This handbook is designed to help the Control Account Manager (CAM) plan and manage assigned tasks, using earned value management. Information is provided in outline form for brevity. The CAM roles and responsibilities have been copied from associated procedures.

If you have questions, please consult the applicable Fermi procedures, the Earned Value Management System Description, or speak with a member of the Project Controls staff.

Earned Value Management System

Fermi Research Alliance

Office of Project Support Services

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DEFINE AND ORGANIZE WORK

The Project Execution Plan contains the assumptions and guidance required to complete DOE-directed work. The Project Management Plan further defines project parameters and objectives. It identifies the plans, organization, and systems to be used by those responsible for managing project work scope.

Organization is identifying the functional groups and individuals responsible for the various tasks required by the project's scope of work.

Earned Value Management System Description

2.0 Organization

….

The Project Manager has the authority and the responsibility to execute the project within the scope, budget, and schedule agreed to with the customer. The Project Manager delegates the same responsibility to the Control Account Managers (CAMs) for the control accounts assigned to them.

During the project initiation phase, prior to CD-0 on DOE projects, the team begins the development of an initial Work Breakdown Structure (WBS) and an initial approximation of the project's budget and schedule. At this stage of the project, summary level planning (i.e., design, construction, etc.) is being developed in a conceptual sense.

Project Managers need to continue to assess the organization of the project throughout the project's life cycle. This includes refining the structure of the WBS and ensuring staff are properly trained to fulfill their assigned roles and responsibilities. Planning the work scope for the project from initiation to completion is essential to control "scope creep." All stakeholders must unilaterally accept the project scope fairly early in the planning process and prior to Final Design. Once the Performance Measurement Baseline (PMB) is determined, a final Project Execution Plan is issued, outlining the scope, budget, and schedule for the project, which is then reviewed and updated at all major phases of the project. The IPT charter and membership can change as the project evolves throughout the execution phase.

All projects operating under EVMS are required to develop a WBS Dictionary. The WBS Dictionary is a set of specific definitions that describe how work is carried out to develop, design, construct, equip, and manage the project. It defines each element to at least the control account (CA) level in terms of the content of the work to be performed.

Project WBS, OBS, and RAM (EVMS Procedure 12.PM-001) describes the formal process of organizing and structuring project work scope.

2.3 ORGANIZATIONAL RESPONSIBILITY

2.3.1 Organizational Breakdown Structure

….

The individual assigned responsibility for accomplishing work at the control account level is designated as the Control Account Manager (CAM).

2.3.2 Control Accounts

A control account is a management control point at which budgets (resource plans) and actual costs are accumulated and compared to an objective measurement of work performed for management control purposes. The control account is the minimum level in the WBS structure where project cost and schedule performance is compared. A control account is a natural management point for planning and control since it represents the work assigned to one responsible organizational element for one WBS element, which is the point at which the WBS and OBS intersect. The control accounts are determined by the scope of the management tasks. A single CAM is assigned to one or more of these control accounts and is responsible for the planning and control within their control account(s) and the identification, analysis, and reporting of significant variances that may occur during project execution.

2.6 TRAINING

All personnel involved in planning or implementing the EVMS process, including existing staff and on-site contractor personnel, new hires, and transfers, are trained at the level applicable to their roles and responsibilities. At a minimum, EVMS training requires that Project Managers and Control Account Managers read the current version of this Earned Value Management System Description document and complete EVMS training when first associated with a project. These individuals may also be required to read additional EVMS reference materials or addendums as identified by specific project requirements. Refresher training for those involved in active projects will be required on an annual basis.

APPENDIX B

Control Account Manager (CAM) *– The member of the project team responsible for the performance defined in a Control Account and for managing the resources authorized to accomplish the tasks.*

Collaborator – *A university or laboratory partner who participates in a project by providing labor and/or materials through direct funding from the project, or through in-kind contributions.*

Organizational Breakdown Structure (OBS) - *A depiction of the project organization arranged to indicate the line-reporting relationships within the project context.*

Responsibility Assignment Matrix (RAM) - *A structure that relates the project organization structure to the work breakdown structure to help ensure that each element of the project's scope of work is assigned to a responsible individual.*

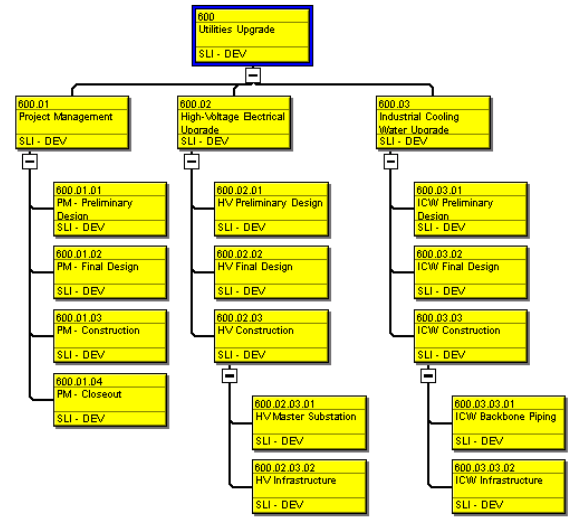
Work Breakdown Structure (WBS) - *A product-oriented grouping of project elements that organizes and defines the total scope of the project. The WBS is a multilevel framework that organizes and graphically displays elements representing work to be accomplished in logical relationships. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services. It is the structure and code that integrates and relates all project work (technical, schedule, and cost) and is used throughout the life cycle of a project to identify and track specific work scopes.*

Work Breakdown Structure Dictionary - *A listing of work breakdown structure elements with a short description of the work-scope content in each element.*

PROCEDURES: PROJECT WBS, OBS, RAM NUMBER 12.PM-001 **REVISION** 3 **EFFECTIVE: 08/18/13**

"4.5 Development Process: The Project Manager will identify the staff resources and the organizations necessary to participate in the planning and execution of the project. The Project Manager will seek agreement with the line management of these organizations as to their role and extent of involvement, based on initial project requirements. The Project Manager will then assemble the project team and develop the project's OBS and RAM. *The assignment of CAMs, as required to complete the RAM, will be with the concurrence of line management. For purposes of the project organization, all CAMs report to the Project Manager."*

Work Breakdown Structure Example



WORK PLANNING, BUDGETING, AND AUTHORIZATION; RISK MANAGEMENT

The processes of planning, scheduling, and budgeting are interrelated and interactive. To develop a time-phased budget plan, the schedule must come first. Planning and scheduling must be performed in a formal, complete, and consistent way.

SCHEDULING

The CAM will break assigned work into manageable tasks and create a logic-driven schedule of activities to complete those tasks. Schedule traceability (vertical integration) and schedule interaction (horizontal integration) is achieved through the WBS and key milestones.

Earned Value Management System Description

3.4.1. Project Schedule

The development of the Project Schedule is the responsibility of the entire project team and may involve multiple iterations in order to reach a workable plan for accomplishing the work scope. The Control Account Managers (CAMs) are responsible for the content and accuracy of their respective schedules.

….

The time phasing … involves applying schedule logic to each task which identifies the key relationships between the activities that determine their proper sequencing. Not all work can be completed simultaneously and not all work is accomplished serially. With input from control account managers and their subordinates, the proper logic ties are created.

3.4.2 Baseline Schedule

When the project schedule described in section 3.4.1 has gone through the necessary number of iterations and is deemed complete and accurate by the CAMs and the Project Manager, it is ready to be baselined.

MILESTONES

Milestones are broken down to lower levels to facilitate more frequent tracking of project progress:

Milestone Levels

L0 – DOE Acquisition Executive for Critical Decision
L1 – DOE Program Office (OHEP Federal Program Manager)
L2 – DOE Fermi Site Office (Federal Project Director)
L3 – Fermilab Directorate (Lab line manager with oversight responsibility)
L4 – Project Manager
L5 – Subproject Managers
L6 – Control Account Managers
L7 - Others

All milestones are defined in P6 under Notebook Topic "Milestone Description."

PROCEDURES: PROJECT SCHEDULING NUMBER 12.PM-004 **REVISION** 4 **EFFECTIVE: 08/18/13**

"3.2 Control Account Manager (CAM) is responsible for

• developing the required list of activities and intermediate milestones associated with each of their control accounts
• specifying the nominal duration for each activity
• specifying the detailed labor, material, and subcontract resource assignments for each activity
• specifying risks, uncertainties, and to the extent possible, mitigation strategies
• specifying the desired predecessor–successor relationships between activities and milestones
• specifying target dates or other constraints for each activity and/or milestone, if needed
• providing supplementary notes for control accounts, as needed"

COST ESTIMATES

The CAM will prepare a Basis of Estimate (BoE), including supporting documentation, to support the resources planned to complete assigned work scope.

Earned Value Management System Description

3.5.1 Cost Estimating

….

Project Managers and CAMs are responsible for identifying and documenting risk and contingency estimates as part of the baseline planning process.

PROCEDURES: COST ESTIMATING
NUMBER 12.PM-005 **REVISION** 4 **EFFECTIVE: 08/18/13**

"3.2 Control Account Manager (CAM) is responsible for
• developing cost estimates and establishing time-phased control account budgets
• managing the opening and closing of chargeable task codes as appropriate to support currently active work scope
• identifying and documenting risk and contingency estimates, though contingency ownership and management is defined by the change control process
• managing the execution of the work
• providing periodic status update information
• keeping the Project Manager apprised of any changes to the estimated cost at completion
• preparing basis of estimate documentation using direct costs"

CONTROL ACCOUNT PLANNING

Day-to-day management is accomplished at the Control Account level. Most management actions taken at higher levels are on an exception basis. The CAM is assigned the responsibility and authority for planning a Control Account and ensuring the performance of work in accordance with the plan and Work Authorization. Near-term effort is planned in detailed Work Packages (WP). Far-term effort may be identified in Planning Packages (PP), until further details are known. The budget for the PP is identified specific to work scope, is time-phased to the extent possible, and has controls which prevent its use in performance of other work. PP are converted to WP no later than six months before work is scheduled to begin, with some exceptions (i.e., procurements where terms are not known until nearer the time of the order).

Earned Value Management System Description

3.5.2 Baseline Budget

…
The project baseline budget excluding contingency is referred to as the Performance Measurement Baseline (PMB). This is graphically shown in Figure 3.1.Other terms and components of the baseline budget and TPC include:

*• **Total Project Cost (TPC)**: The total project cost consists of all costs associated with a project, including contingency. It is the sum of all capital costs and the other project costs associated with the project, including engineering studies, conceptual design, construction, startup, and costs to complete transition and facility occupancy.*
*• **Management Reserve:** The portion of the project budget allocated by the customer and under the authority of the project for management control purposes rather than being designated for the accomplishment of specific tasks. Its purpose may also be predefined by the customer. It is not part of the Performance Measurement Baseline (PMB).*
*• **Contingency:** The portion of the project budget that the customer holds in reserve to accommodate known risks as well as unknown risks that are within the scope of the project. It may also be used for additional scope and work that is necessary to meet current project mission requirements, but was inadvertently omitted but required. Contingency is not part of the PMB. (See Section 3.6 for additional information**).***
*• **Budget at Completion, (also called Contract Budget Base):** The sum of all project budgets, any summary level planning, and any undistributed budget. The Budget at Completion equals the Performance Measurement Baseline.*
*• **Performance Measurement Baseline (PMB):** The Performance Measurement Baseline is the time-phased budget plan against which project performance is measured. The performance measurement baseline is the sum of all budgets distributed to the project, summary level planning, plus undistributed budgets. The PMB does not include contingency. The PMB is altered only through the change control process.*
*• **Control Account budgets:** Distributed budgets planned in detail and allocated to specific Control Accounts. Through the life of the project, the baseline budget is eventually distributed and planned in detail within Control Accounts. The Control Account budget is the sum of the budgets for Work Packages and Planning Packages within each Control Account.*
*• **Work Package budgets:** Natural subdivision of Control Account budgets that constitute the basic building blocks in planning, controlling, and measuring project performance. Work Package budgets are directly traceable to activities and tasks planned in detail to support specific scopes of work.*
*• **Planning Package budgets:** Those portions of a project Control Account for future work that is not*

yet practicable to plan at the Work Package level. Planning Packages are time-phased in accordance with known schedule requirements for resource planning and are refined as detailed requirements become clearer and the time to begin work draws nearer.

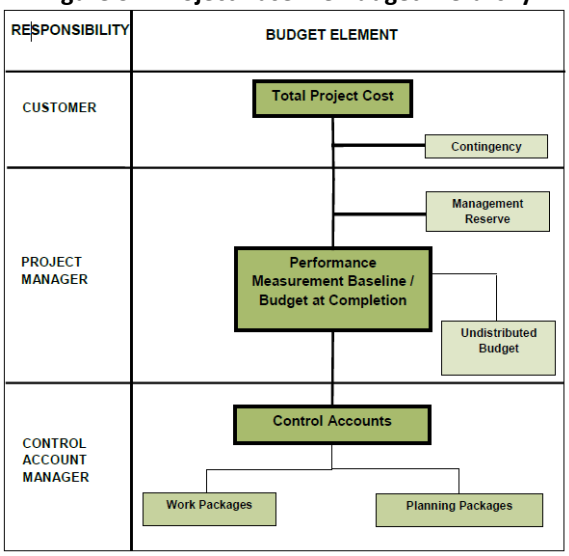
*• **Distributed budget:** Work Package and Planning Package budgets allocated as part of a project Control Account.*

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

*• **Authorized Unpriced Work -** Any change to the contract statement of work that has been authorized by the customer and is being worked on, but for which no price has yet been negotiated.*

The time-phased baseline budget plus time-phased contingency must match the customer-provided funding profile for the project. For projects that include significant third party subcontractors (i.e. A/E or General Construction Contracts), annual budget requirements are time phased so that the project can maintain adequate schedule progress.

Figure 3.1 Project Baseline Budget Hierarchy



3.5.3 Control Account Planning

Control account planning consists of those efforts needed to establish time-phased budgets for each control account identified for project execution. The CAM has the primary responsibility for developing and managing the control account budget. Project management provides CAMs with budget guidance and a common planning capability to perform resource costing, indirect rate applications, and other calculations. This is done in conjunction with the project controls staff. Control account budgets are a summation of the budgets for all of the work packages and planning packages assigned to the control account. Each work package budget in dollars is calculated by applying each resource's rate to the resource level (e.g., hours or other units of effort or dollars for materials and other direct costs), factoring in escalation to actual year dollars and then applying the appropriate indirect burdens. Project management and the CAM come to agreement on the work scope to be accomplished as well as the accompanying budget and schedule necessary to support the required effort.

Control account budgets may be further subdivided into one or more work packages and/or planning packages in the project schedule. The CAM selects the performance measurement technique (PMT) – the method for measuring the work performed for each work package. Only a single PMT may be used on each work package. Control account budgets in the EVMS are governed by the following guidelines:

• The sum of budgets for work packages and planning packages equals the control account BAC value.

• The CAM must be able to provide the basis for the budgets of all work packages.

….

APPENDIX B

*• **Control Account Plan (CAP)** – Report from cost processor showing the time phased budget for the control account by work package by month.*

PROCEDURES: CONTROL ACCOUNTS, WORK PACKAGES, PLANNING PACKAGES
NUMBER 12.PM-002 **REVISION** 4 **EFFECTIVE: 08/18/13**

"3.2 Control Account Manager (CAM) is responsible for

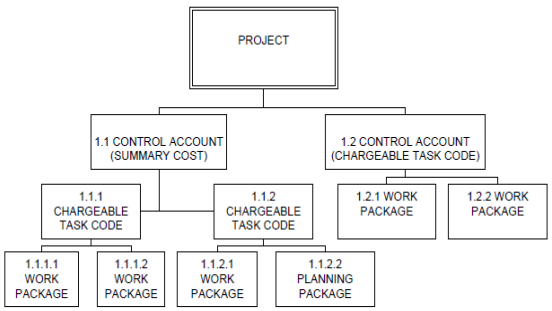
• preparing detailed scope, schedules, and cost estimates for the control account
• subdividing the work into work packages and planning packages
• planning and budgeting assigned control accounts
• analyzing and managing control account performance

• execution of the scope of all work packages within a control account
• identifying the Performance Measurement Technique (PMT) to be used to track each work package"

[See the **Work Performance and Measurement** section below for more detail on Performance Measurement Techniques]

"4.0 PROCEDURES
4.1 Control Accounts (CAs)
….
A control account uses a chargeable task code in the Fermilab financial management system to collect actual costs. Control accounts may consist of multiple lower level chargeable task codes, which roll up to the control account level. It is the project's prerogative to use multiple lower level chargeable task codes, which can help with capitalization, tracking costs, and analysis of variances. See Figure 1 below for the relationships between work packages, chargeable task codes, and control accounts."

Figure 1 Control Account Structure



WORK AUTHORIZATION

All project work is described and authorized via the work authorization process. The Work Authorization Document (WAD) assures the assigned CAM is specifically informed and authorized to perform the work scope, schedule for performance, and budget for that work. WADs are issued once the baseline has been established and updated within one month of implementation of a Change Request for each affected Control Account.

Earned Value Management System Description

3.7 WORK AUTHORIZATION

Internal Work Authorization: *The objective of the internal work authorization process is to ensure that all defined project work is authorized by the Project Manager and formally communicated to the appropriate and responsible CAM. ….*
The total authorized work scope, budget, funding, and contractual commitments are released to the CAMs through the use of Control Account Plan/Work Authorizations, a sample of which is included in Work Authorization (EVMS Procedure 12.PM-003). Formal work authorization with signed documentation begins at the same time as earned value reporting. For DOE projects, this will be sometime between CD-1 and CD-2.

The Project Manager delegates work down to the CAMs within the authority provided in Control Account Plan/Work Authorization form.

PROCEDURES: WORK AUTHORIZATION NUMBER 12.PM-003 **REVISION** 4 **EFFECTIVE: 8/18/13**

"3.2 Control Account Manager (CAM) is responsible for
• developing CA details
• signing Work Authorization document
• managing to parameters contained in the Work Authorization document
. . . .
Work Authorization Document (WAD) - A group of documentation consisting of the Work Authorization Form and supporting attachments (as outlined in Procedure 12.PM.003) that represents the agreement between the Project Manager and CAM for the work to be completed."

RISK MANAGEMENT

The CAM, in concert with the L2 manager, shall identify risks, opportunities, and mitigation plans during project planning. Throughout the project, the CAM will monitor and forecast status of assigned risks or opportunities.

Earned Value Management System Description

3.2 Risk Management

….

As the project progresses, new information and insights allow the Project Manager to refine the identified risks and mitigation strategies or remove the risk from consideration once it is no longer applicable. This is accomplished through regular (normally monthly or as specified in the project's PMP) review of project risks by Control Account Managers (CAM) as they analyze cost and schedule variances, develop corrective actions, and execute the corrective actions to completion. In addition, risks are considered during the development of Estimates to Complete (ETC) by the CAM.

PROCEDURES: RISK MANAGEMENT
NUMBER 12.PM-009 **REVISION 0 DRAFT**

"Section 1.03 Roles and Responsibilities
….
(d) Subproject Managers and Control Account Managers
The risk management responsibilities of Control Account Managers (CAMs) and respective Subproject Managers are:

- Conduct risk identification sessions associated with their subproject
- Make initial determination of risk probability and impact to the appropriate WBS level
- Document and maintain subproject risk data
- Facilitate input to the risk register from risk items within their subproject and Project risk items with owners in their subproject
- Develop and execute risk mitigation plans for risk items within their subproject and Project risk items with owners in their subproject to the appropriate WBS level
- Communicate with the PM, the Risk Manager, Project Office, Risk Management Board and Project team on their risk status, issues and actions
- Oversee ownership of risk
- Perform risk reviews within their subproject organization."

ACCOUNTING CONSIDERATIONS

Labor Costs – Time keeping for labor uses a Fermi Time and Labor (FTL) Recording system. The Financial Manager issues a weekly labor report showing the hours charged against CTCs. CAMs should review these reports, informing the Financial Manager of mischarges and the necessary corrections as soon as possible. The Financial Manager submits corrections to the appropriate administrative groups for processing within the FLT system via historical edits to timecards. Historical edits to time cards for prior fiscal years are not permitted; hence, the need for timely review and submission of corrections.

Material & Services Costs – Material is costed upon receipt of materials or invoice. The monthly Financial Report will show costs at a lower level of detail (transaction data) than the summary data imported into the cost processor database.

Open Commitments – The Open Commitments portion of the Financial Report records the unpaid value of open purchase orders issued.

All work packages are assigned to one and only one Chargeable Task Code (CTC).

Labor and burden rates are maintained within the Cobra controlled-access rate table. Rates are established by the Finance Section. All rates are reviewed annually and monitored monthly. Labor rate adjustments are normally made prospectively, not retroactively. Burden rates are adjusted retroactively to the beginning of the affected FY.

Earned Value Management System Description

4.1.2 Cost Code Structure

The cost code structure for each project is developed in conjunction with the development and integration of planning, scheduling, and assignment of work scope/task to the responsible organization. Subsequently, these planning tasks lead to the creation of control account numbers (projects and tasks) in the financial accounting system that identify the correct chargeable task code, and control account, for specific items of work.

The Project Office submits a request to Finance to open a chargeable task code in the financial accounting system for collecting actual costs. See Control Accounts, Work Packages, Planning Packages (EVMS Procedure 12.PM-002) for more details.

All direct labor, material, subcontracts, and other direct costs (ODC) are charged directly to the chargeable task codes associated with the control accounts that are assigned at the job or task level. Indirect charges also accumulate in these codes, applied as rates to the appropriate direct charges.

4.1.5 Material Cost and Accounting

Encumbrances are recognized at the point an approved order is placed. Equipment and material costs enter the general ledger through the accounts payable system. When an invoice is received the accounts payable group applies the invoice to the appropriate purchase order (PO) and the cost is recorded. If further approvals are required, or if receipt of goods has not been entered into the system, the invoice is placed on hold. Once the receiving department has recorded receipt in the procurement system, or the PO requestor acknowledges physical receipt of materials by signing the invoice or sending electronic approval, invoices are approved for payment. The hold is then released and the payment is processed by the accounts payable group. The receipt of materials in the procurement system provides the system with information needed so that monthly accruals are automatically recorded for items that have been received but not invoiced. Additionally, Fermilab accounting procedures are in place to record receipt of material not physically received at Fermilab. This allows project management to record estimated actual costs in cases where value has been earned but invoices have not yet been received.

4.1.6 Subcontract Cost

Subcontract costs are entered into Fermilab's project accounting system via the accounts payable system when an invoice is received and applied to a specific PO. The same procedures referred to in the Material Cost and Accounting section are used to record monthly accruals for uninvoiced subcontract costs.

4.1.7 Accounting Adjustments

Retroactive adjustments to a previous period's reported actual costs are prohibited. Adjustments are recorded in the current accounting period. Redistribution of indirect variances is done at year end, but the incremental change is recorded in the

current accounting period. Prior accounting periods are not restated.

….

4.2.2 Indirect Cost Pools

Some of the larger cost pools (relative to the total mix of indirect cost pools) at Fermilab are labor burdens, program support burden, materials and services burden, common site support, and the general and administrative cost (G&A). The current CAS Disclosure Statement may be obtained from the CFO.

4.2.3 Allocation of Indirect Costs to Projects

Indirect costs are allocated using individual rates that are applied to the base cost of discrete and specified resources (labor, procurements, services, etc). The basis of each cost allocation is reviewed annually by the CFO to assure that each indirect cost pool is appropriately identified with the correct set of beneficiaries. As explained in 4.2.1 and 4.2.2, the composition of each indirect cost pool and the beneficiaries associated with each indirect cost pool are fully disclosed within the CAS disclosure statement.

….

5.1.2.1 Performance Measurement Data

….

Actual Cost of Work Performed (ACWP) *is the cost for work that has been completed or partially completed (actual cost plus accruals). Actual costs are accumulated in the Fermilab Accounting System by control account, or rolled up to the control account level if collected at lower level chargeable task codes. Accruals are routinely added through Fermilab's accounting system when the control account manager and/or project management determine that some accomplished work has not been invoiced in the month earned, through consultation with affected parties and with accounts payable.*

APPENDIX B

Accrual Method - *An accounting method in which: revenue is recognized when earned rather than when collected; expenses are recognized when incurred rather than when paid. Accrual-basis accounting is essential to accurate performance and progress information on contracts.*

Direct Costs *are any cost specifically identifiable with or attributable to a particular project. Therefore, direct costs include any costs identifiable with the assigned tasks of a specific project. These costs include labor, travel, subcontract, and procurement costs or any other costs directly associated with a specific project. Fermilab includes burdened costs such as fringe and vac/opto (other paid time off) as part of direct costs.*

Indirect Costs - *Costs that cannot be attributed or assigned to a system as direct cost; may also be referred to as burden or overhead. For example: Common Site Support, Material Services Acquisition and General & Administrative (G&A) costs.*

Other Project Costs (OPC) - *Costs for engineering, design, development, startup, and operations, which are essential for project execution and are funded with operating-expense funds.*

Uncosted Labor *– Labor accounted for in work package estimates, but at a $0 rate in the budget. Such a rate may be used for scientific effort at the customer's direction.*

WORK PERFORMANCE AND MEASUREMENT

Performance measurement for the CAM consists of evaluating activity status. The value of the work completed in terms of the planned budget is determined at the close of each accounting period. It is called the Budgeted Cost of Work Performed (BCWP). Several earned value or performance measurement techniques (PMT) are available to the CAM.

PMT

Discrete Effort (Effort that produces a tangible product). As defined in the ***Earned Value Management System Description (5.1.1),*** *[t]here are a variety of PMTs available:*

• ***Milestone****: Milestones are defined, and relative weights are assigned to them based on an objective measure. At any point, the value earned is the original work package budget multiplied by the combined weight of the completed milestones and divided by the total weight of all milestones. This method can be applied to any work package and is generally the preferred method for work packages that span more than two fiscal periods.*
• ***Percent Complete****: The CAM determines percent complete, preferably based on some sort of objective measurement of work completed and remaining.*
• ***Units Complete****: This PMT is applicable to any work package that comprises a predefined number of similar tasks. The value earned at any point in time is simply the work package budget multiplied by the number of these tasks completed and divided by the total number to be done. Use of this PMT assumes that budgets are based on the units being measured.*
• ***50-50****: 50% of the value is earned as soon as the work package is started, and the rest is earned when it is completed. This PMT should be used only for work packages that span a maximum of two fiscal accounting periods since value cannot be earned in any intervening periods.*
• ***0-100****: No value is earned until the work package is completed; at which point, the entire budget is earned. This method should be used only if the work package is scheduled to start and finish in the same fiscal accounting period.*
• *User-Defined %: A variation of the 50-50 PMT. The percentage earned at the start of the work package (1 to 99%) is defined in advance by the user. The remaining percentage is earned when the work package is completed. This method should be used only for work packages whose schedule dates span a maximum of two fiscal accounting periods.*

Level of Effort - effort with no tangible product. Budgeted and earned by passage of time. BCWP is always equal to BCWS.

The CAM designates the PMT most appropriate to the way in which BCWS is planned. The earning method is determined at the time the work package is prepared. PMTs on already opened work packages cannot be changed. For unopened work packages, PMTs can be changed only through the change control process.

Earned Value Management System Description

5.1 PERFORMANCE MEASUREMENT
Work packages are established during planning and opened when the Budgeted Cost of Work Scheduled (BCWS), is expected to occur. Each work package uses one Performance Measurement Technique (PMT) to track work progress. The PMT is specified by the CAM and adheres to the following:
• ***Stability****: One PMT is chosen for each work package. The selected technique and milestone(s) should not be changed after the work package is opened.*
• ***Objectivity****: Completion of an event (for discrete work) is based upon predetermined criteria or tangible product.*
• ***Ability to audit****: The procedure and criteria for evaluation will facilitate audit of the Earned Value (EV), or Budgeted Cost of Work Performed (BCWP) reported.*

5.1.1 Performance Measurement Techniques (PMT)
The Control Account Managers specify the performance measurement technique for each of the work packages they manage. PMTs should be consistently applied to similar work packages across a project. PMTs should be applied such that objective measurements can be made at appropriate intervals to demonstrate progress on the activities to which they have been assigned.
….

STATUS/PROGRESS

The CAM will update the schedule with status on a monthly basis.

Earned Value Management System Description

3.4.3 Working Schedule

Once the baseline schedule has been established..., it will be necessary to update actual progress on a per-period and cumulative basis and compare it to the baseline plan. For FRA, the update period is monthly, with the cutoff date being the last day of each month. The process of statusing the schedule will involve:

a) Project controls personnel issuing "turnaround" reports to the CAMS near the end of each reporting period.

b) CAMS returning progress information in the form of actual dates and/or new schedule forecast information for each activity in the report. The reports typically address all activities within a time window that looks ahead six-months beyond the current reporting period.

c) CAMS providing data for each in-progress activity that allows updating its physical percent complete.

d) Project controls personnel vetting the information supplied by the CAMS and then incorporating it into the working schedule to obtain an updated forecast schedule. It is important to note that progress information is not used to modify dates in the baseline schedule except through the baseline change control process.

….

5.1.2.2 Evaluation of Planned Value

The time-phased budget (BCWS) represents the plan against which performance is measured. At the control account level, the baseline is the result of assigning the necessary resources to the scheduled tasks (work packages) as part of the process of detail planning for the control account. The process includes identifying the tasks, scheduling the tasks, identifying the resources, and determining the PMT. Work to be accomplished in a control account must be performed in a logical, consistent manner to help provide consistency in determining the baseline and accomplishing the work. To avoid unrealistic variances, the BCWS is established according to the control account manager's decision on how the work is to be accomplished, and the PMT is selected to ensure that BCWS is achieved in the same manner as the BCWS was planned.

5.1.2.3 Current Schedule Statusing

…

The current schedule represents the remaining work and will be archived periodically.

• ...

• Every month, each control account manager will determine the status of each open or scheduled activity in the current schedule for which they are responsible and the schedule will be updated accordingly. Various methods are used to assess the status for different kinds of activities to ensure that progress is being determined objectively.

• ...

• Subcontracts not subject to earned value provisions have requirements for subcontractors to develop a schedule that supports the details in the project schedule. The control account managers are responsible for ensuring that the methods used to status these schedules result in an objective measurement of progress.

PROCEDURES: PROJECT SCHEDULING NUMBER 12.PM-004 **REVISION** 4 **EFFECTIVE: 08/18/13**

"4.3 Schedule Maintenance

At regular intervals, but not less than monthly, the CAMs review planned and completed activities to determine progress, described in Monthly Status Reporting, EVMS Procedure 12.PM-006. As required by project management, Project Controls may provide on a regular basis critical path analyses, resource usage reports, forecast schedules, and other analysis reports."

ANALYZE AND REPORT

Schedule status is updated monthly, progress is summarized, and actual costs are imported into the cost processor database. Information is provided in the project manager's monthly reports, which also include forecast completion dates and forecast cost at completion. If performance measurement results in schedule or cost variances in excess of established thresholds, analyses must be made to determine their cause and the appropriate corrective action. The CAM is mainly concerned with variances that exceed thresholds established for the project. Analyses of these variances provide opportunities to identify problems to management and obtain whatever guidance and/or resources necessary for their resolution.

Elements required to measure progress are:

- Schedule Status
- Budgeted Cost of Work Scheduled (BCWS)
- Budgeted Cost of Work Performed (BCWP)
- Actual Cost of Work Performed (ACWP)

The ACWP and BCWP monthly data is entered into the database at the end of each month. BCWS is already in the database, as taken from the approved baseline. The following are also determined in performance reports:

Schedule Variance	= BCWP-BCWS
Cost Variance	= BCWP-ACWP
Variance at Completion	= BAC- EAC

Earned Value Management System Description

5.2.2 Variance Analysis

Variance analyses allow control account managers to identify and communicate cost, schedule, and EAC divergences from the performance measurement baseline.

5.2.3 Performance Indices

The control account managers will apply various metrics to assess the performance of their assigned control accounts. These performance metrics will provide additional insight and a basis for the CV and SV analysis. All metrics will be updated at least monthly. The metrics employed should be for both current and cumulative performance. Time-phased metrics include a Cost Performance Index (CPI=BCWP/ACWP) and a Schedule Performance Index (SPI=BCWP/BCWS). The control account manager will assess the cumulative metrics to look for control account performance trends.

5.2.5 Control Account Performance Analysis

The control account managers prepare variance analysis statements or explanations for each control account exceeding established variance thresholds. The control account managers are responsible for determining the cause of the variance and its impact on the control account and the related activities and milestones, developing a corrective action plan (as appropriate), and including this information in the appropriate sections of the monthly report.

Control account managers periodically (at least annually) develop a comprehensive ETC at the control account level using all available information to arrive at the best possible estimate.

5.2.6 Project Performance Analysis

Project performance analysis is an ongoing process that includes routine and ad hoc analyses of problem causes, corrective actions, risk analysis, and cost savings opportunities. The process is formalized via the monthly report, which includes a review of cost and schedule performance information, identification of significant problem areas, and the status of corrective actions.

Control Account Managers periodically develop a comprehensive EAC at the Control Account level using all available information to arrive at the best possible estimate.

…

An EAC based on predictive performance measures increases the probability that the project is executed within the overall budget objectives. Monthly EAC reviews are essential for management decisions including the planning of project future funding requirements. On a monthly basis, CAMs review the status of expended effort and the achievability of the remaining forecasted work using all available information to arrive at the best possible EAC.

Comparisons of the EAC to the BAC must be made frequently enough for management to ensure project performance and resource availability is not adversely impacted. Routine EAC analysis and review at the Control Account level by the CAM ensures that the EAC continuously reflects a valid projection of project costs.

5.3.1 EVMS Reporting

Project management will provide regular reports to the customer and senior management on project status. The level, frequency, and distribution of reporting will be defined in the Project Execution Plan (PEP). EVMS reporting shall begin at a time determined by Fermi Management in order to demonstrate the EVMS system is in place, effective, and tracking project progress. For DOE 413.3B projects, EVMS reporting into PARS II is required when baselined at Critical Decision-2 approval. The report is generated from schedule status Information, cost status from the financial system, and internal monthly narrative progress reports prepared by the CAMs. The focus of this report is exception reporting. Significant problems or issues are highlighted, along with corrective actions taken or needing to be taken.

PROCEDURES: MONTHLY STATUS REPORTING NUMBER 12.PM-006 **REVISION** 5 **EFFECTIVE**: 8/18/13

"3.4 Control Account Manager is responsible for

• Providing progress information to PC staff for input to the RLS for the monthly report
• Working with Project Financial Analyst to prepare and submit monthly accruals to accounting
• Providing narrative input for monthly status report
• Analyzing cost and schedule variances
• Preparing variance reports and required corrective action plans
• Monitoring and reporting corrective action on a monthly basis
• Evaluate and update ETC when required"

ANALYSIS CONSIDERATIONS

Favorable and unfavorable variance must be evaluated. The reasons for underruns as well as overruns need to be examined, because they could be masking a serious problem.

Preparation

- The computer-generated performance reports provide current period, cumulative, and at-completion statistical data. Control accounts that have schedule variances or cost variances that exceed the established thresholds are reviewed and a Variance Analysis Report (VAR) prepared by the CAM.

Thresholds – The following are minimum thresholds assigned for all variances. The customer, FRA management, or the project may determine that the thresholds need to be modified to more effectively manage the project. This may be done via a formal change to the PEP or PMP.

Variance Analysis Thresholds for Control Accounts		
Green Thresholds – Cost and Schedule Performance falling outside of yellow or red thresholds		
Yellow Thresholds		
Cost Variance Schedule Variance	Type	Threshold limit
Dollars	Current Period	≥ ± 5% to < ± 10% and ≥ $50K
	Cumulative	≥ ± 5% to < ± 10% and ≥ $100K
Hours	Current Period	≥ ± 5% to < ± 10% and ≥ 350 hrs
	Cumulative	≥ ± 5% to < ± 10% and ≥ 700 hrs
Red Thresholds		
Cost Variance Schedule Variance	Type	Threshold limit
Dollars	Current Period	≥ ± 10% and ≥ $100K
	Cumulative	≥ ± 10% and ≥ $200K
Hours	Current Period	≥ ± 10% and ≥ 700 hrs
	Cumulative	≥ ± 10% and ≥ 1400 hrs

Note: This applies to SV% (Schedule Variance in %) or CV% (Cost Variance in %) and the SV or CV in $ or hours.

Green variances are small and may not warrant any actions.

Yellow variances are considered a warning that in future reporting periods the variance could trend into the red threshold range. These variances shall be analyzed to determine if corrective actions are required.

Red variances are considered significant and require Variance Analysis Reports to be generated.

Variance analysis identifies

- Problem
- Cause
- Impact
- Corrective action, including "get well" date

Areas to address

- Poor initial planning or estimating
- Technical breakthroughs or problems
- Cost of labor, material, or ODCs higher or lower than planned
- Inflation and new labor contracts
- Front-end loading
- Potential impact to milestones

REPORTING

There are two basic report categories: customer and in-house. Customer performance reports are established with fixed content and timing. Each month, the project exports data from the cost processor to the DOE PARS II reporting system, to

include an electronic copy of the schedule. In-house reports support internal management needs and include briefings provided by the Project Manager at the monthly PMG and POG.

FUNDS MANAGEMENT

There is a distinction between budget and funds. **Budget** represents the overall target for cost performance associated with the scope of work. **Funds** represent the actual dollars currently available (appropriated by DOE) for accomplishing the work.
Budget Authority (BA) – {Describe}
Budget Obligation (BO) – {Describe}

The CAM supports the Project Manager in ensuring that the obligations in any fiscal year are within the funding provided by DOE.

CHANGES/REVISIONS

Revisions may be made to the performance measurement baseline via a controlled approval process.

Internal replanning is undertaken within the scope, schedule, and Total Project Cost of the project. Four of the most common "replanning rules" are as follows:

1. Retroactive changes to BCWS, BCWP, or ACWP are strictly prohibited, except to correct errors.
2. Closed work packages will not be reopened.
3. Work scope will not be transferred from one Control Account to another without the associated budget.
4. Remaining work shall be replanned at least one accounting period prior to the start of that work, except for….
5. Minor modifications are discouraged and should not be implemented.

Work packages that are opened (in process or overdue for start) will not be replanned, except with customer concurrence or direction.

Earned Value Management System Description APPENDIX B

Change Request *– The documentation that describes a change in scope, cost, or schedule, initiating as a request to the Project Manager, and ultimately resulting in approval or disapproval, with associated appropriate implementation into the PMB.*

Contingency - *The budget identified by the customer and the project, for managing known and unknown risks. The release of this budget is controlled by the customer and managed through the change control process by approval thresholds defined in the PEP and PMP. Contingency is not part of the Performance Measurement Baseline.*

Directed Change - *A change imposed on a project(s) that affects the project's baseline. Example of directed changes include, but are not limited to, (1) changes to approved budgets or funding and (2) changes resulting from DOE policy directives and regulatory or statutory requirements.*

Management Reserve – *The portion of the project budget allocated by the customer and under the authority of the project for management control purposes rather than being designated for the accomplishment of specific tasks. The customer will determine whether it will be used on each project and, if so, its purpose may also be pre-defined by the customer. It is not part of the Performance Measurement Baseline (PMB). The release of this budget is managed as part of the total contingency through the change control process and determined by approval thresholds defined in the PEP and PMP.*

PROCEDURES: CHANGE CONTROL NUMBER 12.PM-007 **REVISION** 4 **EFFECTIVE: 08/18/13**

"3.3 Control Account Manager (CAM) is responsible for
• Identifying potential changes
• Preparing Change Requests in conjunction with Project Controls
• Reviewing, approving, and disapproving applicable CRs
• Submitting Change Requests to Project Manager"

"4.1 Internal Replanning and Changes
Fermilab may prepare and implement internal change requests for review and approval within the limits of the PEP-approved thresholds, as necessary to accommodate budget, schedule, or technical scope changes. The objective of internal replanning is to reflect a more accurate and realistic project plan. These replanning actions may be appropriate to adjust future work due to budget, schedule, and technical problems that:
• have caused the original plan to become unrealistic.
• require a reorganization of work or personnel in order to increase the efficiency for accomplishing the effort.
• require different engineering or construction approaches

Internal replanning is intended for in-scope changes and replanning of future work. Internal replanning to accommodate adjustments to future work (e.g., project scope evolves, technical approaches change, or resource availability changes) is a normal project management process. The effect is most easily seen in changes to the schedule and budget distribution.

All budget changes to the baseline as a result of internal changes are documented in a change request and follow change control processes as defined in this procedure. Internal changes may be within a single control account or require transfers between control accounts. Typical internal changes include:

• Scope and budget transfers between control accounts
• Changes in make vs. buy decisions requiring replanning
• Changes to the work approach that change the control account scope or the Budget at completion (BAC)
• Contingency and management reserve transfers
• Future rate changes (including Fermilab indirect rate changes) significant (as defined in the PMP) enough to warrant replanning
• Funding revisions that affect resource availability
• Adjusting subcontract budget values to reflect negotiated values
• Adjusting material budgets to reflect modifications to material lists after design phases
• Converting planning packages to work packages
• Changes to Project Organization and/or personnel including Project Management and CAMs.

The following restrictions apply to any type of internal replanning:

• Internal replanning efforts are allowed on open work packages as long as the past portion of the work already completed is not affected, but will require documented Customer approval prior to change. Changes to open WPs will be limited to Customer directed changes or formal reprogramming. Retroactive changes to the previously reported BCWS, BCWP, and ACWP are prohibited, except for the correction of errors. Accounting adjustments must be made in the current period, in accordance with financial accounting procedures.
• Only the future portion, i.e. portion of work to be performed beyond the current performance period, of open work packages may be changed. The start date for any work package, opened or unopened, can only be changed on future work that has not yet started as of the current performance period.
• Minor modifications to work packages are discouraged and, in most cases, should not be implemented. For example, vendor actual costs that are slightly higher than estimated in the PMB should not be adjusted by change control at the work package level, since slightly lower costs in another work package could balance costs within a control account, thus not requiring any management action.
• The time phasing of the BCWS may be changed in open work packages, as long as the following two conditions apply: (1) the changes only affect future budgets/efforts; and (2) the work packages continue to support key milestones in the schedules after the changes are implemented.
• A budget transfer from one control account to another is prohibited unless the accompanying work is also transferred. This transfer is accomplished by returning the budget to management reserve, and then releasing the management reserve to the control account where the work will be performed.
• An internal change must be approved before a budget revision can be formally incorporated into the performance measurement baseline and its associated work executed. Changes shall not be implemented until the approval process described in the PEP has been completed. Approvals may be obtained by signature or electronic means.
• Internal changes and plans are reviewed to ensure that replanning does not result in the application of budget intended for future work to a near-term effort."

AUDIT/REVIEW

The CAM is the most significant contributor to the successful operation of the FRA Earned Value Management System (EVMS), and to successful completion of internal or external audits or reviews. Day-to-day management takes place at the Control Account level. If each Control Account is not managed competently, project performance will suffer regardless of the sophistication of higher level management systems. The CAM must be expert in all areas of Control Account performance. It is not enough to be technically competent. The CAM must be familiar with all aspects of the EVMS. Internal reviews are made periodically to provide assurance that the CAMs are properly trained in the operations and use of the management system.

The consequences of non-compliance to established FNAL EVMS process or procedures would result in a loss of certification. The loss of FNAL certification will have serious impacts to FNAL's ability to perform projects by limiting the financial support or funding provided by DOE. Compliance to EVM ANSI 748-b standards is a funding requirement imposed by DOE Order 413-b. Another serious consequence of FNAL loosing EVMS certification is the impact this loss would have on the High Energy Physics (HEP) community. Presently HEP is exempt from some of the stipulations in DOE 413-b. These exceptions would be revoked by a HEP project laboratory showing enough gross negligence or disregard to ANSI 748-b standards as to loose certification. The impact to the HEP community would potentially limit the community from performing many planned or future projects. The loss of this exemption could also be realized as projects show poor compliance to the established EVMS, even if the certification is not revoked.

ABBREVIATIONS/TERMINOLOGY

ACWP — Actual Cost of Work Performed
AE — Acquisition Executive
A/E – Architect/Engineer
ANSI — American National Standards Institute
BAC — Budget at Completion
BCWP — Budgeted Cost of Work Performed
BCWS — Budgeted Cost of Work Scheduled
CA – Control Account
CAM — Control Account Manager
CASB – Cost Accounting Standards Board Disclosure Statement
CBB — Contract Budget Baseline
CD — Critical Decision
CDR — Conceptual Design Report
CFO — Chief Financial Officer
CO — Contracting Officer
CPR — Cost Performance Report
CV – Cost Variance
D&D – Demolition and Decommissioning
DOE — U.S. Department of Energy
EAC — Estimate at Completion
EIA – Electronic Industries Alliance
ES&H – Environment, Safety and Health
ETC — Estimate to Complete
EVMS — Earned Value Management System
FFP – Firm Fixed Price
FRA – Fermi Research Alliance
FY — Fiscal Year
G&A – General and Administration
GAAP – General Accepted Accounting Principles
IPT — Integrated Project Team
LOE — Level of Effort
MOU – Memorandum of Understanding
NEPA — National Environmental Policy Act
OBS — Organizational Breakdown Structure
ODC – Other Direct Costs
OECM — Office of Engineering and Construction Management
OPC — Other Project Costs
OPSS – Office of Project Support Services
PA – Oracle eBS Project Accounting
PB — Performance Baseline
PED — Project Engineering and Design
PEP — Project Execution Plan
PMB — Performance Measurement Baseline
PMT — Performance Measurement Technique
PMP – Project Management Plan
RAM — Responsibility Assignment Matrix
RFP — Request for Proposal
SOW — Scope of Work
SPA – Short version for BCW**S**, BCW**P**, **A**CWP
SV — Schedule Variance
TEC — Total Estimated Cost
TPC — Total Project Cost
UB — Undistributed Budget
UChicago – University of Chicago
URA – Universities Research Association
VAR — Variance Analysis Report
WBS — Work Breakdown Structure

SUMMARY OF RESPONCIBILITIES

<u>Control Account Manager (CAM) responsibility:</u>

- The performance defined in a Control Account and for the managing the resources authorized to accomplish the task.
- The content and accuracy of their respective schedules.
- Developing the required list of activities and intermediate milestones associated with each of their control accounts.
- Specifying the nominal duration for each activity.
- Specifying the risks, uncertainties, and to the extent possible, mitigation strategies.
- Specifying the desired predecessor-successor relationships between activities and milestones.
- Specifying target dates or other constraints for each activity and/or milestone, if needed.
- Providing supplementary notes for control accounts, as needed."
- Identifying and documenting risk and contingency estimates as part of the baseline planning process.
- Developing cost estimates and establishing time-phased control account budgets.
- Managing the opening and closing of chargeable task codes as appropriate to support currently active work scope.
- Identifying and documenting risk and contingency estimates, though contingency ownership and

management is defined by the change control process.

- Managing the execution of the work.
- Providing periodic status update information.
- Keeping the Project Manager apprised of any changes to the estimated cost at completion.
- Preparing basis of estimate documentation using direct cost.
- Planning a Control Account and ensuring the performance of work in accordance with the plan and Work Authorization.
- Developing and managing the control account budget
- Preparing detailed scope, schedules, and cost estimates for the control account.
- Subdividing the work into work packages and planning packages.
- Planning and budgeting assigned control accounts.
- Analyzing and managing control account performance.
- Execution of the scope of all work packages within a control account.
- Identifying the Performance Measurement Technique to be used to track each work package.
- Developing CA details
- Signing Work Authorization document
- Managing to parameters contained in the Work Authorization document.
- Conduct risk identification sessions associated with their subproject.
- Make initial determination of risk probability and impact to the appropriate WBS level.
- Document and maintain subproject risk data.
- Facilitate input to the risk register from risk items within their subproject and Project risk items with owners in their subproject.
- Develop and execute risk mitigation plans for risk items within their subproject and Project risk items with owners in their subproject to the appropriate WBS level.
- Communicate with the PM, the Risk Manager, Project office, Risk Management Board and Project team on their risk status, issues and actions.
- Oversee ownership of risk.
- Perform risk reviews within their subproject organization.
- Ensuring that the methods used to status these schedules result in an objective measurement of progress.
- Determining the cause of the variance and its impact on the control account and the related activities and milestones, developing a corrective action plan.
- Providing progress information to PC staff for input to the RLS for the monthly report.
- Working with Project Financial Analyst to prepare and submit monthly accruals to accounting.
- Providing narrative input for monthly status report.
- Analyzing cost and schedule variances.
- Preparing variance reports and required corrective action plans.
- Monitoring and reporting corrective action on a monthly basis.
- Evaluate and update ETC when required.
- Identifying potential changes.
- Preparing Change Request in conjunction with Project Controls.
- Reviewing, approving, and disapproving applicable CRs.
- Submitting Change Requests to Project Manager.

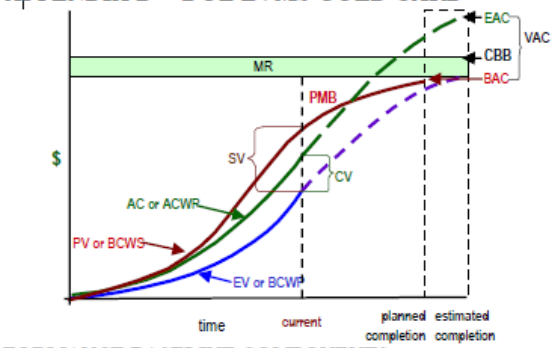
<u>Project Manager Responsibilities:</u>

- Continue to assess the organization of the project throughout the projects life cycle to prevent scope creep.

- Ensuring that staff is properly trained to fulfill their assigned roles and responsibilities.
- To execute the project within the scope, budget, and schedule agreed to with the customer.
- Identifying and documenting risk and contingency estimates as part of the baseline planning process.
- Schedule status is updated monthly, progress is summarized, and the actual costs are imported into the cost processor database which is provided in the project manager's monthly report.
- Development of the Project Schedule and WBS is the responsibility of the entire project team as outlined by specific rolls. The PM, as the lead of the team, is ultimately responsible for the completeness, accuracy, and coordination of all project scope and schedule.

DOE EVMS GOLD CARD

APPENDIX B —DOE EVMS GOLD CARD



PERFORMANCE BASELINE COMPONENTS

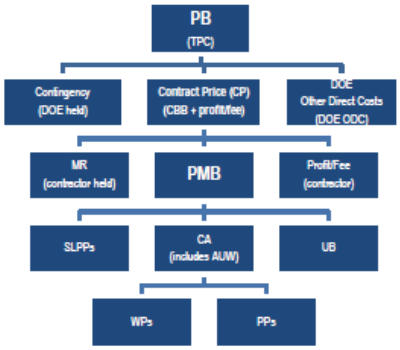
(Performance Baseline must clearly doCument scope/KPPs, TPC and CD-4 date)

AUW	=	Authorized Unpriced Work (contractually approved, but not yet negotiated
CA	=	Control Account (includes AUW) = WPs + PPs
CBB	=	Contract Budget Base = PMB + MR
CP	=	Contract Price = CBB + profit/fee
MR	=	Management Reserve is held by contractor (Contingency is held by DOE)
PB	=	Performance Baseline (TPC) = CP + Contingency + DOE ODC
PMB	=	Performance Measurement Baseline = CAs + UB + SLPPs
PP	=	Planning Package (far-term activities within a CA)
SLPP	=	Summary Level Planning Package
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 of Work Performed
PV	=	Planned Value	=	BCWS	=	Budgeted Cost of Work Scheduled
BAC	=	Budget at Completion	=	Σ BCWS	=	Sum of Budgeted Cost of Work Sched

*For analysis purposes, AC, EV and PV calculations may be based on various time peric e.g., monthly, cumulative, last 3 months from CD-2 or BCP or internal replan.



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*

CPI	=	EV / AC	=	BCWP / ACWP	= Cost Performance Index
SPI	=	EV / PV	=	BCWP / BCWS	= Schedule Performance Index
$TCPI_{BAC}$	=	WR / (BAC - $ACWP_{cum}$)	=	BAC-based To Complete Performance Index	
$TCPI_{EAC}$	=	WR / (EAC - $ACWP_{cum}$)	=	EAC-based To Complete Performance Index	

COMPLETION ESTIMATES

EAC	=	BAC / CPI_{cum}	=	Estimate at Completion (general)
EAC_{CPI}	=	AC_{cum} + WR / CPI_{cum}	=	Estimate at Completion (CPI)
$EAC_{composite}$	=	AC_{cum} + WR / (CPI_{cum} · SPI_{cum})	=	Estimate at Completion (composite)
ETC	=	EAC - AC_{cum}	=	Estimated to Complete

Cost Performance Index (CPI) is the dollar value of work accomplished for each dollar spent.

Schedule Performance Index (SPI) is the dollar value of work accomplished for each dollar of work planned.

To Complete Performance Inces (TCPI) is the cost efficiency that much be achieved in the remaining period of performance to complete the total work scope within the BAC / EAC target.