

OPA (SC-28) Mini - Review Summary
Department of Energy/Office of Science Review of the
NuMI Off-Axis v Appearance Experiment (NOvA) Project

Review Date: **August 14, 2012**
 Location of Project: **Fermilab**
 Committee: **5 Members, 5 Observers**
 Program Manager: **Ted Lavine**
 Federal Project Director: **Pepin Carolan**
 Acquisition Executive: **Pat Dehmer, SC-2**
 Current Critical Decision: **CD- 3**

NOvA PROJECT STATUS as of August 14 2012		
Project Type	MIE / Cooperative Agreement	
CD-1	Planned: 5/2007	Actual: 5/2007
CD-2	Planned: 10/2008	Actual: 9/2008
CD-3	Planned: 3a – 2/2009 3b – 10/2009	Actual: 3a – 10/2008 3b – 10/2009
CD-4	Planned: 11/2014	Actual:
TPC Percent Complete	Planned: 68.1%	Actual: 69.6%
TPC Cost to Date	\$187.1M	
TPC Committed to Date	\$233.5M	
TPC	\$278M	
TEC	\$204.2M	
Contingency Cost (w/Mgmt Reserve)	BAC: \$19.9 M EAC: \$10.0 M	
Contingency Schedule on CD-4	6 months	24%
CPI Cumulative	0.94	
SPI Cumulative	0.98	

SUMMARY

A Department of Energy/Office of Science (DOE/SC) mini-review of the **NuMI Off-Axis v Appearance Experiment (NOvA)** project was conducted via televideo on August 14, 2012. The review was chaired by Daniel R. Lehman, Director, Office of Project Assessment, SC. **The purpose of this review was to evaluate the current status of the project, especially in light of two outstanding technical issues.**

The Committee found that the NOvA project is progressing. **With respect to one of the outstanding technical concerns, the wave shifting fiber potential damage issue,** the Committee noted that the Quality Assurance (QA) approach taken to address the fiber damage issue appears to be comprehensive and has resulted in a mitigating strategy and path forward for the project. On the second issue, **the failure of the Avalanche Photo Diodes (APDs), the project team continues to actively address the APD issues.**

1. TECHNICAL

The NOvA project team has focused on investigation of issues identified during the May 2012 DOE/SC min-review. These include the surface coating of the APD and the integrity of optical

fibers in the detector modules during assembly and transport. The project continues to actively address the APD issues. The project also encountered a concern with the adhesive used in block construction, and has addressed this expeditiously.

With regard to the APD failure issue, silicone- and parylene-coated APDs operated in a dry environment have demonstrated 80-90% survival rates over a period of weeks to months. Although the measured quantum efficiency of parylene-coated APDs is about 5% less than silicone-coated APDs, the parylene coating is more uniform, and applied to more of the APD surface. Based on a small sample, the parylene-coated devices also appear to survive cold operation better. NOVA should continue to seek and engage experts in the field who could provide guidance on APDs.

Further investigation of the fiber damage problem has been carried out. In order to check on damage in shipment, three round trips of modules were made in May 2012. Comparison of status before and after shipping has provided reassurance that module shipping is not the source of the fiber damage. Module autopsy was unsuccessful because the act of gaining access to the fibers in modules invariably damaged the fibers. Since light transmission through a damaged fiber is typically about 90%, the team adopted the strategy of replacing single fibers during construction since implementing the fix and consequent QA entails small effort. Modules with single damaged fibers will be used in the most downstream blocks.

The project reacted promptly to the fiber damage issue. It identified a path forward that is reasonable given the project completion constraints. The project team should continue to monitor whether fiber ‘damage’ worsens with time and whether it matters.

The Block Pivoter surface has been flattened to specification, and the device has been tested successfully. Congratulations to the project on completing this key task!

Difficulties were encountered with the structural epoxy used for constructing the blocks (since the surface finish of the PVC has been changed since the adhesive requirements were originally developed early in the project). Two fixes were adopted: roughening the surface of appropriate parts of the modules with Scotch Brite to ensure better adhesion; and using an alternate epoxy on the advice of the manufacturer. Shear strength tests indicate success in meeting requirements. The roughening process at Ash River, performed on finished modules, has not damaged the fibers or introduced leaks. The extra effort needed for surface processing appears to be acceptable.

Responding to the structural adhesive issue cost several weeks of schedule. The response to the problem is reasonable. Although the surface roughening has not caused any module damage, e.g. fiber breakage or new leaks, the project team should continue to watch for possible problems. The team might consider performing, in parallel with construction, accelerated lifetime tests of the adhesive.

Recommendation

- 1. Test the first ~100 final, production APD assemblies in a dedicated setup in order to validate the production parts, or find early signs of failure.**

2. COST, SCHEDULE and FUNDING

The Committee determined that the project’s cost and schedule impacts and related risks for the major outstanding issues have been properly identified and quantified and there appear to be no

unidentified outstanding risks related to cost and schedule requiring high-level management attention. The project team has undertaken a quantitative analysis to evaluate potential future contingency needs and mitigation strategies, including preliminary decisions dates, to recover cost contingency. The Committee remained concerned with the continued cost and schedule contingency use trends. Without continued, diligent contingency management, the remaining cost contingency may be insufficient to complete the project.

At this time, NOvA is approximately 70 percent complete. Cost and schedule performance to-date remain satisfactory. The project has used \$4.6M in contingency between May 2012 and July 2012 reducing current project contingency to approximately \$10M (11% based on current EAC to go). Based on the project team's analysis, potential cost contingency requirements range from approximately \$6M-\$12M. The project team identified approximately \$3M-\$6M in known or possible cost contingency savings. The project is no longer pursuing any additional increases in scope and plans to process a change request to remove Block 29 from the Far Detector. Since the May 2012 DOE/SC mini-review, schedule contingency has decreased from 8 months to 6 months (24%).

Critical production and assembly activities have been initiated and several important early critical path milestones have been met albeit after several months delay. However, steady-state production and assembly performance trends have not been established. The Committee noted that the next four months will be critical in determining project success.

Recommendations

None.

3. MANAGEMENT

The Committee noted that the QA approach taken to address the fiber damage issue appears to be comprehensive and has resulted in a mitigating strategy and path forward for the project.

The Committee recommended that Fermilab evaluate the necessity of applying the Laboratory's increased General and Administrative (G&A) rates to the NOvA project, as it is not unusual for projects at other locations to be granted reduced rates or to have the existing rates "grandfathered" for the term of the project which facilitates a stable environment for planning.

The Committee also suggested that the spare parts that were originally to be covered or reimbursed off project should continue to be handled that way.

It was also observed that the additional attention from senior Laboratory management has been beneficial to the project.

Recommendations:

- 2. Initiate a weekly "update" on the major activities on the project to the program office. This should include the metrics/progress on the project.**
- 3. Schedule a mini-review for November 20, 2012.**

Prepared By: Kurt Fisher, SC-28

Date: August 15, 2012