Fermilab

Final Report

Director's CD-1 Review of IERC

August 30 - September 1, 2016

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Table of Contents

Table of Contents 3

Executive Summary 5

Introduction 6

Technical Systems 8

Project Management 11

- Cost and Schedule 11
- ESH&Q 16
- Management 18

Appendices 22

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1.0 Executive Summary

To meet the mission needs of the future program, Fermilab is proposing to build a new state-of-the-art building that will allow the co-location of engineers, scientists and laboratory spaces. Currently these functions are spread out over the Fermilab site. Co-location will improve collaboration and efficiency and an alternatives analysis showed that this was the most cost effective solution. The IERC building is a critical part of the overall Campus Master Plan.

The conceptual design phase of the project has been completed resulting in a 97,500 gsf building that meets mission need and is located next to and in front of Wilson Hall. This is a highly visible location and consideration of this has been taken into account in the design.

Programming for the building has been extensively studied and prioritized. A description of the process of gathering the information and the detailed results (e.g. which groups, systems and functions fit within the 97,500 gsf building and which would be added or removed if the size changes during preliminary and final design) should be captured in the documentation and presented in the IPR along with a description of how the programming will be refined during the preliminary and final design stages.

The strategy of CM/GC is also being used by LBNF but is otherwise new to Fermilab. The planning and procurement strategy (going out for bids for the next phases of the project) needs to be carefully managed and the experience of IARC as well as other projects should be carefully studied and incorporated.

The project schedule proposes a construction start in FY18 and completion in FY21 (internal milestones).

The project manager is currently also acting as the L2 CAM for construction management. This role should be filled before the award of the CM/GC contract. Preferably it would be filled with a person with CM/GC experience in time for participation in the source evaluation committee.

The cost and schedule have been developed but some work remains to be done to be ready for the IPR. The cost and schedule contingency appears sufficient for a project at this stage.

The project presented in a breakout a reasonable approach to scope contingency (i.e. additive vs. deductive scope) but needs to ensure that it is consistent in all project documents and that the presentations are aligned accordingly before the CD-1 IPR.

The project team is functioning well and should be able to complete the work required to prepare for the CD1 IPR and to successfully manage the remaining phases of the project.

2.0 Introduction

The Particle Physics Project Prioritization Panel (P5) May 2014 report recommended the development of an international, coherent short- and long-baseline neutrino program hosted at Fermi National Accelerator Laboratory (Fermilab). Implementing these recommendations will require significantly increased collaboration and interactions among Fermilab staff, who will in turn be working with scientific collaborators and international partners in the design, construction, and operation of physics experiments. Currently, these staff and their associated manufacturing, assembly, engineering, and technical facilities are scattered among three parts of the campus. As a result, they are unable to efficiently collaborate on ongoing and planned projects in support of the laboratory's mission.

Co-location of these staff would improve collaboration because it would increase interactions among the various groups and reduce down-time spent traveling across the site. From an infrastructure standpoint, however, Fermilab currently lacks sufficient space to do this. In addition, many of these spaces are inadequate to accommodate current and planned scientific programs because they are obsolete (e.g., leaking roofs, inadequate HVAC systems) and do not support the configuration or specification needs of current and future technical programs.

Fermilab has developed a campus master plan to respond to this need. The proposed Integrated Engineering Research Center (IERC) is the largest, most visible and important component of the campus master plan. The proposed IERC Project is to provide 73,000 to 165,000 GSF of laboratory and office space for engineering technical groups necessary to support the scientists and project teams pursuing the P5 mission, who are located in adjoining Wilson Hall.

The project presented a conceptual design for a 97,000 square foot energy efficient and environmentally sustainable laboratory and office building that would provide 21st-century, state-of-the-art laboratories, technical, and office space for particle physics-related research and development projects.

The project will be funded predominantly by the DOE Science Laboratories Infrastructure (SLI) program, with support from Laboratory overhead to fund all pre-CD-1 activities including the conceptual design and the selection of an A/E firm for preliminary and final design stages. The point estimate for the TPC is $86M.

The SLI program conducted a pre-conceptual planning and Mission Validation Internal Review in July 2014. The review recommended that the programs and Fermilab develop a conceptual cost schedule and programming plan in preparation for CD-0. CD-0 was approved in July 2015 with a cost range of $44M-$144M and 67,000-133,000 gross square feet. The DOE CD-1 review is scheduled for Nov. 2016.

A number of acquisition strategies were considered and the project is planning to proceed with a CM/GC approach for the preliminary/final design and construction phases.

In response to the Fermilab Director's request for a review to assess the project's readiness for DOE CD-1 review the Chief project officer assembled a team of experts with experience on similar projects. The review took place from Aug. 30-Sept. 1, 2016. The project presented their CD-1 documentation and gave a

series of plenary and parallel presentations as well as responding to questions from the committee. The responses to the charge questions as well as findings comments and recommendations are presented below.

2.0 Technical

Subcommittee: Tom Hamernik, Phil Matton

Charge Questions:

- Have the performance requirements been appropriately and sufficiently defined for this stage of the project? Yes.

- Is the conceptual design sound and likely to meet the performance requirements? Yes, with the expectation that the responses the Project Team provided to questions during this review are adequately incorporated into the CDR.

Findings

- No ODH protection is included.
- Each of the requirements listed in the IERC Science and Technical Requirements document includes a reference to provisions in the CDR or the Programming Report.
- IERC is to be protected from fire using wet sprinklers.
- Bridge cranes exist and are in service throughout Si-Det while the CDR states that no bridge cranes are required. The intent is to specify mobile or fixed jib cranes.
- More than 100 parking spaces are displaced during construction.
- HVAC systems serving laboratory spaces are appropriately independent from office and collaboration mechanical and natural ventilation systems.
- House and laboratory electrical loads will be served from opposite ends of the double-ended main switchgear to enhance power quality delivered to the laboratory.
- Network and communications systems are included in the project scope.
- A 250kW diesel powered standby generator is remotely located on the east side of the Main Ring shielding berm allowing the berm to shield it visually and acoustically from IERC.
- Clean rooms are required to maintain a relative humidity range of from 30% to 50%.

- Provisions for Non-Hazardous laboratory exhaust are discussed on page 107 of the CDR, which indicates that the central exhaust system will be housed in the mechanical penthouse. Page 91 states that no mechanical penthouse will be provided.

- The capacity of the existing sanitary sewer, and potentially other utilities, while presently unknown, will be explored during Preliminary Design.

Comments

- Parking near Wilson Hall is limited. Consider developing a temporary parking plan for spaces displaced during construction.

- It's not clear from the project schedule that time has been budgeted for site investigation activities such as topographic surveys, utility surveys, and geotechnical explorations. Allow sufficient time for soil borings, laboratory testing, and the development of the geotechnical report and the gathering of other site data needed for Preliminary Design.

- Consider including a summary list or table of utility services to be provided to each of the lab spaces and their capacities.

- During the next round of programming, clarify the standby power generator capacity and confirm how much experimental equipment can be put on it.

- Consider defining the Building Risk Category (i.e. I - IV) and Seismic Design Category (i.e. A-D) in the building code analysis section of the CDR.

- The design of the building exhaust needs further clarification to make sure it won't be an aesthetic problem and to also make sure there won't be inadvertent intake of exhausted air. Once this has been done a plume study should be performed.

- Wilson Hall is iconic and the project team has shown respect for its status and architecture while working within the selected site's constraints. Consider exploring all options with respect to siting or configuring the structure (such as progressively stepping back or angling the upper levels away from Wilson Hall) to decrease the IERC's visual encroachment into the entrance axis.

- The Project Team stated that all documents will be stored on FESS Engineering file servers. Consider developing 3D building interface models of the high bay laboratories to facilitate future clean room/laboratory planning and development. These models can be stored in TeamCenter.

- Consider segregating mechanical and electrical equipment as a best practice. This could be accomplished with separate rooms or zoning within the same room. Providing surplus floor area for future expansion of the utility infrastructure should also be taken into account.

- The natural ventilation requires further investigation. In particular, what are the filtering requirements and what impact will turbulent outside air have on the building's airflow design.

Operable windows and natural ventilation is appealing but introduces a risk to air quality and potential maintenance concerns. Screens in use at the laboratory are reported to clog with cottonwood seed. Consider the maintenance implications carefully.

- In keeping with the idea that the facility is intended to be flexible, consider including a screened utility yard proximate to the building for the inevitable new dewar, specialty gas tank, or other equipment to avoid negatively impacting the building aesthetics.

- Given the long intended life of IERC, review no cost/low cost options that enable future capability. Consider including bridge crane support steel as part of the base scope so that crane rails and bridge cranes could be easily added if needed in the future. Consider including ample spare conduits and utility chases to facilitate the redevelopment of the spaces and expansion facilities.

- Wet sprinklers systems and green roofs present a risk to clean rooms housing costly test equipment and materials. Consider how this risk can be mitigated.

Recommendations

1. Improve the traceability between the programming requirements identified in the Programming Report and the technical scope defined in the CDR prior to the DOE CD-1 IPR.

2. Capture all the work that has been done in identifying planned functions and services needed to support laboratory operations (e.g. exhaust) as presented in the responses to questions during the review. Include the response in the Conceptual Design Report prior to the DOE CD-1 IPR.

3.0 Project Management

3.1 Cost and Schedule

Subcommittee: Jennifer Fortner, Luisella Lari, Joel Sefcovic

Charge Questions:

- Has a credible and sufficient alternatives analysis been performed? Yes, with minor updates, the self performed Alternatives Analysis is sufficient for selection of the alternative.

- Are the estimated cost and schedule ranges credible and realistic for this stage of the project? Yes, the cost and schedule range is realistic. However, the point estimate - of which the range is based - has significant credibility issues. It was assessed that the project can absorb the corrections related to the point estimate within the cost and schedule range proposed.

- Is adequate scope, cost, and schedule contingency included? Yes, while updates are needed related to the contingency, the available amount appears adequate.

Findings

- Five alternative delivery models to meet the Mission Need were evaluated within the self performed Alternatives Analysis. The alternatives were screened for viability. Three of the five alternatives were compared via life-cycle analysis across: capital investment costs, energy and utility consumption costs, general maintenance costs and major equipment repair and replacement costs (sustainability), and costs associated with productivity loss and opportunity loss. Additionally, a sensitivity analysis was performed using weighted scores for net present value, collaboration, modern mission ready facilities, environmental safety and health, and location site condition. The selected alternative coincided with the lowest life-cycle cost.

- The project's acquisition strategy is to use a tailored approach with design by an Architectural/Engineering firm and construction by a Construction Management/General Contractor (CM/GC).

- The proposed project Total Project Cost (TPC) range is $74-86 million, developed around a target of $68 million. This is within the CD-0 preliminary TPC range for the project.

- An estimated breakdown of planned costs for the point estimate includes: a Total Estimated Cost (TEC) of $67.05 million, Contingency of $17.95 million (21.1 percent on TEC, 26.8 percent on to go), and Other Project Costs (OPC) of $1.0 million.

- The cost basis is supported by two preliminary cost estimates developed by a parametric approach using the conceptual design and a November 2015 Chicago area construction market study for escalation. The January 2016 cost estimates were reconciled to within 1.4% of each other. An updated estimate was provided by the A/E in August 2016 and has not been independently estimated. The newly provided A/E estimate did not state a maturity classification; however, the total cost estimate is represented per the project team as a Class 4 estimate, -15% to +20%.

- A link appears between the Laboratory Program, through the CDR, to the Preliminary Cost Estimates. The basis of the conceptual estimate was formed around a 97,500 gsf fully fit out.

- The Key Performance Parameters (KPPs) for the project are presented as 73,000 gsf for Threshold and 165,000 gsf with site improvements for Objective with a point estimate of 97,500 gsf. This is within the CD-0 preliminary KPP range for the project.

- The project presented during a breakout session a 90/100/110 scope contingency solution where 90% solution is 73,000 gsf fit-out and furnished, 100% solution is 97,500 gsf fit-out and furnished, and 110% solution is site improvements, Wilson Hall connector stair, and additional square footage.

- A project risk registry is in place. There are a total of 32 open/active pre-mitigated risks with 3 high, 21 medium, and 8 low. The risk register includes only threats and no opportunities. Risks were developed as an iterative process per the Fermi Risk Management Procedure. The project does not have a standalone Risk Management Plan (RMP). The project team states that the risks are reviewed at least quarterly The risks are qualitative in nature at this stage of the project. Each risk has a description, mitigations/handling strategy, probability, impacts, and score. The current expected value of items within the risk register is $4.45 million.

- The IERC Project CD-3 will be tailored to be split into two – a CD-3A for Site Preparation concurrent with CD-2, and a CD-3B for Building Construction that will follow at the end of final design. Additionally, the final design will proceed while the Independent Project Review (IPR) and CD-2 are in process.

- The proposed project Level 1 CD-4 milestone is fourth quarter FY 2023, which includes 23 months of schedule contingency from Level 4 CD-4.

- A Primavera P6 schedule with time-phased project scope was presented. The resource loaded schedule is funding profile constrained. A technically driven schedule has not been evaluated.

- The project has estimated within the Primavera schedule 24 months for design (preliminary and final) and 42 months for construction (12 months site prep, 24 months main building, and 6 months of building closeout). The current project schedule represents Site Prep taking place in January 2018.

- The critical path provided from the Primavera P6 schedule runs from Conceptual Design to Site Prep Final Design into Site Prep and then Building Construction with an 80 day gap in first quarter FY17 into the second quarter.

- The project presented a funding, obligation, and budget profile by fiscal year and quarter. The quarterly profile exceeds the funding profile in first quarter FY17, fourth quarter FY17, and first quarter FY18 as currently presented.

Comments

- The self performed Alternatives Analysis is sufficient for selection of the alternative, however, the project should confirm if the selected alternate is still attractive at the Threshold KPP area (currently at 73,000 gsf) and the analysis should consider the maintenance and operations cost of the remaining existing space (currently at 24,500 gsf).

- The cost basis itself is well documented within the A/E and ICE, however, these estimates were unable to trace to the basis of estimate documents and resource loaded schedule information provided. The project needs to provide a clear trace between these estimates. Additionally, the project needs to clarify how escalation and design/pricing contingency is or is not included in the estimate used within resource loaded schedule.

- The presented Class 4 estimate would meet the guidance provided within DOE Guide 413.3-21. However, the project has not fully assessed the uncertainty within the project's estimates. Thus, this is only a top down approach to assessing the cost estimate. A supported estimate should be provided, which includes the estimate uncertainty/maturity assigned within the basis of estimates.

- The project's documented, presented, and discussed KPPs and scope contingency approach needs to be clarified and aligned accordingly between all project documents.

- The use of the Fermi Risk Management Procedure for the primary process related to risk is viewed as an acceptable practice in principle. However, to meet the intent of a Risk Management Plan (RMP) within DOE Order 413.3b, the project needs to document within the Project Management Plan (PMP) and/or Preliminary Project Execution Plan (PPEP) deviations from the Fermi procedure, specifics that are related to the project's risk scoring, and the frequency of reviewing risks. The project should make the use of the Fermi procedure in lieu of a Risk Management Plan clearer to reviewers. Consider using something similar to how the cost estimate process was explained and do not mark the Fermi Risk Management Procedure as the project's Risk Management Plan.

- The project's risk register is detailed but could be improved by adding several missing risks (see the Management section for details), reviewed for incorporation of all cost impacts (CM/GC standing army), and having mitigation responses reviewed to align with the Fermi procedure. Additionally, the risk matrix does not currently include technical impacts as an option. This exclusion should be reevaluated by the project.

- The project schedule estimates for design appear adequate, however, the estimates for the construction duration are in conflict with the basis of estimate from the A/E, which is listed at 18 months. The project should review and reconcile this discrepancy since the resource loaded schedule currently shows over 42 months for construction, which would requiring additional costs for things like general conditions. Additionally, the estimates provided from the A/E and/or ICE typically includes a short narrative to include basic assumptions and scope basis of the estimates provided.

- While the project critical path schedule appears to run through the correct upper level WBS elements, the actual activities that are driving the critical path within the construction area are support activities. Additionally, Site Prep is near critical (at 3 days of float) but is set to begin in the month of January. Given the winter weather in the Chicagoland area, this could prove to be problematic for maintaining schedule. The project should review critical path and overall project schedule for accuracy.

- The WBS Dictionary, Milestone Dictionary, and schedule have inconsistent information. Deliverables that are discussed within the WBS Dictionary are not present as a milestone in the schedule nor in the Milestone Dictionary. These project documents should be made more consistent and traceable.

- The funding, obligation, and budget profile presented is insufficient. The project needs to revisit the schedule and costs such that they can remain below the funding profile provided by the program office with allowance for continuing resolutions (at least three months) and probable contingency usage.

- Despite modifications needed to the cost and schedule, as noted above, the contingency appears to be adequate for this stage of the project.

Recommendations

3. Prior to the CD-1 IPR, consider updating the Alternatives Analysis to confirm if the selected alternate is still attractive at the Threshold KPP and include results for the maintenance and operations cost for remaining existing space.

4. Revise the funding, obligation, and budget profile prior to the CD-1 IPR such that the project can remain below the funding profile provided with allowance for continuing resolutions and probable contingency usage.

5. Revisit and revise the resource loaded schedule prior to the CD-1 IPR related to funding limitations, FTE leveling, accurate critical path, and high float values.

6. Refine, prior to the CD-1 IPR, the basis of estimate documentation to include the ability to trace to the A/E estimate documentation provided, assess the overall estimate uncertainty for the project, support the needed contingency value, and confirm the stated Class estimate.

7. Prior to CD-1 IPR, update and ensure consistency of project documentation, specifically: WBS Dictionary, Milestone Dictionary, resource loaded schedule, basis of estimate documentation, and presentations.

8. Update and review the risk register for missing risks, impacts, and mitigation strategies prior to CD-1 IPR.

3.2 ESH&Q

Subcommittee: Nimmi Kovvali, Amber Kenney

Charge Questions:

- Is the ESH&Q being appropriately addressed for this stage of the project? Yes, however ES&H aspects of the building should be evaluated and incorporated into the design documents once more detailed programming is complete.
- Are Integrated Safety Management Principles being followed? Yes

Findings

- PHAR is developed and appears to include the known hazards of the conceptual design.
- Fermilab's ISM plan is detailed in the Fermilab ESH Manual. Integrated safety principles are being integrated into this stage of the project.
- The IERC Quality Assurance Plan has been developed appropriately for this stage of the project. Quality Assurance was not addressed in any plenary talks.
- The HPSB Guiding Principles have been incorporated into the building design.
- A Categorical Exclusion was approved for IERC in December 2015.
- The risk register includes some ESH&Q risks, mainly for the construction phase.
- Specific programming details related to utilities and other laboratory needs was not found in either the programming or CDR documentation.
- The current hazardous materials inventory for the building can be comfortably accommodated in the Type B occupancy classification for the project. However, specific control areas within each floor are not defined.
- The next phase of program planning will further inform the project of operational hazards.

Comments

- While the required information is available in the PHAR, it would be beneficial to organize the information to delineate construction and operational hazards.
- Evaluate the need for building control areas per IBC Tables 414.2.2 / 307.1 (1) / 307.1(2) to accommodate future chemical needs in the building.

- The funding model for what is included in construction versus what is to be covered by the experimental programs should be defined clearly. Carefully evaluate what safety systems are required in laboratory spaces for use on day one.

- No exhaust capacity is provided in IERC at this time. Ensure the program confirms this decision. It would be difficult to make exhaust capacity available after design is complete.

- The CDR speaks to "Non Hazardous Lab Exhaust" for Laboratories. Clarify this exhaust need. The CDR does not list "Laboratories" as a space classification in the schematics on Page 45 in Figure 3.12.

- During the next round of programming, clarify the standby power generator capacity and ensure critical safety system capacity is sufficient.

- Traffic plans for construction are being developed. Careful consideration should be given to traffic flow and emergency response including pedestrian and bicycle traffic.

- PHAR mentions the potential need for Low Conductivity Water (LCW), while the CDR does not reference it at all. Similarly, the CDR defines the need for tepid water for safety showers and eyewash stations but the program does not reflect it at this time.

- The PHAR does not discuss the use of sealed sources. During the site visits, several areas had "radioactive material" signs on the doors. Discussions revealed that these are small test sources with no impact on the design of the lab areas.

Recommendations

9. Incorporate control areas into the building design.
10. Confirm program requirements to ensure the following are not needed in the building - exhaust for work with hazardous materials, safety showers and eyewash stations, oxygen deficiency monitors, gas cabinets, etc.
11. Clarify information in the PHAR under 5.10 Ionizing Radiation, to specify the use of sealed radiological sources.
12. The QA Plan and implementation elements should be included in the plenary session.

3.3 Management

Subcommittee: Mike Finder, Bob Kephart, Troy Lark, Brenna Flaugher

Charge Questions:

- Is the Project being appropriately managed? Yes, the project team is functioning well and should be able to successfully manage the project throughout the remaining phases of the project.

- Is the Integrated Project Team established and functioning? Yes, the IPT is established and meeting on a monthly basis.

- Are the management structure and resources adequate to begin the Preliminary Design and to support the project through construction to successful completion? Yes, but the role of CM will need to be filled before the CM/GC contract award.

- Is the required DOE order 413.3b documentation (e.g. Acquisition Strategy, Preliminary Project Execution Plan, Risk Management Plan, and Preliminary Hazard Analysis Report) complete? Yes, drafts of the required DOE order 413.3b documentation are complete. However, the RMP needs further refinement.

Findings

- The project team is qualified, experienced, and has worked together on previous Fermi projects.
- The PPEP contains a well defined Project Organization Chart that defines the IPT members, project roles, personnel, and reporting structure. IPT is meeting monthly.
- The Project Manager is also currently acting as the CM in the organization chart.
- The PPEP and Acquisition Strategy have been drafted and are acceptable for this phase of the project.
- The PPEP defines the Threshold Key Performance Parameter (KPP) equal to 73,000 gsf and the Objective KPP equal to 165,000 gsf and site improvements.
- The project has a well-developed risk assessment process that involves quarterly reviews that include the project team.
- The project Risk Register includes several threats but does not include opportunities.

- A project-specific Risk Management Plan was not provided. However, the Risk Management Plan was included as a section in the PMP. Additionally, a generic "Fermilab Risk Management Procedure for Projects" was provided.

- The Acquisition Strategy includes an A/E design contract approach and a single CM/GC contract approach with separate tasks for the two construction phases (site prep and building).

- The project plans to pre-qualify the pool of CM/GC's to be issued the RFP.
- The project plans to award the CM/GC contract at 50% Preliminary Design.
- The project presented a CM/GC procurement schedule of approximately 11 months in duration.
- Projects at Fermilab have traditionally used the design-bid-build delivery method. The project team explored alternate delivery methods with the IERC project and concluded that CM/GC is the preferred delivery method for the project.

- CM/GC is a new delivery method at Fermilab but is also being utilized by the LBNF project.

- The proposed CD-1 cost range of $73M-$85M (TEC)/$74M-$86M (TPC) is tighter than the CD-0 range of $44M-$146M (TEC)/$45M-$146M (TPC).
- Two cost estimates were prepared for the conceptual design. One was performed by the A/E's cost estimator and one was performed by an independent estimator. Both estimates were based on a 97,500 gsf building solution. The ICE was within 1.4% of the A/E estimate.

- Both cost estimates utilized the UniFormat for the Conceptual Design cost estimates.

- The project developed a preliminary schedule and proposed a combined CD-2/3a milestone after the completion of the building preliminary design and site prep final design.

- In the breakout sessions, the project proposed a bid strategy that includes a base scope equal to a 97,500 gsf facility fully-fit out (100% target solution). The project proposes a 10,000 gsf deduct alternate (90% solution). Additional square footage expansions and scope enhancements are also planned (110% solution).

- The bid strategy specified in the PPEP proposes a base scope of 73,000 gsf multi-story lab building fit out and alternates for building expansion up to 165,000 gsf and various scope enhancements including site improvements.

- The project plans to procure a Commissioning Agent during the Preliminary Design Phase using a Best Value-based selection resulting in a firm fixed price.

- The project plans to procure a Testing Agent during the Construction Phase using a Best Value-based selection resulting in a firm fixed price.

- For the Conceptual Design Phase, the project contracted with an A/E firm through a Master Agreement.

- The project plans to compete the A/E services contract for the Preliminary, Final Design, and Construction Administration phases.

- The project is reporting 19% EDIA (% of construction).

Comments

- The project team is functioning well and should be able to successfully manage the project throughout the remaining phases of the project.

- In the PPEP, the project should consider using a Project Organization Chart with roles only (no names) so that the PPEP does not require revision/re-approval when project personnel change. The IPT Charter would continue to include names for project roles.

- Consider continuing the use of Uniformat cost estimating framework (in lieu of MasterFormat) for cost estimates from CM/GC and ICE through the end of Final Design in order to better manage costs associated with major building systems.

- Consider monthly risk assessment reviews (in lieu of quarterly) going forward.

- Consider reviewing lessons learned from other projects within the DOE complex who have successfully used the CM/GC delivery model.

- Consider reviewing lessons learned from recent large buildings built on the Fermilab site (e.g. IARC OTE and HAB) and other sites within the DOE complex. The project should pay particular attention to contractual issues that may lead to cost increases and/or schedule delays.

- The Risk Register is missing several project risks that the project should consider incorporating before the CD-1 IPR including:

  - Schedule delays associated with the CM/GC procurement

  - Schedule delays associated with the loss of key experience CM/GC personnel during the project

  - Schedule delays associated with work stops or contractor terminations due to poor performance.
  - Schedule delays associated with replacing and retraining CM/GC subcontractors mid-project due to bidding issues.
  - Disputes and additional associated costs resulting from poor delineation between site prep and construction project scope.
  - Schedule delays resulting from interactions with other lab activities (e.g. PIP-II) or Accelerator operations (feeders, comm ducts).
  - Program changes during construction.

- Review all options for the procurement strategy and contract details related to the acquisition of the A/E for the Preliminary Design, Final Design, and Construction Administration phases.
- The project's plan to award the CM/GC contract at 50% preliminary design is appropriate. However, an aggressive procurement schedule will be required to meet that goal.
- The project should have a clearly defined process and set of requirements to pre-qualify the CM/GC firms.
- The project should validate the planned durations and sequences associated with the CM/GC procurement schedule.
- In the breakout sessions, the project proposed a bid strategy that includes a base scope equal to a 97,500 gsf facility fully-fit out (100% target solution) with a 10,000 gsf deduct alternate (90% solution). The project should consider raising the Threshold KPP to more closely align with the 90% solution (87,000 gsf in lieu of 73,000 gsf).
- The project's plan to compete the preliminary and final design A/E services contract is a best practice.
- Consider adding a Program Verification phase at the beginning of preliminary design to ensure the selected A/E has ownership of the program.
- The project's plan to engage a Commissioning Agent during the design phase is a best practice.
- Consider engaging an independent Building Envelope Commissioning Agent to review the final design and to commission the building enclosure system during the construction phase.
- Before CD-2, consider drafting an Interface Control Document that delineates scope responsibilities between the project and other parties.

Recommendations

13. Fill the role of CM CAM before the award of the CM/GC contract. Preferably, the CM CAM would be experienced in the CM/GC project delivery method and would participate on the CM/GC evaluation committee.
14. Prior to the CD-1 IPR, clarify the approach to scope contingency (i.e. additive vs. deductive scope) and ensure all project documents and presentations are aligned accordingly.
15. Prior to the CD-1 IPR, clarify the documentation approach to the Risk Management Plan.
16. Prior to the CD-1 IPR, review all documents to ensure consistency within and among documents.
17. Review and incorporate appropriate lessons learned from IARC/OTE design and construction.

4.0 Appendices

A. Charge

B. Agenda

C. Review Committee Contact List and Writing Assignments

Appendix A

Charge

Director's CD-1 Review of IERC
August 30 - September 1, 2016

Fermilab

Directorate
630.840.3211 (phone)
630.840.2900 (fax)

Memorandum

29-Jul-2016

To: Mike Lindgren, Chief Project Officer

From: Nigel Lockyer, Director

Subject: Director's CD-1 Review of the Integrated Engineering Research Center (IERC)

Please organize and conduct a Director's Review of IERC on August 30-September 1, 2016 to assess the project's readiness for the DOE CD-1 review and approval process. The purpose of the Review is to assess all aspects of the project's conceptual design and associated plans.

The review committee should respond to the following questions:

1. **Design and Scope.** Have performance requirements been appropriately and sufficiently defined for this stage of the project? Is the conceptual design sound and likely to meet the performance requirements?
2. **Cost and Schedule.** Has a credible and sufficient alternatives analysis been performed? Are the estimated cost and schedule ranges credible and realistic for this stage of the project? Is adequate scope, cost, and schedule contingency included?
3. **Management.** Is the project being appropriately managed? Is the Integrated Project Team established and functioning? Are the management structure and resources adequate to begin the Preliminary Design and to support the project through construction to successful completion? Is the required DOE Order 413.3b documentation (e.g. Acquisition Strategy, Preliminary Project Execution Plan, Risk Management Plan, and Preliminary Hazard Analysis Report) complete?
4. **Environment, Safety, Health, and Quality (ESH&Q).** Is ESH&Q being appropriately addressed for this stage of the project? Are Integrated Safety Management Principles being followed?

The committee is asked to present a draft of their report at the review closeout and to issue the final report within two weeks of the review's conclusion.

Nigel Lockyer
Director
Fermi National Accelerator Laboratory

Fermi National Accelerator Laboratory / Kirk and Pine Street / P.O. Box 500 / Batavia, IL 60510 / 630.840.3000 / www.fnal.gov / fermilab@fnal.gov
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Appendix B

Director's CD-1 Review of IERC
August 30 - September 1, 2016

Agenda

Director's CD-1 Review of IERC
August 30 - September 1, 2016

AGENDA

Tuesday, August 30, 2016

8:30 a.m.	Executive Session – Comitium (WH2SE)	
	• Charge to Committee	M. Kaducak
9:00 a.m.	Welcome and IERC Project Overview – One West (WH1W)	
	• Welcome and Introductions	M. Lindgren
	• Campus Strategy and Project Overview	R. Ortgiesen
	• Science	E. Gottschalk
10:00 a.m.	Break – Outside One West	
10:15 a.m.	Design and ES&H	
	• Conceptual Design	G. Van Zandbergen
	• ESH&Q	D. Mertz
11:00 a.m.	Break	
11:15 a.m.	IERC Project Management	K. Sienkiewicz
	• Acquisition Strategy	
	• Analysis of Alternatives	
	• Cost and Schedule	
	• Project Management Approach	
	• Risk Management Approach	
12:00 p.m.	Lunch – 2nd Floor Crossover	
1:15 p.m.	Site tour: Existing Spaces of IERC Program	
2:15 p.m.	Break – Outside Comitium (WH2SE)	
2:30 p.m.	Breakout Sessions	
	#1: Management – Comitium (WH2SE)	
	#2: Cost and Schedule – Snake Pit (WH2NE)	
	#3: Technical – Curia II (WH2SW)	
	#4: ES&H – Black Hole (WH2NW)	
4:30 p.m.	Executive Session – Comitium (WH2SE)	
5:30 p.m.	Adjourn	
6:00 p.m.	No Host Dinner	

Wednesday, August 31, 2016

8:00 a.m.	Executive Session / Report Writing – Comitium (WH2SE)
9:00 a.m.	Breakout Sessions (Continued in Same Rooms)
	#1: Management
	#2: Cost and Schedule
	#3: Technical
	#4: ES&H
11:30 a.m.	Executive Session / Report Writing / Lunch – 2nd Floor Crossover
1:00 p.m.	Meet with IERC Project Team to Review Committee Questions – Comitium (WH2SE)
3:00 p.m.	Executive Session / Report Writing
5:00 p.m.	Adjourn

Thursday, September 1, 2016

8:00 a.m.	Executive Session / Dry Run – Comitium (WH2SE)
10:00 a.m.	Meet with IERC Project Team to Review Committee Questions (if needed)
10:30 a.m.	Executive Session / Report Writing
11:30 a.m.	Closeout Presentations with IERC Project Team and Fermilab Management – One West
12:30 p.m.	Adjourn

Appendix C

Review Committee Contact List and Writing Assignments

Director's CD-1 Review of IERC
August 30 - September 1, 2016

Chair

Brenna Flaugher, FNAL	630-840-2934	brenna@fnal.gov

Project Management

Mike Finder, ANL*	630-252-2920	mfinder@anl.gov
Bob Kephart, FNAL	630-840-3135	kephart@fnal.gov
Troy Lark, FNAL	208-419-6070	tlark@fnal.gov
Brenna Flaugher, FNAL	630-840-2934	brenna@fnal.gov

Cost & Schedule

Jennifer Fortner, ANL*	630-252-5558	jfortner@anl.gov
Luisella Lari, FNAL	630-840-6929	llari@fnal.gov
Joel Sefcovic, ANL		jsefcovic@anl.gov

ESH&Q

Nimmi Kovvali, SLAC*	650-926-3094	kovvalin@slac.stanford.edu
Amber Kenney, FNAL	630-840-2977	tamber@fnal.gov

Technical

Tom Hamernik, FNAL*	630-840-4712	hamernik@fnal.gov
Phil Matton, ANL	630-252-7963	pmatton@anl.gov

*Lead

Observers

Steve Neus, DOE/FSO	630-252-2097	steven.neus@ch.doe.gov