**Fermilab**
**FY2002 Self-assessment**
**Process Assessment Report**
**For**
**Division/Section:** Particle Physics Division

**Date:** October 1, 2002

Division/Section performing assessment

Particle Physics Division (PPD)

Name of organization that owns assessed process

PPD MINOS Department

Organization Strategy

The MINOS Detectors will be key elements in the Fermilab Long Baseline Neutrino Oscillation Program. Results from the MINOS Experiment will contribute to our fundamental understanding of the neutrino, one of the fundamental building blocks of matter.

Names of Personnel on Assessment team

Regina Rameika, Greg Bock, Rob Plunkett

Name of process assessed

Management of the MINOS Portion of the NuMI Construction Project

Brief description of process to be assessed

The MINOS Detector Construction Project is responsible for the construction of neutrino detectors at the Far (Soudan Underground Laboratory) and Near (Fermilab) Sites of the MINOS Experiment. The project has been baselined at a cost of $ 45 M. The work is performed by experimental groups from Universities and Laboratories (ANL and FNAL). The MINOS Project Manager is a member of the Particle Physics Division.

1. Are metrics associated with this process? If so, what are they?

Indicator 1 : Monthly Reports submitted "on-time" (12 possible)

11-12 = Outstanding
9-10 = Excellent
6- 8 = Good
4 - 5 = Marginal
<4 = Unsatisfactory

Indicator 2 : The number of monthly PMG meetings held (12 possible)

11-12 = Outstanding
9-10 = Excellent
6- 8 = Good
4 - 5 = Marginal
<4 = Unsatisfactory

Indicator 3 : Achievement of recommendations from Director's Reviews of the project (number varies)

90 – 100% = Outstanding
75 – 89% = Excellent
60 – 74% = Good
50 – 59% = Marginal
<50 % = Unsatisfactory

Indicator 4 : Achievement of recommendations from Office of Science reviews of the project (number varies)

90 – 100% = Outstanding
75 – 89% = Excellent
60 – 74% = Good
50 – 59% = Marginal
<50 % = Unsatisfactory

The overall metric grade will be assigned using a simple average of these 4 indicators.

2. What are the names of the procedures associated with this process?

In addition to standard project management practices and common sense, we follow the procedures and requirements laid out in the following documents :

NuMI Project Execution Plan
NuMI Project Management Plan
DOE Order 413 : LCAM

3. Are these procedures being followed? Are they current?

Procedures are current and are being followed.

4. Describe the methodology used to assess this process.

Our assessment documents the number of Project Management Group Meetings held, the number of Director's reviews held, the number of DOE Lehman-style reviews held and the recommendations made from each review.

Monthly reports are done by the project. The number of monthly reports done on time is counted.

5. Results of the assessment:

   a. *Are the existing process controls adequate?*

We believe that the current level of management and oversight is adequate for the MINOS Project.

   b. *Have any notable practices been identified?*

The Safety record at Soudan continues to be excellent. The crew and supervisors are extremely vigilant.

   c. *Have any major deficiencies been identified?*

Cost reporting delays impede our ability to understand the true earned value of the construction project. Every effort must be made to minimize these.

   d. *Is the process working effectively? What improvements can be made?*

We will work more closely with the Fermilab and University purchasing and invoicing departments to minimize payment of invoices. We will track cost variances more closely.

   e. *How does current performance compare to last assessment, other similar labs, industry?*

We have been told repeatedly that the NuMI Project Monthly Report is one of the few Monthly Reports submitted to the DOE HEP system that conveys real and timely information that is genuinely useful for assessing Project status.

*f. What are the results for the metric?*

Indicator 1. The NuMI Project Office prepares and submits Monthly Reports to the DOE Project Manager, The target date for submission is the end of the month following the month which the report describes. During FY02 Reports were filed on the following dates :

| | | |
|---|---|---|
| September '01 | 10/25/01 | OT |
| October '01 | 12/3/01 | |
| November '01 | 1/3/02 | |
| December '01 | 1/24/02 | OT |
| January '02 | 2/25/02 | OT |
| February '02 | 4/1/02 | |
| March '02 | 4/23/02 | OT |
| April '02 | 6/3/02 | |
| May '02 | 7/3/02 | |
| June '02 | 7/29/02 | OT |
| July '02 | 9/3/02 | |
| August '02 | 9/30/02 | OT |

For FY02 50% of the reports were submitted OT "on-time", and none were submitted more than a few days late; (Grade = Good)

Indicator 2. The Fermilab Director's Office, via the Laboratory's Deputy Director, convenes a Project Management Group which meets regularly to review the status of the project and to review and recommend actions on the Change Requests presented by the Project team. The goal is to meet monthly, though the meetings may be cancelled if the Director is not available or there are no significant issues. During FY02 PMG meetings were held on the following dates :

10/9/01
11/13/01
2/12/02
3/12/02
4/9/02
5/14/02
9/10/02

For FY02 seven PMG's out of a possible 12 were held. (Grade = Good)

Indicator 3. Two Director's Reviews of the NuMI Project were held during FY02

April 2, 2002 : Primary Beam Extraction

April 23-24 : NuMI Construction WBS 1.1 and 1.2

Since these reviews focused on the NuMI portion of the project there were no action items to be addressed by the process described in this assessment. (Grade = N/A)

Indicator 4. Two DOE Office of Science Reviews were held in FY02. The dates of these are listed below along with the recommendations for the MINOS portion of the project.

January 30 – 31, 2002

1. Maintain vigilance against cost growth.
2. Reduce cost-reporting delays to less than one month
3. Include summary entries for WBS 2.0 and 3.0 in cost reports.

May 21 – 23, 2002 :

1. Maintain vigilance against cost growth.
2. Conduct a pre-production review of the manpower, time, and equipment required to check out all ND production electronics cards in order to be ready for the fall 2003 full system integration test at the CalDet at CERN.
3. Explore means to fully exploit the cosmic-ray and atmospheric-neutrino physics potential of the FD SM1 from the time of the start of running this summer.
4. Maintain the good safety record at the Soudan site. Continue to hold monthly joint safety meetings and equipment inspections.

Evaluation for Indicator 4 :

Recommendation #1 (January and May). To be certain we have been diligent in trying to keep costs down. Uses of contingency are made only after careful review by both Project and Laboratory management. (Achieved)

Recommendation #2 (January) – This recommendation appears difficult to achieve. For some Universities the minimum reporting delay is three months. With more diligence and negotiation this could possibly be reduced to two months. This is important for Project Management so that cost variances can be interpreted more reliably. (Not yet achieved)

Recommendation #3 (January) Complete. (Achieved)

Recommendation #2 (May) Review is being planned for November. (Achieved)

Recommendation #3 (May) Data taking and analysis in progress. (Achieved)

Recommendation #4 (May) Continuous (Achieved)

Summary for Indicator 4: 6 of 7 achieved : 86% = Excellent

g. *Adjectival grade achieved*

Indicator 1 : Good
Indicator 2 : Good
Indicator 3 : N/A
Indicator 4: Excellent

Overall Grade : Good

Identified opportunities for improvement

Having set "on-time" monthly reports as a metric the Project Team will endeavor to achieve a higher percentage of on-time submission of the reports.

Schedule for implementation of improvements

Improvements in performance on existing procedures can be implemented immediately.

Status of improvements from previous assessment

NA

Attachments (supporting data, worksheets, reports, etc.

1. Example of a MINOS Portion of the Monthly Report (Executive Summaries by the Level 1 and 2 Project Managers )
2. Agenda from the May 2002 Office of Science Review of the NuMI Project

**MINOS DETECTORS (WBS 2.0) – R. Rameika(August)**

In August good progress on the assembly of Supermodule 2 continued. The re-rating of all near detector modules was completed and the near detector electronics test at Caldet was successfully commissioned.

Some examples of statistics for the production status at the end of the month are given below. (Production items that have been listed as 100% complete in prior months are not shown here. Also, small adjustments to the nature of the statistics have been changed to better reflect measurable quantities affecting detector installation.)

| WBS | Production Items | %Complete |
|---|---|---|
| 2.1 | Far detector steel planes for Super Module 2 | 23% |
| 2.2 | Scintillator strip | 91% |
| 2.2 | WLS fiber delivered | 100% |
| 2.2 | Assembly of clear fiber cable for far detector | 98% |
| 2.2 | M16 PMTs delivered (minus the number returned) | 99% |
| 2.2 | M64 PMTs delivered | 96% |
| 2.2 | Far MUX boxes complete and delivered to Soudan | 65% |
| 2.2 | Far detector module production | 83% |
| 2.2 | Near detector module production | 98% |
| 2.2 | Far detector modules delivered to Soudan | 67% |
| 2.4 | Far detector planes installed at Soudan | 59% |

2.5 Near detector planes assembled at New Muon Lab 70%

**Steel and Coils (WBS 2.1) - J. Kilmer, J. Nelson**

The SM1 coil has been operating routinely all month. All components of the magnet calibration system for SM1 have been installed except a power supply control interface box which is currently being shipped to Soudan.

The long sections of the near detector coil were shipped to Fermilab and placed in storage until their installation in the near detector. This completes all large purchases for the coil system components. Some minor purchases of supplies for installation remain.

Production of steel plates for the far detector (FD) continued this month. At Bethlehem Steel, the rolling of all steel plates for supermodule 2 (SM2) continued. A total of 22 planes of FD steel were cut at Olympic Steel and delivered to Soudan this month. This brings the total FD steel delivered to Soudan to 299 planes or 23% of the total for SM2.

**Scintillator Detector Fabrication (WBS 2.2) - D. Michael**

**Overview**

Production of scintillator system components continued to proceed well. The integrated completion of construction of components is approximately 89%. Production is managing to keep pace with installation demands.

Evaluation of the near detector modules is now effectively complete. After re-evaluation of all module maps and careful consideration of optimal use of modules in the near detector it has been determined that only around 10-20 modules will require repair. We anticipate that this will be done within the current planned budget at Argonne.

The cause of non-linearity in the light injection has been determined to be due to wavelength variation vs pulse-height in the LEDs combined with a strong variation in the WLS fiber absorption at the relevant wavelengths. Possible solutions are being studied.

Many production tasks are at the threshold of completion and planning work continues on how to end production. There are several issues on manpower and final production quantities that are under discussion.

**Electronics and Data Acquisition (WBS 2.3) – G. Pearce, J. Thron**

**Overview**

Lots of progress was made at the CalDet testbeam at CERN. The near electronics has now been connected to the all the planes that were planned using the M64 PMTs. It has been tested in the many modes it may be required to run in. A number of minor problems were found, but they have all been fixed. The near electronics is now able to take data either using its own dynode trigger or an external trigger that will be common to both the near and far electronics. The far electronics had a firmware change made to the VARC in order to accommodate the external trigger; this is working well and tracks have been seen in the detector using it. The DAQ system has kept pace with these changes and is able to handle readout of all combinations of the near and far electronics. The first studies of correlating the near and far electronics signals have been done and they show good time and pulse height matches. The clock distribution system has also been working well keeping the two disparate systems synchronized.

The installation of the far electronics at the Soudan mine is continuing smoothly. There are now enough RPS units to allow unattended running of the detector and for the old ones to be cycled back to the manufacturer for a logic update. The HV control system software can now handle the second supermodule.

Far Detector Installation (WBS 2.4) - J. Nelson

In August, the far detector (FD) installation effort focused on finishing the last few details of Supermodule 1 (SM1), routine operation of SM1, and routine installation of Supermodule 2 (SM2).

MINOS collaboration physicists and Soudan minecrew staff completed assembly of 23 additional detector planes, for a total of 288 planes, were installed by the end of August. This is an average installation rate of 6.5 planes per week. An additional 28 SM2 planes, for a total of 285 planes, were commissioned this month. The first 192 planes of the detector were operated routinely on evenings and weekends in August to record long runs of cosmic-ray muon and atmospheric neutrino data for calibration and performance studies. The SM1 coil was operated routinely through the month. The coil only tripped once and this was due to an operator's error.

Other accomplishments during August included completing all light injection (LI) cables through the currently commissioned planes, fixing the few remaining LI miscablings in SM1, and initiation of production LI calibrations for SM1 and SM2. The DCS group installed three new RPS units to replace some units without full functionality. The cabling for the SM1 magnet calibration system was completed and the readout system was commissioned.

The routine delivery and checkout of steel and scintillator continued throughout the

month. This work is summarized below along with plane installation and commissioning statistics:

- Steel plates delivered to Soudan:
  for 28 detector planes (total of 315 planes or 65% of detector),
- Steel plates moved underground:
  for 26 detector planes (total of 296 planes or 61% of detector)
- Scintillator modules delivered to Soudan:
  for 22 planes (total of 327 planes or 67% of detector)
- Scintillator modules moved underground:
  for 24 detector planes (total of 317 planes or 65% of detector)
- Scintillator modules prepared for installation:
  for 25 planes (total of 316 planes or 65% of detector)
- Detector planes assembled and mounted:
  23 planes (total of 288 planes or 59% of detector)
- Detector planes commissioned and reading out:
  24 planes (total of 285 planes or 58% of detector)

There were no injuries at Soudan this month. August's Joint Soudan Laboratory Safety meeting focused on safety and operation of the MINOS magnet's coil. On average this month one physicist shift leader and eight collaboration physicists worked in the underground lab each day on installation-related tasks.

Near Detector Installation (WBS 2.5) - C. James

No plane assembly was performed during August, while the supply of scintillator modules builds back up.

The Near Module Review Board completed its work in August, re-rating all existing scintillator modules. After re-rating, the location of modules with a bad strip was checked, to be sure the total number of such strips did not exceed an allowed maximum, and also that these strips are distributed properly within the detector. There are a few modules on planes assembled last spring that will be removed and replaced; the total is no more than 10. The Review Board was also able to determine exactly what module types of what quality are needed to complete the detector, and how many modules require repair (no more than 12). These summary results, and all the maps for the modules, have been posted from the Near Detector Installation home page.

**Agenda from the May 2002 DOE Office of Science Review of the NuMI Project**

**Department of Energy Review**
**of the**
**Neutrinos at the Main Injector (NuMI) Project**
**AGENDA**

**Monday May 20, 2002 (Underground Tour)**

| | | |
|---|---|---|
| 2:00pm | Tour of Fermilab Underground Tunnel & Halls | |

**Tuesday, May 21, 2002 (COMITIUM)**

| | | |
|---|---|---|
| 8:00 am | DOE Executive Session | D. Lehman |
| 9:00 am | Opening Remarks | M. Witherell, K. Stanfield |
| 9:15 am | Project overview, management changes, risk analysis, and recommendations from previous reviews | G. Bock |
| 10:15 am | Break | |
| 10:30 am | Neutrino Beam Overview (WBS 1.1) – (Summary Cost, Schedule, past 6 months progress and next 6 months objectives, significant changes/decisions) | B. Baller |
| 11:15 pm | Civil Construction (WBS 1.2) – (Summary cost, schedule, past 6 months progress, and next 6 months objectives, significant changes/decisions, Tunnel and Halls) | D. Bogert |
| 12:00 pm | Working Lunch | |
| 12:45 pm | Tour (Construction Site, MI-8, New Muon Laboratory) | |
| 1:30 pm | Civil Construction (WBS 1.2) – (Outfitting, Service Buildings, cost and schedule) | R. Plunkett |
| 2:00 pm | MINOS Detector Status (WBS 2.0) | G. Rameika |
| 2:30 pm | Parallel Sessions<br>- Civil Construction – R. Plunkett (Lead)<br>- Technical Components – B. Baller (Lead)<br>- Procurement – R. Huite (Lead)<br>- ES&H – M. Andrews (Lead) | |
| 5:00 pm | DOE Executive Session | |
| 6:30 pm | Adjourn | |

Wednesday, May 22, 2002

| | | |
|---|---|---|
| 8:30 am | Parallel Sessions<br>– Technical Components – B. Baller (Lead)<br>- Civil Construction – C. Laughton (Lead)<br>- Procurement – R. Huite (Lead)<br>- ES&H – M. Andrews (Lead) | |

| | | |
|---|---|---|
| | - Management – G. Bock (Lead) | |
| 12:00 pm | Lunch | |
| 1:00 pm | Summary Presentations (Comitium) | Bock |
| 2:00 pm | DOE Subcommittee Discussions | |
| 3:00 pm | DOE Executive Session | |

**Thursday, May 23, 2002 (COMITIUM)**

| | |
|---|---|
| 8:30 am | Subcommittee working session |
| 10:00 am | **DOE Executive Committee session – Dry Run** |
| 12:00 pm | **Lunch** |
| 1:00 pm | Close out |
| 2:00 pm | Adjourn |