Ad Hoc Committee to Assess the Science Proposed for a Deep Underground Science and Engineering Laboratory (DUSEL)

Board on Physics and Astronomy

Division on Engineering and Physical Sciences

National Research Council of the National Academies

Peter Fisher

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Origin

In early 2010, NSF and DOE commissioned a report from the National Research Council (NRC), the research arm of the National Academies, to give an assessment of the scientific case for the proposed Deep Underground Science and Engineering Laboratory. The NRC Board on Physics and Astronomy selected the committee and developed a Statement of Task.

The report was aimed at the agencies evaluating the DUSEL project.

The full report may be found at

http://www.nap.edu/catalog.php?record_id=13204

NRC reports are public, reviewed and formally released when complete.

Statement of Task

The committee will undertake an assessment of the proposed DUSEL program, including:

1. An assessment of the major physics questions that could be addressed with the proposed DUSEL and associated physics experiments,
2. An assessment of the impact of the DUSEL infrastructure on research in fields other than physics,
3. An assessment of the impact of the proposed program on the stewardship of the research communities involved,
4. An assessment of the need to develop such a program in the U.S., in the context of similar science programs in other regions of the world,
5. An assessment of broader impacts of such an activity, including but not limited to education and outreach to the public.

Membership

ANDREW J. LANKFORD, University of California at Irvine, Chair

YORAM ALHASSID, Yale University

EUGENIO COCCIA, University of Rome Tor Vergata

CHARLES FAIRHURST, Itasca Consulting Group, Inc.

BRADLEY W. FILIPPONE, California Institute of Technology

PETER FISHER, Massachusetts Institute of Technology

TAKAAKI KAJITA, University of Tokyo

STEPHEN E. LAUBACH, University of Texas at Austin

ANN NELSON, University of Washington

RENE A. ONG, University of California at Los Angeles

FRANK J. SCIULLI, Columbia University

MARJORIE SHAPIRO, University of California at Berkeley and E. O. Lawrence Berkeley National Laboratory

JAMES M. TIEDJE, Michigan State University

DAVID WARK, Imperial College London

Process

First Meeting - Dec. 14-15, 2010, Washington DC - agency perspectives (DOE, NSF, NSB), DUSEL PAC, Fermilab), Project Overview, Science presentations.

Teleconference Jan. 27, 2011 - science topics

Second Meeting - Feb. 3-4, 2011, Irvine CA - science presentations, international aspects, report drafting.

Third Meeting - Mar. 25-27, 2011, Irvine, CA - produce first draft of report

April 2011 - Review period

July 12, 2011 - release, briefings

Process II

During the course of the study, the status of DUSEL changed as a result the NSB decision not to award bridge funds (before first meeting) and the DOE initiation of the Marx in February committee to consider costs in preparation for a decision on how to go ahead with at least some aspects of the project.

As our Statement of Task did not involve cost or site assessments, we evaluated the physics potential of a large underground laboratory such as DUSEL. We did not compare sites, assess costs or prioritized with respect to the broader program.

Context

This reports builds on previous studies:

- 2007 NSAC long range plan for nuclear physics
- 2008 HEPAP-P5 strategic plan for particle physics
- 2009 PASAG priorities for particle astrophysics
- 2011 AC-GEO DUSEL science review

Discussion focussed on how the scientific situation may have changed since these reports were written.

Summary of Report

Conclusion: Development of an underground research facility in the United States would **supplement and complement underground laboratories around the world**. A U.S. facility could build upon the **unique position of the United States that would allow it to develop a long-baseline neutrino experiment using intense beams from Fermilab**. It could accommodate one of **the large direct detection dark matter experiments** and **one of the large neutrinoless double-beta decay experiments** that are needed by the international effort to resolve these critical scientific issues, while **sharing infrastructure among these three experiments that are of comparable import**. It could also host and share infrastructure with other underground physics experiments, such as an accelerator to study nuclear astrophysics, and with underground experiments in other fields. An underground research facility would benefit the U.S. research communities, and would guarantee the United States a leadership role in the expanding global field of underground science.

My General comments

The Statement of Task was specific to science and the proposed program was evaluated in the broad context of the current scientific situation.

Particle and nuclear physics is the clear driver for an underground laboratory in the US. However, BGE will make good use of the facilities.

Particle and nuclear physics needs to speak with *one voice* for an underground laboratory. The science case is clear, but without total support, the project could easily languish.

Input to
NRC DUSEL Study

First Meeting – Dec. 14-15, 2010 - Washington

- **Perspectives from:**
  - NSF – Joe Dehmer, Ed Seidel
  - DOE/HEP – Dennis Kovar
  - NSB – Barry Barish (Caltech)
  - Program Advisory Committee
    - Physics - Mike Witherell (UCSB)
    - BGE - Mark Zoback (Stanford)
  - Fermilab – Pier Oddone
- **DUSEL Project Overview** - Kevin Lesko (LBNL)
- **Science Presentations:**
  - Long Baseline Neutrinos – Bill Marciano (BNL)
  - Proton Decay & Other Physics – Bob Svoboda (UC Davis)
  - Dark Matter – Bernard Sadoulet (Berkeley)
  - Biology – T.C. Onstott (Princeton)
  - Geoscience + Engineering – Derek Ellsworth (Penn State)
  - Nuclear Astrophysics – Michael Wiescher (Notre Dame)
  - Double Beta Decay – Steve Elliott (LANL)

Shortly after NSB decision not to provide bridge funding.

Second Meeting – Feb. 3-4, 2011 - Irvine

Shortly before release of
President's FY2012 budget request.

- International aspects – Eugenio Coccia (Rome)
- Additional information on selected topics:
  - Long baseline neutrinos
    - Neutrino target, beam line issues – Vaia Papadimitriou (FNAL)
    - LBNE technical challenges – Jim Strait (FNAL)
  - Geoscience/Geoengineering
    - Dewatering & DuRA – Larry Murdoch (Clemson)
    - Faulting studies – Leonid Germanovich (Georgia Tech)

- Jan. 27, 2011 teleconference to collect information:
  - DAEdELUS – Janet Conrad (MIT) & Michael Shaevitz (Columbia)
  - Gravitational wave experiments – Vuc Mandic (Minnesota)
- Other input via: references, input, direct investigation

Timeline
of NRC DUSEL Study

Timeline & Meetings - p. 1

Nov. 2010 – Committee fully constituted

Dec. 2, 2010 – NSB Committee on Programs and Plans voted not to recommend a bridging award

Dec. 14-15, 2010 – First Meeting – Washington

- **Future of DUSEL was uncertain at this time.**
- **Barish: "NSF / NSB key decision will be after PDR, whether to proceed to FDR?"**

Dec. – Feb. - Committee discussions regarding course

Jan. 27, 2011 – Teleconference – input on future opportunities

Feb. 3-4, 2011 – Second Meeting – Irvine

- **More detailed input, where needed**
- **Committee decides to complete study as soon as possible.**

Timeline & Meetings - p. 2

Feb. 14, 2011 – President's FY2012 budget request

- "NSF eliminates funding for DUSEL."

Feb. 28, 2011 – DOE commissions cost & schedule review of options for major physics expts

Throughout the above process, the Committee received assurances from the agencies that its report is important to proper consideration of proposed science.

Mar. 25-27, 2011 – Third Meeting – Irvine

- **First draft of report completed.**

May 9, 2011 – Presentation to NSB – Status