

**Director's CD-1 Review  
of the  
Muon to Electron Conversion Experiment (Mu2e) Project  
April 3-5, 2012**

**Charge**

The Committee is to conduct a Director's CD-1 Review of the Muon to Electron Conversion Experiment (Mu2e) Project to assess if the project meets the Critical Decision 1 (CD-1) "Approve Alternative Selection & Cost Range" CD-1 requirements as specified in DOE O 413.3B. Additionally this review is a preparation for a planned DOE Independent Project Review/Independent Cost Review (IPR/ICR) scheduled for June 5-7, 2012. Mu2e had received CD-0 on November 25, 2009.

The Mu2e Project will construct a new facility to enable the world's most sensitive search for charged lepton flavor violation by searching for the conversion of a muon to an electron in the field of a nucleus. Mu2e will be ~10,000 times more sensitive than the world's current best limit. The project consists of modifications to the existing Fermilab accelerator complex, construction of a new external beamline, construction of a new detector hall on the Fermilab site and construction of a new detector to search for muon conversion. The detector includes a complex system of superconducting solenoids, a collimation and charge selection scheme for producing the world's most intense muon beam, a low mass tracking detector operating in vacuum, a crystal calorimeter and a cosmic ray veto. In addition to Fermilab other collaborating institutions will implement various aspects of this project.

As a cost cutting measure there have been significant changes to the scope of the accelerator and solenoid subsystems and modest changes to the conventional facilities subsystem. The scheme for delivering beam to Mu2e has been significantly simplified and now requires fewer machines and fewer beam manipulations, but the delivered beam power is 1/3 of the original 25 kW. The solenoids have also been simplified. The magnet iron surrounding the Production and Detector Solenoids has been removed, the peak field in the Production Solenoid has been reduced and the coil configuration in the downstream section of the Detector Solenoid has been simplified. The Accelerator and Solenoid subcommittees are asked to evaluate the technical aspects of these subsystems to ensure that they are feasible and still satisfy the performance requirements.

In addition to the committee reviewing the changes to the project's design since the Director's Impendent Conceptual Design Review conducted on May 03-05, 2011, they are to assess the project's progress on addressing the relative recommendations from that review.

The main focus of this review is to look at the project's cost, schedule, management, and ES&H. The project will present a Cost Range that the review committee is to assess and determine if it is appropriate based on the following factors: the scope of work; the maturity of the design; the Basis of Estimate (BOE); and the risks associated with the scope of work. The team will also look at the WBS – Work Breakdown Structure, WBS Dictionary, BOE – Basis of Estimate documentation, risk and contingency analyses, RLS – Resource Loaded Schedule, and time phased funding and cost profiles. The committee is asked to review each of these items, for quality, completeness, and accuracy. Furthermore, the committee is asked to review and assess the quality of and comment on the additional formal project management documentation required for CD-1 approval.

In performance of a general assessment of progress, current status, and the identification of potential issues, the committee should address the following specific questions:

Design Review Charge Questions for the Accelerator and Solenoid:

1. Is the design technically adequate? Is the design likely to meet the technical requirements? Are the physics requirements clearly stated and documented? Have these requirements been translated into technical performance requirements and specifications, if not yet are there plans to do so?
2. Can the design be constructed, inspected, tested, installed, operated and maintained in a satisfactory way?
3. Is there adequate supporting documentation to support the conceptual design and the transition to developing the preliminary design?
4. Are the risks (on technical, cost, and schedule basis) of the selected base design approach and alternatives understood and are appropriate steps being taken to manage and mitigate these risks? Have areas been identified where value engineering should be done? If value engineering has been performed is it documented?
5. Has the project acceptably addressed the relative recommendations from the independent Director's Conceptual Design Review of Mu2e that was conducted on May 03-05, 2011?

Cost, Schedule, Management, and ES&H Charge Questions:

6. Has the Project developed a quality resource loaded schedule? Has all the work been appropriately identified, estimated and scheduled, including the work associated with performing the preliminary design, final design and value engineering activities?
7. Are the estimated cost and proposed schedule ranges realistic, consistent with the technical and budgetary objectives, and justified by the supporting documentation?
8. Has the Project implemented a Risk Management Process by identifying risks, performing a risk assessment and started developing mitigation plans at an appropriate level for the CD-1 stage?
9. Is the Project Team adequately staffed and does it possess adequate experience to successfully carry out the Project?
10. Is the current staffing level adequate to complete the work to achieve CD-2? If not, has the appropriate staffing level been identified in the schedule and has a staffing plan been developed to acquire the future staffing needs?
11. Are ES&H aspects being properly addressed given the project's current stage of development?
12. Is the documentation required by DOE O 413.3B in order and is the Mu2e Project ready for a DOE CD-1 review in June?

Finally, the committee should present findings, comments, recommendations, and answers to the above questions at a closeout meeting with Mu2e and Fermilab's management. A written report will be provided within two weeks after the review.