FRA
Earned Value Management System
Overview

May 11, 2009

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Presentation Outline

- EVMS History at the Lab
- FRA EVM System and Documents
- EVMS Process
- Topics for Clarification from Readiness Assessment
- Summary

Earned Value History

- EV has been performed at some level since the Main Injector Project in the 1990s.
- A standard Cost Processing Tool (Cobra) was selected and used to support EVM on the NuMI Project starting in 1998.
- Each project had their own EVMS process and procedures but used Cobra as the cost processer.
- 1st Draft of Fermilab EVMS Description was generated in 2006, no implementing procedures at that time
- The FRA System Description and Implementing Procedures were approved for use 17 October 2008
- NOvA is the first project to implement the FRA EVMS and represents a typical project at Fermilab. NOvA's implementation of the FRA System started in October 2008.

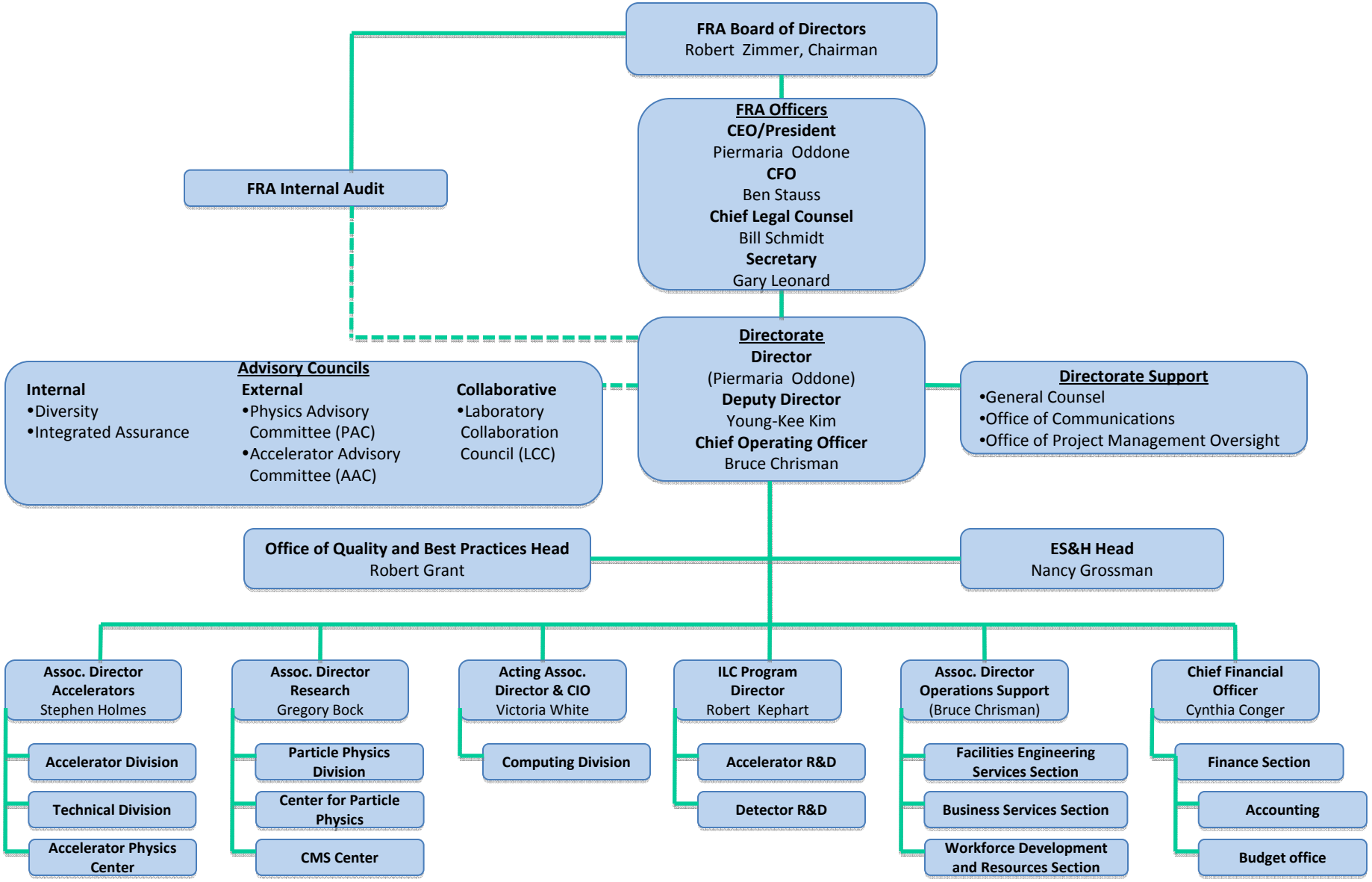
FRA EVMS Documents

- EVMS Documents
  - FRA Earned Value Management System Description
  - 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
  - 12.PM-005 Cost Estimating
  - 12.PM-006 Monthly Status Reporting
  - 12.PM-007 Change Control
  - 12.PM-008 EVMS Surveillance & Maintenance
- Ownership
  - Office of Project Management Oversight (OPMO) - responsible for maintaining the EVMS and maintaining interfaces with existing Fermilab business and management systems
  - Office of Quality and Best Practices (OQBP) - responsible for surveillance of the EVMS to ensure Lab adherence to the approved certified system

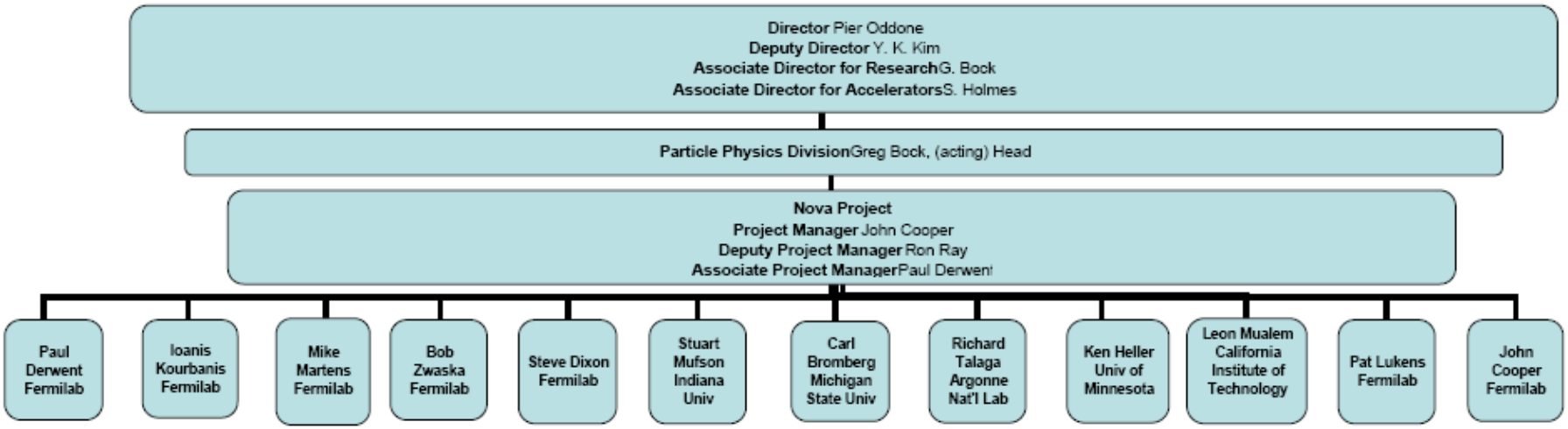
Primary Project Management Tools

- Accounting
  - ➢ Oracle's e-Business Suite - Project Costing Module - aka Project Accounting (PA)
- Scheduling
  - ➢ Deltek Open Plan & Microsoft Project
- EV Cost Processor
  - ➢ Deltek Cobra

Fermi Research Alliance (FRA) Organization



NOvA Project's Organization



FRA EVMS

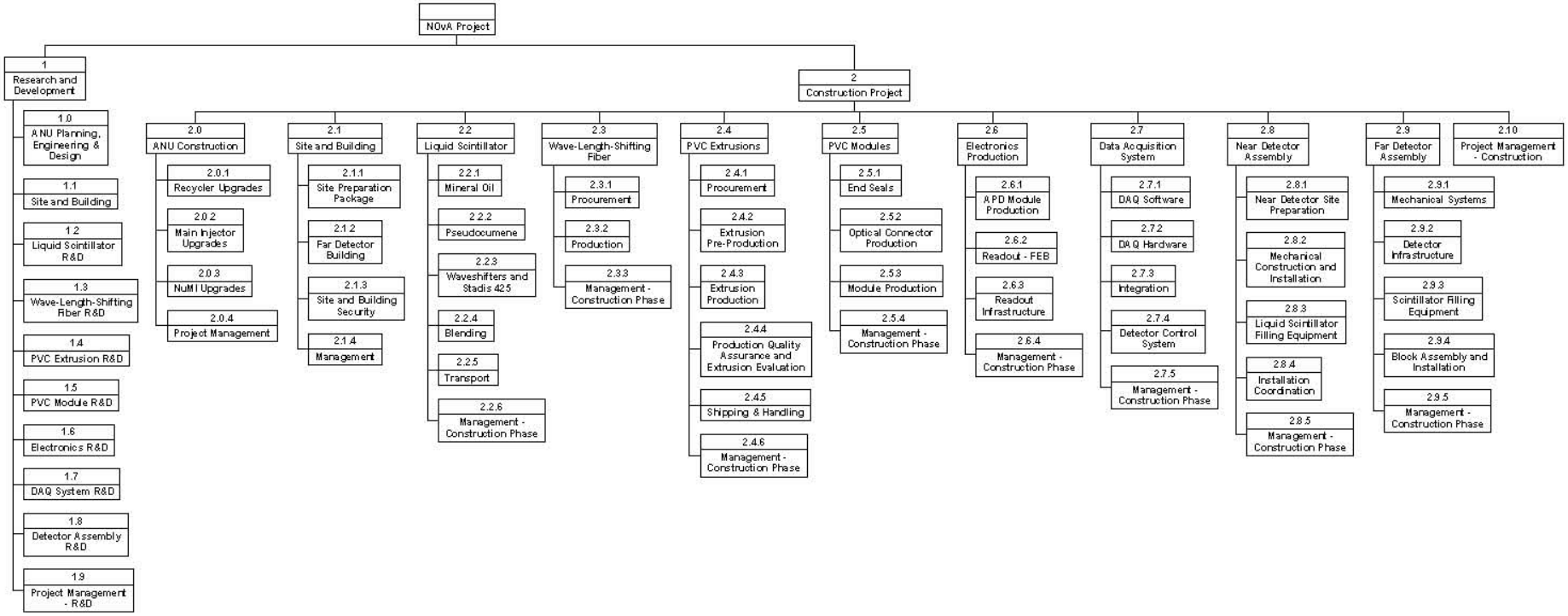
- Consistent with ANSI/EIA-748 Standard for Earned Value Management Systems
  - Organization
  - Planning, scheduling and budgeting
  - Accounting considerations
  - Analysis and management reports
  - Revisions and data maintenance
- Crosswalk between ANSI/EIA748 and the System Description / Implementing Procedures is in Appendix A of System Description

Organization

- Work Breakdown Structure developed with a product-oriented focus
- WBS Dictionary defines the scope of each WBS element
- Organizational Breakdown Structure is established to ensure the project's scope of work can be efficiently managed
- Organization is likely to include collaborating institutions (universities and/or laboratories) within and outside of the USA
- Responsibility Assignment Matrix establishes the key control points and the managers of the entire project scope

NOvA WBS

(high level)



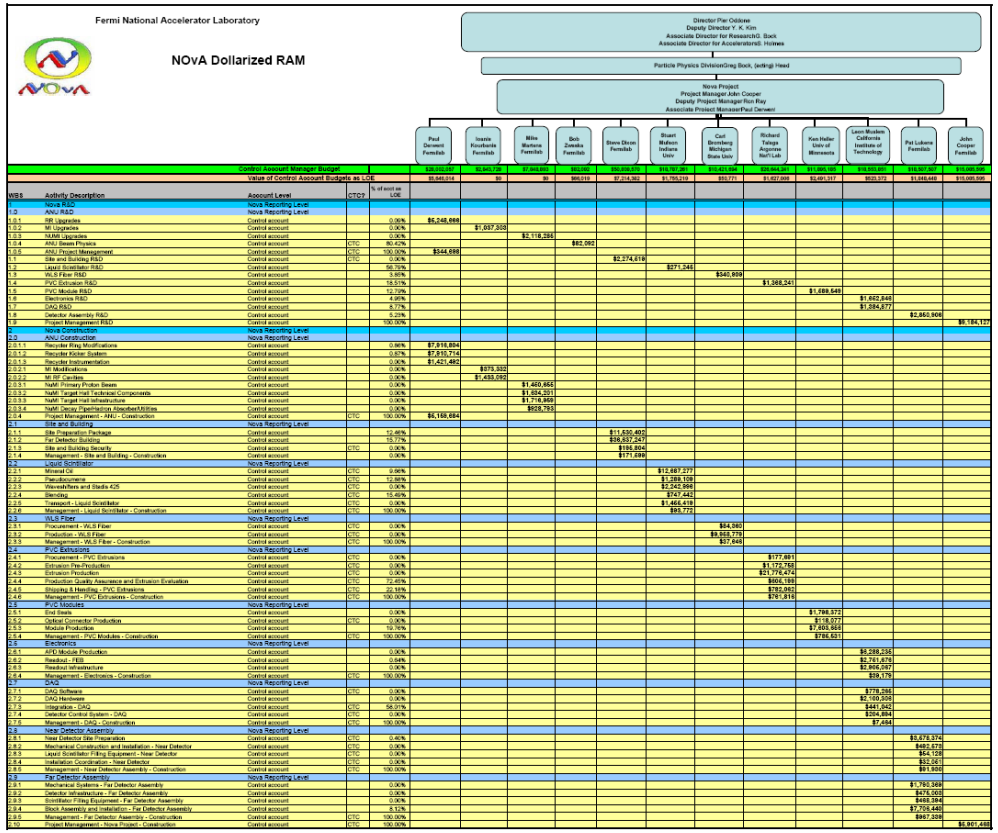
Dollarized RAM (12 CAMs)

- **67 Control Accounts, 12 CAMs**
  - **All CAMs are L2 in WBS except Accelerator WBS L2 divided into 4 L3s**

- Derwent -- $ 28.0 M
- Kourbanis- $ 2.8 M
- Martens --- $ 7.8 M
- Zwaska --- $ 0.1 M

CAMs are at WBS L3

- Dixon ------ $ 50.8 M
- Mufson ---- $ 18.8 M
- Bromberg - $ 10.4 M
- Talaga ----- $ 26.6 M
- Heller ----- $ 11.9 M
- Mualem --- $ 18.6 M
- Lukens ---- $ 18.5 M
- Cooper ---- $ 15.1 M



Planning, Scheduling and Budgeting

- A key part of baseline planning is establishing the project assumptions
- Schedule development is a iterative process among the CAM, Functional Managers, Project Controls and the Project Manager
- Work Packages and Planning Packages
  - We have not utilized Planning Packages in the past. The FRA System allows for both. We anticipate using Planning Packages on future projects.
- Risk Management is an integral part of the planning process and is key driver in establishing cost and schedule contingency
- A consistent approach is used in developing and documenting cost estimates
- Work Authorization
  - External Work Authorization - DOE to FRA
    - Difference between Line Item and Major Item of Equipment (MIE) Projects
      - Line items authorized by directives
      - MIE authorized by Financial Plan Guidance and achieving Critical Decisions
    - NOvA is an MIE Project
  - Internal Work Authorization -Project Manager to CAMs

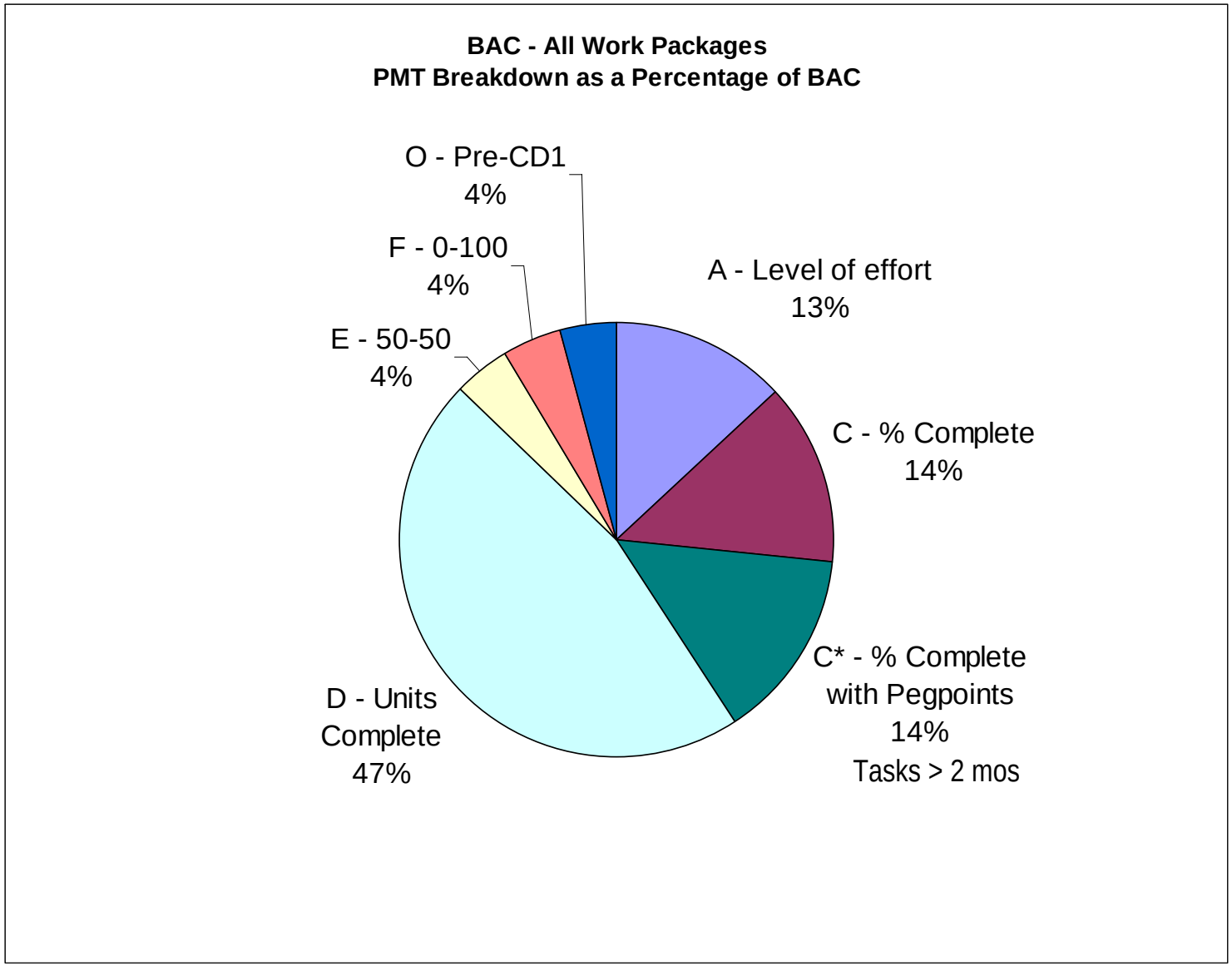
Planning and Scheduling Process

- NOvA uses Open Plan, the schedule has ~ 5,000 tasks and milestones
- **Scheduling Guidelines given to CAMs:**
  - Instructed by the Project Manager to provide best estimates for the duration of every task
  - There should be no hidden contingency in the schedule
  - Tasks with schedule uncertainty should have estimated cost contingency designed to speed up the work commensurate with the risk
    - We do have ~250 documented risks and a Risk Registry
- See **NOvA Key Assumptions** document (NOVA-doc-2954) for more details
  - This also has cost assumptions:
    - estimating instructions, labor cost assumptions, materials & services cost assumptions, escalation assumptions, cost guidance from DOE (funding profile), indirect cost assumptions at universities
  - Other key technical assumptions:
    - expectations from other Fermilab efforts assumed as pre-requisites to NOvA, risk of PVC structure,…
  - **Other scheduling guidelines:**
    - critical path guidance, assumed CD dates, assumptions about the Fermilab operating schedule since NOvA installation must fit within periodic shutdowns

Schedule Development

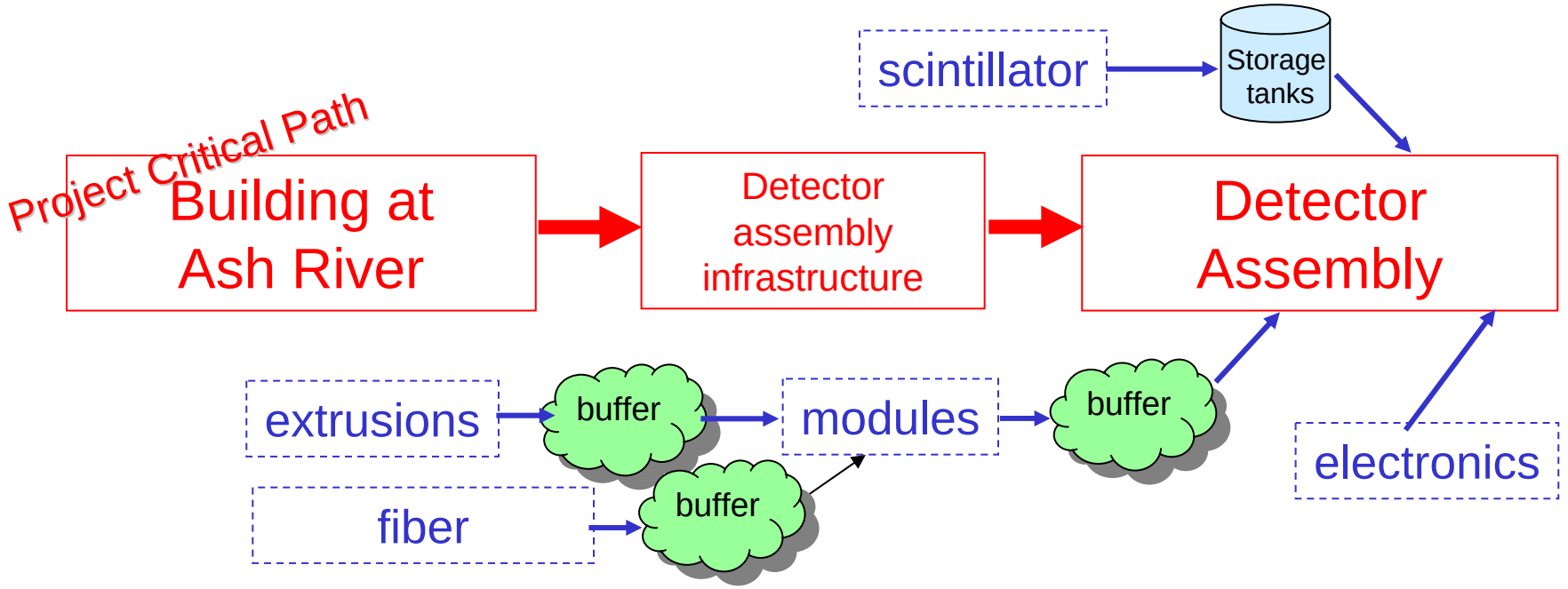
- Done by the CAMs, bottom up, linked all tasks
- Change Requests also cover schedule changes, not just cost changes Addition of tasks, re-ordering of tasks
  - Prime example is the major re-work of our schedule to accommodate a funding driven shutdown of the project in Dec 2007 with a restart in Feb 2009 (later advanced to Aug 2008)
- Performance Measurement techniques set for each task.
  - We have a clear preference for objective units
    - Pounds of PVC, gallons of scintillator, meters of fiber, numbers of PVC modules built, numbers of electronics boards completed, numbers of detector blocks assembled at Ash River.
    - Numbers of accelerator modules of different types completed, tested
    - Cubic feet excavated for building, yards of concrete, ….
  - but we use all FRA allowed PMTs
    - Prefer to use 50-50 and 0-100 for short tasks, 1-2 months
    - % complete also used, with peg points (documented in notes field of Open Plan) to define % complete amounts in advance for tasks > 2 months
    - Level of Effort used primarily on management tasks

NOvA Project PMTs



Critical Path: Two parallel paths

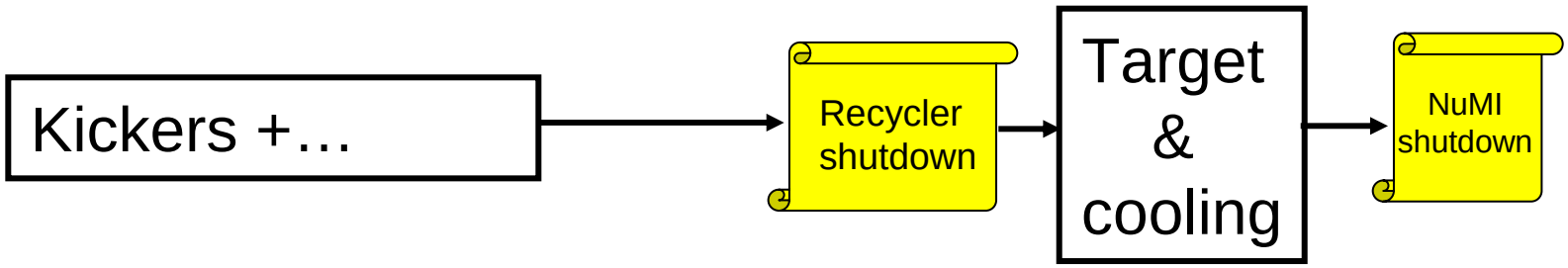
- **FIRST PATH:**
- We can't build the detector without a building at Ash River
  - Therefore we must push the building as fast as possible from the start



- **"Technical" <u>Project Critical Path</u>**
  is building, tools, then assembly at Ash River
  - Bill Freeman has done a complete critical path analysis of Open Plan and we understand the details of all these links and exactly what happens if we move one or more segments around in time
  - NEEDED this because out actual schedule is NOT technically driven. It is driven by the funding profile from DOE.

Schedule: SECOND parallel path

- Accelerator & NuMI upgrades use Fermilab Accelerator Division workforce, and all these people have additional operational responsibilities in the current Fermilab program.
  - So we have a leveled resource, leveled from outside the project
  - Given the operational uncertainties, we must push the Accelerator & NuMI as hard as possible and use the workforce to the fullest extent possible when available



- **The two parallel paths interact softly:**
  - Common contingency to ensure success
  - We want an operational neutrino beam after each shutdown so that commissioning of the detector can proceed for CD-4
  - But, commissioning of the accelerator upgrades from 400 kW to 700 kW is not required for CD-4

Work Authorization

- Project Office authorizes work through Work Authorization Documents
  - Approved by Scheduler, Financial Officer, CAM, Project Manager
  - Example on next slide
- WAD must be in place before a control account, any of its subsidiary chargeable task codes can be opened
  - Suzanne Saxer (Field Financial Officer) is responsible for checking the prerequisites
  - NOvA has 67 control accounts and then another ~200 chargeable task codes
    - Actual costs are accumulated at this chargeable task code level & rolled up to the control accounts.
- Labor at Fermilab is effort reported to open Fermilab chargeable task codes
  - Monthly Effort reports from all divisions available to CAMs for checking the data
- Moving funds outside of Fermilab to other institutions also requires Purchase Order and
  - Memorandum of Understanding (MOU)
    - Over-arching document describing expected contributions and responsibilities of institutions
    - Signed by Fermilab and the Institution's management
  - Statement of Work (SOW)
    - One for each FY detailing amounts expected to be funded by Fermilab
    - Signed by Fermilab, Institution's management, and the CAM(s)

WADs

WORK AUTHORIZATION FORM
NOvA Project

Control Account Title: Site Preparation Package

Control Account Number: 2.1.1

Work Breakdown Structure Element: WBS 2.1.1

Period of Performance: 27Sep07 to 05Nov09

Current Authorized Budget (in AY$ with all burdening): $11,530,402

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

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.

In addition to the CAMs approval of all third party commitments (i.e., Memorandums of Understanding (MOU) with other institutions, purchase orders, and subcontracts), the following is required:

- Commitments must be approved by the Project Manager for all R&D work > $1000, and for construction work where commitments values are greater than $10,000.
- To move funds to collaborating institutions, the CAM is to see that the following is in place before executing the purchase order:
  - MOU with the collaborating institution, singed by both parties, including the Project Manager.
  - 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 Project Manager.
  - This Work Authorization with all approvals.

Any change to this document will be implemented through the Change Control procedures.

Approvals will be done through the NOVA DocDB on the Work Authorization Document file.

Signature chain will be Scheduler, Financial Officer, Control Account Manager, and Project Manager.

Chargeable task codes will not be opened without a signed work authorization form.

NOvA (E929)

NuMI Off-Axis ν_e Appearance Experiment

NOvA Home Fermilab at Work

NOVA Document 3322-v3
[NOvA DocDB Home]

Work Authorization Document for Control Account 2.1.1
(Document Status: Approved)

Document #: NOVA-doc-3322-v3
Document type: Work Authorization
Submitted by: Elaine McCluskey
Updated by: Elaine McCluskey
Document Created: 24 Oct 2008, 11:20
Contents Revised: 01 Apr 2009, 11:42
DB Info Revised: 01 Apr 2009, 11:42

Update Document | Update DB Info | Add Files | Watch Document

Abstract:
This document contains files or links to other files in NOVA-docdb that constitute this Work Authorization Document.

Files in Document:
- CAP-CA-2.1.1.pdf (29.5 kB)
- NOvA WAD form CA 2.1.1.doc (79.5 kB)
- WBS Dictionary 1.1, 2.1.pdf (7.7 kB)
- WP Schedule for Control Account (WAD Spreadsheet CA_2.1.1.pdf, 21.7 kB)

Get all files as tar.gz, zip.

Topics:
- Project Management:Work Authorization

Authors:
- Steve Dixon

Keywords:
control_account

Notes and Changes:
revised form, updated CAP and schedule

Referenced by:
- NOVA-doc-3401: CAM Notebook for 2.1.1 (Approved)

Signoffs:
- William S. Freeman (signature complete)
  - Suzanne L. Saxer (signature complete)
    - Steven Dixon 880343 (signature complete)
      - John W. Cooper 937155 (signature complete)

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MOUs and SOWs

	WBS (incl. associated 1.x)	MOU	FY08 SOW	FY09 SOW	FY10 SOW
Coop Agreement	2.1	**18-Dec-07**	NA	NA	NA
Transition to CA, U of Minn	2.1	**19-Jan-07**	24-Jul-08	NA	NA
Indiana U - Astrophysics	2.2,2.6	**17-Jul-08**	22-Aug-08	16-Dec-08	
Indiana U - Physics	2.9	**12-Nov-07**		10-Nov-08	
Michigan State	2.3	**28-Aug-08**	22-Aug-08	19-Feb-09	
Argonne	2.4,2.8,2.9	**16-Oct-07**	22-Aug-08	27-Aug-08	
U of Minn	2.5,2.6	**14-Feb-08**	26-Aug-08	10-Mar-09	
CalTech	2.6	**13-Jun-08**	20-Jun-08	3/16 draft	
Harvard	2.6	**22-Aug-08**	26-Aug-08	25-Mar-09	
U of Virginia	2.6	**15-Oct-08**		26-Jan-09	
Duluth		**8-Nov-07**	NA	NA	

MOUs and SOWs

- Example text on EVMS from MOU:

III. Reporting, Costs and Schedule

1. Reporting

MSU will document as NOvA notes the procedures, analyses and results obtained as this work progresses. MSU will provide material for NOvA Project monthly reports in a timely fashion, including descriptive material, financial reporting, monthly task status reports and information needed for the NOvA Project's monthly earned value management analysis.

2. Estimated Costs and Schedule

MSU and Fermilab will jointly develop annual Statements of Work to provide detailed descriptions of the work covered by this MOU, including cost and schedule estimates. MSU will monitor the progress of this work in order to provide ample notice of projected deviations from the cost and schedule estimates. If it is determined that additional funds will be needed, the Fermilab NOvA Project Manager will evaluate available options and, in consultation with MSU, determine the best means of supplying the required resources.

- From SOW:

III. Reporting, Costs and Schedule

1. Reporting

The IU HEAP group will document the procedures, analyses and results obtained as NOvA notes as this work progresses. IU HEAP will provide material for NOvA Project monthly reports in a timely fashion, including descriptive material, financial reporting, monthly task status reports and information needed for the NOvA Project's monthly earned value management analysis.

Signatures on MOUs & SOWs

- Michigan State MOU

Approvals

The following concur in the terms of this Memorandum of Understanding.
These terms will be updated as appropriate in Amendments to this Memorandum.

Institutional Approvals:

Carl Bromberg 8/23/08
C. Bromberg, Prof., MSU (date)

D. Mahanti 8/25/08
S. D. Mahanti, Prof. and Associate Chair, Physics and Astronomy Dept., MSU

27 aug 08
E. Pedawi, Con&Gr Admr/S, MSU Contracts and Grants Administration

8/28/08
J. Cooper – NOvA Project Manager, Fermilab – date

8/29/08
G. Bock – Acting Particle Physics Division Head, Fermilab – date

9/2/08
P. Garbincius – Associate Director for Research for Project Oversight, Fermilab – date

- Argonne FY09 SOW

IV. Approvals

The following concur in the terms of this Statement of Work.
These terms may be updated as appropriate in Amendments to this document.

Institutional Approvals

27 August 2008
D. Ayres - NOvA Group Leader, HEP Division, Argonne National Laboratory - date

8/27/2008
H. Weerts - HEP Division Director, Argonne National Laboratory - date

8/27/08
J. Cooper – NOvA Project Manager, Fermilab - date

8/28/08
G. Bock – Particle Physics Division Head (acting), Fermilab - date

9/2/08
P. Garbincius – Associate Director for Research for Project Oversight, Fermilab - date

NOvA Project Cost Account Manager Approvals

27 Aug 08
P. Lukens – Detector Assembly (WBS 1.8, 2.8, 2.9) - date

8/27/'08
R. Talaga – PVC Extrusions (WBS 1.4, 2.4) - date

CAMs

Accounting Considerations

- Fermilab's Oracle eBS (electronic Business Suite) used for actual costs
- Accruals done in Oracle eBS, except for the Cooperative Agreement
- Effort Reporting & Payroll used for Fermilab labor
  - Labor at other institutions appears as M&S to us, but is "labor" in the Open Plan schedule
- 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 Costs are extracted from eBS and loaded into Cobra monthly
  - Cobra and eBS totals are reconciled

Accounting Considerations (Project Accounting)

Used to collect actual costs and commitments

- Identified by a project number and task number (Chargeable Task Code - CTC)
- WBS based: mirrors the project WBS
- CTC's may be set at the control account level or at a lower WBS level if finer detail is desired
- Indirect costs distributed via rates set by CFO

Accounting Considerations (Actual Costs)

Labor

- Effort reporting and Payroll data combine to generate labor costs
- Labor burdens (fringe, paid time off) applied in PA

Materials & Services

- Invoicing often lags behind the receipt of goods/services
- The Oracle eBS Material Management System automatically accrues costs for items that have been "received" at Fermilab but not yet invoiced
- Service Accruals
  - Ability to record 'receipts' for services
- Minimizes artificial variances where earned value not offset by invoiced costs

Accounting Considerations (Integration)

- Schedule status transferred from Open Plan to Cobra
- Actual costs imported from PA to Cobra
- EV Calculated
- Monthly project reports generated
- Cobra reports reconciled to control totals from PA

Accounting Procedure on the Cooperative Agreement

- Cooperative Agreement is University of Minnesota Funds and not in the Fermilab accounting system
- Procedure NOVA-doc-3550

Monthly Accrual Reporting

- The University of Minnesota Development Manager, or designee, will provide monthly accruals for the costs expended by the Development Manager (Hines Interests), Architectural/Engineering Firms and Construction Contractors.
- The accruals will be broken down by NOvA Project Work Breakdown Structure (WBS) Chargeable Task Code.
- These accruals will normally be forwarded to the Fermilab by the 25th of each month.
- After review by the NOvA Project Control Account Manager for Site and Buildings, the NOvA Project Financial Officer will enter the accruals into the Fermilab Earned Value Cost Processor. Cobra

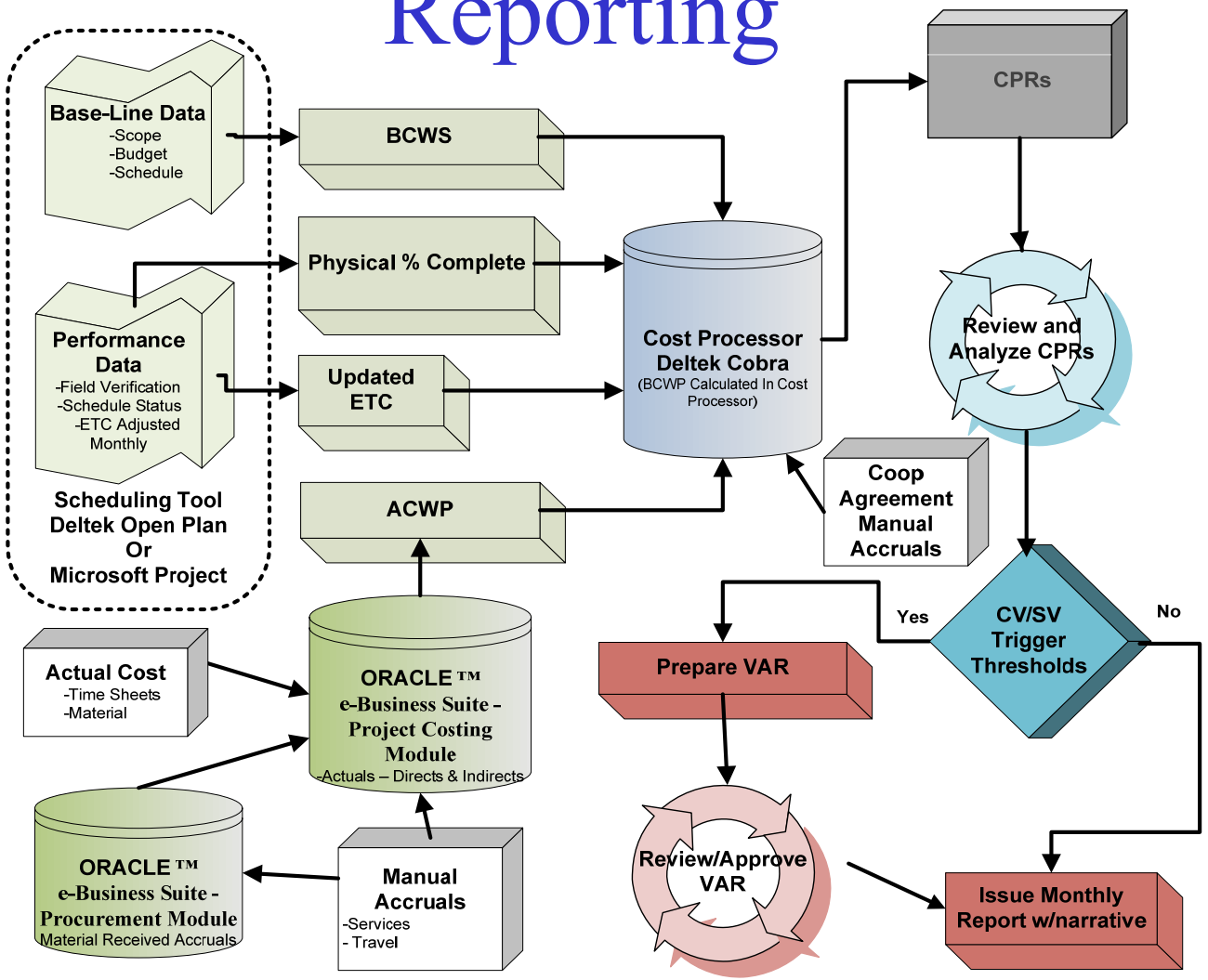
Monthly Cost Reporting

- The Principal Investigator for Cooperative Agreement, or designee, will provide backup data or reports to reflect costs paid that month.
- The reports (known as Summary Statement for Account) will be provided electronically at the completion of the normal University of Minnesota accounting period.

Reconciliation

- On a periodic basis, to align with DOE reporting requirements for the Cooperative Agreement and/or the American Recovery and Reinvestment Act, the Principal Investigator for Cooperative Agreement, or designee, will provide a copy of the University of Minnesota's Enterprise Financial Systems Report that details the actual costs applied against the Cooperative Agreement. It is anticipated that the American Recovery and Reinvestment Act will require a quarterly report.
- The NOvA Project Financial Officer will reconcile the accruals with the quarterly report and adjust the cost reporting within the Fermilab Earned Value Cost Processor as required.

Monthly Analysis and Management Reporting



Analysis and Management Reports
(continued)

- FRA management monitors project performance including EV data from:
  - Project monthly reports
  - Monthly Project Management Group (PMG) meeting chaired by an Associate Director
  - FRA Director's Reviews prior to DOE's Office of Project Assessment review and Critical Decisions

Project Management Group Meetings

- Monthly meetings to discuss project progress, pending work, and current/ potential issues
- Institutionalized practice for all projects covered by DOE O413.3A
- Members
  - Project Office
  - Divisions supplying project resources
  - Supporting Sections (i.e. ES&H, Procurement, etc)
  - Directorate (i.e. Associate Directors, OPMO)
  - DOE (Federal Project Director, Program Manager)
- Members have direct control over resources, so can take action if issues arise
- PMG also function as project change control board

Project Management Group Meetings – Typical Agenda

- Project Summary Status Report
- Financial Summary
- Variance Details
- Variance Analysis Progress
- Schedule Summary
- Risk Summary
- Procurements
- Labor Resources
- Change Request Status
- Action Items from prior month
- Action Items from this meeting

Variance Analysis Reporting Thresholds

Variance	Type	Threshold limit
Cost	Current Period	≥ ± 10% and ≥ $100K
	Cumulative	≥ ± 10% and ≥ $100K
Schedule	Current Period	≥ ± 10% and ≥ $100K
	Cumulative	≥ ± 10% and ≥ $100K

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

- Apply at Control Account
- Default Thresholds

Variance Analysis Reports

- VARs reviewed extensively by Project Manager
- NOvA Project uses DocDB sign-off feature for approvals
- Reviewed at Technical Board Meetings (with all CAMs to look for impacts across separate Control Accounts)
  - An example:
    - WBS 1.6 reported ahead and may impact IPND
    - WBS 1.7 reported behind, no software team available, working on solution, may impact IPND
    - Same CAM in both cases!
- Corrective Action Log (NOVA-doc-3614) reviewed and updated with action status regularly

Variance Analysis Reports

portion of CPR5 summary by control account for March

- This control account level view is available in CAM notebooks for all to review.
- View at L2 is provided in monthly report.

Report Period: Mar-09																			
	Cur. 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	483,699	129,437	119,009	**-354,262**	**-73%**	10,428	8%	0.27	1.09	1,807,727	1,283,986	1,352,822	**-523,741**	**-29%**	-68,836	-5%	0.71	0.95	5,248,666
1.0.2 MI Upgrades	45,338	13,530	50,136	-31,809	-70%	-36,606	-271%	0.30	0.27	154,911	156,180	202,020	1,270	1%	-45,839	-29%	1.01	0.77	1,037,303
1.0.3 NUMI Upgrades	211,698	27,220	33,114	**-184,478**	**-87%**	-5,894	-22%	0.13	0.82	623,639	798,701	459,305	**175,062**	**28%**	**339,396**	**42%**	1.28	1.74	2,118,285
1.0.4 ANU Beam Physics	7,472	7,859	1,127	388	5%	6,733	86%	1.05	6.98	43,636	49,437	1,127	5,801	13%	48,311	98%	1.13	43.89	82,092
1.0.5 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	-38,251	0	0%	38,251	-100%	1.00	0.00	2,274,519	2,274,519	1,628,232	0	0%	**646,286**	**28%**	1.00	1.40	2,274,519
1.2 Liquid Scintillator R&D	4,643	4,643	8,017	0	0%	-3,374	-73%	1.00	0.58	268,501	260,807	219,156	-7,694	-3%	41,652	16%	0.97	1.19	271,245
1.3 WLS Fiber R&D	33,394	4,047	22,329	-29,347	-88%	-18,283	-452%	0.12	0.18	205,602	238,061	283,251	32,459	16%	-45,190	-19%	1.16	0.84	340,909
1.4 PVC Extrusion R&D	89,826	11,151	13,860	-78,674	-88%	-2,709	-24%	0.12	0.80	1,096,549	949,362	988,776	**-147,187**	**-13%**	-39,414	-4%	0.87	0.96	1,368,241
1.5 PVC Module R&D	280,623	23,729	83,722	**-256,894**	**-92%**	-59,992	-253%	0.08	0.28	1,109,819	574,021	1,124,776	**-535,798**	**-48%**	**-550,755**	**-96%**	0.52	0.51	1,589,549
1.6 Electronics R&D	195,816	47,508	19,099	**-148,309**	**-76%**	28,409	60%	0.24	2.49	624,865	360,537	568,945	**-264,328**	**-42%**	**-208,407**	**-58%**	0.58	0.63	1,652,846
1.7 DAQ R&D	127,939	5,403	33,098	**-122,535**	**-96%**	-27,695	-513%	0.04	0.16	467,357	223,447	831,234	**-243,911**	**-52%**	**-607,787**	**-272%**	0.48	0.27	1,384,877
1.8 Detector Assembly R&D	194,043	13,234	166,325	**-180,810**	**-93%**	**-153,091**	**-1,157%**	0.07	0.08	1,464,812	892,200	1,899,469	**-572,612**	**-39%**	**-1,007,269**	**-113%**	0.61	0.47	2,850,906
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%	-175,658	-2%	1.00	0.98	9,184,127
Construction																			
2.0.1.1 Recycler Ring Modifications	3,605	2,582	4,259	-1,023	-28%	-1,677	-65%	0.72	0.61	28,869	4,929	5,292	-23,940	-83%	-363	-7%	0.17	0.93	7,916,804
2.0.1.2 Recycler Kicker System	80,000	10,063	278	-69,936	-87%	9,785	97%	0.13	36.17	244,665	14,270	622	**-230,395**	**-94%**	13,648	96%	0.06	22.93	7,910,714
2.0.1.3 Recycler Instrumentation	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	1,421,492
2.0.2.1 MI Modifications	4,298	120,030	2,587	**115,732**	**2,693%**	**117,443**	**98%**	27.93	46.40	5,935	121,425	2,587	**115,490**	**1,946%**	**118,838**	**98%**	20.46	46.94	373,332
2.0.2.2 MI RF Cavities	3,891	9,794	14,489	5,903	152%	-4,696	-48%	2.52	0.68	14,462	13,684	29,091	-778	-5%	-15,407	-113%	0.95	0.47	1,433,092
2.0.3.1 NuMI Primary Proton Beam	25,870	0	39,632	-25,870	-100%	-39,632	-100%	0.00	0.00	142,174	13,636	47,120	**-128,538**	**-90%**	-33,483	-246%	0.10	0.29	1,450,655
2.0.3.2 NuMI Target Hall Technical Compone	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	1,634,201
2.0.3.3 NuMI Target Hall Infrastructure	0	12,656	1,658	12,656	100%	10,998	87%	N/A	7.63	0	34,804	10,294	34,804	100%	24,511	70%	N/A	3.38	1,716,959
2.0.3.4 NuMI Decay Pipe/Hadron Absorber/U	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	928,793
2.0.4 Project Management - ANU - Construct	74,637	74,637	20,943	0	0%	53,694	72%	1.00	3.56	349,040	349,040	271,736	0	0%	77,304	22%	1.00	1.28	5,159,684
2.1.1 Site Preparation Package	15,202	32,349	118,939	17,147	113%	-86,589	-268%	2.13	0.27	399,208	399,208	400,646	0	0%	-1,438	0%	1.00	1.00	11,530,402
2.1.2 Far Detector Building	92,146	212,982	70,288	**120,837**	**131%**	**142,694**	**67%**	2.31	3.03	188,372	1,268,871	746,197	**1,080,499**	**574%**	**522,674**	**41%**	6.74	1.70	36,637,247
2.1.3 Site and Building Security	0	0	0	0	0%	0	0%	1.00	1.00	0	0	0	0	0%	0	0%	1.00	1.00	195,804
2.1.4 Management - Site and Building - Cons	15,653	0	0	-15,653	-100%	0	0%	0.00	1.00	31,305	0	0	-31,305	-100%	0	0%	0.00	1.00	171,599
2.10 Project Management - Nova Project - Co	74,032	74,032	59,497	0	0%	14,534	20%	1.00	1.24	804,259	804,259	648,395	0	0%	**155,864**	**19%**	1.00	1.24	5,901,468

Variance Analysis Report Example

- FYI, these are approved electronically by the CAM and the PM using NOVA-docdb
- Note corrective action anticipated, and ETC was revised in March!

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		

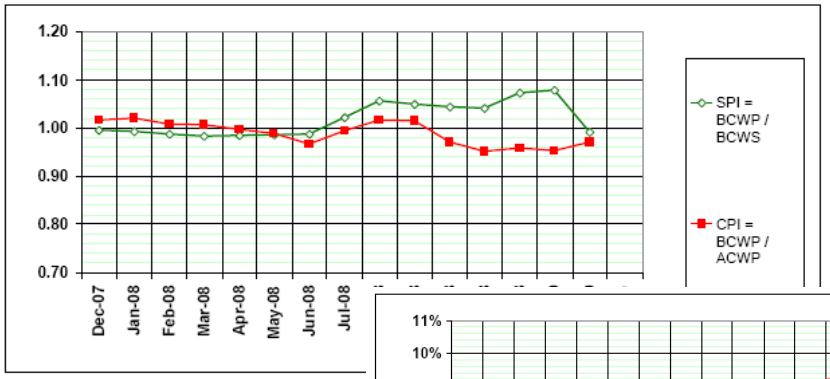
Estimate to Complete/Estimate at Completion

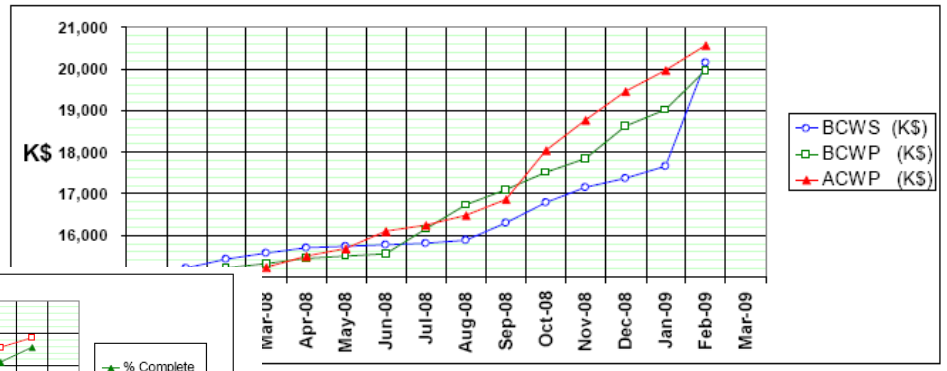
- CAMs review ETC/EAC at control account level during monthly status cycle
- If felt to be inaccurate, CAMs propose ETC change to project manager via email
- Project manager assesses; if approved, information forwarded to Project Controls for input into forecast baseline and updating in Cobra.
- ETC log is maintained to track ETC changes

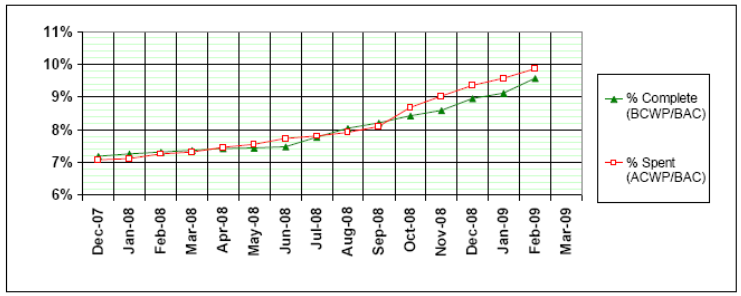
NOvA Log of Estimate to Complete Changes						
ETC#	Item	WBS items	CAM	estimated amount	approved?	date of email approval
1	Labor reductions on 1.0.3	1.0.3.2, 1.0.3.3	Martens	< $100K decrease in base estimate	yes	4/15/2009
2	Near Cavern updated estimate following Conceptual design by Harza, checked by Wightman	2.8.1.4.5, 2.8.1.4.6	Lukens	only $20K increase in base estimate, but a change in contingency estimate from 100% to 50%	yes	4/15/2009

How do we use EV data?

- **Examples on the previous page indicate that the CAMs are quickly coming up to speed on vigilant oversight using our available reports.**
- **Have we taken any actions based on VARs?**
  - My prime example actually comes from last fall. Clear variance in R&D work CPI led me to scale back the scope of the Full Size Assembly Prototype from 10-12 layers to only 6.
- **I actually make various plots from the data each month**
  - Making the plots forces one to look at the data and think about it.
  - I expect many CAMs to start doing the same as they see the positive aspect of all this work – e.g., CA 1.0.3 March VAR noted possibility of revising ETC and included plots to support the proposal
- **Our Open Plan Schedule has break point milestones in it where we decide if we should try for more than 14 kt.**
  - Will use EV data to determine if that makes sense, by reviewing EAC versus TPC.





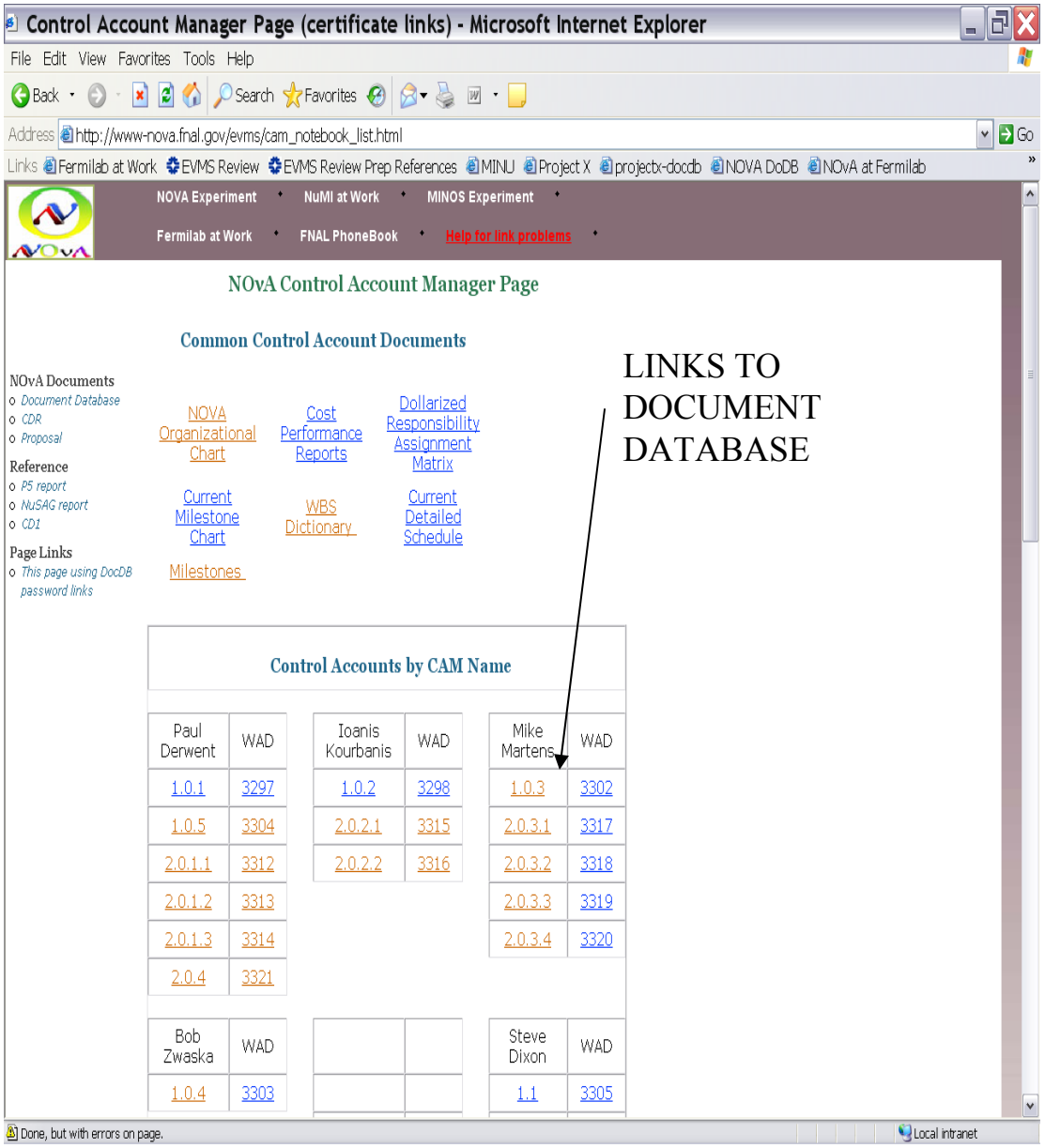


Monthly EV Reports

- Files linked into the CAM notebooks:
  - NOVA-doc-1919 – Monthly Turnaround Reports in Open Plan
  - NOVA-doc-2844 – Monthly Open Plan Schedule Snapshots with Progress Info
  - NOVA-doc-942 – Monthly Open Plan Backup File
    - Some CAMs look directly into Open Plan, some use pdf snapshots above
  - NOVA-doc-3372 – Monthly CPRs from Cobra
    - CPR 1 by Chargeable Task Code
    - CPR 1 by Control Account
    - CPR 1 by Fund Source
    - CPR 1 by Fund Source and WBS L2
    - CPR 5 by Control Account which is loaded into CAM Notebooks – PM sends this one to CAMs with reminder to do VARs.
- Others
  - Project Monthly Reports
    - Includes narrative input from CAMs so that other CAMs and the Project Office are up to speed.

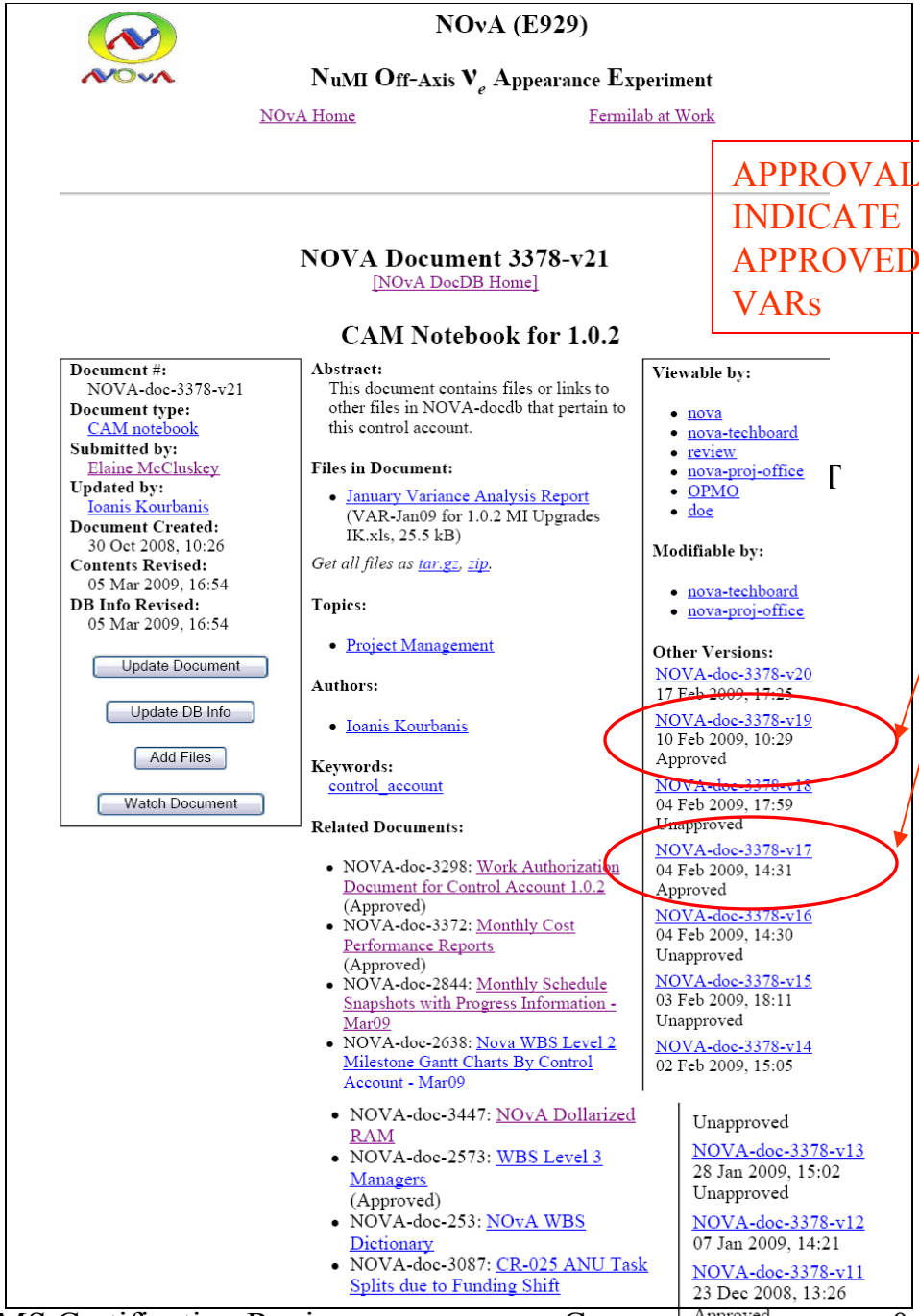
CAM Notebooks

- CAM notebooks are maintained electronically for each control account via the project website and document database:



Electronic CAM Notebooks

- Contains VARs
- Includes links to
  - WAD
  - CPRs
  - Schedule status
  - Milestone charts
  - Org chart
  - WBS Dictionary
  - Applicable CRs
- We have printed active CAM notebooks for this review to make it easier to compare documents
- CAMs can show you the electronic version upon request



Revisions and Data Maintenance (Change Control Process)

- Change Control Thresholds are project specific and agreed on with DOE.
- 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)

Change Control Process

- NOvA change control is described in NOVA-doc-131
  - To date the PM has signed all CRs regardless of thresholds, controlling startup

	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) CAM
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.

NOTE: INFORMATION FOR LEVEL 0 – LEVEL 2 CHANGES IS COPIED FROM THE PROJECT EXECUTION PLAN

Log of Changes (full log available)

- We do this in an Access database so we can keep track of the sum of changes to date for thresholds

CR #	CO Title	Prel Cost Impact (no contingency)	Prel Sch Impact	Final Cost Impact (no contingency)	Final Schedule Impact	Date Closed	Awaiting
Changes with Status:	**Approved by PM**						
55	Leak Checking System for IPND	$31,600.00	none	$31,694.16	none		
56	PVC Modules – Accommodating 2-Glue Sealing Solution	$134,714.00	none	$136,169.32	none		
58	IPND Fiber QA Labor Adjustment	$42,306.00	none	$42,305.02	none		
60	MI RF Cavities Baseline Date Adjustments	$24,212.00	none	$22,078.65	none		
61	Partial DAQ SW Reassignment to UMNTC	$1,148.00	none	$1,149.59	none		
63	Vertical Slice Test 3	$46,859.00	none	$46,877.83	none		
64	Water Vapor Transmission Tests	$16,610.00	none	$16,628.02	none		
65	Caster Jack Construction	$19,781.00	none	$19,847.37	none		
	Total Prelim Cost:	$317,230.00	**Total Final Cost:**	$316,749.96			
Changes with Status:	**Disapproved**						
5	Extension of I-DEAS CAD Model Engineer thru FY08 for FD Ass'y Integration	$0.00				1/4/2008	
6	Extension of FEA Engineer Effort thru FY08 for Far Detector Structural Analysis	$0.00				1/4/2008	
19	Move FY08 Travel From Constn to R&D for WBS x.2	$0.00				2/21/2008	
	Total Prelim Cost:	$0.00	**Total Final Cost:**				

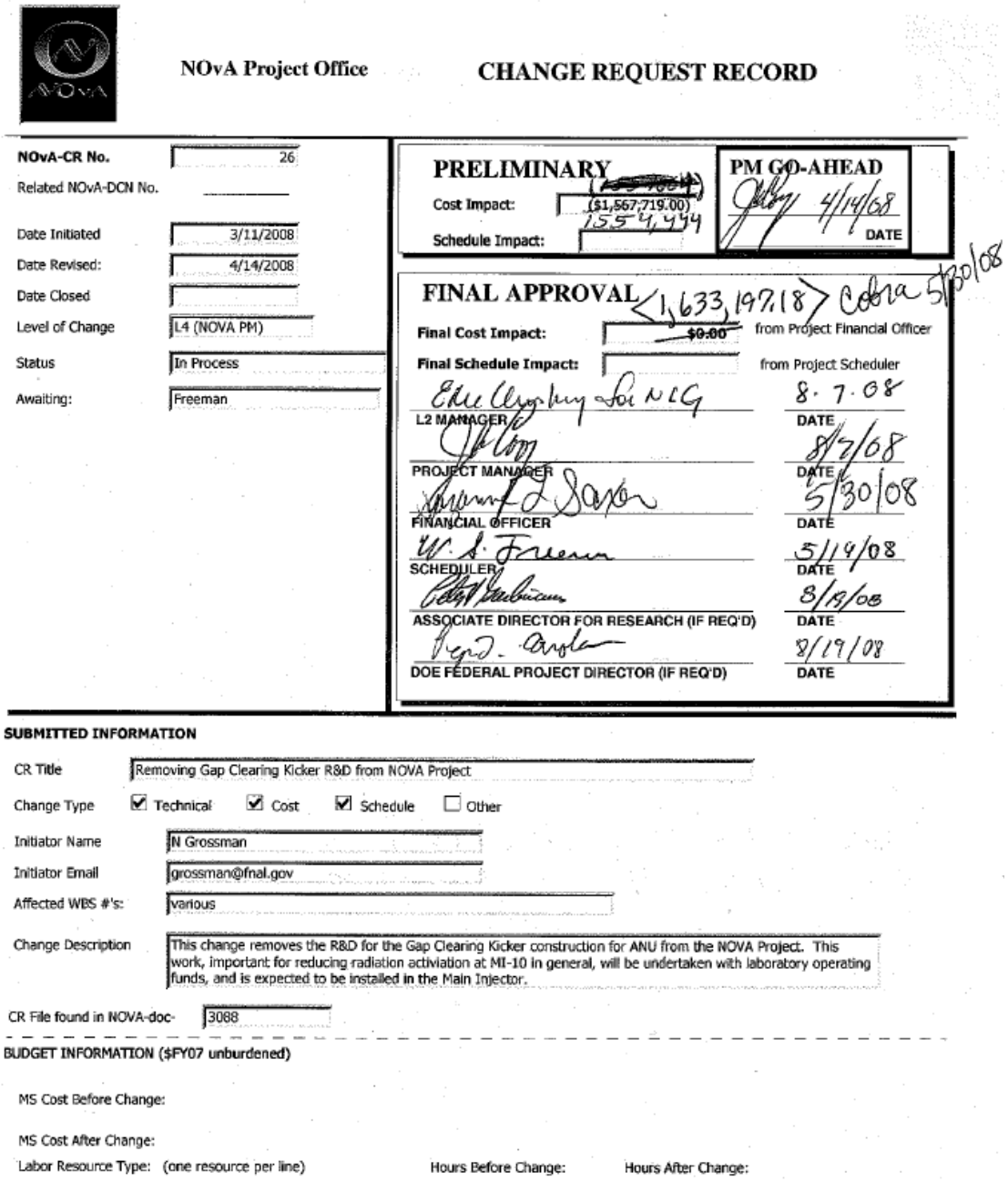
Log of Changes (full log available NOVA-doc-3191)

- List requiring Associate Director or FPD approval so far

CR #	CO Title	Final Cost Impact (no contingency)	Final Schedule Impact	Date Closed	Awaiting
Changes with Status:	**Approved by DOE FPD**				
1	Near Detector Prototype ASIC	($51,849.94)	none	3/18/2008	
2	IPND ASIC Production	($55,833.39)	none	3/18/2008	
3	ASIC Prototype II	$55,913.32	none	3/18/2008	
4	IPND FEB Production	$27,366.92	none	3/18/2008	
7	Produce Electronics Box	($10,220.00)	none	3/18/2008	
8	Housing Manufacture - Prototype Mold Simplification, Testing Design	$0.00	none	3/18/2008	
52	Procure New Sealant Dispensing Equipment	$100,484.69	none	12/23/2008	
53	Kicker PFL Frames	$147,394.08	none	2/10/2009	
54	ANU Beam Tube Brazing Changes	$296,998.61	none	2/17/2009	
57	Cumulative Change Request A	$0.00		2/17/2009	
	Total Final Cost:	$4,362,988.16			

Example Change Request CR026

- Backup documents are attached in the document file
- Each CR has its own NOVA-docdb file



NOvA Project Office

CHANGE REQUEST RECORD

NOvA-CR No. 26

Related NOvA-DCN No.

Date Initiated 3/11/2008

Date Revised: 4/14/2008

Date Closed

Level of Change L4 (NOVA PM)

Status In Process

Awaiting: Freeman

PRELIMINARY

Cost Impact: ($1,567,719.00) 1554,444

Schedule Impact:

PM GO-AHEAD 4/14/08 DATE

FINAL APPROVAL <1,633,197.18> Cobra 5/30/08

Final Cost Impact: $0.00 from Project Financial Officer

Final Schedule Impact: from Project Scheduler

L2 MANAGER 8.7.08 DATE

PROJECT MANAGER 8/7/08 DATE

FINANCIAL OFFICER 5/30/08 DATE

SCHEDULER 5/14/08 DATE

ASSOCIATE DIRECTOR FOR RESEARCH (IF REQ'D) 8/19/08 DATE

DOE FEDERAL PROJECT DIRECTOR (IF REQ'D) 8/19/08 DATE

SUBMITTED INFORMATION

CR Title: Removing Gap Clearing Kicker R&D from NOVA Project

Change Type: ☑ Technical ☑ Cost ☑ Schedule ☐ Other

Initiator Name: N Grossman

Initiator Email: grossman@fnal.gov

Affected WBS #'s: various

Change Description: This change removes the R&D for the Gap Clearing Kicker construction for ANU from the NOVA Project. This work, important for reducing radiation activiation at MI-10 in general, will be undertaken with laboratory operating funds, and is expected to be installed in the Main Injector.

CR File found in NOVA-doc- 3088

BUDGET INFORMATION ($FY07 unburdened)

MS Cost Before Change:

MS Cost After Change:

Labor Resource Type: (one resource per line) Hours Before Change: Hours After Change:

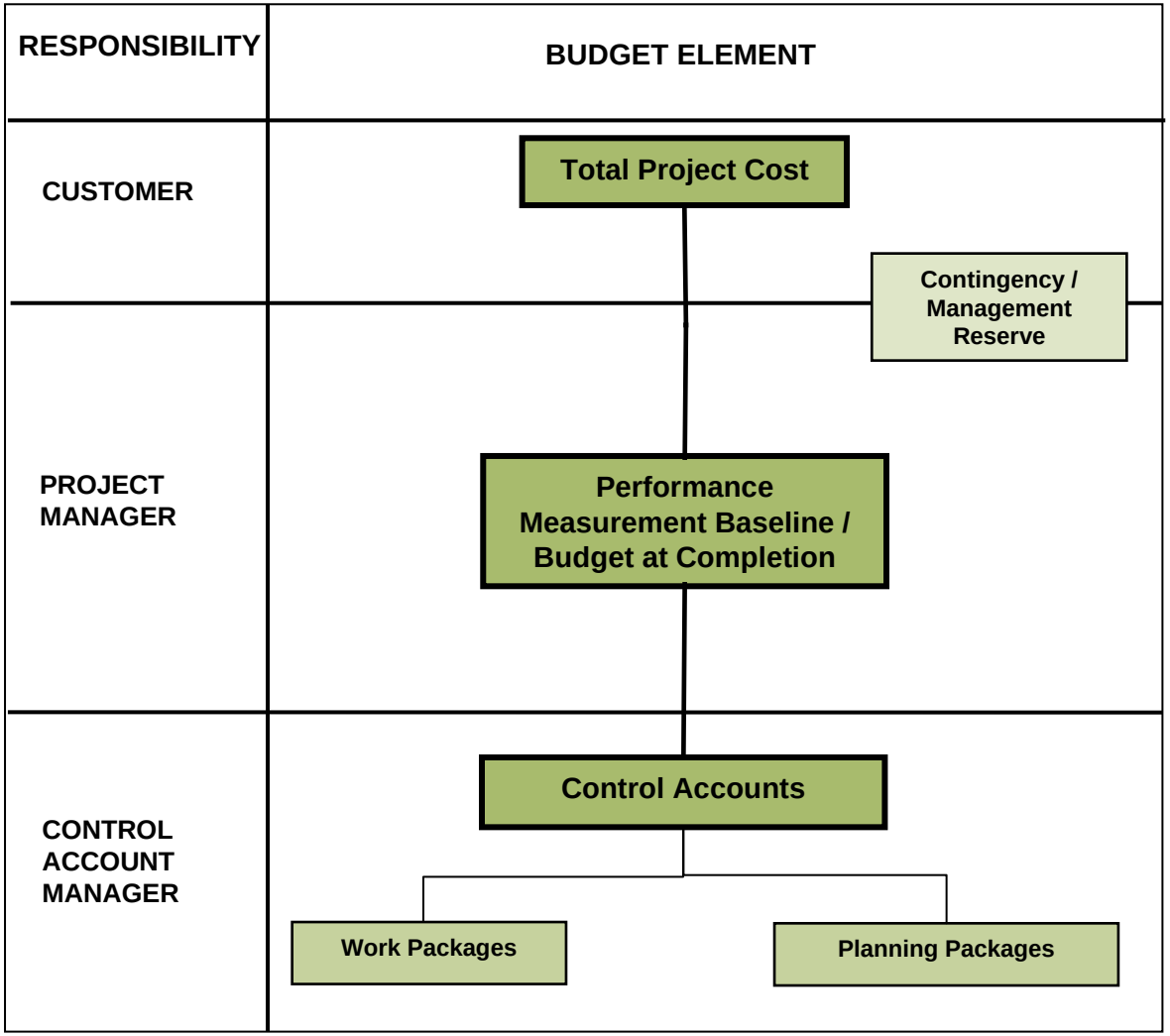
Topics for Clarification from January Readiness Assessment

- FRA Accounting System vs. Fermilab Accounting System
- Contingency/Management Reserve
- Non Costed Scientist Labor
- Uncompensated Overtime for Exempt Employees

FRA Accounting System vs. Fermilab Accounting System

- FRA, LLC was formed solely to contract with the Department of Energy to manage and operate Fermilab, a government-owned facility.
  - FRA is required by contract to maintain a separate set of books for transactions entered into under the M&O contract.
  - A set of financial systems, owned by the government and managed by FRA, exists at Fermilab to process all contract-related transactions.
  - Since all FRA projects are funded under the DOE contract, it is this set of financial systems and processes on which FRA's EVMS relies, and may be referred to internally as "Fermilab's accounting system".

Contingency/Management Reserve



Contingency/Management Reserve

- FRA definition:
  - The amount of the total budget used by the customer and the project for management control purposes.
  - Amount is managed according to established approval thresholds defined in the Project Execution Plan (PEP) and the Project Management Plan (PMP).
  - The release of these funds is managed through the change control process
  - Contingency / management reserve is not part of the Performance Measurement Baseline.

NOvA Project's Thresholds

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) CAM
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NOTE: INFORMATION FOR LEVEL 0 – LEVEL 2 CHANGES IS COPIED FROM THE PROJECT EXECUTION PLAN

Non Costed Scientist Resources

- Implementing Procedure 12.PM-005 Cost Estimating
  - For scientific labor on DOE projects, the labor rate will be set to comply with "OHEP Guidance to Ensure Compliance with DOE O413.3A."
- Per OHEP guidance, scientist labor is included in the project cost under certain circumstances
- The scientist hours are loaded into the schedule and the cost processor
- Scientist work is tracked by schedule task and milestone progress
- In general, work packages with non costed scientist labor also have costed labor, which allows EV to be measured on that work
- FRA is working with OHEP and others to address this in a consistent manner across labs

Uncompensated Overtime for Exempt Employees

- Currently exempt employees (salaried) are not required to record time worked over 40 hours in a week
- Cost is apportioned to the appropriate charge task code(s) based on the ratio of time spent over the reporting period
- For example:

Employee projects	Hours recorded	Percent of employee cost in reporting period charged to each project
Project A	20 hours	40%
Project B	20 hours	40%
Project C	10 hours	20%

Summary

- Documentation has been provided for you on the review website ahead of time
- Additional documentation has been added, including
  - March data
  - December through March monthly reports
  - Cooperative Agreement MOU
  - ETC log
- The agenda for the review is on the website
  - Has links to maps showing meeting rooms
  - Escorts to the rooms can be arranged
- We believe we are ready for DOE EVMS Certification.
- FRA is ready to support the review team in the evaluation of our EVMS.