

LBNE Reconfiguration Engineering/Cost Working Group 2nd Meeting

April 19, 2012

Present Committee Members:

- Jim Strait, FNAL (deputy chair)
- Bruce Baller, FNAL
- Mike Headley, SURF
- Marvin Marshak, U. Minnesota
- Christopher Mauger, LANL
- Elaine McCluskey, FNAL
- Vaia Papadimitriou, FNAL
- Bob O'Sullivan, FNAL
- Jeffrey Appel, FNAL (Scientific Secretary)

Present Invitees:

- Jeff Dolph (LBNE Systems Engineer)
- Tracy Lundin (LBNE CF project manager)
- Joel Sefcovic (LBNE project controls for CF)
- Jim Stewart (LBNE (former) WCD project manager and expert-at-large)

Draft Agenda

- 15:35 SC Update Jim Strait
- Workshop agenda
 - any other news
- 15:45 CF cost models Tracy Lundin
- Summary of costs at Homestake and opportunities for cost reductions
 - Summary of costs at Fermilab and opportunities for cost reductions
 - Approach to costs at Soudan and Ash River
- 16:00 LAr cost models Bruce Baller
- Cost vs detector size
 - Cost on surface vs underground
 - Approach to costs at Soudan and Ash River
 - Opportunities for cost reductions
- 16:15 Beam costs Vaia Papadimitriou
- Opportunities for cost reductions
 - Any work to do if NuMI is chosen option?
- 16:25 ND costs Christopher Mauger
- Approach to mini-ND (detector-in-a-manhole)
 - Adapting NDC designs to NuMI line and MINOS near hall

16:35	Documentation	Bob O'Sullivan
16:45	BNL 5 kT proposal	Jim Stewart/Jeff Dolph
17:00	Adjourn	

The meeting did not keep much to the agenda times; while starting on time, ending about 18:15.

The next meeting of the Engineering/Cost Working Group will be Monday, April 23, 2012.

Cost numbers will not be published except at high levels, to avoid compromising later, competitive bidding for the Project.

Workshop

The agenda for the Engineering/Cost Working Group part of the LBNE Reconfiguration Workshop was discussed. While there is much interest in near-detector options, it is not a cost driver and presentations should focus on the beam and far detector. In talking about where money might be saved, identify any risks associated with the savings.

[Following the meeting, it was discovered that the amount of time allotted on the agenda: 10'+5' for the introduction plus 60'+25' for detectors and far-site conventional facilities (CF) plus 40'+20' for the beam and near-site CF adds up to more than the time between when these talks begin (1:00) and when they end (3:30).]

So far, the Steering Committee has not ruled out any of the six options it called for in the Working Group charge.

The next Working Group meeting on Monday will focus on sketches (as complete as possible) of the Workshop talks.

Building Blocks

There is a new version of the building-blocks note, edited to match the options in the charge better. No costs need be included in Project estimates for work prior to the start of FY2013 (October 1, 2012). However, the cost cap appears to be \$650M in then-year dollars. So, the nearly \$50M already spent would not be part of the Project cost.

BNL 5 kT proposal

Jim Stewart presented a top-down cost estimate for a 5 kT detector sited at a Homestake depth of 4850 ft. Starting with \$700M total project cost and removing beam and near detector funds, he aimed for \$198M for the far detector. Although using the same general area as the reference design, given the size of the detector, it can be positioned closer to the drifts. Estimates are close to scaled numbers from the

Reference Design, but a few discrepancies will be investigated. It will be necessary to document the assumptions in the estimates. For example, underground infrastructure is minimized. Big costs included are for shafts and hoists. For the shaft work at Homestake, these costs are to rehabilitate two existing shafts since the shafts do exist today. The assumption of no cost for rock removal due to anticipated reuse of rock for local roads was challenged as inconsistent with recent attempts to get takers and past experience, e.g., for NuMI. It was also noted that the duration of an LBNE Phase 1 is too long to delay renovations of the Ross and Yates shafts until a Phase 2. There was discussion of the fact that the focus of the Steering Committee is only on Phase 1 of a reconfiguration of the LBNE Project.

Conventional Facilities Cost Estimates

Tracy Lundin presented the status of conventional facilities cost estimates. So far, estimates exist for 5, 17, and 33 kT detectors at the surface at Homestake, Soudan, and Ash River. Rehabilitation of the Oro Hondo shaft is not in cost estimates for Phase 1. There were also estimates for detectors at the 4850 ft depth at Homestake and 2340 ft depth at Soudan. There is plenty of power at both Homestake and Soudan, but possibly not at Ash River (where the voltage on the primary line was already doubled to increase the power available to NOvA there. Another doubling is unlikely to be feasible.

[The shielding over the surface building was mentioned yesterday during at the meeting. After the meeting, it was pointed out that the building cost that Steve Dixon provided for the NOvA Ash River building – being used as the basis of the surface CF estimates – includes 4 ft of concrete roof and 6” of barite (but allowed structurally for 12” of barite). Steve said this was the equivalent of 3m of soil shielding, and Marvin said it was expected to reduce cosmic ray rates at the floor of the building to ¼ of what it would be outside the building.]

Half the elements in a cost matrix for conventional facilities are available, with the rest expected by the end of the week.

LAr Detector Cost Scaling

Bruce Baller presented status of LAr-detector cost estimates. Cryogenic-system costs were noted not to scale with detector size. Most materials and services costs scale, but labor does not. Also, for a small enough detector on the surface, it is less expensive to have a single detector cryostat and a surface storage dewar than splitting the detector into two cryostats. Most cost estimates are site-independent. However, some such as welder rates at remote sites, are not site independent. At this time, the directly-calculated marginal costs for an extra 1 kT of detector do not match that calculated by taking the difference in cost between the largest and smallest detectors and dividing by the mass difference.

Beamline Cost Reduction Options

Vaia Papadimitriou reviewed options for reduced beamline costs, with the constraint that the beamline must be upgradable to a 2.5 MW. Options considered included:

- Reduced length and diameter of the decay pipe
- Reduced soil shielding
- Increasing the slope of the hill to aim the beam
- Using an impermeable bathtub to allow reduced shielding
- Removing magnets from the beamline and running at lower momentum
- Using NuMI-style targets and horns, even existing devices
- Building less-capable remote handling systems and accepting longer periods for failed-component replacement
- Reusing existing steel for the target pile
- Conventional facilities savings; e.g., caissons under only part of the target hall

Documentation

Bob O'Sullivan presented three groups of forms for entering data in a unified system for compilations (which can be found in the LBNE Document Database). This will be the basis for a value-engineering-like evaluation.

It is expected that the forms can be filled out in the next month, meaning only two weeks before the June draft document is due! Costs should be entered in FY2010 dollars as described in the Building Blocks Document.

Minimizing Near Detector Costs

Christopher Mauger described work that has already started on a minimum near detector for the Homestake direction. Conceptual designs include options for a muon detector only, a liquid-argon (LAr) detector, and a gaseous-argon (GAr) detector. Magnetized detectors are being considered.

For a muon detector, carbon-composite tubes may be substituted for the stainless-steel considered earlier. Remote deployment of detectors in deep man-hole style shafts could be used. Detectors would be built on the surface and then lowered down the shaft.

Concerns about these ideas include the need to get to significant CP-violation sensitivity, which is likely to require argon in the near detector for a LAr far detector. Also of concern is putting a person down a 150 ft shaft, even if there is no gas or liquid in the detector.

There are already two full-scale near-detector designs, and changing these designs would require strong justification.

Near-detector considerations for the NuMI beam include the same concern about the need for an argon device to minimize systematic uncertainties in CP-violation measurements. The Physics Working Group has been asked to reply to this issue.

Is it possible to modify existing LAr designs to fit into the MINOS Near Detector Hall? What about a "straw-tube" tracker in a magnetic field?

Could a NOvA near detector be adequate initially? Again, it is thought that an argon-based detector would be needed for CP violation measurements. Other detectors would be useful beam monitors, but not finally enough.

Work has not yet started on the issue of a near detector for the Ash River direction.