

Memorandum of Understanding

between

University of Minnesota, Duluth

and

Fermi National Accelerator Laboratory

for

**NOvA Experiment R&D
and Construction Work**

October 11, 2007

I. Preamble

This Memorandum of Understanding is made between the University of Minnesota, Duluth (Duluth) and the Fermi National Accelerator Laboratory Particle Physics Division (Fermilab). This document represents an understanding between Duluth and Fermilab in connection with NOvA detector assembly design and 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

Duluth will perform detector assembly design and construction work for the NOvA experiment. This MOU covers work for NOvA WBS 1.8 and 2.9 (detector assembly) and WBS 1.7.18 (DAQ Global Trigger) 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) Full height prototype monitoring system. Work with Argonne to design, build and install the structure monitoring system for the full-height engineering prototype (FHEP) at Fermilab.
- b) Far detector structure monitoring system. Design, build and install the structure monitoring system for the far detector at Ash River, Minnesota.
- c) Global Trigger subsystem of the Data Acquisition System. Design, implement, and support the software which triggers the saving of the experimental data.

2. Personnel

The contact person and supervisor for these NOvA activities at Duluth is Alec Habig.

3. Payment Authorization

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

4. Deliverables

Duluth will develop and document the designs of the FHEP and far detector structure monitoring systems, and the Global Trigger software. These documents will be controlled in a way that is understood by Duluth staff and the NOvA Project Office. Duluth will build and install the far detector structure monitoring system at Ash River.

5. Institutional Contribution of Services and Equipment

1) Services

The services of Duluth 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

Duluth 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

Duluth, subject to adequate funding from other external sources, will support the normal research operating expenses (such as physicists' salaries, physicist travel expenses, miscellaneous supplies, administrative support, etc.) of the Duluth 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 Duluth technical personnel 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 Duluth procurement, as specified in annual Statements of Work.

Duluth 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. Fermilab will also provide the site and associated infrastructure for the full height engineering prototype.

7. Resources Required from Other Institutions

The successful completion of the Duluth detector assembly tasks covered by this MOU depends upon many contributions to this work by institutions other than Duluth and Fermilab Particle Physics Division. These include

- a) Argonne: components for the FHEP structure monitoring system; specifications for strain gauges, pressure sensors and other instrumentation for the far detector structure monitoring system.

- b) Virginia: Interface electronics to the far detector DCS system.
- c) Minnesota, Twin Cities: far detector site and detector infrastructure; assembly crew effort to install the far detector structure monitoring system.
- d) Fermilab Computing Division: integration of the Global Trigger with the rest of the DAQ.

III. Reporting, Costs and Schedule

1. Reporting

Duluth will document as NOvA notes the designs and procedures developed as this work progresses. Duluth 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

Duluth 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. Duluth 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 Duluth, determine the best means of providing the required resources.

IV. Other Considerations

1. Safety and Engineering Practices

All detector components will be constructed and assembled in conformity with Duluth safety policies and practices, Duluth engineering standards and Duluth ES&H policies and practices. Equipment and operating procedures provided by Duluth will conform to the NOvA Project ES&H and Integrated Safety Management policies and practices. Any Duluth 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 Duluth will be identified by Duluth property tags as required by Duluth 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

Alan Habig 10/15/2007
A. Habig - NOvA Group Leader, Department of Physics, University of Minnesota Duluth - date

Jonathan Mays 10/18/2007
J. Mays - Department Head, Department of Physics, University of Minnesota Duluth - date

T. Holst 10/18/2007
T. Holst - Dean, College of Science and Engineering, University of Minnesota Duluth - date

J. Cooper 10/29/07
J. Cooper - NOvA Project Manager, Fermilab - date

J. Strait 13 Nov 07
J. Strait - Particle Physics Division Head, Fermilab - date

H. Montgomery 11/13/2007
H. Montgomery - Associate Director for Research, Fermilab - date