Memorandum of Understanding

between

Indiana University

and

Fermi National Accelerator Laboratory

for

NOvA Experiment R&D and Construction Work

October 14, 2007

I. Preamble

This Memorandum of Understanding is made between Indiana University on behalf of the Department of Physics (Indiana) and the Fermi National Accelerator Laboratory Particle Physics Division (Fermilab). This document represents an understanding between Indiana and Fermilab in connection with NOvA mechanical engineering, prototype studies and detector construction 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

Indiana will perform engineering, development and construction work for the NOvA experiment. This MOU covers mechanical work for NOvA WBS 1.8, 2.8 and 2.9 (detector assembly) from October 1, 2007 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) Electrostatic charging measurements. Conduct and document prototype measurements of liquid scintillator electrostatic charging effects during vertical module filling.
b) Liquid scintillator handling equipment. Design and fabricate liquid scintillator supply, handling and filling equipment for the IPND, near and far detectors. Provide technical supervision for the installation and operation of this equipment.
c) Expansion tanks. Design and fabricate the liquid scintillator expansion tanks for the far detector horizontal modules.
d) Management. Provide physicist effort to manage WBS Level 3 tasks for WBS 1.8, 2.8 and 2.9

2. Personnel

The contact person and work supervisor for NOvA detector assembly activities at Indiana is James Musser.

3. Payment Authorization

The appropriate Cost Account Manager will notify Indiana when funds have been approved for specific tasks covered by this MOU. This notification will usually consist of a Fermilab purchase order. Indiana will not commit resources to NOvA tasks covered by this MOU until such notification has been received.

4. Deliverables

Indiana will perform and document scintillator filling R&D studies to ensure that procedures for filling far detector vertical modules mitigate the buildup of dangerous electrostatic charges. Indiana will design and fabricate liquid scintillator handling equipment for the IPND, near detector and far detector, and will describe this equipment in engineering drawings, specifications and project planning documents. These documents will be controlled in a way that is understood by Indiana staff and the NOvA Project Office.

Indiana will manage the production of far detector expansion tanks and will prepare liquid scintillator handling equipment for the IPND, ND and FD facilities. Indiana will provide on-site

technical supervision for the installation and operation of this equipment at the detector locations.

5. Institutional Contribution of Services and Equipment

1) Services
   The services of Indiana 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
   Indiana facilities and equipment will be made available to the degree necessary to carry out the work described above. These include
   a) Lab and workshop areas,
   b) Computers,
   c) Normal test equipment.
3) Operating Costs
   Indiana, subject to adequate funding from DOE, will support the normal research operating expenses (such as physicists' salaries, physicist travel expenses, miscellaneous supplies, administrative support, etc.) of the Indiana group working on the NOvA experiment.

6. Fermilab Resources Required

In addition to the costs listed in annual Statements of Work, Fermilab will provide funds for Indiana engineer travel and for materials and equipment purchases necessary to perform this work. Large purchases will usually be made through the Fermilab Procurement department but some purchases may be made through Indiana procurement, as specified in annual Statements of Work. Fermilab will provide the sites for the installation and operation of the IPND and the near detector. Fermilab will also procure and install the scintillator supply piping for the IPND and the near detector.

Indiana performance of the detector assembly work described in this MOU will require a substantial commitment Fermilab effort and M&S funds, as described in the NOvA Project resource loaded schedule. This includes management, mechanical engineering and technical effort from the Particle Physics Division.

7. Other Resources Required

The successful completion of the Indiana detector assembly tasks covered by this MOU depends upon tasks performed by Indiana under the terms of other NOvA Project MOUs, and by contributions by institutions other than Indiana and Fermilab. These include

a) University of Minnesota: far detector site operation and maintenance; detector modules with appropriate ports for scintillator filling and expansion tank connections; far detector assembly crew effort for installing and operating scintillator handling equipment.
b) Indiana (WBS 2.2): production of liquid scintillator to fill the IPND, near and far detectors.

III. Reporting, Costs and Schedule

1. Reporting

Indiana will document as NOvA notes the procedures, designs and results obtained as this work progresses. Indiana 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 earned value management analysis.

2. Estimated Costs and Schedule

Indiana 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. Indiana 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 Indiana, 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 Indiana safety policies and practices, Indiana engineering standards and Indiana ES&H policies and practices. Equipment and operating procedures provided by Indiana will conform to the NOvA Project ES&H and Integrated Safety Management policies and practices. Indiana equipment used at Fermilab or Ash River will conform to all Fermilab safety policies and practices.

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. All items owned by Indiana will be identified by Indiana property tags as required by Indiana policy.

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.

Institutional Approvals

J. Musser – Department of Physics, Indiana University - date

Marcia Landen 10/17/07

Marcia Landen, Executive Director of Sponsored Research Services - date

11/12/07

J. Cooper – NOvA Project Manager, Fermilab - date

13 Nov 07

J. Strait – Particle Physics Division Head, Fermilab - date

11/13/2007

H. Montgomery – Associate Director for Research, Fermilab - date