

The schedule is updated in alignment with the accounting calendar to ensure the schedule status can be related to the financial performance as well. The maturity objective of this attribute is to ensure the IMS gives project management a comprehensive status of authorized work scope to enable the time tracking and communication of project performance. Recording the current status of the scheduled/authorized work facilitates forecasting of subsequent work as well as provides the ability to produce updated and accurate critical and driving paths. 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. Accurate status and forecasts enable project management to evaluate and implement actions designed to ultimately complete the project within contractual parameters. Schedule forecasts are commensurate with the risk identified on the project. An IMS enables project management to perform time-based analyses and SRAs, both of which are critical to the success of meeting project commitments. The SRA is defined as a requirement in attribute J.1.

Developing a baseline schedule, measuring performance against it, and estimating when remaining activities will start or finish are essential elements of good schedule management. Equally important is the meaningful analysis of project schedules that gives the project team a rational basis for decision-making to meet project objectives. Time-based schedule analysis is the process of assessing the magnitude, impact, and significance of actual and forecast variations in the baseline schedule 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 determining 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.

Effectiveness Criteria

B.2.1. *The "time now" status date aligns with accounting period information and is updated monthly.*

Statusing the schedule is done consistently following an established business rhythm and updated in alignment with the accounting calendar. 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. When the IMS is statused per 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 are no activities that have not been started before the data date, nor are there actual start or actual finish dates after the data date. In addition, activities are required not to be statused out of sequence on the basis of the status of their predecessors. For example, a predecessor is typically completed before a successor activity can start with an FS relationship. If the successor does start out of sequence, the relationship is overcome by events and is to be deleted in the status file and replaced with a meaningful

predecessor and successor for each activity. In a dynamic environment with constantly shifting circumstances, it is crucial to control changes or revisions that impact the baseline. Schedules are typically updated at the close of each monthly accounting period and are the responsibility of the CAM. The CAM controls 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 under the direction of the PM, typically with concurrence from the government. Schedule changes 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 the rationale provides management sufficient visibility when reviewing and approving the change. This topic is further discussed in the Change Control subprocess section of this appendix.

The baseline IMS is statused monthly but may not use the same data date as the forecast IMS. This is to ensure that the logic has been statused for all baseline changes for the month and that the longest path is logical. The forecast IMS is statused, at a minimum, at the conclusion of each accounting period.

B.2.2. *Schedule forecasts consider the SRA. Activity duration estimates represent the most likely time the work should take.*

The SRA is defined in risk management subprocess J.1. The point of this requirement is that the SRA and basis of estimate (BOE) are used to plan realistic durations for the activities in the baseline and forecast IMS. Total durations (remaining + actuals) are required never to be reduced to less than the expectations. Durations are to be reviewed in the future when negative status indicates that they may be too aggressive. Realistic durations ensure the reliability of the CD-4 estimate.

B.2.3. *Schedule updates are reviewed monthly with schedule stakeholders, and changes are effectively communicated to inform management decision-making. Schedule status is monitored and tested to assess system health and integrity. Problems are identified, logged, tracked, mitigated, corrected, and closed.*

After a project is baselined, resource and schedule information is routinely updated. To ensure the IMS is kept current, any authorized changes made on the project are documented in a disciplined and timely manner. Ensuring these changes are done consistently following the approved change procedure is crucial to the accuracy of the schedule and the critical and near driving paths. In addition to confirming changes to baseline start and finish dates, updates are made to an activity's remaining duration and relationships (i.e., logic links) with other activities when necessary. In addition to confirming the start and finish dates, updates are made to an activity's duration length and modifications to relationships (links) between activities when necessary. The impacts of these changes are 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 PM. PMs ensure the information reported is accurate and consistent with the status period. In addition to making decisions based on status, to validate the quality of the schedule, automated or manual internal checks are employed to monitor its health and integrity. The baseline and forecast schedules are closely related as the status schedule was first derived from the baseline schedule. CAMs forecast completion dates for work that has departed from the original plan to ensure that projected schedule slippages are surfaced for management action promptly. Project status is 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 becomes questionable. The forecast schedule becomes questionable if CAM status and forecasts to activities and milestones significantly change from month to month. For example, a predecessor typically is completed before a successor activity can start with an FS relationship. If the successor does start out of sequence, the relationship is overcome by events and is deleted in the status file and replaced with a meaningful predecessor and successor for each activity. Part of ensuring the IMS provides the current status is making sure the objective completion criteria are determined in advance and used to measure progress toward the determination of technical achievement. An activity is 0 percent complete when it has not yet begun, and it is 100 percent complete when it is finished. The contractor's scheduling system also indicates the remaining duration (time) the activity will consume for the determination of the expected completion of technical objectives.

Activities not already in the baseline schedule may be added to the forecast schedule under the above circumstances as either an estimate-to-complete (ETC) non-variance at completion (non-VAC) activity or ETC VAC activity. It is associated with and aligned with the work scope already in the PMB.

The two differ as follows:

- 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.
    - For example, because of a workaround, instead of two activities over the 3 months, the forecast re-spreads the effort to three activities over 4 months. Resources remain the same, so there is no cost impact; however, the duration has changed.
    - The contractor provides adequate justification where resources are not assigned to these additional activities.
    - The contractor ensures 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, such as an emergency effort, emerging work, or REA.
    - Additional costs are considered in the EAC.

In either situation, the existing IMS network is typically expanded (and calculated) to consider ETC activities. Also, the use of either activity type in the forecast schedule is limited and not a substitute for the absence of an adequate level of detail and fidelity in the baseline 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 for (the budgeted cost of work performed [BCWP]) and actual costs (actual cost of work performed [ACWP]), the month-end accounting period coincides with the schedule reporting period (schedule status date or data date). Completion criteria are to be very clear. An example of this is using activity names to describe completion criteria, such as, "complete soil compaction test number one".

B.2.4. *The schedule may be assessed more frequently than monthly, and results in the schedule providing current status and related data used in project planning, re-planning, and decision-making.*

While schedule status assessments are required monthly at a minimum to update the schedule in alignment with the contractor's accounting period, they may occur more frequently as is beneficial and needed by the contractor or its stakeholders. A dynamic, fast-moving project may need more frequent updates to ensure the schedule is up to date and performing to expectations.

Problems occur over the life of the project. Some require workaround planning. To maintain the forecast schedule, workaround plans are incorporated into the project forecast IMS and support the applicable WP and CA schedules (meaning they are to be associated with the effort causing the workaround). This includes rework and alternative sequencing. The activities and revised logic ties representing workaround plans are required to 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 linked back to the same CA and WP that the workaround 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). 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 (a BCR, for example), the CAM is still responsible for verifying the realism of the changes. The analysis explains changes to the 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 is discussed as applicable. Workaround or recovery plans and associated impacts caused by project changes are also provided. The schedule narrative addresses progress to date and discusses any significant schedule changes such as added/deleted WPs, PPs or activities, any significant logic revisions, and any/all changes in programmatic schedule assumptions. Finally, the analysis, if required, can forecast future potential delays or potential problems. This type of analysis is done as needed and provided to the customer and the project team to assist in the schedule risk management process. Activities associated with work as part of an 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 the Change Control subprocess section for baseline change details.

Occasionally, however, it may be necessary to add activities in the forecast schedule that are not reflected in the baseline schedule. These activities 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.

B.2.5. *Schedule forecasting is integrated with the risk management subprocess (Section 3.2).*

Impact of Ineffectiveness

If the schedule is not statused and updated at least monthly, it can hinder a PM's ability to communicate the project timeline necessary to accomplish the technical scope, evaluate progress, and provide reliable schedule forecasts for remaining work. If the monthly update is not performed in alignment with the accounting calendar, there is no way to determine how much the schedule may affect the overall costs of the project. 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 statused out of sequence, the schedule is not providing accurate or reliable information for decision-making. As work is completed and any risk or opportunities are realized, they can significantly affect the subsequent IMS activities leading to early or late finishes.

Avoiding delays is a top priority for contractor PMs—without exception, a poorly conceived project leads to crippling delays, consuming thousands of labor hours and millions of dollars:

- The lack of near-term detail planning creates a baseline schedule that does 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.
- Risk mitigation activities in the project schedule that do not align with the risk register mean that the risk management process has not been fully integrated into the IMS; thus, those risks may not be correctly quantified or effectively managed.
- 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 statused out of sequence, the schedule is not providing accurate or reliable information for decision-making.
- A baseline schedule without traceability to the original does not give management visibility into reasons for the change, nor the impact of the change, to understand how the original plan evolved into the current plan.

Special Considerations

None.

B.3. Horizontal Integration

The IMS is a network schedule that describes the sequence of work (horizontal integration) and identifies significant interdependencies that indicate the actual way the work is planned and accomplished in enough detail to support the project driving and critical paths development (Table 12). Horizontal integration refers to the logical relationships among tasks in the IMS, from the project start through the project end. All activities aside from the project start and finish milestones contain at least one predecessor and one successor. However, it is not enough to just ensure that every activity has a predecessor and successor. Schedules consider all horizontal interdependencies between and among CAs, WPs, PPs, activities, and supporting schedules (such as engineering, production, and subcontractor). 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.

Horizontal integration is integrated with the material management and subcontract management subprocesses.

Table 12. Attribute B.3. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**The IMS contains little or no horizontal integration, and logic dependencies are unclear or missing among activities.**	**The IMS contains most of the horizontal integration and logic dependencies among activities.**	**All activities are logically defined within the IMS. The flow of work is appropriate for the effective execution of work.**	**All activities are time- sequenced in the IMS on the basis of horizontal logic. There are no "target/fixed" dates imposed except for incoming external milestones and the project start and finish dates. Driving and critical paths are identified and used to proactively manage the project.**
	Activities are held in place by constrained dates. Logical dependencies between activities are not identified. It is not possible to produce a credible critical path due to a lack of logic among activities. LOE activities are on the critical or driving path in the IMS and are linked to discrete activities.	A few activities are not logically linked, and constraints, leads, or lags are overused. Logic links exist within specific scopes of work, but some are not integrated within activities across the entire project. A critical path can be produced for the network with some logical flaws. Only a few LOE activities are on the critical or driving path in the IMS and linked to discrete activities. The horizontal integration subprocess is coordinated with the subcontract management subprocess.	(B.3.1) No standalone activities are in the schedule (all activities have at least one predecessor and one successor). (B.3.2) Logic links, including external links, are maintained and are explainable. Activities follow a logical relational sequence (design, procure, and construct). Out-of-sequence logic does not exist. (B.3.3) The IMS only includes the use of constraints, leads, or lags that have appropriate justifications and are documented. A valid critical path can be produced for the network. The logic and critical path are continuously maintained, giving management insight to make timely decisions. (B.3.4) The IMS reflects any changes (contractual or other), and this process is repeatable from month to month. (B.3.5) LOE activities are not on the IMS critical or driving path and are not linked to discrete activities. (B.3.6) The horizontal integration subprocess is integrated with the subcontract management subprocess.	The IMS considers good work sequence planning with horizontal integration. Schedules are logic-linked among all key activities. Horizontal schedule integration is monitored and reflects the execution plan of the work. It is automatically tested to assess system health and integrity. Corrective actions are implemented, and recurring issues are resolved. Logic ties maximize the use of FS logic relationships as appropriate, with other logic types justified and documented. Routine surveillance results are disclosed to key stakeholders, who maximize the use of these results. The network is mostly free of lags and constraints. There are no redundant logic ties. Milestone dates are driven by logic, except for incoming external milestones or other justified and documented constraints. The full horizontal integration detail can be clearly and logically explained. Horizontal integration is continuously improved and optimized.

Objective

All activities are logically defined in the IMS. The flow of work is appropriate for its effective execution. The building of predecessor and successor logic relationships at the working level, a networked schedule, is necessary for planning activities and events, logically sequenced for progressive development and implementation, providing a road map for timely completion of contractual/project requirements. 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. With all the logic in place, a valid critical path through the entire project can be derived, giving all stakeholders insight into the schedule. This gives PMs the ability to evaluate and implement actions designed to ultimately complete the project within contractual parameters.

Effectiveness Criteria

B.3.1. *No standalone activities are in the schedule (all activities have at least one predecessor and one successor).*

A comprehensive IMS plays a crucial role in ensuring that project scope, time, and cost can be tracked and monitored. To ensure success, the scope of work is clear, activity durations are realistic, resources are assigned for accomplishing the work, and dependencies and logic between activities are assigned that model the sequence of work that represents how delays in one activity could impact future activities. Without the identification of dependencies and subsequent logic relationships, knowing how delays in individual activities will ultimately affect other related activities in the later stages of the project is difficult. The IMS network establishes a logical sequence of work that leads through key milestones, events, or decision points to the completion of project objectives. Milestones that could influence the IMS calculations have the appropriate predecessor and successor links established in the baseline and in the forecast schedule to provide management with the correct dates and paths.

DOE clarification. Examples of activities without both a predecessor and successor are limited. Project start logically only has successors, and project finish (CD-4) or intermediate external deliveries logically only have predecessors. Logically, these are the only exception to EC3.1.

B.3.2. *Logic links, including external links, are maintained and are explainable. Activities follow a logical relational sequence (design, procure, and construct). Out-of-sequence logic does not exist.*

The IMS represents a model of the activities planned to execute the project work scope. To obtain a logical assembly of events and activities, the scheduling process is 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 schedule network is a model of how the project will accomplish the goals and deliverables reflected in the contract. The granularity of both the baseline and forecast schedule demonstrates that they are sufficient to promote a clear understanding of the work scope and resource dependencies at the work performance level. This means the detailed activities are planned in a sequence of the way they will be worked, and logic links are being established between activities where resource dependencies exist. All activities in the schedule have both predecessor and successor relationships, except for logical external receipts or deliveries, including the project start and end. External interfaces that may impact the project schedule are shown as predecessors or successors to activities in the project. These relationships define the order in which work will be performed.

Because schedule visibility task (SVT) activities are often related to non-PMB project scope that needs to be performed to complete the project, establishing the appropriate network interdependencies increases the usefulness of the IMS as a management tool by identifying potential impacts. Essentially, the projects use SVTs to represent the work performed by others that is not part of the PMB but impacts project success.

The logical sequence of design and construction WP activities and PPs in the project schedule from start to finish reflects a strategy capable of meeting the scope specifications and requirements and indicates how the project will be built and its cost. In addition, all activities and milestones are 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 are also contained in the forecast schedule. The logical sequence of design, construction, decontamination and decommissioning (D&D), and remediation type capital asset projects reflects how the site will be improved and success is measured. Activity-level relationships and interdependencies (key handoffs) indicate 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 is used to accurately reflect the actual way they work is accomplished

B.3.3. *The IMS only includes the use of constraints, leads, or lags that have appropriate justifications and are documented. A valid critical path can be produced for the network. The logic and critical path are continuously maintained, giving management insight to make timely decisions.*

Relationships with excessive lead or lag time are avoided in the IMS. If relationships with large lead or lag times cannot be avoided, they are justified. 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 3-day lag between pouring the concrete and the ability to be able to build on it. The 3-day lag is a missing activity of the concrete curing. Typically lags represent fixed relationships based on laws of nature or an external event outside the scope of the project. For all cases outside PMB, lags can be modeled using an SVT activity. All lags greater than 22 days require justification. Neither leads nor lags are used to adjust or manage dates within the IMS. A lag is a requirement that cannot be avoided such as concrete curing or a DOE review of a document.

Date constraints are anything that limits or restricts the 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, are 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. Avoiding the use of mandatory constraints in the IMS is recommended. Hard constraints include:

- Mandatory start or finish
- 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 on the basis of status. Soft constraints are most commonly used to model resource restrictions or provide material or subcontractor delivery dates. They are justified and less than or equal to 15% of the incomplete activities. Soft constraints are defined as “start or finish on or after.”

"As late as possible" is sometimes discussed as a constraint but it is a management practice that is typically limited in its use as it does not integrate with the risk management subprocess and is not a realistic planning technique.

B.3.4. *The IMS reflects any changes (contractual or other), and this process is repeatable from month to month.*

Once the project schedule is completed and approved, it becomes a formal control document. Consequently, any changes to the project schedule's baseline are formally documented and approved following the contractor's internal operating procedures.

B.3.5. *LOE activities are not on the IMS critical or driving path and are not linked to discrete activities.*

The contractor PM ensures 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 or contractual event date calculations, or place LOE activities on the critical path.

B.3.6. *The horizontal integration subprocess is integrated with the subcontract management subprocess (Section 3.2).*

Impact of Ineffectiveness

Noncompliance with this attribute can hinder a PM'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 PMs: without exception, a poorly conceived project leads to crippling delays, consuming thousands of labor hours and millions of dollars:

- 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 usable critical path for managerial analysis and decisions.
- 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 permit the schedule network to accurately represent the impacts of schedule slips.
- Lack of a detailed 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.

Special Considerations

The FS relationship type provides a logical path through the program. A relationship type such as start-to-start (SS) or finish-to-finish (FF) can cause resource conflicts when the tasks depend on one another while also taking place at the same time.

DOE also clarified that the project start, CD-4, and intermediate deliveries are the expected deviations from the requirement that all activities have a predecessor and successor.

B.4. Vertical Integration

Vertical integration refers to the alignment and consistency of data throughout all levels of the schedule hierarchy, from detailed level field and subcontractor schedules up through summary level or "milestone only" schedules (Table 13). Schedules consider all vertical interdependencies between and among CAs, WPs, PPs, activities, and supporting schedules (engineering, production, and subcontractor). In addition, detailed level schedules are vertically traceable to deliverables found in the WBS, SOW/SOO, IMP, or similar contract requirements document.

Table 13. Attribute B.4. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**The IMP/IMS contains little or no vertical integration, and vertical alignment of dates between various schedule levels cannot be demonstrated.**	**Consistent with the SOW/SOO and WBS, the IMP/IMS contains most of the vertical integration and most activities can be vertically traced within each level of the schedule.**	**All activities are vertically traceable within all levels of the schedule hierarchy. The flow of work is appropriate for its effective planning and execution.**	**A meaningful and thoughtful schedule hierarchy exists within a singular IMS and is utilized in the communication and decision-making process.**
	The scheduling system and the process does not provide for roll-up or decomposition of the schedule to higher or lower levels of detail. Where schedule roll-ups do exist, vertical alignment of start/finish dates between levels cannot be demonstrated.	Schedules of varied levels of detail can be produced; however, there is not 100% vertical alignment of work scope and start/finish dates within each level of the schedule. Vertical Integration is coordinated with the subcontract management subprocess.	(B.4.1) Schedules with various levels of detail can be produced and alignment of scopes and dates within each level can be demonstrated. Activities can be rolled up to align with dates of parent WPs; WPs can be rolled up to align with dates of parent CAs. Vertical integration reflects any changes (contractual or other), and this process is repeatable from month to month. (B.4.2) The schedule hierarchy and vertical integration is continuously maintained, giving management insight to make timely decisions. (B.4.3) Regardless of whether the schedule levels exist within a single schedule tool or a variety of tool sets, supplemental schedules, such as subcontractor schedules and MRP or like systems, they are consistent with the IMS at the aggregated level. (B.4.4) Vertical Integration fully incorporates the subcontract management subprocess.	Schedules with various levels of detail are produced and utilized for communication and decision-making. The singular IMS aligns with major project milestones and events. Routine surveillance results are fully disclosed to all key stakeholders. Vertical schedule integration and traceability (consistency of data between various levels of schedules, including subcontractor and field-level schedules) are monitored, and data are automatically tested to assess system health and integrity. All levels of schedules align. Necessary corrective actions are implemented and completed, and recurring issues are resolved. The IMS WBS coding the structure enables the summarization of the schedule at all levels and ensures that all MRP data are represented at some aggregate level of completion. Vertical integration is continuously improved and optimized.

Any approach to scheduling features both vertical integration (from detailed activities to top-level) and horizontal integration (across activities at the same level; see B.3 Horizontal Integration). In general, the IMP can be thought of as the top-down planning tool and the IMS as the bottom-up execution tool. 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.

Objective

All activities are vertically traceable within all levels of the schedule hierarchy. The flow of work is appropriate for effective planning and execution of work. Schedules with various levels detail all work in unison to ensure an overall status of the project is available to render insight for management to make decisions. Of prime importance, and basic to all scheduling systems, is the identification of the goals of the contract to a time interval for accomplishment. This entails the identification of contract milestones to calendar dates for important project decisions. These

milestones provide the most basic planning goals for the contractor at the summary master level, toward which intermediate and detailed scheduled activities and milestones are developed and traceable consistent with start and completion dates through all levels of the schedule.

Effectiveness Criteria

B.4.1. *Schedules with various levels of detail can be produced, and alignment of scopes and dates within each level can be demonstrated. Activities can be rolled up to align with the dates of parent WPs; WPs can be rolled up to align with the dates of parent CAs. Vertical integration reflects any changes (contractual or other), and this process is repeatable from month to month.*

The traceability between the various levels of schedules is designed to ensure that all technical milestones and activities within the IMS are time-integrated at ascending schedule levels appropriately aligned with the completion of major events or milestones. The IMS is based on a hierarchical structure with the discrete LOE activities found at the lowest level summarized to a WP or PP level through the CA and then to the total project level. The IMS is expected to have more granularity in the near term and less detail moving toward the future. The number of schedule levels (or tiers) is a function of project complexity and size.

The primary schedule in P6 may be supported by other typical schedules, including the following:

- *Milestone Summary*. This is a high-level schedule, typically one or two pages, that may be presented at a DOE monthly review. The dates align with the primary project IMS baseline and forecast.
- *Plan of the Day, Operations Schedules*. Typically, 3 months or less, and daily or weekly fidelity below the IMS. The dates and performance are consistent with the forecast IMS.

B.4.2. *The schedule hierarchy and vertical integration are continuously maintained, giving management insight to make timely decisions.*

Following the completion of the IMP or equivalent, 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.

B.4.3. *Regardless of whether the schedule levels exist within a single schedule tool or a variety of tool sets, supplemental schedules, such as subcontractor schedules and material requirements planning (MRP) or like systems, they are consistent with the IMS at the aggregated level.*

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 supports the next higher level. There may be additional levels that are also vertically integrated. Detail schedules such as field-level and supplemental schedules are not required to be in the IMS but are vertically traced to the IMS. Subcontractor schedules align vertically, regardless of the implementation method chosen to represent them in the IMS. HDV material procurement and delivery information in the IMS aligns with information in other sources, such as a material tracking database.

B.4.4. *Vertical integration fully incorporates the subcontract management subprocess (Section 3.2).*

Impact of Ineffectiveness

Noncompliance with this attribute can hinder a PM'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 PMs: without exception, a poorly conceived project leads to crippling delays, consuming thousands of labor hours and millions of dollars.

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.

Special Considerations

None.

B.5. Integrated Master Schedule (IMS) Resources

A fully networked, resource-loaded IMS is a foundational component to a valid time-phased PMB. A valid project IMS addresses the availability of resources to achieve the schedule objectives (Table 14). At a minimum, a resource-loaded IMS contains all labor, material, and equipment costs, including unit prices and quantities. Resource planning of both labor (hours) and non-labor (currency) at the appropriate level to aid in the decision-making process is key to ensuring a fully executable plan. The IMS can also be used to roll up schedules at the program or portfolio level. Resource planning also can occur above the project level.

Table 14. Attribute B.5. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some activities in the IMS contain assigned resources.**	**Most activities in the IMS include assigned resources.**	**All activities in the IMS have allocated resources. Resource limitations have been defined and gaps identified.**	**The IMS reflects realistic resource requirements to effectively manage staff and material requirements. Resources are consistently analyzed and leveled to minimize disruptions caused by the imbalance of resource requirements to resource availability levels.**
	The IMS lacks resource loading to aid in the development of the baseline plan and decision-making process.	The IMS may include resource-loading for resource types deemed critical to project success. Full resource-loading may exist but only on activities identified as critical where resource-loading does not represent all requirements to achieve planned objectives. For critical activities with resource loading, resource needs align with activity durations (such as 2 hours/day for 10 days compared with 10 hours/day for 2 days). The IMS is coordinated with the authorization and budgeting, material management, subcontract management, and risk management subprocesses.	(B.5.1) There is an understanding of the resource requirements and limitations needed to develop a time-phased baseline plan and complete the planned scope within the contract period of performance. (B.5.2) For all activities, resource needs align with activity durations (for example, 2 hours/day for 10 days compared with 10 hours/day for 2 days). Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (B.5.3) The resource-loaded IMS is traceable to all labor, material, and equipment costs, including unit prices and quantities, and both discrete and LOE WPs. (B.5.4) The IMS is integrated with the authorization and budgeting, material management, subcontract management, and risk management subprocesses.	Resource leveling/allocation is performed to proactively manage resources at the activity and project level. Resource optimization is a continuous process, ensuring requirements are identified far enough into the future to consider labor constraints and meet allocated material/equipment lead times. The IMS resources are automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Resource details can be clearly and logically explained by the CAMs and PMs. Routine surveillance results are fully disclosed to all key stakeholders, who maximize their use. IMS resources are continuously optimized.

The IMS resources are integrated with the authorization and budgeting, material management, subcontract management, and risk management subprocesses.

Objective

All activities in the IMS have allocated resources, resource limitations have been defined, and gaps identified. An integrated schedule facilitates the establishment of a valid PMB. Scheduling authorized work facilitates effective planning, status, 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 path and enables project management to evaluate and implement actions designed to ultimately complete the project within contractual parameters. An IMS gives project management a comprehensive status of the authorized work scope and facilitates the timely tracking and communication of project performance.

The resources are to be time-phased consistent with the way the scope is to be accomplished. This approach provides meaningful product-related or management-oriented events for performance measurement.

Effectiveness Criteria

B.5.1. *There is an understanding of the resource requirements and limitations needed to develop a time-phased baseline plan and complete the planned scope within the contract period of performance.*

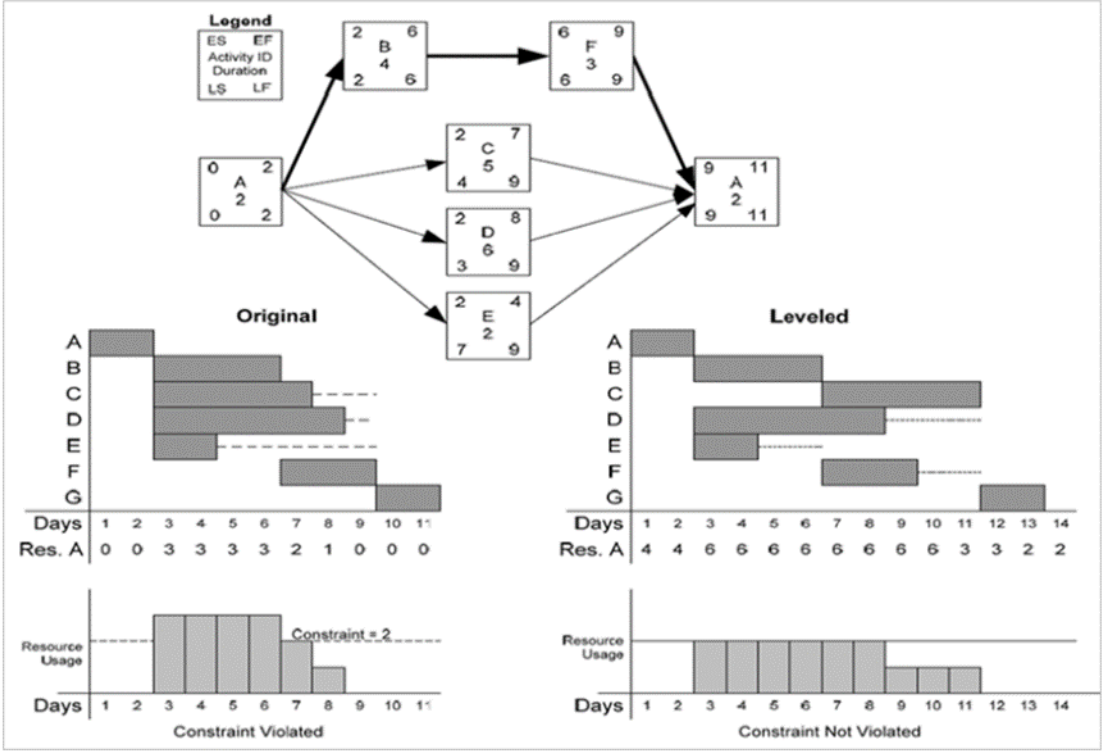
Resources are how work is accomplished. To achieve the IMS, resources drive WP, PP, and activity-level durations. The EVMS process considers the availability of personnel, facilities, and equipment to perform the defined work needed to execute the project. Precedence logic is established between activities that have resource requirement dependencies.

SVTs represent work in the IMS that does not have resource requirements or scope and thus is not included as part of the contractor's PMB cost but is related to and may potentially impact 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 are 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 helps separate SVTs from other activities during filtering, grouping, and scheduling health assessment exercises. SVTs 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 lag rationale is usually hidden, if it exists at all.

B.5.2. *For all activities, resource needs align with activity durations (for example, 2 hours/day for 10 days compared with 10 hours/day for 2 days). Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

Resource availability is 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. Projects recognize that the quality of resource estimates—including the assumptions used for resource allocation for work items—affects the schedule risk (Figure 9).

Figure 9. Resource Allocation



Resource requirements, availability, and hours are considered in the determination of WP activity and PP durations. Ensuring the type (trade group) and quantity of resources are identified and understood and not over- or under-allocated is important, for example, two plumbers for 10 days, or 10 plumbers for two days. Resource conflicts (over- or under-allocations) influence the project's critical path and near critical paths. To support the establishment of realistic activity durations, the need and availability of resources are determined by the scheduling tool (P6, for example). The over-allocation of resources is justified and documented at the activity level. As a minimum, the balance between the need and availability of resources are reviewed quarterly. Over-allocation falls into two types:

1. *Brief periods*. No project is perfectly level in its resource requirement, for example, working 70-hour weeks to catch up.
2. *Longer periods.* 6 months or more of overcapacity mean it is not achievable. Overtime for a long duration is not realistic or effective. The effort is rescheduled to reduce or eliminate the over-conflict.

B.5.3. *The resource-loaded IMS is traceable to all labor, material, and equipment costs, including unit prices and quantities, and both discrete and LOE WPs.*

The IMS (both resource-loaded and with a critical path) is developed and maintained for the project. At a minimum, a resource-loaded IMS contains all labor, material, and equipment costs, including unit prices or quantities. For firm fixed-price contracts, the total contract cost is also included in the IMS (see DOE O 413.3B).

B.5.4. *The IMS resources are integrated with the authorization and budgeting, material management, subcontract management, and risk management subprocesses (Section 3.2).*

Impact of Ineffectiveness

Noncompliance with this attribute can hinder a PM'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 PMs; without exception, a poorly conceived project leads to crippling delays, consuming thousands of labor hours and millions of dollars.

Lack of a detailed plan limits the usefulness of the IMS and PMB in giving program management situational awareness of schedule activity and resource details. These details are needed for effective program execution and management assessment of progress for proactive resolution of issues impacting cost, schedule, and technical achievement of program objectives.

Special Considerations

None.

B.6. Schedule Detail

Schedules are detailed at the lowest level needed to set a foundation for horizontal and vertical schedule integration (Table 15). They include the detailed activities and milestones that depict the work scope that represent all discrete or LOE WPs and PPs identified in the PMB, as required. It is developed and used as the blueprint for the day-to-day management and control of work by the CAM. Detailed schedules contain activity start and finish dates based on physical accomplishment and are integrated with project time constraints.

Table 15. Attribute B.6. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**The lowest level of the network schedule is missing a significant number of detailed activities and milestones.**	**The lowest level of the network schedule includes the most detailed activities and milestones.**	**The lowest level of the network schedule includes all detailed activities and milestones to meet contract requirements.**	**The level of detail in the schedule is used to proactively manage the project to meet contract requirements.**
	The level of schedule detail does not depict the project work scope represented by WPs and PPs in the PMB. The schedule contains a mix of low- and high-level activities, which may reflect the entire project scope but provide minimal definition for execution of the work. The use and rationale of schedule calendars cannot be explained or justified. There is no documented "rolling wave" or event/planning horizon process.	The level of schedule detail depicts most of the project work scope represented by WPs and PPs in the PMB. The schedule, though not fully documented, contains details needed to manage the execution of work and provides enough confidence to meet project constraints and committed timelines. Activity durations are proportionate with the reporting cycle and can be easily measured and managed. Schedule detail is coordinated with the budgeting and work authorization and analysis and management reporting subprocesses.	(B.6.1) The level of schedule detail depicts all of the project work scope, as required. (B.6.2) The schedule flows logically and reflects the work to be accomplished. Milestones are linked and logically relate to relevant activities. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (B.6.3) Activities are granular and detailed enough to indicate the way work scope is accomplished and managed. There is a high level of confidence in the project delivery dates and associated costs. (B.6.4) Project constraints, calendars, rationale, and activity durations are documented, justified, and supported by logical resource and cost allocations. The schedule links key detailed WPs and PPs (or lower-level activities) with summary activities and milestones. The project adheres to a documented "rolling wave" or event/planning horizon process. (B.6.5) The schedule has completed an external review, such as an integrated baseline review (IBR), to ensure all scope is captured to ensure all scope is captured in a detail appropriate for the project scope. (B.6.6) Schedule detail is integrated with the budgeting and work authorization and analysis and management reporting subprocesses.	The schedule is clear and competently structured at an appropriate level of detail. Schedule data are monitored and used for management control and are automatically tested to assess system health and integrity. Necessary corrective actions are implemented and completed, and recurring issues are resolved. Issues identified by the external assessment are monitored and tracked to closure. In case of major contract modifications, a new IBR is completed. Routine surveillance results of the schedule detail are fully disclosed to all key stakeholders, who maximize their use. The schedule detail can be clearly and logically explained by CAMs and the PM. The schedule detail is continuously improved and optimized.

Activities in the detailed schedule contain sufficient detail, including consideration of work calendars and availability and allocation of resources. The project schedule defines the scope of work to be undertaken and the timetable for completion, but the coding structure schema, including the WBS, ensures the planning, scheduling, budgeting, work authorization, and cost accumulation management subsystems are integrated. The data derived from one subsystem is relatable, and consistent with, the data of each of the other subsystems.

The schedule network is a model of how the project will accomplish the goals and deliverables reflected in the contract. The baseline and forecast schedules are granular enough to promote a clear understanding of the work scope at the work performance level and to ensure accurate performance status. This means the detailed activities are planned and sequenced in the way they will be performed.

Schedule detail is integrated with the budgeting and work authorization and analysis and management reporting subprocesses (Section 3.2).

Objective

The lowest level of the network schedule includes all detailed activities and milestones to meet contract requirements. Composing schedules with enough detail and granularity sets the foundation for effective planning, status, and forecasting, all critical to project success. The schedule details are planned at a low enough level to ensure management value, appropriate resource allocations, and objective measures of physical accomplishment. Although all contractual effort is planned and controlled through the CA, 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 practical for the effort (the planning horizon) using the CA WP. Budgets beyond this time frame are recorded on the CA PP, 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 6-month planning window to their natural completion.

Effectiveness Criteria

B.6.1. *The level of schedule detail depicts all of the project work scope, as required.*

The CA is broken down as much as possible into short-term units of work called WPs. The CAM develops and uses these WPs as basic building blocks 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, keeping the activities that make up a WP homogeneous and to a relatively short duration (no more than 44 working days) is useful. Otherwise, interim measures using quantifiable backup data (QBD) can be assigned to a WP to reduce the problems associated with calculating the network and determining the amount and value of completed in-process work.

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

Long-duration WPs (greater than 6 months) run a higher risk of developing cost and schedule variances, stemming from challenges in keeping to a plan likely to change. Also, long-duration WPs may impede 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.

The term PP has meaning in both the schedule and EVMS budgeting tool. PPs are determined in maturity attribute C.7. In the IMS, they may be high level. Therefore, they may be supported by lower-level activities as necessary to create a realistic longest path.

B.6.2. *The schedule flows logically and reflects the work to be accomplished. Milestones are linked and logically relate to relevant activities. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The IMS reflects a logical ordering and sequence of work, from start to finish, capable of meeting project scope requirements. For example, after completing hanging drywall, when all the seams are taped and finished, the work can proceed to paint. The establishment of milestones and events helps to place workflow in its proper order. Durations and links together make for a logical flow.

B.6.3. *Activities are granular and detailed enough to indicate the way work scope is accomplished and managed. There is a high level of confidence in the project delivery dates and associated costs.*

The goal of limiting discrete schedule activities to no longer than 44 working days within WPs is to enhance the schedule's fidelity to enable early warnings and focus management attention on schedule workarounds. Earned value techniques (EVTs) are captured at the activity level to further substantiate QBD for long-duration WPs. These EVTs imply discrete work efforts and are appropriate for the length of the WP and the type of work being accomplished. Under no circumstances is the length of an activity, or combination of activities, longer than its parent WP. Because QBDs are associated with performance measurement, they are identified and reported at either the WP or activity level.

The actual progress of an activity from start to its finish is determined using earned value measurement principles. 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 is weighed against the time for doing so. For activities of an extended duration, indicating the technical percentage of completion helps in tracking actual progress against the baseline plan; for activities of relatively short duration, it is less important to track progress in such detail.

A *work-around* is an alternate sequence and duration to overcome a known problem. Work-around plans need to be put into the IMS and linked to be able to drive the longest path. A work-around is in the forecast-only IMS.

B.6.4. *Project constraints, calendars, rationale, and activity durations are documented, justified, and supported by logical resource and cost allocations. The schedule links key detailed WPs and PPs (or lower-level activities) with summary activities and milestones. The project adheres to a documented "rolling wave" or event/planning horizon process.*

A reliable and efficient planning and scheduling process is essential in managing the project effectively. Maintaining a realistic baseline schedule because 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 significantly affect 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 are often performed regularly (every 6 months, year, next major milestone, or event, etc.). Thus, the baseline schedule most useful for 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 on the aggregated workflow execution strategy plans and then, as those plans enter the near-term planning horizon, would be decomposed to a greater level of detail to reflect current project circumstances.

A rolling wave or block planning approach, as a planning horizon method, comprises cycles of detail planning. These cycles are typically 6 months; although when practicable, instead of time-based, the cycles are based on the period between project technical milestones within CD phases that are 6 to 12 months apart. Within the rolling wave/block planning window, detailed WPs and their associated activities are planned with greater fidelity to enable for execution-level detail. Beyond the rolling wave and block plan spans, there are typically PPs 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 federal managers are typically cautious to promote or require detailed planning beyond the near-term rolling wave/block planning period. In dynamic projects, it can be ineffective to plan in detail for periods beyond that because detail plans beyond 1 year may become obsolete before they start.

A planning horizon strategy has advantages:

- Ensuring an execution plan that can be used by the entire project team to manage the work
- Rendering detail only for a short period that is well known
- Ensuring that the detail always exists into the future
- Being cost-effective compared with the detailed planning of the entire project

Rolling wave technique. While all project effort is planned and controlled through the CA, most contractors recognize that it may not be practicable or possible to do grassroots planning for an entire project. Considering this limitation, they plan budgets in detail for activities scheduled to start within planning horizons of 3 to 6 months using the CA WPs. Budgets beyond this time frame are recorded on the CA PP. The conversion of PP (or far-term) budgets into precise WP (or short-term) budgets typically starts 30 days before when PPs enter the planning horizon.

Block planning technique. Budgets are typically detailed and planned for the next major project technical milestone, or event. Typically, planning blocks range from 6 to 12 months. Budgets beyond this time frame are recorded on the CA PP. The transfer of PP (or far-term) budgets into precise WP (or short-term) budgets typically starts 30 to 60 days before the beginning of the block. This process is followed until all PP budgets have been incorporated into a detailed plan. Before the completion of each block, the CAM, together with functional team members, prepares a detailed schedule (or blueprint) for the use of staff hours (or labor dollars) needed to complete all activities within a block of time.

B.6.5. *The schedule has completed an external review, such as an IBR, to ensure all scope is captured in a detail appropriate for the project scope.*

This review could be an internal company review or external (IBR). Either is external to the project, ensuring the scope has been fully incorporated. Missing scope is not achievable and causes schedule delays.

B.6.6. *Schedule detail is integrated with the budgeting and work authorization and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

Noncompliance with this attribute can hinder a PM'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

PMs: without exception, a poorly conceived project leads to crippling delays, consuming thousands of labor hours and millions of dollars:

- The lack of near-term detail planning creates a baseline schedule that does not furnish sufficient information to determine actual progress, develop reliable forecasts based on performance to date, and manage priorities to accomplish project cost and schedule objectives.
- Lack of a detailed plan limits the usefulness of the IMS and PMB for giving program management situational awareness of schedule activity and resource details. These details are needed for effective program execution and management assessment of 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.

Special Considerations

None.

B.7. Critical Path and Float

The schedule identifies a logical critical path and driving paths to manage the project (Table 16). The critical path is the path of the longest duration through the sequence of activities with the least amount of total float. It is also 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 delay in activities along with this or adjacent paths. 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. Changes in the forecast project milestones may impact the critical path. Critical paths used for the project are consistent among key stakeholders. The driving path is the longest sequence of tasks from the time now to an interim program milestone. If a task on a driving path slips, the forecast interim program milestone date slips. Critical path and driving path identification and analyses are essential to ensure timely completion of the authorized work and to prevent slippage of the project end date.

Table 16. Attribute B.7. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Negative or excessive float values in the network schedule affect the critical path activities and milestones. Activities have incorrect durations or logic.**	**The critical path shows related activities and milestones from start to finish, and few float values are negative or excessive.**	**Logical critical and driving paths reflect customer work priorities, identifying key stakeholder interfaces, subcontracts, and material procurements.**	**Logical critical and driving paths reflecting current customer work priorities are used to proactively manage the project to meet contract completion objectives.**
	The schedule includes negative or excessive float, activities may be missing, and precedence logic may be incomplete or inaccurate. Activities and milestones may not be able to meet their required finish dates on the basis of precedence logic, duration, and status.	The schedule includes the longest continuous path of activities and milestones from start to finish, calculating the least amount of total float. Most activities and milestones can meet their required finish dates on the basis of precedence logic, duration, and status.	(B.7.1) The critical and driving paths are logical and comprise the longest sequence of activities and milestones to achieve the project completion objective. The critical path follows a logical relational sequence (plan, develop, design, procure, execute, or other). Near-critical paths are also identified and assessed. (B.7.2) Monthly performance and progress evaluation of the schedule gives management continuing insight. Float values are managed to optimize the schedule. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (B.7.3) The schedule is designed for effective integrated project management purposes and contains a calculated critical path for the entire contractual period of performance. (B.7.4) Baseline critical path activities and milestones report no negative float values, and few float values are excessive. (B.7.5) CAMs and PMs can clearly and logically explain the critical path and float details. They manage to float, resulting in an optimized schedule at all levels.	Baseline critical path activities and milestones report no negative or excessive float values. Schedule data are monitored and used for management control and are automatically tested to assess system health and integrity. Necessary corrective actions are implemented and completed, and recurring issues are resolved. Each milestone (completion or interim) or control point has distinct driving and near-driving paths to identify the longest sequence from time now to that milestone or control point. The schedule and critical the path have undergone an external review, such as an IBR. Routine surveillance results of the critical path and total float are fully disclosed to all key stakeholders, who maximize their use. The critical path and total float are proactively managed and continuously optimized.

Total float is the amount of time an activity can be delayed from its early start date without delaying the project finish date. An excessive float value may indicate missing activities or incomplete or inaccurate logic or duration in the schedule. A negative float value in a schedule indicates that activities and milestones cannot meet their required finish dates on the basis of precedence logic, duration, and status. The presence of a negative float value in the baseline schedule indicates an unachievable plan, which needs to be addressed. A negative float value in the forecast schedule is reported to support management review and decision. Excessive negative float in the forecast schedule that is not mitigated is reviewed and the constrained milestone is forecast for the impact.

The critical path may change for the project as near-critical paths are delayed more than the critical path; schedule float indicates this phenomenon. Schedule float that is the least (positive or negative) indicates the activities, based on status, that are now the most critical to complete to maintain the overall critical path. Understanding the changes in float can help with work prioritization and excessive positive schedule float may indicate logic issues that need to be addressed.

Critical path and float are integrated with the budgeting and work authorization, analysis and management reporting, material management, and subcontract subprocesses.

Objective

Logical critical and driving paths reflect customer work priorities, identifying key stakeholder interfaces, subcontracts, and material procurements. A fully networked and resource-loaded IMS enables (1) the production of the critical and driving paths, and (2) program managers to evaluate and implement actions designed to ultimately complete the program effort within contractual parameters. The critical path determines the project's earliest completion date and focuses the team's energy and management's attention on the activities that lead to project success. Establishing a valid critical path is necessary for examining the effects of any activity slippage. A review of the calculated critical path reveals activities that are causing delays in accomplishing work and those that jeopardize the project timeline. This analysis helps management focus on these activities to develop workaround plans and seize opportunities. Accurate total float values are necessary to understand the relative importance of each activity as it relates to the overall critical path. Scheduling with total float ensures limited resources are assigned to tasks most likely to impact the critical path—and thus the project end date—if not completed on planned dates.

Effectiveness Criteria

B.7.1. *The critical and driving paths are logical and comprise the longest sequence of activities and milestones to achieve the project completion objective. The critical path follows a logical relational sequence (plan, develop, design, procure, execute, or other). Near-critical paths are also identified and assessed.*

The IMS identifies the project critical path—the path of longest duration through the sequence of activities (typically with the least amount of total float)—and driving paths to manage the project. The critical path and driving paths reflect customer work priorities, identifying key stakeholder interfaces, subcontracts, and material procurements. The critical path is also the longest path of related incomplete activities in the logic network from time now, whose total duration determines the earliest project completion. The critical path determines the project's earliest completion date and focuses the team's energy and management's attention on the activities that lead to project success. The baseline schedule is subject to formal change control, which could impact a major project milestone and the critical path. Changes in forecast major project milestones and the forecast critical path are documented and explained from one month to the next. Although the IMS contains LOE activities, this type of work is not 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. Controls for baseline and forecast schedules prevent LOE activities on the critical path. The controls include the prevention of incomplete discrete activities with greater than 15 predecessor activities except for major events (CD-2/3/4).

B.7.2. *Monthly performance and progress evaluation of the schedule gives management continuing insight. Float values are managed to optimize the schedule. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

A review of the calculated critical path reveals activities that are causing delays in accomplishing work and those that jeopardize the project timeline. This analysis helps management focus on these activities to develop workaround plans and seize opportunities. A negative float value in the forecast schedule is reported to support management review and decisions. Excessive negative float in the forecast schedule that is not mitigated is reviewed and the constrained milestone is forecast for the impact. 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. The schedule delivered to the customer is consistent with that used by the contractor. Critical paths used for the project are consistent among key stakeholders.

B.7.3. *The schedule is designed for effectively integrated project management purposes and contains a calculated critical path for the entire contractual period of performance.*

The contractor demonstrates that the scheduling technique meets the minimum requirements of network scheduling to verify the attainability of project schedule objectives and to integrate the project schedule among all related components. The IMS reflects significant project events, external dependencies, and decision points to facilitate the planning and execution of the work scope. The network links all project milestones, events, and activities in logical cause-and-effect sequences to determine the time needed to complete work. This technique facilitates the calculation of the project's 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. The schedule has a continuous longest path for the entire remaining project period of performance.

B.7.4. *Baseline critical path activities and milestones report no negative float values, and few float values are excessive.*

Schedule float is used 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 to maintain the overall critical path. PMs 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. A simple approach is to status weekly accomplishments and then review all remaining work monthly.

Total float is the amount of time an activity can slip before the project end deliverable is impacted. Total float greater than 10% of the remaining duration in the calendar year is considered high and raises the question of whether the activity is linked to an appropriate successor. Float management is the number one tool for managing priorities. If the float is reasonable, then an early warning indicator is the degradation of the schedule float. Particularly important is identifying and substantiating the sequences and relationships among the activities necessary to complete the critical and near-critical (or low float) paths. Total float represents the total time a discrete (non-LOE) activity can be delayed without causing a delay to the project/program. The existence of excessive float does not automatically constitute poor planning and scheduling, or an invalid IMS.

A large positive float can indicate missing network relationships. Schedule relationships are required when

- technically required;

- resource constraints are missing; or
- preferential logic is missing (a common cause of high float). Activities are sequenced over time to be achievable. Not everything can be done at the same time, so some soft links may be appropriate to build a logical and executable IMS.

Precedence logic defines the sequence of work and how activities relate 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 activities are missing or the schedule contains incomplete or inaccurate precedence logic. Often, 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's critical path.

Negative total float in a project schedule indicates that activities and milestones cannot meet their required finish dates on the basis of precedence logic, duration, and status. The more negative the float value is, the larger the issue for the elements of the schedule that are required to be recovered to meet their finish date requirements. A negative float in the baseline schedule indicates an unachievable plan and is addressed whenever present. A negative float in the forecast schedule is more common and represents a call for action, that is, preparing and implementing a recovery plan to address the condition. Persistent, unaddressed large negative float in the forecast schedule is an early warning that project dates for deliveries or events may not be met.

B.7.5. *CAMs and PMs can clearly and logically explain the critical path and float details. They manage float, resulting in an optimized schedule at all levels.*

CAMs are responsible for ensuring the executability of the schedule and the realism of the total float. They need to understand their effort on the critical path. They also need to receive reports and understand the changes in total float for the current month. DOE interprets high float on the basis of remaining project duration. This creates a declining expectation of the total float as it nears the project's complete milestone.

While total float of an activity more than the threshold can on occasion be acceptable and signify those activities that do not have to be completed within 10% of remaining duration before they impact an event or milestone or the completion date of the project, it is assessed from the standpoint of optimizing the allocation of resources. Specifically, the planning and scheduling process identifies the availability of resources to execute workflow, generating resource plans that are iteratively developed until aligned with budget levels and resource constraints. Given the complexity of projects/programs, including constraints on job sites due to additional security and nuclear safety measures and the availability of special skills/materials, activities having excessive float and the reasons thereof are not overlooked. Instead, these are judiciously planned and transparently communicated. Note that excessive float is commonly utilized as a risk mitigation strategy. However, using excessive float in this manner without regard to the integration with all other facets of project management, specifically a project's risk management process, can lead to avoidable planning, scheduling, and budgeting issues caused when there is a divergence in the planned progression.

During planning and scheduling, and routine surveillance, a methodology such as below is instrumental to assess, resolve, and manage activities with high total float.

1. Identify, document, and report activities with total float more than the threshold of 10% of a project's remaining duration.
2. Activities with total float more than the threshold are to be analyzed via a "schedule walkdown" (schedule review) by the PM, CAM(s), PCE(s), risk manager(s), and technical SME(s) to mitigate silo planning and merge bias and ensure appropriate workflow and corrections to logic links and durations are made as needed via established change control procedures. Results are documented. Key things to assess include:
    a. workflow relationships,
    b. resource constraints,
    c. preferential logic, and
    d. activity durations.

Schedule walk-downs (reviews) also engage and consider the risk management process. If the excessive float activities are identified as risk mitigation actions, then review their integration with the project's risk register. These activities are thoroughly evaluated, including an assessment of the risk trigger dates. Additionally, a population of similar types of excessive float activities such as procurements can manifest as a workflow bow-wave and introduce additional risks such as those associated with material management system discrepancies as well as quality and physical degradation due to inappropriate storage.

Justification for activities that have total float greater than the threshold are documented and routinely reviewed in future schedule walk-downs to determine if adjustments can be made to workflow, logic links, and/or durations, or ensure that the documented justification remains valid. The primary goal of planning and scheduling is not to build schedules to meet metric thresholds, but to ensure logic, durations, and overall workflow of the project is accurate. This active and ongoing management process to understand and manage the risks associated with high total float are documented and assessed as part of a contractor's self-governance program. Alternate metrics and controls may be applicable to verify the process is still in control and risk is managed. An alternate method for work that can be done in any sequence might be used to demonstrate the activities with total float more than the threshold are being managed and not overlooked.

Impact of Ineffectiveness

Noncompliance with this attribute can cause misallocation of time, money, or resources to tasks less likely to impact the project end date. Substantially high or low (negative) float values may indicate missing or incorrect logical relationships. Float values are integrated with the horizontal integration attributes to ensure the accuracy of the calculated total float values.

Negative or excessive float may indicate a schedule network that is not adequately defined or that does not have accurate precedence relationships between activities. This condition produces a resource plan and workflow that may not be feasible and result in an inaccurate project critical path. A negative float indicates an unachievable schedule, which is reassessed with new activity sequencing or workarounds to avoid schedule delays. A project schedule that is not based on resource availability is incomplete and undoubtedly not executable or realistic.

Special Considerations

DOE clarified that in P6 the longest path function is used to calculate the critical path as described in the B.7 maturity level template. In P6, the longest path feature is used rather than the user-defined "critical path." In this attribute, the critical path or driving path is considered the P6 longest path function.

B.8. Schedule Margin (SM)

Establishing SM in the schedule is an optional management technique that helps projects deliver on time, on target, and on cost (Table 17). SM is created by inserting activities to represent the time necessary to account for estimated schedule risks and uncertainties. SM is used to mitigate schedule risk and increase the accuracy of downstream forecasts. Although SM duration generally decreases over time as risks expire and uncertainties diminish, the duration can increase as additional risks and uncertainties are discovered. The customer's schedule contingency, if included in the schedule, is reflected consistently with SM.

Table 17. Attribute B.8. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**SM determination is in the initial stages; some project risk factors have been identified.**	**SM is mostly defined; most project risk factors are identified but not fully approved.**	**SM is defined, documented, and approved. SM is commensurate with the project risk identified.**	**SM is actively managed to help inform management decision-making.**
	There is no basis for determining the SM activity duration. SM is not based on the project risk management process. Controls for maintaining and dispositioning use of SM are inadequately understood.	The schedule is informed by most risk factors from the risk register for establishing the SM. SM may have been identified, but its relationship to the critical and driving paths may be unclear. SM may not be fully integrated with the project risk management process. It is not entirely clear how SM and total float analysis are reconciled and traceable to end-item milestone objectives. A plan is in place to complete the required outputs and meet the intent for the SM. The SM duration is justifiable, traceable to its source, and coordinated with the risk management subprocess	(B.8.1) The schedule is informed by all risk factors from the risk register for establishing the SM. (B.8.2) The project has established an SM by inserting activities to represent the time necessary to account for the estimated schedule risks and uncertainties. (B.8.3) The SM duration is fully justifiable and traceable to its source and integrated with the risk management subprocess.	The schedule includes risk mitigation activities, as appropriate, and clearly demonstrates that the project is structured to be executable within schedule constraints and with acceptable risk. Routine surveillance results of the SM are fully disclosed to all key stakeholders, who maximize their use. Necessary corrective actions are implemented and completed, and recurring issues are resolved. The SM detail has completed an external review, such as an IBR, and has key stakeholder approval.

The amount of SM established directly relates to the estimation of schedule risk inherent in accomplishing the project goals and deliverables. The relationship between SM and risk in the schedule is documented and reviewable.

SM duration is clearly tied to the risk management process, where its establishment can be based on SRA results. The project schedule identifies SM as a single, non-resource activity positioned between the last discrete resourced activity in a critical or major decision phase and the critical or major decision milestone. This placement enables management to evaluate the impact of realized risks on the schedule for the next milestone and act to address possible risks to the project. Although SM duration generally decreases over time as risks and uncertainties diminish, the duration can increase as additional risks and uncertainties are discovered.

SM is integrated with the risk management subprocess.

Objective

SM is defined, documented, and approved. SM is commensurate with the risk identified on the project. Once the PMB has been established, contractor PMs take the appropriate steps to identify, examine, and assess potential risks in the baseline schedule. 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. 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.

Effectiveness Criteria

B.8.1. *The schedule is informed by all risk factors from the risk register for establishing the SM.*

The establishment of the SM is based on an SRA which is described in attribute J.1.

SM in the IMS represents the project's schedule reserved to meet the project completion date. The duration of the SM in the baseline and forecast schedule are 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 forecast SM may be changed under the direction of the contractor PM. SM may be consumed (overtime) in the forecast schedule with monthly changes documented in the IPMR/CPR Format 5 report. This analysis considers 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 consumed, it is reflected in the schedule with 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 for 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.

As a quick assessment of the risk to complete the project as planned, the duration of the forecast schedule margin can be compared with the duration of baselined work remaining on the project. If 50% of the total baseline duration remains, for example, we would expect 50% of the forecast schedule margin duration to still exist. If the percentage of remaining forecast schedule margin duration is greater than the percentage of remaining baseline work duration, the risk of schedule delay is lower. However, if the percentage of remaining forecast schedule margin duration is less than the percentage of remaining baseline work duration, the risk of schedule delays is greater. This is an excellent metric along with negative float to determine whether the project is potentially facing significant schedule delays.

B.8.2. *The project has established an SM by inserting activities to represent the time necessary to account for the estimated schedule risks and uncertainties.*

If contractor SM is used, it is located in the IMS as a single non-resource activity positioned between the last discrete activity in a critical or major decision phase and a critical or major decision milestone (such as CD-3 or CD-4). It also can be placed before CD-2. This placement enables management to evaluate the impact of realized risks on the schedule for the next CD

milestone and act to address possible risks to the project. The schedule margin does not drive (be a predecessor to) discrete activities. If schedule margin is used in the IMS, whether modeled using an SVT, or constrained milestones creating a duration gap, it is identified in the IMS. To ensure clarity, the activity name contains the text "SCHEDULE MARGIN", and a code field is assigned to support the filtering requirements of schedule analysis. Guidance regarding the application of DOE held SM in the IMS is found in Section J.1.3.

B.8.3. *The SM duration is fully justifiable and traceable to its source and integrated with the risk management subprocess.*

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 a formal change control process and ETC/EAC forecast process (Section 3.2).

Impact of Ineffectiveness

If schedule margin (SM) is used in the schedule, its use follows 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. The improper use of schedule margin can lead to unachievable schedule commitments. The lack of schedule margin can result in over-commitment of planned completion dates which are not reflective of a mature, risk-informed schedule. Alternatively, overuse of schedule margin can lead to poor project management practices and an everchanging project completion date.

Special Considerations

B.8 handles the planning and status of schedule margin based on remaining risks.

J.1 covers the SRA and the establishment of the original direction of the baseline and forecast IMS.

B.9. Progress Measures and Indicators

Progress measures and indicators are established to accurately assess schedule progress and to address the physical or tangible completion of work (Table 18). They are typically established first by the identification of interim goals to measure the progress of the project, which avoids subjectivity in the assessment of work accomplished.

The objective interim performance measures are aligned with the IMS tasks and activities to enable accurate performance assessment. A sufficient number of interim measures are defined after the detailed schedule task/activities are established and are based on the completion criteria developed for each increment of work.

Table 18. Attribute B.9. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some progress measures and indicators are established. Few interim performance goals and measures are identified.**	**Most progress measures and indicators are established based on physical products and performance goals. Interim performance goals and measures are identified.**	**Progress measures and indicators are established and used based on physical products and performance goals. Interim performance goals and measures are identified and approved.**	**Progress measures are used to facilitate collaborative discussions and establish mutual expectations. They are integrated with, and substantiate, technical, schedule, and performance targets, deliverables, reviews, and events.**
	Few milestones and events by which to measure the progress of the project are identified. Accomplishment is assessed from the amount of work completed on the basis of time. Some scheduled tasks contain meaningful progress indicators.	The schedule is event-based and considers most, but not all, milestones, and events traceable to the contract and project execution plan. Completion criteria are used to further assess the physical or tangible completion of work. Most scheduled tasks contain meaningful progress indicators.	(B.9.1) The schedule is event-based and considers all milestones and events traceable to the contract and project execution plan. Anomalies are identified and informed corrective actions. (B.9.2) Performance and progress evaluation occur, at a minimum, in alignment with the reporting of actual costs. (B.9.3) Key project milestones are logically linked within the schedule. The schedule integrates directly from the master plan and supplements it with additional levels of detail. (B.9.4) A sufficient number of interim measures are defined to ensure performance is measured as accurately as possible. (B.9.5) Adequate numbers of milestones and goals are established to measure the progress of the project. (B.9.6) Documented interim measures are based on the completion criteria developed for each increment of work used to assess the physical and technical completion of work.	Performance measures are used for planning and goal setting, creating mutual stakeholder expectations. The schedule is event-based consisting of a hierarchy of project events, with each event being supported by specific accomplishments, each associated with specific criteria to be satisfied for its completion. Critical target dates, project milestones, contractual events, accomplishment criteria, and project decision points are identified and used to plan and assess the progress of work. Routine surveillance results are fully disclosed to all key stakeholders, who maximize their use. Schedule performance data are monitored and used for management control and are automatically tested to assess EVMS health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. The identification of interim goals by which to measure the progress has completed an external review, such as an IBR. In case major contract modifications occur, a new IBR has been completed. The schedule has a hierarchy of key milestones that fully identify key project decision points for effective progress measurement at all levels of the networked schedule.

Progress measures justify progression to the next CA or lower-level task or activity. An interdependent schedule establishes and maintains the relationship between technical achievement and progress status. Progress measures are objective criteria for determining the accomplishment of project phases and milestones that constitute the start or completion of the work scope.

Objective

Progress measures and indicators are established and used based on physical products and performance goals. Interim performance goals and measures are identified and approved. The identification of milestones, deliverables, and significant accomplishments in the schedule make it possible to place an objective value on the amount of work required to meet performance goals

and, as work is proven accomplished, proceed to the next set of activities in the schedule. The contractor ensures objective interim performance goals and measures are identified and used for developing the project schedule and avoids subjectivity in the assessment of work accomplishment and progress.

Completion criteria for WPs and activities indicate what constitutes completion. Naming conventions of activities play an important role in clarifying completion. 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 confusion during the status cycle.

Effectiveness Criteria

B.9.1. *The schedule is event-based and considers all milestones and events traceable to the contract and project execution plan. Anomalies are identified and informed corrective actions.*

The IMS contains project milestones, events, decision points as well as external dependencies. For the establishment of higher-level milestones, as part of the contract between the 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. The CD milestones help define the boundary points between project initiation, definition, execution, and operations (Figure 10). 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 plans and the IMS are used to track project technical and schedule status, including all significant mitigation efforts that support the risk management process.

B.9.2. *Performance and progress evaluation occur, at a minimum, in alignment with the reporting of actual costs.*

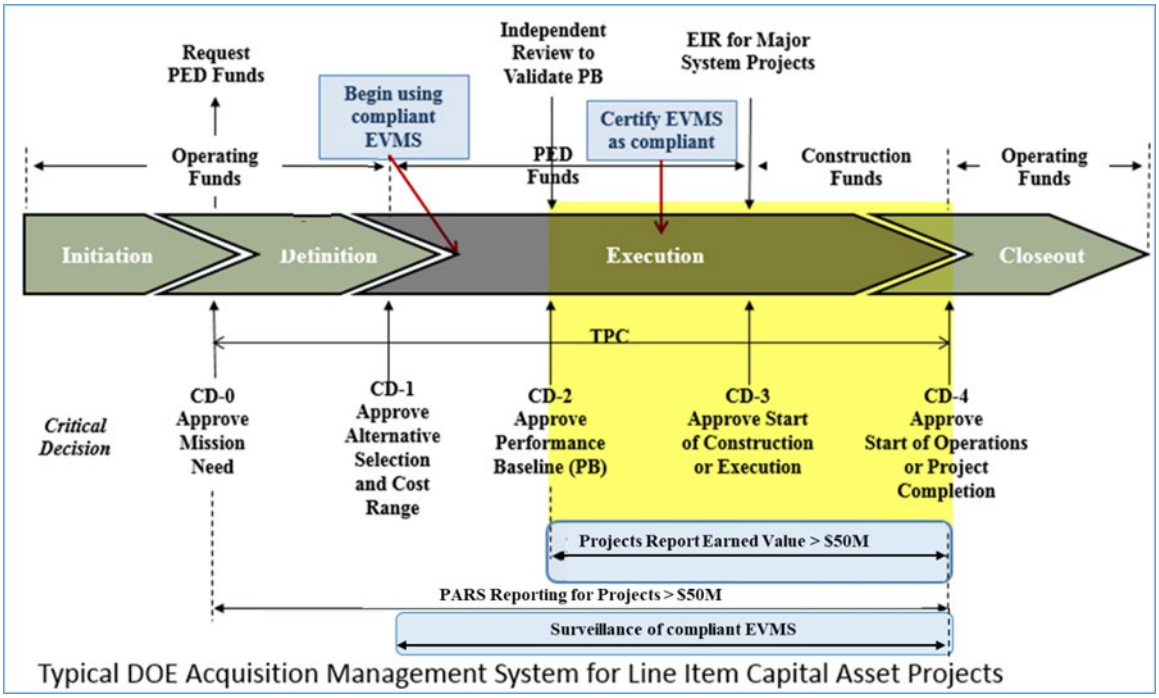
The forecast IMS is status as a minimum on the accounting month-end. This is integrated with major subcontractors and partners that are statused within one week of the prime. This is to ensure that BCWP is consistent throughout the entire project.

B.9.3. *Key project milestones are logically linked within the schedule. The schedule integrates directly from the master plan and supplements it with additional levels of detail.*

The IMP comprises a hierarchy of project events, in which each is supported by specific accomplishments, and each accomplishment is based on satisfying specific completion criteria. The IMS is an integrated, networked schedule containing all the detailed WPs and PPs (or lower-level activities) necessary to support the events, accomplishments, and criteria of the IMP.

The IMP depicts the overall structure of the project including critical milestones and events. It defines 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.

Figure 10. DOE O 413.3B CD Process and EVMS Requirements



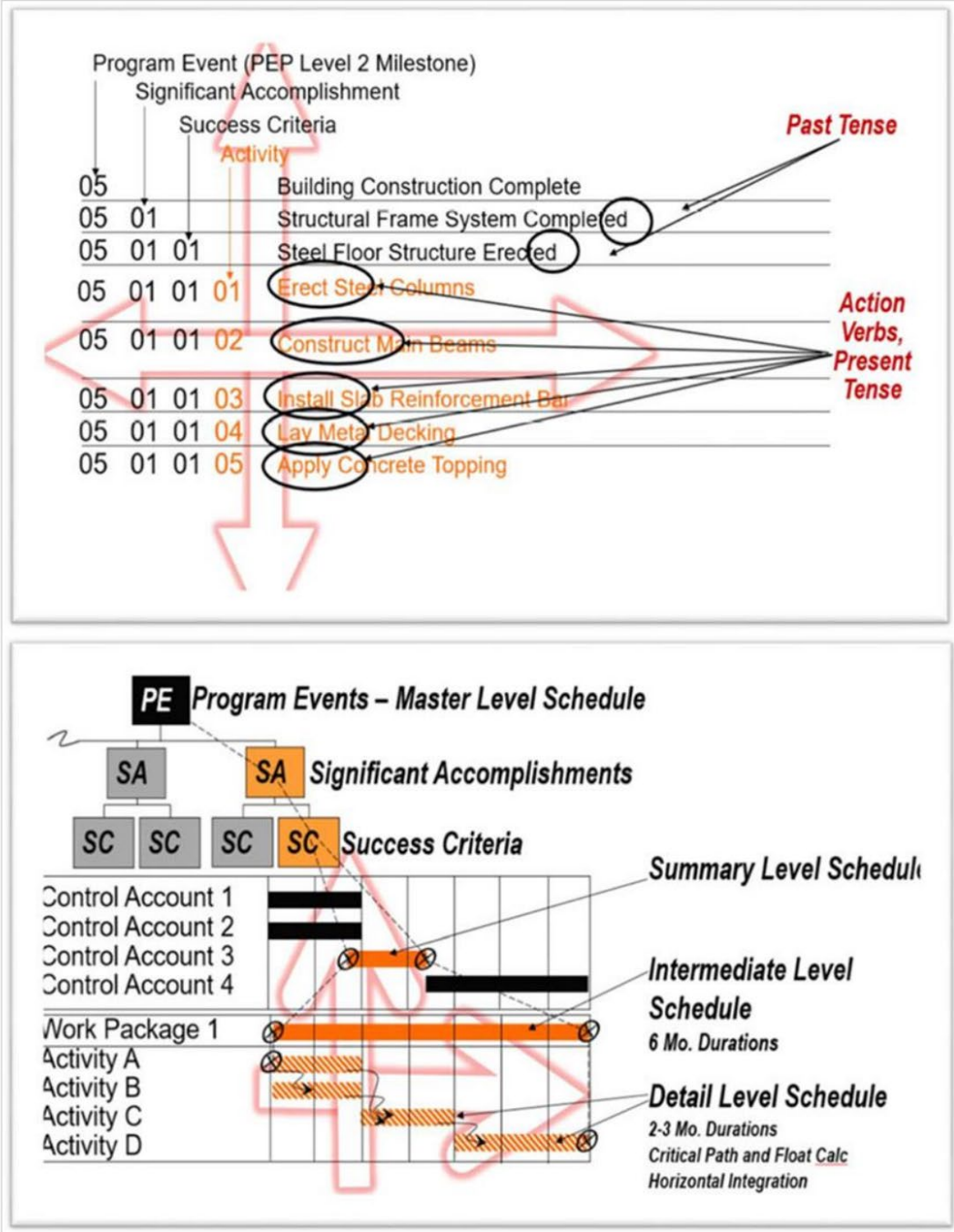
In the absence of an IMP, interim milestones and control points are used for planning and as indicators of progress to provide a close correlation to the accomplishment of technical work scope. An 'event' is defined as a high-level maturity point. This is typically CD-1, CD-2, CD-3, and CD-4. Accomplishments are generally the 5-10 things at a high level that when complete indicates the event is complete. The criteria are the steps that prove the accomplishment has been finished. Having the schedule hierarchy in this fashion shows that the schedule is based on accomplishing the technical objectives of the project. The IMS is directly traceable to the IMP, or 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 paths with the least amount of float.

Figure 11 shows the single numbering schema that enables traceability through the project schedule. Each activity is 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 are typically written in the past tense to signify accomplishment at complete, such as structure erected. Activities are typically written using action verbs, and present tense to signify what actions are required to achieve the Success Criteria. WP activities of 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 (Figure 11).

Figure 11. IMP and IMS Single Numbering System



B.9.4. *A sufficient number of interim measures are defined to ensure performance is measured as accurately as possible.*

The IMS detail tasks/activities align with the objective interim performance measures to enable accurate performance assessment. A sufficient number of interim measures are defined after the

detailed schedule tasks and activities are established to ensure performance is measured as accurately as possible.

B.9.5. *Adequate numbers of milestones and goals are established to measure the progress of the project.*

The scheduling system is initially constructed to ensure that there are technical and other milestones (goals or other concrete evidence of work activity completion) that can be used to measure how much work has been accomplished at any point in time throughout the life of a project.

B.9.6. *Documented interim measures are based on the completion criteria developed for each increment of work used to assess the physical and technical completion of work.*

Interim performance goals and measures are identified and approved. From a schedule perspective, the time-based impact of technical performance progress measured using QBDs at the WP activity level is reconciled within the IMS calculation. The project schedule considers objective product or milestone completion criteria that are meaningful indicators of progress and address the physical or tangible completion of work. Interim measures are based on the completion criteria developed for each increment of work and provide a basis for objectivity, limiting the subjectivity of the measurement of work accomplished. Accurate schedule status depends on the selection of objective measures of progress to indicate work completion. These measures are necessary to substantiate technical achievement against the schedule plan and justify progression to the next CA or lower-level task/activity. 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. Completion criteria for work packages and activities/milestones clearly indicate what constitutes completion. Naming conventions of activities play an important role in providing clarity to "what complete looks like."

Impact of Ineffectiveness

Without identifying objective products and milestones in the schedule that are meaningful interim indicators of progress, the project team cannot rely on the schedule to track actual technical accomplishments 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 them on time.

Special Considerations

None.

B.10. Time-Phased Performance Measurement Baseline (PMB)

The PMB is an integrated, time-phased budget plan for the accomplishment of all work scope and technical requirements, which is fully aligned with resource planning and the project schedule (Table 19). This means the authorized work activities in the IMS align with the time-phased budget and resource plans.

The time-phased PMB is integrated with the budgeting and work authorization subprocess.

Table 19. Attribute B.10. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**The time-phased PMB and the resource plan is inadequate or insufficient due to missing resources or being unrealistic. It does not reflect how it meets all work scope and technical requirements within budget and schedule constraints.**	**Most of the time-phased PMB and resource plan is established but does not reflect how it meets all work scope and technical requirements within budget and schedule constraints.**	**The time-phased PMB and resource plan is fully established and meets all work scope and technical requirements within budget and schedule constraints**	**The time-phased PMB and the resource plan is tested automatically utilizing a parametric or other statistical method, and is actively used by management to inform decision-making.**
	Technical requirements and key performance parameters are not aligned to the work scope and the time-phased resource plan. The schedule shows inconsistent resource distributions with significant peaks and valleys reported for the levels needed. There is limited documentation related to how the time-phased resource plan was established for accomplishing the work scope.	Most technical requirements and key performance parameters are aligned to the work scope and the time-phased resource plan. The documented time-phased resource plan, while not optimal, is considered achievable for accomplishing the work scope. The Time-Phased PMB is coordinated with the Budgeting and Work Authorization subprocess.	(B.10.1) All technical requirements and key performance parameters are aligned to the work scope and the time-phased resource plan. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (B.10.2) The project has completed an external review, such as an IBR, to ensure that the time-phased PMB and resource plan meets all work scope and technical requirements within cost and schedule constraints. (B.10.3) The time-phased resource plan and subsequent resource levels are optimized for accomplishing the work scope. (B.10.4) The time-phased PMB is integrated with the budgeting and work authorization subprocess.	Resource allocation determinations are documented and have been developed utilizing a parametric or other statistical methods against previous similar work. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of the PMB are fully disclosed to all key stakeholders, who maximize their use. Identified issues resulting from the external assessment are monitored and tracked to closure. An external review is conducted with each major contract modification. The PMB is continuously improved and optimized.

Objective

The time-phased PMB and resource plan is fully established and meets all work scope and technical requirements within budget and schedule constraints. Realistic time-phased budgets, tied to the authorized scope of work, are established as early as possible after contract award or authorization to proceed (ATP) to promote effective performance measurement. An integrated schedule facilitates the establishment of a valid PMB. Scheduling the 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. When maintained properly, the IMS provides project management insight into the program's progress and its planned and forecast duration. When the PMB and schedule baseline are realistic with meaningful performance measures or interim milestones representative of technical accomplishment, time-based analysis of the planned and actual status of completed work can be used to provide reliable forecasts of completion dates for scheduled work.

Effectiveness Criteria

B.10.1. *All technical requirements and key performance parameters are aligned to the work scope and the time-phased resource plan. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The baseline schedule is a plan that represents the way the work scope will be executed at the time it is established. This plan ensures resources for accomplishing the work are time-phased and consistent with all authorized and scheduled work scope and technical requirements. The contractor ensures that the resource plan is executable within budget and schedule constraints. The baseline schedule is maintained to continually enable a comparison of the planned and actual status of technical accomplishment based on milestones or other indicators used by the contractor for control purposes. As the PMB is maintained to reflect a realistic plan in terms of resource requirements, the baseline schedule also reflects a realistic plan in terms of activity durations. The schedule is baselined to be consistent with 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 that the use of late dates is not for reasons of having the EVMS generate positive metrics.

The baseline estimates are supported by historical estimates as available. These types are supported by parametric estimates to support projects with different technical requirements. This ensures the baseline is reasonable and based on sound reason. Normally this detail is available at CD-2 and used to establish budgets and durations after the CD-2 approval.

B.10.2. *The project has completed an external review, such as an IBR, to ensure that the time-phased PMB and resource plan meets all work scope and technical requirements within cost and schedule constraints.*

The IBR or equivalent was discussed in Effectiveness Criteria B.6.5.

B.10.3. *The time-phased resource plan and subsequent resource levels are optimized for accomplishing the work scope.*

Resource leveling is a project management technique that involves resolving overallocation or scheduling conflicts to ensure a project can be completed with the available resources. Resources include the time, materials, or tools needed to complete a project. The purpose of resource leveling is to get the most out of available resources while working within the project's time, cost, and scope constraints.

The project puts realistic resource capacities in the IMS as applicable or justifies why the resources are unlimited from the project perspective.

B.10.4. *The time-phased PMB is integrated with the budgeting and work authorization subprocess (Section 3.2).*

Impact of Ineffectiveness

A less than fully established time-phased PMB does not fully align with the time-phased resource plan and the project schedule impacts government and contractor management's ability to use the PMB as a common reference point for evaluating and communicating cost and schedule progress and providing reliable schedule forecasts for remaining work. 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 project back on plan.

Lack of a detailed plan inhibits the usefulness of the IMS and PMB for giving 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.

Special Considerations

None.

Subprocess C. Budgeting and Work Authorization

The budgeting and work authorization subprocess focuses on developing plans and strategies to achieve the desired project cost, schedule, and technical objectives, including the identification of short-and long-term resource needs. The 12 attributes that constitute this subprocess set the foundation for integrating scope, schedule, and budget into a baseline, against which performance is measured. This baseline, called the PMB, is managed primarily at the CA 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. This gives the government and contractor a common reference point for discussing project progress and status.

Budgeting and work authorization is the subprocess for establishing cost targets for individual segments of authorized work, giving permission only for authorized work, and reflecting the authorized changes in the budget.

The budgeting and work authorization subprocess considers the following key factors:

- **C.1.** The authorized scope, schedule, and budget align at the WP and PP levels, including the alignment of budgets with the project schedule to establish the time-phased PMB.
- **C.2.** SLPPs contain a scope that cannot be practically identified to a CA and is held at the project level until further defined.
- **C.3.** All WADs identify the authorized scope of work, performance period, and the budget reconcilable to the WBS, control account plans (CAPs), BOE, and project schedule.
- **C.4.** All WADs are approved before the authorized work is allowed to begin and actual costs are incurred.
- **C.5.** All budgets are planned and authorized by elements of cost (EOCs).
- **C.6.** All WPs and PPs are logical decompositions of authorized work scope, schedule, and budget that are distinguishable subdivisions of a CA with realistic and short durations.
- **C.7.** WP and PP budgets are based on dollars, hours, or other measurable units assigned to the authorized work scope.
- **C.8.** Appropriate EVTs are assigned and performance is earned consistent with the way work was planned, performed, and progress measured.
- **C.9.** LOE work scope is identified and controlled with minor exceptions where CAs record separate WPs for LOE and discrete activities.
- **C.10.** The management reserve (MR) budget is established and identified separately from the PMB and commensurate with the risk identified in the project.
- **C.11.** Undistributed budget (UB) values have an identified work scope and are appropriately recorded in a control log and distributed/dispositioned promptly.
- **C.12.** The project's target cost value is reconciled with the PMB and MR values.

As shown in Figure 5, the budgeting and work authorization subprocess considers 12 management attributes that collectively account for 178 (or 18%) of the 1,000 possible points of

the maturity model at level 5. Of these, C.1 is the highest weighted management attribute (Figure 6).

C.1. Scope, Schedule, and Budget Alignment

This attribute aims create a time-phased, resourced plan against which the accomplishment of authorized work is measured (Table 20). Alignment among the project scope, schedule, and budget is critical for effective project control. The PMB is time-phased in alignment with the IMS. Similarly, the budget is aligned per the appropriate accounting calendar for the authorized work scope, including all CAs and SLPPs.

Projects establish and maintain a time-phased budget baseline at the CA level, against which program performance can be measured. Initial budgets set for performance measurement are based on either internal management goals or the external customer negotiated target cost, including estimates for authorized but undefinitized work. The budget for far-term efforts may be held in higher-level accounts until an appropriate time for allocation at the CA level.
The scope, schedule, and budget alignment for PMB development is integrated with the organizing, planning and scheduling, analysis and management reporting, material management, and subcontract management subprocesses.

Table 20. Attribute C.1. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**The scope, schedule, and budget are not aligned. The budget data does not match the IMS for the time-phasing of the PMB.**	**The scope, schedule, and budget are aligned at the CA level. The budget data is in alignment with the IMS for the time-phasing of the PMB to the CA level.**	**The scope, schedule, and budget are aligned at the WP/PP level. The budget data is in alignment with the IMS for the time-phasing of the PMB to the WP/PP level.**	**The IMS time-phasing of the PMB is at least to the WP/PP level (or lower), matches the project/ program's resource plan, and is proactively used to inform management decision-making.**
	Both the EVMS budgeting tool and the IMS contain project data. However, the time-phased data in the budget tool does not align with what is being reported in the IMS. The IMS does not show time-phasing of scope, but rather it shows event timeframes or milestone events.	The time-phasing of the budget data aligns with both the WADs and the IMS, at the CA level. The time-phasing of the budget data does not align at the WP/PP level in the IMS, nor does it align at the WP/PP level within the CAP. The Scope, Schedule and Budget Alignment for PMB development is coordinated with the Organizing, Planning and Scheduling, Analysis and Management Reporting, Material Management, and Subcontract Management subprocesses.	(C.1.1) The time-phasing of the budget data aligns with the authorized scope, the IMS, and the CAP at both the CA and WP/PP levels. (C.1.2) The scope, schedule and budget alignment for PMB development is integrated with the organizing, planning and scheduling, analysis and management reporting, material management, and subcontract management subprocesses.	The time-phased data in the budgeting tool is supported by a resource plan that shows the project stakeholders have a viable plan for labor and resource allocation needed to perform the authorized scope. The scope, schedule and budget alignment is monitored, used for management control and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of scope, schedule and budget alignment is fully disclosed with all key stakeholders, who maximize their use. The scope, schedule and budget alignment is continuously improved and optimized.

Objective

The scope, schedule, and budget are aligned at the WP and PP level. The budget data align with the IMS for the time-phasing of the PMB to the WP and PP level. This plan ensures that resources for accomplishing the work are time-phased and 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 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 schedule. Establishing realistic budgets, directly tied to the authorized scope of work, is essential for each organization responsible for performing project efforts. Also, the PMB is established and used as early as possible after contract award or ATP for effective performance measurement.

Effectiveness Criteria

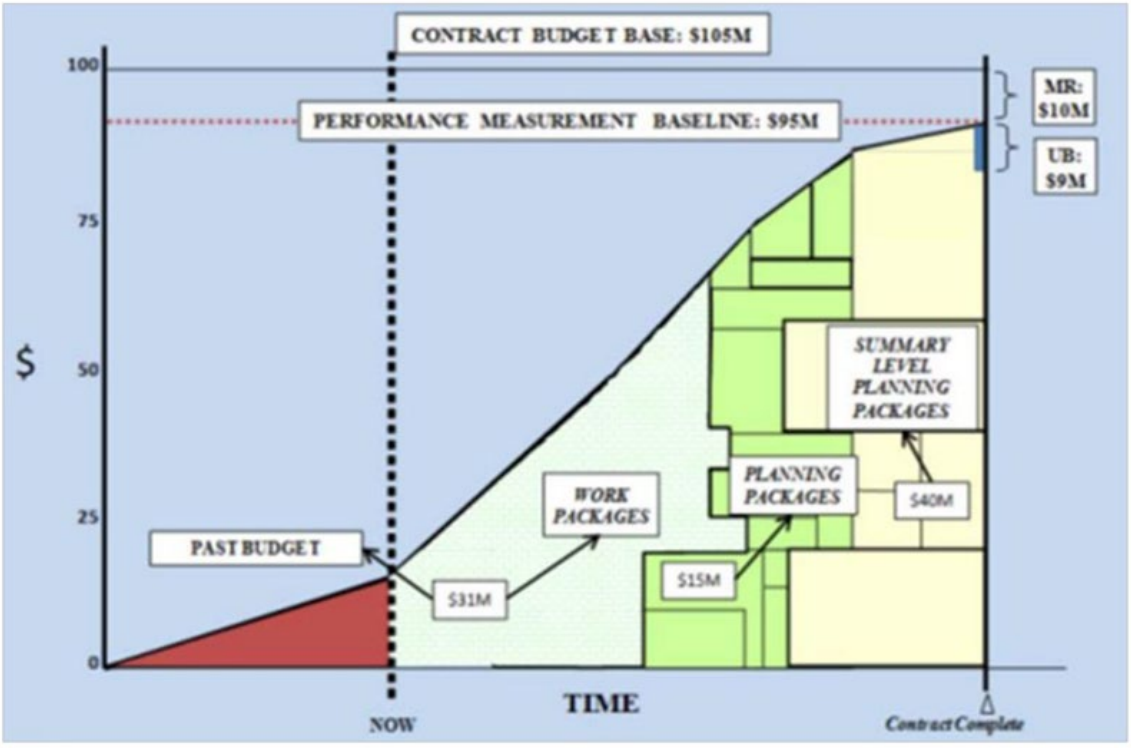
C.1.1. *The time-phasing of the budget data aligns with the authorized scope, the IMS, and the CAP at both the CA and WP/PP levels.*

This criterion ensures that the same scope is aligned with the same schedule, which is aligned with the same budget in the cost and schedule systems. The alignment of authorized work scope, schedule, and budget between cost and schedule subsystems is critical for establishing a credible PMB and meaningful performance measurement. Every CA and SLPP has related work scope, schedule, and budget to develop a common reference point for the accurate and meaningful measure of performance and progress. Planning work scope to an unrelated schedule and budget will result in operating inefficiencies and reporting errors.

The PMB is an integrated time-phased budget plan for accomplishing work scope requirements on a project having complete alignment to resource planning and the project schedule (Figure 9). The PMB includes any UB that is not yet time-phased (See attribute D.10) before its distribution. The PMB's time-phased budget is 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 ensures the resource plan is executable within budget and schedule constraints and is realistic to achieve the work scope. Additionally, the contractor uses current rates (approved, provisional, or proposed) when establishing the PMB. CA budgets, including material and subcontract budgets, are time-phased and consistent with the project schedule. The budgets by CA reported in the RAM reconcile with the budgets by CA written in the IPMR Format 1.

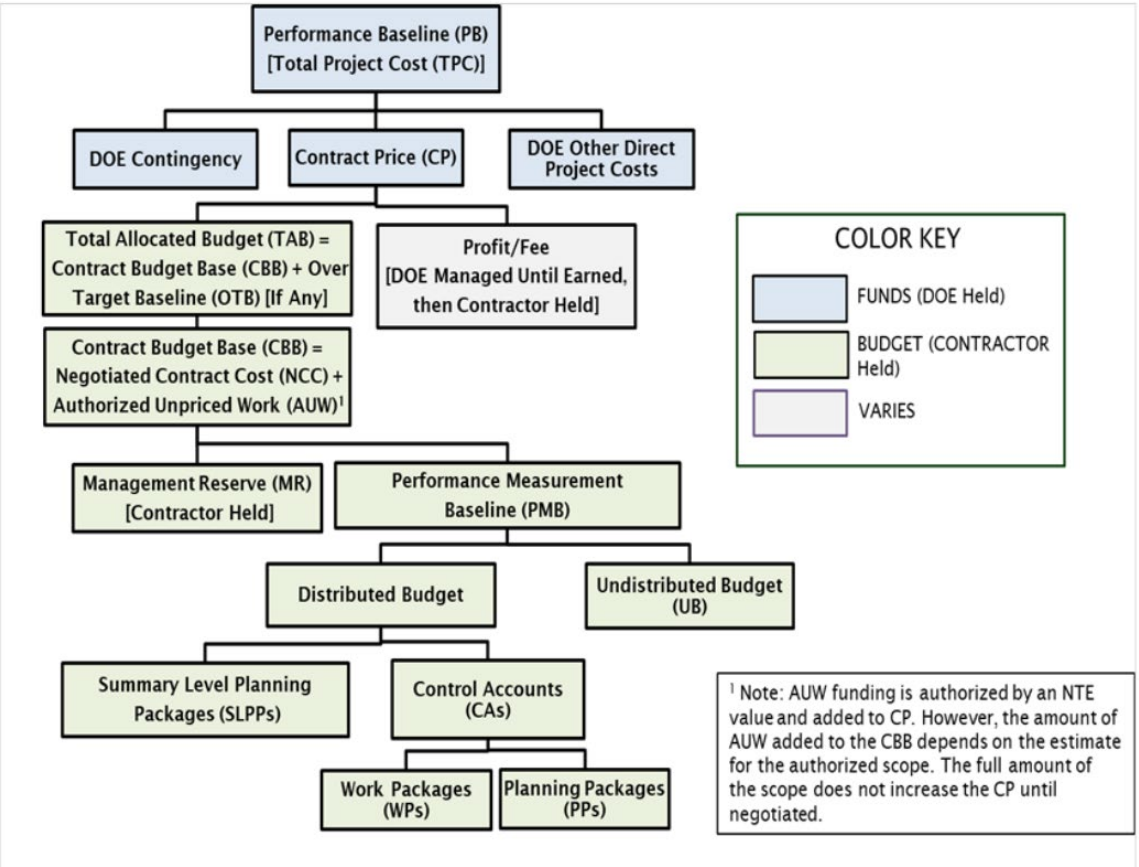
The PMB is planned consistent with the IMS's baseline schedule dates and durations for authorized work (Figure 12). As CAs and WPs are scheduled to begin, the CA scope, budget, and baseline schedule are authorized as documented in the work authorization. At a minimum, charges are collected at the CA 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 occur at the WP level. When work is stated 100% complete, the applicable charge numbers for that labor scope are closed; however, they may need to remain open for lagging costs (estimated actuals reported) or rate changes for final year-end reconciliation. The CAM remains responsible for the current EAC until the final closure.

Figure 12. Time Phasing the PMB



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 for managing 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 work measurement 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 that are critical in arriving at an accurate EAC. Figure 13 depicts a project baseline hierarchy, including an explanation of budget (contractor held) versus funds (DOE held).

Figure 13. Baseline Hierarchy



Zero budget WP activities have no performance measurement value and thus have an adverse impact on the establishment and maintenance of the PMB. However, on a limited basis, the use of zero budget, non-resource baseline activities are permissible for scheduling fixed-price procurements only. The use of these activities is intended to enhance the planning and scheduling of subcontract work to increase the effectiveness/usefulness of the project schedule. The budgeted dollar value of the progress payment (or payment milestone) is identified in the project schedule. A logical network diagram describes how all procurement-related zero budget, non-resource activities flow through the project schedule. They are to be logically linked to the progress payment milestone for which the work is intended so that the progress payment milestone is dependent on the 100% completion of all of the required zero budget, non-resource baseline activities. Like all other budgeted activities in the project baseline schedule, these activities reflect how the work will be executed and follow the exact configuration control requirements defined in the contractor's EVM system description. These activities are replicated in the forecast schedule. The total number of incomplete activities from the project start through the current period is not to equal or exceed 5%. It is essential that the contractor emphasize their limited use, given that they are not a natural feature within a PMB.

C.1.2. *The scope, schedule, and budget alignment for PMB development is integrated with the organizing, planning and scheduling, analysis and management reporting, material management, and subcontract management subprocesses (Section 3.2).*

Impact of Ineffectiveness

An inaccurate PMB impacts the 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 to effectively implement actions to maintain or bring the program back on plan. To support project management, direct costs are required to 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.

Special Considerations

This maturity attribute is intended to focus on the budgetary aspects of the PMB, whereas attribute B.10 focuses on the time-phasing of the PMB. DOE also clarified the budget versus funds aspects and the zero-budget activities (ZBAs).

C.2. Summary Level Planning Packages (SLPPs)

SLPPs are established above the CA level for future efforts that cannot be practically identified by a CA (Table 21). Each SLPP identifies scope, schedule, and associated budget, amended by the end of the project delivery period. The SLPP budgets are identified specifically to the work for which it is intended, time-phased, periodically reviewed for validity, and not used to perform other scopes of work. SLPPs are subdivided to the extent practical into CAs at the earliest opportunity. SLPPs need to be integrated with the planning and scheduling, and change control subprocesses.

Table 21. Attribute C.2. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**SLPP budgets have changed over time without evidence of scope addition or deletion. SLPPs contain a scope that is actively being delivered.**	**SLPPs contain a scope that has sufficient detail to be assigned to a CAM and to be time-phased into the existing schedule.**	**(C.2.1) SLPPs contain a scope that cannot be practically identified to a CA and is held at the project management level until further defined.**	**The project actively evaluates SLPP scope and enforces restrictions on the time allowed for a scope to stay undefined.**
	SLPPs have incurred actual costs and are being performed. SLPPs exist in the IMS in the current period or within the freeze period. After the establishment of the initial PMB, SLPPs are not monitored or assessed for scope, schedule, and budget until the end of the project, or reconciled in budget logs during conversion into CAs.	Following the issuance of a supplemental agreement, SLPPs are planned based upon the authorized scope, schedule, and budget. Upon contract modifications, the internal contract authorization identifies the scope, period of performance, and budget; and the PM assigns responsibility to planning the SLPP in the IMS. The SLPPs are coordinated with the planning and scheduling and change control subprocesses.	(C.2.2) Existing SLPPs are routinely evaluated for scope, schedule, and budget to the end of the project, and when converted to CAs, SLPPs are assigned to a CAM and reconciled in budget logs. (C.2.3) The SLPPs are represented in the IMS and time-phased into the existing schedule. (C.2.4) The project team ensures that the responsible engineer (or functional manager) assigned responsibility for the SLPP has properly planned the SLPP for the authorized scope, schedule, and budget. (C.2.5) The SLPPs are integrated with the planning and scheduling and change control subprocesses.	SLPPs are continuously evaluated for scope, schedule and budget to the end of the project. SLPP and budget log data are monitored, used for management control, and are automatically tested to assess system health and integrity. Routine surveillance results of SLPPs are fully disclosed to all key stakeholders, who maximize their use.

Objective

The maturity objective of this attribute facilitates the establishment of a valid PMB using SLPPs when it is impractical to plan authorized work in CAs. These budgets are identified to higher WBS or organizational levels for subdivision into CAs at the earliest opportunity.

Effectiveness Criteria

C.2.1. *SLPPs contain a scope that cannot be practically identified to a CA and is held at the project management level until further defined.*

C.2.2. *Existing SLPPs are routinely evaluated for scope, schedule, and budget to the end of the project, and when converted to CAs, SLPPs are assigned to a CAM and reconciled in budget logs.*

The PMB, exempting UB, is the time-phased budget plan that comprises SLPPs and CAs. SLPPs are for a 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 detailed in WPs for the near-term effort and planned in PPs for the far-term effort.

SLPPs are an aggregation of work for far-term efforts due to the lack of definition. SLPPs are regularly monitored and assessed to determine the practicality of distribution to CAs. SLPP scope, schedule, and budget are distributed to a CA when practicable but consistent with rolling wave planning processes and freeze period controls before the work begins. SLPPs and PPs without a distinct scope, schedule, and budget defined by EOC impact management's visibility into remaining far-term efforts. 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 action 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.

C.2.3. *The SLPPs are represented in the IMS and time-phased into the existing schedule.*

SLPPs are considered in the baseline IMS to determine the project's critical path, milestones, and deliverables. SLPPs may be supported by detailed activities to support additional linkage and a robust network. LOE is recommended to be in separate PPs from discrete.

C.2.4. *The project team ensures that the responsible engineer (or functional manager) assigned responsibility for the SLPP has properly planned the SLPP for the authorized scope, schedule, and budget.*

In functional departments, specific team members are responsible for SLPP planning. These functional managers can be PMs, future CAMs, or others as long as they understand the scope, schedule, and budget of the SLPPs.

C.2.5. *The SLPPs are integrated with the planning and scheduling, and change control subprocesses (Section 3.2).*

Impact of Ineffectiveness

SLPPs without a distinct scope, schedule, and budget defined by EOC question the PMB validity and hinder management's visibility and understanding of the remaining far-term effort.

Special Considerations

None.

C.3. Work Authorization Documents (WADs)

The purpose of this attribute is to establish budgets for authorized work to identify significant cost elements (labor, material, etc.) as needed for internal management and control of subcontractors (Table 22).

Table 22. Attribute C.3. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	Some WADs identify SOW, period of performance, and budgets, and are traceable to the WBS, OBS, CAP, CAM's BOE, and schedule.	Most WADs identify the scope of work, period of performance, and budgets, and are traceable or reconcilable to the WBS, OBS, CAP, CAM's BOE, and schedule.	All WADs identify the scope of work, period of performance, and budgets, and are traceable or reconcilable to the WBS, OBS, CAP, CAM's BOE, and schedule.	Traceability and reconciliation of WADs are institutionalized in the tools, monitored, and documented monthly, and proactively used to track authorized work and associated scope, schedule, and budget and to assign or transfer ownership to each CA.
	WAD policies and procedures are not yet reviewed. WAD data sources (WBS, OBS, CAP) are not fully developed. WADs/CAPs are not fully supported by EOC breakouts and periods of performance. They are not traceable to time-phasing in the schedule nor planned according to how work will be executed. Some WADs authorize scope, schedule, and budget, based in part on the associated BOE.	WAD policies and procedures are drafted and reviewed. WAD data sources (WBS, OBS, CAP) are in various stages of development. WADs/CAPs are supported by EOC breakouts and periods of performance. WADs may not be fully traceable to time-phasing in the schedule nor planned according to how work will be executed. Most WADs authorize scope, schedule, and budget, based on an associated BOE. Procedures are in place addressing the development and use of BOEs by those responsible for authorizing, planning, and performing the work. Differences between BOE and WAD values are traceable and reconcilable. Work authorization is coordinated with the organizing and planning and scheduling subprocesses.	(C.3.1) WAD policies and, procedures are approved and implemented across the applicable scope for all CAs. (C.3.2) WAD data sources are fully developed, approved for use, and under configuration control. CAPs are budgeted by EOC as an extension of the WADs. WADs are fully traceable to time-phasing in the baseline schedule and planned according to how work will be executed. (C.3.3) All project work scope, schedule, and budget (including hours, as applicable) identified in the WADs are realistic and reconcilable with the associated BOE based on past performance of similar nature, documented, or proven estimating practices, or similar methods. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. WADs provide the basis for a mutually agreed-to scope, schedule, and budget that serves as the basis for measuring performance, forecasting budgets, schedules, and managing work. (C.3.4) Differences between BOE and WAD values are understood, reconcilable to material, procurements, and subcontracts, and used as a basis for the identification of risks and opportunities. (C.3.5) Work authorization is integrated with the organizing and planning and scheduling subprocesses.	Throughout the project lifecycle, BOEs are continually updated based on known risks, realized risks, and performance to date. WADs are continuously maintained and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved, leading to continuous improvement and optimization. Routine surveillance results of WADs data are fully disclosed to all key stakeholders, who maximize their use.

WADs identify the Scope of Work (SOW)/Statement of Objectives (SOO), period of performance, and budgets (including hours, as applicable). The Work Authorization is used to

verify that the start of work and the expenditure of costs are initiated through a documented authorization process. This process provides budget authorization for the CAM to start work efforts. Approved work authorization precedes the baseline start and actual start of work. Work does not begin before authorized by an initial work authorization. Formally authorizing the work ensures the assignment of all project work scope to the responsible organization is documented, and the resources required for completing the work are budgeted and acknowledged by the management team before the commencement of work. A budget is established for the work scope, which is then further broken down by the EOC for labor, material, subcontractor, and other direct charges required.

Work authorization is integrated with the organizing, and planning and scheduling subprocesses.

Objective

All WADs identify the scope of work, period of performance, and budgets, and are traceable or reconcilable to the WBS, OBS, CAP, CAM's BOE, and schedule.

Approved work authorization precedes the baseline start and actual start of work. No work begins before an initial work authorization authorizes work. Formally authorizing the work ensures the assignment of project work scope to the responsible organization is documented, and the resources required for completing the work are budgeted and acknowledged by the management team before the commencement of work. A budget is established for the work scope that is then further planned by the EOCs for labor, material, subcontractor, and other direct charges required.

Effectiveness Criteria

C.3.1. *WAD policies and procedures are approved and implemented across the applicable scope for all CAs.*

C.3.2. *WAD data sources are fully developed, approved for use, and under configuration control. CAPs are budgeted by EOC as an extension of the WADs. WADs are fully traceable to time-phasing in the baseline schedule and planned according to how work will be executed.*

Work authorization includes the CA related to the WBS element and responsible organization. An approved CA by way of the work authorization process is the contractor PM's vehicle to delegate responsibility for the budget, schedule, and technical scope requirements to a designated CAM. The WAD is an integration document that demonstrates the integration of scope, schedule, and budget for the CA. A CA budget is established for the work scope that is then further planned by EOCs for labor, material, subcontractor, and other direct charges required to accomplish it. The establishment of the initial PMB begins shortly after CD-1 approval.

C.3.3. *All project work scope, schedule, and budget (including hours, as applicable) identified in the WADs are realistic and reconcilable with the associated BOE based on past performance of similar nature, documented, or proven estimating practices, or similar methods. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. WADs provide the basis for a mutually agreed-to scope, schedule, and budget that serves as the basis for measuring performance, forecasting budgets, schedules, and managing work.*

The formal work authorization process extends from the project level to the CA/SLPPs. 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 developing the WP budgets, as details by EOC are found in this document. The WP budgets plus PP budgets (if any) sum to equal the CA budget. Material and installed equipment budgets are 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 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 similar equipment. 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 are converted to dollars by applying 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.

The EC also requires problems to be identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. For DOE purposes, this required process is discussed in subprocess area G.

C.3.4. *Differences between BOE and WAD values are understood, reconcilable to material, procurements, and subcontracts, and used as a basis for the identification of risks and opportunities.*

The basis of the estimate is continuously reviewed and reconciled with the WAD's budget and period of performance. PM and CAM discuss significant differences, and consideration is made for entry as a risk or opportunity in the risk register.

C.3.5. *Work authorization is integrated with the organizing, planning and scheduling subprocesses (Section 3.2).*

Impact of Ineffectiveness

Inadequate work authorization increases the risk of performing unauthorized work and cost overruns. Unauthorized expenditures, budgets, and scheduled activities before formal work authorization may indicate a lack of program management attention and control over resources, baseline plans, and schedule resulting in poor execution of contract 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.

Special Considerations

None.

C.4. Work Authorization Prior to Performance

Scope, schedule, and budget authorization are needed before work performance is executed and actual costs are incurred (Table 23). Approved WADs precede the baseline start and actual start of work. Work does not begin before work scope, schedule, and budget are formally authorized by an approved WAD. This process serves as both a planning and control function. It ensures that the assignment of the program work scope to the responsible organization is documented. It also ensures that the resources required for completing the work are budgeted by EOCs within

the baseline schedule period of performance and are acknowledged by the management team before the commencement of work.

For emerging work associated with Authorized Unpriced Work (AUW), authorization is needed before work is performed and actual costs are incurred. Interim authorization may be approved by the contractor PM through a directive as long as it is replaced with a formal work authorization approved by the CAM. This process allows for authorization of emergency work consistent with the intent of earned value.

Work authorization before the performance process is integrated with the planning and scheduling and accounting considerations subprocesses to ensure actual costs are not incurred before the WAD signature.

Table 23. Attribute C.4. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**Some WADs are approved before the work is allowed to begin and actual costs are incurred.**	**Most WADs are approved before the work is allowed to begin and actual costs are incurred, but the authorized value does not align or is not reconcilable to the budgeting tool.**	**All WADs are approved before the work is allowed to begin and actual costs are incurred. The authorized value in the WAD aligns and is fully reconcilable to the budgeting tool.**	**WADs authorized values are traceable and continually reconcilable to the budgeting tool.**
	WAD policies, procedures, and processes identifying roles and responsibilities (signature approvals) are not yet drafted and reviewed for alignment with the governing requirements. WADS are unsigned and are not issued before work performance. A dollarized RAM or similar document identifying the intersection of the WBS and the OBS at the CA/CAM level is not yet developed. CA charge numbers unique to the CA for cost accumulation and reporting are not yet established.	WAD policies, procedures, processes identifying roles and responsibilities (signature approvals) drafted and reviewed for alignment with the governing requirements, but not yet approved. WADS are signed and issued before work performance for most scopes. A dollarized RAM or similar document identifying the intersection of the WBS and the OBS at the CAM level is in draft development but requires reconciliation and validation. CA charge numbers unique to the CA for cost accumulation and reporting established, but reports require reconciliation and validation. The work authorization before performance process is coordinated with the planning and scheduling and accounting considerations subprocesses.	(C.4.1) WAD policies, procedures, and processes identifying roles and responsibilities (signature approvals) align with governing requirements and are approved and implemented for use. WADS are authorized before work performance for all applicable scope. (C.4.2) A dollarized RAM or similar document identifying the intersection of the WBS and the OBS at the CA/CAM level is reconciled, validated, approved, and implemented for use. (C.4.3) All necessary change control documentation has been generated including cost account charge numbers unique to the CA (for cost accumulation and reporting) are established, reconciled, and validated. (C.4.4) The work authorization before performance process is integrated with the planning and scheduling and accounting considerations subprocesses.	Work authorization before performance is monitored, used for management control, and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of the work authorization process are fully disclosed to all key stakeholders, who maximize their use. The work authorization process is continuously improved and optimized.

Objective

All WADs are approved before the work is allowed to begin and actual costs are incurred. The authorized value in the WAD aligns and is fully reconcilable to the budgeting tool.
Approved work authorization precedes the baseline start and actual start of work. No work begins before an initial work authorization authorizes work. Formally authorizing the work ensures the assignment of project work scope to the responsible organization is documented, and the resources required for completing the work are budgeted and acknowledged by the management team before the commencement of work. A budget is established for the work

scope that is then further planned by the EOCs for labor, material, subcontractor, and other direct charges required.

Effectiveness Criteria

C.4.1. *WAD policies, procedures, and processes identifying roles and responsibilities (signature approvals) align with governing requirements and are approved and implemented for use. WADS are authorized before work performance for all applicable scope.*

Approved WADs precede the baseline start and actual start of work. No work begins before work scope, schedule, and budget are formally authorized by WADs. This process is both a planning and control function to ensure that the assignment of program work scope to the responsible organization is 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 before the 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 maybe a week, a month, or longer as long as it has a 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 two months with a formal work authorization that the CAM also approves. 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 the new project scope is the result.

C.4.2. *A dollarized RAM or similar document identifying the intersection of the WBS and the OBS at the CA/CAM level is reconciled, validated, approved, and implemented for use.*

WADs have the necessary authorizing signatures confirming that the PM authorizes the CAM to begin work and incur the expenditure of costs before the start of work. The CAM is identified in the RAM. The CAM name and budget value listed on the WAD is the same CAM name and budget value listed in the RAM (at the CA level).

C.4.3. *All necessary change control documentation has been generated, including cost account charge numbers unique to the CA (for cost accumulation and reporting), are established, reconciled, and validated.*

All necessary documentation has been completed before the work effort is performed, and the expenditure of costs for that work is incurred.

C.4.4. *The work authorization before the performance process is integrated with the planning and scheduling and accounting considerations subprocesses (Section 3.2).*

Impact of Ineffectiveness

Unauthorized expenditures, budgets, and scheduled activities before formal work authorization may indicate a lack of program management attention and control over resources, baseline plans, and schedule resulting in poor execution of contract requirements.

Special Considerations

None.

C.5. Budgeting by Elements of Cost (EOC)

Through a formal work authorization process, resources required to execute the CA's scope of work are identified, planned, and budgeted by EOCs (Table 24). EOCs are a subset of the CAs and WP budgets. CAs are planned, budgeted, and segregated by EOC—labor, material, subcontract and other direct costs. The budget for indirect costs established via application of associated indirect rates is also available, such as in an indirect EOC equivalent when applicable.

Budgets for direct costs are those chargeable to a specific WP and include labor, materials, equipment, and any other resources defined by the project, along with indirect burdens. The time-phasing of material budgets is consistent with when the material is expected to be received and consumed for acceptable points for planning and measuring material. Budgets for subcontractors are time-phased to support project schedule requirements at acceptable points for planning and measuring subcontracts to vendors. Budgets may be stated in units of currency, hours, or other measurable units consistent with the budget values reflected in the CAPs. Providing the budget for indirect costs supports reconciliation between the accounting system cost elements and EVMS cost system EOCs, mitigates distortion of direct EOC variances, and enhances management's analysis and understanding of the indirect rate impacts.

EOC budgeting is integrated with the indirect budget and cost management and material management subprocesses.

Table 24. Attribute C.5. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some CA budgets are planned and authorized by EOC (labor, material, subcontract, other direct costs, and indirect costs).**	**Most CA budgets are planned but not all authorized by EOC.**	**All CA budgets are planned and authorized by EOC.**	**CA budgets by EOCs are traceable, reconciled monthly, and proactively used to track authorized work and associated scope, schedule, and budget and to assign or transfer ownership to each CA.**
	Policies, procedures, and processes establishing segregation by EOC are not yet drafted or reviewed for alignment with the governing requirements. System structure and resource coding for cost element segregation is not yet developed. EOCs are not yet integrated with the EVMS.	Policies, procedures, and processes establishing segregation by EOC were drafted, but not yet reviewed for alignment with the governing requirements. System structure and resource coding for cost element segregation are developed, but not yet reconciled or validated. EOCs are integrated with the EVMS, but not yet reconciled or validated. The EOCs are coordinated with the indirect budget and cost management and material management subprocesses.	(C.5.1) Policies, procedures, and processes establishing segregation by EOC are reviewed for alignment with the governing requirements and approved for implementation. (C.5.2) System structure and resource coding for cost element segregation are reconciled and validated for implementation and use. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (C.5.3) EOCs are integrated with the EVMS, traceable, reconciled, and validated for use. (C.5.4) The EOCs are integrated with the indirect budget and cost management and material management subprocesses.	EOC budgets are monitored, used for management control, and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of EOCs are fully disclosed to all key stakeholders, who maximize their use. The EOC budgets are continuously evaluated for opportunities to improve or optimize.

Objective

The maturity objective of this attribute is to ensure that all CA budgets are planned and authorized by EOC. An essential part of project planning and establishing a PMB is the establishment of budgets for all the authorized work. Identification of the budget EOCs documents the required resources and places work scope with the performing organization. Each CA contains the resources necessary to complete the assigned effort and budgets reflecting these resources. Budgets established at the CA level are planned by elements of cost.

Effectiveness Criteria

C.5.1. *Policies, procedures, and processes establishing segregation by EOC are reviewed for alignment with the governing requirements and approved for implementation.*

C.5.2. *System structure and resource coding for cost element segregation are reconciled and validated for implementation and use. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

EOCs are a subset of the CA and WP budgets. Initially, the BOE was developed and broken out by EOC to provide enough detail for resource planning. EOC budgets found in the WAD are direct descendants of the BOE. EOCs may vary by contractor as company accounting practices control them.

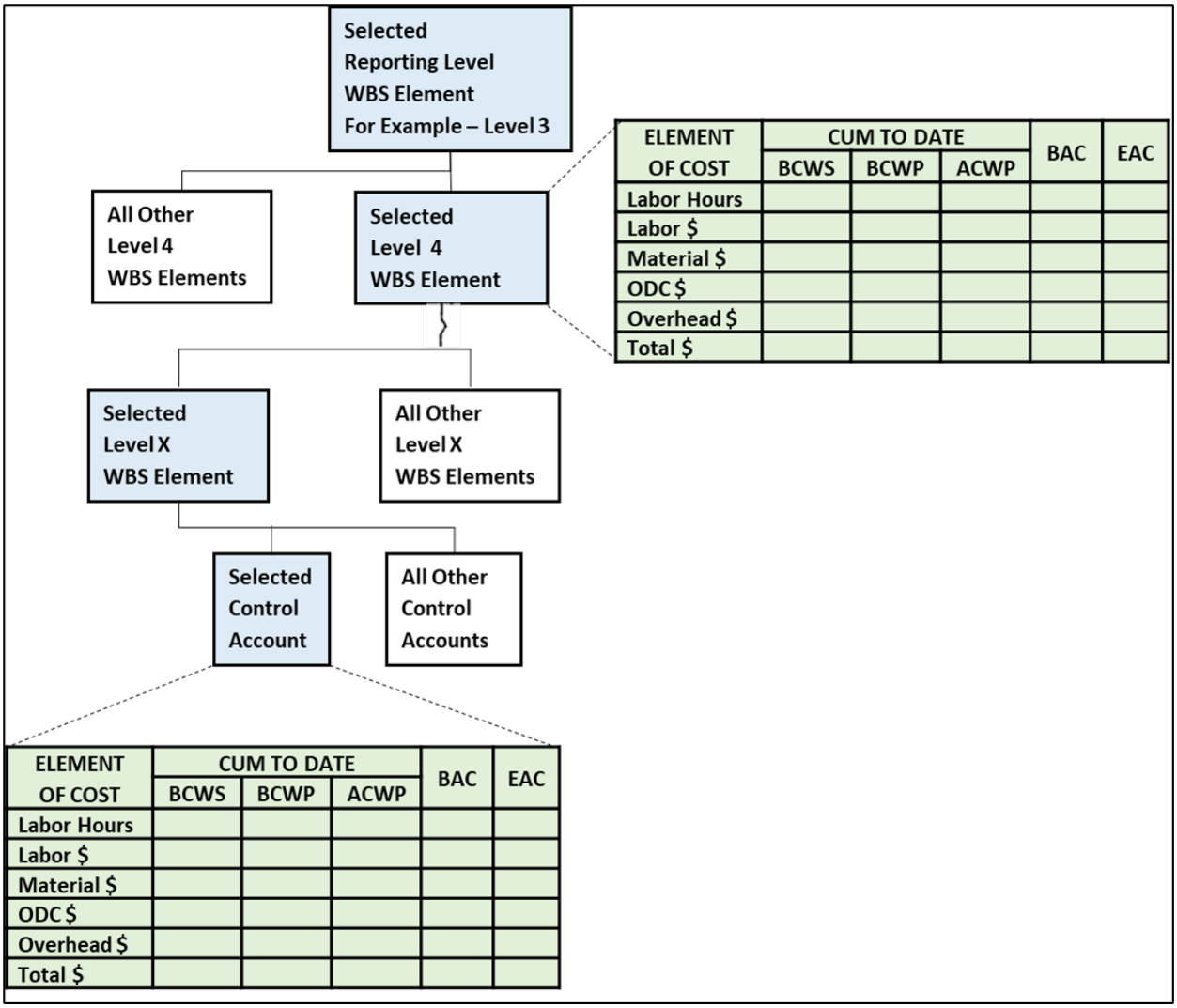
Budgets for direct costs are those chargeable to a specific WP and include labor, materials, equipment, and other resources defined by the project. The time-phasing of material budgets is consistent with when the material is expected to be received and consumed (See H.2 for acceptable points for planning and measuring material). Budgets for subcontractors are time-phased to support project schedule requirements (See Maturity I.2 for acceptable points for planning and measuring subcontracts to vendors). (See Maturity E.2 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. Far-term work efforts that cannot be detail planned are contained in PPs that have budgets segregated by EOC. CA material and subcontract EOCs are segregated from all other EOCs at the WP level. Figure 14 depicts the segregation by cost element.

The EC also requires that “Problems are identified, logged, tracked, mitigated, corrected and closed, giving management insight to make timely decisions.” This has been captured in subprocess G.3.

C.5.3. *EOCs are integrated with the EVMS, traceable, reconciled, and validated for use.*

The EOCs utilized for budgeting work scope are consistent with the approved Disclosure Statement. Identifying budgets for overhead costs supports reconciliation between the accounting system cost elements and the EVMS budgeting tool.

Figure 14. EOC Vertical Alignment



Most projects input full rates in the EVM budgeting tool. This enables the budgeting tool to handle any rate combination that exists in the entity. However, there may be cases where wrap rates are used. Wrap Rates are composite rates combined into a multiplier consistent with the disclosure statement forward pricing rates approved by DOE. When wrap rates are used, an indirect EOC equivalent, which is a unique element in the EVMS budgeting tool equivalent to a direct EOC, is available for reporting the indirect burden (budget and actuals) consistent with the accounting system.

- The indirect EOC equivalent is reconciled with indirect cost burdens in the accounting system. This ensures that labor, material, and subcontract EOCs are consistent and unburdened, as described in the CAS Disclosure Statement.
- The wrap rates for labor differ from material and ODC as applicable. Typically, only labor receives overhead.
- The indirect EOC equivalent actuals reconcile with the accounting system fringe, overhead, and G&A in the accounting system.

- Price/usage analysis is done in hours/direct cost/units without wrap rates.
- Wrap rates are provided by or approved by the CFO/Finance team as consistent with the forward pricing rates.
- Wrap rates are reviewed monthly and changed any time a base component is changed.
- It is recommended that wrap rates are only developed for rates with the same base. This is typically Fringe, Overhead, and G&A. This permits the wrap rates to calculate correctly in all circumstances.
- A separate breakout of G&A rates is recommended to comply with the IPMR DID (Section 3.2.4.3) specified in DOE O 413.3 Contract Requirements Document.

For projects with full rates in the EVMS budgeting tool, an indirect EOC equivalent is recommended for actuals only. This is to keep burdens separate from direct elements of cost. If an indirect EOC equivalent is not used for actuals, then actual burdens would need to be put as burdens for each direct EOC. This ensures that labor costs and other direct EOCs receive their fair share of the indirect costs. Indirect EOC budgets are not required if the contractor can run reports that break out direct versus indirect CA variances.

Furthermore, CAMs can segregate direct and indirect cost variance. While CAMs do not directly control indirect cost, they understand the applied indirect impacts and incorporate them into the root cause and corrective action of the CA.

C.5.4. *The EOCs are integrated with the indirect budget and cost management and material management subprocesses. (Section 3.2)*

Impact of Ineffectiveness

Lack of planning and establishing a 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 CA work scope within schedule and budget constraints. Ensuring CA 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 before formal work authorization may indicate a lack of program management attention and control over resources, baseline plans, and schedule resulting in poor execution of contract 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.

Lack of planning and establishing a 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 CA work scope within schedule and budget constraints. Ensuring CA budgets are authorized and planned by EOCs facilitates management insight into program performance at the resource level.

Special Considerations

Please reference the results of attribute A.5 for resource and schedule alignment. DOE clarified that projects need the ability to segregate direct variances in EOC from indirect cost variances, recommending a separate EOC to cover the indirect cost. Identifying, logging, tracking,

mitigating, correcting, and closing problems related to allocating budget by EOC and giving management insight to make timely decisions is covered in attribute G.3. DOE also clarified the expectations if wrap rates are used in the EVMS budgeting tool.

C.6. Work Package Planning, Distinguishability, and Duration

WP planning begins with the logical decomposition of the authorized CA scope, schedule, and budget into executable and measurable segments of work (Table 25). A WP is a distinguishable subdivision of the CA, reflecting how work will be executed, assignable to a single organizational element. WPs support accurate performance measurement by assigning the appropriate EVT, segregated by elements of cost and including an appropriate EVT.

WPs are distinguishable from other WPs. WPs are where the work is planned in detail, technical progress is measured, and earned value is determined. WPs contain specific time-phased resource requirements in dollars, hours, or other measurable units.

WPs have relatively short durations. Longer tasks are acceptable, but progress is objectively measured using the appropriate EVT and Quantifiable Backup Data (QBD).

To the extent it is practicable to identify the authorized work in discrete WPs and establish budgets for this work in terms of dollars, hours, or other measurable units. Where the entire CA is not subdivided into WPs, identify the far-term effort in larger PPs for budget and scheduling purposes. This attribute ensures CA work scope is partitioned into executable and measurable segments of work that are accomplished within the authorized CA period of performance (POP).

The WP planning process is integrated with the planning and scheduling subprocesses.

Table 25. Attribute C.6. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some WPs are logical decompositions of authorized scope, schedule, and budget, distinguishable subdivisions of a CA, with realistic durations.**	**Most WPs are logical decompositions of authorized scope, schedule, and budget, distinguishable subdivisions of a CA, with realistic, short durations.**	**All WPs are logical decompositions of authorized scope, schedule, and budget, distinguishable subdivisions of a CA, with realistic, short durations.**	**WPs are planned, current, distinguishable, and continually monitored by project management to inform proactive decision-making.**
	Some processes are in place to ensure that the WPs are established correctly. WPs are not decomposed and planned in sufficient detail to manage the project effectively.	Most processes are in place to ensure that the WPs are established correctly. The process requires that the WPs are planned as far in advance as practicable, reflect the actual way the work will be executed, and contain the authorized scope, schedule, and budget distinguishable from other WPs. They are based on time-phased resource requirements in dollars, hours, or other measurable units, and are assigned (C.12.1) appropriate EVTs. Some WPs have realistic durations that are supportable by a technical or another realistic basis of estimate with relatively short durations. However, the level of detail is not sufficient to effectively manage the project. WP planning is coordinated with the planning and scheduling subprocess.	(C.6.1) The processes to establish WPs have been developed, documented, and approved. (C.6.2) WPs are planned as far in advance as practicable, reflecting the actual way the work will be executed. WPs are based on the most current definition of work and contain authorized scope and budgets that include specific time-phased resource requirements in dollars, hours, or other measurable units. Progress is objectively measured using the appropriate EVT and QBD. (C.6.3) WPs have realistic durations that are supportable by a technical or another realistic basis of estimate with relatively short durations (such as 1 or 2 months), with longer duration WPs having objective intermediate measures of performance and QBDs. (C.6.4) WP planning is integrated with the planning and scheduling subprocess.	All WPs are planned as far in advance as practicable, reflecting the actual way the work will be executed. All WPs are distinguishable and have realistic durations. WP planning, distinguishability, and duration are monitored, used for management control, and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of WP planning, distinguishability, and duration are fully disclosed to all key stakeholders, who maximize their use. The WP planning process is continuously improved and optimized.

Objective

All WPs are logical decompositions of authorized scope, schedule, and budget, distinguishable subdivisions of a CA, with realistic, short durations. A WP has the following characteristics:

- 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?
- Is future work that cannot be planned in detail subdivided to the extent practicable for budgeting and scheduling purposes?
- Do all WPs and PPs have a budget or assigned value expressed in terms of dollars, labor hours, or other measurable units?
- Is a single EVT (Discrete, LOE, or Apportioned) assigned per WP?
- Are WPs distinguishable from all other WPs, including the titles being unique and consistent with the scope of the WP?
- Are WP or activity (where performance is taken) EVTs consistent with how the resource budgets (all elements of cost) are planned to be performed and progress measured?
- Are detailed WPs planned as far in advance as practicable, and is work progressively subdivided into detailed WPs as requirements are defined?
- Can the WP and PP budgets be substantiated? (See attribute C7)

Effectiveness Criteria

C.6.1. *The processes to establish WPs have been developed, documented, and approved.*

C.6.2. *WPs are planned as far in advance as practicable, reflecting the actual way the work will be executed. WPs are based on the most current definition of work and contain authorized scope and budgets that include specific time-phased resource requirements in dollars, hours, or other measurable units. Progress is objectively measured using the appropriate EVT and QBD.*

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

C.6.3. *WPs have realistic durations that are supportable by a technical or another realistic basis of estimate with relatively short durations (such as 1 or 2 months), with longer duration WPs having objective intermediate measures of performance and QBDs.*

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. 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 a specific product or service with distinct and measurable outputs that relate 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 PP quantities, sizes, and durations within a CA 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 are 22 working days or less per the GAO *Schedule Assessment Guide* (GAO-16-89G), which states the following:

> In general, estimated detail activity durations for near-term effort are e 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 are one working week or less. If management requires monthly updates, then near-term activity durations are required to 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 is to 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 represent two accounting months according to most accounting calendars. Discrete WPs may be longer than 44 working days (up to 6 months, or 132 working days) when supported by short-duration activities or QBDs with technical progress points. QBDs are also known as rules of credit in some implementations. 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.

C.6.4. *WP planning is integrated with the planning and scheduling subprocess (Section 3.2).*

Impact of Ineffectiveness

When WPs are indistinguishable as subdivisions of the CA, management is unable to understand the way work will be executed, assignable to a single organizational element. WPs support accurate performance measurement through the assignment of the appropriate EVT, segregated by elements of cost, and include an appropriate EVT.

Special Considerations

See C.8 for EVT assignments.

C.7. Measurable Units and Budget Substantiation

WPs and PPs contain the authorized scope of work and budgets that include time-phased requirements in dollars, hours, or other measurable units (Table 26). The use of measurable units provides a basis for planning and accurate and objective performance assessment. WP and PP budgets are based on authorized work and realistic timelines to substantiate their accuracy and planning value. WP and PP quantities, sizes, and durations vary subject to scope, internal management needs, and the size and complexity of the project. PPs are broken down to the extent practical for scope, schedule, and budget substantiation.

Table 26. Attribute C.7. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some WP/PP budgets are based on dollars, hours, or other measurable units and assigned to authorized scopes of work and realistic timelines.**	**Most WP/PP budgets are based on dollars, hours, or other measurable units and are assigned to authorized scopes of work and realistic timelines.**	**WP/PP budgets are based on dollars, hours, or other measurable units and are assigned to authorized scopes of work with realistic timelines.**	**WP/PP budgets are proactively used by management in decision-making, ensuring the PMB is planned at an executable level that supports meaningful performance measurement.**
	A documented process to establish measurable units and substantiate WP/PP budgets does not exist. Few measurable units are used as the basis for planning and performance measurement. WP and PP budgets when added together do not equal the value of the CAs.	A documented process to establish measurable units and substantiate WP/PP budgets exists with some gaps. In many cases, measurable units are used by management as the basis for planning and performance measurement. Most WP/PP budgets are established in terms of dollars, hours, or other measurable units. WP and PP budgets when added together do not equal the value of the CAs.	(C.7.1) A documented and approved process to establish measurable units and substantiate WP/PP budgets exists. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (C.7.2) Measurable units are used by management as the basis for planning and performance measurement, with minor exceptions. (C.7.3) WP/PP budgets are established in terms of dollars, hours, or other measurable units. (C.7.4) WP/PPs are consistent with detailed engineering, manufacturing, construction, or other schedules. (C.7.5) WP/PP budgets are consistent with subcontractor baseline plans and are integrated and traceable. (C.7.6) All of the WP and PP budgets when added together equal the value of the CAs.	The governance process requires verification of WP/PP budgets to ensure alignment. All measurable units are associated with WP/PP budgets. Measurable units are automatically monitored to assess system health and integrity. Necessary corrective actions are implemented and completed, and recurring issues are easily resolved. Budgets for high-value production and critical material are planned discretely. Management uses all measurable units as the basis for planning and performance measurement. Routine surveillance results of measurable units are fully disclosed to all key stakeholders. The units are realistic, meaningful, and accurately used to status, report, and analyze performance. All material planning and performance measurement is based on dollars, hours, or other measurable units. The measurable units process is continuously improved and optimized.

Distributing all CA budgets to either WPs or PPs ensures the PMB is planned at an executable level that supports meaningful performance measurement.

Also, this attribute provides that the sum of all WP budgets plus PP budgets within a CA equals the CA budget. The budgets of all CAs that constitute the PMB need to be valid to ensure the PMB is valid. In all cases, the value of the budget assigned to individual WPs and PPs within the CA sum to the total value authorized for the CA.

Objective

WP/PP budgets are based on dollars, hours, or other measurable units and are assigned to authorized scopes of work with realistic timelines. To the extent practicable, authorized work is identified in discrete WPs, and budgets for this work in terms of dollars, hours, or other measurable units are established. Where the entire CA is not subdivided into WPs, identify the far-term effort in larger PPs for budget and scheduling purposes. To maintain the integrity of the PMB, the WP and PP BACs sum to the associated CA's authorized BAC. The sum of the CA's WP and PP BACs 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.

Effectiveness Criteria

C.7.1. *A documented and approved process to establish measurable units and substantiate WP/PP budgets exists. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

C.7.2. *Measurable units are used by management as the basis for planning and performance measurement, with minor exceptions.*

This approach provides meaningful product-related or management-oriented events for performance measurement. Where a CA cannot be planned in WP detail, the work scope, budget, and schedule requirements are held in PPs.

C.7.3. *WP/PP budgets are established in terms of dollars, hours, or other measurable units.*

Budgets, established at the WP level identifying specific resource requirements in dollars, hours, or other measurable units, provide the detail for effective execution of the baseline plan. The resources are to be time-phased in how the detailed work is to be accomplished.

C.7.4. *WP/PPs are consistent with detailed engineering, manufacturing, construction, or other schedules.*

The IMS may have more detail below the WP/PP level to support the development of a realistic critical path, as applicable. It is consistent with detailed engineering, manufacturing, and construction plans and schedules.

C.7.5. *WP/PP budgets are consistent with subcontractor baseline plans and are integrated and traceable.*

The IMS may have more detail below the WP/PP level to support the development of a realistic critical path, as applicable. It is consistent with detailed subcontractor baseline plans and schedules.

C.7.6. *All of the WP and PP budgets when added together equal the value of the CAs.*

The purpose of this effectiveness criteria 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 sum to the total budget authorized for that CA. The system reviewer and the CAM have always been 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 does a CAM have an amount of budget that is not assigned to a segment of work. This amount would constitute MR, which never exists at the CA level. The system reviewer ensures that the contractor's EVM system description gives adequate attention to this requirement and ensures that the CAs adhere to this summation principle in actual practice.

Impact of Ineffectiveness

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 with 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. A budget without a 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.

Special Considerations

None.

C.8. Appropriate Assignment of Earned Value Techniques (EVTs)

The selection of EVTs is based on the duration and nature of the work contained in the WP and is supported by how the work is planned and performance will be earned (Table 27). The overarching goal is to ensure that a single EVT (at the WP level) is consistent with the type of work, how the work is planned, and provides for accurate performance measurement. EVTs can be (1) discrete: associated with work that has a specific product or service with distinct and measurable outputs; (2) apportioned: associated with work of a supporting nature tied directly to a discrete technical activity; or (3) LOE: associated with work of a general or supportive nature, not tied directly to a discrete technical activity. Discrete EVTs may be further broken down into other subcategories to better define how performance will be taken (for example, percent complete, 50/50, or 0/100). EVTs also may be assigned to a level below the WP, provided that they align with the parent WP EVT. For example, a discrete WP may contain lower-level details (activities) comprising percent complete, 50/50, and 0/100 EV methods. Still, it does not contain LOE or apportioned effort assignments commingled with the discrete assignments.

Assignment of EVTs is integrated with the organizing, and planning and scheduling subprocesses.

Table 27. Attribute C.8. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**Some WPs are assigned appropriate EVTs.**	**Most events are consistent with how the resource budgets are planned, performed, and progress measured.**	**EVTs are assigned and performance is earned consistent with the way work was planned, performed, and progress measured.**	**Appropriate EVTs are used to proactively manage the project toward completion and to inform effective decision-making.**
	The process of appropriately assigning EVTs to the WPs is not documented. Some WPs contain an EVT that is appropriate for the duration and type of work and consistent with how the resource budgets are planned, performed, and progress measured. Where EVTs are assigned below the WP level, commingling of various EVTs may exist.	A documented process to appropriately assign EVTs to WPs is established, with some gaps. Most WPs contain an EVT that is appropriate for the duration and type of work, resulting in an accurate and objective performance measurement assessment. Where EVTs are assigned below the WP, most can demonstrate an absence of commingling of various EVTs. The Assignment of EVTs is coordinated with the organizing and planning and scheduling subprocesses.	(C.8.1) A documented and approved process to appropriately assign EVTs to WPs is established. (C.8.2) WPs contain an EVT that is appropriate for the duration and type of work, resulting in an accurate and objective performance measurement assessment. To the extent possible, WPs maximize the use of discrete EVTs. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (C.8.3) Where EVTs are assigned below the WP level, there is a documented process of how the BCWP is summarized to the WP. Each WP can demonstrate an absence of commingling of various EVTs. CAs that commingle discrete and LOE techniques have proper controls to limit distortion of performance measurement and variance analysis. (C.8.4) The assignment of EVTs is integrated with the organizing and planning and scheduling subprocesses.	WPs with appropriate EVTs are used to assess the performance of subcontractors, vendors, and others per the business rhythm. EVT assignments are monitored, used for management control, and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. EVTs are integrated with detailed engineering, manufacturing, or other schedules. EVTs are consistent with how the resource budgets are planned, performed, and progress measured. Routine surveillance results of EVT assignments are fully disclosed to all key stakeholders, who maximize their use. CAs that commingle discrete and LOE are actively monitored and managed to limit distortion of performance measurement and variance analysis. EVT assignments are continuously optimized.

Objective

EVTs are assigned and performance is earned consistent with the way work was planned, performed, and progress measured. Because it may not be practicable to do grassroots planning for an entire project for which there is insufficient information to make detailed planning practical, PPs (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 PP budgets have been detailed plan. The selection of an appropriate WP EVT enables accurate and objective performance measurement. The selection of 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.

Effectiveness Criteria

C.8.1. *A documented and approved process to appropriately assign EVTs to WPs is established.*

C.8.2. *WPs contain an EVT that is appropriate for the duration and type of work, resulting in an accurate and objective performance measurement assessment. To the extent possible, WPs maximize the use of discrete EVTs. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The selection of an appropriate EVT enables accurate and objective performance measurement. The selection of 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. 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 has a good workable definition (in its EVM system description and practice) of what constitutes a WP. Each WP also is identified as to its result (the part it plays in accomplishing the scope of work of the CA).

Additionally, and of most importance, is identifying appropriate, objective completion criteria that align with how technical performance will be accomplished and are essential for accurate measurement of progress (or BCWP). The completion criteria answer the question: "What does 'done' look like, rather than what work has been done?" Completion criteria are typically found and defined in the titles of WPs or their activities in the IMS.

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

The selection of an EVT that best reflects the activity 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 is established no earlier than the actual receipt of the material items in place of the preferred receipt (with inspection and acceptance). More suitable representations of material progress are points in time closer to the point of usage or consumption, such as release from inventory to work-in-progress and delivery to the user when applicable (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 supported by a plan detailing technical or physical accomplishment. HDV materials are planned discretely using objective milestones or another rational basis to measure the amount of material received. If there is no guidance to differentiate between low and HDV material, all material is planned as discrete HDV material requirements. LOE may be the appropriate EVT for some low-value material items provided there is company guidance.

Another technique called PERT cost is defined as cost/EAC. The key to this technique is a regular review of the EAC. It is preferred to LOE for low-value material but may only be used for low-value material.

The planned budget is consistent with the point in the material cycle when performance is expected to be claimed. For example, suppose milestones were set up to claim performance for critical or high-value material upon receipt and acceptance. In that case, the budget needs to be planned against them and scheduled accordingly. This alignment ensures a valid measurement of

schedule variance. Procurement activities are part of the construction process and are scheduled as such.

PPs represent the portion of a CA that has not yet been detailed planned. They 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 CAs, but still have scope, schedule, and budget by elements 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 the achievement of milestones/events or other indicators. To achieve the requirement for the objective measurement of project progress indicative of a specific quantity installed or another technical achievement, the integration of work scope, schedule, and budget is always maintained. The CAM establishes interim milestones and WPs (or lower-level activities) that serve as progress indicators. CA planning interfaces and aligns directly with critical milestones and events, accomplishments, criteria, or other progress indicators listed in supplemental schedules. Performance metrics ensure that maximum time is allowed through early warnings of developing problems for management action to keep the project on plan. The intent of earned value related 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 does not have a schedule variance, and if it is behind or ahead of schedule, it has 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 the 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 completed within the same accounting month as the start. They do not exceed 22 workdays in duration. The objective indicator is the WP exit criteria.
- 50/50 is limited to WP with durations of two accounting periods (44 workdays 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 require objective indicators. These are typically WPs that exceed two accounting periods in duration and are 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 include enough technically based QBDs so at least one can be completed every month, preventing artificial schedule and cost variances. QBDs need to demonstrate consistency with the BCWS. QBD steps have dates and demonstrate the ability to earn the budget if on schedule.

- 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 of whether any actual work was performed. For this reason, the use of LOE as an EVT is limited solely to work that is not measurable.
- An apportioned effort is work associated with other discrete work and therefore has no specific unique objective indicators; however, the methods of the apportionment are documented, logical, and demonstrable. The apportioned effort has 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.

C.8.3. *Where EVTs are assigned below the WP level, there is a documented process of how the BCWP is summarized to the WP. Each WP can demonstrate an absence of commingling of various EVTs. CAs that commingle discrete and LOE techniques have proper controls to limit distortion of performance measurement and variance analysis.*

High dollar material is segregated from other elements of cost into separate WPs as performance is earned differently. (HDV is defined in attribute H.2.) It is planned and scheduled according to material need dates to support the negotiated delivery dates of final products. Leading up to final negotiations, the need date is used for planning and scheduling purposes. If a negotiated delivery date occurs before the actual need date, the baseline project schedule reflects the negotiated delivery date. This ensures the accurate assessment of material performance measurement to align with the procurement system. Enough detail on HDV/CI is included in the project schedule for timely identification of problems and delays in 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 analyze to identify and differentiate categories of material, appropriate planning method, and the associated EVT. This analysis distinguishes between material and subcontracted effort. (See Maturity H.1 for further information on HDV).

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

- WPs do not commingle discrete and LOE activities. If LOE activities are contained within a predominantly discrete CA, the LOE work does not exceed 10 percent, and the cost performance of the discrete work is discernable.
- LOE comingling with discrete work at the activity level follows the commingling restrictions in the Maturity discussion.
- Discrete activities associated with EVTs (follow the EVT duration effectiveness criteria).
- BCWP is calculated by activity and BCWP dollars are summarized to the WP level in the EVMS budgeting tool to calculate the WP percent complete.

The IMS is the source for dates and progress of the effort to the EVMS budgeting tool. The technical basis of progress is reported to the EVMS budgeting 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 is documented, consistent and accurate.

When the CAM provides status to the schedule, at least monthly, the same information is accurately reflected in the products from the EVMS budgeting 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 budgeting tool based on physical % complete or other fields, not on a percent complete based on elapsed planned duration. With these processes in place, many issues identified in the EVMS data can easily be traced back to the IMS for cause, impact, and corrective action.

Schedule status is more complicated with partners and subcontractors. As discussed further in the Subcontract Management subprocess, the key is that the prime contractor schedule is updated regularly with timely inputs from the subcontractor schedules for BCWP consistency. Consistency is defined as within one week of the prime. Calendars that are not consistent may require the partner/subcontractor to status the schedule at least twice each month, once on their month-end and once on the prime's month-end. This ensures both the prime longest path and BCWP are consistent with the IMS and support the partner month-end process.

C.8.4. *The assignment of EVTs is integrated with the organizing and planning, and scheduling subprocesses (Section 3.2).*

Impact of Ineffectiveness

The selection of inappropriate EVTs would not allow 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 periods 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 action plan will vary from the baseline plan. Long duration WPs (greater than six 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 are not accomplished.

Failure to separately identify a single EVT where performance is taken can result in an ineffective baseline for performance measurement. Unless every WP or its activities can be identified to its result with clear exit criteria that align with 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, EVTs 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 budgeting tool are out of alignment with reporting progress, management and customer are deprived of sufficient reliable information to make competent management decisions

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

Special Considerations

None.

C.9. Identify and Control Level of Effort (LOE) Work Scope

LOE is authorized work activities that, by their nature, are either not measurable (there is no measurable output/product) or for which measurement is impracticable (Table 28). LOE activities are typically administrative or supportive and may include work in areas such as program management, contract administration, financial management, security, field support, help desk support, or clerical support.

LOE WPs are separately identified from discrete effort WPs and apportioned effort WPs. The commingling of LOE and discrete effort in a CA is minimized. When LOE and discrete scope are commingled in a CA, the performance of the discrete effort and LOE is separately evaluated to ensure visibility into the EVT for measuring the performance of the discrete effort and LOE.

Additionally, this attribute identifies and controls the LOE activity by time-phased budgets established to measure performance associated with technical effort. Only that effort that is not measurable or for which measurement is impracticable may be classified as LOE. The purpose of this effectiveness criteria is to ensure LOE is limited only to activities that are not or cannot be discretely planned.

Identifying and controlling LOE work scope is integrated with planning and scheduling, and analysis and management reporting subprocesses.

Table 28. Attribute C.9. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**LOE work scope is not appropriately identified and has no distinction between LOE and discrete activities.**	**Most LOE work scope is identified, with some lack of distinction between LOE and discrete activities.**	**LOE work scope is identified and controlled, with minor exceptions. CAs have separate WPs for LOE and discrete activities.**	**The LOE EV is thoughtfully applied only where appropriate and is segregated to avoid distorting or masking discrete performance, allowing for meaningful cost and schedule variances and metrics.**
	Documented processes explaining the appropriate use of LOE for measuring work performance are largely not in place and inconsistently applied. Substantial work scope that is general or supportive or has no product, cannot be measured or is impractical to measure, is not identified or coded as LOE. No discernable effort has been taken to minimize the use of LOE for measuring the performance of the work scope.	Documented processes explaining the appropriate use of LOE for measuring work performance are mostly in place and consistently applied however with exceptions. Most work scope that is general or supportive or has no product, cannot be measured or is impractical to measure, is identified or coded as LOE. Separate evaluation (managerial analysis) of LOE and discrete is challenging. Some discernable effort has been taken to minimize the use of LOE for measuring the performance of the work scope. Identifying and controlling LOE work scope is coordinated with the planning and scheduling and analysis and management reporting subprocesses.	(C.9.1) Documented processes explaining the appropriate use of LOE for measuring work performance are fully in place and consistently applied. (C.9.2) With a few minor exceptions, work scope that is general or supportive or has no product, cannot be measured, or is impractical to measure, is coded as LOE. (C.9.3) A discernable effort has been taken to minimize the use of LOE for measuring the performance of the work scope. The commingling of LOE and discrete effort in a CA is minimized; and if commingled, LOE and discrete have unique codes to limit distortion of CA performance. Problems are identified, logged, tracked, mitigated, corrected, and closed. (C.9.4) Identifying and controlling LOE work scope is integrated with the planning and scheduling and analysis and management reporting subprocesses.	Documented LOE measurement processes are approved and consistently applied with no exceptions. All work scope that is general or supportive or has no product, cannot be measured, or is impractical to measure, is coded as LOE. LOE work scope is evaluated, tracked, adjusted, and updated monthly to support management decision-making. LOE work scope is automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. The amount of LOE is well understood and able to be communicated by management. Routine surveillance results of LOE work scope are fully disclosed to all key stakeholders, who maximize their use.

Objective

With minor exceptions, LOE work scope is identified and controlled. CAs have separate WPs for LOE and discrete activities. Classification of work scope as LOE is limited to activities that have no practicable, measurable output or product associated with the 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.

When controlling the use of LOE, the following aspects are required:

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

Effectiveness Criteria

C.9.1. *Documented processes explaining the appropriate use of LOE for measuring work performance are fully in place and consistently applied.*

C.9.2. *With a few minor exceptions, work scope that is general or supportive or has no product, cannot be measured, or is impractical to measure, is coded as LOE.*

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 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 cannot 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 provides a documented method (process flow) for how LOE work is distinguishable from 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 the LOE. Staffing of LOE is also an indication. Management level activities are typically planned by headcount (hours will peak in longer accounting months) and are also tracked typically as LOE.

C.9.3. *A discernable effort has been taken to minimize the use of LOE for measuring the performance of the work scope. The commingling of LOE and discrete effort in a CA is minimized; and if commingled, LOE and discrete have unique codes to limit distortion of CA performance. Problems are identified, logged, tracked, mitigated, corrected, and closed.*

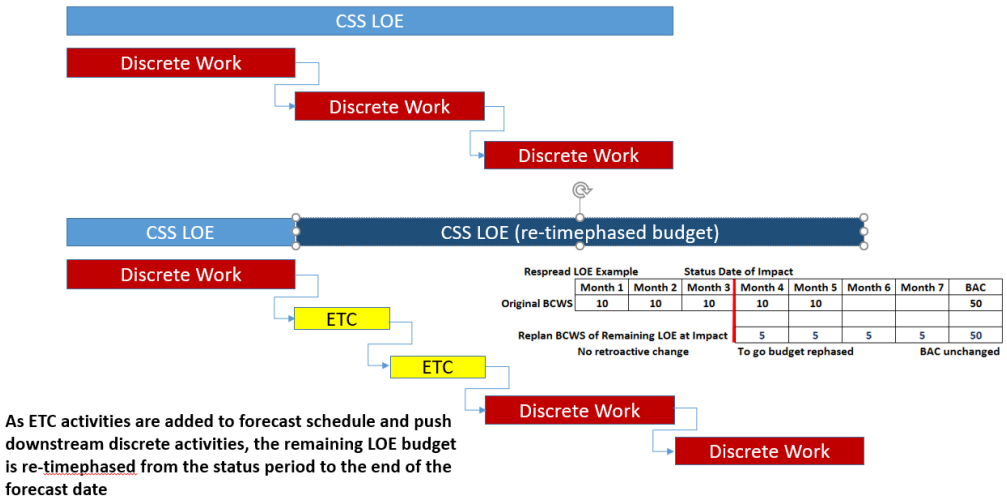
Suppose LOE WPs and discrete WPs are contained in a CA. In that case, it needs a means to measure the performance of the discrete work separately: actual costs are either accumulated at the WP level or within the CA, or they are accumulated separately for LOE and discrete work. As a general rule, the amount of LOE WP budget at complete (BAC) within a predominately discrete CA does 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 is 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 the discrete effort if LOE and discrete EVT types are commingled within a single CA. When a CA contains WPs planned with both discrete and LOE, care is 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 Services (CSS)[11] and other similar support efforts typically are budgeted using the LOE method. If a significant technical/design issue arises during construction, zero budget ETC activities are added to the forecast schedule and sequenced using precedence logic with the discrete construction work it is impacting. The resultant effect shows the slip/downstream impact on related activity start/finish dates and necessitates the update of cost ETCs. Earned value (or BCWP) for the baseline discrete construction activities (Figure 15, top) can only be claimed when each is completed (Figure 15, bottom). The associated baseline construction support LOE activity (long bar) is to be extended to align with the forecast finish date of the last discrete construction activity with its remaining budget re-time phased linearly. The EAC value for the construction support LOE is also 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. CSS work scope is fully addressed in the EVM system description, including the establishment of a threshold level for when ETC activities (aka, zero budget activities) are 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.

Figure 15. Construction Support Services LOE Model



C.9.4. *Identifying and controlling LOE work scope is integrated with planning and scheduling, and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

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

[11] Previously referred to as Title III.

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.

Special Considerations

While LOE effort is included in the IMS, LOE WPs/activities are not predecessors 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.

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

C.10. Identify Management Reserve (MR) Budget

MR is a budget set aside for in-scope unforeseen events that may arise during the project (Table 29). Because MR is a separate budget that is not yet tied to work, it does not form part of the PMB. The MR budget is commensurate with the level of risks and opportunities identified by the project. As such, the MR budget is used for risk mitigation and opportunity capture efforts, but only when in scope to the contract and scope of work.

Table 29. Attribute C.10. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**MR budget has not been established.**	**An MR budget is established but is not commensurate with risk levels on the project.**	**An MR budget is established and identified separately from the PMB. MR is commensurate with the risk identified in the project.**	**The MR budget and associated risks and opportunities are proactively managed through an identified risk management process and used to inform decision-making.**
	The process to identify the MR budget has been started, but the project has no MR budget set aside for unplanned events yet.	An MR budget is established as a cumulative value, usually as a percentage of total PMB, without regard to current or future risk events. Often this value is mandated by the customer or by a rule of thumb. The establishment of the MR budget is coordinated with the risk management subprocess and the subcontract management subprocess, as applicable.	(C.10.1) An MR budget is established based on the prime contractor's estimated risk values for the project and further defined through a comprehensive probabilistic event-based analysis. (C.10.2) The MR budget is not tied to a specific PMB work scope. Any problems are identified, logged, tracked, mitigated, corrected, and closed. (C.10.3) The establishment of the MR budget is integrated with the risk management and subcontract management subprocesses, as applicable.	The MR budget is proactively monitored and continuously managed through a comprehensive probabilistic event-based analysis. The MR budget is automatically adjusted and optimized as the project progresses. Necessary corrective actions or adjustments are implemented, completed, and recurring issues resolved. The MR budget is supported by a scheduled risk assessment. Unrealized risk is evaluated on an established periodicity and forecast MR needs are updated relative to updated risk analysis. Routine surveillance results of the MR budget are fully disclosed to appropriate key stakeholders, who maximize their use.

MR budget is not a contingency that can be eliminated from contract prices during subsequent negotiations or used to absorb the cost of project changes. The MR budget held in reserve is not viewed by the project as a source for added work scope.

Additionally, this attribute identifies MR and facilitates the project's planning, communication, coordination, control, motivation, and performance. Controls are in place to ensure budgets that are established for MR are separately identified and controlled.

The establishment of the MR budget is integrated with the risk management subprocess and the subcontract management subprocess, as applicable.

Objective

An MR budget is established and identified separately from the PMB. MR is commensurate with the risk identified in the project. 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. MR is not a source of funding for additional work scope or the elimination of performance variances. In doing so, it jeopardizes the legitimacy of the PMB. MR is held outside of the PMB.

Effectiveness Criteria

C.10.1. *An MR budget is established based on the prime contractor's estimated risk values for the project and further defined through a comprehensive probabilistic event-based analysis.*

MR is the contractor's budget set aside for management control purposes and used at the discretion of the contractor's PM; the government cannot direct contractor use of MR. The contractor's customer does 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 is not to 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), MR can remain after all work is completed under the contract or subcontract.

Examples where MR budget has improperly defined scope may include but are not limited to instances where either the contractor's MR or broken down and identified to specific risk items or even found in the PMB (not associated with the Subcontractor's MR) within SLPPs or CAs as PPs without definitive scope. 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 is not to 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. When MR is broken down and identified to specific risks, the system reviewer includes a 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 also addresses all identified risks, opportunities, and their corresponding estimates rather than merely projecting the expenditure of the remaining MR. If a budget is found within the PMB that is set aside for risk, the system reviewer includes a check to see if the budget is being used to eliminate cost variances.

DOE contingency budgets are budgets that are available for risks 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.

C.10.2. *The MR budget is not tied to a specific PMB work scope. Any problems are identified, logged, tracked, mitigated, corrected, and closed.*

MR is the budget set aside for 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 the budget to track and mitigate project risks. MR is not associated with a specific scope of work until allocated to a CA and, therefore, is not included in the PMB. MR is not a source of budget for additional work scope (out of scope of the contract/project) or the elimination of performance variances. MR belonging to a major subcontractor is incorporated into the prime contractor's EVMS with traceability to the subcontractor's reported MR. The establishment of the MR budget by the contractor PM is 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. In DOE, the MR is established from the high-end TPC range. The amount is adjusted at CD-2 based on the final risk analyses in the ICE and validated in the EIR. This is normally done through an analysis of risk to establish the 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 the elimination of performance variances. Using MR budget solely to adjust cost variances is not a legitimate reason for distributing MR budget. MR is not allocated to offset accumulated overruns or underruns.

C.10.3. *The establishment of the MR budget is integrated with the risk management and subcontract management subprocesses, as applicable (Section 3.2).*

Impact of Ineffectiveness

Without MR, the project management team would not be able to budget for and measure the performance of unplanned or unforeseen in-scope work.

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

Special Considerations

Guidance regarding the maintenance of MR has been included in subprocess area G.1. DOE deconflicted between attribute J.1 and C.10. MR establishment is in C.10.

C.11. Undistributed Budget (UB)

UB is an identified and controlled budget that applies to a specific project effort and is identified with the authorized work scope (Table 30); it has not yet been distributed below the WBS reporting level either directly to CAs or SLPPs or dispositioned to be removed from the contract. UB is a transient amount because once it is distributed to either CAs/SLPPs or dispositioned to be removed from the contract, it ceases to be UB. Because UB is tied to work scope, it forms part of the PMB. UB accounts are to be distributed/dispositioned promptly as the work scope is finalized and distributed to MR/CA's or SLPPs. This authorized work scope and budget relationship is also maintained when the work scope and the related budget are removed from the distributed budget and placed in UB pending further negotiations and disposition with the customer.

Table 30. Attribute C.11. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**No formal UB process is identified or utilized for the project/ program.**	**The process to identify and controlling UB is documented. However, UB values have not been identified and associated with the scope. Values are not distributed promptly to CAs or SLPPs.**	**UB values have an identified work scope and are logged appropriately in a UB or Contract Budget Base (CBB)/Project Budget Base (PBB) log. They are distributed/dispositioned promptly.**	**UB is monitored and distributed within one accounting period. Scope being dispositioned for removal from the contract may require more than one accounting period.**
	Some effort has been initiated to identify UB, but no documented process exists on the use or management of UB.	The UB identification process may not always be followed or has gaps. UB transactions are distributed/dispositioned (either to MR/definitized CA/WPs, or contractually removed from project, or transferred to) periodically. UB Identification is coordinated with the analysis and management reporting and change control subprocesses.	(C.11.1) The project has an approved process for the establishment and control of UB and follows the process monthly while maintaining a UB log. (C.11.2) UB accounts are distributed/dispositioned promptly as work scope is finalized and distributed/ dispositioned to CAs, SLPPs, or for removal from the contract. If not possible to disposition UB promptly (within 3 months), documentation has been completed inclusive of an explanation and a plan to disposition UB. (C.11.3) All transactions to/from UB are managed by the Change Control Board (CCB), and they are always documented through formal change control. (C.11.4) UB identification is integrated with the analysis and management reporting and change control subprocesses.	Transactions to/from UB are monitored and automatically distributed/dispositioned promptly, usually within one accounting period from log entry, with exception of delays in contract direction. All UB transactions are managed through a formal project Change Control process including a project CCB. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of UB transactions are fully disclosed to all appropriate stakeholders, who maximize their use. The UB identification and control process is continuously improved and optimized.

Scope and associated budgets that may reside in UB include the following:

- AUW
- Newly definitized work scope
- Work that has been de-scoped but not yet contractually removed from the project

UB identification is integrated with the analysis and management reporting and change control subprocesses.

Objective

UB values have an identified work scope and are logged appropriately in a UB or Contract Budget Base (CBB)/Project Budget Base (PBB) log. They are distributed/dispositioned promptly. UB is a budget that applies to a specific contractual effort that has not yet been distributed to CAs or SLPPs. UB may also contain scope subject to removal from the distributed baseline due to contractual changes. Identifying 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 is distributed promptly.

Projects identifying UB consider whether it is part of the PMB, has a defined scope traceable to contractual actions, and is controlled and limited to the newly authorized effort that cannot yet be distributed to WBS and OBS elements at or below the reporting level?

Effectiveness Criteria

C.11.1. *The project has an approved process for the establishment and control of UB and follows the process monthly while maintaining a UB log*.

C.11.2. *UB accounts are distributed/dispositioned promptly as the work scope is finalized and distributed/ dispositioned to CAs, SLPPs, or for removal from the contract. If not possible to disposition UB promptly (within three months), documentation has been completed, inclusive of an explanation and a plan to disposition UB*.

UB is a budget that applies to a specific contractual effort that has not yet been distributed to CAs 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 is distributed promptly as the work scope is finalized and distributed to CAs or SLPPs. UB may also contain scope subject to removal from the distributed baseline because of contractual changes. Budgets for the near-term portion of the scope are allocated commensurate with when the work is authorized.

UB is part of the PMB and has a budget associated with a 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 is tracked within UB until allocated to the time-phased PMB or MR. Changes are documented in a log detailing the monthly transactions and providing current values. Format 5 of the IPMR/CPR, as applicable, discusses the composition of the UB balance in terms of the project authorization. Scope and associated budgets that may reside in UB include the following:

- Authorized unpriced work (AUW)
- Newly definitized work scope
- 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.

C.11.3. *All transactions to/from UB are managed by the Change Control Board (CCB), and they are always documented through formal change control*.

A configuration control board (CCB) is the group that plays an essential role in an organization's EVMS implementation. This board usually include representatives from various department in

the company. The overall goal of a CCB is to make decisions that increase the operational efficiency and usefulness of the EVMS' ability to support the project.

C.11.4. *UB identification is integrated with the analysis and management reporting and change control subprocesses (Section 3.2).*

Impact of Ineffectiveness

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.

Special Considerations

Additional guidance regarding the management of the UB is included in subprocess G.

C.12. Reconcile to Target Cost Goal

A project baseline that reflects the common agreement between the two parties, for example, a customer and contractor, provides a common reference point for progress assessment (Table 31). It provides recognition of contractual requirements and precludes unauthorized changes to the PMB. The target cost is reconciled with the PMB and MR. This reconciliation includes a comparison of the Contract Budget Base (CBB) (sometimes known as the Project Budget Base (PBB)) to the Negotiated Contract Cost (NCC) plus Authorized Unpriced Work (AUW). The CBB is also reconciled with the Total Allocated Budget (TAB) to consider the cost value of an OTB. The sum of the CA budgets for higher-level WBS elements, UB, and MR reconciles with the TAB.

Table 31. Attribute C.12. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**The target cost for the project cannot be reconciled with the PMB and MR with confidence.**	**The target cost for the project is reconciled with the PMB and MR with minor gaps.**	**The target cost for the project is reconciled with the PMB and MR.**	**Project management proactively uses a process to reconcile target cost with PMB and MR, to continuously improve performance.**
	The project control log has been established and some of the following are populated: MR, UB, PMB, CBB/PBB, TAB. Reconciling project costs and developing internal reports showing the summarization from cost account to PMB is not easily achievable, with little confidence inaccuracy.	The project control log contains most of the following data: MR, UB, PMB, CBB/PBB, and TAB. The CBB reconciliation is coordinated with the analysis and management reporting subprocess.	(C.12.1) The project control log contains all of the following data: MR, UB, PMB, CBB/PBB, TAB. (C.12.2) A complete reconciliation of the project control log occurs monthly and is reconciled to the TAB. (C.12.3) Monthly performance and progress evaluation is in place and provides management with continuing insight into effective closed-loop corrective actions and the ability to adjust in a timely fashion through closure. (C.12.4) The CBB/PBB reconciliation is integrated with the analysis and management reporting subprocess.	A complete reconciliation of the project control log is automatically performed each month and reconciled to the TAB. Monthly verification is part of management performance reports. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of the CBB/PBB reconciliation are fully disclosed to appropriate stakeholders, who maximize their use. The CBB/PBB reconciliation process is continuously improved and optimized.

Additionally, this attribute provides that the program target cost goal is reconciled with the sum of all internal program budgets and MR. The project's Negotiated Contract Cost (NCC) plus Authorized Unpriced Work (AUW) reconcile with the CBB/PBB/Total Allocated Budget (TAB).

The CBB/PBB reconciliation is integrated with the analysis and management reporting subprocess.

Objective

The target cost for the project is reconciled with the PMB and MR. 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. Project management needs to account for all budgets 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 consistency. 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 value known as the CBB/PBB. The CBB/PBB also equals the TAB unless there is a recognized OTB. In that case, the TAB is reconciled to the CBB/PBB plus any recognized over target budget. (for more information related to OTB/OTS.)

Effectiveness Criteria

C.12.1. *The project control log contains all of the following data: MR, UB, PMB, CBB/PBB, and TAB*.

A control log exists that reconciles MR, UB, PMB, CBB, TAB, and the CA budgets.

C.12.2. *A complete reconciliation of the project control log occurs monthly and is reconciled to the TAB*.

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.

C.12.3. *Monthly performance and progress evaluation is in place and provides management with continuing insight into effective closed-loop corrective actions and the ability to adjust in a timely fashion through closure.*

Project management needs to account for all budgets 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 consistency. The CBB/PBB also equals the TAB, unless there is a recognized OTB. In that case, the TAB is 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).

C.12.4. *The CBB/PBB reconciliation is integrated with the analysis and management reporting subprocess (Section 3.2)*.

Impact of Ineffectiveness

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 established and fully understood by all parties to support both performance assessments and funding requirements. The 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 cause performance reporting to be unreliable, subject to challenge, and suspect for use in making sound decisions.

Special Considerations

None.

Subprocess D. 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 budgeting tool at the level of detail required for performance analysis and reconcilable to contract performance reports. All financial transactions are documented, approved, and recorded properly in the financial accounting system on a consistent and timely basis per Generally Accepted Accounting Principles (GAAP) and applicable Cost Accounting Standards (CAS). As the EVMS budgeting tool uses direct cost data from the contractor's accounting system to accurately report project costs and conduct EVMS performance and variance analysis, the accounting system is critical to ensuring that EVMS performance data is reliable and auditable. The primary objective of the four ASU maturity model attributes (D.1–D.4) that constitute this category is to ensure cost data is accurately collected for a valid comparison of budgets and performance.

The accounting considerations process requires the direct costs recorded in a formal and accepted accounting system to be reconcilable with the ACWP reported in the EVMS budgeting tool. Direct costs are accumulated and charged to CAs consistent with planned budgets and acceptable costing techniques (D.1). Actual costs are accurately accumulated and summarized in the EVMS budgeting tool by the project's WBS and OBS elements (D.4). All indirect costs allocable to a project are properly recorded and correctly allocated (D.3). If direct costs for work accomplished have not yet been formally recorded in the accounting system, accruals or estimated actuals are used for EVMS performance reporting and assessment (D.1).

The accounting considerations subprocess considers the following key factors:

- **D.1.** All direct costs are recorded at (or below) the CA level on the same basis that the budget was established and in accounting for the project's disclosure statement.
- **D.2.** Actual costs (ACWP) reported for the period of performance can be reconciled with the accounting system monthly with identified reconciliation errors corrected promptly.
- **D.3.** Charge codes are opened and closed for cost collection consistent with the start and completion of work.
- **D.4.** Direct costs for labor, material, subcontractor, and other direct costs are accumulated in a single CA.

As shown in Figure 5, the accounting considerations subprocess considers four management attributes that collectively account for 65 (or 7%) of the 1,000 possible points of the maturity model at level 5. Of these, D.2 and D.3 are the highest weighted management attributes (Figure 6).

D.1. Direct Costs

The direct cost is assigned to a project consistent with the pertinent budgets to achieve effective performance management (Table 32). A project's cost-charging structure established in the accounting system ensures that actual costs collected are directly compared with associated budgets for that completed work (BCWP).

The project classifies its direct costs (direct labor, material, and other direct costs) as consistent with the approved Cost Accounting Standards (CAS) disclosure statement.

Table 32. Attribute D.1. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**Some documented processes exist addressing the classification of direct costs and the collection of direct costs in a CA. The cost accounting disclosure statement has not been submitted.**	**Most processes addressing the classification of direct costs, and the collection of direct costs at or below the CA, are established, documented, but not yet approved. The cost accounting disclosure statement has been submitted but not yet approved.**	**All processes to record, manage, and control the classification of direct costs are established and can be relied on for the accurate collection of direct costs. All direct costs are recorded at or below the CA on the same basis as the budget was established and recorded by EOC. The cost accounting disclosure statement has been approved.**	**Direct costs associated with work performed by the prime, subcontractors, vendors and others charging to the contract are current and6 complete. The charge numbering system is structured in a manner that produces consistent recording and reporting of direct costs. Adjustments to recorded costs are performed only to correct minor accounting errors.**
	The project lacks documented processes for the collection of direct costs by EOC in a CA. The project has a cost accounting disclosure statement that identifies direct costs, but it has gaps. There is no documentation identifying anomalies or confirmation they have been corrected. As a result, the project cannot verify direct costs are recorded in the CA on the same basis as the budgets were established by EOC. Accordingly, cost variances submitted to the customer each month cannot be relied upon.	The cost accounting disclosure statement identifies each of the direct costs along with the direct cost categories. Most direct costs are recorded in the CA on the same basis as the budget was established, and at a minimum by EOC. The project classifies most direct costs consistent with the accounting disclosure statement. Although some informal documentation exists identifying anomalies and their corrective action, the project program cannot confirm that direct costs collected by CA provide a valid comparison to budgets and performance. Direct costs are coordinated with the subcontractor management and analysis and management reporting subprocesses.	(D.1.1) Anomalies (labor cost transfers, material, and subcontractor estimated actuals) between the accounting system and EVMS are documented regularly and (D.1.2) corrective actions are tracked to closure. (D.1.3) Adjustments to recorded costs are performed to correct accounting errors. (D.1.4) All cost data and direct costs collected by CA provide a valid comparison to budgets and performance. Direct Costs are consistent with CAS disclosure statement. EOC and accounting cost elements are reconciled and consistent. (D.1.5) Direct costs are integrated with the subcontractor management subprocess, ensuring accurate recording and reporting of direct cost data. Direct costs are integrated with the analysis and management reporting subprocess, producing timely analysis of performance, development of forecasts, and decision-making.	A process to identify and correct cost anomalies are established and used monthly. Anomalies are typically closed within two accounting periods. This ensures cost data is accurately collected and valid comparison of budgets and performance is provided. Cost variances provided to the customer each month are timely and valid. Direct costs data are routinely monitored, continuously optimized, and used for management control and are automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of direct costs are fully disclosed to all key stakeholders, who maximize their use.

The project's direct costs are recorded at or below the CA on the same basis as budgets were established and, at a minimum, by EOC. EOCs are defined in the cost accounting system disclosure statement for the project and are consistent with the accounting system tracking of EOCs for direct cost elements.

The direct costs are integrated with the subcontractor management and analysis and management reporting subprocesses.

Objective

All processes to record, manage, and control the classification of direct costs, are established and can be relied on for the accurate collection of direct costs. All direct costs are recorded at or below the CA on the same basis as the budget was established and recorded by EOC. The cost accounting disclosure statement has been approved.

The following describes the characteristics of direct costs:

- The contractor classifies its direct cost (direct labor, material, other direct costs) and credits consistent with their approved disclosure statement.
- The contractor documents anomalies between the accounting system and the EVMS budgeting tool
- Direct costs are recorded in the CA on the same basis as budgets were established and by EOC at a minimum.

Effectiveness Criteria

D.1.1. *Anomalies (labor cost transfers, material, and subcontractor estimated actuals) between the accounting system and EVMS are documented regularly.*

At all times, these source records are traceable and reconciled with the accounting commitment, obligations, actual values, the EVMS budgeting 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 critical aspects of this process:

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

Subcontractor invoices may be delayed from the performance. The material also has timing anomalies. Attribute D.2 has the estimated actuals. This attribute documents the differences from various sources.

D.1.2. *Corrective actions are tracked to closure.*

Corrective action identified for anomalies is closed promptly. Once verified complete, they are closed.

D.1.3. *Adjustments to recorded costs are performed to correct accounting errors.*

Record the direct costs in a manner consistent with the budgets in a formal system controlled by the general books of account. Identified anomalies are corrected promptly. Accounting errors are usually corrected with accruals or journal vouchers that directly affect the accounting system.

D.1.4. *All cost data and direct costs collected by CA provide a valid comparison to budgets and performance. Direct Costs are consistent with the CAS disclosure statement. EOC and accounting cost elements are reconciled and consistent.*

Charge numbers are tracked in the WBS consistent with the budgets. This means the charge number has the coding to be tracked in the same WP /CA the budget is tracked against. This allows for an accurate cost variance.

The Maturity D.1 EVMS accounting system compliance requirements seek to maintain overall consistency with the disclosure statement. EOCs such as labor, material, and Other Direct Costs

(ODC) defined in the contractor's disclosure statement for the project are consistent with the accounting system tracking of EOCs for direct cost elements and unburdened before rate application. This means that burdens are not added to direct costs but are tracked separately in the EVMS budgeting tool (See D.2 for the indirect EOC recommendation and C.5 for the wrap rate discussion). Actual resources expended in accomplishing the work are recorded on the same basis resource budgets were assigned if meaningful comparisons are to be made.

D.1.5. *Direct costs are integrated with the subcontractor management subprocess, ensuring accurate recording and reporting of direct cost data. Direct costs are integrated with the analysis and management reporting subprocess, producing timely analysis of performance, development of forecasts, and decision-making (Section 3.2).*

Impact of Ineffectiveness

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 accrue cost by EOC in the same WP/activity as the budget would invalidate variance analysis and inhibit the EAC generation. Failure to reconcile the purchasing system, the accounting system, and the EVMS budgeting tool could understate the EAC reported to DOE and impact contractor funding requirements. Inability to reconcile the EVMS budgeting tool ACWP with the accounting system actuals compromises the accuracy of ACWP reported to DOE.

Special Considerations

DOE clarified some terminology in the matrix. Accruals are fixes to anomalies done in the accounting systems and estimated actuals are fixes to resolving timing discrepancies with performance. The Maturity Model has estimated actuals in the Effectiveness Criteria in both D.1 and D.2. It also has BCWP and ACWP consistency in both D1 and D3. For consistency in interpretation and to only cover the requirement once DOE made the following interpretation:

- D1 covers the documentation of anomalies and consists of Direct EOCs between the accounting system and EVMS budgeting tool.
- D.2 covers the reconciliation with the accounting system and estimated actuals/accruals.
- D3 covers the BCWP and ACWP anomaly reconciliation.

D.2. Actual Cost Reconciliation

The purpose of this attribute is the reconciliation of ACWP (Table 33). It also seeks to maintain overall consistency with the disclosure statement. The ACWP in the EVMS budgeting tool is formally reconciled each month with the actual costs in the accounting system, and any anomalies are identified and corrected. This is a reconciliation of the total cost of all cost elements, both direct and indirect, allocated to the project. The project needs to have timely, actual cost reports from collaborating partners. Estimated ACWP and accounting system accruals are used to account for incurred costs that have not yet been billed.

Table 33. Attribute D.2. Maturity Level Template

LOW	MEDIUM	HIGH

Table 33. Attribute D.2. Maturity Level Template

1	2	3	4	5
Not yet started.	**Some documented processes exist addressing ACWP reconciliation. ACWP is reconciled between the EVMS and accounting system annually or at contract completion.**	**Most processes addressing ACWP reconciliation is in place. ACWP is reconciled between the EVMS and accounting system on a quarterly basis and identified issues are corrected.**	**All processes addressing ACWP reconciliation are documented. ACWP is reconciled between the EVMS and accounting system monthly. Identified reconciliation errors are corrected promptly.**	**ACWP is reconciled between the EVMS and accounting system more frequently than monthly. Identified reconciliation errors are corrected expeditiously.**
	Issues identified during reconciliation is documented but may not be corrected and could reoccur. Incurred cost reports comparing the EVMS ACWP to the accounting system (general ledger) are not available. The project is unable to determine whether ACWP reconciliation differences are due to timing (estimated actuals), or more importantly, whether the cost variance and associated performance management is accurate.	The project implements processes designed to ensure ACWP reported in the EVMS is reconciled to the accounting system, but the processes are not formally documented and approved. The project is able to determine whether ACWP reconciliation differences are due to timing differences or due to errors. Issues identified during reconciliation is documented and corrected within a few months, but this time lag adversely impacts the cost variance and associated performance measurement reported to the customer each month. Actual cost reconciliation is coordinated with the subcontractor management subprocess.	(D.2.1) The project has documented processes designed to ensure ACWP reported in the EVMS is reconciled by Elements of Cost for a total cost to the accounting system, and implements those processes monthly. (D.2.2) During the reconciliation process the project can determine whether anomalies are due to timing differences or errors. Both are documented and tracked to closure. (D.2.3) Issues identified during reconciliation is documented and corrected expeditiously to minimize impacts on the reported cost variance and associated performance measurement. (D.2.4) Actual cost reconciliation is integrated with the subcontractor management subprocess.	The project implements automated processes designed to ensure ACWP reported in the EVMS is continuously reconciled to the accounting system. Cost reconciliation data are monitored, used for management control and automatically tested to assess system health and integrity. Routine surveillance results of cost reconciliation are fully disclosed to all key stakeholders, who maximize their use. Issues identified during reconciliation are documented and corrective action is initiated immediately. This ensures the cost variances and associated performance measurements reported to the customer each month are representative of actual performance. The cost reconciliation process is continuously improved and optimized.

The actual cost reconciliation is integrated with the subcontractor management subprocess.

Objective

All processes addressing ACWP reconciliation are documented. ACWP is reconciled between the EVMS and accounting system monthly. Identified reconciliation errors are corrected promptly.

The maturity objective of this attribute 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. 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.

The following describes the characteristics of direct costs:

- ACWP in the EVMS budgeting tool is formally reconciled each month with the actual costs in the accounting system.
- Estimated actuals or accruals are used to document anomalies

Effectiveness Criteria

D.2.1. *The project has documented processes designed to ensure ACWP reported in the EVMS is reconciled by Element of Cost for a total cost to the accounting system, and implements those processes monthly.*

This EC requires the reconciliation to ACWP from the accounting system to be reconciled by EOC.

D.2.2. *During the reconciliation process the project can determine whether anomalies are due to timing differences or errors. Both are documented and tracked to closure.*

The primary assumptions are that the EVMS reported actuals to reconcile with the accounting systems and are supported, if required, by estimated actuals and or accruals. The calculation of ACWP is also consistent with the disclosure statement, which means calculated with rates consistent with the CAS 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 are reconciled at the end of each accounting period, and the results of the reconciliation are 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 is consistent with BCWP in terms of the reporting period. (attribute D.3)
- Reconciliation is required at the project level by EOC.
- Estimated actuals are justified at the level applied.
- Reconciliation is both monthly and cumulative to date.
- CAs and WPs are opened and closed based on the actual start and actual completion of work contained therein for cost collection.

D.2.3. *Issues identified during reconciliation are documented and corrected expeditiously to minimize impacts on the reported cost variance and associated performance measurement.*

If the EVMS budgeting tool does not reconcile with the accounting system, the errors can be:

- New charge numbers in accounting that have not been added to the EVMS budgeting tool
- An EOC mismatch between the accounting systems and the EVMS budgeting tool.
- Different levels or reports ran between the accounting and EVMS budgeting tool
- Accruals or Estimated Actuals not in one or the other tool

Regardless of the reason, if the total project does not reconcile, it is recommended the analysis continues at the CA or WP as appropriate to isolate the problem. Problems are fixed monthly until the errors are under $1K cumulative.

Maturity D.1 defined anomalies. Maturity D.3 documented BCWP and ACWP consistency. D.2 has the reconciliation. Regardless estimated actuals are used to reconcile between the accounting system and the EVMS budgeting tool. Estimated actuals are input into the EVMS budgeting tool. They are supported by source records that may include:

- Subcontractor invoices

- Material receipts
- Journal Vouchers.
- Labor corrections
- Others as warranted

Estimated actuals may also be known as accruals. Accruals are done directly in the accounting systems.

The accounting reconciliation is Accounting System + Estimated Actuals (if any) = Actuals in the EVMS budgeting tool. The reconciliation may not be finalized until later in the monthly cycle as some anomalies are not identified until an analysis is complete of earned value performance supporting variance analysis. At the end of the accounting month, the final reconciliation is reviewed and approved when the formula above is true. This occurs before the PARS upload to DOE.

D.2.4. *Actual cost reconciliation is integrated with the subcontractor management subprocess (Section 3.2).*

Impact of Ineffectiveness

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). Inability to reconcile the EVMS budgeting tool ACWP with the accounting system actuals compromises the accuracy of ACWP reported to DOE.

Failure to reconcile the purchasing system, the accounting system, and the EVMS budgeting tool could understate the EAC reported to DOE and impact contractor funding requirements. Inability to reconcile the EVMS budgeting tool ACWP with the accounting system actuals compromises the accuracy of ACWP reported to DOE.

Special Considerations

DOE clarified the accounting reconciliation is cumulative, monthly, and by EOC.
The Maturity Model has estimated actuals in the Effectiveness Criteria in both D.1 and D.2. It also has BCWP and ACWP consistency in both D1 and D3. The Maturity Model has estimated actuals in the Effectiveness Criteria in both D.1 and D.2. It also has BCWP and ACWP consistency in both D1 and D3. For consistency in interpretation and to only cover the requirement once, DOE made the following interpretation:

- D.1 covers the documentation of anomalies and consists of direct EOCs between the accounting system and EVMS budgeting tool.
- D.2 covers the reconciliation with the accounting system and estimated actuals/accruals.
- D.3 covers the BCWP and ACWP anomaly reconciliation.

D.3. Recording Direct Costs to Control Accounts or Work Packages

The charge numbers associated with the project's CAs or WPs are opened for cost collection at the start of work and closed after the associated work (Table 34). The forecasted schedule contains the most current detailed plan identifying the start date of the first WP and the completion date of the last WP in a CA. Charge numbers for each WP are opened and closed for

cost collection consistent with the most current detailed plan. It is the responsibility of the CAM to proactively manage CAs and WPs to ensure they are opened and closed to charges consistent with the most current plan. Although charge numbers may need to remain open for lagging vendor invoices (to reverse estimated actuals) or rate changes, any anomalies, such as mischarges, will continue to be investigated and resolved. Closed charge numbers may be reopened on a case-by-case basis for accounting reconciliation.

Table 34. Attribute D.3. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some documented processes exist to ensure charge numbers associated with CAs or WPs are opened and closed for cost collection.**	**Most processes are documented to ensure charge numbers associated with CAs or WPs are opened and closed for cost collection, as appropriate. The EVMS generally can integrate open and closed charge numbers with the accounting system.**	**All processes ensuring charge numbers associated with the CAs or WPs are opened and closed for cost collection, consistent with the start and completion of work requirements, are in place**	**All charge numbers associated with the CAs or WPs are integrated with the direct costs in the accounting system. Any errors are corrected expeditiously, informing management decision-making.**
	There are some project processes designed to ensure charge numbers assigned to CAs or WPs are opened/closed for cost collection consistent with the associated work. The EVMS does not have the capability to integrate open and closed charge numbers with the accounting system. Direct costs are not recorded in the EVMS consistent with start/completion of work and are not integrated with the accounting system. This lack of integration between the EVMS and accounting system results in direct ACWP not being accurately recorded in the EVMS consistent with the work being performed.	The project implements processes designed to ensure charge numbers associated with CAs or WPs are opened/closed for cost collection at the start of work or the completion of work. Although most processes are documented, they are not yet approved. Direct costs are recorded in the EVMS consistent with the start/completion of work, with a few exceptions. Direct costs are generally integrated with the accounting system, but there may be exceptions. There is some informal documentation identifying these exceptions between the direct costs recorded in the EVMS and the accounting system. But the project has not taken proactive steps to monitor and ensure the start/completion of work is consistent with the cost collection of direct ACWP in the EVMS. The process of recording direct costs to CAs or WPs is coordinated with the analysis and management reporting subprocess.	(D.3.1) The project implements documented and approved processes each month to ensure charge numbers associated with CAs or WPs are opened/closed for cost collection consistent with the start/completion of work. (D.3.2) The direct costs recorded in the EVMS are integrated with the direct costs in the accounting system. Charge numbers assigned to CAs or WPs are consistently opened/closed based on the start/completion of work. Identification of anomalies is investigated monthly, and their corrective action is documented to closure. (D.3.3) The process of recording direct costs to CAs or WPs is integrated with the analysis and management reporting subprocess.	Monthly actual charges expended accomplishing the work are recorded such that meaningful comparisons can be made. This ensures the validity of the cost variance analysis and enhances the EAC reported to the customer each month. Direct cost data are monitored, used for management control, and automatically tested to assess system health and integrity. Metrics are documented and maintained each month monitoring any corrections. Necessary corrective actions are implemented, completed, and recurring issues resolved. A report is generated each month tracking CA or WP direct charges and this is provided to the appropriate project personnel (CAM, project controls, etc.) to review. Anomalies are tracked to closure and documented in a log and typically corrected in the following accounting period. This ensures that the integration between the EVMS and accounting system is continuously improved.

The actual costs reported in the EVMS, including estimated actual costs, reconcile with the accounting system. The actual costs for accomplishing work are recorded on the same basis that resource budgets are assigned so that meaningful comparisons can be made. In all cases, the ACWP is recorded in the same month that BCWP is recorded, with limited exceptions for some Level of Effort (LOE) WPs, such that there are no months that have significant BCWP without ACWP, and vice versa.

Recording direct costs to CAs or WPs is integrated with the analysis and management reporting subprocess.

Objective

All processes ensuring charge numbers associated with the CAs or WPs are opened and closed for cost collection, consistent with the start and completion of work requirements, are in place.

Effectiveness Criteria

D.3.1. *The project implements documented and approved processes each month to ensure charge numbers associated with CAs or WPs are opened/closed for cost collection consistent with the start/completion of work.*

This EC requires that charge numbers are open and closed with the start and completion of the work. In integration with the indirect budget and cost management subprocess, the charge number may be closed for labor charges only. Final rates are applied at yearend and for consistency with the Cost Accounting Standards (CAS) the charge number for nonlabor is closed at fiscal year-end to get final rates. This only applies if the accounting changes cannot accrue to closed charge numbers.

D.3.2. *The direct costs recorded in the EVMS are integrated with the direct costs in the accounting system. Charge numbers assigned to CAs or WPs are consistently opened/closed based on the start/completion of work. Identification of anomalies is investigated monthly, and their corrective action is documented to closure.*

The accounting system generates ACWP. The maturity wording EVMS is better described as BCWP. 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 are 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 the process of correction. The primary sources for correction of labor errors are cost transfers or an individual justification.
- HDV material 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 is recorded consistently in the same month as the BCWP is recorded. There are no months with significant BCWP without ACWP or vice versa. As a general rule of thumb, "significant" is when BCWP is greater than $2K. The term accrual is a substitute for estimated actuals. Accruals are typically done directly in the accounting system and based on a purchase order, journal transfer, or other verifiable records. If they are done in the accounting system, this may be met since the reconciliation is between the accounting system and the EVMS budgeting tool. All estimated costs (estimated actuals) used for performance reporting are reconcilable between the accounting general ledger and the EVMS budgeting tool.

The purchasing system typically has separate approvals. There are several basic documents from the accounting system that influence the EVMS budgeting 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 identifies an EAC impact for the anticipated value in the EVMS budgeting tool where applicable.
- 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 is made to determine the commitment amount that is to be accrued in the accounting system concerning the terms and conditions of any multi-year contracts and their impact on the execution year. This analysis identifies the appropriate value to be represented in the EVMS budgeting tool. The EAC is also 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 at which BCWP is claimed for HDV material. At this point, the obligation to pay is 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 require the purchase order, the purchase request, and the vendor invoice to verify material, quantity, and dollar amount to make an accurate payment to the vendor.
- Inventory Usage Documentation – The accounting system accounts for the cost of material used, including scrap, rework, test rejections, and unanticipated test quantities.

As the results are analyzed each month, they are categorized. Certain EVTs typically account for part or a majority of the BCWP and ACWP alignments.

- LOE can cause a gap when starting early or late. If this continues, the LOE is replanned to when it will occur.
- 0/100 or 50/50 with a schedule slip. Estimated actuals are not required.
- Closed WPs. This type of anomaly is reviewed to see if the charge number was closed prematurely.
- Labor transfers, material, and subcontractors are typically timing differences that are accounted for with estimated actuals when significant.

This maturity attribute intends to determine whether actuals are recorded consistent with the corresponding budget and performance. This means that the effort is charged the same WP where it is budgeted. It does not require that the EOCs in the accounting system match the EOCs in the EVMS budgeting tool. However, the accounting direct EOCs need to be changed when input into the EVMS budgeting tool. EOCs charged typically vary over time. There is no expectation that the budget is changed if an EOC is not charged or charged differently. The CAMs understand the charges by EOC and are able to explain the differences in variance analysis. The CAM has the option to change the 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 payment system and has employee salary information. Various source records are inputs such as timecards, material purchase orders, and payments that are inputs or cost sources put into the accounting system. For EVMS budgeting tool actuals (ACWP) to be credible, these source records need to be valid, approved, reconciled, and auditable.

D.3.3. *The process of recording direct costs to CAs or WPs is integrated with the analysis and management reporting subprocess (Section 3.2).*

Impact of Ineffectiveness

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 the budget would invalidate variance analysis and inhibit the EAC generation. Failure to reconcile the purchasing system, the accounting system, and the EVMS budgeting tool could understate the EAC reported to DOE and impact contractor funding requirements. Inability to reconcile the EVMS budgeting tool ACWP with the accounting system actuals compromises the accuracy of ACWP reported to DOE.

Special Considerations

DOE clarified the expectation that BCWP is aligned in timing to ACWP. A threshold of $2K is acceptable.

The Maturity Model has estimated actuals in the Effectiveness Criteria in both D.1 and D.2. It also has BCWP and ACWP consistency in both D.1 and D.3. For consistency in interpretation and to only cover the requirement once DOE made the following interpretation:

- D.1 covers the documentation of anomalies and consists of Direct EOCs between the accounting system and EVMS budgeting tool.
- D.2 covers the reconciliation with the accounting system and estimated actuals/accruals.
- D.3 covers the BCWP and ACWP anomaly reconciliation.

D.4. Direct Cost Breakdown Summary

The purpose of this attribute is to summarize direct costs from CAs into the work breakdown structure without the allocation of a single CA to two or more work breakdown structure elements (Table 35). 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. Also, this attribute summarizes direct costs from the CAs into the organizational elements without the allocation of a single CA to two or more organizational elements. 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 through the OBS without being allocated to two or higher level OBS elements.

Table 35. Attribute D.4. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**The project lacks the documented processes required to ensure CA direct cost EOCs are not distributed to two or more higher-level WBS and OBS elements.**	**Most documented processes exist ensuring CA direct cost EOCs are not distributed to two or more higher-level WBS and OBS elements, with minor gaps.**	**All processes are documented and approved ensuring CA direct cost EOCs are not distributed to two or more higher-level WBS and OBS elements.**	**Direct cost summary at the WBS and OBS are proactively managed by each month, allowing the project to immediately inform management.**
	The charge numbering the system employed (if one exists) does not prevent a CA EOC from being distributed to two or more higher-level WBS and OBS elements.	Most processes ensuring CA EOCs are not distributed to two or more WBSs and OBSs are documented but they are not approved. The charge numbering system used by the project allows some CAs to be distributed to two or more higher-level WBS and OBS elements. Anomalies are identified and some are corrected. These anomalies limit accurately reporting at the WBS and OBS levels. Performance assessment is impacted since the actual costs may not all be related to work performed. The direct cost breakdown summary is coordinated with the organizing subprocess.	(D.4.1) The organization implements documented and approved processes each month. (D.4.2) The project charge numbering system ensures that no CAs are distributed to two or more higher-level WBS and OBS elements. (D.4.3) The project monitors direct cost distribution by WBS and OBS monthly. Anomalies are identified, tracked, and corrected no later than the following accounting period, ensuring accurate performance assessment reported to the customer each month. (D.4.4) The direct cost breakdown summary is integrated with the organizing subprocess	A formal monthly business rhythm process is used to automatically track all charge number anomalies each month in a log, with corrective actions initiated immediately. Recurring issues are resolved. Surveillance results that reveal systemic issues are utilized to continuously improve the system. This the process fosters an accurate summarization by WBS and OBS and provides project management visibility into the current cost of products or services procured and enhances forecasting of potential future costs.

Actual direct costs can be accurately summarized at all levels of the WBS and OBS to support project management with performance measurement data. Cost collection accounts are mapped to a single element within the WBS and OBS. The WBS and OBS roll-up structures contain no division/distribution of lower-level cost to multiple higher-level WBS and OBS elements, which helps to ensure performance measurement data integrity when summarized by WBS and OBS.

A work order/job order/task code charge number uniquely identifies direct costs at the CA level, at a minimum enabling accumulation and summarization of costs to higher levels of the WBS and OBS. Through the use of this coding, allowable costs are collected, at a minimum, within the CA by element of cost (EOC). Cost collection rolls up from the lowest defined level through the WBS and OBS hierarchies without distribution to two or more higher-level WBS and OBS elements.

The direct cost breakdown summary integrates with the organizing subprocess.

Objective

All processes are documented and approved, ensuring CA direct cost EOCs are not distributed to two or more higher-level WBS and OBS elements.

Accurate cost summarization by the 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 CA 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 CAs are accurately summarized through the WBS without being allocated to two or higher-level WBS elements. The charge number structure uniquely relates direct costs to CAs and facilitates the summarization of costs by the WBS. This practice assures direct costs are summarized and reported only within a single WBS element. The validity of the resulting performance metrics enhances management's ability to make programmatic decisions and properly forecast future costs for the remaining work. Actuals may be by WP or CA. The advantage to WP level is to integrate cost variance availability at the WP level.

Accurate cost summarization by the OBS element provides management visibility into current costs incurred by organizational elements in the production of the products and services. Confirmation that direct costs are accurately accumulated and summarized supports management's effective analysis of performance measurement information and forecasting potential future resource requirements and costs. Direct costs are collected, at a minimum, at the CA and summarized to successively higher OBS levels for reporting and performance measurement purposes. The charge number structure uniquely relates direct costs to CAs and facilitates the summarization of costs by the OBS. This practice assures direct costs are 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. The validity of the resulting performance metrics enhances management's ability to make programmatic decisions and properly forecast future costs for the remaining work.

The following describes the characteristics of direct costs summarization:

- Direct costs are summarized by the element of cost, from the CA or WP charge number level through the WBS hierarchy without allocation of a single CA to two or more higher-level WBS elements.
- Direct costs are summarized by the element of cost, from the CA or WP charge number level through the OBS hierarchy without allocation of a single CA to two or more higher-level OBS elements.

Effectiveness Criteria

D.4.1. *The organization implements documented and approved processes each month.*

D.4.2. *The project charge numbering system ensures that no CAs are distributed to two or more higher-level WBS and OBS elements.*

This attribute intends to verify that actual direct costs are summarized through the WBS and OBS 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/OBS levels 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 through the WBS/OBS without being allocated to two or higher-level WBS/OBS elements. Assurance that accurate cost data is being reported throughout the various levels of the WBS/OBS provides project management with the confidence that the data is

reliable. The 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 attribute A.4, the CA is at the intersection of the WBS and OBS. Charge numbers are required in EIA-748 at the CA level and recommended at the WP level. Regardless, actual costs (ACWP) are to be summarized so that actual charge number traceability is maintained in the summarization of EOCs. The contractor's charge number structure uniquely relates the direct costs of the CAs' work performed (and WPs within the CAs if costs are collected at that level) to facilitate the summarization of those costs to the applicable WBS/OBS element. This practice assures direct costs are summarized and reported only within a single WBS/OBS element, and the costs are directly related to the work performed.

D.4.3. *The project monitors direct cost distribution by WBS and OBS monthly. Anomalies are identified, tracked, and corrected no later than the following accounting period, ensuring accurate performance assessment reported to the customer each month.*

The summation of ACWP is required to be consistent with the accounting reconciliation totals by the element of costs. The ACWP for IPMR Format 1 equals the OBS Format 2 totals.

D.4.4. *The direct cost breakdown summary is integrated with the organizing subprocess (Section 3.2).*

Impact of Ineffectiveness

Failure to summarize direct costs by WBS/OBS 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/OBS 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. Failure of the OBS means that the organization's budgets are inconsistent with the project scope. 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.

Special Considerations

None.

Subprocess E. Indirect Budget and Cost Management

Indirect costs are a broad category that typically represents a majority of project costs and is defined as costs that cannot be directly charged to only one project but are to 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 indirect resources that allocate their time.

Because indirect costs are significant when compared with total project costs, EIA-748 requires that the indirect cost structure is defined, and the company organization or function is identified for the responsibility for controlling indirect (overhead) costs (see E.1), indirect costs are budgeted (see E.2), indirect actuals are accrued (see E.3), and indirect analysis is performed (see E.4). Although this process parallels at a high level the traditional application of earned value, some differences warrant a difference:

- Indirect costs are grouped into indirect pools, then allocated against the appropriate bases to yield the planned indirect rates.
- Indirect costs are typically annually based on 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 the stability of indirect rates and control of indirect costs. Management of indirect costs may include scope reduction (for example, no 4th quarter overhead training).
- The CFO typically has overall responsibility for indirect rate management.
- Indirect costs are not managed through EVMS CAs but rather through the assignment of responsibility to the managers who are most directly responsible for supplying indirect services and responsibility for the indirect staff. Such authorization responsibility is often placed separately at each overhead pool or category.
- An Indirect analysis is performed by the responsible indirect cost manager but is also to be considered by the project's CAMs during CA 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 is required to document who is responsible for budgeting, charging, and analysis of major components in each significant pool in their accounting policy, procedures, authorization memos, or EVM system description.

The indirect budget and cost management subprocess consider the following key factors:

E.1. The function responsible for indirect account management is in place, and documented processes addressing the management and control of indirect rates/costs are in place and approved.

E.2. Indirect budgets are established by cost element and consistent with approved cost pools that are adjusted as needed.

E.3. Indirect costs are properly recorded and correctly allocated to projects.

E.4. Indirect cost variances are identified and analyzed regularly according to established analysis thresholds.

As shown in Figure 5, the indirect budget and cost management subprocess consider four management attributes that collectively account for 55 of 1,000 (or 6%) of the 1,000 possible points of the maturity model at level 5. Of these, E.2 Indirect Budget Management is the highest weighted management attribute, as shown in Figure 6.

E.1. Indirect Account Organization Structure

The purpose of this attribute is to identify the organization or function responsible for controlling overhead (indirect costs) (Table 36). Ensure the contractor has an organization that is responsible for establishing, approving, managing, controlling, and assigning resources to overhead (indirect costs) budgets.

Table 36. Attribute E.1. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**Some documented processes exist addressing the management and control of indirect rates/costs. The CAS disclosure statement has not been submitted.**	**Most documented processes addressing the management and control of indirect rates/costs are in place. The CAS disclosure statement has been submitted but not approved.**	**The function responsible for indirect account management is in place. Documented processes addressing the management and control of indirect rates/costs are in place and approved. The CAS Board disclosure statement has been approved.**	**Comprehensive management and control of indirect rates/costs are proactively addressed continually. The CAS disclosure statement is regularly monitored.**
	Documented processes for the management of indirect rates do not exist. An "ad hoc" indirect account organization structure for the management of indirect costs exists, with several significant gaps. Accounting documents such as the CAS Board disclosure statement identifying some indirect cost pools exist but have not been submitted for stakeholder approval. Cost pools implemented are not consistent with the process or CAS Board disclosure statement. The organization has accounting documents such as the CAS Board disclosure statement that identify the treatment of indirect costs, but documents have not been submitted for approval.	Processes for the management of indirect rates are implemented, but not formally documented and approved. An indirect account organization structure for the management of indirect costs exists, with a few gaps that can be easily resolved. The accounting documents such as the CAS Board disclosure statement identifying each indirect cost pool have been submitted for approval by key stakeholders.	(E.1.1) Processes for the management and control of indirect rates are documented, approved, consistently implemented, and aligned with the accounting calendar. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (E.1.2) An approved indirect account organization structure exists with those responsible for the management of indirect rates identified. (E.1.3) The approved accounting documents such as the CAS Board disclosure statement identify each of the indirect cost pools used by the project.	Accounting documents such as the CAS disclosure statement, indirect rates, and budgets are proactively monitored monthly to ensure they are consistent with the indirect cost pools. Responsibility, assignment, and authority are documented. The indirect account organization processes are consistently applied for resource assignment, budget establishment, and control of indirect costs. The indirect account organization structure is monitored to assess for management control as part of the EVMS health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of the indirect account organization structure are fully disclosed to all key stakeholders. The indirect account organization structure and indirect cost management processes are continuously improved.

The organization or function responsible for indirect account management is identified and its structure established. This structure includes indirect manager assignment, responsibility, and authority, how indirect budgets are established, as well as how indirect cost expenditures are managed, controlled, and documented. The designated indirect account managers have the authority to implement documented processes that define resource assignment, budget establishment, and control for indirect costs.

An independent entity is responsible for accounting and financial oversight (e.g., EMCBC and NMB-63), or an auditing firm may audit specific indirect cost rates or the overarching accounting system for conformance with the organization's disclosure statement or other contract administration purposes. However, under the construct of an EVMS, visibility into indirect rates, budgets and costs, and the governing processes and formalized management structure is not redundant to reviews for other business systems but is unique to the effective implementation and use of the EVMS for successful management of a project. Because indirect costs typically account for a major portion of project costs, written procedures that clearly define the indirect cost management processes, as well as formal assignment of roles, responsibilities, and authorities to organizational staff, are necessary. These procedures establish a framework for effective management and control of indirect costs.

The project management staff charged with planning, executing and delivering within scope, schedule, and budget objectives have a mutual relationship with those charged with establishing and managing organizational efforts tied to indirect cost objectives. The former incorporates indirect rates and indirect variance impacts into its project planning, budgeting, and forecasting processes to establish both realistic baselines and estimates at complete; the latter recognizes how indirect cost variances and indirect rate changes affect project cost objectives and take corrective action as necessary to address such indirect cost variances.

Objective

The function responsible for indirect account management is in place. Documented processes addressing the management and control of indirect rates/costs are in place and approved. The CAS Board disclosure statement has been approved.

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

The following describes the characteristics of an Indirect Account Organization Structure:

- There is a process that clearly defines the indirect account structure, indirect manager's assignment, responsibility, and authority, how indirect budgets are established, and indirect cost expenditures controlled and managed

Effectiveness Criteria

E.1.1. *Processes for the management and control of indirect rates are documented, approved, consistently implemented, and aligned with the accounting calendar. Problems are*

identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.

The process documentation outlines the steps needed to control indirect rates from start to finish. The project demonstrates a willingness to address problems in a documented and timely manner. The terms management and control of indirect rates need to be clarified. A process needs to develop that:

- Defines the indirect pools and basis;
- There is a process that clearly defines the indirect account structure, indirect manager's assignment, responsibility, and authority, how indirect budgets are established, and indirect cost expenditures controlled and managed;
- Defines the organization responsible for overall indirect pool ownership;
- Defines the organizations responsible for the indirect resources and indirect annual budget management;
- Defines the annual indirect budget allocation process to indirect managers;
- Defines the process of indirect actual accrual consistent with the indirect budgets;
- Defines the threshold and the process for indirect variance analysis;
- Defines the process for notification to the project of indirect rate performance for the fiscal year; and
- Defines the indirect allocation process to project costs.

This attribute covers the process contained in the requirements for E.2, E.3, and E.4 attributes. Note: The Effectiveness Criteria wording has "consistently implemented", which is captured in E.2, E.3, and E.4.

E.1.2. *An approved indirect account organization structure exists with those responsible for the management of indirect rates identified.*

Note: The Effectiveness Criteria "indirect rates" is interpreted as the complete indirect process.

The contactor identifies 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. As indirect costs can significantly impact the cost of a project, the contractor PM needs 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 are typically budgeted and controlled separately at the functional or organizational manager level. Typical indirect types of costs include overhead, burden, cost of money, and G&A. The EVM system description or indirect procedures identify managers who are assigned responsibility and authority for controlling indirect costs and who have the authority to approve the 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.

A key aspect of this attribute is the linkage of authority and responsibility for indirect resources. Finance typically has responsibility for the indirect rates. However, the senior leadership team has responsibility for the organization's resources and delegated responsibility for a portion of the indirect overhead budget. The senior leadership team may be referred to as Indirect CAMs or

simply senior leadership team. The function may be delegated to lower senior leadership team functions as long as the indirect resource authority is also delegated.

Discussion of Pool types is relevant for understanding the intent of this attribute.

- Overhead has a numerator and denominator. Typically, the organization allocates the numerator to managers responsible for the indirect charging resources (such as Engineering, IT, HR). However, the denominator is typically site-wide and managed by the overall finance rate manager in the CFO organization and not allocated. In essence, only the numerator of the overhead rate is allocated.
- G&A is a type of total cost limited to things like corporate flow-down and site leadership. They are not typically allocated to departments and managed by finance.
- Fringe costs are part of overhead and typically benefit from direct resources. They are not typically allocated to lower levels and are managed by finance and human resources.
- These are general guidance to understand the intent of the expectation to have indirect budget allocations below the pool level. In all cases that the budget is not allocated and held by finance, there is still a requirement that they are planned via a time-phased budget that is consistent with attributes E.2, E3, and E4.

E.1.3. *The approved accounting documents, such as the CAS Board disclosure statement, identify each of the indirect cost pools used by the project.*

The management process for indirect rate pools, including both the base and numerator aspects, is documented to ensure responsibility is clear. Those designated are consistent with company organizational structures and indirect procedures. Those responsible also are required to have documented authority, within limits, over charges within the pools. Contractors are expected to define those responsible for the development and control of indirect budgets and expenditures. Additionally, the contractor defines thresholds and a process for management by exception for indirect performance and analysis. The SD, indirect policies, and disclosure statement are expected to be consistent with all defined indirect responsibility and implementation. Significant function organizations are required to have clarifying instructions that define indirect functions within their responsibility.

Several terms are typical in indirect cost management that are defined below.

- Booking Rate – The rate for the current fiscal year applied monthly to project costs.
- Final Rate – At the end of the fiscal year, the final rate is developed that eliminates the annual indirect budgets and actuals and allocates the costs to projects. This is the final rate and the booking rate is no longer applicable for the same fiscal year.
- Rates are approved by the cognizant DOE Approval Authority.
- Forward Pricing Rate Agreement – This goes by several titles. This is the agreement with DOE for rates used in proposals for five years. It is the forecast for rate performance assumptions in the future. This is provided by Finance to the projects for use in the PMB and EAC rates.

Impact of Ineffectiveness

Since indirect costs account for a major portion of the project costs, the contractor PM cannot effectively manage and control the 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.

Special Considerations

DOE clarified the unique aspects of indirect costs management and the expectation of indirect allocation responsibility. DOE also clarified that the Level 4 first bullet "consistently implemented and the related level 5 second paragraph is actually in E.2, E.3, and E.4. DOE also clarified that "indirect rate management" in the maturity E.1 is a reference to the indirect management process as a whole.

E.2. Indirect Budget Management

The purpose of this attribute is the establishment of overhead budgets for each significant organizational component for expenses that become indirect costs (Table 37). 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. Ensure indirect budgets (such as overhead, G&A, and cost of money) are established and included in the PMB at the appropriate level for visibility.

Table 37. Attribute E.2. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**Some indirect budgets are planned annually or consistent with approved pools. Indirect rates are not updated or consistently incorporated into the PMB.**	**Most indirect budgets are consistent with approved pools and associated rates but may be inconsistently implemented. Indirect rates are not adjusted after the initial establishment each year.**	**Indirect budgets are established annually by cost element and consistent with pools. Indirect rates are adjusted at least once annually if needed, such that the PMB represents a realistic baseline plan. (E.2.4)**	**Indirect budgets are proactively established and managed. Indirect budgets are consistent with prior year experience, and rates are reviewed/changed more frequently, such as quarterly, to prevent large year-end adjustments.**
	Indirect budgets are inconsistently managed and allocated across the project. Indirect budgets are not projected into the future, and corresponding indirect rates are not adjusted annually. Forward pricing rates or rate forecasts are not available to the project resulting in a PMB that does not represent a realistic baseline plan for all authorized work.	Indirect budgets and indirect rates are established annually but management's forecasting focus is on the near term (1 year, for example) and little, if any, emphasis is placed on future years. Indirect budget performance reviews are conducted intermittently and thus there are no mid-year rate adjustments based on analysis of performance where applicable, potentially resulting in a PMB that does not represent a realistic baseline plan. Indirect budget management is coordinated with the change control and analysis and management reporting subprocesses.	(E.2.1) The project implements documented and approved processes defining the indirect budgeting process monthly. (E.2.2) At the end of the accounting year, all indirect expenses are allocated. Indirect budgets or indirect rates are forecast for the entire project period of performance ensuring the PMB represents a realistic baseline plan. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (E.2.3) Indirect budgets are managed by regular reviews ensuring each project receives its fair share of indirect costs. The most current indirect rates are used to develop and update the baseline (such as approved, provisional, or proposed). (E.2.5) Indirect budget management is integrated with the change control and analysis and management reporting subprocesses.	A formal monthly business rhythm has been implemented by the contractor ensuring indirect budgets are effectively managed by comparing to actual indirect expenses. Indirect budget data are monitored and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. The indirect budget process is robust and consistent with the disclosure statement. Routine reports and surveillance of budget status are provided monthly and are fully disclosed to all key stakeholders, who maximize their use. Metrics are tracked allowing trends to be identified documenting over/under allocation of indirect expenses, disclosing issues immediately, and providing real-time information to the project. Monitoring and updating provisional/booking rates as warranted ensures the PMB reported to the customer each month contains the most current rates, represents a realistic baseline plan, and prevents large year-end adjustments.

Budgets for indirect costs are established and approved consistent with indirect processes. Indirect budgets are incorporated into the PMB per documented processes and current rates (approved, provisional, proposed, or recommended). Adjustments are generally made at the contract level with input from both contractor and customer.

Indirect budget management is integrated with the change control and analysis and management reporting subprocesses.

Objective

Indirect budgets are established annually by cost element and consistent with pools. 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 ensure that indirect costs are applied fairly and appropriately. By comparing actual indirect expenses to established indirect budgets, the company can determine whether the absorption of indirect expenses based on existing documented allocation schemes is on track or whether allocation rates need to be adjusted. Contractor recurring rate performance reviews are conducted regularly (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.

Indirect rates are adjusted at least once annually if needed, such that the PMB represents a realistic baseline plan. 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 following describes the characteristics of Indirect Budget Management:

- Indirect budgets that are time-phased by cost elements are developed and managed.
- Current rates are established at the pool level consistent with the budgets at the lower levels as appropriate.
- Current FPRA rates are implemented in the PMB, ETC within the EVMS budgeting tool.

Effectiveness Criteria

E.2.1. *The project implements documented and approved processes defining the indirect budgeting process monthly.*

The project has to implement the indirect rates into the PMB and monitor monthly the forecast for indirect rates for the current year. This is a program's direct responsibility for tracking indirect costs allocated.

E.2.2. *At the end of the accounting year, all indirect expenses are allocated. Indirect budgets or indirect rates are forecast for the entire project period of performance ensuring the PMB represents a realistic baseline plan. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The EC "At the end of the accounting year, all indirect expenses are allocated" is captured in E.3 and not this attribute. Just as with direct budgets, indirect budgets are required to be included in the PMB using the current rates at the time of baseline establishment to ensure the PMB represents a realistic baseline plan as specified in the contractor's EVM system description.

Current rates are also to be used for the EAC consistent with the latest rates by finance for the indirect pools.

The contractor establishes indirect (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 are 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 FPRA and current fiscal rates are used when planning the initial baseline, ETC, and subsequent baseline/forecast changes related to contractual changes or internal replanning. MR, if available, may be used for increases/decreases in indirect rates. These rates may be either forward pricing rate proposed (FPRP), forward pricing rate provisional, or forward pricing rate approved (FPRA). The forecast may incorporate higher rates than the FPRA to manage indirect rate risk as warranted. If these rates do not cover the entire duration of the project, the contractor is required to 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 are also used in BCWP calculations. The "final" rates are updated for actual costs over a year and are applied to the actual direct costs for ACWP reporting.

E.2.3. *Indirect budgets are managed by regular reviews, ensuring each project receives its fair share of indirect costs. The most current indirect rates are used to develop and update the baseline (such as approved, provisional, or proposed).*

There are regular periodic reviews between finance and the projects to review the rate status and forecast impacts. These reviews are more frequent in the latter portion of the fiscal year. During comprehensive annual project EACs, the projects query finance about the latest rate assumptions. These efforts support effective project EAC and impact assessments by the project to enhance the EAC accuracy. Note the current rate aspect was covered by E.2.2.

Another aspect of this Effectiveness Criteria is at least annually finance reviews the consistency of the indirect pools to their base. In other words, projects receive only applicable costs. An example of concern would be unique programmatic overhead costs such as security applies only to one type of effort applied to projects that are not applicable. Both the numerator and the base of the rate need to be consistent with the project that benefits from the costs.

E.2.4. *Indirect budgets are established annually by cost element and consistent with pools.*

Indirect budgets are to be established consistent with the organization defined in Maturity attribute E.1. These budgets are annually planned monthly for the current fiscal year.

The budgets are allocated at the beginning of the financial planning process, and then the budget is allocated to appropriate cost elements for management purposes.

Cost elements in accounting are different than elements of cost in the EVMS budgeting tool. Cost elements break out details in the department overhead budgets. They are natural extensions. For example, The Infrastructure Technology Overhead budget typically tracks items such as:

- Indirect Computers
- Telecommunications
- Networks

E.2.5. *Indirect budget management is integrated with the change control and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

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 the total cost to the government based on contractor performance/progress and would invalidate the PMB as a realistic baseline plan.

Special Considerations

DOE clarified the indirect planning aspects of the indirect management process. DOE also deconflicted between E.2.2 and E2.3 as worded in the maturity model regarding project rate application. DOE also clarified that part of the level 4 expectations are covered by attribute E.3 regarding the application of actual rates that do not apply to E.2.

E.3. Record/Allocate Indirect Costs

The purpose of this attribute is to record all indirect costs to be allocated to the project (Table 38). Ensure all indirect costs are properly and correctly allocated in a consistent manner to the contracts that apply and at the level where overhead budgets are established.

Table 38. Attribute E.3. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some documented processes are in place to ensure indirect costs are properly and correctly recorded and allocated to projects/ programs.**	**Most processes are in place to ensure indirect costs are properly and correctly recorded and allocated to projects/programs, but they are not approved.**	**All processes are designed, documented, and approved to ensure indirect costs are properly recorded and correctly allocated to projects/programs.**	**Indirect costs are accurately recorded and allocated. This allows management to effectively and proactively control indirect costs.**
	The project lacks the documented processes required to ensure indirect costs are properly and correctly recorded and allocated to projects/programs. The project is unable to verify whether indirect costs are charged to the appropriate indirect cost pool.	The project implements processes designed to ensure indirect costs are properly and correctly recorded and allocated to the project. However, the processes are not yet approved. Misapplied and unallocated indirect costs are identified and corrected periodically. This adversely impacts projections of project Estimate at Completion (EAC). Most indirect costs are charged to the appropriate indirect cost pool. Indirect cost reports documenting the current year's indirect budget by cost element, indirect charge numbers, and cost collection account structure. This results in indirect costs not being properly aligned with indirect budgets.	(E.3.1) The project implements documented and approved processes designed to ensure indirect costs are properly and correctly recorded and allocated to the project. Management responsibility and authority are clearly defined in the processes. (E.3.2) Misapplied and unallocated indirect costs are identified, tracked, and corrected immediately, no later than the following accounting period, giving management insight to make timely decisions. (E.3.3) All indirect costs are charged to the appropriate indirect cost pool and correctly allocated to the applicable project. Indirect costs are monitored each month ensuring they are consistent with the budgets. Any mischarges are corrected immediately, no later than the following month. This allows accurate variance analysis and EAC projections.	The project proactively monitors indirect costs each month to ensure they are accurately recorded and allocated. This allows the project to immediately disclose issues and provide the customer with real-time information. A formal monthly business rhythm ensures incurred indirect costs are consistent with the budgets and promotes variance analysis resulting in successful cause/impact/corrective action. Metrics are collected and documented automatically ensuring trends are immediately identified, disclosed to the customer, and corrected allowing the project to achieve and maintain cost targets. Indirect cost allocation is continuously optimized such that the project does not experience significant year-end adjustments.

Indirect costs are for common activities that cannot be identified specifically with a particular project or activity, and are typically budgeted and controlled separately at the functional level or organization's managerial level. Indirect costs are allocated to the project by applying rates that are consistent with indirect budgets. Indirect costs are charged to the appropriate indirect cost pools consistent with the established indirect budgets levels. It is important to have a documented process and organizations established specifically to manage and control indirect costs.

Objective

All processes are designed, documented, and approved to ensure Indirect costs are properly recorded and correctly allocated to projects/programs. The potential negative cost impact of poor indirect cost performance on 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 (budgeted values for indirect costs versus the actual indirect costs allocated) and potential management actions to control costs.

Effectiveness Criteria

E.3.1. *The project implements documented and approved processes designed to ensure indirect costs are properly and correctly recorded and allocated to the project. Management responsibility and authority are clearly defined in the processes.*

Attribute E.1 covered the indirect process, management, and approval aspects. The contractor ensures 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.

E.3.2. *Misapplied and unallocated indirect costs are identified, tracked, and corrected immediately, no later than the following accounting period, giving management insight to make timely decisions. If incurred indirect costs vary significantly from budgets, periodic adjustments are to be made to prevent the need for a significant year-end adjustment. (See Maturity attributes G.1 and G.2). Indirect Cost allocation processes are required to ensure management responsibility for indirect cost management is aligned with the authority to manage indirect costs to support effective cost control.*

E.3.3. *All indirect costs are charged to the appropriate indirect cost pool and correctly allocated to the applicable project. Indirect costs are monitored each month ensuring they are consistent with the budgets. Any mischarges are corrected immediately, no later than the following month. This allows accurate variance analysis and EAC projections.*

The CAS disclosure statement identifies the allocation base and indirect cost pools by the 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 allocations vary significantly from budgeted FPRA rates, periodic adjustments are required to be made to prevent the need for a significant year-end adjustment (see E.2).

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, that is, 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 occur 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, and computing equipment. A contractor ensures that custodial only has custodial type charges.

Impact of Ineffectiveness

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 a clear definition of organizational assignments and authority level for each indirect pool/category can lead to a lack of indirect cost control and serious cost overrun problems for projects.

Special Considerations

None.

E.4. Indirect Variance Analysis

Actual indirect costs are regularly compared to indirect budgets to identify, analyze, and report variances and corrective actions (Table 39). Ongoing indirect variance analysis provides visibility into potential indirect cost overruns or underruns and the opportunity to develop and implement management action plans to meet project objectives.

Table 39. Attribute E.4. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some documented processes are in place to address the establishment of thresholds and the performance of indirect variance analysis.**	**Most of the processes are in place to address the establishment of indirect variance thresholds and the performance of indirect variance analysis.**	**All processes addressing the establishment of thresholds and performance of indirect variance analysis are implemented. All indirect cost variances are identified and analyzed regularly to inform project/ program EAC.**	**Indirect variances are managed proactively to implement corrective actions and mitigate the impacts of identified issues, where practical.**
	The project lacks the documented processes required to ensure thresholds are established and indirect variance analysis is conducted. Indirect variance analysis results, if conducted, are infrequently used to inform project Estimates at Completion (EACs), and seldom result in corrective actions or adjustments to rates. Some indirect thresholds or indirect cost variances and associated corrective actions are identified and reviewed for insight into their impact on overall project cost performance. Typically, indirect variance analysis or corrective actions are only developed when performance significantly deviates from the indirect plans, and decisions regarding rate adjustments and rate forecasts are made impacting the EAC.	The project implements documented processes to ensure thresholds are established and indirect variance analysis and corrective actions are conducted, but the processes are not yet approved. Most of the indirect cost thresholds and variances are identified, documented, and reviewed for insight into their impact on overall project cost performance. Some corrective actions including rate adjustments are implemented to address identified issues. However, not all indirect cost variances are identified or reviewed which limits management's ability to forecast future indirect cost performance as well as develop corrective action plans intended to regain project objectives. The impact of indirect variances is sometimes addressed at the project level within analyses and EACs. The indirect variance analysis is coordinated with the analysis and management reporting subprocess.	(E.4.1) The project has documented and approved processes to ensure thresholds are established and indirect variance analysis and corrective actions are developed regularly. The indirect organization provides pending rate changes quarterly. (E.4.2) All of the indirect cost thresholds are reviewed regularly by the indirect category, and variances and corrective actions are identified and reviewed for insight into their root cause and impact on overall cost performance. This facilitates management's ability to forecast future indirect cost performance as well as develop corrective action plans intended to regain project objectives. Indirect corrective action plans, which may include rate adjustments, are implemented, tracked, and resolved expeditiously. (E.4.3) The impact of indirect variances is identified and addressed at the project level and within CA variance analyses and EACs. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (E.4.4) The indirect variance analysis is integrated with the analysis and management reporting subprocess.	Indirect variance data are routinely monitored and used for management control and are automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. The indirect organization provides pending rate changes monthly. Routine surveillance results of indirect variance are fully disclosed to all key stakeholders, including senior management and the customer, who maximize their use. Senior management is actively engaged in the ongoing indirect cost analysis, which enhances their ability to forecast future indirect cost performance. Management also monitors corrective action plans at the organizational indirect cost center levels to regain or mitigate impacts to project objectives. Indirect rate analysis is integrated with risks and the EAC update process and can monitor the overall impact on the project EAC. The indirect variance process is continuously improved and optimized.

Indirect costs represent a significant part of a project's total cost and variances associated with indirect budgets need to be understood, monitored, analyzed, controlled, and integrated into planning, reporting, forecasting, and decision-making.

Generally, CAMs have little or no direct responsibility or control associated with the analysis of indirect budgets and actual indirect costs. Commonly, it is the role and responsibility of management assigned to oversee indirect budgets and actual costs, engage in recurring analysis and communicate the results of indirect variance analysis to the appropriate project personnel. PMs, CAMs, and others are responsible for knowing and integrating the results of indirect variance analysis into project planning, control, and decision-making. CAMs and others are responsible for knowing and integrating the results of indirect variance analysis into project planning, control, and decision-making.

The indirect variance analysis is integrated with the analysis and management reporting subprocess.

Objective

All processes addressing the establishment of thresholds and performance of indirect variance analysis are implemented. All indirect cost variances are identified and analyzed regularly to inform project/ program EAC.

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 continuously enables the contractor to adjust rates promptly to complete an accurate EAC for individual projects/contracts. Project management understands 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 is 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 (CAS) Disclosure Statement.

The following describes the characteristics of Indirect Cost Variance Analysis:

- Variances between budgeted and actual indirect costs are identified and analyzed routinely consistent with the budget authority in Maturity E.1. If significant variances occur, are management corrective actions taken to reduce indirect costs, and is project management notified.
- Indirect analysis thresholds are established by each budget category.

Effectiveness Criteria

E.4.1. *The project has documented and approved processes to ensure thresholds are established and indirect variance analysis and corrective actions are developed regularly. The indirect organization provides pending rate changes quarterly.*

The Maturity EC says "Project," which DOE interprets as the indirect thresholds in finance to be consistent with the last sentence regarding rate changes. Indirect variance analysis thresholds need to be established. Variances over the threshold are reviewed and the budget versus actuals are analyzed by cost element as to what is causing the variance. The analysis is summarized at the rate pool level and projects from finance on rate performance are provided at least quarterly to the project organization.

E.4.2. *All of the indirect cost thresholds are reviewed regularly by the indirect category, and variances and corrective actions are identified and reviewed for insight into their root cause and impact on overall cost performance. This facilitates management's ability to forecast future indirect cost performance as well as develop corrective action plans intended to regain project objectives. Indirect corrective action plans, which may include rate adjustments, are implemented, tracked, and resolved expeditiously.*

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.

Indirect variance thresholds reflect the nature of the indirect budgeting process. The budget process is annual and therefore an initial higher variance threshold is appropriate and a lower one toward the end of the fiscal year. An example illustrates the concept and the actual numbers are not a requirement.

- 1st Fiscal Quarter 10%
- 2nd Fiscal Quarter 8%
- 3rd Fiscal Quarter 4%
- 4th Fiscal Quarter 1%

Expectations – the first quarter is between 8-15%. The last quarter is close to 2 or 1%. This reflects that year-end corrective action is not possible and if significant it is explaining the year-end rate issues that may have impacted the final allocations. There are declining periods for quarters 2-3. If declining balances are not implemented, then the threshold for year-end is required to be used throughout the year.

The results of the analysis of indirect cost variances are documented. This analysis provides project management visibility into the reasons for potential or realized indirect cost performance deviations that contribute to the overall indirect pool. 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 are made to prevent the need for a significant year-end adjustment

E.4.3. *The impact of indirect variances is identified and addressed at the project level and within CA variance analyses and EACs. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The 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 or project controls analyst. Indirect rate management is crucial to meeting project cost objectives. This EC 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 variances. The importance of analyzing indirect cost performance requires the exercise of maximum discipline in following the established indirect cost control procedures. The results of the indirect analysis are provided to project and business managers for their use in forecasting the impact on the project EAC.

E.4.4. *The indirect variance analysis is integrated with the analysis and management reporting subprocess (Section 3.2).*

Impact of Ineffectiveness

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.

Special Considerations

DOE clarified that the first Effectiveness Criteria is referencing indirect analysis led by finance and is not related to project variance analysis.

In E.4.2 DOE clarified the expectations of indirect variance analysis thresholds with examples.

Subprocess F. Analysis and Management Reporting

Analysis and management reporting is the subprocess for calculating, analyzing, and reporting the cost and schedule variances, along with providing reasons for significant variances, implementing corrective actions, and calculating new Estimates at Completion. The analysis and management reporting subprocess focus on management use of the EVMS performance data to detect and act upon early technical, schedule, or cost deviations from the PMB. This subprocess establishes the minimum requirements for generating and analyzing cost and schedule variances, establishes and implements corrective action plans, and maintains credible EACs at both the CA and total project levels. The performance data used for variance analysis are generated from the EVMS. To ensure cost and schedule variances are valid, the EVMS method used to derive the BCWP is consistent with the method used to plan and resource the associated work. The applicable actual direct costs map or trace to the accounting system. 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 optimizes 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 subprocess. This requires analysis of indirect cost performance and their impacts on the ETC for the remaining work. This subprocess further requires the performance data to be accurately summarized from the CA level to the contractually mandated reporting level so that the same data is used to internally manage and execute the project is being communicated externally to the government. 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 or risks to project execution. Lastly, each month contractors evaluate and update ETCs and derive CA 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.

DOE's interpretation of the intent of each of the five analysis and management reporting attributes and expectations for implementation are below. The analysis and management reporting subprocess considers the following key attributes:

- **F.1.** Variances are calculated, traceable, and reconcilable with source inputs from the EVMS and the accounting system.
- **F.2.** Variance analysis exceeding thresholds that have an impact on the project are analyzed and reported for each CA.
- **F.3.** Performance measurement data are summarized from the CA level to the WBS and OBS level, and support management needs and customer reporting.
- **F.4.** Analysis and corrective actions are documented, approved, and used monthly with managerial actions and are commensurate with risks identified to the project.
- **F.5.** CA EACs and the range of project level EACs are generated at least monthly and commensurate with the risk identified to the project.

As shown in Figure 5, the analysis and management reporting subprocess consider five management attributes that collectively account for 109 (or 11%) of the 1,000 possible points of

the maturity model at level 5. As shown in Figure 6, F.4 Management Analysis and Corrective Action and F.5 Estimate at Completion (EAC) are the highest weighted management attributes.

F.1. Calculating Variances

The purpose of this attribute is to calculate schedule variance and cost variance (Table 40). At least monthly, generate the following information at the CA 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.

Table 40. Attribute F.1. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**The documented processes do not include the formulas for CV and SV or lack requirements for the accuracy and traceability of source data used to calculate the variance.**	**The documented processes include formulas for correctly calculating CV and SV but lack requirements for accuracy and traceability of source data used to calculate the variances.**	**The formulas for CV and SV are correctly documented, calculated, traceable, and reconcilable with source inputs from the EVMS and the accounting system.**	**Project leadership proactively uses timely and reliable CV and SV to inform management decision-making and action. CVs and SVs are true indicators of schedule and cost performance.**
	Documentation of the EVMS formulas used to calculate CV and SV do not link with data produced by the accounting system. For incomplete discrete WPs, the BCWP reported in the current period is inconsistent with the method used to plan and resource the associated work (BCWS).	EVMS formulas are consistent with data produced by the accounting system and are used to calculate CV and SV. However, it is difficult to ensure the source data is accurate, traceable, and reconcilable. EV calculations are consistent with external reports and project requirements. For most incomplete discrete WPs, BCWP in the current period is consistent with the method used to plan and resource the associated work (BCWS). Calculation of variances is coordinated with the budgeting and work authorization subprocess.	(F.1.1) The process of CV and SV calculation requires accurate, traceable, and reconcilable source inputs from EVMS and the accounting system to CA level cost and schedule variance calculations, resulting in timely and reliable information. (F.1.2) EVMS formulas are consistent with data produced by the accounting system. (F.1.3) In conjunction with updated EACs, VAC calculations are provided to support reports in terms of trends and the overall impact on the cost of the project. (F.1.4) For incomplete discrete WPs, BCWP is consistent with the method used to plan and resource the associated work (BCWS). (F.1.5) Calculation of variances is integrated with the budgeting and work authorization subprocess.	Project management is actively engaged in the ongoing processes to provide realistic plans and budgets to provide and monitor realistic calculations of CV and SV. CV and SV are automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. The use of automated tools to support the calculations has clear traceability to ensure source data is accurate and reconcilable as this provides an output that is trusted and valued for making project decisions. Routine surveillance (internal, external, or joint) of CV and SV is fully disclosed to all key stakeholders, who maximize their use. The CV and SV process is continuously improved and optimized by incorporating lessons learned from specific projects/programs.

The emphasis of this attribute depends on accurate cost and schedule performance data generated on a routine basis. For project management to assess both progress and variances as compared to the baseline, reliable and auditable data are generated on time, monthly at a minimum, in alignment with the contractor's accounting reporting periods.

EVMS formulas are used to produce visibility into project performance, planning, analysis, and decision-making. Proper application of EVMS formulas provides the PM and others with the

analysis needed to focus resources on areas in need of attention. Formulas to calculate Cost Variance (CV), Schedule Variance (SV), and Variance at Completion (VAC) are consistent with data produced by the accounting system and include budget, earned value, and actual costs that are reconcilable with the earned value management (EVM) and accounting systems. As work is progressed based on EVTs, the corresponding budget value is "earned" and is represented as the BCWP. BCWP is the primary data element for which BCWS and ACWP are compared to determine schedule and cost performance status. The resulting variance gives early insight into cost and schedule status for improved visibility of program performance. EVMS performance data is available and used in these formulas to produce timely, accurate, reliable, and auditable analyses of project performance.

The calculation of variances is integrated with the budgeting and work authorization subprocess.

Objective

The formulas for CV and SV are correctly documented, calculated, traceable, and reconcilable with source inputs from the EVMS and the accounting system.

The following describes the characteristics of attribute F.1 Calculating Variances:

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

Effectiveness Criteria

F.1.1. *The process of CV and SV calculation requires accurate, traceable, and reconcilable source inputs from EVMS and accounting systems to CA level cost and schedule variance calculations, resulting in timely and reliable information.*

For analysis and variance reporting, the following data elements are identified, periodically, at the CA level:

- BCWS represents the amount of work planned.
- BCWP represents the amount of work 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, result 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).

F.1.2. *EVMS formulas are consistent with data produced by the accounting system.*

The DOE Gold Card (Attachment 1) includes standard formulas for calculating CVs, SVs, and VACs which are followed to ensure accurate variances are being reported. The formulas follow:

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

F.1.3. *In conjunction with updated EACs, VAC calculations are provided to support reports in terms of trends and the overall impact on the cost of the project.*

Management reports are the reports that review and assess a project's performance on a month-to-month basis. These reports enable the project team to track past and present performance and assist in making informed business decisions.

F.1.4. *For incomplete discrete WPs, BCWP is consistent with the method used to plan and resource the associated work (BCWS).*

The contractor ensures it uses the same method for calculating both BCWS and BCWP. Monthly BCWS values are 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 are chosen so that when BCWP is calculated it matches the monthly resource plan as closely as possible. The method used depends upon the type of effort involved in each WP, that is, discrete, LOE, or apportioned. Regardless of the type of effort involved or the method chosen by which to measure earned value, BCWS is 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 the 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 the 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 are always to be the same.

F.1.5. *Calculation of variances is integrated with the budgeting and work authorization subprocess (Section 3.2).*

Impact of Ineffectiveness

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

Special Considerations

None.

F.2. Variances to Control Accounts (CAs)

The purpose of this attribute is to 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 (Table 41). The ability to analyze deviations from the established plan permits management at all levels to implement corrective actions rapidly and effectively to regain project/contract objectives. Because the majority of contractor accounting and budgeting systems are based on a synchronized accounting calendar, unless an alternate reporting frequency is mandated, variance analysis is conducted per this same cadence. The collection and analysis of CVs, SVs, and VACs are required to be completed per external IPMR/CPR reporting requirements.

Table 41. Attribute F.2. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some documented processes are in place to consistently analyze variances at the CA level. Variance analysis thresholds are not set.**	**Most documented processes are in place to consistently analyze significant variances at the CA level. Variance analysis thresholds are set, with some gaps.**	**All processes are documented to consistently analyze significant variances at the CA level. Variance analysis thresholds are set and used for decision-making.**	**Significant variances at the CA level are proactively used by management to inform decision-making. Corrective actions are initiated as soon as issues are identified.**
	The processes needed to identify cost and schedule variances have been started but they are not documented. The variance analysis report does not identify causal factors (efficiency, rate, timing, etc.) and potential impacts on the project. Timely analysis of cost and schedule variance is not available to support resource decisions. Corrective actions/mitigation processes are not performed.	The processes needed to identify cost and schedule variances have been documented, with some exceptions. The variance analysis report identifies causal factors (efficiency, rate, timing, etc.) and potential impacts on the project. Schedule variance analysis is supplemented with IMS analysis and assesses the impact on future activities on the critical path. Timely analysis of cost and schedule variance is mostly available to support resource decisions. Most of the corrective actions/mitigation plans processes are developed. Variance analysis generally identifies the problem, its causes, planned or possible corrective actions, and impacts on the project (cost, schedule, and technical).	(F.2.1) The processes needed to identify cost and schedule variances have been documented and approved. (F.2.2) The variance analysis report identifies root causes influencing variance along with corrective actions and potential impacts on the project. (F.2.3) Labor cost variance analysis is substantiated from source records evaluating the rate and quantity variances. Material cost variance analysis is substantiated from source records evaluating price and usage variances. (F.2.4) Variance thresholds are established and used to define the meaning of "significant", consistent with project procedures. (F.2.5) Timely analysis of cost and schedule variances is available to support resource decisions. The cost and schedule variances are linked back to the baseline, as well as to IMS activities and any resulting impacts on the critical path, near-critical paths, and driving paths. (F.2.6) The monthly corrective action management process is a closed-loop process. Corrective actions/mitigation plans are all identified. Variance analysis correctly identifies the problem, its causes, planned or possible corrective actions, and impacts on the project (cost, schedule, and technical).	Variance thresholds established and used to define the meaning of "significant," are strictly followed by the project at all levels. CA Managers (CAMs) are routinely engaged in reviewing thresholds and making decisions. Variance thresholds are monitored automatically and tested. Compensatory measures are understood and initiated immediately. Necessary corrective actions are implemented, completed, and recurring issues resolved. Significant variances are addressed, documented, and integrated consistently with related processes (such as the planning and scheduling, subcontract management, and risk management subprocesses). Routine surveillance results of variance thresholds are fully disclosed to all key stakeholders, who maximize their use. Variance thresholds are continuously improved and optimized. Significant cost, schedule, and technical impacts to the CA are identified, discussed, and reported monthly at the appropriate levels.

Performance measurement data, by the 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, is documented in formal operating procedures.

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

Significant variances that have an impact on the execution of the project are analyzed in detail at the CA level and reported as required. Cost or schedule variances to each CA are discussed and documented, including technical reasons. Project procedures defining thresholds are used to identify significant variances that require reporting of root cause analysis, corrective actions, and

impacts on the project. Deviations from the established plan are analyzed, permitting management to forecast future performance and implement corrective actions to support project objectives rapidly and effectively.

Objective

All processes are documented to consistently analyze significant variances at the CA level. Variance analysis thresholds are set and used for decision-making. Without this visibility 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, is facilitated. The purpose of this attribute is to ensure both significant SVs and CVs are analyzed, at least monthly, at a level of detail required to manage the effort, that is, to enable management decision-making and corrective action.

The following describes the characteristics of CA variances:

- All significant cost, schedule, and technical impacts are aligned to the CA concerning the contractor's internal thresholds and are discussed and documented.
- Variances are addressed in the detail needed by program management.
- Variance analysis thresholds exist and are appropriate for the projects.

Effectiveness Criteria

F.2.1. *The processes needed to identify cost and schedule variances have been documented and approved.*

F.2.2. *The variance analysis report identifies root causes influencing variance along with corrective actions and potential impacts on the project.*

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 CA 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, the 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 on the CA and project. Corrective action is how the variance is mitigated or the EAC updated.

The VAR narrative identifies quantitatively the cause of the variance and then identifies the root causes. The expectation is that the majority of the variance exceeding the threshold is addressed. Current variances are addressed separately from cumulative variances.

- Cost variance (CV): An example is a $100K cumulative cost variance for a labor account that may be attributable to $20K indirect rates, $50K to widget technical problems, and $30K to labor rate variances. Analysis discussion also addresses elements of cost if significant and whether the CV will continue. For cumulative and current period HDV material CV analysis, reference attribute H.4 Material Price/Usage Variance. The formula used to calculate PV or UV is provided below.
- Schedule variance (SV): Analysis of schedule variance also addresses the floating 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 schedules 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 relates the impact of the ongoing CV to the projected VAC. For analysis of VAC HDV material, reference attribute H.4 Material Price/Usage Variance. Formulas used to calculate PV or UV are provided below.

The following considerations are in the VAR quality checklist, which is incorporated in the ECRSOP:

- Are all CA level variance trips explained? *
  - Current or cumulative cost?
  - Current or cumulative schedule?
  - Variance at completion?
  - Cost and schedule explained separately?
- Is at least 80% of CA variance dollar value explained?
- Major drivers of variance are explained in terms of root cause and clear enough to demonstrate not only the what but the drilled-down why? Is the schedule addressed in terms of days/total float? *
- "Significant" anomalies at the WP level are reported and explained in CA VAR.
  - BCWP w/o ACWP (or) ACWP w/o BCWP
  - Any negative BCWS, BCWP, or ACWP
  - Percent complete < 100% where ETC is zero
  - Zero or negative budget at WP level
  - $TCPI_{EAC}$ delta > 10%: future performance more than 10% different than past CPI
- Are WP variances consistent with CA level?
  - If not, is WP level masking explained?
- CA VAR is clear regarding EOC that drives the variance. WPs are typically EOC pure (direct labor, material, subcontract, ODCs).
- Are variances segregated by rate and usage?
- Have all BCPs that impact CA data been explained in VAR?
- Retroactive changes are discussed as an anomaly in the CA VAR regardless of reporting thresholds. Ensure VAR:
  - Identify freeze period/retroactive change
  - Describe the overall impact
  - Reference reason for the change
  - List BCP number
- If there is a significant adjustment, such as a rate distribution or labor correction, the VAR mentions the significant adjustment and includes an analysis of the variance excluding the anomaly.

- Is the specific impact on the project for scope, schedule, and budget discussed? *
  - If "none", explain why no consequence.
  - Does impact relate to the root cause?
  - State impact on project schedule including critical path and other CAs.
  - State impact on EAC.
- Outline specific actions to be taken? *
  - If "none", explain why.
  - When will it be completed?
  - What is the expected outcome?
- Are all corrective actions (except where no further action is necessary) included in the corrective action tracking log?
  - Who, What, When adequately defined?
- Are corrective actions tracked to closure in the CA tracking log? If incomplete, are all actions statused? If actions are forecast, is there an explanation in the log?
- Does the time-phased ETC justification indicate assumptions applied to future scope that would explain the forecast? Trends referenced? *
- Is TCPI within 10% of Cumulative CPI? If more than a 10% difference when CA is greater than 10% complete, is there an explanation of why the future scope will perform differently from the past scope in the EAC section of the VAR? $TCPI_{EAC}$ of 1.0 is a red flag indicating EAC has not been reviewed.
- Most impacts are expressed in $K. Mixing Hours, Quantities and Dollars can be confusing. Values are shown using both parentheses and negative signs:
  - favorable variance (+$40K)
  - unfavorable variance (-$40K)
- Good write-ups use statements that dig down, such as "Due to" and "Because of".
- VAR wrote at a level understood by those with limited exposure to the project?
  - Is the language as simple and clear as possible?
  - Are uncommon acronyms spelled out?
  - Avoid phrases "none" and " within threshold" which typically add no value to the VAR.
- VAR signed by CAM? Submitted on time?

Note: The checklist scores each element on a scale of 100. Passing is 80.0% or higher. It also is an excellent tool developed by contractors and adopted by DOE to improve internal VAR quality.

F.2.3. *Labor cost variance analysis is substantiated from source records evaluating the rate and quantity variances. Material cost variance analysis is substantiated from source records evaluating price and usage variances.*

Comparing the budgeted value of work completed to the actual cost of that work provides a valuable indication of the cost efficiency of work accomplished. This cost variance provides

management with an indicator of actual cost problems and maybe trended to see future impacts. Cost variance may be discussed in terms of rate impact versus efficiency (hours) impact for the significant labor elements of cost. Project procedures defining thresholds are normally used to define the significant level applicable to that situation.

It is recommended that the price/usage and rate variance be conducted and provided to the CAM monthly. CAMs use this information when documenting variance as required.

Price and usage material analysis formulas are provided below:

- Price Variance = (Earned Value Unit Price - Actual Unit Price) x Actual Quantity
- Usage Variance = (Earned Value Quantity - Actual Quantity) x Earned Value Unit Price

F.2.4. *Variance thresholds are established and used to define the meaning of "significant", consistent with project procedures.*

Analysis of cost and schedule variances and VACs are conducted at the CA level monthly. 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 may vary based upon the type, size, and risk associated with each contract. However, the requirement for such thresholds exists in the procedures and the thresholds used on a given project/contract are documented in a project directive.

Notes on thresholds for variance analysis. Thresholds are reviewed annually for effectiveness. The recommended threshold is 10% and X dollars, where X depends on the BCWS for the annual period. Beware of "or" thresholds as they excessively are tripped causing inefficient requirements for analysis.

F.2.5. *Timely analysis of cost and schedule variances is available to support resource decisions. The cost and schedule variances are linked back to the baseline, as well as to IMS activities and any resulting impacts on the critical path, near-critical paths, and driving paths.*

This section describes the cost and schedule impacts on the CA as well as any impact on programmatic events or other CAs. For schedule variances, the following are described: the impact on the critical path (a delay in a critical activity's completion affects the project completion), float, schedule margin (where applicable), contractual milestones, or delivery dates. This section also addresses significant impacts on the ETC.

F.2.6. *The monthly corrective action management process is a closed-loop process. Corrective actions/mitigation plans are all identified. Variance analysis correctly identifies the problem, its causes, planned or possible corrective actions, and impacts on the project (cost, schedule, and technical).*

The project demonstrates a willingness to address problems in a documented and timely manner. The problems need to address the root cause – that issue that if addressed would have mitigated or eliminated the variance from occurring. From the root cause, corrective action can be developed. All variances above a threshold include corrective action which may be to update the ETC/EAC.

Impact of Ineffectiveness

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 to regain project/contract objectives. The success of the project can be jeopardized.

Special Considerations

Only variances that exceed established thresholds are analyzed in detail. (*) Identifies the five (5) VAR checklist items that are mandatory to pass. Additional VAR checklist conditions include that there is no partial credit given for each checklist item scored (i.e., score all or nothing) and significant is defined as contributing to the top 80% of variance.

F.3. Performance Measurement Information

The purpose of this attribute is to summarize the data elements and associated variances through the program organization or work breakdown structure to support management needs and any customer reporting specified in the project (Table 42). This attribute 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.

Table 42. Attribute F.3. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**Some of the processes to summarize performance measurement information are in place. Only a few elements of performance measurement information are summarized from the CA level to the WBS and OBS levels.**	**Most of the processes to summarize performance measurement information are in place. Most of the elements of performance measurement information are summarized from the CA level to the WBS and OBS levels.**	**All processes to summarize performance measurement information are in place. All elements of performance measurement information are summarized from the CA level to the WBS and OBS level, and support management needs and customer reporting.**	**Performance measurement information outputs, products, and results are integrated into project planning, control, and decision-making. They are proactively used by leadership and stakeholders at all levels to actively manage the project.**
	Few performance data elements (BCWS, BCWP, ACWP, BAC, and EAC) are calculated at or below the CA level and summarized from the CA level up through the WBS and across the OBS to the total project level. The calculation and summarization processes are lacking and may not promote accurate management insight, or enable budget integrity, reconciliation, and customer reporting.	Most of the performance data elements (BCWS, BCWP, ACWP, BAC, and EAC) are calculated at or below the CA level and summarized from the CA level up through the WBS and across the OBS to the total project level. The calculation and summarization processes have open items; therefore, they may not always promote accurate management insight, or enable budget integrity, reconciliation, and customer reporting.	(F.3.1) All of the performance data elements (BCWS, BCWP, ACWP, BAC, and EAC) are calculated at or below the CA level and summarized from the CA level up through the WBS and across the OBS to the total project level. (F.3.2) The calculation and summarization processes provide accurate management insight and enable budget integrity, reconciliation, and customer reporting, per the business rhythm. This evaluation provides management with continuing insight into root causes and effective closed-loop corrective actions. (F.3.3) Summarized analysis and management reporting information reported to the customers is from the same source as used by internal contractor management. (F.3.4) The data elements reconcile between internal and external reports. Performance data correctly represents the current condition of the project.	Composite analysis of detail-level problems supports management actions across OBS and WBS elements. Variance analyses, internal/external reporting thresholds, narrative analysis providing root cause, variance impact, and corrective action are used to actively manage the project monthly, and recurring issues are resolved. Performance measurement information is monitored and automatically tested to assess system health and integrity. Corrective action/mitigation plans, tasks, milestones, exit criteria, and schedules are established. Routine surveillance results are fully disclosed to all key stakeholders, who maximize their use. Summarized performance measurement data and variances allow management to focus on potential or realized problem areas. Performance measurement is continuously improved and optimized.

Understanding the relationship between scope, cost, schedule, and risk is critical to successful project execution. Performance measurement information includes BCWS, BCWP, ACWP, Budget at Completion (BAC), and Estimate at Completion (EAC). This information is used to identify problem areas at all levels of the organization and project scope of work (OBS and WBS).

Performance measurement information is summarized from the (CA) to the project level through the WBS and OBS for management analysis needs and customer reporting. It is used to analyze project performance, as the basis for decision-making, and in both internal and external communications. Performance measurement information is critical to calculating and using variances used by PMs, customers, and others to provide insight and understanding of project performance, status, and forecasts.

Objective

All processes to summarize performance measurement information are in place. All elements of performance measurement information are summarized from the CA level to the WBS and OBS level, and support management needs and customer reporting. All the data elements (BCWS, BCWP, ACWP, BAC, and EAC) are calculated at the CA level and summarize from the CA level up through the WBS and across the OBS to the total contract level without being divided among two or 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.

The following describes the characteristics of summarizing performance measurement information: Performance measurement information is summarized from the CA to the project level through the WBS and OBS for project management analysis purposes and customer reporting.

Effectiveness Criteria

F.3.1. *All of the performance data elements (BCWS, BCWP, ACWP, BAC, and EAC) are calculated at or below the CA level and summarized from the CA level up through the WBS and across the OBS to the total project level.*

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 PMs 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 are cognizant of the cost and schedule performance for the area of their responsibility.

F.3.2. *The calculation and summarization processes provide accurate management insight and enable budget integrity, reconciliation, and customer reporting, per the business rhythm. This evaluation provides management with continuing insight into root causes and effective closed-loop corrective actions.*

The variance analysis is calculated monthly and summarized to the reporting level at DOE. For example – the total project analysis in the IPMR reporting is consistent with the CA status at a higher level.

F.3.3. *Summarized analysis and management reporting information reported to the customers is from the same source as used by internal contractor management.*

In a compliant implementation, there is only one set of data. Project management has 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.

The project establishes that the EVMS is the authoritative source for developing plans, schedules, and budgets. The EVMS is an integrated scope, schedule, and budget control system that comprises workflow processes, reports, and data management systems working together in an orderly and cost-effective manner. This system is the primary budget and schedule management tool used to meet both external and internal project management objectives.

F.3.4. *The data elements reconcile between internal and external reports. Performance data correctly represents the current condition of the project.*

Accurate monthly reporting is a very essential part of providing insightful information that reflects the actual project conditions (Section 3.2).

Impact of Ineffectiveness

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.

Special Considerations

None.

F.4. Management Analysis and Corrective Actions

The purpose of this attribute is to implement managerial action taken as the result of earned value information (Table 43). The availability of timely and accurate EVMS data for variance analysis provides management with early insight into the magnitude of potential problems. Subsequent management response, by all levels, is required to mitigate the impacts on project objectives.

Management analyzes Earned Value (EV) information as a part of their responsibility for implementing corrective actions and decision-making. All levels of management use performance measurement data to promote effective project execution. Current data produced by the EVMS are available to managers and reported (internally and externally) on a timely basis. Data analysis and management reporting are of sufficient quality to ensure effective integrated project management practices are followed and decisions made.

Table 43. Attribute F.4. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**The process to analyze EV information and identify and implementing corrective actions has started but is not documented.**	**Most processes for management analysis and corrective actions are established and documented, with some gaps.**	**All processes for management analysis and corrective actions are documented, approved, and used monthly. Managerial actions are commensurate with the risk identified on the project.**	**A comprehensive, end-to-end, and closed-loop approach is used for proactively identifying, tracking, and implementing corrective actions monthly or more often.**
	Some documented processes are in place to analyze EV information and implement managerial actions.	Management analysis provides insight into the effectiveness of corrective actions. The PM has a plan to track problem resolution to completion, but it has not been implemented consistently. Management analysis and corrective actions are coordinated with the organizing, planning and scheduling, and risk management subprocesses.	(F.4.1) Monthly management analysis is in place with continuing insight into corrective actions and the ability to adjust in a timely fashion through closure. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (F.4.2) Strategies and plans are in place to manage threats (uncertainties with negative consequences) and opportunities (uncertain future states with benefits) to the project. (F.4.3) Management analysis and corrective actions are integrated with the organizing, planning and scheduling, and risk management subprocesses.	Management analysis, corrective actions, and predictive metrics are monitored and used for management control and are automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Problems and recovery are tracked through completion with realized internal management benefit, with little or no wasted effort. Routine surveillance results of management analysis and corrective actions are fully disclosed to all key stakeholders, who maximize their use. Management analysis is continuously improved and optimized.

Management analyzes reports using EVMS information to implement corrective action, track progress, minimize impacts, and make decisions. For effective management control, corrective actions are identified at the appropriate level and tracked to resolution and closure. CAMs have sufficient authority and control over the resources to effectively implement corrective actions.

A formalized approach to preparing problem analysis, establishing corrective action plans, and tracking their resolution ensures management's insight into project execution continuously. Early identification of problems permits management to react in a timely fashion and assign additional resources as needed. Timely, current, and accurate data and analysis improve management decision-making.

Risk management is the identification, evaluation, and prioritization of risks (or the effect of uncertainty on objectives) followed by coordinated action and application of resources to minimize, monitor, and control the probability or impact of unfavorable events to maximize the realization of opportunities.

Management analysis and corrective actions are integrated with the organizing, planning, and scheduling, and risk management subprocesses.

Objective

All processes for management analysis and corrective actions are documented, approved, and used monthly. Managerial actions are commensurate with the risk identified on the project. Earned value information is incorporated into project management reviews with internal managers 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 are 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 aligns with the contractor's EVMS data and information to identify the progress made toward 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 are identified at the appropriate level and then formally tracked to resolution and closure.

The following describes the characteristics of Management Analysis and Corrective Actions:

- The contractor's management uses and analyzes earned value information (at least monthly) as a part of their decision-making.
- Corrective actions are identified, including activities to reduce cost/schedule impacts. Corrective actions include a complete schedule and the identification of the persons responsible for executing the corrective action plans.

Effectiveness Criteria

F.4.1. *Monthly management analysis is in place with continuing insight into corrective actions and the ability to adjust in a timely fashion through closure. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

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, identifying 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, and all user data and information comes from the EVMS.

F.4.2. *Strategies and plans are in place to manage threats (uncertainties with negative consequences) and opportunities (uncertain future states with benefits) to the project.*

Corrective Action Plans identify risks, specific actions, mitigation steps, completion schedules, and the responsible managers. These plans are developed in the EVMS. Once corrective action plans are developed, they are documented in the VAR. These plans identify specific actions that are required, risk mitigation steps, a completion schedule, and identification of the responsible persons. The plans are documented, implemented, and monitored until the resolution of the problem. An effective project management approach ensures 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 are incorporated into a formal risk management process. If variances are unrecoverable, an explanation of the impact on the project is provided. If corrective action is not taken, explain how the impact does not adversely affect the accomplishment of project objectives.

While there is no requirement for a corrective action log, the corrective actions are required to be tracked and reflect the problem/cause, the corrective action, the responsible person, the 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 identifies the activities, the 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.

F.4.3. *Management analysis and corrective actions are integrated with the organizing, planning and scheduling, and risk management subprocesses (Section 3.2).*

Impact of Ineffectiveness

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 the 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 are 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)

Special Considerations

None.

F.5. Estimates at Completion (EAC)

The purpose of this attribute is to develop revised estimates of cost at completion based on performance to date, commitment values for material, and estimates of future conditions (Table 44). Compare this information with the PMB to identify variances at completion that are important to company management and any applicable customer reporting requirements including statements of funding requirements.

Table 44. Attribute F.5. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**Some processes are in place to develop, update and report an EAC.**	**Most processes are in place to develop, update and report EACs at the CA and project levels.**	**All processes to develop, update, and report EACs are documented and approved. CA EACs and project level EACs are generated monthly. CEAC has developed annually. EACs are used to manage and support project decision-making. EACs are commensurate with the risk identified on the project.**	**EAC generation is optimized and compared automatically to formulae-generated IEACs.**
	Some EACs are established. Management has little ability to gain visibility into resource requirements to make quantitative-based decisions. Monthly EACs are not realistic and not based on performance to date, material commitment, actual cost to date, etc.	EACs are based on performance to date and estimated performance for the duration of the remaining authorized work. EACs are communicated to the customer via internal reports and established contract requirements. EACs consider project progress as well as impacts associated with the scope and schedule changes. This includes assessments of the effort required for completing all WPs and PPs in the CA plan. The process reflects the impact of material price and usage analysis, labor rate and volume analysis, and analysis of indirect rates. Most subcontractor estimates are incorporated into the prime contractor's EACs. Direct rates to value ETC resources are based on rate tables. The EACs are coordinated with the planning and scheduling, accounting considerations, indirect budget, cost management, risk management, and subcontract management subprocesses.	(F.5.1) EACs are evaluated monthly and adjusted to reflect actual project progress and performance, scope and schedule changes, and the cost of completing all remaining authorized work. EACs are integrated with the project risk register and based on identified and emerging risks and opportunities. The PM explains the differences between the most likely EACs and the CAM's EACs. (F.5.2) EAC realism is assessed based on comparisons between the Cost Performance Index (CPI) and To Complete Performance Index (TCPI), and comparison to generated Independent EACs (IEAC). EACs are reconciled with funding, inform funding profile changes, and are communicated to the customer in internal reports and funding documents. (F.5.3) EACs include accurate and timely incorporation of subcontractor estimates. Direct/indirect rates are up-to-date and used to value ETC resources based on updated rate tables. Problems are identified, logged, tracked, mitigated, corrected, and closed. A CEAC is conducted annually and is fully documented and justified. (F.5.4) The EACs are integrated with the planning and scheduling, accounting considerations, indirect budget and cost management, risk management, and subcontract management subprocesses.	EACs are proactively and continuously reviewed, monitored automatically, and updated to reflect physical progress as well as the scope and schedule changes. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of EACs are fully disclosed to all key stakeholders, who maximize their use. The CEAC generated annually, or more frequently if performance indicates the current estimate is invalid, is assessed by management as it is produced. Accepted standard formulas are used to generate IEACs which are used to compare with and substantiate the project generated EACs. The EAC process is continuously improved and optimized.

This attribute ensures 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 is the basis for completion dates and funding requirements.

A properly established, maintained, and reported Estimate at Completion (EAC), which is timely, comprehensive, accurate, reliable, and auditable, enhances management's visibility into resource requirements (budget, labor resources, facilities, etc.) to complete the authorized work scope; mitigate technical/scope, schedule, and cost issues; address risks and opportunities; make quantitative-based decisions; and effectively plan for project success. There are three components to an EAC process: the monthly CA EAC developed by the CAM; the monthly

project level EACs developed by the PM; and the annual Comprehensive EAC (CEAC) developed by the PM and project team.

CA EACs and project level EACs are realistic, based on performance to date, material commitment, actual cost to date, knowledgeable projections of future performance, estimates of the cost of contract work remaining (including known risks and opportunities), and direct and indirect rates. They are not constrained by funding availability but are compared with respective Budgets at Completion (BAC) to identify Variances at Completion (VAC) to ensure continuous visibility into the reasonableness of the CAM's original plan (baseline) and reporting to internal management and customers. The CA EAC is based on evaluating resource requirements by EOC for remaining effort and generating an Estimate to Complete (ETC) at the WP/PP level. The sum of each CA's WP and PP ETCs is added to the CA's actual cost to develop the CA EAC (sometimes referred to as the Latest Revised Estimate (LRE)). CA EACs are summarized through the WBS and OBS to the project level. The project level EAC is expressed in three justifiable final cost outcome positions based on risks and opportunities: Best Case, Worst Case, and Most Likely. The Best Case EAC reflects the lowest potential cost based on the most favorable set of circumstances. The Worst-Case EAC reflects the highest expected cost based on the least favorable set of circumstances. The Most Likely EAC reflects the value that the PM believes is the most probable and achievable outcome. Differences between these monthly EACs are reconcilable, and the Most Likely EAC is compared with current funding statements. Updated EAC values are used to calculate VAC, as given in attribute F.1.

At least annually (or more frequently, if performance indicates the current estimate is invalid) an assessment of the project level EAC is required. The CEAC, also known as a bottom-up EAC, encompasses a greater degree of formality and examination than monthly CA EACs and project level EACs. The CEAC involves the collective efforts of the entire project team under the direction of the PM.

EACs are integrated with the planning and scheduling, accounting considerations, indirect budget and cost management, risk management, and subcontract management subprocesses.

Objective

All processes to develop, update, and report EACs are documented and approved. CA EACs and project level EACs are generated monthly. CEAC has developed annually. EACs are used to manage and support project decision-making. EACs are commensurate with the risk identified on the project.

A properly established and maintained EAC ensures continuing visibility into the cost, schedule, risks, and opportunities, as well as the resource requirements (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 CA level EACs for the 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.).

The following describes the characteristics of EACs:

- 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?

- 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?
- Are estimates of costs at completion an accurate, detailed, unembellished depiction of the cost of a project, CA, or WP/PP? The cost estimate has a single total value and may have identifiable component values including:
  - Performance to date
  - Material commitments
  - Actual costs to date
  - Knowledgeable projections of future performance
  - Estimates of the cost for contract work remaining (including known risks and opportunities) to be accomplished
  - Applicable direct and indirect rates
- 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?
- Are the contractor's estimates of costs at completion reconcilable with cost data reported to the government?

Effectiveness Criteria

F.5.1. *EACs are evaluated monthly and adjusted to reflect actual project progress and performance, scope and schedule changes, and the cost of completing all remaining authorized work. EACs are integrated with the project risk register and based on identified and emerging risks and opportunities. The PM explains the differences between the most likely EACs and the CAM's EACs.*

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. 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 are tied with internal reports. There also needs to be reconciliation between the summarization of EAC from the WBS/OBS and the PMs most likely addressed in Format 5 of the IPMR/CPR. This reconciles the internal and externally reported EACs.

The earned value defines 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, 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 scopes within the Contract Target Cost (budget) and Contract Completion Date (schedule).

As with all estimates, the level of uncertainty of an EAC varies 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 on the project cost goals.

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 several other factors, such as current direct and current 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 is 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 calculate 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 grassroots 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 is undertaken. It is important to note that these calculations do not consider any "thinking" about the considerations mentioned above concerning 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 are 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.

F.5.2. *EAC realism is assessed based on comparisons between the Cost Performance Index (CPI) and To Complete Performance Index (TCPI), and comparison to generated Independent EACs (IEAC). EACs are reconciled with funding, inform funding profile changes, and are communicated to the customer in internal reports and funding documents.*

Monthly, the CAM reviews the status of the expended effort and the viability of the forecast. This analysis focuses 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 the 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 helps ensure a more accurate projection of project costs. When updates are made to existing forecasts, these significant changes are briefed to project management.

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

- $TCPI_{EAC}$ = (BAC - $BCWP_{cum}$) / (EAC - $ACWP_{cum}$) = EAC-based To-Complete Performance Index
- $TCPI_{EAC}$ index is compared to the CPI_{cum} index and is within +/-0.10 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.

$TCPI_{EAC}$ 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 project percent complete is greater than 10%, then a comparison of the $TCPI_{EAC}$ to CPI to test the EAC is warranted. The EAC at the CA level are reviewed for currency at a 0.05 difference between $TCPI_{EAC}$ and CPI_{cum}. At a 0.10 difference, the EAC is evaluated and updated if it cannot be justified. In the calculation of this metric, a 0.10 or higher number indicates the EAC is understated. A value equal to or less than (0.10) indicates the EAC is overstated.

Reviewing an EAC for achievability or reasonableness is a good practice at the project level. Two checks of EAC realism are 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 the CA needs to be to achieve the EAC being forecast. The TCPI is to be within +/- 0.10 of the CPI to be considered achievable or justified.
- Comparison of EAC to the best case/worst case IEACs to provide a range. These formulas are most accurate when the project is 10% complete. Outside of these ranges, the formula may not predict the most accurate outcomes.
- Cum CPI Method — The Cost Performance Index (CPI) measures the historical efficiency of 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} X 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 are within +/- 0.10 of each other. If there are larger differences, the contractor PM reviews the EAC for CAs that may have driven the EAC higher than necessary.

Summary of EAC Metrics:

Metric	Calculation	Recommended Use
$TCPI_{EAC}$	(BAC - $BCWP_{cum}$) / (EAC - $ACWP_{cum}$)	$\geq$ 10% Complete
CUM CPI Method	BAC / CPI_{cum}	$\geq$ 10% Complete
CPI X SPI (MICOM)	BAC – BCWP / (SPI * CPI)	> 10% Complete

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 testing, they all are considered one integrated test. Depending on the phase of the project, certain EACs may not be

relevant. The $TCPI_{EAC}$ formula is accurate for most of the project phases. Typically, none of the calculations are reliable below 10% complete.

F.5.3. *EACs include accurate and timely incorporation of subcontractor estimates. Direct/indirect rates are up-to-date and used to value ETC resources based on updated rate tables. Problems are identified, logged, tracked, mitigated, corrected, and closed. A CEAC is conducted annually and is fully documented and justified.*

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 the element of cost at the WP, PP, and SLPP levels (or lower depending on where resources are identified) for the remaining effort and is added to the cumulative ACWP to calculate the EAC. The ETC is developed using the most current indirect rates. This calculation includes evaluating the type and quantity of resources required to complete project objectives. At a minimum, direct costs are collected at the CA 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. Monthly, the CAMs review the status of the expended effort and the viability of the forecast. Subcontractor EACs are included in the prime EAC.

Annually, at a minimum, a comprehensive EAC is required to 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 ensures continuous 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 the element of a cost enhance the contractors' visibility into critical resource requirements.

The review of ETCs always includes a review of the latest schedule forecast dates, as the schedule forecast drives costs and is continually evaluated. Because resource allocation and availability drive the schedule forecast dates, resources included in the ETC are planned consistently with the schedule forecast and timing. Said a different way, the ETC and the forecast schedule demonstrate cost and schedule traceability. This traceability also means that the resource spread in the schedule is the same as the resource spread for the entire work scope in the EVMS budgeting 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 are coordinated with functional management to ensure the EAC is achievable. The EACs consider 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.

CAMs have the responsibility to review for currency their CA EACs every month during the variance analysis process. Thresholds do not have to be exceeded to change an EAC, just knowing 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, or scope changes. The ETC is prepared by resources based on variances that occur by EOC. Monthly EAC analysis focuses on performance to date within the CA, 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. The EAC may require updating on the basis of technology trends that may precede significant schedule 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 whether it is to 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 updates. Effectively maintaining the CA 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 are based on valid data.

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 needs to be repeated more frequently if project performance deems the current EAC is no longer valid. This Comprehensive EAC Kickoff needs to include, but not be limited to, ground rules and assumptions, and overall schedule for completing the comprehensive EAC, the 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 the guidance in the contract or DOE O 413.3B. The ground rules may include the use of more conservative rates (higher rates than the FPRA) to mitigate the risk of rising rates.

While the monthly EAC is a routine assessment, the comprehensive EAC process addresses all facets of the project. 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 is also 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 or 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 on the performance to date?
- Will the project cost performance impact the corporate financial condition?

F.5.4. *The EACs are integrated with the planning and scheduling, accounting considerations, indirect budget and cost management, risk management, and subcontract management subprocesses (Section 3.2).*

Impact of Ineffectiveness

When the EAC is not properly maintained, the project does not have visibility into cost and schedule risks and opportunities, as well as the resource requirements (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 the remaining work scope, including material purchases and subcontract efforts, creates uncertainty and increases the risk of EAC jumps and schedule slips (unwelcome surprises).

Special Considerations

None.

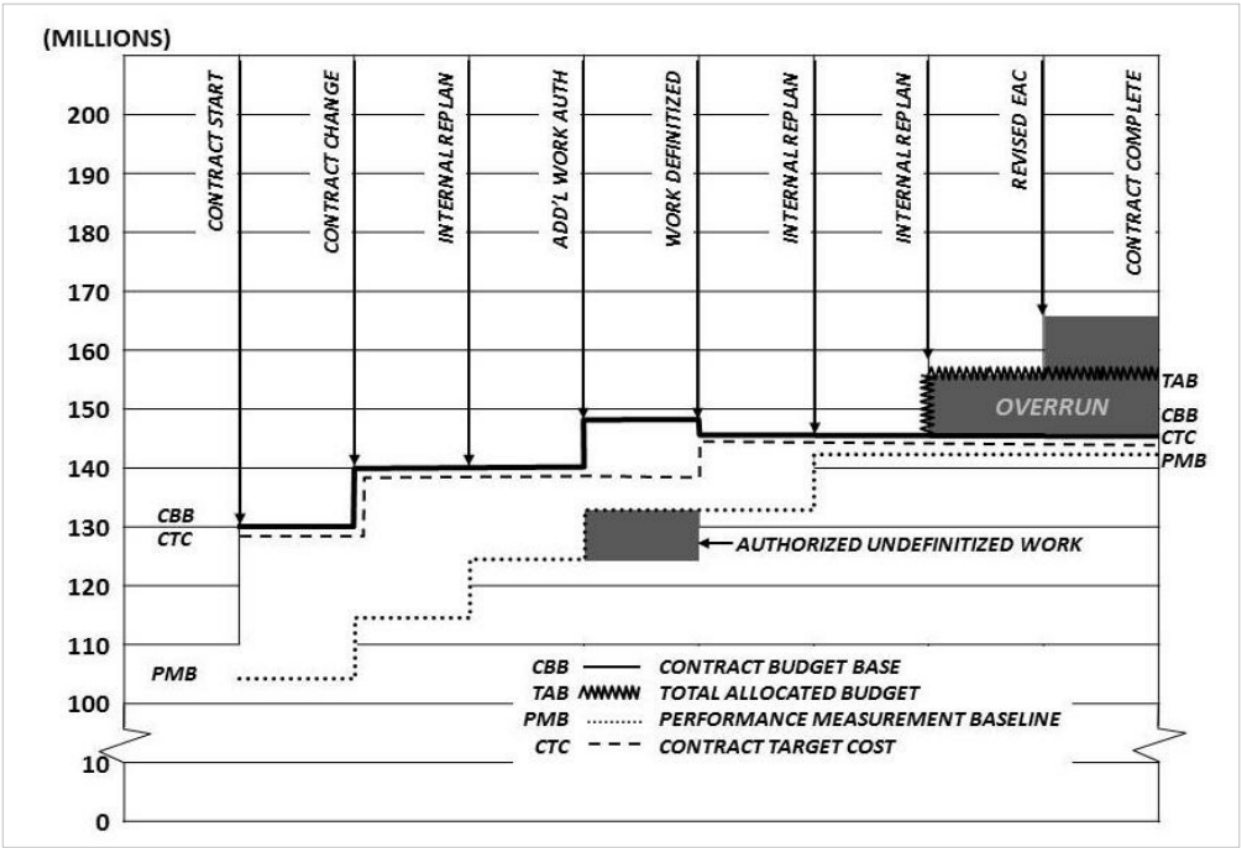
Subprocess G. Change Control

Change control is the subprocess for systematically controlling, analyzing, communicating, and recording the changes to the project baseline (such as PMB, MR, UB). The revisions and data maintenance category focuses on maintaining an accurate and reliable CBB/PBB and PMB throughout its period of performance (POP). The objective of the six attributes (G.1–G.6) that constitute this subprocess is to establish the requirements for implementing a formal change control process that preserves the integrity of the PMB and corresponding EVMS data and information. These attributes 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 are formally controlled and properly documented using a systematic approach. Ensuring authorized contractual changes and contractor internal changes are incorporated into all affected budgets, schedules, work authorizations, and other project documentation promptly before the commencement of that work ensures the PMB reflects all authorized work scope (G.2). Implementation of the Change Control attributes 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, or budgets (G.3). The distribution of MR and UB is accomplished through the use of a formal change control process. MR is controlled by limiting its use either to risk contained within a formal risk register or for in-scope unforeseen efforts not previously identified and budgeted in the PMB. To ensure that budgets for newly authorized work remain tied to the associated scope, UB is used to control the distribution of work using a holding account (G.1).

To maintain the accuracy/validity of performance measurement data, and its use for making reliable cost/schedule projections, retroactive changes to the data are controlled and limited to certain circumstances only (G.4). 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 (G.5). It may be necessary for the Total Allocated Budget (TAB) for the work to exceed the CBB/PBB, a condition known as an OTB, or for the baseline schedule to exceed contract milestones, a condition known as an OTS. The process of establishing an OTB or an OTS is called formal reprogramming and may be considered where improved insight and management control would result. Prior coordination between the contractor and the customer of an OTB, including customer approval, reinforces this mutual management of the project (G.6). (Figure 16 shows examples of changes to the baseline.)

Figure 16. Example of Revisions and Data Maintenance Process



DOE's interpretation of the intent of each of the six change control attributes and expectations for implementation are below. The change control subprocess considers the following key factors:

- **G.1.** MR and UB Logs exist and are fully maintained.
- **G.2.** Changes to the PMB are authorized and done promptly.
- **G.3.** All baseline changes are reconcilable to the CBB/PBB and the original value of the contract/project.
- **G.4.** Retroactive changes are limited to the 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.
- **G.5.** Authorized changes to the CBB/PBB and TAB are documented, reviewed, and approved.
- **G.6.** An OTB/OTS is performed with prior customer notification and approval.

As shown in Figure 5, the change control subprocess considers six management attributes that collectively account for 116 (or 16%) of the 1,000 possible points of the maturity model at Level 5. As shown in Figure 6, G.2 Incorporate Changes in a Timely Manner is the highest weighted management attribute.

G.1. Controlling Management Reserve and Undistributed Budget

The purpose of this attribute is to control MR and UB transactions (Table 45). The distribution of MR and UB is accomplished through the use of a formal change control process. MR is controlled by limiting its use either to risk contained within a formal risk register or for in-scope unforeseen efforts not previously identified and budgeted in the PMB. MR is not to be used to offset poor performance (such as cost overruns) or cover costs that are out-of-scope to the contract. Conversely, it is to be used to accommodate unforeseen changes that are in-scope to the contract, budgetary changes to future work scope caused by rate adjustments, and other unknowns. To ensure that budgets for newly authorized work remain tied to the associated scope, UB is used to control the distribution of work using a holding account. Once the responsible organizations for the new scope have been identified, the budget is transferred from UB to the appropriate CAs. This ensures budget and scope are not transferred independently. Changes to MR and UB budgets are formally and separately controlled, tracked, and reported detailing monthly transactions and providing current budget values. A Contract Budget Base/Project Budget Base (CBB/PBB) log is used to track PMB, UB, and MR changes. The CBB/PBB log also serves to identify reporting period (monthly) end-values, reporting period changes to/from MR, PMB, and UB, and current MR and UB budget balances.

MR and UB changes are integrated with the analysis and management reporting subprocess.

Table 45. Attribute G.1. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some of the processes outlining the steps/actions needed to control MR and UB are in place. MR and UB logs do not exist.**	**Most of the processes outlining the steps/actions needed to control MR and UB are in place and documented. MR and UB logs exist, however, are not fully maintained.**	**The documented processes outlining the steps/actions needed to control MR and UB are in place and approved. MR and UB Logs exist and are fully maintained.**	**MR and UB are proactively managed to inform decision-making.**
	MR and UB Logs do not exist. MR is being misapplied. It is being used to offset poor performance (such as cost overruns) or cover costs that are out of the scope of the contract. UB cannot be identified with a defined scope. A process to ensure the timely clearing of budget and related scope in the UB account does not yet exist.	MR and UB use and changes are documented in logs, but individual transactions may not be separately reconcilable to internal monthly baseline changes. There may be a few misapplications of MR, including its use to offset poor performance (such as cost overruns) or cover costs that are out-of-scope to the contract. UB has a defined scope and has been appropriately distributed to the PMB. With some exceptions, there is the timely clearing of the budget and related scope in the UB account. MR and UB changes are coordinated with the analysis and management reporting subprocess.	(G.1.1) All MR and UB changes are documented monthly in logs showing at a minimum the date and title of the change action, associated WP, CA, descriptive title, and reference numbers as needed for tracing back to the originating change documentation. (G.1.2) Risk mitigation or realization activities are identified with all MR transactions. These transactions are coordinated with the risk management process for the re-evaluation of residual risk. (G.1.3) MR is used per contractual documentation. The new contractual work scope is not budgeted with MR, but instead comes from contingency and is documented via the formal contract change modification process and approved accordingly. (G.1.4) UB has a defined scope and has been appropriately distributed to the PMB in a timely and effective manner. (G.1.5) MR and UB changes are integrated with the analysis and management reporting subprocess.	All MR and UB changes are documented and reported in published logs. The control of MR and UB by the PM is proactive and effective. MR and UB are monitored and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. The review of the MR budget and its distribution is subject to, managed, and controlled by a Change Control Board (CCB) or equivalent. An accurate relationship between the budget amounts in the UB account and the scope of work authorized for each budget value is consistently maintained. Routine surveillance results of MR and UB are fully disclosed to all key stakeholders, who maximize their use. MR and UB changes are continuously reviewed and optimized.

Objective

The documented processes outlining the steps/actions needed to control MR and UB are in place and approved. MR and UB Logs exist and are fully maintained.

Effectiveness Criteria

G.1.1. *All MR and UB changes are documented monthly in logs showing at a minimum the date and title of the change action, associated WP, CA, descriptive title, and reference numbers as needed for tracing back to the originating change documentation.*

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. The process documentation outlines the steps needed to record MR and UB changes in logs. The project demonstrates a willingness to address problems in a documented and timely manner.

G.1.2. *Risk mitigation or realization activities are identified with all MR transactions. These transactions are coordinated with the risk management process for the re-evaluation of residual risk.*

Throughout the life of the project, MR enables the PM to respond to future unanticipated events within the contract's work scope, by distributing the budget to track and mitigate project risks. The MR transaction details the actions to reduce or eliminate the project's exposure to potential risks and reduce the likelihood that those risks will occur.

G.1.3. *MR is used per contractual documentation. The new contractual work scope is not budgeted with MR, but instead comes from contingency and is documented via the formal contract change modification process and approved accordingly.*

New work scope is anything that is outside the current parameters of the contract. If a customer asks for additional features or services considered beyond the scope requirements of the current contract, this is considered to be "out of scope".

There may be a few misapplications of MR, including its use to offset poor performance (such as cost overruns) or cover costs that are out-of-scope to the contract. 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. MR is not to be limited for use to a specific CLIN as MR has nothing to do with scope or funding when it is established.

The contractor includes a clear definition of MR in the EVM system description. For clarity and consistency, the EVM system description defines the process and lists allowable conditions under which MR may be approved and allocated to 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. The distribution into and application out of MR are formally allocated through the change control process. Through this process, the MR budget is transferred to/from WPs within the PMB. The process ensures that the use of MR meets the stated criteria in the EVM system description. MR cannot be used to offset accumulated overruns or underruns.

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 (such as 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 (such as subcontractor activities that are negotiated post-project award).

Management ensures 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 buys decision where the alternative requires less budget, then the increase to MR reconciles. These offsetting entries would be recorded in the CBB/PBB log against the appropriate budget elements.

G.1.4. *UB has a defined scope and has been appropriately distributed to the PMB in a timely and effective manner.*

UB accounts are to be cleared in a reasonably timely manner as the work scope is finalized and distributed to CAs or to SLPPs. This authorized work scope and budget relationship are also be maintained when the work scope and the related budget are removed from the distributed budget and placed in the UB pending further negotiations with the customer.

G.1.5. *MR and UB changes are integrated with the analysis and management reporting subprocess (Section 3.2).*

Impact of Ineffectiveness

Failure to distribute MR and UB transactions promptly may result in delays in detailed planning and budgeting, and work execution that may not fully represent the work scope of the change.

Special Considerations

The identification of MR and UB is in C.10 and C.11, respectively.

G.2. Incorporate Changes in a Timely Manner

The purpose of this attribute is to incorporate authorized changes promptly, recording the effects of such changes in budgets and schedules (Table 46). In the directed effort, before negotiation of a change, base such revisions on the amount estimated and budgeted to the project organizations. 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.

Table 46. Attribute G.2. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some of the processes to accurately incorporate and document authorized changes to the PMB promptly are documented.**	**Most of the processes to accurately incorporate and document authorized changes to the PMB promptly are documented.**	**All processes to accurately incorporate and document authorized changes to the PMB promptly are documented and approved.**	**PMB updates are used to inform effective and proactive decision-making as directed changes occur.**
	The processes needed to accurately incorporate authorized scope, schedule, and budget changes to the PMB have been started but they are not yet documented. Scope, schedule, and budget changes are poorly integrated into the project schedule. For unpriced change orders, detailed planning and budgeting for near-term work are not performed. Baseline change control documentation and approvals do not exist or are incomplete. The authorized scope, schedule, and budget changes to the baseline are inadequately reflected in the change control practices and logs.	The processes needed to support authorized changes are incorporated in the PMB in a documented, disciplined, and timely manner are in place, with some exceptions. Most of the authorized budget, scope, and schedule changes are integrated into the project schedule. For unpriced change orders, the process for detail planning and budgeting for near-term work is in place and followed. A few incorporated changes arbitrarily eliminate existing cost and schedule variances. Changes to the PMB are coordinated with the planning and scheduling, budgeting and work authorization, and analysis and management reporting subprocesses.	(G.2.1) All of the authorized scope, schedule, and budget changes are integrated into the PMB in a documented, disciplined, and timely manner. Change documents are updated in a timely and appropriate manner or as soon as practical, but no later than two accounting periods. (G.2.2) Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (G.2.3) For unpriced change orders, detailed planning and budgeting documents are maintained for near-term work. After definitization, any budget remaining in UB is planned and budgeted within CA, SLPP, or MR. (G.2.4) Changes to the PMB are integrated with the planning and scheduling, budgeting and work authorization, and analysis and management reporting subprocesses.	Changes to the PMB are monitored and automatically updated and tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Unpriced change orders are expeditiously planned, budgeted, documented, and monitored. Distributed budget is updated continuously as changes are authorized. Routine surveillance results of changes to the PMB are fully disclosed to all key stakeholders, who maximize their use. 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 correct management actions and decisions. The process of incorporating changes into the PMB is continuously improved and optimized.

Changes to the project are integrated into the existing baseline documents (scope, schedule, and budget) in a timely and appropriate manner to maintain the validity of the Contract Budget Base (CBB), Project Budget Base (PBB), and PMB. This in turn avoids the execution of new work scope without a performance measurement budget providing continuous, accurate performance measurement information to management. There are two basic change control concepts as a result of the change to the PMB and CBB/PBB. There are definitized changes from supplemental agreements or undefinitized changes from change orders or letter contracts. For unpriced change orders, contractors develop a best estimate of the cost of the new work scope. This estimate does not consider constraints of authorized funding or Not to Exceed (NTE) values and is for planning and budgeting purposes to establish initial budgets in the PMB. Until contractual definitization, budgets may be established for near-term work only with the remaining budget held in the UB. Once definitization is complete, all remaining budgets in UB are planned within CAs or SLPP, as soon as practical. Incorporating changes do not arbitrarily eliminate the existing cost and schedule variances.

The effective implementation ensures control and suitability are established by the project in executing the authorized scope within the established schedule, enhancing internal and external management confidence in making project decisions. The PMB always reflects the most current plan, including authorized changes, allowing baseline documentation to be properly modified to reflect the current plan. By ensuring that budget and schedule revisions and changes to the PMB

are documented and traceable, the integrity of the PMB is maintained. This provides CAMs with valid CA plans against which to execute and measure performance.

Changes to the PMB are integrated with the planning and scheduling, budgeting and work authorization, and analysis and management reporting subprocesses.

Objective

All processes to accurately incorporate and document authorized changes to the PMB promptly are documented and approved. 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 attribute 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.

The following describes the characteristics of change control:

- Authorized changes are incorporated into the PMB promptly.
- Unpriced change orders for detailed planning are maintained for near-term work. After definitization, any budget remaining in UB will be planned and budgeted within CAs, SLPP, or MR.
- Changes do not arbitrarily eliminate existing costs and schedule variances.

Effectiveness Criteria

G.2.1. *All of the authorized scope, schedule, and budget changes are integrated into the PMB in a documented, disciplined, and timely manner. Change documents are updated in a timely and appropriate manner or as soon as practical, but no later than two accounting periods.*

DOE requires changes are incorporated within the next fiscal period as the change authorization. Management ensures 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. Incorporating changes does not arbitrarily eliminate the existing cost and schedule variances. Authorized changes are processed promptly, 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 (such as a 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. Whether DOE contract directed or contractor internal approved changes, the IMS, EVMS budgeting tool, WADs, dollarized RAM, and CBB/PBB log are updated in the same reporting period that the change control is implemented. The baseline reflects 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 or contingency are authorized by the customer.

G.2.2. *Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The process documentation outlines the steps needed to record and integrate authorized scope, schedule, and budget changes to the PMB from start to finish. The project demonstrates a willingness to address problems in a documented and timely manner.

G.2.3. *For unpriced change orders, detailed planning and budgeting documents are maintained for near-term work. After definitization, any budget remaining in UB is planned and budgeted within CA, SLPP, or MR.*

UB is a budget that applies to the 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 are distributed to CAs 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, the 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 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. 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 is 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.

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 in the scope, schedule, 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, 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. 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 to be started immediately, preceding negotiations to definitize the final budget. 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 is required to be placed in UB at the time the AUW is authorized until distributed. AUW is 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.

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 have accurately identified all authorized work scope on the 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 establish a CBB/PBB for the entire scope of work, the budget established for AUW represents 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, that is, either planned and budgeted into CAs, SLPPs, or MR as soon as practical or removed from the CBB/PBB.

G.2.4. *Changes to the PMB are integrated with the planning and scheduling, budgeting and work authorization, and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

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 promptly after a stop-work order may result in delays in detailed planning and work execution. Failure to reclaim the budget (in the event of a stop-work) promptly 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.

Special Considerations

DOE clarified the requirement for internal changes to be documented within one accounting period after approval of the contractor baseline change documentation (such as a BCR) and the documented changes for the IMS, EVMS budgeting tool, WADs, dollarized RAM, and CBB/PBB log be updated in the same reporting period that the change control is implemented. DOE also clarified the definition of undefinitized changes/unpriced change orders is the same as authorized unpriced work (AUW).

G.3. Baseline Changes Reconciliation

The purpose of this attribute is to document changes to the PMB and 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 (Table 47). Documented changes to the PMB always reflect the most current plan for accomplishing the effort. To ensure the ongoing integrity of the CBB/PBB, budget traceability throughout the project life cycle is maintained. Current budgets 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. A properly maintained and documented Contract Budget Base (CBB) / Project Budget Base (PBB) and PMB is crucial for 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 correct management actions and decisions. Current budgets are reconciled with prior budgets for effective management control.

Table 47. Attribute G.3. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some processes exist for reconciliation and traceability to the original value of the contract.**	**Most processes exist for reconciliation and traceability to the original value of the contract and include the most necessary approvals and information for effective control.**	**All processes to ensure elements are reconciled to the original value of the contract include all necessary approvals and information for effective control. The processes are defined, documented, and approved.**	**Processes are optimized to ensure adjustments to the CBB/PBB and the PMB are reconcilable and traceable via contract budget logs.**
	Some baseline changes are reconcilable to the prior baseline. Budget logs and baseline change documentation do not include all necessary approvals and information for effective control. Accurate adjustments to the CBB/PBB and the PMB are not possible. Contractual change documents that transmit and authorize the change or addition to work, schedule, and budget to the CBB do not exist. Change documentation (contract modifications, change control logs, change requests, authorization documents, scheduling documents, etc.) does not exist or is not updated. Few distributions of additional budgets are tracked in change control logs. The PMB has few activities controlled in the freeze period to prevent unnecessary adjustments.	Most baseline changes are reconcilable to the prior baseline through the use of budget logs and baseline change documentation. When making adjustments to the CBB/PBB and the PMB, traceability from original CA values to current values is generally possible via contract budget logs. Most contractual change documents that transmit and authorize the change or addition to work, schedule, and budget exist. Contractual change documents transmit and authorize most changes or addition of work, schedule, and budget to the CBB/PBB. Change control logs track the distribution of most of the additional budgets. The PMB has most activities controlled in the freeze period to prevent unnecessary adjustments. Reconciliation of baseline changes is coordinated with the budgeting and work authorization, planning and scheduling, and analysis and management reporting subprocesses.	(G.3.1) All baseline changes are reconcilable to the CBB/PBB and the PMB through the use of budget logs and baseline change documentation. (G.3.2) WADs exist for new work scope, schedule, and budget. When adjusting the CBB/PBB and the PMB, traceability from original CA values to current values is possible. Budget authorizations accurately reflect the modified scope of work. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight. (G.3.3) Contractual change documents transmit and authorize all changes or addition of work, schedule, and budget to the CBB/PBB. Change control logs track the distribution of all additional budgets. (G.3.4) The PMB is controlled in the freeze period to prevent unnecessary adjustments, with few immaterial exceptions. (G.3.5) Reconciliation of baseline changes is integrated with the budgeting and work authorization, planning and scheduling, and analysis and management reporting subprocesses.	Reconciliation includes the use of budget logs and baseline change documentation including all necessary approvals and information for accurate and effective control. The PMB is effectively controlled in the freeze period to prevent unnecessary adjustments. Reconciliation of baseline changes and their integration with the Budgeting and Work Authorization subprocess and Analysis and Management Reporting process are automated, monitored, used for management control, and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of baseline change reconciliation are fully disclosed to all key stakeholders, who maximize their use. The process of baseline change reconciliation is continuously improved and optimized.

The need for accurate visibility into performance measurement requires that the CBB/ PBB and the PMB maintain a level of accuracy and relationship to the contract. As changes are made to the contract, the CBB/PBB is adjusted by the amount of change for the communication between the two parties to remain valid. The PMB value is adjusted to reflect the establishment of a budget for the authorized work, with any difference becoming part of the MR. The effective implementation ensures control and auditability are established by the project in executing the authorized scope within the established schedule, enhancing internal and external management confidence in making project decisions. The PMB always reflects the most current plan, including authorized changes allowing baseline documentation to be properly modified to reflect the current plan. By ensuring that budget and schedule revisions and changes to the PMB are documented and traceable, the integrity of the PMB is maintained. This provides CAMs with valid CA plans against which to execute and measure performance. Changes made outside the authorized baseline control processes compromise the integrity of performance trend data and delay visibility into overall project variance from the plan, thus reducing the alternatives available to managers for project redirection or revisions.

Reconciliation of baseline changes is integrated with the budgeting and work authorization, planning and scheduling, and analysis and management reporting subprocesses.

Objective

All processes to ensure elements are reconciled to the original value of the contract include all necessary approvals and information for effective control. The processes are defined, documented, and approved. Authorized changes are incorporated into the PMB and authorization documents updated accordingly before the commencement of work. Documented changes made to the PMB are traceable and substantiated. A baseline change control process governs authorized changes to work scope, period of performance, and budget in the CBB/PBB.

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 CBB/PBB is adjusted by the amount of change 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.

- The following describes the characteristics of PMB Changes and Baseline Changes Reconciliation: Authorized changes to the PMB are documented and traceable.
- Baseline changes are reconcilable to the prior baseline and the baseline change documentation includes all necessary information for effective control.
- Changes to BCWS in open WPs are limited to time phasing the remaining future budget outside the documented freeze period or providing additional detail (not new scope) without a change in BAC.
- BCWS changes to future time phasing are approved.
- MR is limited to authorized work that is within the scope of the contract, but out of scope to a CA.

Effectiveness Criteria

G.3.1. *All baseline changes are reconcilable to the CBB/PBB and the PMB through the use of budget logs and baseline change documentation.*

Every transaction follows 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 the distributed budget. These adjustments 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 WAD is created or updated to reflect the new baseline. The revised baseline is also reflected in the EVMS budgeting tool output for CAPs and also incorporated in the month-end IPMR/CPR. Every transaction for MR or UB is thoroughly documented with the appropriate supporting details in change control documentation. The documentation specifies the affected CAs and contain a good for the proposed change. Requests for MR justify the budget justification request for the CA. The overall purpose of

change control is to understand the historical reasons for changes and be able to trace changes to CAs and WPs.

G.3.2. *WADs exist for new work scope, schedule, and budget. When adjusting the CBB/PBB and the PMB, traceability from original CA values to current values is possible. Budget authorizations accurately reflect the modified scope of work. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight.*

Managers ensure that all baseline change documentation is reconciled throughout the EVMS. The source documents may vary between contractors, depending on the EVMS, but include the following:

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

Note that the contractor's system may also require submission of any proposed QBD as a backup for the EVT. 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 changes from labor to subcontract/material. In all cases, this item represents a change in the work scope and how it will be done and is 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 a different technique. Again, ACWP is not changed when the existing WP is closed, and any CV remains 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 needs to:

- 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 EVMS budgeting tool.
- Provide the justification and documentation for changing the EVTs in open WPs in the IPMR/CPR Format 5.

Refer to attribute C.8 for the Appropriate Assignment of EVTs.

It may be necessary to perform internal replanning actions within the scope of the authorized contract (CBB/PBB or TAB) to compensate for the 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 the 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 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 is adjusted by the amount of change for the communication between the DOE and contractor to remain valid.

G.3.3. *Contractual change documents transmit and authorize all changes or addition of work, schedule, and budget to the CBB/PBB. Change control logs track the distribution of all additional budgets.*

Using a disciplined, systematic change control process to document PMB changes assures 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 always reflects the most current plan for accomplishing the effort. Authorized changes are incorporated into the PMB and authorization documents are updated accordingly before the commencement of work. Documented changes made to the PMB are traceable and substantiated. The contractor's EVM system description describes a process for proper documentation of baseline changes. It is essential for baseline change requests to have supporting detail that shows, by CA, the time-phased budgets by the 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" a picture is often used to fully describe the change.

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 facilities this understanding. Project documentation such as work authorizations, schedules, and project logs provides and demonstrates this reconciliation. Current budgets and schedules reflect the current levels of authorized work and are based on resources needed to complete that work. The budgets are traceable to the original authorized budgets and scope.

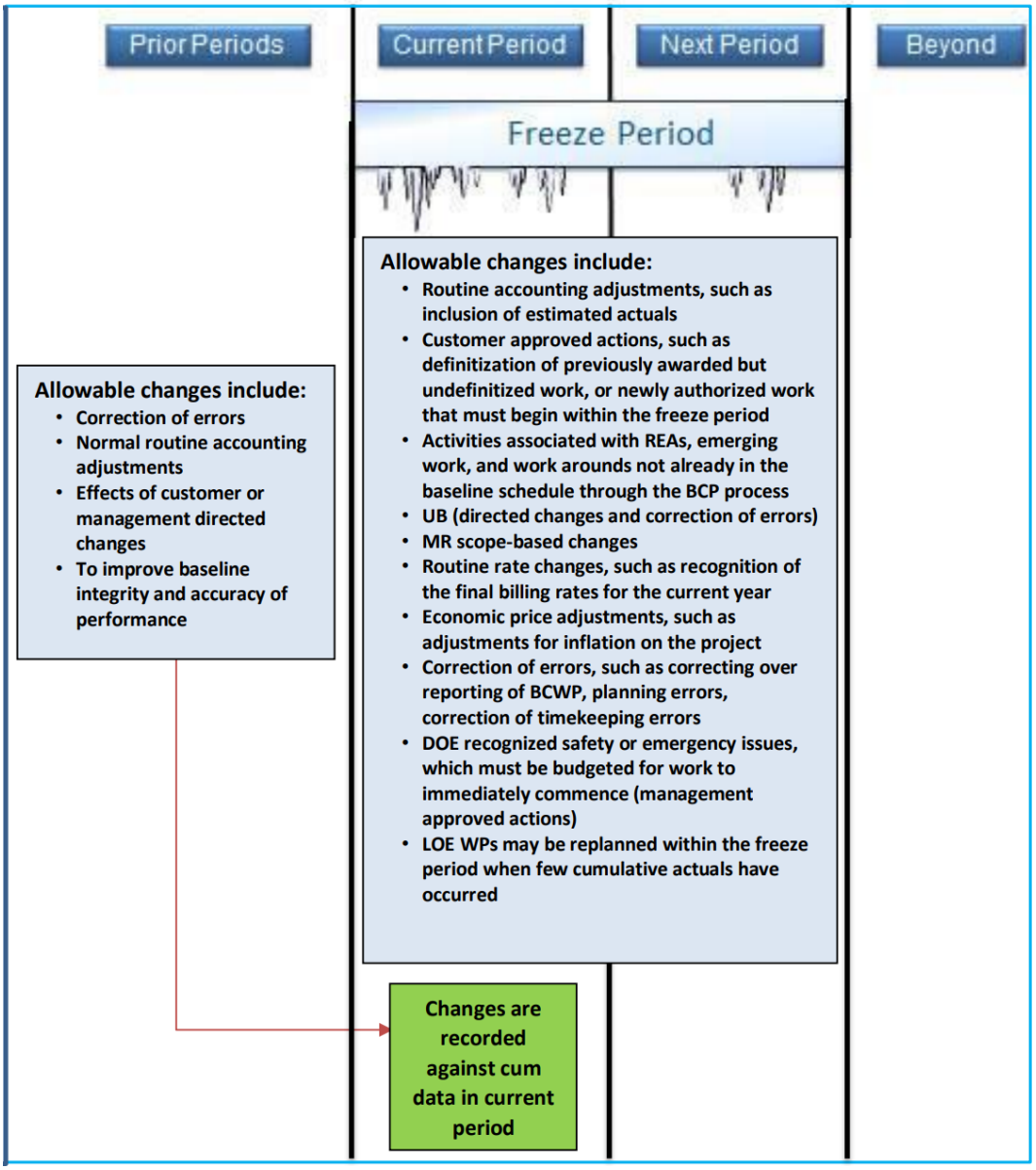
Management ensures that if a change involves UB, it is reconciled with the CAs, SLPPs, or MR. As UB is a temporary holding account for work scope and budget, any baseline change that involves a transaction from UB to CAs or SLPPs or vice versa is offset by a reverse change to the affected accounts. For 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 always is equal to the amount distributed from UB. These offsetting entries would be recorded in the CBB/PBB log against the appropriate budget elements. Most changes involve movement from UB, but there may be occasions when the 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 is to 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.

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, CA 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.

G.3.4. *The PMB is controlled in the freeze period to prevent unnecessary adjustments, with few immaterial exceptions.*

This restricted period encourages detailed CA 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 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 freeze period intends that there is no ability to adjust the budgets or budget time phasing based on actual performance to mask variances. Baseline changes are highly restricted during this defined freeze period to maintain a stable and measurable work plan for ongoing work (Figure 17).

Figure 17. Freeze Period Changes



The freeze period is at least two reporting periods, that is, current plus one. At the beginning of the month, it is the longest and the end of the month is 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 restrict any baseline and accounting changes during a defined freeze period. Baseline and accounting changes are highly restricted during the defined freeze period to maintain a stable work plan for ongoing work, allow meaningful variances, and ensure that planned resources will be available as scheduled. Changes permitted within the freeze period are limited to:

- Routine accounting adjustments, such as the inclusion of estimated actuals.

- Customer approved actions, such as definitization of previously awarded but undefinitized work, or newly authorized work that begins within the freeze period.
- Activities associated with REAs, emerging work, and workarounds 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, and correction of timekeeping errors.
- DOE recognized safety or emergency issues, which are budgeted for work to immediately commence (management approved actions).
- LOE WPs may be replanned within the freeze period when few cumulative actuals have occurred.

The IPMR/CPR Format 5 identifies the reasons for MR transactions, and these 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.

Changes may impact the 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. 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 for the WP to 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 remains 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:

- Adds the additional budget using current planning rates.
- Updates the IMS and link/relink activities as required and realistic.
- Adjusts cumulative BCWP for performance within the EVT. The issue is that the BAC has changed, so the prior cumulative percent complete will change the current BCWP. This includes QBDs, if applicable.
- Provides 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 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.

G.3.5. *Reconciliation of baseline changes is integrated with the budgeting and work authorization, planning and scheduling, and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

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

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 upon which cost and schedule variances are dependent 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 a 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.

Special Considerations

DOE clarified its freeze period requirement of the current month plus one month.

G.4. Control of Retroactive Changes

The purpose of this attribute is to control retroactive changes to records about work performed that would change previously reported amounts for actual costs, earned value, or budgets (Table 48). Adjustments are 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. Control retroactive changes to records about work performed that would change previously reported amounts for actual costs, earned value, or budgets.

Table 48. Attribute G.4. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some processes to control retroactive changes are in place but are not documented.**	**Most processes are documented to consistently control retroactive changes.**	**All processes to consistently identify and control retroactive changes are documented and followed.**	**Retroactive changes are controlled, reviewed monthly, and inform proactive decision-making.**
	The process of effectively implementing change management and control to minimize retroactive change occurrences has not been clearly defined. There is no disciplined approach in place to manage and incorporate retroactive budget and performance adjustments to the PMB. There is little reconciliation between adjusted budget and performance data due to retroactive changes and previously reported data. There is little documentation of budget, earned value, and actual cost adjustments, due to retroactive changes.	Most change control processes exist defining policy for retroactive changes. The policy includes conditions for use such as prohibitions, approvals, and justifications. Change control logs record most of the change activities. In most cases, a disciplined approach is in place to identify, manage and incorporate retroactive budget and performance adjustments to the PMB. The reconciliation between adjusted and previously reported data has minor gaps. There is documentation of budget, earned value, and actual cost adjustments in the logs and reporting data. Control of retroactive changes is coordinated with the accounting considerations, indirect budget, and cost management, and analysis and management reporting subprocesses.	(G.4.1) Change control processes clearly and fully define policy regarding retroactive changes including conditions for use such as prohibitions, approvals, and justifications. Change control logs record all change activities. (G.4.2) A disciplined approach is in place to identify, manage and incorporate retroactive budget and performance adjustments to the PMB. Adjusted and previously reported data is documented and reconciled. Budget earned value and actual cost adjustments are documented promptly. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (G.4.3) Retroactive changes are limited to the 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. (G.4.4) Control of retroactive changes is integrated with the accounting considerations, indirect budget and cost management, and analysis and management reporting subprocesses.	Adjusted and previously reported data are accurately reconciled and documented monthly. This process is repeatable and regularly reviewed by management. Retroactive changes are monitored and automatically reviewed to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Change control logs record all change activities immediately. All adjustments to cost and schedule variances are routinely surveilled and documented with appropriate explanations. They are fully disclosed to all key stakeholders, who maximize their use. Stakeholders can make decisions using up-to-date information produced by the EVMS reflecting all retroactive changes with related explanations. Control of retroactive changes is continuously improved and optimized.

Retroactive changes to the baseline may mask variance trends and prevent the use of the performance data to project estimates of cost and schedule at completion and are controlled. The establishment of internal controls to identify and limit retroactive budget and performance adjustments helps maintain visibility of overall project variance from the plan.

Controlling retroactive changes to budgets or costs for completed work maintains the validity of historical EVMS cost and schedule variance trends and reflects true program performance. A stable baseline and performance information against that baseline are essential to both internal and external management if informed decisions are going to be made based on the analysis of the system-generated information. Uncontrolled changes to the PMB limit the ability to conduct predictive analysis. Multiple, continuing adjustments to the PMB can limit the predictive nature of any analyses.

Control of retroactive changes is integrated with the accounting considerations, indirect budget and cost management, and analysis and management reporting subprocesses.

Objective

All processes to consistently identify and control retroactive changes are documented and followed. This attribute is intended for the active performance period, and it provides guidance for the types of changes (correction of errors, routine accounting adjustments, effects of customer- or management-directed changes, or improving the baseline integrity and accuracy of performance measurement data). Any mass retroactive change as an across-the-board single point adjustment (SPA) can have drastic effects on the project and its progress reports. A retroactive change to monthly data does not only cause management to question the work that was previously thought to have been accomplished, but also impacts the cumulative trend that was previously reflected. The contractor's adjustment method for the effects of a customer-directed change is critical. Changing a CA budget value during a freeze period for customer-directed changes is a legitimate necessity and is considered part of a contractor's internal controls process. Furthermore, the contractor's work authorization process needs to accommodate such changes before the start of work during the active performance period. Otherwise, the authorization process will lag, and it could lead to the establishment of zero-budget accounts or WPs that would result in negative performance values.

The following describes the characteristics of Controlling Retroactive Changes: The contractor limits 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.

Effectiveness Criteria

G.4.1. *Change control processes clearly and fully define policy regarding retroactive changes including conditions for use such as prohibitions, approvals, and justifications. Change control logs record all change activities.*

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 they occurred, to provide visibility.

G.4.2. *A disciplined approach is in place to identify, manage and incorporate retroactive budget and performance adjustments to the PMB. Adjusted and previously reported data is documented and reconciled. Budget earned value and actual cost adjustments are documented promptly. Problems are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

One of the most important EVMS tests is to find out if there have been unauthorized retroactive changes to the baseline. In practice, this 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 reported amounts are to be made in the current reporting period. Another important comparison 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 to allocate the remaining (unused) budget to the future effort. This tendency is usually based on the

contractor not making the distinction between financial funding and EVMS budgeting standards. An EVMS budget baseline intends to maintain visibility of past performance to forecast 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 is 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 is not impacted by this type of adjustment.

A SPA is a process that sets existing contract cost or schedule variances to zero and typically accompanies a replan of the remaining effort to complete 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 is 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 18. It is 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 always reconcile to the actual accounting records.

Figure 18. Single Point Adjustment (SPA) Approaches

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

There are three different approaches for adjusting variances (Figure 18). 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 are implemented sparingly, as resetting variances to zero restricts any insight into performance for several months. In addition, an SPA may result in disintegration between the IMS coming from the scheduling tool and the time-phased budget from the EVMS budgeting tool. In such cases additional steps to restore integration are needed to

ensure the longest continuous path remains from the beginning of the project through CD-4, the schedule has a single point consistent with the time-phased budget resulting from the EVMS budgeting tool, and all of the to-go activities are unchanged. The contractor provides advance notification and requests approval from the contracting officer before the implementation of a SPA. If the contractor also adds a budget during this process that exceeds the target cost, it is known as an OTB.

G.4.3. *Retroactive changes are limited to the 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.*

Replanning, or the realignment of scope, schedule, and budget within the CBB/PBB, is limited to preserving a stable baseline upon which performance is measured. Replanning is generally intended for plans (such as in the next accounting period or outside the freeze period, for example, the 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 the 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 the 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 does not only cause management to question the work that was previously thought to have been accomplished, but it impacts the cumulative trend that was previously reflected. Retroactive changes are 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;
- Economic price adjustments, such as adjustments for inflation on the contract; or
- Does the contractor prevent the future budget from being used to change the budget of current work or to offset schedule/cost variances?

G.4.4. *Control of retroactive change is integrated with the accounting considerations, the indirect budget and cost management, and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

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.

Special Considerations

None.

G.5. Preventing Unauthorized Revisions to the CBB/PBB

The purpose of this attribute is to prevent revisions to the project budget except for authorized changes. Prevent the incorporation of unauthorized revisions into the CBB/PBB (Table 49). Project budget changes are prevented unless authorized changes. Disciplined baseline change control helps maintain the relationship between the Total Allocated Budget (TAB) and the contract value. The information that flows from the execution of the plan represented by the project budget, also known as the Contract Budget Base (CBB)/Project Budget Base (PBB), accurately represents progress in the completion of the authorized scope against the contractual schedule.

Table 49. Attribute G.5. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**The process to control changes to the CBB/PBB and TAB has started but is not documented.**	**Most documented processes to control changes to the CBB and TAB are in place.**	**All processes to control changes to the CBB/PBB and TAB are documented, reviewed, and approved.**	**Changes to the CBB/PBB and TAB are proactively integrated into the project control management decision processes.**
	There is little disciplined management of CBB/PBB and TAB. Change control logs are incomplete.	The CBB/PBB and TAB relationship is being managed in a disciplined manner. The CBB/PBB to contract value relationship is mostly maintained. There is a process in place to control contract changes. Change control logs reflect most of the changes to the PMB and CBB/PBB. The preventing unauthorized revisions to the CBB/PBB process is coordinated with the budgeting and work authorization and analysis and management reporting subprocesses.	(G.5.1) The CBB/PBB to contract value relationship is continuously monitored. Change control logs reflect all changes to the PMB and CBB/PBB and fully reconcile. (G.5.2) Problems related to the CBB/PBB and TAB are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (G.5.3) The preventing unauthorized revisions to the CBB/PBB process is integrated with the budgeting and work authorization and analysis and management reporting subprocesses.	Stakeholders can make timely decisions using up-to-date information produced by the EVMS reflecting all revisions. Unauthorized revisions to the CBB/PBB are monitored and automatically identified using a data driven approach including test metrics. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of CBB/PBB and TAB are fully disclosed to all key stakeholders, who maximize their use. Process and operations are optimized. Fewer hours are being used to execute the process/operation; processes/operations are more intuitive and therefore more broadly accepted, and data are being generated timelier with greater accuracy.

The preventing unauthorized revisions process is integrated with the budgeting and work authorization and analysis and management reporting subprocesses.

Objective

All processes to control changes to the CBB/PBB and TAB are documented, reviewed, and approved. 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.

Effectiveness Criteria

G.5.1. *The CBB/PBB to contract value relationship is continuously monitored. Change control logs reflect all changes to the PMB and CBB/PBB and fully reconcile.*

Disciplined baseline change control helps maintain the relationship between the CBB/PBB at target cost and the project value (includes profit 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 issues a project authorization document at the total project level, at project award, and subsequent revisions to the project value through modifications. These documents 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 the target cost.

G.5.2. *Problems related to the CBB/PBB and TAB are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The contractor has employed controls to test and validate the CBB/PBB/TAB monthly stays in alignment with the project totals. Any problems are logged and closed before reporting for the month to DOE.

G.5.3. *The preventing unauthorized revisions to the CBB/PBB process is integrated with the budgeting and work authorization and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

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 or fee.

Special Considerations

None.

G.6. Over Target Baseline/Over Target Schedule Authorization

The purpose of this attribute is to acknowledge an agreement between the customer and the contractor to allow the additional budget to be added to the project baseline that is not part of the original contract budget base (CBB) (Table 50). The customer has agreed to fund an increased scope that is an amount over and above the negotiated cost. When the performance budget or schedule objectives significantly exceed the project plan and are recognized in the PMB, it may be identified as an Over Target Baseline (OTB) or an Over Target Schedule (OTS). The project maturity, percent complete, remaining duration, and significance of the excess are considered, with an overarching goal of improving the performance reporting and estimating. Prior coordination between the contractor and the customer of an OTB, including customer approval, reinforces this mutual management of the project. The decision to establish an OTB may entail establishing schedule dates beyond contractual delivery dates, commonly referred to as an OTS, as a result of planning future work, planning in-process work, or adjusting variances (cost, schedule, or both). When properly implemented, the OTB allows the project to increase the amount of budget (referred to as an "Above-Target Budget" (ATB)) for the remaining work to a more realistic amount to adequately provide for a reasonable budget objective, work control, and performance measurement. This data allows for both the contractor and the customer to make effective management decisions for the mutual benefit of the project. The timely and effective management of OTS and OTB results in stability for cost and schedule performance. OTB and OTS reflect increases to the Total Allocated Budget (TAB) value and the resources planned to perform the authorized work scope. Prior customer authorization is needed when it exceeds the Contract Budget Base (CBB). Before determining that a project/program will implement an

OTB/OTS, assess that the project is more than 20% complete using the formula: BCWP/BAC. Projects/programs that are generally 20% complete may not be mature enough to make the time and expense of implementing an OTB/OTS worthwhile. Consider implementing an OTS/OTB to regain an executable time-phased baseline for performance measurement when the project's PMB EAC dollar value exceeds the BAC dollar value generally by more than 15% with at least 12 months of work remaining to be completed.

Table 50. Attribute G.6. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**OTB/OTS is performed without customer notification and is not reflected in TAB, CBB, and PMB**	**OTB/OTS is performed with customer notification.**	**OTB/OTS is performed with prior customer notification and approval (if required).**	**OTB/OTS scope is proactively addressed with customer notification, coordination, and approval (if required), after thorough analysis.**
	OTB/OTS implementation results in a discrepancy between TAB, CBB/PBB, and PMB. There is little coordination between customer and contractor towards a mutual agreement of OTB/OTS.	Coordination between customer and contractor towards a mutual agreement of OTB/OTS is occurring with some gaps. TAB, CBB, and PMB values are not appropriately updated with OTB/OTS implementation. OTB authorization is coordinated with the budgeting and work authorization, planning and scheduling, and analysis and management reporting subprocesses.	(G.6.1) Prior approval (if required) of OTB/OTS is occurring between the customer and contractor. The TAB, CBB/PBB, and PMB are updated to reflect OTB/OTS. (G.6.2) Problems related to the OTB/OTS process implementation, and their root causes, are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (G.6.3) OTB/OTS authorization is integrated with the budgeting and work authorization, planning and scheduling, and analysis and management reporting subprocesses.	After a thorough analysis of the budget variance, a solution is developed between parties with realistic goals and mutual agreement (written approval if required). The PMB reflects OTB/OTS and is integrated across the EVMS. Management addresses OTB and OTS in a timely, cooperative, and effective manner resulting in instability for cost and schedule performance. OTB/OTS data are monitored and used for management control and are automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved, leading to continuous improvement. Routine surveillance results of OTB/OTS are fully disclosed to all key stakeholders, who maximize their use. The project has completed an external review, such as an IBR.

OTB/OTS authorization is integrated with the budgeting and work authorization, planning and scheduling, and analysis and management reporting subprocesses.

Objective

OTB/OTS is performed with prior customer notification and approval (if required).

There may be situations when available budgets for the remaining work are insufficient for the 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 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, or for the baseline schedule to exceed contract milestones, a condition known as an OTS. The process of establishing an OTB or an 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 or an OTS. Requests for establishing an OTB or an OTS are 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 or OTS does not change the terms and conditions of the contract but merely serves to improve the management of the remaining work. For special considerations to reset variances or implement a SPA for an OTB/OTS, refer to attribute G.4.3.

Effectiveness Criteria

G.6.1. *Prior approval (if required) of OTB/OTS is occurring between the customer and contractor. The TAB, CBB/PBB, and PMB are updated to reflect OTB/OTS.*

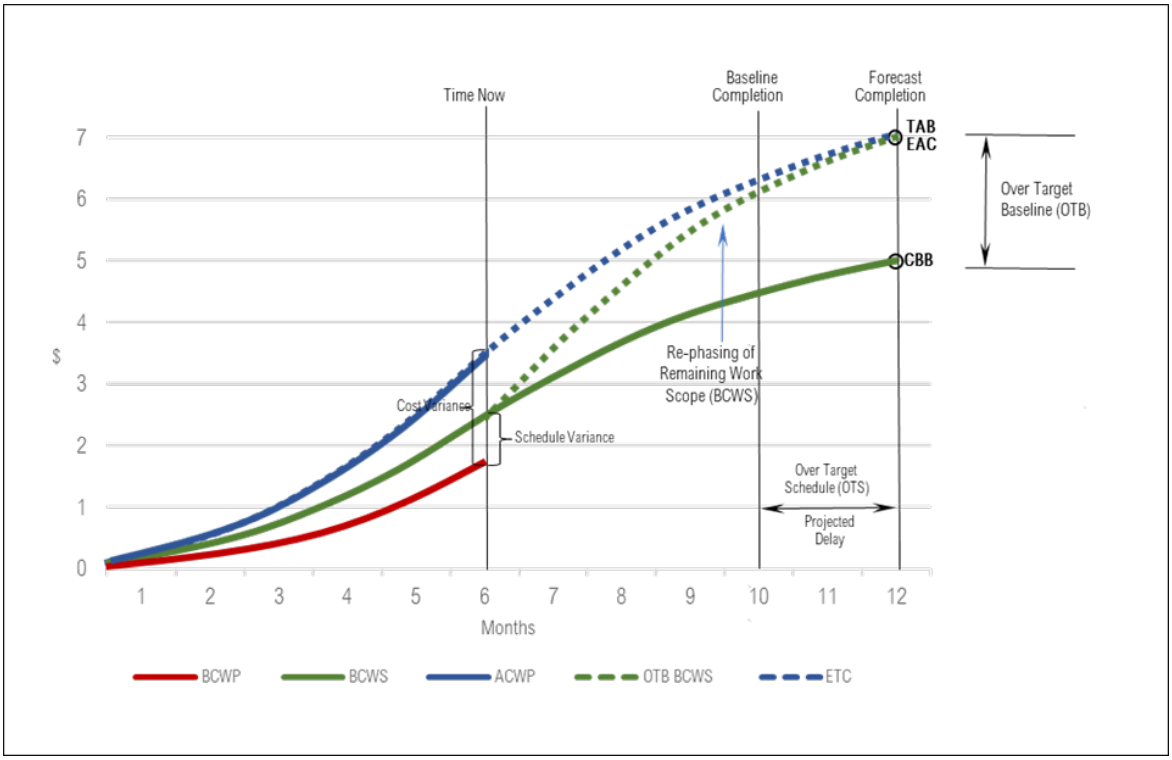
Authorization of budgets above the CBB/PBB is known as an OTB. This OTB is also known as reprogramming and is a significant undertaking by the contractor to replan the remaining baseline. When the amount of the over target budget is added to the CBB/PBB, an OTB results. This new value is known as the TAB. 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 the 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 is required to complete the contract. The primary purpose of 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 considers 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 cannot 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

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 an 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 it requires DOE approval before an OTB can be implemented. Before approving the revised PMB, it is required to 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 reflects the additional costs as overruns without adjusting the CA budgets within the PMB. It is also be noted that an OTB is not a contractual action and the CBB/PBB value is not changed. Subcontractor 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 equals the new TAB (Figure 19).

Figure 19. OTB/OTS S Curve and IPMR/CPR Format 1 Reprogramming Adjustments



CONTRACT PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE Dollars In _____ Form Approved OMB No. 0704-0188

1. Contractor	2. Contract		3. Program	4. Report Period
a. Name	a. Name		a. Name	a. From (YYYY/MM/DD)
b. Location (Address & Zip Code)	b. Number		b. Phase	
	c. Type	d. Share Ratio	c. EVMS Acceptance No Yes (YYYY/MM/DD)	b. To (YYYY/MM/DD)

5. Contract Data

a. Quantity	b. Negotiated Cost	c. Est. Cost of Auth. Unpriced Work	d. Target Profit/Fee	e. Target Price (Value Prior To OTB)	f. Estimated Price (OTB Value (Added))	g. Contract Ceiling	h. Estimated Contract Ceiling	i. Date of OTB/OTS (Implementation Date) (YYYY/MM/DD)

6. Estimated Cost at Completion

	Management Estimate at Completion (1)	Contract Budget Base (2)	Variance (3)
a. Best Case			
b. Worst Case			
c. Most Likely	OTB Value	CBB Value Prior to OTB	OTB Variance Value

7. Authorized Contractor Representative

a. Name (Last, First, Middle Initial)	b. Title
c. Signature	d. Date Signed (YYYY/MM/DD)

8. Performance Data

Item	Current Period: Budgeted Cost: Work Scheduled	Current Period: Budgeted Cost: Work Performed	Current Period: Actual Cost Work Performed	Current Period: Variance: Schedule	Current Period: Variance: Cost	Cumulative To Date: Budgeted Cost: Work Scheduled	Cumulative To Date: Budgeted Cost: Work Performed	Cumulative To Date: Actual Cost Work Performed	Cumulative To Date: Variance: Schedule	Cumulative To Date: Variance: Cost	Reprogramming Adjustments: Cost Variance	Reprogramming Adjustments: Schedule Variance	Reprogramming Adjustments: Budget	At Completion: Budgeted	At Completion: Estimated	At Completion: Variance
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12a)	(12b)	(13)	(14)	(15)	(16)
a. Work Breakdown Structure Element	The Total Allocated Budget (TAB) is the sum of all budgets allocated to a contract for authorized work but doesn't include profit or fee. The TAB consists of the Performance Measurement Baseline (PMB) and all Management Reserve (MR). The TAB reconciles directly to the Contract Budget Base (CBB). If the TAB is greater than the CBB, the difference is attributable to an Over Target Baseline (OTB). Customer authorization must be obtained prior to the start of the OTB implementation process.										Show Changes (If Adjusted)	Show Changes (If Adjusted)	Show Changes (If Adjusted)	Show Changes (If Adjusted)	Show Changes (If Adjusted)	Should Be Zero (At Implementation)
b. Cost of Money																
c. Gen. & Admin. [Non-Add]																
d. Undistributed Budget																
e. Subtotal (Performance Measurement Baseline)																
f. Management Reserve																
g. TOTAL																
9. Reconciliation To Contract Budget Base																
a. Variance Adjustment																
b. Total Contract Variance																

Adjusted Totals

Total of 8.g + 9.a — Total of 8.g + 9.a — Value of 6.c.2 — Value of 6.c.1 — Value of 6.c.3

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 is changed and approved to reflect the amount of the over target budget.

G.6.2. *Problems related to the OTB/OTS process implementation, and their root causes, are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The project demonstrates a willingness to address problems in a documented and timely manner.

G.6.3. *OTB/OTS authorization is integrated with the budgeting and work authorization, planning and scheduling, and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

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. Improper summing of the PMB and MR to the CBB/PBB or the TAB in an OTB causes a loss of visibility in budget management. Failure to properly implement an approved OTB/OTS results in a poorly integrated plan for performance measurement and an increased risk of failure in project execution.

Special Considerations

None.

Subprocess H. Material Management

Material management is the subprocess for planning, controlling, and cost accounting for the acquisition, disbursements, and disposition of material. Material management builds on the planning, budgeting, accounting, and performance measurement of material. Material management systems embrace all of the activities related to materials and are a basic business function that adds value to a finished product. It can also include the procurement of components, subcomponents, equipment, and the raw materials needed for the fabrication and manufacturing processes. As part of the EVMS, the contractor's material management system is integrated with the planning, engineering, estimating, purchasing, inventory, and accounting systems. It is based on the flow of materials, from their initial purchase to their final acceptance, and is a critical function for identification, accountability, and inventory control for all material on contract. The contractor accounts for materials on an applied basis (at the point of consumption) or at various other points (such as upon receipt, payment, or inventory issue or withdrawal). The selected point for the contractor's point of material accountability is reflected in detailed material schedules and budgets; it is not acceptable to schedule and budget for materials at one accounting point and then actually account for them at another point. To do so would distort the performance measurement data and reflect incorrect contractor progress status. For example, if material schedules and budgets are established to show the point of consumption, but the materials are accounted-for and reported in the month when they are paid, a data distortion will result. In this case, monthly performance reporting will likely reflect a cost overrun for materials even though the materials are being consumed at the rate and amount in the schedule and budget.

The material management subprocess includes the following five attributes:

- **H.1.** Material ACWP is recorded on the same basis as its BCWS and BCWP, and reconciled to the accounting system each month where errors are documented and corrected promptly.
- **H.2.** HDV or CI material is separately identified, and performance is recorded at the time of delivery, issuance from inventory, or when consumed.
- **H.3.** The material control system can account for all residual material.
- **H.4.** Material price/usage variance analysis is conducted monthly and corrective action is implemented expeditiously.
- **H.5.** Unit costs and recurring/nonrecurring costs are identified and tracked.

As shown in Figure 5, the material management subprocess considers five management attributes that collectively account for 59 (or 6%) of the 1,000 possible points of the maturity model at level 5. As shown in Figure 6, H.1 and H.2 are the highest weighted management attributes.

H.1. Recording Actual Material Costs

Material costs are collected in the accounting system and transferred to the EVMS, enabling accurate comparison of material budgets and the cost of material received or utilized (Table 51). Material costs are accurately charged to contract CAs using recognized, acceptable costing techniques. ACWP for materials are recorded on the same basis in which BCWS for materials is

planned and BCWP for materials is claimed. However, when progress payments are made based on proof of physical/technical accomplishment, then they form the basis for earned value. When necessary and significant, and when material actuals are not yet available, the use of estimated ACWP is required to ensure accurate performance measurement.

Table 51. Attribute H.1. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	**Some documented processes exist ensuring material ACWP is recorded on the same basis as material BCWS is planned and material BCWP is claimed. Material is reconciled between the EVMS and accounting system annually or at contract completion.**	**Most documented processes exist ensuring material ACWP is recorded on the same basis as its BCWS and BCWP, with a few gaps. Material ACWP is reconciled between the EVMS and accounting system quarterly and anomalies are corrected periodically.**	**All processes are documented and approved ensuring material ACWP is recorded on the same basis as its BCWS and BCWP. Material ACWP is reconciled between the EVMS and accounting system each month and errors are documented and corrected typically within two accounting periods.**	**The project proactively ensures material ACWP is consistent with the corresponding material budget and performance. Metrics are documented and maintained each month. Corrections are monitored to completion, typically within one accounting period.**
	Material anomalies identified during reconciliation are documented but may not be corrected and could recur. Incurred cost reports comparing the EVMS material ACWP to the accounting system (general ledger) are not available and the project is unable to demonstrate the EVMS material ACWP is consistent with the way material was budgeted and performance claimed. The project is also unable to determine whether material actuals/performance differences are due to timing (estimated actuals), or whether the cost variance and associated performance management are accurate.	Incurred cost reports comparing the EVMS material ACWP to the accounting system (general ledger) are available quarterly. This allows the project to determine quarterly whether material actuals/performance differences are due to timing (estimated ACWP) or errors. Issues identified during reconciliation are documented and corrected within the quarter, but this lag adversely impacts the material cost variance, Estimate at Completion (EAC), and associated performance measurement reported to the customer each month. Recording actual material costs is coordinated with the accounting considerations and analysis and management reporting subprocesses.	(H.1.1) Incurred cost reports comparing the EVMS material ACWP to the accounting system (general ledger) are available each month. Estimated ACWP or accounting accruals are used if needed. This allows the project to determine whether material actuals/performance differences are due to timing (estimated ACWP) or errors. (H.1.2) Issues identified during reconciliation are documented, tracked to closure, accurately reported, and corrected expeditiously, typically within two accounting periods. (H.1.3) Recording actual material costs is integrated with the accounting considerations and analysis and management reporting subprocesses.	A formal process has been implemented to ensure EVMS material ACWP is reconcilable to material budgets in the accounting system, monthly. Any anomalies identified during reconciliation are documented, tracked to closure, and corrected in the following accounting period. This ensures that the impact on material cost variances, EAC, and associated performance measurement are minimized, and the material data reported to the customer each month represents actual performance. Material costs are monitored and used for management control and are automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of material costs are fully disclosed to all key stakeholders. The recording of material costs is continuously improved and optimized.

Estimated actuals and accruals were fully discussed in attribute D.1. This includes the material aspects.

Objective

All processes are documented and approved ensuring material ACWP is recorded on the same basis as its BCWS and BCWP. Material ACWP is reconciled between the EVMS and accounting system each month and errors are documented and corrected typically within two accounting periods.

Effectiveness Criteria

H.1.1. *Incurred cost reports comparing the EVMS material ACWP to the accounting system (general ledger) are available each month. Estimated ACWP or accounting accruals are used if needed. This allows the project to determine whether material actuals/performance differences are due to timing (estimated ACWP) or errors.*

Actuals for material are recorded on the same basis as budget and performance are recorded. Material costs are accurately accumulated within charge numbers and charged to the CA level, at a minimum, using recognized and accepted costing techniques. These techniques may vary based on the way material is brought into CAs. For example, material received directly for work that is in the 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 backup commodities. If a LIFO material accountability system is used for warehoused materials, then the original CA budget is 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 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.

Performance for materials is 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 materials are planned and scheduled according to material need dates. After negotiations, the baseline schedule is revised to reflect negotiated delivery dates. Using the negotiated receipt date prevents the early assessment of progress for material that may ultimately be canceled 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, the documentation related to proof of physical accomplishment is examined. Hence, subcontractor progress payments and/or schedule of values are being used as the documented technical 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 is vigilant about not claiming performance without recording invoiced costs to avoid a false positive cost variance. If the invoice lags the material delivery, the contractor accounts for these costs using estimated actuals.

H.1.2. *Issues identified during reconciliation are documented, tracked to closure, accurately reported, and corrected expeditiously, typically within two accounting periods.*

Issues identified in the material actual costs accrual or reconciliation are tracked to closure within two accounting periods.

H.1.3. *Recording actual material costs is integrated with the accounting considerations and analysis and management reporting subprocesses (Section 3.2).*

Impact of Ineffectiveness

If material costs are not accurately collected from the accounting system and transferred to the EVMS, the project team cannot compare those costs with corresponding budgets and completed work. The EVMS will not produce reliable performance measurement data suitable for the material category and may not account for all material items purchased for the contract. The direct costs for material items will not be assigned to a CA/WP consistent with the corresponding budgets for that material and will not provide a valid basis for realistic evaluation of cost variances and realistic EAC projections to DOE. Material cost variances are 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 the material cost.

Special Considerations

None.

H.2. Material Performance

Reliable performance measurement suitable to the material category is key to evaluating cost variances and projecting Estimates at Completion (EAC) (Table 52). Although material dollar value is important, there are Critical Items (CI) that may or may not be High Dollar Value (HDV). Any material considered a high risk that could impact the critical path is separately tracked and monitored each month. BCWP for material (categories of material, HDV/low dollar value, CI material, etc.) is recorded in one of the following ways: 1) upon receipt of the material by the project, but no earlier, 2) as the material is issued from inventory for execution, 3) when the material is consumed, or 4) based on the schedule of values per the Purchase Order (PO) or contract requirements.

Table 52. Attribute H.2. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**Some documented processes exist identifying how and when material BCWP is recorded, including HDV or CI material if applicable.**	**Most processes specifying how and when material BCWP is recorded, including HDV or CI material if applicable, are documented, however, they are not approved. Material BCWP is reviewed quarterly, and any identified issues are corrected periodically.**	**All processes are documented and approved specifying how and when material BCWP is recorded, including HDV or CI material if applicable. Material BCWP is reviewed each month and corrected within the accounting period.**	**The project proactively reviews material BCWP, including HDV or CI material, to ensure it is accurately recorded. Future material requirements are routinely evaluated to assess the potential impact on the project if any.**
	The project lacks the documented processes required to identify, segregate, plan, or track material performance. The project is unable to verify regular material BCWP reported in the EVMS is based on receipt, inspection, and acceptance. HDV/CI material EVMS reconciliation with vendor negotiations is conducted annually or at contract completion. Any material BCWP anomalies identified during reconciliation are documented and corrected at that time, but they could reoccur.	The project implements processes specifying how material, and if applicable HDV or CI material, is identified, segregated, planned, and performance measured. However, these processes are not formally documented. All material BCWP, including HDV or CI material if applicable, is reconciled quarterly. HDV/CI material is also reconciled with vendor negotiations quarterly. The project can identify material BCWP differences, including HDV or CI material if applicable. These differences are identified, documented, and corrected periodically, but the time lag for corrections adversely impacts the material cost variance, EAC, and associated performance measurement reported quarterly as required. Material performance is coordinated with the planning and scheduling and budgeting and work authorization subprocesses.	(H.2.1) The project has documented, and approved processes designed to ensure how material, and if applicable HDV or CI material, is identified, segregated, planned, and performance is measured and implemented those processes monthly. (H.2.2) The EVMS material BCWP, including HDV or CI material if applicable, is not recorded before delivery, issuance from inventory, or consumption. (H.2.3) Material BCWP differences are tracked to closure end-to-end, and corrected expeditiously, typically within two accounting periods. The impact on material cost variances, EAC, and associated performance measurement is minimized and limited to one accounting period. (H.2.4) Material performance is integrated with the planning and scheduling and budgeting and work authorization subprocesses.	The project has established a formal monthly business rhythm to ensure material BCWP is correctly claimed each month. The project conducts a "look ahead" designed to monitor material on the critical path in the next two months. Any potential material impact is forecast and included in the IMS, to ensure that impacts to material cost variances, EAC, and associated performance measurement are minimized, and the material data reported each month represents actual performance. Material performance data are monitored and used for management control and are automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. Routine surveillance results of material performance data are fully disclosed to all key stakeholders, who maximize their use. Material performance is continuously improved and optimized.

Objective

All processes are documented and approved specifying how and when material BCWP is recorded, including HDV or CI material if applicable. Material BCWP is reviewed each month and corrected within the accounting period.

Effectiveness Criteria

H.2.1. *The project has documented, and approved processes designed to ensure how material, and if applicable HDV or CI material, is identified, segregated, planned, and performance is measured and implemented those processes monthly.*

HDV or High Dollar Value material is defined as critical material that requires scheduling and tracking. There are two ways of identifying HDV and the contractor consistently applies the definition. The key concept is HDV are the few items or single procurements of multiple units accounting for a majority of the costs as the HDV target.

1. Pareto Cost Method – The bill of material (BOM) lists all of the material planning to procure. The BOM lists the unit price and the number of units to procure for every item

planned. The unit price times the number of units is the total extended price (TEP). The TEP is sorted by total price and then a line is drawn at 80% of the total costs. Then review the items below the 80% line for any that need to be scheduled and add them to the HDV list.

2. Identification of Category Method – The contractor identifies categories of material by groups such as Purchase Orders, Spares, or Special Procurements such as Glove Boxes. In this method each category is identified as HDV or LDV, review the list to see that it accounts for a majority of the procurement costs.

H.2.2. *The EVMS material BCWP, including HDV or CI material if applicable, is not recorded before delivery, issuance from inventory, or consumption.*

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 is used for both budgeting and applying actual costs for materials. If material is supplied as GFM it is identified as an SVT with no resources/budget applied. Budgets for HDV/CI are planned discretely using objective milestones or another 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 of this type of material. For material to be released in kits, determine how BCWP and ACWP are determined at the time of partial kit releases.

For EIA-748 EVMS compliance, performance for HDV materials is 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. After negotiations, the baseline schedule is revised to reflect negotiated delivery dates. Using the negotiated receipt date prevents the early assessment of progress for material that may ultimately be canceled and cause adjustments for previously claimed earned value.

H.2.3. *Material BCWP differences are tracked to closure end-to-end, and corrected expeditiously, typically within two accounting periods. The impact on material cost variances, EAC, and associated performance measurement is minimized and limited to one accounting period.*

Material BCWP and ACWP differences are tracked in attribute D.3. No unique requirements are captured in this attribute.

H.2.4. *Material performance is integrated with the planning and scheduling and budgeting and work authorization subprocesses (Section 3.2).*

Impact of Ineffectiveness

If material costs (including HDV/CI) are not accurately collected from the accounting system and transferred to the EVMS, the project team cannot compare those costs with corresponding budgets and completed work. The EVMS will not produce reliable performance measurement data suitable for the material category and may not account for all material items purchased for the contract. The direct costs for material items will not be assigned to a CA/WP consistent with the corresponding budgets for that material and will not provide a valid basis for realistic

evaluation of cost variances and realistic EAC projections to DOE. Material cost variances are 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 the material cost.

Special Considerations

BCWP and ACWP material anomalies are captured in attribute D.3.

H.3. Residual Material

The material accounting system provides for full accountability of all material purchased for the project including the residual inventory (Table 53). Residual inventory represents procured material that becomes excess at project completion. The residual inventory provides visibility into excess material available for replacement of failures in the current project, minimum purchase quantities, or future projects/programs having similar deliverables. Processes are in place documenting the identification of any residual material remaining on a project that can be returned or used on another program. This requires residual material credits to be applied each month updating the ACWP and BCWP. This also requires evaluation of the impact on the contractor PM's most likely Estimate at Completion (EAC) or the CAMs' EAC. The establishment of accurate cost accumulation, performance measurement, and identification of residual inventory is essential since the material may constitute a large portion of a project's costs and directly impact the customer funding requirements.

Table 53. Attribute H.3. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**The material control system contains some processes addressing residual material. The project/ program is unable to identify residual material.**	**The material control system contains most processes addressing accountability of residual material. Residual material is evaluated quarterly and identified issues are corrected periodically.**	**The material control system contains all processes addressing accountability of residual material. All processes are documented and approved. Residual material is evaluated monthly or upon availability.**	**Residual material is reviewed and evaluated continuously. The project proactively manages residual material based on expected future performance.**
	The project material control system lacks the documented processes required to identify, track, and dispose of the residual material that is placed in inventory. Accordingly, the EVMS subprocesses do not address how residual material impacts the project EAC. A comparison between the EVMS and the material control system is conducted annually or at project/ program completion to identify residual material. Residual material identified during this comparison is documented but may not be corrected and this situation could reoccur. Accordingly, this could adversely impact the EAC.	Both the project material control system and EVMS implement subprocesses required to identify, track, and dispose of the residual material that is placed in inventory, with some gaps. Residual material is reconciled between the EVMS and the material control system quarterly. Potential residual material is identified and documented periodically. This time lag may adversely impact the material cost variance, EAC, funding requirements, and associated performance measurement reported to the customer since the true material cost is unknown. Residual material is coordinated with the accounting considerations subprocess.	(H.3.1) The project material control system and EVMS have documented, and approved processes designed to ensure how residual material is identified, costs established, tracked, and dispositioned. Opportunities for other uses of residual material are identified expeditiously; this could result in impacts on the EAC and funding requirements. (H.3.2) Residual material is reconciled between the EVMS and the material control system each month. Potential residual material is identified and documented monthly. Since the true material cost is known each month, the impact on material cost variances, EAC, funding requirements, and associated performance measurement is minimized, providing management and the customer real-time data enhancing decision-making. (H.3.3) Problems with residual material tracking are identified and logged. (H.3.4) Residual material is integrated with the accounting considerations subprocess.	Identifying, tracking, and dispositioning residual material is integrated and automated between the EVMS and material control system. This forms the basis for a monthly business rhythm that is in place and fully coordinates assumptions for identifying residual material, predicting performance, and proactive transfer of residual material to another program s, or disposition. This also fosters a proactive and collaborative risk-reduced sparing analysis for timely and continuous identification of residual material. This continuous analysis effectively realizes project/ program savings and alternative best use of material for this or other projects/programs. Routine surveillance results of residual material are fully disclosed to all key stakeholders, who maximize their use. The residual material process is continuously improved and optimized.

Objective

The material control system contains all processes addressing accountability of residual material. All processes are documented and approved. Residual material is evaluated monthly or upon availability.

Effectiveness Criteria

H.3.1. *The project material control system and EVMS have documented, and approved processes designed to ensure how residual material is identified, costs established, tracked, and dispositioned. Opportunities for other uses of residual material are identified expeditiously; this could result in impacts on the EAC and funding requirements.*

The EC discusses opportunities. What this is referring to is residual material is excess from the project perspective. Follow-on projects at the site or other DOE sites may be able to use the residual material. Projects work with the FPD to find other uses for the residual material. If the residual material is transferred the EAC cost for the material is removed from the project.

H.3.2. *Residual material is reconciled between the EVMS and the material control system each month. Potential residual material is identified and documented monthly. Since the true material cost is known each month, the impact on material cost variances, EAC, funding requirements, and associated performance measurement is minimized, providing management and the customer real-time data enhancing decision-making.*

All material purchased or furnished as GFM/GFE is required to 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 the case, then records are kept providing for full 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 the return of residual material. Unused, scrap and residual are interpreted within the normal construction process. Not included as residuals are items not useful for future projects and excess, normally. These records 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 is returned to stores/warehouses 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 include material consumed plus material requirements for schedule assurance based on waste and spoilage trends determined from an appropriate phase of the contract performance.

H.3.3. *Problems with residual material tracking are identified and logged.*

Residual problems are typically not tracking residual material. A system needs set up to track and account for residual material unless an agreement is reached with DOE.

H.3.4. *Residual material is integrated with the accounting considerations subprocess (Section 3.2).*

Impact of Ineffectiveness

Without residual material visibility (including identification, determination of cost, tracking, and disposition), the EVMS cannot produce reliable performance measurement data for the material category and may not be able to account for all material items purchased for the contract. If material costs are not accurately collected from the accounting system and transferred to the EVMS, the project team cannot compare those costs with corresponding budgets and completed work. The direct costs for material items will not be assigned to a CA/WP consistent with the corresponding budgets for that material and will not provide a valid basis for realistic evaluation of cost variances and realistic EAC projections to DOE. Material cost variances are 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 the material cost.

Special Considerations

None.

H.4. Material Price/Usage Variance

Direct costs for material items are assigned to a project consistent with the corresponding budgets for that material (Table 54). Deviations from the established plans for material are analyzed to enable management decision-making and corrective action. Assigning actual incurred direct material costs consistent with the corresponding budgets and performance provides the basis for a realistic evaluation of cost variances and ultimately facilitates Estimate at Completion (EAC) and funding projections. Material cost variances are analyzed and evaluated in terms of both price and usage variances. Usage variance is sometimes known as quantity variance. Understanding whether material cost variances are driven by price or usage assists management in focusing attention on those ordering material (price variance) or those responsible for controlling the number of materials (quantity variance).

Table 54. Attribute H.4. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some documented processes for material variance analysis are in place. The project is unable to provide material variance analysis.**	**Most processes addressing material variance analysis are in place, but not all of them are formally documented. Material variance analysis is conducted at least quarterly and identified issues are corrected periodically.**	**All processes addressing material variance analysis are documented and approved. Material price/usage variance analysis is conducted monthly and corrective action is implemented expeditiously.**	**Information resulting from material price/usage analysis is proactively shared and managed. The contractor evaluates future material requirements and any changes in quantity or price are addressed immediately to mitigate any future impact.**
	The project lacks documented processes needed to define the requirements for material variance analysis. Material price/usage variance analysis is conducted annually or at project completion. Issues identified during the variance analysis are documented but impacts on the EAC are not reported and corrective actions may not be implemented.	The project implements processes required to conduct material price/usage variance analysis, but they are not formally documented. The EVMS can identify the material as an EOC when required. A Bill of Material (BOM) is available to document the material baseline. This allows data from the EVMS and material control system to be compared to current conditions. Material price/usage variance analysis is conducted quarterly. The cause and impact of variances are evaluated, and corrective action is implemented. However, a time lag may adversely impact the EAC reported to the customer. Material price/usage variance analysis is coordinated with the analysis and management reporting subprocess.	(H.4.1) The project uses material price/usage analysis to predict future performance. The EAC reported to the customer is updated each month reflecting corrective actions. Material price/usage problems are identified, logged, tracked, mitigated, corrected, and closed. (H.4.2) The accounting system and EVMS consistently identify the material as an EOC. A BOM is available in the material control system documenting the material baseline and is integrated with the EVMS. Each month, the BOM is compared to current conditions to conduct material price/usage variance analysis. The project can determine whether material variances are driven by price or usage. The cause and impact of variances are evaluated monthly and corrective action is implemented expeditiously. (H.4.3) Material price/usage variance analysis is integrated with the analysis and management reporting subprocess.	The project implements a monthly business rhythm designed to evaluate and correct material cost variances. Data from the EVMS and material control system are automatically compared, and validated, allowing material price/usage variance analysis to be conducted monthly. The cause and impact of material price/usage variances are evaluated, and corrective action is implemented immediately to mitigate future performance issues. The material Estimate to Complete (ETC) and EAC are automatically updated to ensure the data reported each month to the customer is representative of actual performance. Routine surveillance results of material price/usage variances are fully disclosed to all key stakeholders, who maximize their use. The material price/usage variance analysis process is continuously improved and optimized by reviewing prior corrective actions.

Objective

All processes addressing material variance analysis are documented and approved. Material price/usage variance analysis is conducted monthly and corrective action is implemented expeditiously.

The establishment of accurate cost accumulation, performance measurement, and identification of residual inventory is essential since the material may constitute a large portion of a contract's

costs. Material management is accomplished in a manner that provides maximum identification of HDV/CI for effective management visibility. To support project management, direct costs for material items are assigned to a project consistent with the corresponding budgets for that material. This assignment provides the basis for the realistic evaluation of cost variances and ultimately facilitates EAC projections.

Effectiveness Criteria

H.4.1. *The project uses material price/usage analysis to predict future performance. The EAC reported to the customer is updated each month reflecting corrective actions. Material price/usage problems are identified, logged, tracked, mitigated, corrected, and closed.*

Price usage is defined in EC H.4.2. The unique part of this EC is using the price usage analysis monthly and factoring it into the EAC analysis each month.

H.4.2. *The accounting system and EVMS consistently identify the material as an EOC. A BOM is available in the material control system documenting the material baseline and is integrated with the EVMS. Each month, the BOM is compared to current conditions to conduct material price/usage variance analysis. The project can determine whether material variances are driven by price or usage. The cause and impact of variances are evaluated monthly and corrective action is implemented expeditiously.*

Materials cost variances (that is the difference between the budgeted and actual costs of the work performed (BCWP - ACWP = CV)) can be divided into two sources or causes: price variance and usage variance. The price variance is the difference between the budgeted cost for the bill of materials (based upon engineering drawings and technical orders, etc.), including planned quantities for testing and scrap, and the price paid for the bill of materials. By formula:

- Price Variance = (Earned Value Unit Price - Actual Unit Price) x Actual Quantity
- Usage Variance = (Earned Value Quantity - Actual Quantity) x Earned Value Unit Price

The price variance can be determined early in the contract when the materials are ordered and can be used in projections of the estimated cost at completion. The price variance is of prime importance to those responsible for ordering material. Thus, the contractor's material accounting system can quantify the material cost variance into its respective causes, price, and usage variance; and the system adequately determines price variance by comparing the planned commitments to the actual commitments.

H.4.3. *Material price/usage variance analysis is integrated with the analysis and management reporting subprocess (Section 3.2).*

Impact of Ineffectiveness

Without monthly/routine material data and variance analysis, management is unable to use the EVMS information to make timely decisions or to properly assess project material performance. Management cannot analyze material deviations from the established plan nor effectively implement corrective actions to regain project/contract objectives. The success of the project can be jeopardized.

Special Considerations

None.

H.5. Identification of Unit Costs and Lot Costs

The purpose of this attribute is to ensure contractor accounting systems are capable of determining the unit or lot costs of items developed or produced, that is, to identify unit costs, equivalent unit costs, or lot costs when needed (Table 55). When applicable (such as in a production or manufacturing environment), the accounting system has the capability to identify unit costs, equivalent units, lot costs, recurring costs (such as production), and nonrecurring costs (such as testing, development, travel, and nonrecurring expenses) by EOC (such as labor, material, other direct costs, and indirect costs) as required by the project's contract. Also, when applicable, the Manufacturing/Enterprise Resource Planning (M/ERP) system is capable of isolating unit, lot costs, recurring, and nonrecurring costs in a production environment allowing flexibility to plan, measure performance, and forecast in a more efficient way. This segregation is especially important when there are multiple projects/programs in the same production line; it is done for cost reporting purposes and provides visibility into the factors driving project cost growth.

Table 55. Attribute H.5. Maturity Level Template

LOW	MEDIUM			HIGH
1	2	3	4	5
Not yet started.	Some documented processes exist addressing unit costs, equivalent units, lot costs, recurring, and nonrecurring costs by EOC. Some unit costs and recurring/ nonrecurring costs are identified in the current accounting system and M/ERP, with significant gaps.	Most processes are documented providing for the identification and isolation of unit costs, equivalent unit, lot costs, and recurring and nonrecurring costs by EOC. Most unit costs and recurring/nonrecurring costs can be identified in the accounting system and M/ERP, with a few gaps.	All processes to identify and isolate unit costs, equivalent unit, lot costs, recurring, and nonrecurring costs by EOC are documented, approved, and implemented monthly. All unit costs and recurring/ nonrecurring costs can be identified in the accounting system and M/ERP.	The accounting system and M/ERP are integrated, and automatically monitored, and any errors are corrected immediately, typically within the next accounting period.
	The project lacks documented processes for the classification of direct costs and credits. The project's accounting system and M/ERP can separately identify some unit costs, equivalent units, lot costs, recurring, and nonrecurring costs by EOC. But there is a lack of integration between the accounting system and M/ERP.	The project implements processes designed to ensure unit costs, equivalent unit, lot costs, recurring, and nonrecurring costs are identified and provided by EOC. Not all processes are formally documented and approved. The project's accounting system and M/ERP can identify and provide most unit costs, equivalent units, lot costs, recurring, and nonrecurring costs by EOC. There is some integration between the accounting system and M/ERP, but gaps may exist. Most unit cost and recurring/nonrecurring cost anomalies are identified, but the project has difficulty making corrections. The Unit costs and recurring/ nonrecurring costs are coordinated with the accounting considerations subprocess.	(H.5.1) The project's accounting system and M/ERP system are integrated and can identify unit costs, equivalent units, lot costs, recurring, and nonrecurring costs by EOC. Accounting system or M/ERP system anomalies are identified and corrected, typically within two accounting periods. (H.5.2) Although visibility into the factors driving project/ program cost growth is provided to management, customer notification may be delayed. (H.5.3) Problems with unit costs and recurring/nonrecurring costs are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions. (H.5.4) The Unit Costs and Recurring/nonrecurring costs are integrated with the accounting considerations subprocess.	The project monitors all unit costs, equivalent units, lot costs, recurring, and nonrecurring costs by EOC monthly. Management and the customer gain real-time visibility into the factors driving cost growth through a formal business rhythm. Accounting system or M/ERP system anomalies are typically closed the following accounting month. Project management has the flexibility to plan, measure performance, and forecast in a more efficient way when there are multiple projects/programs in the production line. Routine surveillance results of unit costs and recurring/ nonrecurring reports are fully disclosed to all key stakeholders providing visibility into how the project is managing cost and schedule, ensuring sufficient funding is available. The unit costs and recurring/ nonrecurring costs data are continuously optimized.

Objective

All processes to identify and isolate unit costs, equivalent unit, lot costs, recurring, and nonrecurring costs by EOC are documented and approved; they are implemented monthly. All unit costs and recurring/ nonrecurring costs can be identified in the accounting system and M/ERP.

This determination is done for cost reporting and provides visibility into the factors driving project cost growth. The contractor's accounting system can produce a 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 can segregate the costs of production units, lots, or equivalent units by elements of cost (labor, materials, other direct costs, and indirect costs). Additionally, it distinguishes between recurring and nonrecurring costs as required by internal/external reporting requirements. This process gives 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. "Equivalent unit costs" (all things being equal, each unit's cost is approximately equivalent to every other unit's cost) may be established on production contracts where:

- Multiple similar units are produced and delivered to different customers, or
- Units are randomly removed from the production line to support various customer delivery agreements.

The following describes the characteristics of Unit and Lot Costs:

- The contractor's system can provide unit costs, equivalent unit or lot costs in terms of labor, material, and other direct and indirect costs as required by the project.

Effectiveness Criteria

H.5.1. *The project's accounting system and M/ERP system are integrated and can identify unit costs, equivalent units, lot costs, recurring, and nonrecurring costs by EOC. Accounting system or M/ERP system anomalies are identified and corrected, typically within two accounting periods.*

In a production or manufacturing environment, the contractor's accounting system can produce a unit, equivalent units, or lot costs for cost reporting purposes. Just as a contractor acquires materials, vended items, and subcontracted components by the unit of cost so also is the contractor expected to produce 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 attribute may not be applicable in a pure construction, engineering design, or similar type of project. It is normally required when (a) multiple customers are 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.

The accounting system can segregate the costs of production units, lots, or equivalent units by EOC (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 assembly line environment, it is usually sufficient that the accounting system can provide "equivalent" unit costs: the total cost of all the units divided by the number of units produced.

H.5.2. *Although visibility into the factors driving project/ program cost growth is provided to management, customer notification may be delayed.*

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.

H.5.3. *Problems with unit costs and recurring/nonrecurring costs are identified, logged, tracked, mitigated, corrected, and closed, giving management insight to make timely decisions.*

The project demonstrates a willingness to address problems in a documented and timely manner.

H.5.4. *The unit costs and recurring/nonrecurring costs are integrated with the accounting considerations subprocess (Section 3.2).*

Impact of Ineffectiveness

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.

Special Considerations

Because DOE capital asset projects often feature a unique structure or system and not the mass production of a product, the requirement that a manufacturing accounting system is capable of isolating unit and lot costs in a production environment is not required unless specified in the PEP/CRD.

Subprocess I. Subcontract Management

Subcontract management is the subprocess for determining which contracts have the flow-down of EVMS requirements to subcontractors, integrating subcontractor data into the prime contractor's EVMS, or surveilling the subcontractors, and equally important, those typically not having flow-down of EVMS requirements, such as staff augmentation, time and material, and indefinite delivery, indefinite quantity (IDIQ), which could vary task by task. All contracts require reporting of some type, even in the most basic conditions. In all cases, all requirements (including reporting and EVMS flow-down) are in the "terms and conditions" of each contract. Subcontractor management is among the most important aspects of a prime contractor's work, primarily because the work is not self-performed, adding a level of uncertainty concerning qualified and capable resources, and their availability. Subcontractor management is the process of identifying subcontractors and overseeing their work on behalf of a customer. The prime contractor is not only responsible for subcontract management, but all things related to its subcontractors. The subcontract management process expands on the application of performance measurement to subcontracted efforts, maintains that there are management controls unique to subcontracting in place, including the verification and validation of subcontract management practices to ensure timely delivery of an acceptable product and to notify the government of potential subcontract problems that may impact delivery, quantity, or price. Major subcontractors are those identified by the prime contractor per their approved governing policies, procedures, or guides, responsible for reporting the appropriate cost and schedule data to the prime contractor to enable the prime to conduct cost and schedule data analysis and management (corrective action) within the prime's EVMS. For non-major subcontractors, the project is expected to generate this information based on information gathered by the EVMS or the assigned subcontract manager or CAM. The prime contractor may flow-down EVMS requirements to subcontractors based on meeting the applicable thresholds. The performance information reported by the subcontractors is incorporated and integrated into the prime contractor's management system. The prime contractor is responsible for reviewing and assuring the validity of all subcontractors reporting through surveillance and other means. The (H.) Material Management process and (I.) Subcontract Management processes are interdependent in their operations.

The subcontract management subprocess comprises multiple attributes that contribute to the effectiveness of the EVMS. The adequacy of each attribute, both individually and collectively, is assessed by conducting effectiveness criteria testing to gauge their adequacy towards meeting integrated project management requirements. The Subcontract Management process is based on the following three key management attributes to consider:

- **I.1.** Prime contractor processes addressing the EVMS flow-down or data reporting requirements to subcontractors are documented and enforced, and consistent with project risk, size, and complexity.
- **I.2.** All subcontractor work scope is integrated with the prime contractor's EVMS and regularly analyzed and reported to the customer at the appropriate levels.
- **I.3.** The prime contractor applies and enforces documented processes for the oversight of subcontractor performance.

As shown in Figure 5, the subcontract management subprocess considers three management attributes that collectively account for 60 (or 6%) of the 1,000 possible points of the maturity

model at Level 5. As shown in Figure 6, I.2 Subcontractor Integration and Analysis is the highest weighted management attribute.

I.1. Subcontract Identification and Requirements Flow-Down

The purpose of this attribute is to ensure that the subcontract management process expands on the application of performance measurement to subcontracted efforts, maintains that there are management controls unique to subcontracting in place, including the verification and validation of subcontract management practices to ensure timely delivery of an acceptable product and to notify the government of potential subcontract problems that may impact delivery, quantity, or price (Table 56). Because a significant portion of project costs are obligated dollars spent on subcontract work and due to the absence of a direct contractual relationship with the subcontractor, the DOE relies on the prime contractor to manage subcontract work. Subcontractors perform significant work efforts at sites and are an integral part of the site's success. Prime contractors may be fully reimbursed (consistent with reimbursement rules) for subcontracted work and compensated through profit or fee to manage their subcontract effort. Therefore, the DOE ensures the prime contractor exercises adequate control over subcontractors. Subcontract performance management problems can have a significant impact on the prime contractor's ability to meet its contractual obligations. Additionally, the DOE has a contract administration responsibility to ensure the prime contractor is obtaining satisfactory technical or project performance from subcontractors. The larger the dollar value or complexity of the project, the more significant this role becomes. The DOE relies on the prime contractor's EVMS to obtain the needed insights to fulfill its role and responsibilities in the subcontract management process.

Table 56. Attribute I.1. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some prime contractor processes defining the EVMS flow-down or data reporting requirements for major and minor subcontractors exist.**	**Most prime contractor processes defining the EVMS flow-down or data reporting requirements for major and minor subcontractors are documented; however, they may not be approved and routinely enforced.**	**All prime contractor processes addressing the EVMS flow-down or data reporting requirements to subcontractors are documented, approved, and enforced. Subcontractor EVMS flow-down requirements and monthly data reporting requirements are consistent with project risk, size, and complexity.**	**Prime contractor EVMS flow-down or monthly data reporting requirements are consistently applied to subcontractors and proactively monitored to improve subcontract requirements and performance.**
	Major or minor subcontractor EVMS flow-down requirements are not separately identified. The prime contractor manages the subcontractor's work scope using high-level milestones and summary bars. The prime contractor does not distinguish between major and minor subcontractor work scope when requesting performance data.	The prime contractor has identified all subcontractor work scopes. EVMS flow-down or data reporting requirements are applied to most major subcontractors. Subcontract Identification and EVMS flow-down requirements are coordinated with the other EVMS subprocesses.	(I.1.1) The prime contractor has identified all major and minor subcontract work scopes and has applied appropriate EVMS flow-down and data reporting requirements. The prime contractor remains responsible for EVMS data for the management and reporting of minor subcontractors. (I.1.2) A feedback or communication loop has been established by the prime contractor to notify subcontractors to address any issues (scope, schedule, budget, etc.). (I.1.3) Major subcontractors have a documented plan to resolve EVMS flow-down requirement issues which are identified, tracked, corrected, and closed upon successful implementation of the EVMS. In the interim, the prime contractor remains responsible for EVMS data needed for management and reporting. (I.1.4) Subcontract identification and EVMS flow-down requirements are integrated with the other EVMS subprocesses.	A feedback or communication loop is proactively used by the prime contractor, facilitating subcontractors' ability to immediately address any issues (scope, schedule, budget, etc.). Subcontract identification and flow-down requirements are routinely monitored, surveilled, and shared with stakeholders. Necessary corrective actions are implemented, completed, and recurring issues resolved. Subcontract identification and flow-down requirement practices are continuously improved and optimized.

The prime contractor remains responsible for authorized work that is subcontracted including subcontract identification, categorization, organization, management and control, and reporting. The prime contractor is responsible for the flow-down of appropriate EVMS contract requirements to subcontractors for work scope considered by the prime contractor to be "major". Major subcontractors require EVMS to flow-down and deliver critical high-risk, or high-dollar items to the project (Note a critical item may or may not be considered high dollar, but if not tracked, could impact the critical path). Identification of work scope considered by the prime contractor to be major may be the function of a make/buy strategy or some other criteria as described in the prime contractor's approved subcontractor management processes. Based on the customer and prime contractor project management approach for subcontract management, EVMS flow-down to major subcontractors includes applicable EVMS provisions, clauses, or data reporting requirements. Minor subcontractors are not considered by the prime contractor to include critical, high risk, or high dollar work scope, however, the prime contractor is responsible to ensure the integrity of minor subcontractor management processes and performance data. This attribute also includes inter-divisional work within an organization that is considered subcontract-like.

Prime contractor flow-down of EVMS requirements to subcontractors is consistent with project risk, size, and complexity. EVMS flow-down establishes enforceable requirements that enable the prime contractor to receive EVMS performance data from the subcontractor to engage in analysis and evaluation of subcontractor performance. Flow-down of applicable EVMS requirements by the prime contractor to the subcontractor ensures the implementation of sound management practices and processes, including the identification and allocation of subcontractor resources, authorization, and planning of budgets, and reporting of cost, schedule, and technical performance, and assists the prime contractor decision-making providing effective forecasting submitted to the customer each month.

Objective

All prime contractor processes addressing the EVMS flow-down or data reporting requirements to subcontractors are documented, approved, and enforced. Subcontractor EVMS flow-down requirements and monthly data reporting requirements are consistent with project risk, size, and complexity.

For individual subcontracts identified by the prime contractor per their approved governing policies, procedures, or guides, responsible for reporting the appropriate cost and schedule data to the prime contractor to enable the prime to conduct cost and schedule data analysis and management (corrective action) within the prime's EVMS. which are of certain contract types or exceed the stated dollar threshold (as outlined in the prime contractor's approved EVM system description), the prime contractor reviews and provides subcontract EVMS or cost and schedule reporting flow-down requirements. The intent of subcontract EVMS or cost and schedule reporting flow-down requirements is to enable the prime contractor and customer to receive EVMS performance data from the subcontractor to engage in analysis and evaluation of subcontractor performance.

The following describes the characteristics of Subcontract Identification and Requirements Flow-Down:

1. Prime contractor's conformance with DOE 413.3B and contract terms and conditions.
2. Cost and schedule information and data regardless of an EVMS flow-down requirement provides timely and effective support to the project.

Effectiveness Criteria

I.1.1. *The prime contractor has identified all major and minor subcontract work scope and has applied appropriate EVMS flow-down and data reporting requirements. The prime contractor remains responsible for EVMS data for the management and reporting of minor subcontractors.*

When defining the work requirements of the project, it is important to identify those WBS elements to be subcontracted. A make-or-buy decision is an act of choosing between manufacturing a product in-house or purchasing it from an external supplier. Make-or-buy decisions, like outsourcing decisions, speak to a comparison of the costs and advantages of producing in-house versus buying it elsewhere. Major subcontractors' scope is limited to a unique WBS and OBS. Significant subcontracted effort is recognizable within the WBS and the OBS. Prime contractors 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. See A.1.

Once the make-or-buy decision is made, the significant subcontracted effort is recognizable within the WBS and the OBS. Prime contractors define the parameters of a "Major Subcontractor" per their approved EVM system description. It is necessary that each major and HDV/CI subcontractor effort be separate to obtain these performance insights from the prime contractor and that of every other subcontractor. This is typically accomplished by creating separate WBS elements (at the CA and WP levels) for each of the subcontracted products/services. The prime contractor maintains awareness of the overall progress of the project, including the progress of each subcontractor. The subcontractors will report their progress at the total and CA levels regularly. Based on the information contained in this reporting, the prime contractor prepares a monthly progress report for all stakeholders. Subcontractors report to the prime contractor, who is ultimately responsible to the customer for their work. Therefore, the subcontractor is liable to the prime contractor, but not directly to the customer. That said, an informed customer regularly engages the prime contractor on the progress of the subcontract work scope and its effects on the overall progress of the project.

I.1.2. *A feedback or communication loop has been established by the prime contractor to notify subcontractors to address any issues (scope, schedule, budget, etc.).*

To the extent that the prime contractor issues subcontracts for resources or material in the performance of the contracted project scope of work, the prime is responsible for flow-down of the appropriate cost and schedule reporting requirements to subcontractors to enable the prime contractor to report cost and schedule data from and manage with a compliant EVMS.

I.1.3. *Major subcontractors have a documented plan to resolve EVMS flow-down requirement issues which are identified, tracked, corrected, and closed upon successful implementation of the EVMS. In the interim, the prime contractor remains responsible for EVMS data needed for management and reporting.*

If, at the time of award, the subcontractor's EVMS has not been determined by the prime contractor as complying with contract terms and conditions, or the subcontractor does not have an existing EVMS (or like management control systems and processes), the prime contractor working with the customer takes necessary actions to develop an action plan to resolve EVMS flow-down or cost and schedule reporting requirements.

I.1.4. *Subcontract identification and EVMS flow-down requirements are integrated with the other EVMS subprocesses (Section 3.2).*

Impact of Ineffectiveness

Failure to properly identify subcontractor work efforts and assign the appropriate flow-down requirements often leads to disputes, claims, project delays, substandard work, and possible quality and safety issues. This leads to project failure, often resulting in the client getting their project late which negatively impacts the contractor's reputation.

Special Considerations

None.

I.2. Subcontract Integration and Analysis

The purpose of this attribute is to ensure that the subcontract management process maintains that the prime contractor ensures the subcontractor's monthly cost and schedule performance data reported are current, accurate, complete, repeatable, auditable, verified, and at the right level of detail which facilitates management analysis and corrective actions (Table 57). All subcontract work scope is integrated into the prime contractor's EVMS to enable the prime contractor to effectively manage and analyze the total project work scope. Fully integrating subcontractor effort into the prime contractor's EVMS ensures the planning, scheduling, budgeting, work authorization, cost accumulation, estimating/forecasting, and risk processes accurately depict and report project performance, and provide the customer with the most current and accurate information available each month. Subcontracted work scope and performance integration with the prime contractor's EVMS is achieved through a coding structure that uses unique identifications (IDs). This allows for subcontract work scope to be separately identified and recognizable, evaluated, and reported. The prime contractor engages in the end-to-end analysis of subcontract performance data to facilitate complete and accurate integration with prime contractor reporting. The end-to-end analysis provides a comprehensive understanding of subcontract performance and supports the ability to develop reasonable estimates of future costs, schedules, and technical performance. Analysis of subcontract performance from the established baseline plan permits management at all levels to rapidly and effectively implement corrective actions to regain project objectives. Without visibility into and the understanding of baseline plan deviations, the success of the project is jeopardized.

Table 57. Attribute I.2. Maturity Level Template

LOW		MEDIUM		HIGH
1	2	3	4	5
Not yet started.	**Some documented processes exist addressing integration and analysis of subcontract work scope with the prime contractor's EVMS.**	**Most prime contractor processes detailing the integration and analysis of subcontract work scope with the prime contractor's EVMS are documented but not approved and enforced.**	**All prime contractor processes addressing subcontractor integration with the prime contractor's EVMS are documented, approved, and enforced. All subcontractor work scope is integrated with the prime contractor's EVMS and regularly analyzed and reported to the customer at the appropriate levels.**	**All subcontractor performance data is submitted, reviewed, and incorporated as part of the prime contractor's performance at the appropriate levels. This occurs in the same month it is reported to the customer, enhancing decision-making.**
	Subcontractors are not separately identified with unique IDs and their work scopes are not integrated within the EVMS. The prime contractor is unable to analyze the subcontractor's performance data. The subcontractor's monthly cost and schedule performance data may not be current, accurate, complete, repeatable, auditable, and reflective of the actual conditions of performance and progress to date.	Only high-risk subcontractor work scope is integrated with the prime contractor's EVMS using a common coding structure. The prime contractor only analyzes high-risk subcontractor performance data. The remaining subcontract work scope is not analyzed. Therefore, the prime contractor may not be able to verify whether subcontractors will deliver the product or service on time or within budget. Subcontractor integration and analysis are coordinated with the organizing, planning and scheduling, budgeting and work authorization, analysis and management reporting, change control, and risk management subprocesses.	(I.2.1) The prime contractor integrates subcontractor work scope at the level needed to support the development and maintenance of the critical path. All subcontractor work scope, schedule, and budget data are integrated within the prime contractor's PMB at the appropriate levels. (I.2.2) The prime contractor conducts a monthly end-to-end analysis of subcontractor cost and schedule performance data and variances to verify they are current, accurate, complete, repeatable, auditable, and consistent with actual conditions of performance and progress, and whether the subcontractor is deviating from the baseline plan. Any needed corrective actions to achieve objectives are implemented. (I.2.3) MR and UB belonging to a subcontractor are incorporated with the prime contractor's EVMS and traceable to the subcontractor's reported MR/UB values. (I.2.4) Subcontractor integration and analysis are integrated with the organizing, planning and scheduling, budgeting and work authorization, analysis and management reporting, change control, and risk management subprocesses.	Monthly changes to the subcontractor's work scope and baseline plan are coordinated with the prime contractor. Changes are effectively controlled to maintain the integrity of the prime contractor's performance data. Routine surveillance, monitoring, and automated testing of subcontractor data are conducted to assess system health and integrity and identify data anomalies and performance issues. Necessary corrective actions are implemented, completed, and recurring issues resolved. The prime contractor and subcontractor accounting calendars are aligned for timely data integration and early visibility into issues. The prime contractor and subcontractor have open communications and a collaborative working relationship. The prime contractor coordinates any Over Target Baseline (OTB)/Over Target Schedule (OTS) with the customer and subcontractor to properly manage its implementation. Subcontract integration and analysis practices are continuously improved and optimized.

Subcontractor integration and analysis is integrated with the organizing, planning and scheduling, budgeting and work authorization, analysis and management reporting, change control, and risk management subprocesses.

Objective

All prime contractor processes addressing subcontractor integration with the prime contractor's EVMS are documented, approved, and enforced. All subcontractor work scope is integrated with the prime contractor's EVMS and regularly analyzed and reported to the customer at the appropriate levels

The prime contractor conducts a meaningful analysis of subcontractor performance data throughout the project lifecycle. The single source of current, accurate, and complete data for the project team is the prime's EVMS, ensuring everyone is on the same page and working from the same set of data, and information is used by all stakeholders. Typically, the prime contractor

develops a subcontractor management plan that identifies and integrates the work of a subcontractor into a cohesive project plan with the subcontractors' understanding of where their work efforts fit into the overall project. The plans, budgets, and schedules of each subcontractor are coordinated by the prime contractor to assure that the overall work efforts of the subcontractor are integrated into the project's PMB through the use of approved and documented processes and procedures.

The following describes the characteristics of Subcontractor Integration and Analysis:

- Unambiguous subcontracts are established that include a Statement of Work.
- Subcontractors are integrated into a cohesive project plan with all subcontractors understanding where their work efforts fit into the overall project.
- Interfaces between the prime contractor and subcontractors, as well as among the subcontractors, are clearly understood and documented.
- Before starting work, subcontractors are provided authorization to proceed. This authorization is given in writing via an approved work authorization process.
- Formal teaming is established and implemented. This practice contributes to reducing the risk of misunderstandings or isolationism.

Effectiveness Criteria

I.2.1. *The prime contractor integrates subcontractor work scope at the level needed to support the development and maintenance of the critical path. All subcontractor work scope, schedule, and budget data are integrated within the prime contractor's PMB at the appropriate levels.*

The budget for authorized subcontractor work is based initially on the prime contractor's estimated value and needs to be updated to reflect final negotiations. Authorized subcontracted work needs to be integrated into the prime contractor's PMB. Baseline and forecast schedules are developed that establish schedule constraints and identify contractual and significant internal events and milestones. Intermediate schedules are then established that clearly show key interfaces and the interdependencies of the prime contractor's work efforts. Concurrent project team meetings are conducted regularly to provide visibility into the work being performed and provide an opportunity for discussion among the project partners.

There is a difference between subcontractors with an EIA-748 requirement and fixed-price type subcontractors. Subcontractors with an EIA-748 requirement have their own IMS and are linked with the prime. For fixed price subcontracts the prime needs to plan the subcontractor at the level the work is accomplished in their IMS.

I.2.2. *The prime contractor conducts a monthly end-to-end analysis of subcontractor cost and schedule performance data and variances to verify they are current, accurate, complete, repeatable, auditable, and consistent with actual conditions of performance and progress, and whether the subcontractor is deviating from the baseline plan. Any needed corrective actions to achieve objectives are implemented.*

Variance analysis of the subcontractor's cost and schedule performance is conducted regardless of whether the EVMS requirement was flowed down to the subcontractor. A subcontractor with an EIA-748 EVMS flow-down formally implements the EVMS and conducts 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 which is subsequently reported to the DOE. If there are no EIA-748 EVMS flow-down requirements, the responsible prime contractor CAM analyzes 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 define and explain the analysis process for subcontractor performance when there is no EIA-748 EVMS flow-down requirement.

The prime contractor ensures subcontractor performance data are 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 takes the necessary steps towards ensuring the incorporated performance data is consistent and reflective of actual performance to date. Hence, special steps are taken to minimize performance data differences caused by accounting month differences. If the prime contractor and subcontractor accounting calendars are significantly different, then the following steps apply:

- The subcontractor provides 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 reports schedule status within one week of the prime month-end;
- The subcontractor reports costs to the prime for the week ending that corresponds closest to the prime's accounting month-end and IMS date. This may involve the need for estimated actuals based on a subcontractor's weekly actual report; 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 periodically assesses all or portions of the subcontractor's work efforts, including monthly BCWS, BCWP, and Estimate at Completion (EAC) values. 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. Occasionally, the prime contractor may need to eliminate an inappropriate retroactive change reported by the subcontractor, or the subcontractor's EAC may need to be adjusted higher because of some potential Requests for Equitable Adjustments (REAs). In all cases, these changes are documented and justified in the IPMR/CPR Format 5. Typically, the prime contractor assigns one or more CAMs to manage the subcontracted efforts, and these efforts may be part or all of 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 are documented and communicated to the subcontractor and DOE.

The accuracy of these schedules is critical and the CAM or manager responsible for oversight of the subcontractor reviews and approves these schedules. Data aggregation is the process of gathering data and presenting it in a summarized format. The data is gathered from multiple data sources with the intent of combining these data sources into a summary for data analysis. This is a crucial step since the accuracy of project insights from data analysis depends heavily on the amount and quality of data used. The prime contractor gathers accurate data and a large enough amount from each subcontractor to create relevant results. The project demonstrates a willingness to address problems in a documented and timely manner.

I.2.3. *MR and UB belonging to a subcontractor are incorporated with the prime contractor's EVMS and traceable to the subcontractor's reported MR/UB values.*

MR or UB belonging to a subcontractor incorporated into the prime contractor's EVMS with traceability to the subcontractor's reported MR and UB amounts. For subcontractors having an EVMS flow-down requirement, MR belongs to the subcontractor and not the prime contractor. The contractor implementing EVMS (whether it be the subcontractor or prime contractor) identifies all MR and UB. Hence, the requirement is that the subcontractor identifies the MR and UB amounts (which may be zero) and the prime contractor reflects these amounts in their EVMS.

I.2.4. *Subcontractor integration and analysis are integrated with the organizing, planning and scheduling, budgeting and work authorization, analysis and management reporting, change control, and risk management subprocesses (Section 3.2).*

Impact of Ineffectiveness

Failure to properly integrate and analyze subcontractor performance often leads to the loss of EVMS "early warning" opportunities, disputes, claims, project delays, substandard work, and possible quality and safety issues. This leads to project failure, often resulting in the client getting their project late which negatively impacts the contractor's reputation.

Special Considerations

None.

I.3. Subcontract Oversight

The purpose of this attribute is to ensure that the subcontract management process maintains that the prime contractor's oversight of the subcontractor's management processes, and in some instances, a subcontractor's EVMS reliability, includes at a minimum meeting EVMS project contract requirements, subcontractor internal policies, procedures, operating instructions, and other (Table 58). The prime contractor's oversight of the subcontract's management processes and, in some instances, its EVMS, may be performed with or without customer involvement, as required. Continuous oversight includes assessment of timeliness, reliability, accuracy, and completeness of subcontractor products, actions, and decisions. When the prime contractor identifies subcontractor EVMS implementation deficiencies as part of its oversight responsibilities, it furnishes immediate feedback and instructions to the subcontractor for the timely resolution of the issues identified. In these cases, the subcontractor working with the prime contractor is expected to develop and implement a documented corrective action plan (including industry-recognized root cause analysis practice and process). Implementation of corrective actions is timely, adequate, and complete. Subcontractor oversight reports are

appropriately shared with the subcontractor and stakeholders to communicate the strengths and challenges associated with EVMS implementation.

Table 58. Attribute I.3. Maturity Level Template

LOW		MEDIUM		HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**The prime contractor has documented some processes for oversight of the subcontractor's management processes and EVMS.**	**The prime contractor has documented most processes for oversight of the subcontractor's management processes and EVMS. However, the implementation of the processes is inconsistent.**	**The prime contractor applies and enforces documented processes for oversight of the subcontractor's management processes and EVMS.**	**The prime contractor's oversight of the subcontractor management processes is proactive, integrating EVMS as part of the monthly project business rhythm.**
	Some subcontracts requiring EVMS oversight are identified. The prime contractor lacks a formal strategy and plan for subcontractor oversight.	Subcontracts requiring EVMS oversight are mostly identified. However, surveillance of the subcontractor's EVMS and analysis of the subcontractor's management processes are inconsistent. Subcontract Oversight contract requirements are coordinated with the organizing, planning and scheduling, budgeting and work authorization, analysis and management reporting, change control, and risk management subprocesses.	(I.3.1) The prime contractor conducts regular surveillance of the subcontractor's management processes and EVMS to ensure that timely, reliable, and accurate data are produced. These data are reflective of actual conditions for subcontract cost, schedule, and technical performance. (I.3.2) Results from subcontract oversight are integrated with the prime contractor's decision-making process. (I.3.3) Necessary corrective actions are implemented, completed, and recurring issues are tracked to resolution. (I.3.4) Subcontract oversight contract requirements are integrated with the organizing, planning and scheduling, budgeting and work authorization, analysis and management reporting, change control, and risk management subprocesses.	Data and analysis reports resulting from subcontract oversight are routinely monitored and automatically tested to assess system health and integrity. Routine surveillance identifies ineffective or inefficient subcontractor management processes and is fully disclosed to all key stakeholders, who maximize their use. The prime contractor has a documented management and surveillance plan (such as a subcontractor management plan), describing the prime's approach to managing subcontractor requirements and responsibilities for completing specified work scope assignments and delivery of products and services. Where appropriate, the prime contractor uses independent reviews (such as an IBR) on the subcontractor's baselines. Subcontract oversight practices are continuously optimized.

Subcontract oversight is integrated with the organizing, planning and scheduling, budgeting and work authorization, analysis and management reporting, change control, and risk management subprocesses.

Objective

The prime contractor applies and enforces documented processes for oversight of the subcontractor's management processes and EVMS.

Surveillance is the continuous process of reviewing the health of the EVMS. The purpose of surveillance is to ensure the EVMS is effectively implemented and used to manage scope, schedule, and technical performance, and that the performance data generated are current, accurate, complete, repeatable, auditable, and compliant. An effective surveillance process ensures the system is maintained over time and on subsequent applications. Surveillance generally starts once the PMB is established on a newly authorized project and extends through the duration of the project life cycle.

The following describes the characteristics of Subcontractor Integration and Analysis:

- Ensure that the organization's EVMS has been effectively implemented following the organization's EVMS documentation.
- Ensure the EVMS provides current, accurate, complete, repeatable, auditable, and compliant integrated project management information for internal and customer use.
- Assess the project's demonstrated commitment and ability to maintain and use its EVMS as an integral part of its project management process.
- Effectively communicate surveillance findings/results to prime and subcontractor management and follow up to correct systemic problems.

Effectiveness Criteria

I.3.1. *The prime contractor conducts regular surveillance of the subcontractor's management processes and EVMS to ensure that timely, reliable, and accurate data are produced. These data are reflective of actual conditions for subcontract cost, schedule, and technical performance.*

The prime contractor routinely surveils the subcontractor to ensure that the EVMS (or like management control systems and processes) conforms, and continues to conform, with contract terms and conditions. Data integrity is the maintenance of, and the assurance of, subcontractor data reflecting actual conditions of performance. It is a critical aspect of the design, implementation, and usage of the EVMS (or like a management control system) that stores, processes, or retrieves project-related data.

The prime contractor ensures that subcontractor performance data is accurate and consistent with the actual performance to date. Steps are 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 provides 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 reports 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 performs periodic assessments of all or portions of the subcontractor's work efforts, including monthly BCWS, 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's EAC may need to be adjusted higher because of some potential Requests for Equitable Adjustments (REAs). In all cases, these changes are documented and justified in the IPMR/CPR Format 5. Typically, the prime contractor assigns one or more CAMs to manage the subcontracted efforts, and these efforts may be part or all of 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, accurate, complete, repeatable, auditable, and compliant. If not, then the issues are documented and communicated to the subcontractor and the DOE.

I.3.2. *Results from subcontract oversight are integrated with the prime contractor's decision-making process.*

Management reporting includes the results of the subcontractor surveillance process and the impacts of EVMS implementation issues (if any) every month. These reports enable the project team and specifically the contractor PM to track past and present EVMS issues and assist in making informed decisions.

I.3.3. *Necessary corrective actions are implemented, completed, and recurring issues are tracked to resolution.*

Where EVMS issues are identified, the subcontractor's corrective action process includes clear identification of related problems (including industry-recognized root cause analysis practice and process) and thorough documentation of the resources and steps required to mitigate the immediate issues. The corrective action document also includes detailed actions to ensure subcontractor performance measurement data are current, accurate, complete, repeatable, auditable, and compliant before their integration into the prime contractor's EVMS. It is the responsibility of the prime contractor to oversee the subcontractor's corrective actions and to provide the customer with these insights.

I.3.4. *Subcontract oversight contract requirements are integrated with the organizing, planning and scheduling, budgeting and work authorization, analysis and management reporting, change control, and risk management subprocesses (Section 3.2).*

Impact of Ineffectiveness

Failure to properly oversee subcontractor EVMS (or like management control system and processes) often leads to the loss of EVMS "early warning" opportunities, disputes, claims, project delays, substandard work, and possible quality and safety issues. This leads to project failure, often resulting in the client getting their project late which negatively impacts the contractor's reputation.

Special Considerations

None.

Subprocess J. Risk Management

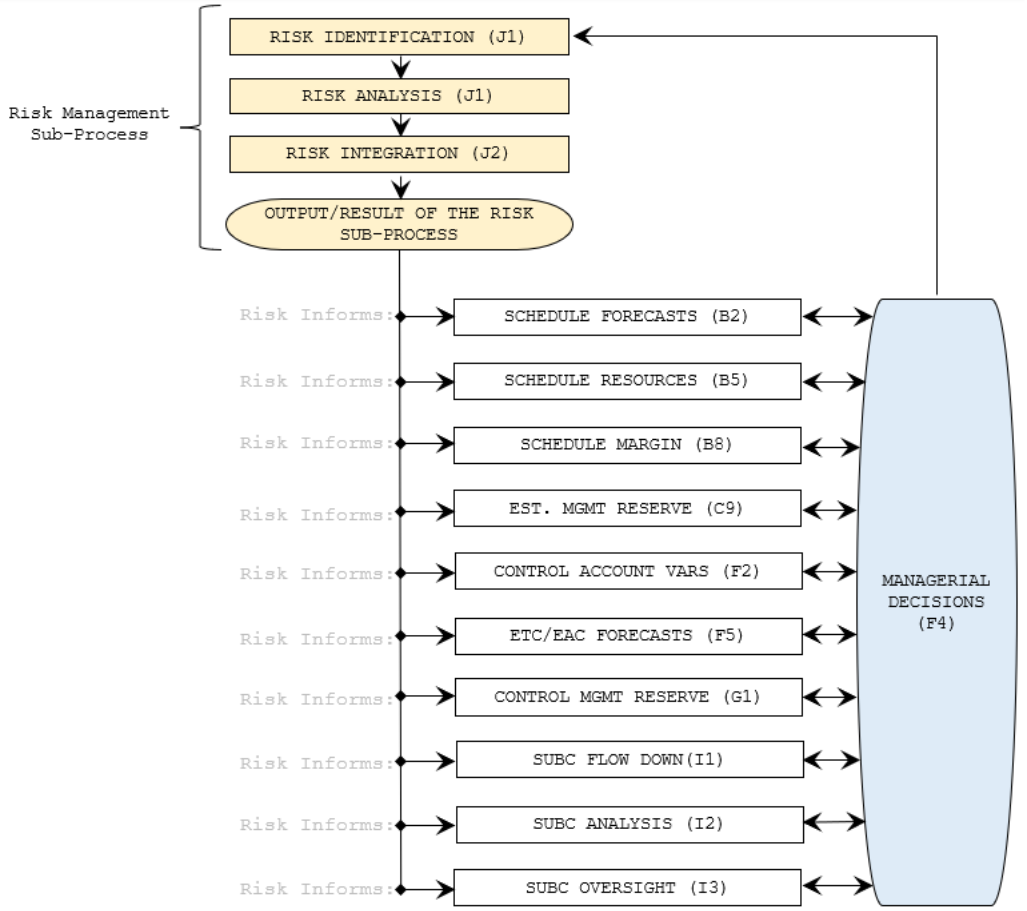
Risk management is the subprocess for identification of risks and opportunities, analysis and mitigation of risks, and integration of risks into the EVMS. Risk management is among the most important aspects of an integrated project management strategy. Risk management is the process of identifying, evaluating, and prioritizing risks, both known and unknown, following the coordinated and economical application of resources to minimize, monitor, and control the probability or impact of threats or to maximize the realization of opportunities. These risks stem from a variety of sources including financial uncertainties, legal liabilities, technology issues, management errors, accidents, natural disasters, and the like. The risk management subprocess effectively identifies risks/opportunities and then actively manages each to minimize the negative impacts risks have on the PMB. While the project cannot entirely avoid risk due to uncontrollable circumstances, it is required by the EVMS to anticipate and mitigate risks through an established risk management process.

The risk management subprocess comprises two attributes that contribute to the effectiveness of the EVMS. The adequacy of each attribute, both individually and collectively, is assessed by conducting effectiveness criteria testing to gauge their adequacy towards meeting integrated project management requirements. The Risk Management subprocess considers the following key factors:

- **J.1.** A risk management plan and an actively maintained risk register are used.
- **J.2.** There is a clear tie between project risks and risk reserves.

The risk management subprocess permeates the EVMS and informs other key subprocesses and attributes to ultimately provide for sound managerial decisions. As shown in Figure 20, 11 other attributes, spanning five subprocesses, integrate with the risk management subprocess (J.1 and J.2) for successful risk management.

Figure 20. Subprocesses Integrating with Risk Management



To enable an effective risk management framework, projects need to understand the types of risks they are facing. Managerial decision-making is integrated with the risk management subprocess to influence risk in a predicted and controlled way.

As shown in Figure 5, the Risk Management subprocess considers two management attributes that collectively account for 60 (or 6%) of the 1,000 possible points of the maturity model at Level 5. As shown in Figure 6, J.1 is the highest weighted management attribute. Overall, the two risk subprocess attributes have the highest weights of all 56 attributes across the 10 subprocesses, indicating the overall importance of risk within integrated project management.

J.1. Identify and Analyze Risk

This attribute ensures that the management of risks (both threats with negative consequences and opportunities with positive benefits) over the life cycle of a project is an integral part of EVM, with touchpoints to each subprocess (Table 59). This supports establishing the basis for appropriate risk reserves, such as contractor's MR, schedule margin (SM), customer's cost and schedule contingency and estimates of cost at completion (EAC), and schedule forecasts. It allows for the execution of the project within the expectation of key stakeholders and project management.

Table 59. Attribute J.1. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some of the processes to incorporate risk planning are in place. Clear ties between risks are not yet in place to support the execution plan.**	**The process to incorporate risk planning is in place, with some gaps. The risk management plan is in place. Some project/ program activities have ties to contingency.**	**The risk planning process is documented and approved. A risk management plan and an actively maintained risk register are used. Appropriate project activities have clear ties to risk reserves and forecasts, as observed in the risk register.**	**A risk register is actively used and surveilled. Routine surveillance results of the risk register are fully disclosed to all key stakeholders to inform decisions and proactively control the project.**
	The risk management plan is under development. Risk owners may not be documented, mitigation steps have not been identified, and surveillance plans are not in place. The corresponding activities are not identified in the schedule or cost estimates at this point. Ties between project activities and contingency such as MR, SM, and customer contingency are not identified.	The risk management plan is developed and in use, with minor issues. The risk owners are partially identified and documented, and mitigation steps have been identified, but not executed. The mitigation steps are incorporated into the schedule and cost as appropriate. Most ties are identified between appropriate project activities and contingency, such as MR, SM, and customer contingency. Risk tools are updated to maintain a current understanding of the risks and risk impacts. This includes SRAs, review of critical elements, review of resource availability impacting critical activities, impacts of updated budget constraints, and the impacts of re-planning as they affect future activities.	(J.1.1) The risk management plan is developed, documented, and in use. A risk register is actively used. Periodic meetings of the risk committee or project team members occur and are documented to update risks and ensure teams work to take advantage of opportunities and avoid threats. A risk manager has been identified for the project. (J.1.2) Risk owners are identified and documented, and actively follow through on mitigation actions. Surveillance occurs as part of the risk management plan to look for the realization of risks at the appropriate times and to encourage the realization of opportunities. (J.1.3) An SRA is used as an integral part of the overall risk process. The SRA validates the sufficiency of schedule margin duration and MR budget. (J.1.4) The range of EACs and schedule forecasts are informed by the risk register and SRA. (J.1.5) Both schedule and cost reflect risk mitigation activities identifiable to the risk register, as appropriate, and with few immaterial exceptions.	Regular meetings of the risk committee or project team members occur, including the customer as needed. Risk owners actively work to avoid a threat or encourage an opportunity. Risk data are monitored and automatically tested to assess system health and integrity. Necessary corrective actions are implemented, completed, and recurring issues resolved. All of the project activities with identified risk have clear ties to risk reserves, active surveillance, ongoing planning, and management. The risk management process is continuously improved and optimized.

A well-executed SRA process can provide the essential strategies for recognizing, reducing, and eliminating possible risks, with a specific emphasis on project schedule risks. The project's risk register is a common repository to document risks and their relationship with the amount of MR budget, SM in the project schedule, and range of EACs. The use of risk conferences (risk reviews), a risk mitigation plan, identification of "who owns risk", and clear communication of risks provide the opportunity for the project to finish within expectations. Risk management considers the master schedule, which agrees with the project objectives, reflects a logical sequence of events, and considers identified cost and schedule risk threats and opportunities. The project tracks each risk event through a process that identifies both the likelihood and consequence of a risk occurring, mitigation steps possible or acceptance, and disposition of the risk once mitigated. The risk management process identifies how the project team tracks risks and how risks are retired. If a risk is transferred, the new owner of the risk agrees and takes actions to either accept or mitigate and manage. A risk tracking system is developed to manage risks effectively. One example is a risk register, which is a document detailing all identified risks, including description, cause, probability of occurrence, impacts on objectives, proposed responses, risk owners, and current status.

Risks occur in both planning and execution. Risks (both cost and schedule) are most often considered at the activity/task level and when realized, the impacts are rolled into both schedule and cost estimates to reflect the impacts on the project. Mitigation steps are also captured in the schedule to include resources applied.

Objective

The risk planning process is documented and approved. A risk management plan and an actively maintained risk register are used. Appropriate project activities have clear ties to risk reserves and forecasts, as observed in the risk register.

Appropriate project activities have clear ties to risk reserves and forecasts, as observed in the risk register. The risk planning process is documented and approved. A risk management plan and an actively maintained risk register are used. Risk identification and analysis is integrated with all other subprocesses. For example, the risks associated with the project scope determine the contract type and dollar value, and how and whether to employ an EVMS. EVMS implementation is modified to match the level of risks, corporate culture, budget and time constraints, and project teams' experience that constitute the overall project environment. EVM and risk management share a common aim of providing project teams, customers, and other decision-makers with the best data and information to identify risks (threat and opportunity) and recommend early action to be taken to limit the impact and probability of threat occurrence or maximize the exploitation of opportunities. Both EVM and Risk Management inform the PMB by using both qualitative and quantitative outputs to provide a better understanding of project progress and predicted future trends.

The following describes the characteristics of Risk Identification and Analysis:

- Identify the threats.
- Assess the vulnerability of critical assets to specific threats.
- Determine the risk (the expected likelihood and consequences of specific types of attacks on specific assets).
- Identify ways to reduce those risks.
- Prioritize risk reduction measures.

Effectiveness Criteria

J.1.1. *The risk management plan is developed, documented, and in use. A risk register is actively used. Periodic meetings of the risk committee or project team members occur and are documented to update risks and ensure teams work to take advantage of opportunities and avoid threats. A risk manager has been identified for the project.*

There are monthly or quarterly risk meetings established to update the risk plan.

J.1.2. *Risk owners are identified and documented, and actively follow through on mitigation actions. Surveillance occurs as part of the risk management plan to look for the realization of risks at the appropriate times and to encourage the realization of opportunities.*

Risk owners are identified as part of the overall project review process. Risk owners are responsible to identify new (emergent) risks or opportunities and managing or closing existing

risks or opportunities as reviewed in a documented surveillance process. Risk or opportunity mitigation actions are tracked using the IMS and risk register until the risk or opportunity is realized or eliminated. Risk owners report directly to the Risk Manager.

J.1.3. *An SRA is used as an integral part of the overall risk process. The SRA validates the sufficiency of schedule margin duration and MR budget.*

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. SRA is a recognized industry best practice that identifies the high-risk areas of the project, determines the likelihood of risk materializing, and assesses 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 begins as soon as the project baseline is implemented. A well-executed SRA process can provide the essential strategies for recognizing, reducing, and eliminating possible risks, with a 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, assesses the impact of possible risk, and more importantly, compiles 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.

An SRA is required at the DOE O 413.3B Maturity Gates (CD-2, CD-3, CD-4) and when a comprehensive EAC is performed as discussed in Maturity F.5. How to conduct an SRA in more detail is contained in the NDIA IPMD PASEG Chapter 10.2 "Schedule Risk Assessment (SRA) – Setup and Execution and Chapter 10.3 Schedule Risk Assessment – Analysis."

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 is documented and available for review. SM may be established based upon the results of an SRA, 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 schedule margin represents the calculated schedule duration of unrealized risks. Schedule margin is established during the planning phase of the project. SM may be established based upon the results of an SRA, for example. Schedule margin durations are traceable to risks found within the Risk and Opportunity register. In addition, durations for schedule margin are updated over time as risks are realized, risks are retired, and the risk register is updated, such that the duration of schedule margin is commensurate with the amount of residual risk remaining on the project. If contractor schedule margin is used, it is defined, documented, and approved and only used immediately preceding a DOE CD milestone such as CD-4 and (scope issue) is reflected in the baseline as well as the forecast schedules. DOE schedule contingency is optional and if used is represented as an activity, clearly defined in the activity name as 'DOE SCHEDULE CONTINGENCY' and placed after the contractor's final delivery.

The relationship between SM and risk in the schedule is documented and available for review. Risks that require mitigation are documented in the Risk Register 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 is required to 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 schedules 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 contractor EVM system description establishes the policy for the development and maintenance of SM.

Normally the duration for schedule margin is validated at CD-2 approval. After the SRA a risk-adjusted date for CD-4 is established. For example, a risk of 80% confidence yields a later CD-4 forecast than a 50% confidence level. The difference between the risk calculated CD-4 date and the IMS calculated one is captured as the original duration for the schedule margin. This ensures the overall IMS begins with the risk probability required.

J.1.4. *The range of EACs and schedule forecasts are informed by the risk register and SRA.*

The EAC is the current estimated total cost for all authorized project work. It equals the cumulative ACWP to date plus the Estimate to Complete (ETC) (estimate of work remaining). EACs are not constrained by funding or negotiated contract costs but focus on the project work scope's projected cost. An accurate well-maintained EAC supports the DOE's ability to provide enough funding to the project. Predicting the EAC and variance at completion is an essential component of the project management and decision-making process. Focus on the final project cost and determine whether additional funding is needed. Report a range of EACs (Best Case, Worse Case, and Most Likely values) monthly. Perform analysis to determine whether those figures are realistic. Each month, the contractor's PM generates a range of estimated costs at completion. The range of estimates is intended to allow contractor management flexibility to express possible cost outcomes. The contactor PM provides the most accurate Estimates at Completion (EACs) possible through program-level assessments of factors that may affect the cost, schedule, or technical outcome of the contract. Such program-level assessments include consideration of known or anticipated risk areas, and planned risk reductions or cost containment measures. As noted in the Government Accountability Office (GAO) Cost Estimating and Assessment Guide, the integration of EVM data and risk management practices allows for the development of EACs for all management levels.[12] EACs are to be reported without regard to the contract ceiling.

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. If this estimate is different from the most likely EAC, the assumptions, conditions, and methodology underlying this estimate are explained briefly in IPMR Format 5. This estimate is for informational purposes only; it is not an official company estimate. There is no requirement for the contractor to prepare and maintain backup data beyond the explanation provided in Format 5.

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. If this estimate is different from the most likely EAC, the assumptions, conditions, and methodology underlying

[12] GAO, *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, GAO-20-195G, March 2020, p. 212.

this estimate are to be explained briefly in IPMR Format 5. This estimate is for informational purposes only; it is not an official company estimate. There is no requirement for the contractor to prepare and maintain backup data beyond the explanation provided in Format 5.

The **most likely estimate** is the contractor's official contract EAC and, as such, takes precedence over the estimates presented in Column (15) of IPMR 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, and probable future conditions. This value need not agree with the total of IPMR Column (15) (Block 8.e). However, any differences are explained in IPMR Format 5 in such terms as risk, use of MR, or higher management knowledge of current or future contract conditions. The assumptions, conditions, and methodology underlying this estimate are to be explained briefly in IPMR Format 5. This EAC need not agree with EACs contained in the contractor's internal data but is reconcilable to them. The most likely EAC is also reconcilable to the contractor's latest statement of funds required as reported in the SRA.

J.1.5. *Both schedule and cost reflect risk mitigation activities identifiable to the risk register, as appropriate, and with few immaterial exceptions.*

Once the PMB has been established contractor PMs take the appropriate steps to identify, examine, and assess potential risks in the baseline schedule. The creation of a networked-based project 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, when applicable, include those activities chosen to mitigate the risk in the baseline and forecast schedule, which aligns with Best Practice 1, Capturing All Activities, and Best Practice 8, Conducting a Schedule Risk Analysis, in the GAO Schedule Assessment Guide. For example, risk mitigation activities in the project schedule that are not in alignment with the Risk Register suggest that the risk management process has not been integrated with the project schedule, and therefore those risks may not be correctly quantified or effectively managed. 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 are 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 always 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. Cross-reference Section B.8.1 for further details.

Impact of Ineffectiveness

Failure to properly identify and analyze risks often leads to disputes, claims, project delays, substandard work, and possible quality and safety issues. This leads to project failure, often resulting in the client getting their project late which negatively impacts the contractor's reputation.

Special Considerations

None.

Risk is not fully documented in EIA-748, but there are ties to each EVMS subprocess. In this attribute, the words “activity” and “task” are used synonymously. DOE also clarified that this attribute includes best, worst, and most likely EACs and removed from attribute F.5. DOE also did not address MR in this attribute and moved the discussion to C.10.

J.2. Risk Integration

The purpose of this attribute is to ensure that throughout the execution of work for a project, risks (both threats with negative consequences and opportunities with positive benefits) are identified, monitored, and managed as a process to support successful completion (Table 60). Integrating risk into the EVMS ensures the technical, schedule, and budget/cost data submitted to the customer each month for both initial establishment and change control of the PMB and development of estimates at completion (EAC) is accurate and complete. Having a risk committee/team which follows a risk management plan is critical to the early detection of risks. The risk committee/team has both customer and contractor representation capturing risk events in a risk tracking tool or register. The realization of a threat or opportunity is addressed with a deliberate action that is planned, monitored, and integrated into the project to support and encourage an opportunity, or to minimize the impact of a threat, ensuring cost and schedule tools are updated to support forecasts. As the project progresses, this integration allows the project to monitor risks at the time they are most likely to occur. Robust communication within the risk committee/team to the PM and customer supports the analysis and use of risk reserves—such as MR, SM, or customer cost and schedule contingency—to apply the right resources to manage the threat or capture the most benefit from an opportunity. Risk events are tracked, with actions and impacts captured in logs to support auditable integration into the EVMS including the identification of risks in the schedule and budget baselines. When risk reserves are used, they are identified in baseline and status schedules. Risk reserves use is tracked when the budget is expended for an associated risk response or action. Risks that have been retired are traceable to schedule and baseline budget plan revisions and may result in updates to the ETC or Budget at Completion.

Table 60. Attribute J.2. Maturity Level Template

LOW	MEDIUM			HIGH
1	**2**	**3**	**4**	**5**
Not yet started.	**Some processes to incorporate risk management in the project are in place.**	**Most of the processes to incorporate risk management in the project are in use, with some gaps.**	**All processes to incorporate the risk management process are documented and in use. Ties between all risks and risk reserves used are logical and clear.**	**The risk management process is proactive and forward-looking to enhance management decision-making ability. The project/ program team is working to address threats and realize opportunities.**
	The processes in the risk management plan are under development and starting to be used by the project to exercise control of risks. Resources needed to address the risk management process are not in place.	The processes in the risk management plan are mostly developed and in use, including the process by which the project will exercise control of risks. The process includes a surveillance plan that targets who is looking for the risk, when they should look (what time window or project phase), and who they should alert. The risk management updates address the retirement of risks as well as updates to active risks, as needed. Implications of changed or retired risk are integrated and evident throughout all EVMS subprocesses. Resources needed to address the risk management process are mostly in place.	(J.2.1) The processes in the risk management plan are in use to exercise day-to-day control of risks. Risk management is auditable and transparent with mitigation plans. Realized risk impacts are integrated into the EVMS to include the schedule and budget implications during the establishment and maintenance of the PMB, EACs, and schedule forecasts. (J.2.2) Owners of specific risks are identified in plans and are actively managing these risks with mitigation steps identified where appropriate. Mitigation steps are executed and communicated. (J.2.3) Threats and opportunities are continually evaluated, updated, and tracked throughout the entire project lifecycle. This covers both known and emerging risks. A surveillance plan is in place and active monitoring of risks is evident during appropriate time windows. (J.2.4) Necessary corrective actions are implemented, completed, and recurring issues resolved. (J.2.5) Retirement of risks as recommended by the risk committee/team is to the PM and customer. These recommendations are acted upon and documented when the retirement is approved.	The risk management process includes routine meetings with both contractor and customer representatives on an appropriate time basis to inform, evaluate and react to threats and opportunities. These meetings are documented, and actions are traceable to all logs and auditable in their integration into the EVMS, including the identification of risks in the schedule and budget baselines. Risk data are monitored, used for management control, and automatically tested to assess system health and integrity. Routine surveillance results of risks are fully disclosed to all key stakeholders. They are informed of the risks and actions to keep the project moving towards a successful outcome in terms of technical scope, schedule, and cost. The project team is working to encourage and develop opportunities identified in the risk management plan to improve performance. A commitment to threat and opportunity management is part of the corporate culture. The risk management process is continuously improved and optimized.

Objective

All processes to incorporate the risk management process are documented and in use. Ties between all risks and risk reserves used are logical and clear. The GAO Schedule Assessment Guide notes that an EVMS is designed to integrate cost estimation, schedule development, system development oversight, and the risk management process.[13] Additionally, the GAO Cost Estimating and Assessment Guide emphasizes the importance of integrating risk management with the EVMS for a comprehensive project view.[14] Risk Integration is a set of practices and processes supported by a risk-aware culture and enabling technologies, that improve decision

[13] GAO, *Schedule Assessment Guide: Best Practices for Project Schedules*, GAO-16-89G, December 2015, p. 166

[14] GAO, Cost *Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, GAO-20-195G, March 2020, Figure 23: Integrating Earned Value Management and Risk Management, p. 212.

making and performance through an integrated approach to how the project manages its unique set of risks and opportunities.

The following describes the characteristics of Risk Integration:

- Risk management is an integral part of all organizational activities.
- A structured and comprehensive approach to risk management contributes to consistent and comparable results.
- The risk management framework and process are customized and proportionate to the organization's external and internal context related to its objectives.
- Appropriate and timely involvement of stakeholders enables their knowledge, views, and perceptions to be considered. This results in improved awareness and informed risk management.
- Risks can emerge, change, or disappear as an organization's external and internal context changes. Risk management anticipates, detects, acknowledges, and responds to those changes and events in an appropriate and timely manner.
- The inputs to risk management are based on historical and current information, as well as on future expectations. Risk management explicitly considers any limitations and uncertainties associated with such information and expectations. Information is to be timely, clear, and available to relevant stakeholders.
- Human behavior and culture significantly influence all aspects of risk management at each level and stage.
- Risk management is continually improved through learning and experience.

Effectiveness Criteria

J.2.1. *The processes in the risk management plan are in use to exercise day-to-day control of risks. Risk management is auditable and transparent with mitigation plans. Realized risk impacts are integrated into the EVMS to include the schedule and budget implications during the establishment and maintenance of the PMB, EACs, and schedule forecasts.*

The risk management plan and status were defined in Maturity J.1. The unique aspect of this EC is Risk Mitigation is scheduled and budgeted with MR. The effectiveness of the risk mitigation is input and updating the risk plan. The EAC is updated based on remaining risks factored by probability. See attribute F.5 for the best, worst, and most likely EAC requirements.

J.2.2. *Owners of specific risks are identified in plans and are actively managing these risks with mitigation steps identified where appropriate. Mitigation steps are executed and communicated.*

The risk plan considers the controls to be put in place to monitor risks throughout the project. The objective of risk mitigation is to reduce the probability or consequences of a risk event to an acceptable threshold and define an appropriate response. The Risk Manager and risk owners are held accountable by the PM and ultimately the customer to ensure risks and opportunities are actively identified and managed. After risk mitigation, the original risk is revaluated for closure or updated.

J.2.3. *Threats and opportunities are continually evaluated, updated, and tracked throughout the entire project lifecycle. This covers both known and emerging risks. A surveillance plan is in place and active monitoring of risks is evident during appropriate time windows.*

A documented surveillance plan is used by the project to continuously identify, quantify, and track active threats and opportunities to technical, schedule, and cost objectives.

J.2.4. *Necessary corrective actions are implemented, completed, and recurring issues resolved.*

The project demonstrates a willingness to address problems and implement corrective actions in a documented and timely manner.

J.2.5. *Retirement of risks as recommended by the risk committee/team is to the PM and customer. These recommendations are acted upon and documented when the retirement is approved.*

The project demonstrates full and open transparency in its execution of the agreed-to risk management plan with the full and active participation of both the contractor and the customer. A consensus-based decision-making process is in place in which all parties (both contractor and government) seek to reach an agreement on a course of action to address the retirement of risks and opportunities.

Impact of Ineffectiveness

Failure to properly integrate risk management as part of decision-making often leads to disputes, claims, project delays, substandard work, and possible quality and safety issues. This leads to project failure, often resulting in the client getting their project late which negatively impacts the contractor's reputation.

Special Considerations

None.

4. System Development And Implementation

A scaled approach to EVMS implementation looks to balance a program or project's size and complexity with its need to manage risk following sound management practices. This scalability allows any program or project to realize the benefits of EVM and to increase or reduce its application and functionalities according to the user's needs. A scaled EVMS implementation recognizes that low-risk projects may not require the same level of planning detail and change control discipline needed for more complex, medium-high risk programs and projects.

For low-medium risk programs or projects with or without contractual EVMS implementation requirements, the 13 project management principles, as discussed in the DOE Order 413.3B-10B, collectively form the basis for establishing an integrated project management approach and determining the scale of EVMS implementation needed. The 13 project management principles are meant to be widely applied to programs and projects requiring the planning, budgeting, and control of resources towards the completion of a work effort. For the proposed implementation of a scaled EVMS, a contractor applies existing management systems and processes in a manner most appropriate to the size, complexity, and risk of the program or project. The contractor works closely with the government customer and other interested stakeholders when making this decision.

It is important to understand that scale is a matter of degree and not the elimination of essential EVMS processes and attributes. A low-medium risk program or project not having a compliance requirement with the EIA-748 EVMS standard can benefit from using the IP2M METRR methodology to help select the subprocesses, attributes, and maturity level best suited for its management needs. For example, a program or project can choose to develop a high-level product-oriented WBS that does not decompose the hierarchy to capture all work requirements but just those deemed critical to the success of the project. Also, a program or project can choose to develop the WBS with no internal checks to validate that the WBS captures all work requirements saving the time and costs of formal oversight. For this example, the necessity of defining work requirements using a product-oriented WBS has not been removed but rather the degree to which it is being developed is significantly reduced. This scenario reflects an EVMS maturity between Levels 2 and 3. Conversely, for those high-risk programs and projects having a compliance requirement with the EIA-748 EVMS standard, there is the necessity to define all work requirements using a singular product-oriented WBS decomposed to levels below the CA that are validated through internal checks from an approved process. This scenario reflects an EVMS maturity of Level 4. Regardless of the scale or the maturity level, the EVMS provides timely, accurate, and actionable data for management decisions and reporting.

When making EVMS scalability decisions, please refer to the 56 IP2M METRR EVMS Maturity templates for a complete listing and detailed description of the EVMS maturity levels. Regardless of the scale, programs and projects need to use care when setting project management expectations and identifying maturity levels to avoid confusion and the over/under the implementation of the EVMS.

5. REFERENCES

1. ASU Joint EVMS Research Study Report, https://ip2m.engineering.asu.edu/

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3. DOE G 413.3-10, *Integrated Project Management Using Earned Valley Management System*, current version, https://go.usa.gov/xupsj

4. DOE Guide 413.3-24, *Planning and Scheduling*, current version, https://go.usa.gov/xups5

5. EIA-748 *Earned Value Management Systems Standard*, https://www.sae.org/standards/content/eia748d

6. NDIA *Earned Value Management Systems Intent Guide to the EIA Standard for EVMS (EIA-748)*, current version, https://www.ndia.org/divisions/ipmd/division-guides-and-resources

7. NDIA *Surveillance Guide*, current version, https://www.ndia.org/divisions/ipmd/division-guides-and-resources

8. NDIA *Earned Value Management System Acceptance Guide*, current version, https://www.ndia.org/divisions/ipmd/division-guides-and-resources

9. NDIA *Earned Value Management Systems Application Guide*, current version, https://www.ndia.org/divisions/ipmd/division-guides-and-resources

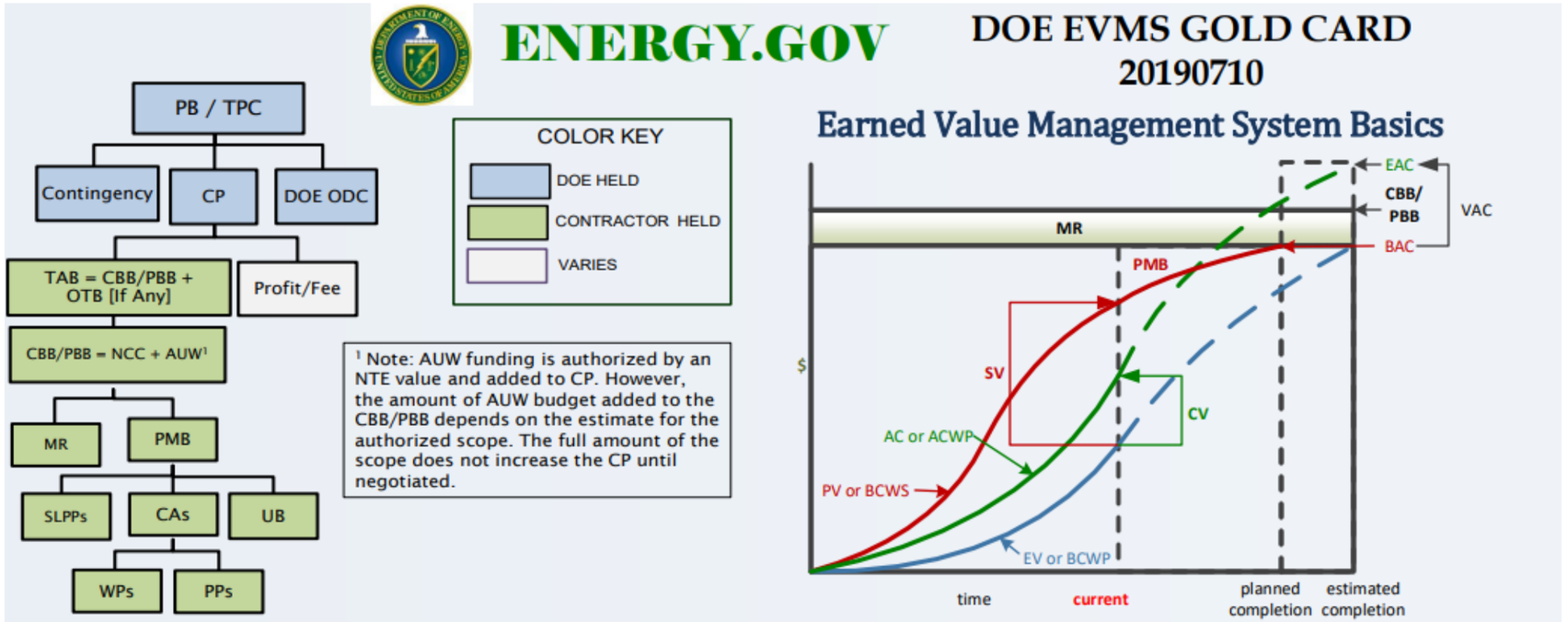
10. NDIA *Earned Value Management System Scalability Guide*, current version, https://www.ndia.org/divisions/ipmd/division-guides-and-resources

11. NDIA *Planning and Scheduling Excellence Guide (PASEG)*, current version, https://www.ndia.org/divisions/ipmd/division-guides-and-resources

12. GAO-20-195G, *Cost Estimating and Assessment Guide*, current version, http://go.usa.gov/xt8E6

13. GAO-16-89G, *Schedule Assessment Guide*, current version, http://go.usa.gov/xt8Ew

ATTACHMENT 1: DOE GOLD CARD



Performance Baseline Components

(Performance Baseline must clearly document scope and CD-4 date)

AUW = Authorized Unpriced Work (contractually approved, but not yet negotiated)
CA= Control Account (includes AUW) = WPs + PPs
CBB = Contract Budget Base = PMB + MR; valid when 1 contract to 1 project; else PBB
CP= Contract Price = CBB + Profit/Fee
MR= Management Reserve is held by contractor (Contingency is held by DOE)
NCC= Contract price less Profit/Fees
ODC= Other Direct Costs
OTB= Established performance budget that exceeds the value of the negotiated contract
PB= Performance Baseline (TPC) = CP + Contingency + DOE ODC
PBB= Project Budget Base = PMB + MR; valid when 1 contract to multiple projects
PMB= Performance Measurement Baseline = CAs + UB + SLPPs
PP= Planning Package (far-term activities within a CA)
SLPP = Summary Level Planning Package
TAB = Total Allocated Budget CBB + OTB or PMB + MR + OTB
TPC = Total Project Cost
UB = Undistributed Budget (activities not yet distributed to CA)
WP= Work Package (near-term, detail-planned activities within a CA)

EVMS Basic Components

AC = Actual Cost= ACWP = Actual Cost of Work Performed
EV = Earned Value=BCWP = Budgeted Cost for Work Performed
PV =Planned Value= BCWS = Budgeted Cost for Work Scheduled
BAC = Budget at Completion=∑BCWS= Sum of Budgeted Cost for Work Scheduled
EAC=Estimate at Completion= ACWP + Estimate to Complete (ETC)

VARIANCES

CV	=	EV – AC	=	BCWP – ACWP	=	Cost Variance
SV	=	EV – PV	=	BCWP – BCWS	=	Schedule Variance
CV%	=	(EV - AC) / EV	=	(BCWP - ACWP) / BCWP	=	Cost Variance (%)
SV%	=	(EV – PV) / PV	=	(BCWP - BCWS) / BCWS	=	Schedule Variance (%)
VAC	=	BAC – EAC			=	Variance at Completion

OVERALL STATUS

% scheduled	=	PV_{cum} /BAC	=	$BCWS_{cum}$/BAC
% complete	=	EV_{cum}/BAC	=	$BCWP_{cum}$/BAC
% budget spent	=	AC_{cum}/BAC	=	$ACWP_{cum}$/BAC
Work Remaining (WR)	=	BAC - EV_{cum}	=	BAC - $BCWP_{cum}$

PERFORMANCE INDICES ***(Favorable is >1.0, unfavorable is <1.0)***

CPI	=	EV / AC	=	BCWP / ACWP	= Cost Performance Index
SPI	=	EV / PV	=	BCWP / BCWS	= Schedule Performance Index
$TCPI_{EAC}$	=	WR / (EAC - AC_{cum})	=	EAC-based To Complete Performance Index	

ESTIMATE AT COMPLETION FORMULAE

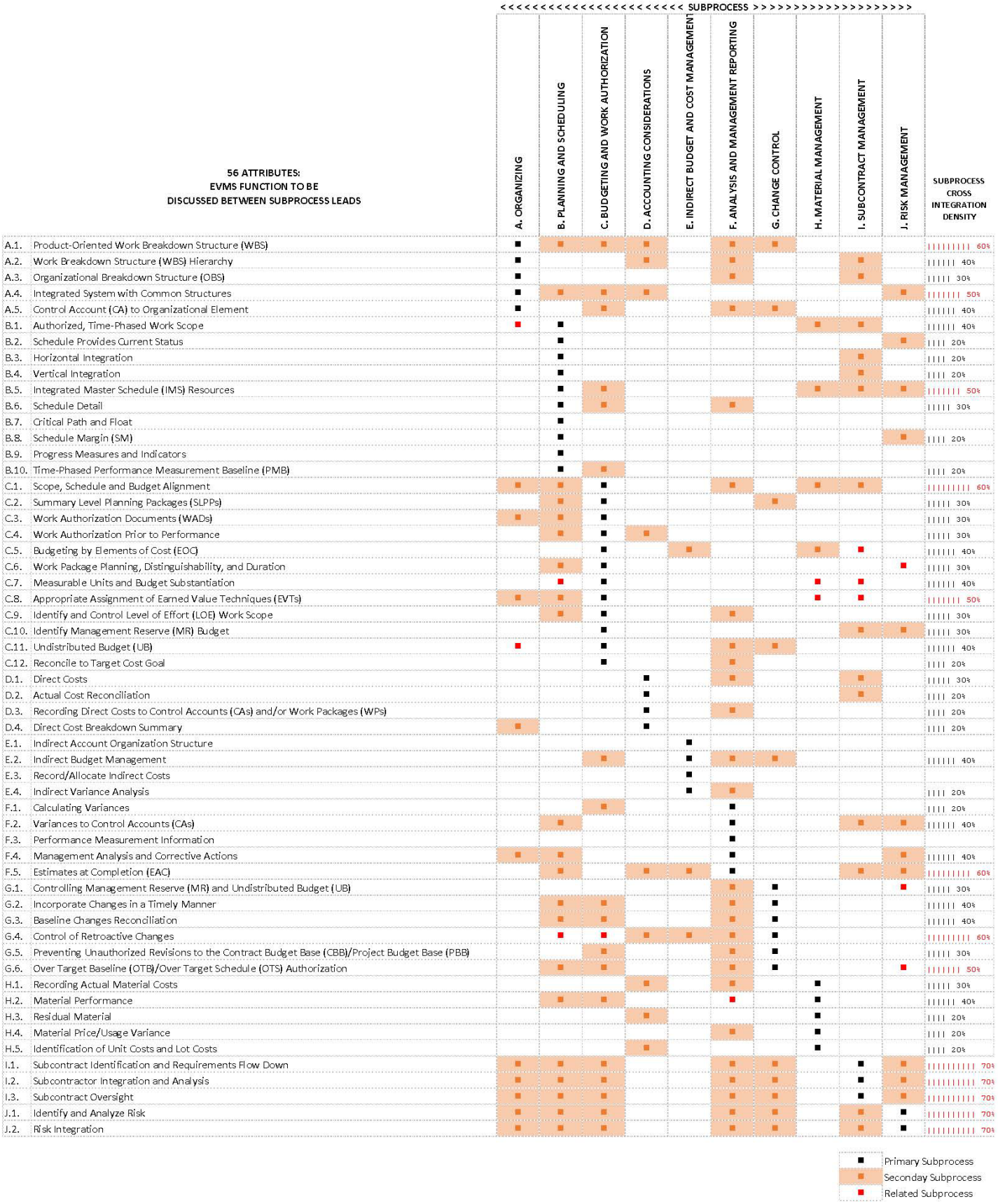
EAC	=	BAC / CPI_{cum}	= Estimate at Completion (general)
EAC_{CPIcum}	=	AC_{cum} + WR/CPI_{cum}	= Estimate at Completion (CPI)
$EAC_{composite}$	=	AC_{cum} + WR/(CPI_{cum} * SPI_{cum})	= Estimate at Completion (composite)
EAC_{CPI3mo}	=	AC_{cum} + WR / CPI_{3mo}	= Estimate at Completion (3 Mo. CPI)

Note: $_{CPI3mo}$ = (IncEVn + IncEVn-1 + IncEVn-2) / (IncACn + IncACn-1 + IncACn-2)

ATTACHMENT 2: ATTRIBUTE TO GUIDELINE CROSSWALK

Attribute	EIA-748 EVMS Guideline
A.1. Product-Oriented Work Breakdown Structure (WBS)	1
A.2. Work Breakdown Structure (WBS) Hierarchy	1
A.3. Organizational Breakdown Structure (OBS)	2
A.4. Integrated System with Common Structures	3
A.5. Control Account (CA) to Organizational Element	5
B.1. Authorized, Time-Phased Work Scope	1, 6, 8, 9, 10
B.2. Schedule Provides Current Status	6
B.3. Horizontal Integration	6, 28
B.4. Vertical Integration	6
B.5. Integrated Master Schedule (IMS) Resources	6, 8, 9, 10
B.6. Schedule Detail	6
B.7. Critical Path and Float	6
B.8. Schedule Margin (SM)	6, 27
B.9. Progress Measures and Indicators	7
B.10. Time-Phased Performance Measurement Baseline (PMB)	8
C.1. Scope, Schedule, and Budget Alignment	8
C.2. Summary Level Planning Packages (SLPPs)	8, 29
C.3. Work Authorization Documents (WADs)	9
C.4. Work Authorization Prior to Performance	9, 16
C.5. Budgeting by Elements of Cost (EOC)	9, 10, 13
C.6. Work Package Planning, Distinguishability, and Duration	10
C.7. Measurable Units and Budget Substantiation	10, 11
C.8. Appropriate Assignment of Earned Value Techniques (EVTs)	10, 12
C.9. Identify and Control Level of Effort (LOE) Work Scope	12
C.10. Identify Management Reserve (MR) Budget	14
C.11. Undistributed Budget (UB)	14
C.12. Reconcile to Target Cost Goal	15
D.1. Direct Costs	16
D.2. Actual Cost Reconciliation	16
D.3. Recording Direct Costs to Control Accounts or Work Packages	16
D.4. Direct Cost Breakdown Summary	17, 18
E.1. Indirect Account Organization Structure	4
E.2. Indirect Budget Management	13
E.3. Record/Allocate Indirect Costs	19
E.4. Indirect Variance Analysis	24
F.1. Calculating Variances	22
F.2. Variances to Control Accounts (CAs)	23
F.3. Performance Measurement Information	25
F.4. Management Analysis and Corrective Actions	26
F.5. Estimates at Completion (EAC)	27
G.1. Controlling Management Reserve (MR) and Undistributed Budget (UB)	29
G.2. Incorporate Changes in a Timely Manner	28, 32
G.3 Baseline Changes Reconciliation	29, 32
G.4. Control of Retroactive Changes	30
G.5. Preventing Unauthorized Revisions to the CBB/PBB	31
G.6. Over Target Baseline (OTB) / Over Target Schedule (OTS) Authorization	8, 31
H.1. Recording Actual Material Costs	21
H.2. Material Performance	21
H.3. Residual Material	21
H.4. Material Price/Usage Variance	21, 23
H.5. Identification of Unit Costs and Lot Costs	20
I.1. Subcontract Identification and Requirements Flow Down	All
I.2. Subcontract Integration and Analysis	1, 2, 3, 6, 8, 9, 10, 16, 21, 23, 27, 31
I.3. Subcontract Oversight	All
J.1. Identify and Analyze Risk	All
J.2. Risk Integration	3, 6, 8, 14, 22, 23, 24, 26, 27

ATTACHMENT 3: ATTRIBUTE INTEGRATION CROSS MATRIX



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