Memorandum of Understanding

between

University of Virginia

and

Fermi National Accelerator Laboratory

for

R&D and Construction Work on the NOvA Experiment

October 15, 2008

I. Preamble

This Memorandum of Understanding is made between the University of Virginia (UVA) High Energy Physics Group and the Fermi National Accelerator Laboratory Particle Physics Division (Fermilab). This document represents an understanding between UVA and Fermilab in connection with the NOvA detectors R&D and fabrication.

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 UVA HEP group will design, test, prototype, and fabricate the Power Distribution Systems (PDS), Detector Controls and Monitoring Systems (DCS) for the NOvA Integration Prototype and Near Detector (IPND), the NOvA Near Detector, and the NOvA Far Detector, as outlined in the NOvA work breakdown schedule (WBS) items 1.6.3 and 2.6.3 (PDS), and 1.7.4 and 2.7.4 (DCS). The two systems will be fabricated at UVA and shipped out to Fermilab and Ash River (the location of the Far Detector. The UVA HEP group will also perform the testing of the installed systems and maintain and support both systems. This MOU will cover work from October 1, 2008 until construction of the NOvA experiment is complete, which is estimated to be the end of 2012. The work outlined below will be performed jointly with personnel from Fermilab and other NOvA collaborating institutions. The following tasks are covered by this MOU:

1) Power Distribution System (PDS)
   a) Design, fabrication, and testing of prototypes for the PDS
   b) Fabrication and testing of the PDS for the NOvA IPND, Near Detector, and Far Detector
   c) Shipping the completed PDS to Fermilab (IPND and Near Detector) and Ash River (Far Detector)
   d) Testing and check-out of the completed systems at Fermilab and Ash River

2) Detector Controls System (DCS)
   e) Design, fabrication, and testing of prototypes of the DCS
   f) Fabrication and testing of the DCS for the NOvA IPND, Near Detector, and Far Detector
   g) Shipping the completed DCS to Fermilab (IPND and Near Detector) and Ash River (Far Detector)
   h) Testing and check-out of the completed systems at Fermilab and Ash River.

2. Personnel

The contact person for NOvA activities at UVA is E. Craig Dukes. The work will be carried out by members of High Energy Physics (HEP) group under the direct supervision of the contact person. The task manager for the PDS is Craig Dukes; the task manager for the DCS is Andrew Norman.

3. Payment Authorization

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

4. Deliverables

UVA will manage the development, production, testing, and delivery of PDS and DCS for the NOvA experiment. UVA will work with Fermilab procurement to purchase the material and equipment required for the PDS and DCS. UVA will test components of the PDS and DCS systems as supplied by other NOvA collaborators, prepare as needed, and determine the modifications required to integrate said components into the PDS or DCS as appropriate for the NOvA detector. The designs, procedures, and results of testing will be documented in articles submitted to the NOvA document archive system. All software development will be committed to the NOvA software repository.

5. Institutional Contribution of Services and Equipment

1) Services
   The services of UVA 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 UVA facilities and equipment will be made available to the degree necessary to carry out the work described above.
   a) Lab space sufficient to accommodate working PDS and DCS prototypes and test stand facilities.
   b) Lab space sufficient to fabricate the components of the PDS and DCS needed for the NOvA IPND, Near Detector, and Far Detctor.
   c) Storage facilities sufficient to accommodate the safe storage of the prototypes and tested production systems prior to their shipment to Fermilab and Ash River.
   d) Access to high speed network and computing cluster for use in network load scaling and reliability testing.
   e) Machine shop and workshop support for the fabrication of custom mechanical components for prototype development.
   f) Computers and computing resources.
   g) Normal test equipment.

3) Operating Costs
   UVA, subject to adequate funding from DOE, will support the normal research operating expenses (such as physicist salaries, physicist travel expenses, miscellaneous supplies, administrative support, etc.) of the UVA 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 materials and equipment purchases necessary to perform this work. Fermilab will also provide specific prototype electronics as outlined in the WBS tasks, for use in the design and testing of the PDS and DCS and for incorporation in the PDS and DCS test stands.

7. Resources Required from Other Institutions

The successful completion of the UVA tasks covered by this MOU depends upon contributions to this work by institutions other than UVA and Fermilab. These include:

a) Harvard University: sample front-end boards (FEB),
b) Indiana University: thermoelectric cooler (TEC) controller.

III. Reporting, Costs and Schedule

1. Reporting

UVA will document as NOvA docdb notes the procedures, analyses and results obtained as this work progresses. UVA 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

UVA 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. UVA 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 UVA, determine the best means of supplying the required resources.

IV. Other Considerations

1. Safety and Engineering Practices

All work will be conducted in conformity with UVA safety policies and practices, UVA engineering standards and UVA ES&H policies and practices. Equipment and operating procedures provided by UVA will conform to the NOvA Project ES&H and Integrated Safety Management 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 UVA will be identified by UVA property tags as required by UVA 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

E.C. Dukes – NOvA Group Leader, University of Virginia

Gerald J. Kane, Jr., Director, Grants and Contracts
Office of Sponsored Programs, University of Virginia

11/13/08

J. Cooper – NOvA Project Manager, Fermilab

11/14/08

~~J. Strait~~ – Particle Physics Division Head, Fermilab
G. Bock (Acting)

11/21/08

~~H. Montgomery~~ – Associate Director for Research, Fermilab
P. Garbincius for Project Oversight