NOνA's Implementation of

FRA's Earned Value Management System

Version 2

December 1, 2008

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Earned Value Management with Open Plan and Cobra

The NOvA project has implemented FRA's Earned Value Management System (EVMS). The FRA EVMS documents can be found at the Fermilab Office of Project Management Oversight website: http://www.fnal.gov/directorate/OPMO/OPMOhome.htm. This document describes NOvA's implementation of the system.

NOvA's EVMS implementation uses Deltek Open Plan for the resource loaded cost and schedule; Deltek Cobra for escalation, burdening, and earned value reporting and analysis; and Fermilab's Oracle Project Accounting system for tracking obligations and actual costs.

Initially, the performance measurement baseline is set up in Open Plan and then integrated into a Cobra program. This provides the time-phased, fully burdened, AY$ project baseline that is used for earned value management and analysis. Cobra also provides tools for controlling and tracking changes to the baseline.

Each month the status from the Open Plan schedule is integrated into the Cobra program. Next the actual costs are extracted from Project Accounting and loaded into Cobra. Note – this can be done prior to loading the status. Finally, Cobra calculates earned value, planned value, and actual cost of work performed, as well as cost and schedule variances. These metrics are used for earned value reporting and analysis.

Quite often, services, goods and materials have been received but the invoicing lags behind. Fermilab's accounting system automatically accrues costs for goods that have been received at Fermilab through the receiving department but not invoiced. It also allows us to accrue costs for services, goods and materials that are not physically received at Fermilab. In order to correctly match costs with the work performed and more accurately account for costs, accruals are an important part of the EVMS. However, since accruals are only an estimate of actual costs based on known information at a point in time, timely receipt of invoices is also an important part of the EVMS.

The NOvA Control Account Managers (CAMs) are responsible for managing the work performed within their control accounts. The project office authorizes the work to be performed through the issuance of Work Authorization documents. Changes must follow the appropriate Change Control mechanism and approval chain.

For Purchase Orders moving funds to NOvA Collaborating Institutions outside Fermilab, the CAM is responsible for seeing that the following items are in place:

1. A Memorandum of Understanding between Fermilab and the Institution, signed by both parties. MOU signatures must include the NOvA Project Manager.
2. A Statement of Work, one for each Fiscal Year (FY), detailing the amounts expected to be funded during that FY. SOW signatures must include the CAM and the NOvA Project Manager.
3. This Work Authorization must be approved by the CAM and the NOvA Project Manager.

Labor (SWF) at Fermilab is not authorized by Fermilab Purchase Order and instead is checked via Fermilab's Effort Reporting Systems. The CAM can analyze/review Fermilab SWF charges to these control accounts by obtaining Project Accounting system reports/queries from the

Project Field Financial Officer (FFO). Further, corrections to effort reporting can be submitted to accounting the following month, if needed.

Each month the CAMs must provide variance analyses for their control accounts where one or both of the following thresholds have been exceeded:

1. The SPI is outside of the range 0.85 to 1.5
2. The CPI is outside of the range 0.85 to 1.5

Submitting Cost Information to the Project Office

The NOνA Project FFO will need monthly accrual information for all purchase orders with the Universities, other laboratories and significant material purchases including but not limited to WLS fiber, mineral oil and scintillator components, PVC resins and PVC extrusions. The CAMs must supply the information via e-mail or provide a designee at the invoicing institution to furnish the required information each month in a timely manner in order to meet the cutoff dates for Fermilab's accounting close cycle. Additionally, timely invoicing is required to facilitate more accurate calculation and analysis of cost variances.

Conclusion

In summary, the elements of earned value management are:

- Set a performance measurement baseline in Open Plan and integrate it into Cobra.
- Status the Open Plan schedule (monthly) and integrate the status into the baseline Cobra program created in step 1.
- Accrue costs for uninvoiced materials, goods, and services each month.
- Obtain invoices for actual costs in a timely manner.
- Extract actual costs from Project Accounting and load them into the baseline Cobra program (monthly).
- Calculate earned value and provided project management with earned value reporting and variance analysis information in a timely manner in order to identify potential risks and opportunities to the project and to efficiently and effectively manage those risks and opportunities (monthly).
- Communicate and control project work being performed through issuance of Work Authorization documents.
- Control and track changes to the performance measurement baseline.

Control Account Manager Instructions for Providing Monthly SubProject Progress Information for Open Plan

Introduction

Entering progress information about an activity consists of specifying the following information:

1) Has the activity started? If so, when?
2) Has the activity finished? If so, when?
3) If the activity has started but not yet finished, how long is its remaining duration?
4) What is the physical completion percentage of the activity?

The "remaining duration" of an activity is fundamental to Open Plan. If it is not provided explicitly, then it is computed from the status date (called "Time Now" in Open Plan), the actual start date, and alternative forms of activity progress information that might be provided. These alternative forms include:

a) Activity percent complete
b) Elapsed duration

Once progress information has been entered into Open Plan for each lowest-level activity, "time analysis" is performed based on "Time Now" and the activities' remaining durations and relationships. This generates a revised schedule that can be compared to the baseline, analyzed for variances, used in forecasting, etc. Once physical completion percentages have been provided or calculated, earned value analysis also can be performed.

Reporting Progress for NOvA

The NOvA Project requires that activity progress be reported on a monthly basis. Each lowest-level activity in Open Plan that is scheduled to start or is in progress during a given month must have progress information reported by the Control Account Manager (CAM) or designee by the 5th working day of the following month. To facilitate this, the Project Office provides a monthly "turn-around" report in pdf and excel formats that is filtered to show those activities scheduled to be ongoing in a time window surrounding the status date. This window includes activities that are scheduled to occur up to two months before and several months after the status date, based on both the baseline dates and the current early/actual dates. One purpose of looking ahead several months is to include activities in the report that are not scheduled to start but may have in fact started early due to out-of-sequence progress. Another purpose is to remind managers of upcoming scheduled work. The purpose of looking backward is to show a somewhat broader time range for the in-progress activities and to remind the manager of those tasks that were reported as complete during the prior month in case there are corrections that need to be made.

An example of a pdf "turn-around report" for a generic project is shown in the left hand panel of Figure 1. The excel version is shown in the right hand panel. These examples have a status date ("Time Now") of December 1, 2006, indicated by the red vertical line in the Gantt chart, and therefore would be used to report progress during the month of November 2006.

There are 13 (16) columns in the tabular part of the pdf (Excel) report. Some of these are for information only. Others are used for data entry. The information-only columns are: Activity ID, Activity Description, Original Duration, Early Start/Finish Dates, Baseline Start/Finish

Dates, Total Units Needed, and Activity Type (excel sheet only). The data entry columns are: Progress Type, Progress Value, Actual Start, Actual Finish, Expected Finish, Physical Percent Complete (PPC), and Units Completed. The data entry fields are surrounded by red borders in the Excel example of figure 1.

Required Progress Information

The required progress information to be provided by each CAM or designee is discussed below.

1) For each lowest-level activity that began during the status month, enter an actual start date. This date often will differ from the corresponding baseline and/or early dates.

2) For each lowest-level activity that ended during the month, enter an actual finish date. This date often will differ from the corresponding baseline and/or early dates. For these finished activities, also enter "Complete" in the "Progress Type" column, and "100" in the "Progress Value" and "PPC" columns.

3) For each lowest-level activity that is still in progress as of the end of the status month, specify its remaining duration. To specify the remaining duration explicitly, enter "Remaining Duration" into the "Progress Type" column and enter the number of whole working days remaining as of the status date into the "Progress Value" column. To specify the remaining duration implicitly, use one of the alternative methods described in the next section.

4) For each lowest-level activity that was scheduled to start during the reporting month but did not actually start, leave its "Progress Type" as "Planned", its progress value as "0", its actual start and finish dates blank, and its PPC as "0". Open Plan will reschedule the activity according to the activity's relationships and the remaining durations of its predecessors when "time analysis" is performed.[1]

Alternative Ways to Implicitly Specify the Remaining Duration

The preferred method of specifying the remaining duration was described in step 3 above – simply enter it explicitly. Note that this method allows the possibility of directly specifying a remaining duration that exceeds the original duration of the activity. In that case you also may also want to change the original duration and/or re-spread the resources assigned to the activity.

Other Alternatives-

1) Enter the actual start date and the activity's percent complete. To do this, enter "Percent Complete" in the "Progress Type" column and enter the desired percentage in the "Progress Value" column. The remaining duration will be computed based on the

[1] If an adjustment to the original duration of an unstarted activity is desired, and you are marking up the pdf form, just write the desired duration in the original duration column. If you are entering information into the Excel sheet, the original duration cells are protected from data entry, so you should enter a comment on the activity row in the turnaround report specifying the desired duration.

original activity duration and the remaining completion percentage. Note that this is an activity completion percentage, based only on the activity duration and start/finish dates. In general it is independent of, and not necessarily equal to, the physical percent complete that is used for earned value analysis.

2) Enter the actual start date and the elapsed duration. To do this, enter "Elapsed Duration" in the "Progress Type" column and enter the duration value in whole working days in the "Progress Value" column. The remaining duration will be computed as the difference between the original duration and the elapsed duration.
3) In addition, an expected finish date for an activity can be provided for reference. This is optional.

Physical Percent Complete and PMT Codes

In all cases one must also provide the physical percent complete (PPC) for the activity. PPC is the quantity that is used by Open Plan and Cobra to compute the Budgeted Cost of Work Performed (BCWP) aka the "earned value." Note that the PPC is not necessarily the same as the activity percent complete. For example, if you have an activity that represents the fabrication of 100 identical pieces and you have fabricated 37 of them by the status date, then the PPC is 37%, irrespective of the fraction of the activity duration that might have elapsed. For such activities you should enter the units completed as of the status date into the "Units Completed" column. That number divided by the total units needed should correspond to the PPC for the task.

For labor-only activities that do not result in the production of a countable set of objects, the PPC is often just equated with the activity percent complete, but that does not have to be the case. The correct approach is to estimate the PPC as the work accomplished divided by the total estimated amount of work needed to perform the activity x 100.

While the PPC, properly calculated, is the correct measure for computing earned value, specifying it directly is sometimes a bit subjective. To remove some of that subjectivity, each lowest-level activity in Open Plan also has a performance measurement technique specified for it via a code value. The code values and their meanings are specified in Table 1. These code values, together with the status information supplied for each activity, are used by Cobra to determine the PPC it uses to compute the earned value for each reporting period, irrespective of the PPC entered on the monthly turnaround report. (Unless code C is specified for the activity, in which case Cobra uses the reported PPC.)

Table 1: Performance Measurement Technique codes specified in Open Plan and used by Cobra for earned value calculations

Code	Name	Definition
A	Level of Effort	Sets BCWP = BCWS i.e. never generates a schedule variance
C	% Complete	The activity physical percent complete is specified directly
D	Units Complete	The units complete are specified and divided by the total required units to determine PPC
E	50-50	50% of the task budget is earned at task start and the remaining 50 % at task completion; typically used only with tasks having duration less than or equal to two reporting periods
F	0-100	No budget is earned until the task is completed; typically used only with tasks having duration less than one reporting period

Table 2: Default guidelines for assigning PMTs to NOvA activities

Code	Name	Default Guideline for PMT Assignment
A	Level of Effort	Some management activities; some R&D activities, typically with longer durations and spanning a fixed length of time that will not change (e.g. spanning a fixed FY)
C	% Complete	Activity not easily matching other PMTs; Long duration tasks (> 6 mos) that use this method often have EV "milestones" specified for them up front, with each milestone corresponding to a particular PPC
D	Units Complete	A countable unit (e.g. km, widgets, gallons, etc.) can be associated with the task and the total units to be produced under the task can be specified
E	50-50	Planned activity duration is greater than 10 working days and less than or equal to 20 working days
F	0-100	Planned task duration is less than or equal to 10 working days

Special Considerations

Note that if the activity "Percent Complete" option is used to report activity progress and the reported activity completion percentage is greater than the percentage computed from the actual start date, the status date, and the original duration (i.e. the activity is ahead of schedule), then the remaining duration will be reduced by Open Plan to reflect this and the finish date will be adjusted to an earlier date during time analysis. Conversely, if the reported completion percentage is less (i.e. the activity is behind schedule), the remaining duration will be increased to reflect the delay implied by the lower reported completion percentage and the finish date will be later than the original plan. If you wish to keep the original planned finish date for such an activity even though it is apparently behind schedule, you will need to indicate that by also providing an expected finish date that is equal to the original finish date, in addition to providing the completion percentage. A comment to this effect should also be entered on the activity row in the turnaround report.

Submitting Progress Information to the Project Office

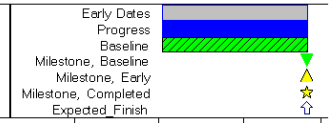
A written markup of the pdf turnaround report often is the simplest and quickest method for reporting progress information. The marked up report can be returned by snail mail, fax, or scanned and e-mailed to project scheduling personnel who will enter the information into the Excel version of the turnaround report and Open Plan.

The excel spreadsheet version of the turnaround report (see fig 2) can be completed by the CAMS if they prefer to type in progress information. It has only tabular information. The Gantt bar chart is not included in it so it may be useful to open and refer to the pdf report while completing the Excel version of the report.

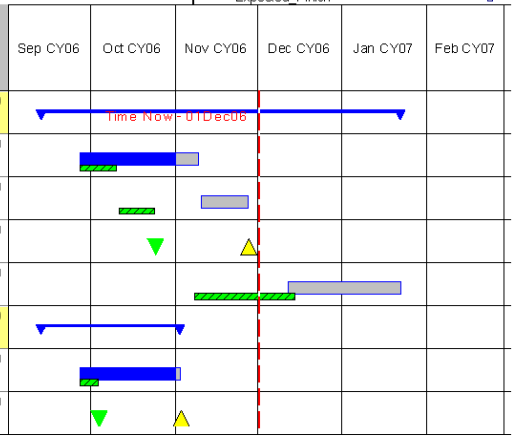
If the progress information provided by the CAMs is incomplete or ambiguous, project office scheduling personnel will contact the appropriate CAM for clarification.

Progress Study

Turnaround Report for Monthly Progress Reporting
Status Date: 12/01/2006
Sample Report



Activity ID	Activity Desc.	Original Duration	Early Dates	Baseline Dates	Progress Type	Progress Value	Actual Start	Actual Finish	Expected Finish	Physical % Complete	Total Units Completed	Total Units Needed
2	**SubProject2**	**87d**	**13Sep06 22Jan07**	**13Sep06 14Dec06**	**Remaining Duration**	**52d**	**13Sep06**			**20.00**	**0**	**0**
2.2	Task 2.2	10d	**27Sep06 09Nov06**	**27Sep06 10Oct06**	Remaining Duration	7d	27Sep06			30.00	0	0
2.3	Task 2.3	10d	**10Nov06 27Nov06**	**11Oct06 24Oct06**	Planned	0				0.00	0	0
2.4	Milestone 2	0	**27Nov06 27Nov06**	**24Oct06 24Oct06**	Planned	0				0.00	0	0
2.5	Task 2.5	25d	**12Dec06 22Jan07**	**08Nov06 14Dec06**	Planned	0				0.00	0	0
3	**SubProject3**	**37d**	**13Sep06 02Nov06**	**13Sep06 03Oct06**	**Remaining Duration**	**2d**	**13Sep06**			**86.67**	**0**	**0**
3.3	Task 3.3	5d	**27Sep06 02Nov06**	**27Sep06 03Oct06**	Remaining Duration	2d	27Sep06			60.00	0	0
3.4	Milestone 3	0	**02Nov06 02Nov06**	**03Oct06 03Oct06**	Planned	0				0.00	0	0



Project: ProgressStudy
View: NOVA_BARVW_55
Filter: Rolling_FiveMonth_Activities = [BOOL.T] and Not_Completed = [BOOL.T]
Sort:
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Enter Progress Type and Progress Value for each activity to be statused
Progress types are: Planned, Complete, Remaining Duration, Elapsed Duration, Activity % Complete
Enter Actual Start and Actual or Expected Finish Dates
Enter Physical Percent Complete

ID	Description	Orig. Duration	Early Start	Early Finish	Baseline Start	Baseline Finish	Progress Type	Progress Value	Actual Start	Actual Finish	Expected Finish	PPC	Units Completed	Total Units Needed	Activity Type
2	**SubProject 2**	**87d**	**9/13/2006**	**1/22/2007**	**9/13/2006**	**12/14/2006**	**Remaining Duration**	**52d**	9/13/2006			**20**	**0**	**0**	**Subproject**
2.2	Task 2.2	10d	9/27/2006	11/9/2006	9/27/2006	10/10/2006	Remaining Duration	7d	9/27/2006			30	0	0	ASAP
2.3	Task 2.3	10d	11/10/2006	11/27/2006	10/11/2006	10/24/2006	Planned	0				0	0	0	ASAP
2.4	Milestone 2	0	11/27/2006	11/27/2006	10/24/2006	10/24/2006	Planned	0				0	0	0	Finish Milestone
2.5	Task 2.5	25d	12/12/2006	1/22/2007	11/8/2006	12/14/2006	Planned	0				0	0	0	ASAP
3	**SubProject 3**	**37d**	**9/13/2006**	**11/2/2006**	**9/13/2006**	**10/3/2006**	**Remaining Duration**	**2d**	9/13/2006			**96.7**	**0**	**0**	**Subproject**
3.3	Task 3.3	5d	9/27/2006	11/2/2006	9/27/2006	10/3/2006	Remaining Duration	2d	9/27/2006			60	0	0	ASAP
3.4	Milestone 3	0	11/2/2006	11/2/2006	10/3/2006	10/3/2006	Planned	0				0	0	0	Finish Milestone

Status Date: December 1, 2006

Figure 1 – Turnaround report samples – Gantt Chart (left), Excel Table (right). For illustration purposes, data-entry cells have been surrounded by red borders in the excel sheet example