Conventional Facilities (WBS 121.06)

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PIP-II Independent Project Review

4-6 December 2018

In partnership with:

India/DAE
Italy/INFN
UK/STFC
France/CEA/Irfu, CNRS/IN2P3

Outline

- Scope/Deliverables
- Requirements
- Interfaces
- Preliminary Design, Maturity
- Design Review Plan
- Technical Progress to Date
- Organization
- Steps to CD-2
- ESH&Q
- Risks and Mitigations
- Responses to CD-1 recommendations
- Breakout Session topics
- Summary

About Me:

- PIP-II Level 2 Manager for Conventional Facilities
- Relevant Experience
  - Licensed Architect;
  - Project Management Professional (PMP);
  - LEED Accredited Professional;
  - 26+ years at Fermilab;
  - NOvA Project L2 Manager for Site and Buildings;
    - 2014 CD-4
    - 2015 U.S. DOE Secretary's Award for Excellence
  - General Plant Project Manager for 15+ years
    - Short Baseline Neutrino (SBN) Near Detector Building;
    - Short Baseline Neutrino (SBN) Far Detector Building;
    - Experimental Operations Center;

Scope and Deliverables

Charge #1

- Conventional Facilities includes the design, procurement and construction of the utilities, roads, structures, enclosures and buildings to support the installation, assembly and operation of the technical components. [1]
- WBS
  - 121.06.01 – Project Management and Coordination
  - 121.06.02 – Site Preparation
  - 121.06.03 – Cryogenics Plant Building (23,245 square feet)
  - 121.06.04 – Utility Plant Building (21,275 square feet)
  - 121.06.05 – Linac Complex (88,550 square feet)
  - 121.06.06 – Booster Connection (7,750 square feet)

[1] See WBS Dictionary in PIP-II-doc-599 for complete description

Scope and Deliverables

Charge #1

- Conventional Facilities includes the design, procurement and construction of the utilities, roads, structures, enclosures and buildings to support the installation, assembly and operation of the technical components.
- WBS
  - 121.06.01 – Project Management and Coordination
  - 121.06.02 – Site Preparation
  - **121.06.03 – Cryogenics Plant Building – CD-3A Request**
  - 121.06.04 – Utility Plant Building
  - 121.06.05 – Linac Complex
  - 121.06.06 – Booster Connection

Scope and Deliverables

Conventional Facilities System Requirements

Charge #1

Conventional Facilities Systems Function and Configuration Document [1]

- Facility Scope

  Associated conventional facilities including enclosures, equipment galleries, and utilities. The linac enclosure will be constructed with a length to accommodate at least two HB650 cryomodules beyond the nominal compliment required for 800 MeV.

- Functional Requirements
  - The siting of the PIP-II facility will be consistent with future replacement of the existing 8-GeV Booster with either an 8 GeV Rapid Cycling Synchrotron or superconducting pulsed linac.
  - The siting of the PIP-II facility will be consistent with future upgrades to provide 100 kW beams to the Mu2e hall on the Muon Campus.
  - The SC Linac will be constructed in a manner that allows installation and commissioning without interruption to ongoing accelerator operations.
  - Facility Lifetime equal to or greater than 40 years

- Safety Requirements

  The Project will be built to applicable DOE and FNAL engineering, safety, and radiation standards as outlined in the Fermilab Engineering Manual and Fermilab ES&H Manual.

[1] Conventional Facilities Systems Function and Configuration Document, TeamCenter Document ED0008133

Interfaces

Charge #1

Breakout Talk

- Project Interfaces
  - *Managed through PIP-II processes* [1]
  - ED0007697 – Site Preparation
  - ED0007698 – Cryogenic Plant Building
  - ED0007699 – Utility Plant Building
  - ED0007700 – Linac Complex
  - ED0007702 – Booster Connection

  Conventional Facilities interfaces with all Level 2 subprojects
- Fermilab Interfaces
  - Infrastructure Connections *(Managed through FESS processes)*
  - General Plant Projects *(Managed through FESS processes)*
  - Accelerator Operations *(Managed through AD processes)*
- International Interface *(Managed through WBS 121.02)*
  - Cryogenic plant is Indian partner deliverable

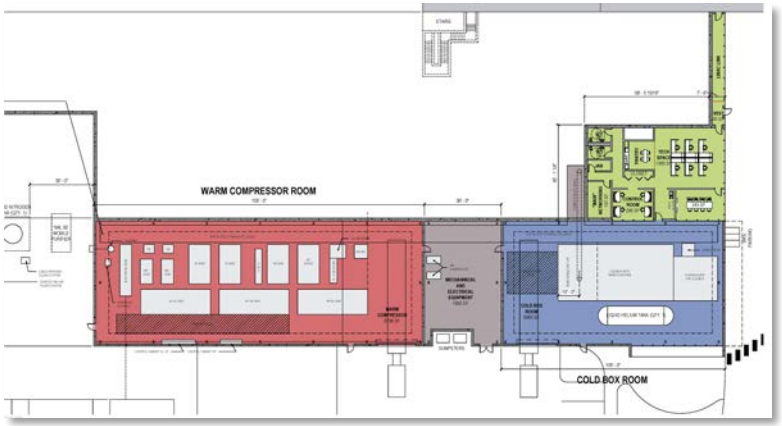
[1] See PIP-II Systems Engineering Management Plan at PIP-II-doc-1539
FESS is Facilities Engineering Services Section

Preliminary Design and Design Maturity

Charge #1

Breakout Talk

- Site Preparation (WBS 121.06.02)
  - 90% Design Maturity
  - Site Clearing package[1]
  - Site Work package[2]
  - Electrical Feeder package[2]
  - Site Restoration/Landscaping package[2]
- Cryogenics Plant Building (WBS 121.06.03)
  - Technical Requirements Complete (~40% design complete) [3]



Cryogenic Plant Building Plan

View Looking Southwest

[1] See TeamCenter ED0008374
[2] See TeamCenter ED0008459
[3] See TeamCenter ED0008373

Preliminary Design and Design Maturity

Charge #1

- Utility Plant Building (WBS 121.06.04)
  - 30% Design Maturity based on Conceptual Design
- Linac Complex (WBS 121.06.05) - 30% Design Maturity
  - High Bay Building
  - Linac Tunnel
  - Linac Gallery
  - Beam Transfer Line
  - 30% Design Maturity based on Conceptual Design
- Booster Connection (WBS 121.06.06)
  - 30% Design Maturity based on Conceptual Design

Design Review Plan

Charge #2

Replace with Chart Provided

Progress to Date Since CD-1

Charge #1, 2

- General Progress Milestones
  - January 2018 - Value Engineering Workshop with the CF team [1]
  - April 2018 – Received updated cost/schedule estimate [2]
  - June 2018
    - Completed Geotechnical Engineering Investigation [3]
    - Chartered and held the first meeting of the PIP-II Architectural Advisory Board [4]
  - July 2018 –
    - Received favorable wetland determination for the US ACOE [5]
    - Developed preliminary shielding strategy for Cryogenics Plant Building with 121.03 (Accelerator Systems)
  - November 2018 – Preliminary Design Report
  - December 2018 – Completed the A/E recompete process

[1] See PIP-II-doc-1377
[2] See PIP-II-doc-333
[3] See PIP-II-doc-1533
[4] See PIP-II-doc-1308 and PIP-II-doc-1548
[5] See PIP-II-doc-1630

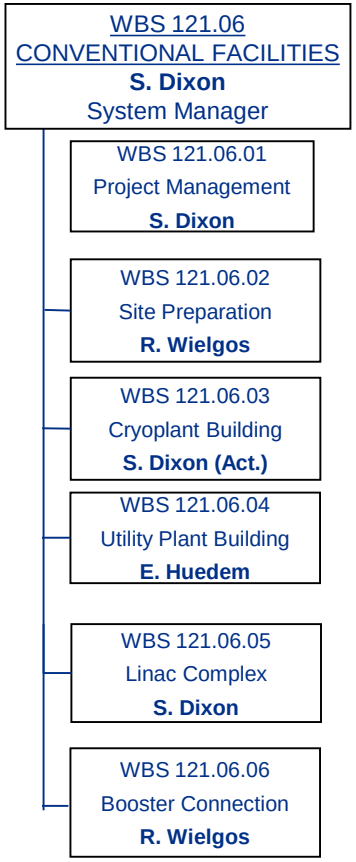
Progress to Date Since CD-1

Charge #1, 2

- Site Preparation – WBS 121.06.02
  - Design is ~90% Complete (scheduled for completion in December 2018)
  - Developed a Site Clearing construction package [1]
  - Received Authorization for Site Clearing package [1]
- Cryo Plant Building – WBS 121.06.03
  - Completed Technical Requirements Design [2]
  - Completed Water Quality Testing [3]

[1] See TeamCenter ED0008374
[2] See TeamCenter ED0008373
[3] See PIP-II-doc-155

Organization



Next Steps toward CD-2/3a

Charge #5

- Site Preparation – WBS 121.06.02
  - Complete the Site Clearing construction (FY19)
    (Goal: Ready to start construction at the time of the Groundbreaking)
- Cryo Plant Building – WBS 121.06.03 (CD-3A Request)
  - Complete Final Design (anticipated for Q3 FY19);
  - Initiate Procurement Processes to be ready to start construction (anticipated for Q2 of FY19);
  - Construction start dependent CD-3A approval and EA FONSI.
- CD-2 Activities
  - Start the detailed design (including 3D building model) for the Linac Complex, Booster Connection, Utility Plant Building (anticipated for FY19);
  - Coordination Mock Up of Linac Tunnel (anticipated in FY19);
  - External Independent Cost Estimate.

EA is Environmental Assessment
FONSI is Finding Of No Significant Impact

Schedule

Charge #1

- Add slide from Luisella with B.O. Milestones

Environment Safety and Health (ES&H)

Charge #6

Consider and plan for ES&H issues throughout the project life cycle

- Conceptual Design Phase
  - ES&H input includes review of the design, input from Tritium Task Force and Life Safety Analysis [1]
- Design Phase
  - ES&H is considered in A/E selection process;
  - ES&H is included in design reviews;
  - Implement Safety by Design process;
  - Incorporate Hazard Analysis Report hazards in the design process [2]
- Procurement/Construction Phase
  - Include safety performance as part of the subcontractor selection process;
  - Detail the responsibilities for team members including the Construction Subcontractor and Fermilab Construction Coordinator;
  - Independent oversight by ESH&Q Section

[1] Life Safety Analysis can be found at PIP-II-doc-120
[2] Hazard Analysis Report can be found at PIP-II-doc-140

Quality Management

Charge #6

Integrated Team Approach

- PIP-II Project Processes [1]
- A/E Design Processes *
- A/E Commissioning * Processes
- FESS Subject Matter Experts
- Laboratory Experts
- Construction Subcontractor *

(*) Quality requirements are incorporated into consultant selection and subcontract terms and conditions

PIP-II CONVENTIONAL FACILITIES QUALITY ASSURANCE RESPONSIBILITY MATRIX

Version Date: October 8, 2018

	PIP-II Leadership	Stakeholders		PIP-II CF TEAM	Fermilab SME	Architect/Engineering Team		Construction Subcontractor	Notes
		PIP-II Subprojects	Fermilab			Design Team	Commissioning Agent		
PRELIMINARY PHASE									
Functional Requirement Specification (FRS)	Review and **Approve** FRS	**Develop and Document Functional Requirements**	Develop and Document Functional Requirements	Review Requirements and Incorporate into FRS	Review and **Approve** FRS	...			
Goals for High Performance Sustainable Building (HPSB) criteria	Review and **Approve** HPSB goals			**Review Conceptual Design and Establish Goals**					See PIP-II-doc-764
Technical Requirements Specification (TRS)	Review and **Approve** TRS	**Develop and Document Technical Requirements**	Develop and Document Technical Requirements	Review Requirements and Incorporate into TRS	Review and **Approve** TRS				
DESIGN PHASE									
Basis of Design (BoD) Document	Review BoD Document	Review BoD Document	Review BoD Document	Review BoD Document	Review BoD Document	**Develop BoD Document based on FRS and TRS**	Review BoD Document		
Energy Model/HPSB Support Materials				Review	Review	**Develop**			
Design Documents		Provide Input	Provide Input	Provide Input	Provide Input	**Develop**	Review		
Preliminary Design Review (60%)	Participate and **Approve**	Participate and **Approve**	Review Design Documents	**Lead, Collect Comments and Develop Report**	Participate and **Approve**	Participate	Review Design Documents		
3rd Party Independent Review				Participate		**Lead** review to ensure team understand comments			
Value Engineering Exercises		Participate	Participate	**Coordinate and Lead**	Participate	Participate			
Cost Estimate				Review/Analyze	Review	**Develop**			
Final Design Review (90%)	Participate and **Approve**	Participate and **Approve**	Review Design Documents	**Lead, Collect Comments and Develop Report**	Participate and **Approve**	Participate	Review Design Documents		
Environmental Review Form	Provide Input		Review and Submit to DOE	**Develop**	Provide Input	Provide Input			
Commissioning Plan				Review	Review	Review	**Develop**		
Commissioning Materials (specifications, training requirements, manuals, checklist, etc)				Review	Review	**Develop and Incorporate into Subcontract Documents**	Review		
Subcontract Documents (technical spec and drawings)		Review	Review	Calculate and Review	Review	**Develop**			
Production Readiness Review (100%)	Participate and **Approve**	Participate and **Approve**	Review Design Documents	**Lead, Collect Comments and Develop Report**	Participate and **Approve**	Participate	Review Design Documents		
PROCUREMENT PHASE									
Request for Proposals				**Assemble and Submit to Procurement**		Provide Subcontract Documents			
Proposal Period Questions		Provide Technical Response	Provide Technical Response	**Coordinate Response**	Provide Technical Response	Provide Technical Response	Provide Technical Response		
Proposal Evaluations	Review as Requested			**Perform Technical Evaluation**		Review as Requested			
Request for Information		Provide Technical Response	Provide Technical Response	**Coordinate Response**	Provide Technical Response	Provide Technical Response	Provide Technical Response		
CONSTRUCTION PHASE									
Submittals (technical, shop drawings, hazard analyses, cost, schedules)				Coordinate, Track and Review	Review	Review	Review	**Submit**	
Construction Coordination Meetings		Participate as Needed	Participate as Needed	Participate	Participate as Needed	Participate	Participate as Needed	**Lead**	
Engineering Changes	Review and **Approve**	Provide Input, Review and **Approve**	Provide Input	**Initiate, Coordinate, Track and Review**	Review and **Approve**	Provide Input, Develop Backup Materials	Provide Input, Develop Backup Materials		
Construction Walkthroughs		Participate as Needed	Participate as Needed	Participate	Participate as Needed	Participate	Participate as Needed	**Lead**	
Commissioning Plan		Participate as Needed	Participate as Needed	Review	Review	Review	**Update, Distribute and Track**	Review	
Construction Activities				Coordinate and Track Progress				**Execute**	
Testing - Equipment		Review Compliance Document	Review Compliance Document	Witness, Review Compliance Document	Review Compliance Document	Review Compliance Document	Witness, Document Compliance	**Execute**	
Functional Test Procedure			Copied	Copied	Review	Review	**Develop**	Copied	
Testing - System Functionality		Review Compliance Document	Review Compliance Document	Witness, Review Compliance Document	Review Compliance Document	Review Compliance Document	**Lead, Witness, Document Compliance**	**Execute**	
As Built, Manuals Documentation		Copied	Copied	Coordinate, Track and Review	Review	Review	Review	**Submit**	
Owner's Training		Participate as Needed	Participate as Needed	Participate	Participate as Needed	Participate as Needed	Document Compliance	**Execute**	
Beneficial Occupancy	Review and **Approve**	Provide Input, Review and **Approve**	Participate as Needed	Coordinate Walkthrough, Document Compliance, **Approve**	Participate as Needed	Participate	Participate as Needed	**Initiate**	
Final Acceptance	Review and **Approve**	Provide Input, Review and **Approve**	Participate as Needed	Coordinate Walkthrough, Document Compliance, **Approve**	Participate as Needed	Participate	Participate as Needed	**Initiate**	
POST CONSTRUCTION / OCCUPANCY									
Seasonal System Functional Test		Review Compliance Document	Review Compliance Document	Witness, Review Compliance Document	Review Compliance Document	Review Compliance Document	Witness, Document Compliance	Execute	

[1] PIP-II Quality Assurance Plan is at PIP-II-doc-142
See PIP-II-doc-2291 for Quality Assurance Responsibility Matrix

Risk Management

Charge #2,7

Breakout Talk

- Conventional Facilities Risks
  - **0** High Risks
  - **15** Medium Risks
  - **31** Low Risks

- Top 3 Risks:
  - RT-121-06-001 – Subproject Requirement Changes
  - RT-121-06-002 – Accelerator Shutdown Schedule
  - RT-121-06-003 – Construction Bids Exceed Estimates

Note: RT-121-01-006 – Inflation Exceeds Assumption is a Project Management Medium Risk

Response to Recommendations

Charge # 8

Breakout Talk

- Director's CD-1 Review (October 2017) [1]
  - 2 Recommendations, both closed
- DOE CD-1 Review (December 2017) [2]
  - 3 Recommendations, all closed
- P2MAC Review (March 2018) [3]
  - 3 Recommendations, all closed

[1] Review ID 47866
[2] Review ID 48107
[3] Review ID 48469

Breakout Sessions

- Conventional Facilities In Depth
  - Schedule, Risks, Interfaces, ESH&Q and Review Recommendations
- Site Preparation
- Laboratory Interfaces
- Cryogenics Plant Building (Joint Session with SRF/Cryo)
- Requirements Documentation

Summary

- Conventional Facilities scope and deliverables are understood and are based on requirements;
- Project Processes are in place and functioning;
  (Risk Management, ES&H, Quality Management, Reviews)
- CD-3A Scope (Cryo Plant Building) is on track;
- We are on track for CD-2/3a and look forward to your feedback
- Thank you for your attention

END