First Executive Session Director's Preliminary Cost & Schedule Review of Project X

March 16-17, 2009

L. Edward Temple, Jr.

Agenda for Executive Session

- Welcome
- Charge to Reviewers
- Review Agenda
- Cost Related Things Needed for CD-0
- Report Outline and Reviewer Assignments
- Assessment of the Project X R&D Plan
- Breakout Session Attendance
- Breakout Session Contact List
- Reporting Out & Report Structure
  - Findings, Comments, and Recommendations
- Cost / Contingency Table
- Discussion

Charge
Director's Preliminary Cost and Schedule Review of Project X
March 16-17, 2009

The Committee is to conduct a Director's Preliminary Mission Need Review of the proposed Project X at Fermilab. The Committee is to review the cost range estimate that has been prepared based on the initial configuration set forth in the Project X Initial Configuration Document (ICD).

The HEPAP / P5 June 2008 Report supports three particular future initiatives that rely on the development of a very high intensity proton source at Fermilab:

- A neutrino beam for long baseline neutrino oscillation experiments: A new 2 megawatt proton source with proton energies between 50 and 120 GeV would produce intense neutrino beams, directed toward a large detector located in a distant underground laboratory
- Kaon and muon based precision experiments exploiting 8 GeV protons from Fermilab's Recycler, running simultaneously with the neutrino program: These could include a world leading muon-to-electron conversion experiment and world leading rare kaon decay experiments.
- A path toward a muon source for a possible future neutrino factory and, potentially, a muon collider at the Energy Frontier: This path requires that the new 8 GeV proton source have significant upgrade potential.

In light of the need to integrate these opportunities into a coherent program for the future of U.S. HEP the committee "recommends an R&D program in the immediate future to design a multi-megawatt proton source at Fermilab and a neutrino beamline to DUSEL… "

Charge (continued)

Assuming the ICD describes at the early concept level a facility that will meet the Mission Need (multi-megawatt proton source) set forth by the HEPAP / P5 Subpanel, the committee should address the following questions / topics:

1. Is the cost range estimate complete?
2. Has the cost range estimate been prepared using a sound estimate methodology?
3. Is the schedule set forth reasonable?
4. Are the labor estimates reasonable?
5. Are the materials and services estimated those needed to deliver the facility?
6. Are the estimates for the M&S reasonable at this early stage of the project?
7. Is the estimated technical contingency appropriate / adequate?
8. Are there ways the cost could be reduced?
9. Is the PED funding profile adequately defined to support a request for PED funds later this year?

The Committee should conduct the review, share their findings / comments / recommendations with the Project X Team and Fermilab management in a closeout meeting, develop a report and submit it to the Fermilab Directorate soon after the review.

Agenda

Director's Preliminary Cost and Schedule Review of Project X

Based on the Initial Configuration Document

March 16 - 17, 2009

Monday, March 16, 2009				
Start	**End**	**Time**	**Subject**	**Presenter**
8:00 AM	8:45 AM	0:45	Executive Session, *One North (WH1NW)*	Ed Temple
8:50 AM	9:00 AM	0:10	Project X Introduction, *One West (WH1W)*	Steve Holmes
9:00 AM	9:30 AM	0:30	Project X Initial Configuration, *One West (WH1W)*	Paul Derwent
9:30 AM	10:15 AM	0:45	Project X Systems and Interfaces, *One West (WH1W)*	Sergei Nagaitsev
10:15 AM	10:30 AM	0:15	**BREAK (outside One West)**	
10:30 AM	11:15 AM	0:45	Cost Estimate Development Process, *One West (WH1W)*	Jim Kerby

11:15 AM	12:30 PM	1:15	Breakout Sessions	
			• Project Management; Cost and Schedule Development; and PM Costs, *Black Hole (WH2NW)*	Steve Holmes*
			• Cavities & Cryomodules for LE Linac and HE Linac, *One North (WH1NW)*	Mark Champion*
			• RF for LE Linac and HE Linac, *Theory 3NW Conf. Room (WH3NW)*	John Reid*
			• Main Injector / Recycler Ring; Transfer Line; and Injection, *Hornets' Nest (WH8XO)*	Dave Johnson*
			• Instrumentation and Controls, *The Req Room (WH4NW)*	Manfred Wendt*
			• Cryogenics, *Snake Pit (WH2NE)*	Arkaidy Klebaner*
			• Conventional Facilities, *ConFESSional (WH5E)*	Russ Alber*
12:30 PM	1:30 PM	1:00	**LUNCH (WH2X)**	
1:30 PM	3:15 PM	1:45	Continue Breakout Sessions as Above	
3:15 PM	3:30 PM	0:15	**BREAK**	
3:30 PM	4:45 PM	1:15	Continue Breakout Sessions as Above	
4:45 PM	6:00 PM	1:15	Executive Session, *One North (WH1NW)*	Ed Temple
7:00 PM			Dinner at Chez Leon	

Tuesday, March 17, 2009			
8:00 AM	9:00 AM	1:00	Executive Session, *One North (WH1NW*)
9:00 AM	10:00 AM	1:00	Answers to Questions, *One North (WH1NW)*
10:00 AM	1:20 PM	3:20	Report Writing with Working Lunch, *One North (WH1NW)* Email Report to terickson@fnal.gov at or before 1:20 PM
2:00 PM	4:30 PM	2:30	Closeout Dry Run, *One North (WH1NW)*
4:30 PM	5:30 PM	1:00	Closeout Presentations with Fermilab and Project X, *Curia II (WH2SW)*
5:30 PM			Adjourn

Cost Related Things Needed for CD-0 Resource and Schedule Forecast

- Rough Order of Magnitude Cost Estimate Range - (-50 percent to +100 percent, for example) of project cost and schedule based on the upper bound of the rough order of magnitude estimate.
- Estimated Cost - resource planning funding profile with a breakout of project engineering and design funds and an explanation of funding needs to proceed from Critical Decision-0 to Critical Decision-1.
- Rough Order of Magnitude Schedule Estimate - identify the estimated dates (fiscal year only) for meeting subsequent Critical Decisions

Resource and Schedule Forecast - Example

ROM Cost Estimate Range: $300M ≤ estimate range ≤ $700M

Estimated Cost.

The estimated cost needed to proceed to CD-1 is $10 million. This estimate is $2 million more than the current funded amount of $8 million. The funding profile by fiscal year for the upcoming FY08-FY12 planning window is contained in the chart below:

Five-Year Planning Period					
Fiscal Year	**08**	**09**	**10**	**11**	**12**
ROM estimate of PED profile		$35M	$40M	$15M	
ROM estimate of 5-yr cost profile	$10 M	$60M	$110M	$120M	$130M

ROM Schedule Estimate.

Current estimated dates for major milestones are as follows:

Conceptual design start	FY2008
Preliminary design start	FY2009
Construction start	FY2010
Startup and testing	FY2012
Operations start	FY2013
Operations complete	FY2015

Things Needed to Prepare for CD-0

(continued)

- Develop High Level Schedule to Identify Schedule Range and Estimated CD Dates
- Develop Cost Estimate Range
  - Total estimate from CD-0 through CD-4 (What was called R&D is now part of the OPC after CD-0)
  - TPC includes TEC, OPC and Contingency
  - Need to split out Project Engineering and Design (PED) funds for use in preliminary design, final design, and baseline development
  - Include impact of risks and alternative designs to establish range
  - Include Spares

Other Pre CD-0 Work

- **<u>Develop estimate to request Project Engineering and Design (PED) funds</u>**. PED funds are requested at CD-0 using a Project Data Sheet as “design only” funds for preliminary and final design. PED funds are not to be used for construction, long-lead procurement, or major equipment items. PED funding requests are developed from historical data or parametric estimates.
- The objectives for the use of PED funds are to:
  - Improve the accuracy of the project cost estimate and support establishment of the Performance Baseline
  - Improve the DOE’s planning, programming, and budgeting process for the acquisition of projects
  - Provide funds for Value Management (VM) activities
- PED funds can be made available at CD-1

Report Outline and Reviewer Assignments
Director's Preliminary Cost & Schedule Review of Project X
March 16-17, 2009

Executive Summary	Ed Temple
1.0 Introduction	Dean Hoffer
2.0 Transfer Lines & Injection	Deepak Raparia Kathy Harkay
3.0 Main Injector Recycler Ring	Thomas Roser Alexis Smith-Bauman
4.0 Instrument & Controls	Willem Blokland Mike Spata
5.0 LE Linac Cavities & Cryomodules	Michael Kelly Eric Chojnicki Joe Preble Marc Ross
6.0 HE Linac Cavities & Cryomodules	Joe Preble Eric Chojnicki Michael Kelly Marc Ross
7.0 LE Linac Power Supplies & RF Distribution Balance	Ali Nassiri Chris Adolphsen Richard York
8.0 HE Linac Power Supplies & RF Distribution Balance	Chris Adolphsen Ali Nassiri Richard York

9.0 Cryogenics	Dana Arenius John Weisend
10.0 Conventional Facilities	Karen Hellman Martin Fallier
11.0 Project Management Cost & Schedule	Walter Henning Mark Reichanadter Dean Hoffer Ed Temple
12.0 Charge Questions	
12.1 Is the cost range estimate complete?	Walter Henning Mark Reichanadter
12.2 Has the cost range estimate been prepared using a sound estimate methodology?	Walter Henning Mark Reichanadter
12.3 Is the schedule set forth reasonable?	Walter Henning Mark Reichanadter
12.4 Are the labor estimates reasonable?	Walter Henning Mark Reichanadter
12.5 Are the materials and services estimated those needed to deliver the facility?	Michael Kelly Dana Arenius
12.6 Are the estimates for the M&S reasonable at this early stage of the project?	Michael Kelly Dana Arenius
12.7 Is the estimated contingency appropriate / adequate?	Walter Henning Mark Reichanadter
12.8 Are there ways the cost could be reduced?	Chris Adolphsen
12.9 Is the PED funding profile adequately defined to support a request for PED funds later this year?	Mark Reichanadter Dean Hoffer

R&D Plan Assessment

- It is requested that each of the technical sub-committees assess the adequacy of the Project X R&D Plan with regard to meeting the needs of the Project X construction project.
- Please document your assessment as appropriate in your sub-committee writeup

Breakout Session Contact List
for
Director's Preliminary Cost and Schedule Review of Project
Based on the Initial Configuration Document
March 16-17, 2009

Breakout Subject Area	**Project Contact**	**Review Committee Contact**
Project Management; Cost and Schedule Development; and PM Costs	Steve Holmes	Walter Henning
Cavities & Cryomodules for LE Linac and HE Linac	Mark Champion	Joe Preble
RF for LE Linac and HE Linac	John Reid	Chris Adolphsen
Main Injector / Recycler Ring; Transfer Line; and Injection	Dave Johnson	Thomas Roser
Instrumentation and Controls	Manfred Wendt	Willem Blokland
Cryogenics	Arkadiy Klebaner	Dana Arenius
Conventional Facilities	Russ Alber	Karen Hellman

Reporting Structure

- Review findings, comments, and recommendations should be presented in writing at a closeout with the Collaboration and Fermilab management.
- Eleven sections as noted above including Cost, Schedule, and Management sections.

Findings, Comments, and Recommendations

- Findings
  - Findings are statements of fact that summarize noteworthy information presented during the review.
- Comments
  - Comments are judgment statements about the facts presented during the review. The reviewers' comments are based on their experiences and expertise.
  - The comments are to be evaluated by the project team and actions taken as deemed appropriate.
- Recommendations
  - Recommendations are statements of actions that should be addressed by the project team.
  - A response to the recommendation is expected and that the actions taken would be reported on during future reviews.

Examples of Findings, Comments, and Recommendations

[NOvA CD-1 Director's Review @ Fermilab]

Findings

- Adhesive choice has an impact on work schedule and ventilation system design. The baseline adhesive was listed as 3M2216 and was said to have a safety factor of 5 for buckling. However a Devcon adhesive was discussed a great deal also. The Devcon adhesive has a sheer strength which was approximately 150% better but it contained a toxic solvent which the 3M2216 did not.

- An adhesive dispenser will be used to apply the adhesive to attach the modules together and to attach the blocks together. The adhesive dispenser can't be defined until the adhesive is chosen.

Examples of Findings, Comments, and Recommendations (continued)

[NOvA CD-1 Director's Review @ Fermilab]

Comment

- Adhesive needs to be determined as quickly as possible to meet timelines. If the 3M2216 meets the design SF of 5 for buckling and over a SF of 4 for shear stress between the planes it seems like it should be used over the Devcon adhesive which has toxic solvent vapors. Adhesive choice will affect assembly and the building (exhaust required) requirements.

Recommendation

1. Determine which adhesive to use as soon as possible. This affects building design and assembly time.

http://www.fnal.gov/directorate/OPMO/Projects/PX/DirRev/2009/03_16/review.htm

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March 16-17, 2009

Final Report - pdf Word

Closeout Presentations

Agenda

Project X Review Website with Talks

Project X Review Website with Project Documents

Review Committee Materials

Charge to the Review Committee

Review Committee

Report Outline and Writing Assignments

Reviewer Assignments for Breakout Sessions

Breakout Sessions Contact List

Executive Session Presentation

Review Closeout Presentation Format

Reviewer Write-ups

- Write-up template is posted on Director's Review Webpage. http://www.fnal.gov/directorate/OPMO/Projects/PX/DirRev/2009/03_16/CloseoutPresentationsPX03-16-09.doc
- Write-ups are to be sent to Terry Erickson at terickson@fnal.gov prior to 1:20 PM on Tuesday, March 17 for the Closeout Dry Run
- A final report will be issued within 2 weeks after the closeout.

Project X Cost Estimate by WBS Level 2

		Total	SWF	M&S	Com To	Com SW	Com M&
1	Project X	$743,545,773	$188,942,289	$554,603,484			
1.1	Project Management	$23,486,856	$19,889,856	$3,597,000			
1.2	LE Linac	$102,709,193	$22,495,803	$80,213,390			
1.3	HE Linac	$222,568,170	$27,096,446	$195,471,724			
1.4	MI/RR	$61,680,357	$12,071,807	$49,608,550			
1.5	PX Instrumentation	$22,999,772	$15,645,066	$7,354,706			
1.6	Controls	$26,426,678	$20,818,858	$5,607,820			
1.7	Cryogenics	$47,641,600	$6,679,600	$40,962,000			
1.8	Utilities & Interlocks	$7,625,914	$1,962,620	$5,663,294			
1.9	Conventional Facilitie	$195,359,000	$46,750,000	$148,609,000			
1.10	8 GeV	$25,497,919	$8,791,919	$16,706,000			
1.11	Integration	$7,550,314	$6,740,314	$810,000			

FY 09 $, no burden, no contingency, and no escalation

Project X Cost Estimate by SubCommittee Part 1

FY09$		Total	SWF	M&S	C Total	C SWF	C M&S
1	Project X	$743,545,773	$188,942,289	$554,603,484			
S/C 1							
1.1	Project Management	$23,486,856	$19,889,856	$3,597,000			
1.11	Integration (RD&D)	$7,550,314	$6,740,314	$810,000			
1.8	Utilities & Interlocks	$7,625,914	$1,962,620	$5,663,294			
S/C 2							
1.10	8 GeV	$25,497,919	$8,791,919	$16,706,000			
1.3.3	Debuncher Beta = 1.0 (copper) Cavity	$1,759,430	$585,360	$1,174,070			
S/C 3							
1.4	MI/RR	$61,680,357	$12,071,807	$49,608,550			
S/C 4							
1.5	PX Instrumentation	$22,999,772	$15,645,066	$7,354,706			
1.6	Controls	$26,426,678	$20,818,858	$5,607,820			
S/C 5							
1.2.1	Ion Source & LEBT	$8,846,656	$1,846,656	$7,000,000			
1.2.2	RF Quad	$1,779,000	$179,000	$1,600,000			
1.2.3	MEBT	$3,751,500	$1,049,000	$2,702,500			
1.2.4	Room Temperature Section	$4,601,000	$1,315,000	$3,286,000			
1.2.5	SSR1 Cryomodules	$10,675,336	$2,989,536	$7,685,800			
1.2.6	SSR2 Cryomodules	$17,043,877	$4,183,977	$12,859,900			
1.2.7	TSR Cryomodules	$24,055,095	$6,061,895	$17,993,200			
1.2.10	LE Linac RD&D (1.2.1 - 1.2.7)	$2,633,525	$1,478,525	$1,155,000			

FY 09 $, no burden, no contingency, and no escalation

Project X Cost Estimate by SubCommittee Part 2

FY09$		Total	SWF	M&S	C Total	C SWF	C M&S
1.3.1	Beta = 0.81 Cryomodules	$22,694,400	$2,430,140	$20,264,260			
1.3.2	Beta = 1.0 Cryomodules	$109,071,680	$10,334,280	$98,737,400			
1.3.6	HE Linac RD&D Plan (1.3.1 - 1.3.2)	$6,941,340	$2,816,340	$4,125,000			
S/C7							
1.2.8	325 MHz RF and Distribution	$26,273,990	$1,712,000	$24,561,990			
1.2.9	325MHz LLRF	$1,819,900	$820,900	$999,000			
1.2.10	LE LinacRD&D (1.2.8 - 1.2.9)	$1,229,314	$859,314	$370,000			
S/C 8							
1.3.4	1.3 GHz RF and Distribution	$74,981,784	$8,074,580	$66,907,204			
1.3.5	1.3GHz LLRF and Global LLRF Systems	$4,767,490	$1,753,700	$3,013,790			
1.3.6	HE Linac RD&D Plan (1.3.4 - 1.3.5)	$2,352,046	$1,102,046	$1,250,000			
S/C 9							
1.7	Cryogenics	$47,641,600	$6,679,600	$40,962,000			
S/C10							
1.9	Conventional Facilities	$195,359,000	$46,750,000	$148,609,000			

FY 09 $, no burden, no contingency, and no escalation

Discussion

- Questions and Answers