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Earned Value Management System Description for the NOνA Project V 0.0

NOνA-doc-1945

Fermilab

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NOvA EARNED VALUE MANAGEMENT SYSTEM DESCRIPTION
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ACRONYM LIST

ACWP	Actual Cost of Work Performed (Actual Cost)
BA	Budget Authority
BAC	Budget at Completion
BCWP	Budgeted Cost of Work Performed (Earned Value)
BCWS	Budgeted Cost of Work Scheduled (Planned Value)
CCB	Change Control Board
CD-1	DOE Critical Decision 1: Approve Alternative Selection and Cost Range
CD-2	DOE Critical Decision 2: Approve Performance Baselines
CPR	Cost Performance Report
DOE	U.S. Department of Energy
DOE-FSO	Department of Energy Fermilab Site Office
EAC	Estimate at Completion
ETC	Estimate to Complete
EV	Earned Value
EVM	Earned Value Management
EVMS	Earned Value Management System
FERMILAB	Fermi National Accelerator Laboratory
HQ	DOE Headquarters
FWP	Field Work Proposal
LOE	Level of Effort
MIE	Major Item of Equipment
M&S	Materials & Services
PCR	Project Change Request
PPEP	Preliminary Project Execution Plan
PMB	Performance Measurement Baseline
PPMP	Preliminary Project Management Plan
QA	Quality Assurance
QAP	Quality Assurance/Procurement
QC	Quality Control
RFP	Request for Proposal
RFQ	Request for Quote
TB	Technical Board
TEC	Total Estimated Cost
WBS	Work Breakdown Structure

1. INTRODUCTION

1.1 PURPOSE

Fermilab is a DOE laboratory; therefore Fermilab projects with a TPC of greater than $20 million (major projects) are required to use an Earned Value Management System that complies with the industry standard for project controls systems described in the American National Standards Institute (ANSI) EIA-748, Earned Value Management Systems. Fermilab's Draft *Earned Value Management System Description* (NOvA-doc-1084) documents the Lab's project management processes essential to effective planning, organization, control and surveillance of major projects at Fermilab. NOvA's Earned Value Management System Description documents the specifics of NOvA's implementation of Fermilab's EVMS and is meant to be a supplement to the Fermilab EVMS document. It is the policy of the NOvA Project Manager that all NOvA project personnel comply with the requirements of the systems described within this document and use them in planning, managing, executing, monitoring, and reporting work.

1.2 OBJECTIVES OF THE NONA EARNED VALUE MANAGEMENT SYSTEM

The NOvA Earned Value Management System is an integrated management control system for project planning, management, execution, cost/schedule performance measurement, analysis, and reporting. Objectives of the NOvA project management system are to:

- Plan all work scope for the project.
- Break down the work scope into finite pieces that can each be assigned to a responsible person to accomplish its technical, cost, and schedule objectives.
- Integrate work scope, schedule, and cost objectives into a performance measurement baseline plan, against which accomplishments will be measured.
- Establish, maintain, and control the baselines, databases, information, and processes necessary to manage the NOvA project successfully.
- Provide mechanisms to objectively measure, monitor, and report the status of the project, comparing the amount and actual costs of work accomplished to the baseline plan.
- Reliably detect and analyze significant variances from the plan, forecast impacts, and prepare an estimate at completion based on performance to date and work remaining.
- Ensure project risks are identified and managed appropriately.
- Establish a framework where quality is both expected and achieved.
- Meet management needs and satisfy the requirements and criteria of DOE 413.3 for an Earned Value Management System (EVMS).

The NOvA project satisfies these objectives by implementing and using an earned value management system that establishes clear performance baselines and provides:

- Managers, workers, and vendors appropriately skilled for their responsibilities.

- Accountability for performance/accomplishments.
- An Earned Value Management System (EVMS) based on measurable work.
- Variance analysis on major items (i.e., critical path or large dollar impacts).
- A formal Change Control Process.
- Risk identification, mitigation, and quality assurance integrated into project execution to ensure the technical, cost, and schedule baselines are achieved.
- Systematic and controlled documentation.

Given the nature of the NOνA project, its management team has elected to utilize key management systems that are already in place at Fermilab. The EVMS for the NOνA Project obtains actual cost data electronically from the Fermilab accounting system and uses a combination of Deltek Open Plan™ for scheduling and Deltek Cobra™ for cost estimating, earned-value planning, earned-value measurement, and variance reporting. For document control, the NOνA project will use an existing document control system called the NOνA document database or NOνA docDB.

1.3 EARNED VALUE MANAGEMENT SYSTEM IMPLEMENTATION

Key factors for implementing NOνA's management systems are described in later sections. They include:

- Overviewing NOνA's earned value management process.
- Establishing project baselines, based on a complete Work Breakdown Structure and systematic planning, estimating, and scheduling of the work.
- Objectively assessing project performance (measuring earned value).
- Calculating, analyzing, and reporting significant variances from the baseline plan, forecasting the impacts, planning and executing corrective action, and revising the estimate at completion.
- Communicating and reporting to and among project participants and with management and sponsors.
- Assuring quality and reflecting quality assurance requirements in plans and implementation.
- Identifying, managing, and mitigating project risk.
- Authorizing work systematically.
- Controlling baseline changes.

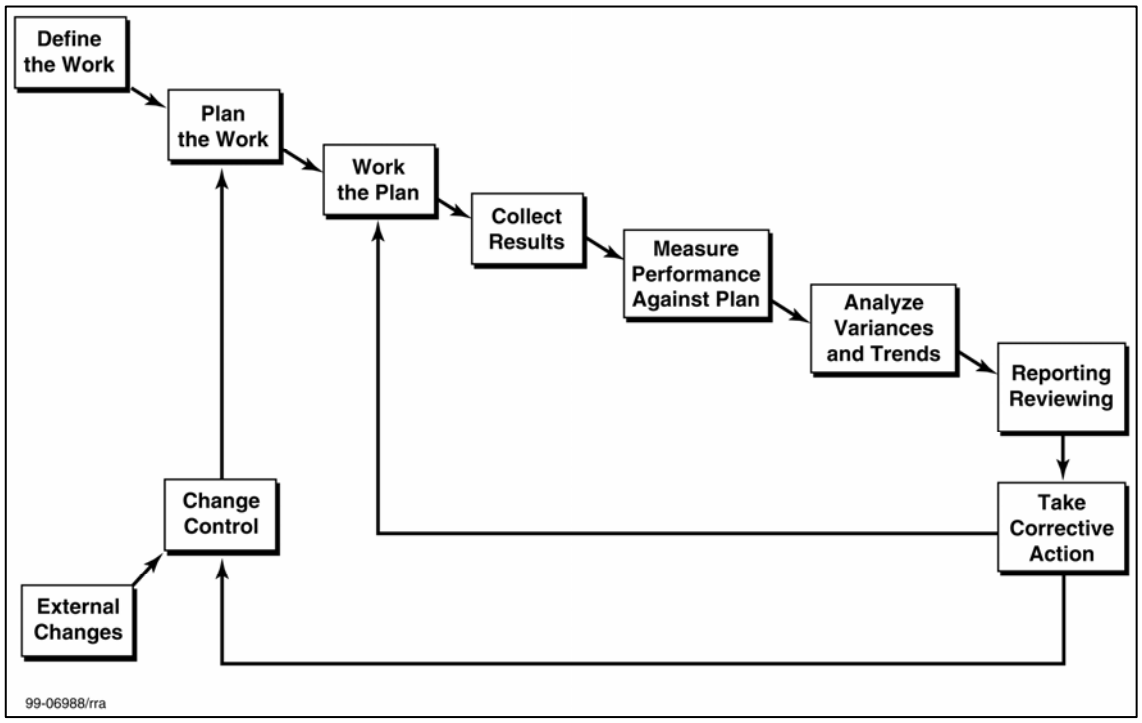
1.4 PROJECT ORGANIZATION

Fermilab's organization for the NOνA Project is shown in NOνA's *Preliminary Project Management Plan* (PPMP, NOνA-doc-129) figure 3.1. The purpose of the project, along with roles and responsibilities of key personnel, are described in the DOE *Preliminary Project Execution Plan* (PPEP, NOνA-doc-130). The NOνA project organization, as expressed in its Organization Breakdown Structure (OBS), is closely aligned with its Work Breakdown Structure (WBS). Some key responsibilities associated with particular earned value management functions are described in later sections of this document.

2. THE EARNED VALUE MANAGEMENT PROCESS

The Earned Value Management System's purpose is to provide closed-loop processes to manage and control project execution effectively. Very simply, the system is intended to ensure that all technical scope within the baseline is clearly defined and planned; work is performed; progress is measured, compared with the baseline plan, reviewed, and reported; variances from the plan are analyzed in a timely manner and alternative courses of action are developed and evaluated; the best course of action is selected; and, if appropriate, the baseline plan is modified accordingly. In addition, NOvA project management needs to be alert to developments and lessons learned from other projects at Fermilab and elsewhere, and also to share its lessons learned within Fermilab and beyond. Figure 2.1 provides a simple sketch of the management processes the NOvA's Earned Value Management System must provide. An overarching requirement is that the system must produce accurate, timely, and consistent data and information that enable performance and trends to be analyzed and effective management decisions to be made in a timely manner.

Fig. 2.1 NOvA Earned Value Management System



3. ESTABLISHING PROJECT BASELINES

To plan the work and establish performance baselines, the NOvA Project uses a scheduling system, which is also used for cost estimation; and a system that receives information from the lab financials database ("actuals"), correlates it with the schedule and cost estimate information and calculates Earned Value and other important project metrics. Both systems are based on a work breakdown structure (WBS) that divides the NOvA project in a hierarchical manner into sub-elements, ensuring that the scope of each item within the project is clearly defined and identified with a unique WBS number. The NOvA project uses Deltek Open Plan™ for scheduling and cost estimating and Deltek

Cobra™ for earned-value planning, earned-value measurement, and earned-value reporting, because these software packages were proven and functioning at Fermilab for these purposes.

3.1 WORK BREAKDOWN STRUCTURE

A Work Breakdown Structure (WBS) has been established for the NOvA Project. This WBS identifies all elements of work on the project within a logical framework that facilitates planning, budgeting, scheduling, assignment of responsibilities, cost tracking, performance measurement, and reporting of status. Modifications will be controlled through the change control process, described in NOvA's *Configuration Management Plan* (CMP, NOvA-doc-131).

3.2 THE BASE COST ESTIMATE

The base cost estimate is made of the estimates for each lowest level WBS element. It consists of an estimate of the cost of items/services to be purchased plus an estimate of the labor effort (time and type) for work planned to be done by Fermilab and personnel at universities and other national laboratories participating in the NOvA Project. The base estimate does not include contingency. The base estimate is prepared by the appropriate Level 2 manager, who employs the best available approach(es) to develop the estimate. The Level 2 manager might contact potential vendors for budgetary estimates, review catalogs, refer to recent Fermilab purchases or completed tasks with closely similar scope, use engineering estimates, or contact others with the requisite cost expertise. Each Level 2 manager maintains Basis of Estimates to document the input and sources for the base cost estimate for each significant entry-level WBS element. The Project Manager is able to review the costs at any level of detail by examining the roll ups of tasks within a given class. The base cost estimate was obtained in FY2007 dollars as direct costs/effort, without escalating to the year the element will be accomplished. Labor rates used in the estimate were obtained from Fermilab's divisions/sections and from NOvA's collaborating universities and national laboratories and include all institutional and Fermilab overheads. Escalation is done external to Open Plan™, within the Cobra™ program that is used to compute earned value. All project cost tracking and accounting will be done within Cobra™ for the duration of the project. Note that the cost estimate is only an estimate. It is used to establish the cost baseline, but it does not commit the Level 2 manager to any particular vendor(s), technical approach, or split between in-house, university, and procured labor.

3.3 ESCALATION AND OVERHEADS

For preparing the resource-loaded schedule, escalated cost estimate, and performance baseline, the NOvA project used escalation rates provided by DOE in Appendix D to the 2009-2013 Field Budget Call. For the cumulative escalation, FY 2007 is the reference year, since the base estimate was prepared in FY 2007 dollars.

Table 3.1 Labor and M&S Escalation Rates

	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Annual Escalation-M&S (%)	0.0	2.2	2.1	2.1	2.1	2.2	2.2
Cumulative Escalation – MS (%)	0.0	2.2	4.35	6.54	8.78	11.17	13.62
Annual Escalation Labor (%)	0.0	4.8	4.8	4.8	4.8	4.8	4.8
Cumulative Escalation Labor (%)	0.0	4.8	9.83	15.10	20.62	26.41	32.48

Applicable Fermilab National Laboratory overheads were applied, in accordance with Fermilab's policy for major, multiyear projects. Note that "base" labor rates include fringe benefits and local organizational overheads. For work contracted to institutions other than Fermilab, labor rates and overheads on labor and M&S purchases are established in Memoranda of Understandings (MOUs) for each institution.

3.4 RESOURCE-LOADED SCHEDULE DEVELOPMENT

Schedule Development

The NOvA project's resource-loaded, resource-leveled schedule was prepared using a combination of bottoms-up planning by the Level 2 managers, followed by a top-down management revision. The Level 2 managers, assisted by an expert operator of Open Plan™, created the fully detailed schedule. The steps followed were to: (1) enter tasks, resources, resource unit costs, and schedule logic into Open Plan™; (2) reschedule (i.e. delay) certain tasks to later fiscal years to level the resource (funding) requirements; (3) and further revise the timing of tasks and the level of contingency applied to resources in the early years to comply with the expected budget authority (BA) profile for the project without sacrificing schedule floats.

Step 1. The Level 2 manager planned the work and identified the tasks and sequence to accomplish the scope of each WBS element, along with any logic linking two or more WBS elements. Coordinating meetings were held to ensure that any links across WBS level 2 systems were identified, recognized, and included by all Level 2 managers involved. The level 2 manager was instructed to enter each task and its required resources (from the Base Cost Estimate) and logic into Open Plan™. Effort was spread across the duration of each task. Logical links and joint milestones involving all level 2 subprojects were also input into Open Plan™ during the development of the Open Plan™ schedule database. Many iterations between the Open Plan™ scheduler and each Level 2 manager allowed the entered data to be checked against the plan, errors to be corrected, and schedule refinements to be developed. The complete resource-loaded Open Plan™ schedule resulting from this approach represents the technically driven schedule, ignoring funding and resource constraints.

Step 2. After all of the WBS activities, resources, and logic were loaded into Open Plan™, the project team will 'level' the schedule to fit within the expected budget profile as provided by the Fermilab Directorate in consultation with OHEP. Fitting into this funding profile will likely require several iterations. Procurements that could be awarded as phased contracts, with a partial commitment in the early years of the project were identified, along with the minimum acceptable value for the first phase. The remainder of the budget required for this procurement was shifted into the following years for subsequent phases. This schedule planning and resource leveling will be done in Open Plan™ by making resources each year available first to the most critical paths in the project, to ensure their progress would be minimally impacted by funding limitations, and also to the required project management/control tasks. The scientific equipment items were reviewed to identify those that could be delayed without impacting the critical path. In addition, the suite was reviewed to identify items that would be critical to have available early.

Step 3. Management will further revise the timing of tasks and the level of contingency applied to resources in the early years to ensure that the resources required in each year remain within the funding profile and adequate schedule float exists in every subsystem to ensure a high probability of delivering the full project scope on schedule and within budget. The resulting schedule will be, consequently, not a technically limited schedule.

The result of this three step process is NOvA's resource-loaded, resource-leveled schedule. The schedule will then be baselined in Open Plan™ and brought into Cobra™. Escalation rates are applied in Cobra™, providing the performance measurement baseline and the escalated baseline cost estimate. The Open Plan™ schedule and the Cobra™ performance measurement baseline are controlled, maintained, and statused as described in Section 3.6.

3.5 SCHEDULE HIERARCHY

The NOvA schedules are "tiered" from the broad level 2 WBS categories defined in section 5 of the PPEP to the detailed project schedule in Open Plan™, to informal daily/weekly task schedules that might be maintained and used by Level 2 managers. The schedule in Open Plan™ and the resulting BCWS in Cobra™ comprise the performance baseline, and are subject to formal change control after receiving CD-2/CD-3a approval.

Level 2 managers are encouraged to have and maintain for their own use informal, detailed daily/weekly work/task/assignment schedules for any subsystem where such a schedule would be helpful.

3.6 COST AND SCHEDULE BASELINE MANAGEMENT

The BCWS in Cobra™ is the performance measurement baseline (PMB). The schedule in Open Plan™ is the baseline schedule. Both are subject to project change control. As work is accomplished, it is recorded in Open Plan™, with the status then imported into Cobra™. The budgeted cost within Cobra™ of the accomplished work becomes the Budgeted Cost of Work Performed (BCWP) or Earned Value. Actual costs incurred or accrued are imported into Cobra™ each month, directly from the Fermilab financial system, becoming the Actual Cost of Work Performed (ACWP). Then Cobra™ integrates the performance measurement components to produce monthly earned value reports, calculate variances, and provide reports and graphs for use in project management.

The schedule baseline and PMB can only be revised using the change control process. The approved thresholds and change control process are described in the CMP. Approved changes will be incorporated into the schedule (Open Plan™) and performance baselines (Cobra™). Future statusing will be compared to the revised baseline. Schedule changes can only affect future work, and cannot retroactively change BCWS, BCWP, or ACWP.

At the time each Request for Proposal (RFP) is issued or each contract is placed, the cognizant Level 2 manager can issue a change order directing that the default resource loading for a specific procurement be changed to more accurately reflect the contracted BCWS (e.g. progress payment milestones and schedule), so long as the contracted or revised plan finishes the work on or ahead of the project's baseline schedule and at or below the baseline estimate for the item. If the contracted cost/schedule exceeds the baseline budget/schedule for an item and if it is desired to change the baseline, a Change Request From must be used and approved per the baseline change process described in the CMP.

3.7 RESPONSIBILITIES

The Project Manager is responsible for maintaining the WBS dictionary, the detailed schedule baseline in Open Plan™, the cost estimate and PMB in Cobra™, the change control process, and project

documentation. This responsibility includes assuring the integrity and documentation of the processes, databases, and data. Monthly he/she will in a timely and accurate manner collect estimates of work accomplished from Level 2 managers and status progress, spot check earned-value reports, perform a critical path analysis, perform major milestone status analysis, generate EVMS reports and graphs in formats required by the project team, and draft the NOνA project's monthly progress report to DOE. On an as-needed basis, the Project Manager will implement approved enhancements to the EVMS and at least annually reviews and (if necessary) updates this NOνA *Earned Value Management System Description*.

The Level 2 managers are responsible for estimating, planning, and performing work in their WBS systems and for ensuring interfaces and obligations with other WBS systems are satisfied. They are responsible for accomplishing the work within the approved technical, cost, and schedule baselines, for accurately assessing and reporting work accomplished on a monthly basis, for analyzing and recovering from significant variances, and evaluating the adequacy of the estimate to completion (ETC).

Each project participant is responsible for alerting the next higher level manager of information, trends, or concerns that could affect successful accomplishment of the NOνA project's cost, schedule, and technical baselines. In addition, each person shall notify the Project Manager of possible errors in the Open Plan™ and Cobra™ files.

4. EARNED VALUE MEASUREMENT

4.1 EARNED VALUE MEASUREMENT REQUIREMENTS

All work progress will be assessed using earned value (EV) techniques. Budgeted Cost of Work Scheduled (BCWS) is the time-phased budget that represents the value of work to be accomplished through a given period of time. As work is actually completed, budget associated with this work is "earned" as Budgeted Cost of Work Performed (BCWP). Budgeted Cost for Work Performed is synonymous with "Earned Value." The following guidelines are followed in determination of BCWP:

- Earned value is determined using the performance measurement technique selected at the time the activity is planned.
- Every scheduled activity within a work package that has resources assigned to it must also be assigned a performance measurement technique (PMT).
- The selected measurement method does not change for the duration of the activity.
- Earned value is determined in a manner that is consistent with the way BCWS is planned.
- Earned value (BCWP) is recorded at the end of each accounting period and before actual costs are known.
- Retroactive adjustments are not made to BCWP previously reported, except to correct mistakes in reporting.
- BCWP can never exceed budget at completion (BAC) for any work package.

4.2 EARNED VALUE MEASUREMENT TOOLS

NOvA has adopted EVM tools and systems previously accepted by DOE. These tools include Deltek Open Plan™ for schedule logic, Project Baseline Definition, and work package progress entry. Deltek Cobra™ is used for cost capture, earned value and variance calculation, and reporting. The personnel involved in the NOvA project at Fermilab have set up and created the NOvA project management databases, the schedule, and the baseline. Section 3 provides information about how the Open Plan™ and Cobra™ databases were created, are controlled, and interact with each other and with the NOvA project team.

4.3 EARNED VALUE PLANNING AND MEASUREMENT

The NOvA Project Manager and appropriate Level 2 manager will agree on an earned value method when authorizing the start of work on each work package. The Project Manager supports this process and the level 2 manager creates and manages the associated documentation. The earned value method options for the project, which are called "performance measurement techniques" (PMTs) in Cobra™, are as follows:

- PMT Code B: Milestone Method. The milestone method is the industry standard method for assessing progress on work packages that span more than two fiscal periods. It can be used on tasks of any duration that have deliverables or milestones, and will be used when practical for activities greater than 6 months in duration and more than $100K in value . The work package is planned with several milestones specified. Each milestone has its scope/deliverable described and is assigned a value. The sum of the values of all milestones equals to the budget at completion (BAC) for the task. The BAC is the cumulative BCWS for the task. Each milestone is represented in Open Plan™ as a one-day activity with resource value equal to the milestone value. Earned value (BCWP) is earned as each milestone is completed. For procurements with multiple deliverables, a reasonable approach is to assign a value to each deliverable and to place each deliverable as a one day activity with that value into the Open Plan™ schedule.

- PMT Code C: Percent Complete. The percent complete method is intended to be used on short duration tasks of no more than six months' duration or low-value tasks budgeted at less than $100K. The percent complete of the activity in the detailed schedule is used to calculate earned value, by multiplying the percent complete by the total value of the task.

- PMT Code A: Level of Effort (LOE) . The Level of Effort method will be used only where there are no definable deliverables (milestones) or when tasks and activities are administrative in nature. Earned value on LOE activities is equal to BCWS.

Within the current year a task can be divided into several activities, each with definite scheduled start and completion dates. When practical, activities longer than six months in duration should have intermediate milestones that provide an objective 'yardstick' for measuring how the work is progressing.

4.4 PLANNING AND MEASURING PROCUREMENTS

Procurements can be planned and measured using any of the above methods. For procurements, value will not be earned unless costs are either incurred or accrued through the Fermilab accounting system, to ensure that the cost variance is not favorably biased. Thus, it is desirable for earned-value milestones

to mimic progress payment milestones/deliverables specified in the contract or otherwise agreed with the vendor. For procurements where full payment is made after delivery, no earned value will be planned or taken until delivery, unless costs are accrued. At about the time the contract is awarded, the appropriate Level 2 manager may submit a Level 5 change order to adjust the BCWS spread to reflect the vendor's proposed schedule of progress payments and milestones, so long as the new spread does not represent a cost increase or schedule delay to the total task.

Procurements are allocated sufficient budget in one fiscal year to complete the procurement, even if milestones and deliverables are expected in a subsequent fiscal year. Deliverables and milestones must be specified for the full length of the task. Alternatively, the budget available for a procurement may be phased across two (or three) fiscal years, and each year would have a separate work package with budget for the second phase in the second fiscal year, with detailed deliverables and milestones enabled by the phase two funding being specified at that time.

4.5 WORK AUTHORIZATION AND WORK PACKAGES

The work package is the tool the NOvA project uses to allocate funding to, authorize work on, and measure the progress of any project task. Work packages are created from the detailed project schedule and developed by the responsible Level 2 manager to cover the scope of work planned for the year and to allocate the appropriate budget. Each work package covers a distinct set of WBS elements. It describes the activities in lower-level WBS sub-elements planned to occur during the year. Each work package must identify the EV method and resource loading for each activity. Approval by the Project Manager authorizes the work. The sum of the actual cost of all work packages completed and the funding authorized to all open work packages cannot exceed the cumulative budget appropriated and authorized for the NOvA project during the year. Work packages may be opened at any time during the fiscal year. The opening of a work package is the method the project uses to formally allocate funding to and authorize work. The baseline schedule from Open Plan™ and the time-phased budget from Cobra™ would typically be incorporated in or attached to the work package.

Each work package will include:
1) The narrative description of the scope of work.
2) Total BA requirements by month for the work package.
3) The total BA required for the full year for each lowest level WBS element in the work package.
4) BCWS profiles by month from Cobra™ for each lowest-level WBS element.
5) The detailed resource-loaded schedule from Open Plan™ of activities planned for the fiscal year.
6) The proposed earned value method for each resource-loaded activity.

4.6 MEASURING WORK PROGRESS TO EARN VALUE

The appropriate Level 2 manager will report at the end of each month on the status or progress (earned value) and adequacy of ETC for each work package that is authorized. Actual start and/or completion dates will be reported by the Level 2 manager and entered into Open Plan™ by the NOvA Scheduler, producing a current working schedule. Comparing the working schedule dates to the baseline schedule dates will define variances. Schedule logic will allow the impact of behind-schedule activities on downstream events to be reported and summarized and the critical path to be analyzed.

To start collecting earned-value status each month, the Project Scheduler will issue Status Update Requests to the responsible Level 2 managers not later than the third to the last working day of the month. The Level 2 managers will review the schedule status for each open work package, prepare the

Status Update Report, and return it to the Project Scheduler by the third working day of the next month. Upon receipt of the Status Update Report, the NOvA Scheduler updates the detailed schedule in Open Plan™. After updating the detailed schedule, the NOvA Scheduler will perform an analysis of the critical path, the key milestones and the high risk activities in the project to determine the current status of the project schedule contingency. The milestones scheduled to occur in the next 6 months, to Tier 4, will be put into a Gantt chart that will display the baseline date, the current forecast date, and any variation in the current forecast date from the previous month. This Gantt chart will be given to the Project Manager by the 10th working day of the month, and will be presented at the monthly PMG meeting and included in the Project's monthly DOE report. The Level 2 managers validate/approve the updates to be sure they accurately reflect the status. In parallel, the Project Manager and/or Deputy Project Manager spot check one or more random status reports to validate their accuracy, and then analyze the schedule for potential impacts to the project critical path, for impacts to Level 1-4 milestones, and to identify any other schedule trends, issues, or concerns that warrant management attention.

The NOvA Scheduler provides a copy of the statused schedule to the Project Financial Officer by the 8th working day of the month. The Financial Officer integrates the information from the statused schedule into Cobra™ to calculate earned value (BCWP).

4.7 ESTIMATE TO COMPLETE AND ESTIMATE AT COMPLETION

The NOvA Project will explicitly track the amount of funding needed to complete the approved scope of work, which is called the Estimate to Complete (ETC). The sum of ETC and the actual cost of work completed is the Estimate at Completion (EAC). Automatically each month, Cobra™ calculates and reports the EAC as the sum of the actual costs to date plus the current BCWS for remaining work. Note that the current BCWS includes any approved baseline changes. In addition, periodically the Level 2 managers will evaluate the adequacy of the current ETC.

A comprehensive "bottoms-up" reevaluation of ETC may be initiated at any time at the discretion of a Level 2 manager (for his/her system), of NOvA Management, or of DOE. The method used to prepare this estimate is the same as was used to prepare the original base estimate (see Section 3.2). Typically the project would make such an estimate prior to a major project review by DOE. NOvA management will report the result of the revised estimate and will use it to manage cost/schedule risk, to pursue more cost-effective technical approaches, and/or in other ways to guide project execution. The option exists to use the change control process described in the CMP to propose a baseline change to formally adopt the updated ETC/EAC as the project baseline. An alternative option is to continue to manage to the existing baseline, carrying, explaining, and recovering from the variances that arise.

Level 2 managers must notify NOvA management promptly, whenever they become aware of new information that indicates likely significant changes in the EAC of their systems.

5. VARIANCE ANALYSIS AND REPORTING

An important part of the NOvA Earned Value Management System is the quantitative measurement of cost and schedule variances from the baseline plan, and the use of this variance information in project management. These variances are determined by comparing three parameters: the Actual Cost of Work Performed (ACWP), the Budgeted Cost of Work Performed (BCWP), and the Budgeted Cost of Work

Scheduled (BCWS), which represents the baseline plan. The BCWS and BCWP were introduced in Section 3. The ACWP comes from the Laboratory's financial/accounting system.

Every month on about the 3rd working day, actual (and any accrued) costs for the previous month for NOvA project work packages are obtained by the Project Financial Officer in electronic form from the Fermilab financial/accounting system. Data from the financial system are not altered. The actual cost data are imported in electronic form into Cobra™ by the 10th working day of the month. These data are the ACWP for NOvA tasks. After the schedule status information is imported into Cobra™, the ACWP, the earned value (BCWP), and BCWS are used by Cobra™ to produce monthly earned value reports, calculate variances, and provide reports and graphs for use in project management not later than the 15th working day of the month. These reports, variances, and graphs are reviewed and validated by the Level 2 managers consulting with the NOvA Scheduler. If errors related to actual costs are identified, they are corrected in the accounting system in the following month.

5.1 REQUIREMENTS

- Progress (earned value or BCWP) is determined on a monthly basis for all active work packages, before actual costs are known.
- Actual cost (ACWP) data is obtained directly from the Laboratory financial system, is validated, and is imported into the earned value reporting module (Cobra™).
- Current month and cumulative-to-date cost and schedule variances are calculated and reported. The cost variance is the BCWP less ACWP. The schedule variance is BCWP less BCWS.
- At-completion estimates (EAC) and variances are calculated based on actual costs to date and the budgeted cost for work remaining to be performed.
- Cost Performance Reports (CPR) in formats desired by management and sponsors are produced.
- Cost and schedule variances that exceed established thresholds (Table 5.1) are analyzed, variance analysis reports are prepared, and variance explanations are included in the monthly progress reports at the designated levels.
- For unfavorable variances exceeding thresholds (Table 5.1), corrective action plans are prepared by the Level 2 managers and are tracked until the work is completed or the variances are within acceptable limits.

5.2 ACTUAL COST DATA

Monthly actual cost data are acquired electronically at the work package level from Fermilab's DOE-approved accounting system by about the 3rd working day of the month. Actual costs entering the accounting system include labor charges, materials and services, overhead costs, and accounting transfers and accruals. Fermilab labor costs are charged to the project via payroll and the Lab's effort reporting system. Materials and Services costs include approved invoices, travel expenses, petty cash expenditures, ProCard purchases, and costs of university or other institutional labor and M&S that have been invoiced to Fermilab by the appropriate institution. Overhead costs, accounting transfers, and accruals are charged to the project by the accounting department. The actual costs are captured in a file that is imported directly into Cobra™ by the Project Financial Officer to produce the ACWP. The Project Financial Officer reviews the actual cost file to (1) ensure that costs are reported for all work packages where progress is reported, and (2) check for obvious accounting errors and misplaced charges. The Project Financial Officer sends an email to the appropriate Level 2 manager(s) and

Project Manager listing any discovered mismatches of type (1) and errors of type (2). Then the Project Financial Officer works with the Accounting Department to correct any errors. The corrections would be reflected in the following month's accounting reports.

The NOνA project management recognizes that reported cost performance can be favorably biased if invoiced/booked costs lag behind the reporting of value earned. This bias can be minimized by either of two techniques: by delaying reporting earned value until invoices enter the accounting system, or by accruing in the accounting system each month the cost expected for the completed/claimed work. Since delaying earned value reporting causes an apparent unfavorable schedule variance, accrual of costs is preferred. Accrual of costs is a labor intensive, manual process, but will be employed where practical.

The Project Financial Officer uses Cobra™ to produce standard EVMS reports and graphs monthly, presenting cumulative to date and monthly BCWS, BCWP, ACWP, and variances. The full set of reports and graphs is distributed to the NOνA Project manager, NOνA Project Manager, and Level 2 managers, for use in managing the project going forward. Reports requested by the DOE Federal Project manager are provided to him, and specific summary reports are included in the NOνA Project's formal monthly progress report.

5.3 COST AND SCHEDULE VARIANCES

Variances capture the difference between the planned and the actual cost and schedule of work accomplished. Using the data in the EVMS, cost variances are calculated as described below each month for the project as a whole, at WBS level 2, and down to the cost account level. Schedule variances are calculated at the work package level.

5.3.1 Cost Variance—Cost performance is measured against the plan by comparing the value of work accomplished (BCWP) to its actual cost (ACWP). Cost variances are expressed as follows:

Cost Variance (CV) = BCWP - ACWP
Percent Cost Variance = [(BCWP - ACWP)/BCWP] x 100

Positive variances indicate a cost under-run condition: more work was accomplished than money was spent. Negative variances indicate a cost overrun condition.

A Cost Performance Index (CPI) will be utilized where:

CPI = BCWP/ACWP

CPI values less than 1.0 represent "cost overrun" condition ("bad") and values greater than 1.0 represent "cost under run" condition ("good").

5.3.2 Schedule Variance—Schedule performance is measured by comparing work accomplished (BCWP) against the plan for work scheduled (BCWS). Schedule variances are expressed as follows:

Schedule Variance (SV) = BCWP - BCWS
Percent Schedule Variance = [(BCWP - BCWS)/BCWS] x 100

Positive variances indicate an ahead-of-schedule condition: more work was accomplished than was scheduled. Negative variances indicate a behind-schedule condition.

The schedule variance for any task or system can be converted into time by comparing the present date with the date the BCWS was supposed to equal the current BCWP.

A Schedule Performance Index (SPI) will also be used where:

SPI = BCWP/BCWS

SPI values less than 1.0 represent "behind schedule" condition ("bad"), and SPI values greater than 1.0 represent "ahead of schedule" condition ("good").

5.4 VARIANCE ANALYSIS

Variance analysis is performed when cumulative cost and/or schedule variances exceeding predetermined thresholds exist in WBS Level 3 or higher systems. Variance thresholds are established for the Project (Level 1) and for Level 2 and Level 3 systems, both as percent and dollar variances (See Table 5.1). Both conditions (CPI/SPI and SV/CV) must be met to exceed threshold. Every month, the Project Financial Officer uses Cobra™ to produce a variance summary for the entire project, down to the work package level, with roll-ups at each higher WBS level. Those Level 1, 2, and 3 systems where cost or schedule variances exceed thresholds are flagged. In cases where both the dollar threshold and the CPI/SPI limits are exceeded, written variance reports are required. It is the responsibility of the appropriate Level 2 manager to provide the required variance reports to the Project Manager, and to develop and implement corrective action plans, if needed.

Table 5.1 Variance Analysis Thresholds (Cumulative)

	Threshold CPI or SPI	Threshold SV or CV Dollar Value
WBS Level 1	<0.95 or >1.05	Overrun > $500 K
WBS Level 2	<0.92 or >1.08	Overrun > $100 K
WBS Level 3	<0.90 or >1.1	Overrun > $30 K

The variance analysis section of the monthly report to DOE contains the NOvA Project Manager's summary of the significant variances, their causes, their likely impacts, and a description of corrective action(s) taken or planned. Significant cost variances likely to be sustained would be reflected in the EAC.

5.5 EVALUATING TRENDS AND MONITORING CORRECTIVE ACTIONS

Trends in project performance will be tracked and evaluated by the Financial Officer on behalf of the Project Manager and the level 2 managers. Trending includes monitoring changes in the earned value and variances over time.

It is the Level 2 manager's responsibility to monitor and report corrective actions until variances are resolved. The normal forum for this reporting is at the weekly Technical Board meetings. The Project Manager also reviews the status of corrective action plans during his routine meetings with each Level 2 manager.

6. COMMUNICATION AND REPORTING

Timely and accurate communication among project participants and stakeholders is a key element of the NOνA Earned Value Management System. This communication includes routine and *ad hoc* meetings, project documents, design drawings and specifications, informal emails, and reporting. The goal of project communication and reporting is to keep project participants and stakeholders sufficiently knowledgeable and up-to-date on important plans and status that they can fulfill their project-related obligations efficiently and effectively. These obligations include satisfying reporting requirements to sponsors, regulators, and management, including fulfilling commitments established in the PPEP.

6.1 MONTHLY PROGRESS AND COST PERFORMANCE REPORT FOR DOE

The Monthly Progress Report to DOE, containing a narrative summary of progress on the entire NOνA project along with EVMS summary data and graphs for the project, is one of the key reports. Per the PPEP, the narrative summary report will be provided to the DOE Federal Project manager for NOνA and to the program manager in the Office of High Energy Physics (OHEP) at DOE HQ starting when CD-1 is approved. NOνA received CD-1 approval in May 2005, and had already been producing narrative monthly progress reports since May 2006. EVMS data for the project will be included in the Monthly Progress Report when the performance baseline is formally established after DOE approval of CD-2.

The Project Manager will oversee the drafting of the Monthly Progress Report and the subsequent review and submittal including the required EVMS data and graphs provided by the Financial Officer. The monthly Status Update Request issued electronically to the Level 2 managers by the Project Manager and Project Scheduler will request a brief narrative summary of progress, status, and issues, as well as work-package schedule status for earned value measurement. The EVMS data and graphs in the Monthly Progress Report will satisfy DOE 413.3 requirements for the Cost Performance Report (CPR) for the project. The variance analysis section of the monthly report to DOE contains the NOνA Project Manager's summary of the significant variances, their causes, their likely impacts, and a description of corrective action(s) taken or planned. After reviewing and finalizing the Monthly Progress Report, the NOνA Project Manager submits it to the DOE Federal Project Manager. Information copies are provided to the Level 2 managers and other members of the Integrated Project Team.

The NOνA Project has been entered into DOE's Project Assessment and Reporting System (PARS). The DOE Federal Project manager for NOνA will provide monthly updates to PARS for the project, starting at CD-2. The NOνA Project Manager will ensure that the Federal Project manager has the information required to make the updates.

6.2 PARS REPORTING

Prior to CD-2, project status will be provided to the NOνA DOE Federal Project Manager for entry into the PARS narrative section at the end of each month for the preceding month. Subsequent to CD-2, earned value data will be provided by the end of each month for the preceding month for entry into PARS. The following color codes, as stated on the PARS web site, will be used. Any rating other than "green" will need to be explained in the PARS narrative section.

"Performance indices (CPI and SPI) are commonly used for project assessment. To assist senior management with interpreting the range of values, color thresholds have been created to categorize projects. These thresholds are based on cumulative cost and schedule performance indices (CPI_PTD and SPI_PTD), and are assessed on projects that are beyond the definition stage. Generally speaking, an index value less than 1 is unfavorable, and a value greater than 1 is favorable. The current guidelines for the color coding are:

GREEN if the performance index is between .90 and 1.15.

YELLOW if the performance index is between .85 and .89 or if the performance index is between 1.16 and 1.25. The project will also be categorized yellow if it has not been updated in PARS within the past 45 days.

RED if the performance index is below .85 or above 1.25 (any value outside of green or yellow)."

(CPI - Cost Performance Index. CPI=BCWP/ACWP;
SPI - Schedule Performance Index. SPI =BCWP/BCWS)

6.3 UNIVERSITY REPORTING

The NOνA Collaboration is composed of a large number of scientists from universities and national laboratories. Several of the large subprojects are the main responsibility of University or national laboratory groups, and managing, communicating, and reviewing the university led efforts must be a high priority to ensure project success. Each group will report its activities monthly by contributing to the subproject narrative included in the DOE monthly report detailed above. In addition, the universities and national laboratories with an MOU and/or SOW will provide cost information for accruals on a monthly basis.

6.4 MEETINGS AND REVIEWS

The NOνA Project uses a series of regularly scheduled meetings and reviews to manage, communicate, and drive the project's technical, schedule, and cost progress. These meetings provide a forum for anticipating and resolving emerging problems, revealing early indications of developing trends and problems, keeping project activities coordinated, and keeping participants informed.

6.3.1 Weekly Technical Board Meetings. The Project holds weekly meetings attended by the Level 2 managers and Project Support Staff to coordinate and expedite work and plans, discuss and evaluate proposed changes, discuss and evaluate risks and mitigation strategies, and generally to identify and resolve project issues.

6.3.2 Routine WBS Level 2 System Meetings. Each Level 2 manager will chair and convene routine meetings of participants and stakeholders involved in the planning and execution of the system scope. The purpose of the meetings is work assignment, planning, coordination, and trouble shooting, etc. The frequency of these meetings will range from weekly to monthly to as needed, depending on the nature of the system and the activities underway.

6.3.2 Monthly Progress Meetings. Once CD-2 approval is granted, progress meetings will be held monthly as needed to review the status of any WBS Level 2 system with variances that exceed the

thresholds defined in table 5.1. The review will focus on the cost, schedule and scope. The meetings will be held shortly after EVMS reports and graphs are provided by the Financial Officer and before the monthly progress report is submitted to DOE. The status review format shall be simple, straightforward and concise. Utilizing trend charts for cost and schedule performance, the WBS Level 2 manager shall present task status, including the following:

- Technical Accomplishments
- Schedule and Cost Status and Variances
- Estimate of EAC
- Procurement Status
- Significant Issues/Problems
- Impact on Key Activities and Milestones planned in the next 60 days

6.3.3 Design Reviews. As needed based on risk analysis or system significance and uniqueness, the NOvA Project Manager, Deputy Project Manager, Associate Project manager, or Level 2 managers will convene meetings to review the preliminary design and final design of systems and subsystems for which such reviews are appropriate. Reviewers will include independent technical experts, knowledgeable project personnel, and/or scientists who will use the system/subsystem when it is complete. The purpose of the design reviews is to validate the technical approach, feasibility, design soundness, cost effectiveness (value engineering), etc. of the design, including its ability to achieve the technical goals.

6.3.4 DOE Reviews. The Director of OHEP is expected to convene routine semiannual reviews of the NOvA Project. Fermilab's NOvA project team will support the DOE Federal Project manager's preparation for these reviews. In addition, OHEP charters major reviews of the NOvA project's overall technical, cost, schedule, and management status, starting with the CD-1 Review in April 2006. These review committees include independent peers from DOE and from other organizations who have expertise in the technical and management fields essential to project success. DOE has established an Energy Systems Acquisition Advisory Board (ESAAB) process for reviewing the readiness of projects for approval of Critical Decisions. The ESAAB reviews of the NOvA project will occur on an as needed basis to support DOE oversight and review.

7. QUALITY ASSURANCE

The NOvA Project employs a Quality Management Program which is described in the *Quality Assurance Program* document (NOvA-doc-1353).

8. RISK MANAGEMENT

The NOvA *Risk Management Plan* (RMP, NOvA-doc-185) provides a structured and integrated process for identifying, evaluating, tracking, abating, and managing project risks in terms of three risk categories: cost, schedule and technical performance.

The NOvA project becomes aware of potential risks in many ways, notably during work planning, meetings, reviews, and via lessons learned from others. Routine meetings, such as weekly Technical Board meetings, routine WBS Level 2 system meetings, and monthly progress meetings, provide important forums for identifying, discussing, and resolving key risk areas and developing and adopting

mitigation plans. Risk has been managed during the planning and design phase by implementing appropriate actions, such as ensuring adequate contingency and schedule float, pursuing multiple parallel approaches, and/or developing backup options. Detector construction projects are well within the experience and expertise of the NOvA collaboration. Every effort has been made to specify these projects in a manner that reduces the risk to an acceptably low level.

9. FUNDS MANAGEMENT

Funds will be made available by the Director to the Project on an annual basis following the receipt of the Initial Financial Plan from DOE. These funds will correspond to a financial plan and a funding profile to project completion as determined by the Director. The funding profile will include contingency in each year of the project. Actual expenditures and commitments on the NOvA Project are limited by the cumulative amount of funds authorized by DOE for the NOvA. At no time shall the cost incurred plus the outstanding commitment balance on each of the subprojects exceed the funding level authorized or granted by the sponsor.

Work packages will be established by the Fermilab Budget Office working with the Project Financial Officer following the WBS structure. The accumulation of M&S costs in these accounts will be initiated through purchase requisitions originating with the engineering and scientific staff assigned to the various subsystems. Signature authority levels will be provided to the appropriate Fermilab financial groups by the Project manager to assure that only authorized work is initiated.

10. BASELINE CHANGE CONTROL

The NOvA project's performance measurement baselines must be managed after CD-2 in a manner that ensures that they are not modified without appropriate approval. In reality, changes are likely during a project's life, so any project requires a system for managing, controlling, and rejecting or implementing them. Thus, NOvA's Earned Value Management System includes a change mechanism, described in the NOvA *Configuration Management Plan* (NOvA-doc-131).

Appendix A

ANSI/EIA-748-A Crosswalk for 32 Criteria

ANSI/EIA-748-A Guidelines	Fermilab EVMS Implementation	NOvA Reference
Category 1: Organization		
Criteria 1-1: Define the authorized work elements for the program. A work breakdown structure (WBS), tailored for effective internal management control, is commonly used in this process.	1.1.1, 1.1.3, 1.1.4	Fermilab EVMS Description NOvA Project Execution Plan (PEP)
Criteria 1-2: Identify the program organizational structure including the major subcontractors responsible for accomplishing the authorized work, and define the organizational elements in which work will be planned and controlled.	1.1.1, 1.1.5, 1.3.5	Fermilab EVMS Description NOvA Project Management Plan (PMP)
Criteria 1-3: Provide for the integration of the company's planning, scheduling, budgeting, work authorization and cost accumulation processes with each other, and as appropriate, the program work breakdown structure and the program organizational structure.	1.1.2, 1.1.6, 1.3.3, 1.3.4, 1.3.5, 1.4	Fermilab EVMS Description NOvA PMP
Criteria 1-4: Identify the company organization or function responsible for controlling overhead (indirect costs).	3.2	CASB DS Part IV, Indirect Costs CASB DS Part 4.4, Treatment of Variances from Actual Cost
Criteria 1-5: Provide for integration of the program work breakdown structure and the program organizational structure in a manner that permits cost and schedule performance measurement by elements of either or both structures, as needed.	1.1.6, 1.3.3, 1.3.4, 1.3.5, 1.3.6	Fermilab EVMS Description NOvA PEP
Category 2: Planning & Budgeting		
Criteria 2-1: Schedule the authorized work in a manner which describes the sequence of work and identifies significant task interdependencies required to meet the requirements of the program.	1.2.1, 1.2.2	Fermilab EVMS Description NOvA PMP
Criteria 2-2: Identify physical products, milestones, technical performance goals, or other indicators that will be used to measure progress.	1.2.1, 1.2.2, 2.1.1, 2.1.2, 2.2,3	Fermilab EVMS Description NOvA PEP & PMP

ANSI/EIA-748-A Guidelines	Fermilab EVMS Implementation	NOvA Reference
Criteria 2-3: Establish and maintain a time-phased budget baseline, at the control account level, against which program performance can be measured. Budget for far-term efforts may be held in higher-level accounts until an appropriate time for allocation at the control account level. Initial budgets established for performance measurement will be based on either internal management goals or the external customer negotiated target cost including estimates for authorized but un-defined work. On government contracts, if an over target baseline is used for performance measurement reporting purposes; prior notification must be provided to the customer.	1.3.1, 1.3.2, 1.3.4	Fermilab EVMS Description NOvA PMP
Criteria 2-4: Establish budgets for authorized work with identification of significant cost elements (labor, material, etc.) as needed for internal management and for control of subcontractors.	1.3.1, 1.3.2, 1.3.4, Section 4	Fermilab EVMS Description NOvA PMP
Criteria 2-5: To the extent it is practical to identify the authorized work in discrete work packages, establish budgets for this work in terms of dollars, hours, or other measurable units. Where the entire control account is not subdivided into work packages, identify the far term effort in larger planning packages for budget and scheduling purposes.	1.3.4, Section 4	Fermilab EVMS Description NOvA EVMS Description NOvA PMP
Criteria 2-6: Provide that the sum of all work package budgets plus planning package budgets within a control account equals the control account budget.	1.3.4	Fermilab EVMS Description NOvA PMP
Criteria 2-7: Identify and control level of effort activity by time-phased budgets established for this purpose. Only that effort which is immeasurable or for which measurement is impractical may be classified as level of effort.	2.1.1 – 2.1.3	Fermilab EVMS Description NOvA PMP
Criteria 2-8: Establish overhead budgets for each significant organizational component of the company for expenses, which will become indirect costs. Reflect in the program budgets, at the appropriate level, the amounts in overhead pools that are planned to be allocated to the program as indirect costs.	3.1.9, 3.2.2 - 3.2.4	CASB DS Part IV, Indirect Costs CASB DS Part 4.4, Treatment of Variances from Actual Cost
Criteria 2-9: Identify management reserves and undistributed budget.	1.3.8	Fermilab EVMS Description NOvA PMP
Criteria 2-10: Provide that the program target cost goal is reconciled with the sum of all internal program budgets and management reserves.	1.3.1, 1.3.2	Fermilab EVMS Description NOvA PMP
Category 3: Accounting Considerations		
Criteria 3-1: Record direct costs in a manner consistent with the budgets in a formal system controlled by the general books of account.	3.1.2 – 3.1.8 Section 4	CASB DS 2.5 Direct Labor CASB DS 2.1, 2.2, & 2.3 Direct Materials CASB DS 2.7 Other Direct Costs

ANSI/EIA-748-A Guidelines	Fermilab EVMS Implementation	NOvA Reference
Criteria 3-2: *(When a work breakdown structure is used)* Summarize direct costs from control accounts into the work breakdown structure without allocation of a single control account to two or more work breakdown structure elements.	3.1.3	Fermilab EVMS Description NOvA PMP
Criteria 3-3: Summarize direct costs from the control accounts into the contractor's organizational elements without allocation of a single control account to two or more organizational elements.	1.3.3, 3.1.3	Fermilab EVMS Description NOvA PMP
Criteria 3-4: Record all indirect costs, which will be allocated to the contract.	3.1.3, 3.1.9, 3.1.10 3.2.2 – 3.2.4	CASB DS Part IV, Indirect Costs CASB DS Part 4.4, Treatment of Variances from Actual Cost
Criteria 3-5: Identify unit costs, equivalent unit costs, or lot costs when needed.	3.3	N/A
Criteria 3-6: For EVMS, the material accounting system will provide for: • Accurate cost accumulation and assignment of costs to control accounts in a manner consistent with the budgets using recognized, acceptable, costing techniques. • Cost performance measurement at the point in time most suitable for the category of material involved, but no earlier than the time of progress payments or actual receipt of material. • Full accountability of all material purchased for the program including the residual inventory.	3.1.6, 3.3	CASB DS 2.1, 2.2, & 2.3 Direct Materials
Category 4: Analysis & Management		
Criteria 4-1: At least on a monthly basis, generate the following information at the control account and other levels as necessary for management control using actual cost data from, or reconcilable with, the accounting system: • Comparison of the amount of planned budget and the amount of budget earned for work accomplished. This comparison provides the schedule variance. • Comparison of the amount of the budget earned to the actual (applied where appropriate) direct costs for the same work. This comparison provides the cost variance.	2.2.2 – 2.2.4 2.3.2 – 2.3.6 2.3.8, 2.4.3 Section 4	Fermilab EVMS Description NOvA PMP
Criteria 4-2: 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.	2.2.2 – 2.2.4 2.3.2 - 2.3.6 2.3.8, 2.4.3 Section 4	Fermilab EVMS Description NOvA PMP

ANSI/EIA-748-A Guidelines	Fermilab EVMS Implementation	NOvA Reference
Criteria 4-3: Identify budgeted and applied (or actual) Indirect costs at the level and frequency needed by management for effective control, along with the reasons for any significant variances.	3.2.2 – 3.2.4	CASB DS Part IV Indirect Costs CASB DS Part 4.4 Treatment of Variances from Actual Cost Fermilab EVMS Description NOvA PMP
Criteria 4-4: Summarize the data elements and associated variances through the program organization and/or work breakdown structure to support management needs and any customer reporting specified in the contract.	2.3.2, 2.3.5 – 2.3.8 2.4.2	Fermilab EVMS Description NOvA PMP
Criteria 4-5: Implement managerial actions taken as the result of earned value information.	2.3.5, 2.3.6, 2.4.2	Fermilab EVMS Description NOvA PMP
Criteria 4-6: Develop revised estimates of cost at completion based on performance to date, commitment values for material, and estimates of future conditions. Compare this information with the performance measurement baseline to identify variances at completion important to company management and any applicable customer reporting requirements including statements of funding requirements.	2.3.5 – 2.3.8	Fermilab EVMS Description NOvA PMP
Category 5: Revisions & Data Management		
Criteria 5-1: Incorporate authorized changes in a timely manner, recording the effects of such changes in budgets and schedules. In the directed effort prior to negotiation of a change, base such revisions on the amount estimated and budgeted to the program organizations.	5.1.2 – 5.1.5 5.1.5.1 – 5.1.5.3 5.1.5.6 – 5.1.5.8 5.2	Fermilab EVMS Description NOvA Configuration Management Plan (CMP)
Criteria 5-2: Reconcile current budgets to prior budgets in terms of changes to the authorized work and internal re-planning in the detail needed by management for effective control.	Section 5	Fermilab EVMS Description NOvA CMP
Criteria 5-3: Control retroactive changes to records pertaining to work performed that would change previously reported amounts for actual costs, earned value, or budgets. Adjustments should be made only for correction of errors, routine accounting adjustments, effects of customer or management directed changes, or to improve the baseline integrity and accuracy of performance measurement data.	1.3.4, 3.1.10 5.1.5.1, 5.1.5.4	Fermilab EVMS Description NOvA PMP NOvA CMP
Criteria 5-4: Prevent revisions to the program budget except for authorized changes.	5.1.2 – 5.1.5 5.1.5.1, 5.2 5.1.5.6 – 5.1.5.8	NOvA CMP
Criteria 5-5: Document changes to the performance measurement baseline.	5.1.2 – 5.1.4	NOvA CMP