Fermi Research Alliance

EVMS Annual Refresher Training

April 2013

Training Purpose

- This training is provided as part of the Fermilab Office of Project Management Oversight EVMS training series.
  - Refresher of basic concepts
  - Refresher training required annually for CAMs and Project Office personnel performing EVM
  - Review issues (CARs and CIOs) identified during Surveillances/Reviews of the FRA EVMS (March 2012)
  - Attendance of this training will be recorded in Fermilab TRAIN database and become part of your training record

FRA EVMS Basics Refresher

FRA EVMS Refresher Outline

- EVMS Concepts
  - EVMS based on ANSI 748b and DOE O413.3B
  - Basic components of ANSI standard are:
    - Organization
    - Planning, Budgeting, Scheduling
    - Accounting Considerations
    - Analysis and Management Reports
    - Revisions and Data Maintenance

FRA EVMS Documents

- Fermilab projects are under FRA EVM System
  - Documentation found at http://www.fnal.gov/directorate/OPMO/PolProc/home.htm
  - System Description, 8 implementing procedures, desktop instructions

Office of Project Management Oversight
Policies and Procedures

Policies

Earned Value Management System Description

OPMO Project Management Procedures

12.PM-001	Project WBS, OBS, RAM	
12.PM-002	Control Accounts, Work Packages, Planning Packages	
12.PM-003	Work Authorization	
12.PM-004	Project Scheduling	Desktop Instructions
12.PM-005	Cost Estimating	
12.PM-006	Monthly Status Reporting	Desktop Instructions
12.PM-007	Change Control	Desktop Instructions
12.PM-008	EVMS Surveillance and Maintenance	

DOE Documents

DOE Policies, Orders, and Guides

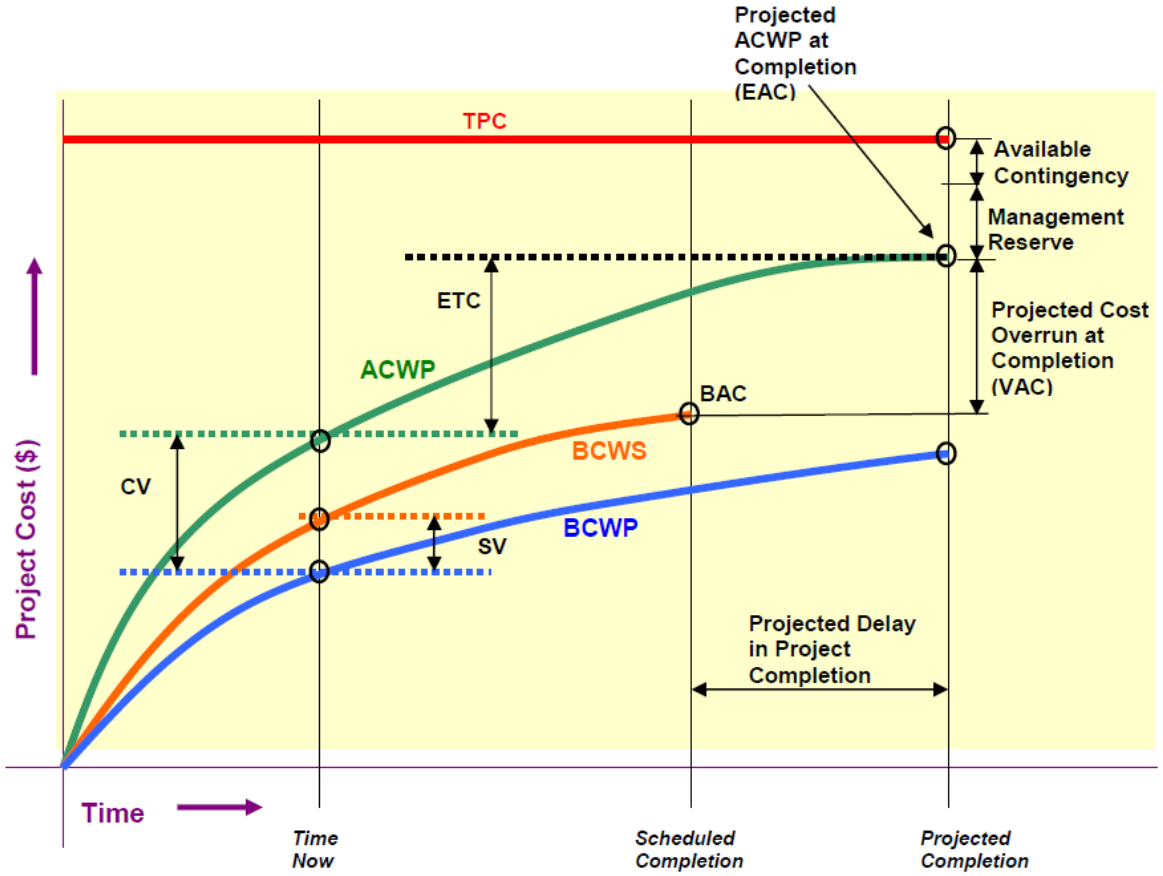
EVMS Data Elements

Performance Formulas

CV = BCWP – ACWP
SV = BCWP – BCWS

CPI = BCWP / ACWP
SPI = BCWP / BCWS

VAC = BAC – EAC



Overall Status

Percent Complete = BCWP $_{CUM}$ / BAC

Percent Spent = ACWP $_{CUM}$ / BAC (OR EAC)

Organization

Work Breakdown Structure developed with a product-oriented focus

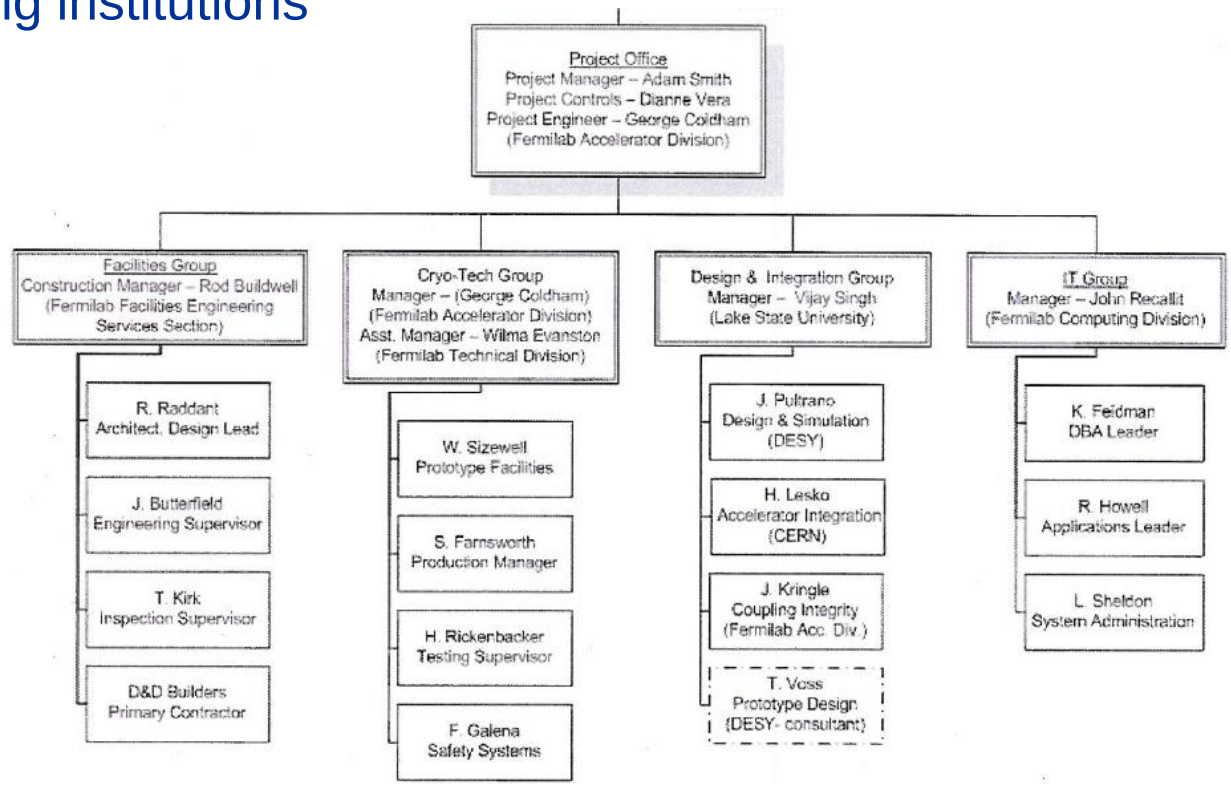
1. 3.			**Cryomodule with Quad**
1. 3. 1.	Y	25/25.1.3.1	**Cryomodule Final Design**
1. 3. 2.	Y	25/25.1.3.2	**Cryomodule Prototype (CM1)**
1. 3. 2. 1.			EDIA for CM1 Components
1. 3. 2. 2.			CM1 Dressed Cavities (8/CM)
1. 3. 2. 2. 1.			Raw Niobium for CM1 Cavity
1. 3. 2. 2. 2.			CM1 Cavity & Helium Vessel
1. 3. 2. 2. 3.			CM1 Cavity Processing
1. 3. 2. 2. 4.			CM1 Cavity Qualification
1. 3. 2. 2. 5.			CM1 Cavity Tuners
1. 3. 2. 2. 6.			CM1 Cavity Dressing
1. 3. 2. 2. 7.			CM1 Cavity Shipping & Handling
1. 3. 2. 3.			CM1 Magnetic
1. 3. 2. 3. 1.			EDIA for CM
1. 3. 2. 3. 2.			CM1 Quad &
1. 3. 2. 3. 3.			CM1 BPM
1. 3. 2. 3. 4.			CM1 Helium
1. 3. 2. 3. 5.			CM1 Current
1. 3. 2. 3. 6.			CM1 Magnet

WBS Dictionary defines the scope of each WBS element

Contained in Control Account				Proj/Task # 25/25.1.3.3
WBS Element Title				**Cavity Processing**
Assumptions	1			Cavities are fabricated by a qualified cavity vendor and are free of weld defects
	2			Cavity delivery from vendors is sufficient to always keep processing facility operational
	3			Maximum number of process cycles/cavity is three
	4			60% of the cavities receive 1 cycle, 30% 2 cycles and 10% 3 cycles
	5			BCP and EP process procedures are performed per PN-12345
Relates to Requirements		1.2.2		Linac technical design parameters
		1.5.5.6		Maximum accelerating gradient in the Linac
Scope of Work				The Scope of Work includes all activities associated with cavity processing including
	1			Receive cavities from vendors and perform QC per PN-23456
	2			Setup and perform BCP and EP cycles as defined in PN-12345
	3			Perform final HPR per PN-45678
	4			Leak check and seal cavity per PN-78910
	5			Ship sealed cavity to VTS
Deliverables	1			Cavities that are processed, sealed and ready for vertical testing
	2			Total number of cavities processed equals 320

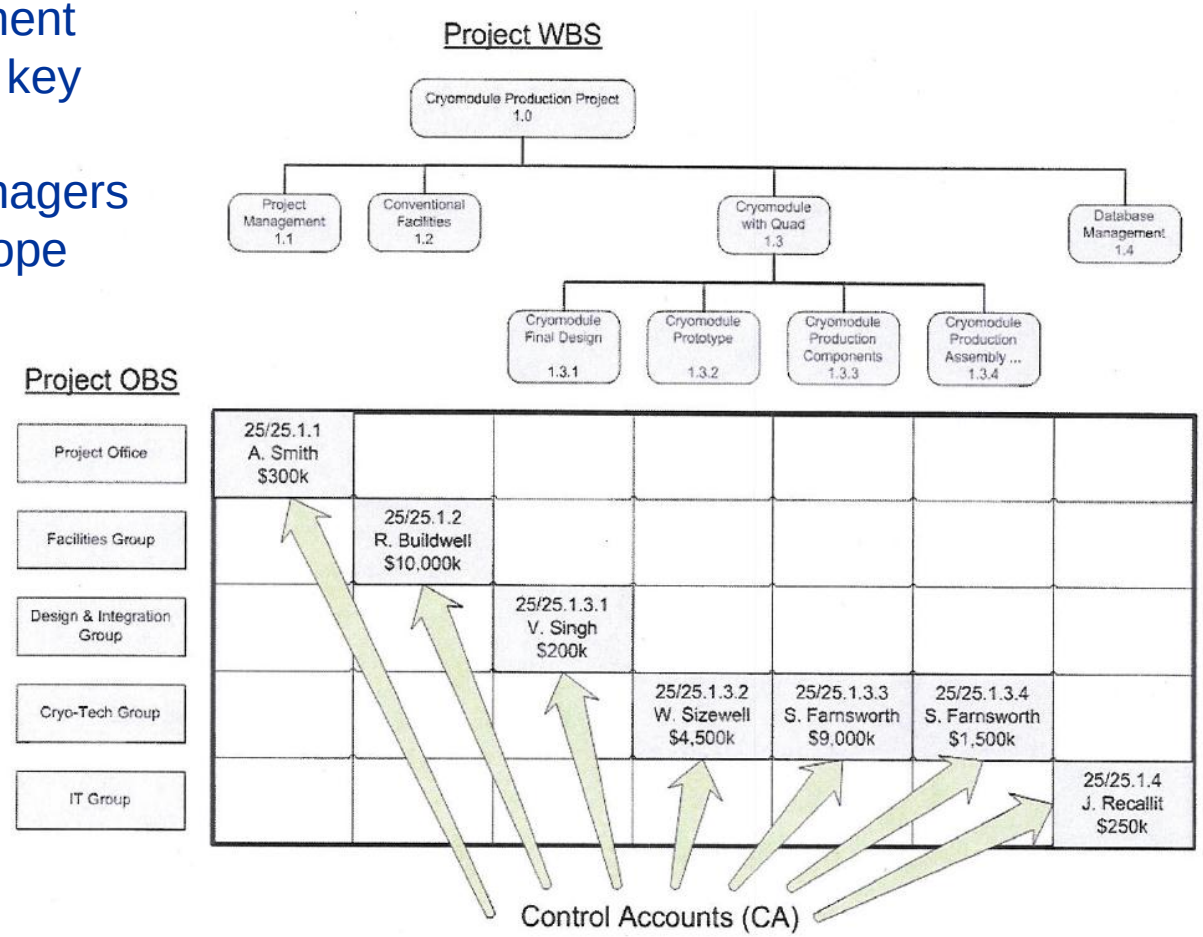
Organization

Organizational Breakdown Structure is established to ensure the project's scope of work can be efficiently managed (likely to include collaborating institutions



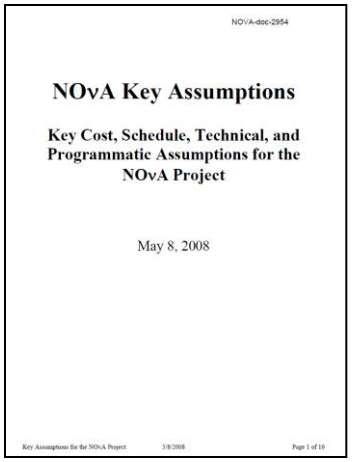
Organization

Responsibility Assignment Matrix establishes the key control points (Control Accounts) and the managers of the entire project scope



Planning, Scheduling and Budgeting

- A key part of baseline planning is establishing the project assumptions
  - This should be initially documented early in the project, and evolve as time progresses.
- Schedule development is a iterative process among the CAM, Functional Managers, Project Controls and the Project Manager
- Work packages and planning packages
  - Work should be planned into detailed planning packages where possible, otherwise, use planning packages to establish a budget, but not work details. Details are to be in BoEs.
- Risk management is an integral part of the planning process and is key driver in establishing cost and schedule management reserve and contingency
- A consistent approach should be used in developing and documenting cost estimates across a project



NOvA-doc-2954

NOvA Key Assumptions

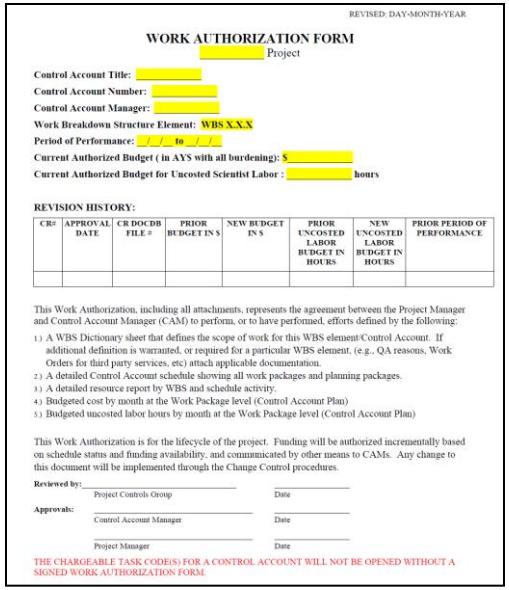
Key Cost, Schedule, Technical, and Programmatic Assumptions for the NOvA Project

May 8, 2008

Key Assumptions for the NOvA Project 5/8/2008 Page 1 of 16

Planning, Scheduling and Budgeting

- Setting a baseline
  - Establishes point at which formal change control to the cost, schedule, and technical baseline will start - Project Internal Baseline (Between CD-1/CD-2)
  - Earned value reporting to DOE must begin at CD-2 and data is uploaded to PARS II for projects ≥ $20M.
- Work Authorization
  - Work must be authorized from the Project Manager to the CAMS before it begins
  - Work authorization documentation contains
    - Scope
    - Schedule
    - Time-phased budget (Control Account Plan)
- Work sent to collaborators requires
  - Memorandum of Understanding (MOU) documenting expected institutional contributions & responsibilities
  - Statement of Work (SOW) for each fiscal year detailing work scope, resources, and costs expected to be covered by Fermilab, and executed through purchase requisition/order process



REVISED: DAY-MONTH-YEAR

WORK AUTHORIZATION FORM

_____ Project

Control Account Title: _____

Control Account Number: _____

Control Account Manager: _____

Work Breakdown Structure Element: WBS X.X.X

Period of Performance: __/__/__ to __/__/__

Current Authorized Budget (in AY$ with all burdening): $_____

Current Authorized Budget for Uncosted Scientist Labor : _____ **hours**

REVISION HISTORY:

CR#	APPROVAL DATE	CR DOCDB FILE #	PRIOR BUDGET IN $	NEW BUDGET IN $	PRIOR UNCOSTED LABOR BUDGET IN HOURS	NEW UNCOSTED LABOR BUDGET IN HOURS	PRIOR PERIOD OF PERFORMANCE

This Work Authorization, including all attachments, represents the agreement between the Project Manager and Control Account Manager (CAM) to perform, or to have performed, efforts defined by the following:

1.) A WBS Dictionary sheet that defines the scope of work for this WBS element/Control Account. If additional definition is warranted, or required for a particular WBS element, (e.g., QA reasons, Work Orders for third party services, etc) attach applicable documentation.
2.) A detailed Control Account schedule showing all work packages and planning packages.
3.) A detailed resource report by WBS and schedule activity.
4.) Budgeted cost by month at the Work Package level (Control Account Plan)
5.) Budgeted uncosted labor hours by month at the Work Package level (Control Account Plan)

This Work Authorization is for the lifecycle of the project. Funding will be authorized incrementally based on schedule status and funding availability, and communicated by other means to CAMs. Any change to this document will be implemented through the Change Control procedures.

Reviewed by:_____ _____
Project Controls Group Date

Approvals: _____ _____
Control Account Manager Date

_____ _____
Project Manager Date

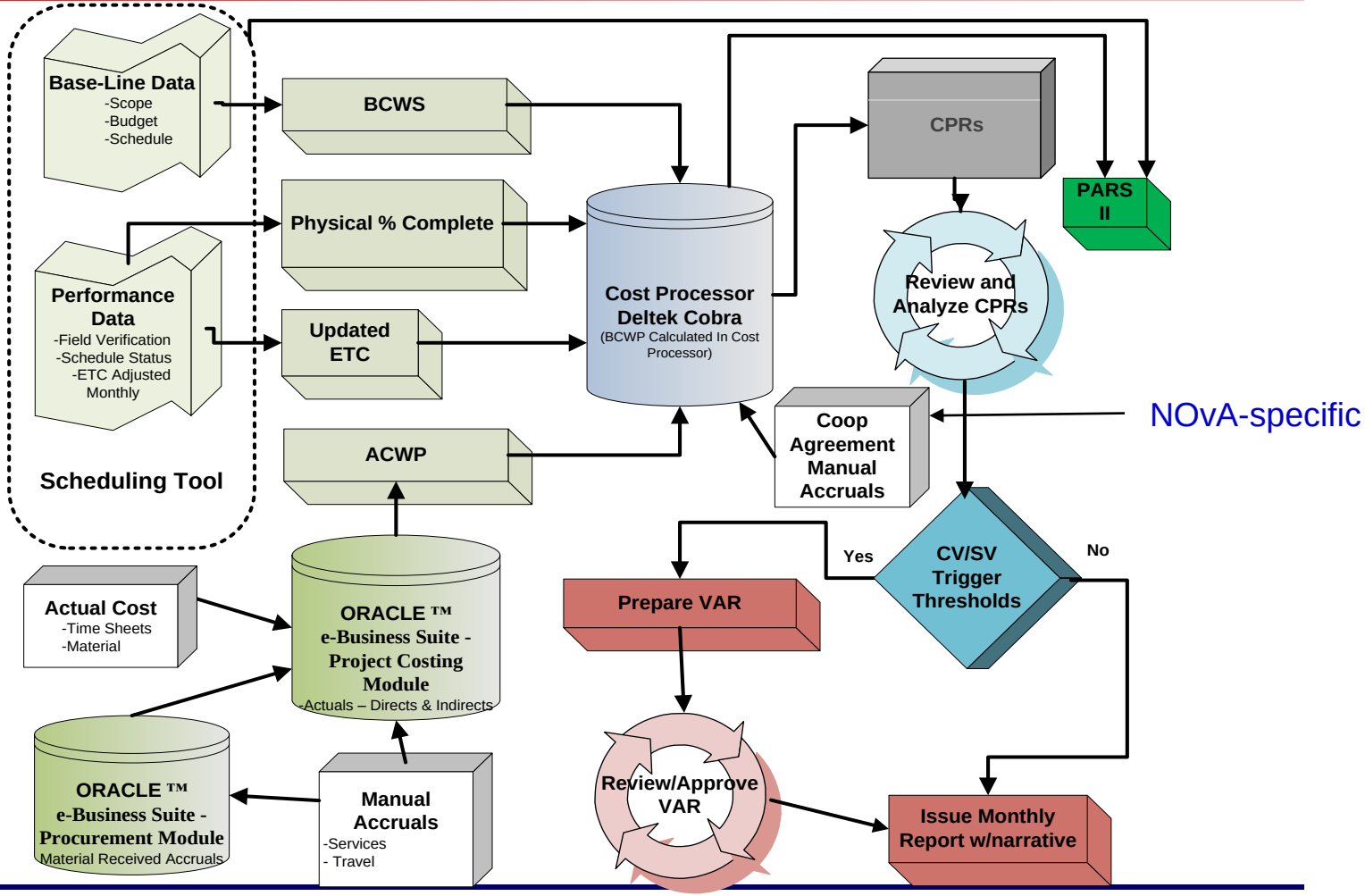
THE CHARGEABLE TASK CODE(S) FOR A CONTROL ACCOUNT WILL NOT BE OPENED WITHOUT A SIGNED WORK AUTHORIZATION FORM.

Accounting Considerations

- Fermilab's Oracle eBS (electronic Business Suite) used to collect actual costs
- Accruals done in Oracle eBS
  - Automatic for material received at Fermilab, manual for services & materials received elsewhere
- Kronos used for Fermilab labor
  - Labor at other institutions appears as M&S to Fermilab managers, but is scheduled as "labor" in the Scheduling Tool (i.e. Primavera P6, Open Plan)
- Indirects are applied in Oracle eBS
  - Rates set at least annually by CFO, adjusted at fiscal year end to reflect actual indirect costs at Fermilab, may be adjusted at interim dates
  - opportunities for pass-through rates
  - cap on indirects for large purchase orders at $500K.
- Actual hours for uncosted Scientist are collected from collaborators on spreadsheets and entered via upload to Cobra monthly
- Actual costs and hours are extracted from eBS and loaded into Cobra monthly (see upcoming graphic on Monthly Status Reporting Cycle)
  - Cobra and eBS totals are reconciled

Monthly Analysis and Management Reporting

- A reminder of the process



Cost Performance Report CPR1

- Produced monthly for CAMs and project manager
- Shows current period and cumulative performance
- Example (partial) from NOvA:

COST PERFORMANCE REPORT
FORMAT 1 - WORK BREAKDOWN STRUCTURE

CONTRACTOR	CONTRACT	PROGRAM	4. REPORT PERIOD
NAME Fermi National Accelerator Laboratory	NAME	NAME NOvA Project	FROM 01-June-2009 TO 30-June-2009

PERFORMANCE DATA

CTC-FndSrc WBS[2] Results...	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
ITEM	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
DA DOE-ACEL MIE													
2.0 ANU Construction													
Fully Burdened AY$k	376	250	106	(126)	144	1,933	1,099	921	(834)	178	31,759	31,720	39
CTC-FndSrcTotals:	376	250	106	(126)	144	1,933	1,099	921	(834)	178	31,759	31,720	39
DC DOE-CA													
2.1 Site and Building													
Fully Burdened AY$k	664	230	1,177	(434)	(947)	3,342	1,940	2,306	(1,402)	(366)	30,456	30,534	(78)
CTC-FndSrcTotals:	664	230	1,177	(434)	(947)	3,342	1,940	2,306	(1,402)	(366)	30,456	30,534	(78)
DD DOE-ACEL R&D													
1.0 ANU R&D													
Fully Burdened AY$k	310	345	117	35	229	3,921	2,905	2,592	(1,016)	313	7,863	7,609	254
CTC-FndSrcTotals:	310	345	117	35	229	3,921	2,905	2,592	(1,016)	313	7,863	7,609	254
DE DOE-DET MIE													
2.1 Site and Building													
Fully Burdened AY$k	67	67	23	0	44	466	466	136	0	331	1,930	1,430	500
2.10 Project Management - Nova Project - Construction													
Fully Burdened AY$k	76	76	51	0	25	1,022	1,022	810	0	212	6,029	5,824	205
2.2 Liquid Scintillator													
Fully Burdened AY$k	112	6	7	(106)	(1)	153	28	15	(125)	12	18,544	19,588	(1,044)
2.3 WLS Fiber													
Fully Burdened AY$k	1	14	0	13	14	5	38	0	34	38	10,084	10,957	(873)
2.4 PVC Extrusions													
Fully Burdened AY$k	20	10	0	(10)	10	336	46	0	(290)	46	25,325	24,858	467
2.5 PVC Modules													

Cost Performance Report by Control Account

- Produced monthly for CAMs and project manager
- Colors indicate threshold trigger – red requires VAR to be written
- Example (partial) from NOvA for costed resources:

Report Period: Aug-09																				
	Current Period									Cumulative										
Control Account	BCWS (AY$)	BCWP (AY$)	ACWP (AY$)	SV (AY$)	SV (%)	CV (AY$)	CV (%)	SPI	CPI	BCWS (AY$)	BCWP (AY$)	ACWP (AY$)	SV (AY$)	SV (%)	CV (AY$)	CV (%)	SPI	CPI	BAC (AY$)
R&D																				
1.0.0 ANU CDR COSTS	0	0	0	0	0%	0	0%	1.00	1.00	0	0	18,630	0	0%	-18,630	-100%	1.00	0.00	0
1.0.1 RR Upgrades	28,885	36,082	62,095	7,197	25%	-26,013	-72%	1.25	0.58	2,661,297	1,695,121	1,900,417	-966,175	-36%	-205,296	-12%	0.64	0.89	5,498,231
1.0.2 MI Upgrades	34,939	49,021	4,036	14,083	40%	44,985	92%	1.40	12.15	337,232	239,910	250,134	-97,322	-29%	-10,224	-4%	0.71	0.96	1,112,863
1.0.3 NUMI Upgrades	104,177	18,049	46,294	-86,128	-83%	-28,245	-156%	0.17	0.39	1,161,268	1,034,181	655,258	-127,086	-11%	378,923	37%	0.89	1.58	2,151,876
1.0.4 ANU Beam Physics	1,767	1,152	0	-615	-35%	1,152	100%	0.65	N/A	75,253	78,843	4,666	3,590	5%	74,176	94%	1.05	16.90	83,252
1.0.6 ANU Project Management	0	0	0	0	0%	0	0%	1.00	1.00	344,698	344,698	258,692	0	0%	86,006	25%	1.00	1.33	344,698
1.1 Site and Building R&D	0	0	0	0	0%	0	0%	1.00	1.00	2,274,519	2,274,519	1,626,970	0	0%	647,549	28%	1.00	1.40	2,274,519
1.2 Liquid Scintillator R&D	2,353	2,310	2,633	-44	-2%	-323	-14%	0.98	0.88	276,064	268,427	257,536	-7,637	-3%	10,891	4%	0.97	1.04	297,296
1.3 WLS Fiber R&D	962	0	0	-962	-100%	0	0%	0.00	1.00	339,617	313,149	297,127	-26,469	-8%	16,022	5%	0.92	1.05	340,909
1.4 PVC Extrusion R&D	18,368	7,883	84,714	-10,484	-57%	-76,831	-975%	0.43	0.09	1,347,527	1,134,800	1,505,342	-212,727	-16%	-370,542	-33%	0.84	0.75	1,368,849
1.5 PVC Module R&D	36,941	11,847	63,796	-25,094	-68%	-51,949	-438%	0.32	0.19	1,474,219	694,361	1,278,582	-779,858	-53%	-584,221	-84%	0.47	0.54	1,860,947
1.6 Electronics R&D	46,197	54,358	-21,134	8,162	18%	75,493	139%	1.18	-2.57	1,308,939	505,339	792,587	-803,600	-61%	-287,247	-57%	0.39	0.64	1,843,797
1.7 DAQ R&D	27,519	42,743	83,396	15,224	55%	-40,653	-95%	1.55	0.51	962,783	352,724	1,166,542	-610,058	-63%	-813,818	-231%	0.37	0.30	1,406,960
1.8 Detector Assembly R&D	4,891	67,650	103,099	62,760	1283%	-35,449	-52%	13.83	0.66	2,183,002	1,239,216	2,429,557	-943,786	-43%	-1,190,341	-96%	0.57	0.51	2,997,719
1.9 Project Management R&D	0	0	0	0	0%	0	0%	1.00	1.00	9,184,127	9,184,127	9,359,785	0	0%	-175,659	-2%	1.00	0.98	9,184,127
Construction																				
2.0.1.1 Recycler Ring Modifications	62,725	2,668	32,169	-60,057	-96%	-29,501	-1105%	0.04	0.08	380,947	51,006	56,055	-329,941	-87%	-5,049	-10%	0.13	0.91	8,548,382
2.0.1.2 Recycler Kicker System	45,481	25,224	12,890	-20,257	-44%	12,334	49%	0.55	1.96	895,065	180,217	132,374	-714,848	-80%	47,843	27%	0.20	1.36	8,383,974
2.0.1.3 Recycler Instrumentation	0	197,539	2,595	197,539	100%	194,943	99%	N/A	76.11	6,022	332,192	6,294	326,170	5,417%	325,898	98%	55.17	52.78	1,565,579
2.0.2.1 MI Modifications	13,796	939	0	-12,857	-93%	939	100%	0.07	N/A	98,456	160,047	184,690	61,591	63%	-24,643	-15%	1.63	0.87	387,063
2.0.2.2 MI RF Cavities	18,370	32,803	14,573	14,433	78%	18,229	56%	1.79	2.25	74,795	80,044	109,561	5,248	7%	-29,518	-37%	1.07	0.73	1,417,766
2.0.3.1 NuMI Primary Proton Beam	30,351	16,743	21,997	-13,608	-45%	-5,254	-31%	0.55	0.76	333,138	115,756	217,448	-217,383	-65%	-101,692	-88%	0.35	0.53	1,520,354
2.0.3.2 NuMI Target Hall Technical Components	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	1,731,802
2.0.3.3 NuMI Target Hall Infrastructure	35,970	0	0	-35,970	-100%	0	0%	0.00	1.00	66,801	61,662	34,677	-5,139	-8%	26,985	44%	0.92	1.78	1,679,794
2.0.3.4 NuMI Decay Pipe/Hadron Absorber/Utilities	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	986,507
2.0.4 Project Management - ANU - Construction	77,012	77,012	46,176	0	0%	30,837	40%	1.00	1.67	729,899	729,899	432,959	0	0%	296,940	41%	1.00	1.69	5,538,307
2.1.1 Site Preparation Package	89,567	1,367,433	1,457,474	1,277,866	1,427%	-90,041	-7%	15.27	0.94	2,788,393	4,405,064	4,444,799	1,616,671	58%	-39,735	-1%	1.58	0.99	11,769,937
2.1.2 Far Detector Building	465,706	693,328	375,885	227,622	49%	317,443	46%	1.49	1.84	1,747,139	2,342,784	1,169,460	585,645	34%	1,173,323	50%	1.34	2.00	20,955,138
2.1.4 Management - Site and Building - Construction	0	18,592	13,679	18,592	100%	4,913	26%	N/A	1.36	244,753	181,576	70,233	-63,177	-26%	111,343	61%	0.74	2.59	556,370
2.10 Project Management - Nova Project - Construction	72,467	72,467	42,755	0	0%	29,712	41%	1.00	1.69	1,169,894	1,169,894	918,788	0	0%	251,106	21%	1.00	1.27	6,028,557
2.2.1 Mineral Oil	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	12,685,556
2.2.2 Pseudocumene	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	1,292,777
2.2.3 Wavechifters and Stadic 426	101,090	0	0	-101,090	-100%	0	0%	0.00	1.00	332,060	0	0	-332,060	-100%	0	0%	0.00	1.00	2,245,985
2.2.4 Blending	3,525	3,525	7,476	0	0%	-3,951	-112%	1.00	0.47	25,013	25,013	22,717	0	0%	2,296	9%	1.00	1.10	753,129
2.2.6 Transport - Liquid Scintillator	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	1,462,105
2.2.8 Management - Liquid Scintillator - Construction	1,946	1,946	2,424	0	0%	-477	-25%	1.00	0.80	13,810	13,810	2,424	0	0%	11,387	82%	1.00	5.70	93,824
2.3.1 Procurement - WLS Fiber	0	20,963	0	20,963	100%	20,963	100%	N/A	N/A	0	63,411	0	63,411	100%	63,411	100%	N/A	N/A	84,374
2.3.2 Production - WLS Fiber	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	9,961,576
2.3.3 Management - WLS Fiber - Construction	906	906	0	0	0%	906	100%	1.00	N/A	6,426	6,426	0	0	0%	6,426	100%	1.00	N/A	37,646
2.4.1 Procurement - PVC Extrusions	4,765	2,721	0	-2,043	-43%	2,721	100%	0.57	N/A	18,371	10,771	0	-7,600	-41%	10,771	100%	0.59	N/A	178,697
2.4.2 Extrusion Pre-Production	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	1,177,552
2.4.3 Extrusion Production	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	21,790,938

Cost Performance Report at Customer Reporting Level

- To be included in monthly report
- Colors indicate threshold trigger
- Example from NOvA (WBS L2) for costed resources:

Report Period: Jun-09														
	Curent Period							Cumulative						
WBS Level 2	BCWS (AY$)	BCWP (AY$)	ACWP (AY$)	SV (AY$)	SV (%)	CV (AY$)	CV (%)	BCWS (AY$)	BCWP (AY$)	ACWP (AY$)	SV (AY$)	SV (%)	CV (AY$)	CV (%)
R&D														
1.0 ANU R&D	310,369	353,815	124,333	43,445	14%	229,482	65%	4,233,200	3,191,938	2,762,635	-1,041,262	-25%	429,302	13%
1.1 Site and Building R&D	0	0	3,925	0	0%	-3,925	-100%	2,274,519	2,274,519	1,638,963	0	0%	635,556	28%
1.2 Liquid Scintillator R&D	0	0	15,518	0	0%	-15,518	-100%	271,245	263,551	241,258	-7,694	-3%	22,293	8%
1.3 WLS Fiber R&D	10,934	5,866	10,545	-5,068	-48%	-4,679	-80%	337,692	313,149	297,127	-24,544	-7%	16,022	5%
1.4 PVC Extrusion R&D	29,435	71,385	45,150	41,950	143%	26,235	37%	1,286,072	1,069,567	1,143,714	-216,505	-17%	-74,147	-7%
1.5 PVC Module R&D	30,081	54,308	45,120	24,226	81%	9,187	17%	1,390,153	673,307	1,132,406	-716,846	-52%	-459,099	-68%
1.6 Electronics R&D	156,635	25,605	150,594	-131,030	-84%	-124,989	-488%	1,126,168	449,127	730,462	-677,041	-60%	-281,335	-63%
1.7 DAQ R&D	155,720	24,126	81,512	-131,593	-85%	-57,385	-238%	834,048	261,621	1,020,368	-572,426	-69%	-758,746	-290%
1.8 Detector Assembly R&D	261,308	66,551	179,189	-194,757	-75%	-112,638	-169%	2,004,466	1,144,490	2,262,902	-859,976	-43%	-1,118,412	-98%
1.9 Project Management R&D	0	0	0	0	0%	0	0%	9,184,127	9,184,127	9,359,785	0	0%	-175,658	-2%
Construction														
2.0 ANU Construction	376,171	250,046	105,661	-126,125	-34%	144,385	58%	1,932,996	1,099,212	920,862	-833,784	-43%	178,350	16%
2.1 Site and Building	731,573	297,128	1,199,990	-434,445	-59%	-902,862	-304%	3,808,256	2,406,618	2,442,185	-1,401,638	-37%	-35,567	-1%
2.10 Project Management - Nova Project - Construction	75,918	75,918	51,269	0	0%	24,649	32%	1,021,510	1,021,510	809,802	0	0%	211,708	21%
2.2 Liquid Scintillator	111,636	5,732	7,152	-105,904	-95%	-1,419	-25%	152,686	27,620	15,241	-125,066	-82%	12,379	45%
2.3 WLS Fiber	949	13,527	0	12,578	1326%	13,527	100%	4,571	38,112	0	33,541	734%	38,112	100%
2.4 PVC Extrusions	19,906	9,701	0	-10,205	-51%	9,701	100%	336,104	45,976	0	-290,129	-86%	45,976	100%
2.5 PVC Modules	15,879	15,879	38,240	0	0%	-22,361	-141%	115,642	115,642	38,240	0	0%	77,402	67%
2.6 Electronics	826	826	879	0	0%	-53	-6%	3,982	3,982	879	0	0%	3,103	78%
2.7 DAQ	235	235	0	0	0%	235	100%	1,128	16,983	0	15,855	1405%	16,983	100%
2.8 Near Detector Assembly	1,774	1,774	0	0	0%	1,774	100%	96,250	84,160	46,427	-12,090	-13%	37,733	45%
2.9 Far Detector Assembly	10,939	10,939	26,997	0	0%	-16,057	-147%	267,041	83,030	36,357	-184,012	-69%	46,672	56%
R&D SubTotal (WBS 1.0-1.9)	954,482	601,656	655,886	-352,826	-37%	-54,230	-9%	22,941,690	18,825,396	20,589,619	-4,116,294	-18%	-1,764,223	-9%
Construction SubTotal (WBS 2.0-2.10)	1,345,807	681,705	1,430,187	-664,102	-49%	-748,482	-110%	7,740,168	4,942,845	4,309,993	-2,797,323	-36%	632,851	13%
Project Total	2,300,288	1,283,361	2,086,073	-1,016,927	-44%	-802,713	-63%	30,681,858	23,768,240	24,899,613	-6,913,618	-23%	-1,131,372	-5%

Variance Analysis
Control Account Reporting Thresholds

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.

- Apply at Control Account level
- Red trigger requires variance analysis report to be written
- Default thresholds – more restrictive thresholds can be used with customer and senior management approval

Variance Analysis
Customer Reporting Thresholds

Customer Variance Analysis Report Thresholds		
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 ≥ $125K
	Cumulative	≥ ± 5% to < ± 10% and ≥ $250K
Hours	Current Period	≥ ± 5% to < ± 10% and ≥ 875 hrs
	Cumulative	≥ ± 5% to < ± 10% and ≥ 1750 hrs
Red Thresholds		
Cost Variance Schedule Variance	**Type**	**Threshold limit**
Dollars	Current Period	≥ ± 10% and ≥ $250K
	Cumulative	≥ ± 10% and ≥ $500K
Hours	Current Period	≥ ± 10% and ≥ 1750 hrs
	Cumulative	≥ ± 10% and ≥ 3500 hrs

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

- Apply at project/customer determined level – NOvA is WBS L2
- Red trigger requires variance analysis report to be written
- Default thresholds – more restrictive thresholds can be used with customer and senior management approval

Variance Analysis Reports (VAR)

- To be written when red threshold is triggered
- VARs to be reviewed by Project Manager and iterated if necessary
- VARs to be signed by the CAM as the Prepare and Approved by the Project Manager in a timely manner **(VARs to be approved by end of monthly cycle – i.e. VAR on Oct data to be approved by end of Nov)**
- Corrective actions to be reviewed at project meetings (with all CAMs to look for impacts across separate Control Accounts)
- Corrective Action Log to be statused regularly **(i.e. monthly)**

VARIANCE REPORT CORRECTIVE ACTION LOG

ID#	Control Account (CA) #	FOR REPORT MONTH/YR		APPROVAL DATE	CLOSED DATE	RESPONSIBILITY (CAM)
1	1.0.1	Oct-08	None needed. In future, will work with Project Controls office to schedule accruals to mitigate variance effects.	2-Jan-09	17-Mar-09	Derwent
2	1.0.2	Oct-08	The CAM had an extensive talk with the level 4 managers about the importance of using the correct codes for effort reporting. We are taking every effort to communicate to everyone working for the project what appropriate codes to use. There was no incorrect effort reporting in October. The CAM also will be looking at the monthly effort reports now available to check that people are reporting their efforts correctly.	22-Dec-08	17-Mar-09	Kourbanis
3	1.0.3	Oct-08	The labor efforts under Control Account 1.0.3 will continued to be monitored to determine if the over estimates of labor remain consistent. If so, the estimates for future tasks can be reviewed.	16-Dec-08	17-Mar-09	Martens
4	1.0.4	Oct-08	The CAM will monitor these tasks knowing that the schedule and cost variances should eventually come within the limits, and are not (presently) indicative of true progress.	16-Dec-08	17-Mar-09	Zwaska
5	1.0.5	Oct-08	We will correct the ~thousand dollars of incorrect charges in FY09. We can not correct the inccorect charges in past FY's and thus most of this variance will remain. I have sent out e-mail to all the people working on this project speaking to the importance of using the correct codes for effort reporting. I have clarified with people the items that are considered "management" and should be charged to the 2.0.4 code (1.0.5 is now closed).	29-Dec-08	17-Mar-09	Derwent
6	1.2	Oct-08	The IU SOW will soon be in place and this work will take place starting in the second quarter of FY09. Since this work took only 1/2 time tech hours, 1.2 can catch up with the most of the planned work by the end of the June 30, 2009.	20-Dec-08	17-Mar-09	Mufson

Variance Analysis Report Example

By Control Account →

Explanation addresses triggered variances →

Provides corrective action →

CLASSIFICATION (When Filled In)

CONTRACT PERFORMANCE REPORT

FORMAT 5 - EXPLANATIONS AND PROBLEM ANALYSES

FORM APPROVED
OMB No. 0704-0188

1. CONTRACTOR	2. CONTRACT		3. PROGRAM	4. REPORT PERIOD
a. NAME Fermi National Accelerator	a. NAME		a. NAME NOvA Project	a. FROM (YYYYMMDD) 2009/02/01
b. LOCATION (Address a Batavia, Illinois	b. NUMBER		b. PHASE	b. TO (YYYYMMDD) 2009/02/28
	c. TYPE	d. SHARE RATIO	c. EVMS ACCEPTANCE (YYYYMMDD NO X YES	

1.0.3 NUMI Upgrades

	BCWS	BCWP	ACWP	SV in $	SV in %	CV in $	CV %	SPI	CPI
Current:	238,849	20,992	31,614	-217,857	-91%	-10,622	-51%	0.09	0.66
Cumulative	411,941	771,482	426,192	359,540	87%	345,290	45%	1.87	1.81
	BAC	EAC	VAC in $	VAC in %	CPI to BAC	CPI to EAC			
At Comple	2,118,285	1,761,275	357,010	17%	0.80	1.01			

Thresholds Exceeded: Current Period Schedule, Current Period Cost, Cumulative Schedule, Cumulative Cost

Explanation of Schedule Variance:

In December 2008 the NOvA project was rebaselined to start in Febuary 2009 with the expectation that funding would be restored by the US Congress at that time. In the summer of 2008 a supplemental appropriations bill provided funding for the NOvA project earlier than expected but the project was not rebaselined. With funding and resources available, work began within control account 1.0.3 ahead of schedule. Begining work early helps mitigate NOvA risk #95 (see Nova docdb 2841) which is the potential lack of Accelerator Division personnel. Therefore the work is cumulatively ahead of schedule.

Starting in February 2009, the amount of scheduled work for the month was greater than the amount actually performed for the month, but there still remains a cumulative positive schedule variance. The plot (seen below) of the BCWP and ACWP shows that we have not ramped up the pace of work on control account 1.0.3 to match the start of the basline schedule.

Explanation of Cost Variance:

The cost variance has been steadily growing and is due to a systematic over estimate of the manpower needed to complete the tasks. The plot (seen below) shows that the CPI has consistently remained between about 1.7 and 2.1.

Corrective Action:

To address the schedule progress the CAM for 1.0.3 will work with the support departments and Level 4 managers to make sure that labor resources are assigned to the upcoming tasks. To address the cost variance, the best choice is to revise the estimate at completion (EAC) downward by $300k to $1.82M.

Monthly Summary (to include technical causes of VARs, Impacts) and Corrective Action(s):

The tasks under Control Account 1.0.3 are ahead of schedule, but the recent pace of progress has not kept up with the scheduled pace. The task are under budget since there has been a systematic over-estimate of the manpower requirements. The CAM for 1.0.3 will work to make sure resources are assigned to the upcoming tasks and recommends revising the EAC from $2.11M to $1.81M.

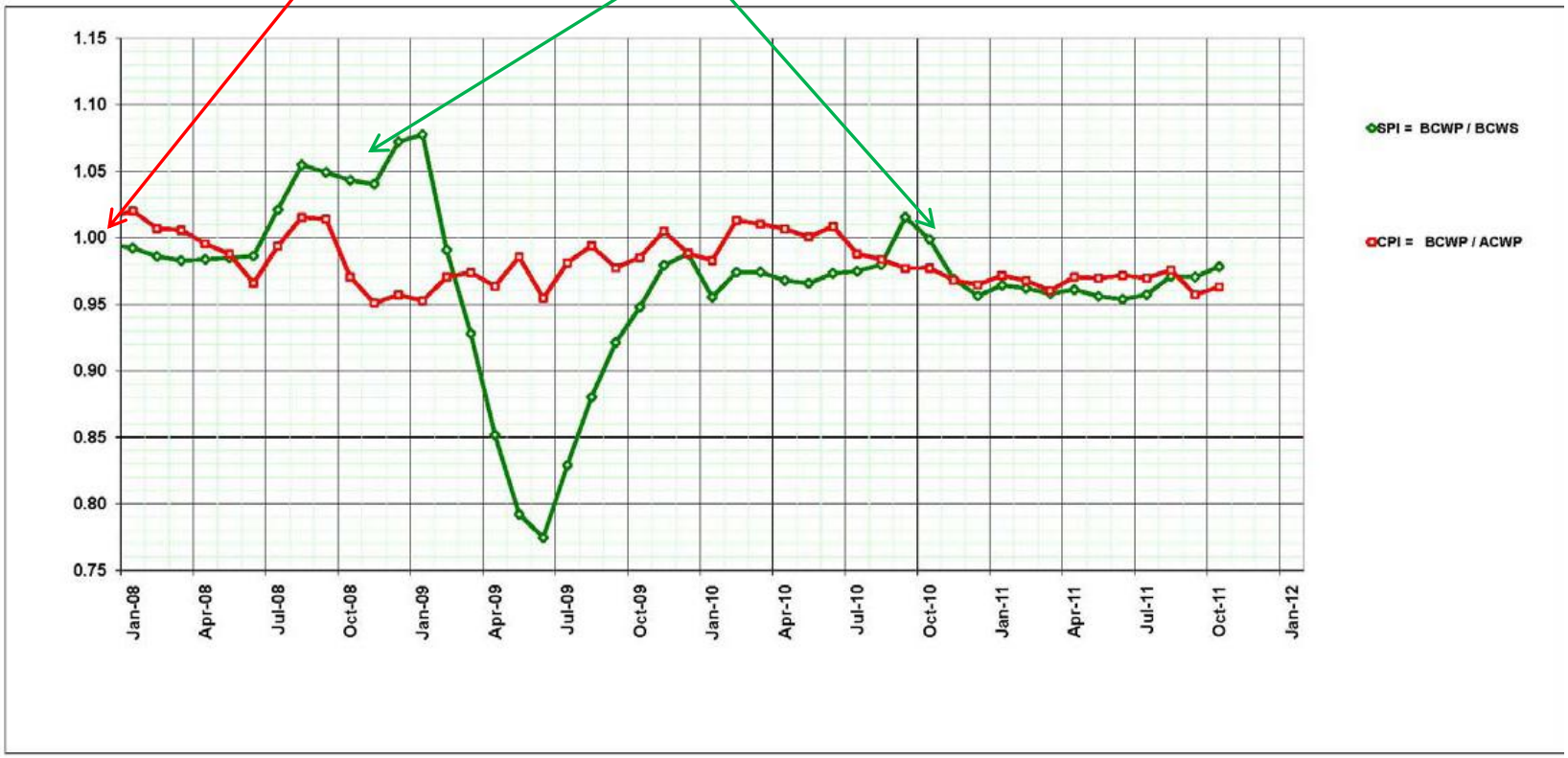
Prepared by:	Date:	Approved by:	Date:
Mike Martens	03/25/09		

Other Useful EV Chart

SPI/CPI Trend Chart

Around 1.0 – good!

Trending upward or downward – warning!



Monthly Reports

- Monthly project reports must include earned value information
- Earned value information to be included:
  - Status of key milestones
  - Progress narrative
  - Baseline change control log actions
  - Project management comments
  - EVMS data
  - Variance explanations (if required)
- Narratives may be included to provide more information about the project
- Monthly Reports to be issued timely **(Oct Report issued by end of Nov)**

Estimate to Complete/Estimate at Completion

- Provides a forecast by the project manager and CAMs of cost of the project at completion

Est. At Comp. | Act. Cost of Work Perf. | Est. To Comp.

- EAC = ACWP + ETC
  - ETC is a <u>forecast.</u> There are multiple ways to forecast
    - Calculated method results can be used as reference for ETC/EAC analysis.
    - Manual method, calculated at the work package level, based on specifying remaining quantities/costs on each lowest-level activity.
- In some cases EAC forecast changes may become baseline changes

EAC/ETC Process Summary

- EAC/ETC changes are a forecast
- CAMs are to ensures that the EAC continuously reflects a valid projection of project costs. 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.
- When substantive changes to the ETC appear on the horizon, CAMs submit the necessary changes to the PM for approval and for subsequent incorporation into the working/forecast schedule and Cobra by Project Controls. ETC changes may also be initiated directly by the Project Manager.
- On at least an annual basis, the project manager will request that all CAMs review their ETC, and submit a detailed, bottoms-up estimate for the remaining work to establish a new EAC

Revisions and Data Maintenance (Change Control Process)

- Changes are only done on work in the future, not to change past performance
- Change Control Thresholds are project specific
  - High level thresholds (DOE's) are identified in the Project Execution Plan (PEP).
  - Lower level thresholds (FRA's) are identified in the Project Management Plan (PMP)
- NOvA example

DOE THRESHOLDS FRA THRESHOLDS

	Secretarial Acquisition Executive (Level 0-A) Deputy Secretary	Acquisition Executive (Level 0-B) SC-1	Associate Director OHEP (Level 1)	DOE NOvA Federal Project Director (Level 2)	Fermilab Associate Director (Level 3)	NOvA Project Manager (Level 4)	Subproject Manager (Level 5)
Technical	A change in scope that affects the ability to meet a Key Performance Parameter (KPP) and the ability to satisfy the mission need.	A change in scope that affects the ability to meet a KPP and the ability to satisfy the mission need.	Any change in the KPPs as referenced in PEP section 3.2.	Any significant change to the technical scope (as described in PEP sect. 5) that affect ES&H requirements or meeting Project Closeout definitions in PEP Table 7.2.	Major technical changes that are significant departures from the technical baseline. Changes that affect ES&H or impact PoT projections by more than 10%. Out-of-scope changes to upgrade physics capabilities.	Related technical changes to multiple subprojects that do not diminish performance	Minor technical changes to a single subproject that does not diminish performance
Schedule	≥ 6 month (cumulative) delay in the CD-4 completion date.	a 3 to 6 month (cumulative) delay in the CD-4 project completion date.	Any change to a level 1 milestone > 3 months, or up to a 3 month delay in CD-4 project completion date .	Any change to a Level 2 milestone > 1 month or a Level 1 milestone < 3 months.	Any change that results in the delay of a Level 3 Director's milestone.	Any change that results in the delay of a Level 4 milestone by more than one month.	Any change that results in the delay of a Level 5 milestone by more than one month
Cost	Increase in excess of $25M or 25% (cumulative) of the CD-2 Total Project Cost baseline.	Any increase in the CD-2 Total Project Cost baseline.	Any change in Total Estimated Cost or Total Project Cost.	Any cumulative use of contingency of > $1M.	Increase in the cost of a single item by more than $250k. Increase in the Project base cost exceeding $500k during the previous 12 months.	Increase in the cost of a single item by more than $100k.	Increase in the cost of a single item by more than $25k.

Revisions and Data Maintenance (Change Control Process)

- Changes must be documented and approved
- Work Authorizations are updated after baseline changes
- Change logs are used to track and report change history, as well as management reserve and available contingency

CR#	WBS	Description of Change	Date	Level	Cost Impact	Schedule Impact	From Contingency or Mang Res Funds	Approval Status
001								
002								
003								
004								
005								
		Total Cost of Changes			0			

Original Baseline Management Reserve	0
Changes	0
Remaining Management Reserve	0
Original Baseline Contingency	0
Changes	0
Remaining Contingency	0

Key to Implementing a EVMS

Timeliness

- Progressing/Forecasting
- Analysis
- Corrective Action
- Change Control
- Reporting

Internal Surveillance/Review
March 2012
CARs and CIOs

Deficiencies Identified

- 5 - Corrective Action Reports (CARs)
- 5 - Continues Improvement Opportunity (CIOs)

CAR01 - Estimate at Completion is not Utilized/Understood/owned by CAM

- The CAMs continue to have difficulty understanding and taking full ownership of the EAC calculations based on responses during the CAM interviews. Some CAMs EAC were directly impacted by the problems with accruals. A similar CAR was written during the 2011 EVMS Surveillance Review identifying the same issue which has not been corrected as of this 2012 EVMS Surveillance Review.

CAR02 – Implementation of Change Requests

- Change Requests are being implemented in the baseline prior to final approval. Administrative changes not part of CR process e.g. CAM change. The full cost/schedule impact from the proposed change request is not fully documented in the change request documentation package. A similar CAR was written during the 2011 EVMS Surveillance Review identifying the same issue which has not been corrected as of this 2012 EVMS Surveillance Review.

CAR03 - Timing of VARs and Quality needs improvement

- The quality and timeliness in preparation and approval of the Variance Analysis Reports (VARs) are not adequate for providing effective analysis of cost and schedule variances for proper use by the CAMs and project management. Explanations and Corrective Actions need improvement and the CAMs need to improve their understanding of the trends and how to develop corrective actions. A similar CAR was written during the 2011 EVMS Surveillance Review identifying the same issue which has not been corrected as of this 2012 EVMS Surveillance Review.

CAR 04 - Objective Measurement of EV for % complete method

- The use of percent complete for performance measurement is subjective per the CAMs for many activities particularly activities with durations of longer than two months. While Peg Points are used they are not providing objective performance measurement. A similar CAR was written during the 2011 EVMS Surveillance Review identifying the same issue which has not been corrected as of this 2012 EVMS Surveillance Review.

CAR05 – Schedule Integrity

- The NOvA Project Schedule contains open relationships, constraints, lags and based on some CAM interviews, the CAMs did not seem to "own" the schedule, in particular, they were not sure why constraints were used in the schedule. A CIO was written during the 2011 EVMS Surveillance Review Schedule identifying some of the same scheduling related issues which have not been fully resolved as of this 2012 EVMS Surveillance Review.

CIO-01* Accrual Procedure needs clarification

- The Accrual procedure is inconsistent in providing valid estimates of current cost incurred. The CAMs need to be held responsible for accruals to ensure the actual cost of work performed and the estimate at completion are both accurately represented in the monthly reports.

** CIO Requires a corrective action plan.*

CIO-02* - Corrective Action Log not used effectively

- A corrective action log has been created which tracks corrective actions required stated in the variance analysis reports. Improvements are needed to provide effective tracking of the identified corrective actions to close. There has been progress made in this area (from the last review) but additional improvement is needed

** CIO Requires a corrective action plan.*

CIO-03* - Major subcontractors should be included in OBS

- The Organizational Breakdown Structure needs to identify major subcontracts that are performing the work. A determination is needed as to what constitutes a major subcontract.

** CIO Requires a corrective action plan.*

CIO-04* Additional CAM Training

- CAM Training is still needed in a variety of process areas within EVMS, in fact a more comprehensive approach is recommended. A few examples include: Opening/Closing process for CA, Terminology e.g. EAC, WAD, CAP, and the use and purpose of the Corrective Action Log. This list is not an inclusive list.

** CIO Requires a corrective action plan.*

CIO-05 – Disclosure Statement Is Not Current

- Disclosure Statement has not been updated by recent DOE change in capitalization threshold to $500K.