

Memorandum of Understanding
between
Michigan State University
and
Fermi National Accelerator Laboratory
for
NOvA Experiment R&D
and Construction Work

August 11, 2008

I. Preamble

This Memorandum of Understanding is made between Michigan State University (MSU) and the Fermi National Accelerator Laboratory Particle Physics Division (Fermilab). This document represents an understanding between MSU and Fermilab in connection with NOvA detector mechanical engineering and development work. This document does not constitute a legal contractual obligation on the part of either of the parties. It reflects an arrangement that is currently satisfactory to the parties involved.

II. Responsibilities

1. Activities

The MSU High Energy Physics (HEP) Group working on NOvA will perform mechanical engineering and development work for the NOvA experiment. This MOU covers work for NOvA WBS 1.3 and 2.3 (Wavelength Shifting Fiber) from August 1, 2008 until construction of the NOvA experiment is complete. The work outlined below will be performed jointly with personnel at Fermilab and other NOvA collaborating institutions.

- a) Measure and compare the light yield and attenuation properties for R&D samples of Wavelength Shifting (WLS) Fiber obtained from the supplier, Kuraray Co., Japan.
- b) Analyze the results of WLS Fiber measurements to select the optimum dye concentration.
- c) Prepare Requests for Proposal for the production and delivery of WLS Fiber during the R&D and Construction stages of the NOvA experiment.
- d) Construct a facility at MSU to perform Quality Assurance (QA) on WLS Fiber purchased during R&D and Construction stages of the NOvA experiment. Construct a similar facility to be delivered to the supplier, Kuraray Co., Japan, before production begins for the Construction stage of the experiment. Instruct Kuraray in the operation of the facility to provide Quality Control (QC) data to NOvA.
- e) Perform Quality Assurance measurements on each spool of WLS Fiber provided to the NOvA experiment. Compare these measurements with the supplier's QC measurements noting any discrepancies. Post QA and QC results to the NOvA central database in the required format.
- f) Following QA, store WLS Fiber at MSU until required by the Module Factory. Ship available WLS Fiber to the Module Factory when requested at least 4 weeks in advance of the required delivery date.
- g) Provide technician and physicist effort to manage tasks for WBS 1.3 and 2.3 during production of WLS fiber.

2. Personnel

The contact person for the QA activities at MSU is Carl Bromberg. Members of the MSU HEP Group working on NOvA will carry out the QA work.

3. Payment Authorization

The appropriate Cost Account Manager will notify MSU when funds have been approved for specific tasks covered by this MOU. This notification will usually consist of a Fermilab

purchase order. MSU will not commit resources to NOvA tasks covered by this MOU until such notification has been received.

4. Deliverables

MSU will develop a QA facility to measure NOvA WLS Fiber. MSU will describe this work in engineering drawings, specifications and project planning documents. These documents will be controlled in a way understood by MSU and the NOvA Project Office.

MSU will receive, perform QA, report results, store and ship the NOvA WLS Fiber. MSU will work with Fermilab procurement to solicit and evaluate proposals for NOvA WLS Fiber.

5. Institutional Contribution of Services and Equipment

1) Services

The services of the MSU Administrative Staff will be available to the NOvA experiment to the degree required to carry out the work described in this document.

2) Facilities and Equipment

The following MSU facilities and equipment will be made available to the degree necessary to carry out the work described above:

- a) HEP high-bay area,
- b) HEP Lab and workshop areas,
- c) HEP Computing,
- d) HEP test equipment.

3) Operating Costs

MSU, subject to adequate funding from the National Science Foundation, will support the normal research operating expenses (such as physicists' salaries, physicist travel expenses, miscellaneous supplies, administrative support, etc.) of the MSU group working on the NOvA experiment. Funds for foreign travel of physicists in support of NOvA will be provided by the experiment.

6. Fermilab Resources Required

In addition to the costs listed in annual Statements of Work, Fermilab will provide funds for MSU engineer travel and for materials and equipment purchases necessary to perform this work. Most purchases will be made through the Fermilab Procurement department but some small purchases will be made through MSU procurement.

MSU reporting of the QA work described in this MOU will require database work performed by the Fermilab Computing Division.

7. Resources Required from Other Institutions

The tasks covered by this MOU are largely independent of other institutions. However, the managers at the University of Minnesota must request fiber for the module factory at least 4

weeks in advance of the required delivery date. This will allow sufficient time to prepare the fiber crates and to make proper arrangements for commercial shipment.

III. Reporting, Costs and Schedule

1. Reporting

MSU will document as NOvA notes the procedures, analyses and results obtained as this work progresses. MSU will provide material for NOvA Project monthly reports in a timely fashion, including descriptive material, financial reporting, monthly task status reports and information needed for the NOvA Project's monthly earned value management analysis.

2. Estimated Costs and Schedule

MSU and Fermilab will jointly develop annual Statements of Work to provide detailed descriptions of the work covered by this MOU, including cost and schedule estimates. MSU will monitor the progress of this work in order to provide ample notice of projected deviations from the cost and schedule estimates. If it is determined that additional funds will be needed, the Fermilab NOvA Project Manager will evaluate available options and, in consultation with MSU, determine the best means of supplying the required resources.

IV. Other Considerations

1. Safety and Engineering Practices

All detector components will be constructed in conformity with MSU safety policies and practices, MSU engineering standards and MSU ES&H policies and practices. Equipment and operating procedures provided by MSU will conform to the NOvA Project ES&H and Integrated Safety Management policies and practices. All items at the NOvA Ash River site will conform to Fermilab and University of Minnesota ES&H policies.

2. Equipment Ownership

All items purchased or fabricated wholly with funds supplied by Fermilab will remain the property of Fermilab. Such items will be properly identified with Fermilab property tags as required by Fermilab policy. As required by MSU policy, MSU property tags will identify all items owned by MSU.

IV. Approvals

The following concur in the terms of this Memorandum of Understanding.
These terms will be updated as appropriate in Amendments to this document.

~~_____~~
C. Bromberg – NOvA Group Leader, Professor, MSU Dept. of Physics and Astronomy – date

~~_____~~
Wolfgang Bauer – Professor and Chair, MSU Dept. of Physics and Astronomy – date

~~_____~~
Michigan State University, Contracts & Grants Administration – date

~~_____~~
J. Cooper – NOvA Project Manager, Fermilab – date

~~_____~~
G. Bock – Acting Particle Physics Division Head, Fermilab – date

~~_____~~
P. Garbincius – Associate Director for Research for Project Oversight, Fermilab – date

Approvals

The following concur in the terms of this Memorandum of Understanding.
These terms will be updated as appropriate in Amendments to this Memorandum.

Institutional Approvals:

Carl Bromberg 8/23/08
C. Bromberg, Prof., MSU (date)

S. D. Mahanti 8/25/08
S. D. Mahanti, Prof. and Associate Chair, Physics and Astronomy Dept., MSU

E. Pedawi 27 Aug 08
E. Pedawi, Con&Gr Admr/S, MSU Contracts and Grants Administration

J. Cooper
J. Cooper – NOVA Project Manager, Fermilab – date

G. Bock
G. Bock – Acting Particle Physics Division Head, Fermilab – date

P. Garbincius
P. Garbincius – Associate Director for Research for Project Oversight, Fermilab – date