

Statement of Work

by

**Argonne National Laboratory
High Energy Physics Division**

for

NOvA Experiment R&D and Construction

During Fiscal Year 2009

August 27, 2008

I. Preamble

This Statement of Work (SOW) is made between the Argonne National Laboratory High Energy Physics Division (Argonne) and the Fermi National Accelerator Laboratory Particle Physics Division (Fermilab). This document represents an understanding between Argonne 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 Argonne HEP Division will perform mechanical engineering and development work for the NOvA experiment. This SOW covers mechanical work for NOvA WBS 1.4 (PVC extrusions), WBS 1.8 (detector assembly) and WBS 2.9 (far detector assembly). This SOW covers work from October 1, 2009 through September 30, 2009, and includes the following activities. The work outlined below will be performed jointly with scientists and engineers at Fermilab and other NOvA collaborating institutions.

- a) Final engineering designs and cost estimates. Complete final engineering designs and cost estimates for all WBS 2.4 and 2.9 equipment and procedures, as required for CD3b approval.
- b) Integration Prototype Near Detector (IPND). Set up the IPND block assembly facility in Building 366 at Argonne. Fabricate, install and commission block assembly fixtures. Build one prototype block and one of the four blocks for the detector. (The last three blocks will be completed in FY 2010.)
- c) PVC physical properties. Perform tests to determine long-term physical properties and other mechanical properties of NOvA PVC extrusions.
- d) PVC quality control and quality assurance. Develop prototype instruments for quality control measurements of PVC flatness and thickness at the extruding factory. Develop instruments and procedures for detailed quality assurance tests of selected PVC samples. Explore the possibility of extending the functionality of a single instrument to perform both flatness and thickness measurements.
- e) Management. Provide engineering effort to manage WBS Level 2 and 3 tasks for WBS 1.4, 1.8 and 2.9.

2. Personnel

The contact person for NOvA activities at Argonne is Richard Talaga. The engineering and development work will be carried out by members of the Argonne HEP Division Mechanical Support Group under the direct supervision of the task manager, Vic Guarino. The table below lists the Argonne personnel who will perform the work covered by this Statement of Work. The full-time-equivalent (FTE) fractions shown in the table include the time available for the work described in this SOW, for the work carried over from the FY08 SOW (especially the assembly of

the FSAP full scale assembly prototype), and also provide some modest contingency to handle unanticipated problems.

Argonne Personnel Available for FY09 Work on NOvA WBS 1.4, 1.8 and 2.9		
Name	Title	FTE
Rich Talaga	Physicist	0.7
Vic Guarino	Mechanical engineer	0.8
Allen Zhao	Mechanical engineer	0.7
Ken Wood	Engineering assistant	0.6
Frank Skrzecz	Engineering assistant	0.4
Zeljko Matijas	Technician	1.0
Tim Nephew	Technician	1.0

3. Payment Authorization

The appropriate Cost Account Manager will notify Argonne when funds have been approved for specific tasks covered by this SOW. This notification will usually consist of a Fermilab purchase order. Argonne will not commit resources to NOvA tasks covered by this SOW until such notification has been received. If several cost accounts are active at Argonne, it is understood that funds cannot be moved between tasks without appropriately approved NOvA Project change control documentation.

4. Deliverables

Argonne will develop tooling, fabrication and assembly procedures for building NOvA PVC extrusions and detector components, and will describe this work in engineering drawings, specifications and project planning documents. These documents will be controlled in a way that is understood by Argonne staff and the NOvA Project Office.

Argonne will complete final engineering designs and cost estimates needed for CD3b approval. Argonne will also prepare tooling and assembly facilities for Integration Prototype Near Detector block assembly and will build a prototype block and the first block for this detector. Argonne will work with Fermilab procurement to solicit and evaluate proposals for NOvA extrusion production.

5. Institutional Contribution of Services and Equipment

- 1) Services. The services of Argonne 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 Argonne facilities and equipment will be made available to the degree necessary to carry out the work described in this document.
 - a) Bldg 366 high-bay area, where IPND blocks will be built,
 - b) Lab and workshop areas,
 - c) Computers,
 - d) Normal test equipment.
- 3) Operating Costs. Argonne, 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 Argonne group working on the NOvA experiment.

6. Fermilab Resources Required

In addition to the costs listed in Section III.2 below, Fermilab will provide funds for Argonne 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 Argonne procurement.

Argonne performance of the detector assembly work described in this SOW will require a substantial commitment Fermilab effort and M&S funds, as described in the NOvA Project resource loaded schedule.

III. Reporting, Costs and Schedule

1. Reporting

Argonne will document as NOvA notes the procedures, analyses and results obtained as this work progresses. Argonne 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. Cost estimate

The first table below shows the estimate of the total cost of ANL effort and ANL M&S purchases required to perform this work during FY 2009. The total cost to Fermilab is \$677,706. The estimate uses Argonne rates for Engineers (\$163.06/hour), Engineering Assistants (\$118.60/hour), Technicians (\$100.86/hour) and Designers (\$89.40/hour). Costs are in FY 2009 dollars and include all Argonne overheads.

The second table shows the funding allocations for the first and second halves of FY09 separately. Costs include ANL overhead charges, including 15.2% on ANL M&S. It is understood that the funding may arrive via Fermilab Purchase Order in several increments, following approval by the Cost Account Managers and the Project Manager.

ANL Effort and M&S Costs (including ANL overhead costs)

Task	Engineer (hours)	EA (hours)	Technician (hours)	Designer (hours)	Labor FY09\$	M&S FY09\$
1.4. PVC R&D	598	320	412	0	\$177,016	\$2,304
1.8. Det Ass'y	764	880	1730	0	\$403,434	17,003
2.9. FD Ass'y	364	0	0	208	\$77,949	\$0
Totals	1726	1200	2142	208	\$658,399	\$19,307

Funding Profiles for ANL Resources (including ANL overhead costs)

Resource	Oct08-Mar09	Apr09-Jun09	Totals
1.4. PVC R&D	\$59,122	\$120,198	\$179,320
1.8. Det Ass'y	\$127,697	\$292,740	\$420,437
2.9. FD Ass'y	\$46,916	\$31,033	\$77,949
ANL Totals	\$233,735	\$443,971	\$677,706

During this period of performance, the NOvA group at Argonne will monitor the costs and progress of this work regularly, with a view to providing ample notice if the cost of Argonne technical effort is projected to exceed the estimate described in this document or subsequent amendments. If it is determined that additional funds for effort will be required, the Fermilab NOvA Project Manager will evaluate available options and, in consultation with Argonne, determine the best means of supplying the additional effort.

3. Schedule

The work described in this SOW will be completed on or before September 30, 2009. Argonne will make every effort to complete individual tasks on or before the milestone dates shown in the Open Plan cost and schedule plan.

IV. Other Considerations

1. Safety and Engineering Practices

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

IV. Approvals

The following concur in the terms of this Statement of Work.
These terms may be updated as appropriate in Amendments to this document.

Institutional Approvals

D. Ayres 27 August 2008

D. Ayres - NOvA Group Leader, HEP Division, Argonne National Laboratory - date

H. Weerts 8/27/2008

H. Weerts - HEP Division Director, Argonne National Laboratory - date

J. Cooper 8/27/08

J. Cooper - NOvA Project Manager, Fermilab - date

G. Bock 8/28/08

G. Bock - Particle Physics Division Head (acting), Fermilab - date

P. Garbincius 9/2/08

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

NOvA Project Cost Account Manager Approvals

P. Lukens 27 Aug 08

P. Lukens - Detector Assembly (WBS 1.8, 2.8, 2.9) - date

R. Talaga 8/27/08

R. Talaga - PVC Extrusions (WBS 1.4, 2.4) - date