

# **Status of the NRC DUSEL Study**

**presentation to HEPAP**

**Andrew J. Lankford**

**Committee Chair**

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**Rockville, MD – June 23, 2011**

# Status of the NRC DUSEL Study

presentation to the  
Committee on Programs and Plans  
of the National Science Board

Andrew J. Lankford  
Committee Chair  
*Department of Physics & Astronomy*  
*University of California, Irvine*

Experimental particle physicist,

- specialty: exploration of the *Energy Frontier* (LHC)
- strong interest in cosmology & in nuclear physics
- no involvement in DUSEL program

Rockville, MD – June 23, 2011

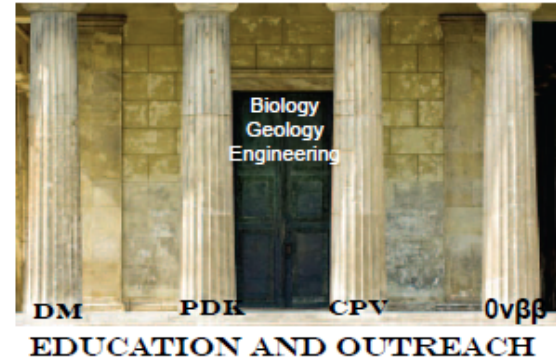
# **Brief Overview of Proposed DUSEL as Seen by the Project**

# Overview of DUSEL as Proposed

## DUSEL Founded on a Suite of Critical, Multidisciplinary Experiments

Founded on Four Experimental Physics Pillars  
and  
Three Research Tenets:

1. Dark Matter Searches
  2. Long Baseline Neutrinos from FNAL
  3. Proton Decay
  4. Neutrinoless Double Beta Decay
- ❖ Diverse multidisciplinary research efforts in Biology, Geology, and Engineering
  - ❖ Additional well-motivated experiments
  - ❖ Integral Education and Outreach

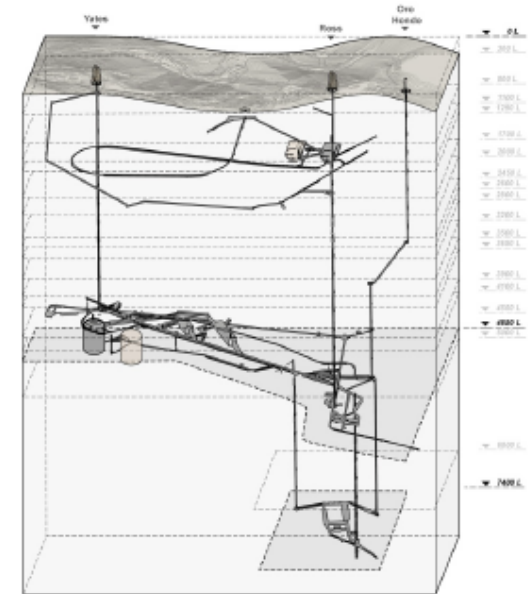


From : *DUSEL Project Overview*  
Kevin Lesko  
at NRC DUSEL Study  
Dec. 14, 2010

# Proposed Initial DUSEL Program

## DUSEL Facility Designed to Host this Suite of Critical Experiments

- Physics
  - Long Baseline Neutrino and Proton Decay
    - Water Cherenkov and/or Liquid Argon Detectors totaling 200kT WCE
  - Dark Matter
    - at least one Generation-3 experiment
    - R&D, Generation-1 and -2 as consistent with Sanford Lab scope
  - Neutrinoless Double Beta Decay
    - a ~ tonne-class experiment
    - Generation 2 (~100-kg) effort as consistent with Sanford Lab scope
  - Nuclear Astrophysics Facility
  - Advanced Low Background Counting & Assay
- Biology - Geology - Engineering
  - Fixed Ecohydrology sites and distributed efforts
  - Fixed Coupled Processes site
  - Fixed CO<sub>2</sub> Sequestration (vertical) site
  - Fixed Geophysics and Geology sites and distributed efforts
  - Initial efforts as consistent with Sanford Lab scope (~16 efforts)
- Education and Outreach Facility
  - Initial efforts as consistent with Sanford Lab scope



# **Introduction to NRC Study & Study Process**

# Background of NRC Study

- **Underground research facilities:**
  - **Required by several critical physics questions**
  - **Offer opportunities to address other important science questions**
- **Science goals reviewed & documented by many studies over 10 yr**
  - **For instance, some recent examples:**
    - **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**
  - **Another example: 2004 NSTC report recommended:**
    - **NSF lead conceptual development of an underground facility**
    - **DOE & NSF together identify core suite of physics experiments**
- **In preparation for final deliberations, NSF and DOE commissioned this independent NRC study**

# Statement of Task

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

- An assessment of the **major physics questions** that could be addressed with the proposed DUSEL and associated physics experiments,
- An assessment of the impact of the DUSEL infrastructure on research in **fields other than physics**,
- An assessment of the impact of the proposed program on the **stewardship** of the research communities involved,
- 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,
- An assessment of **broader impacts** of such an activity, including but not limited to education and outreach to the public.



# NRC Committee Formation

- **Multi-disciplinary, international committee**
  - **Multi-disciplinary - experts from:**
    - **Particle physics, nuclear physics, particle astrophysics**
    - **Biology, geosciences and engineering**
  - **International – experts from:**
    - **Europe and Asia**
- **Independent – no potential conflicts, no participants currently in:**
  - **DUSEL project**
  - **Proposals for DUSEL science**
  - **Current Sanford Lab research**
  - **DUSEL advisory committees**
- **NRC selected committee based on input from:**
  - **National Academies members (NAS & NAE)**
  - **Board of Physics & Astronomy members**
  - **The National Academies Directories (incl. members of previous committees)**

# Committee Members

## Multi-disciplinary, international committee

- **Andrew J. Lankford (Chair)** – UC Irvine – particle physics
- **Yoram Alhassid** – Yale – nuclear, CM physics
- **Eugenio Coccia (Italy)** – Rome “Tor Vergata” – particle astrophysics
- **Charles Fairhurst (NAE)** – Itasca Consulting Group – geo-engineering
- **Bradley Filippone** – Caltech – nuclear physics
- **Peter Fisher** – MIT – particle physics
- **Takaaki Kajita (Japan)** – Tokyo – particle astrophysics
- **Stephen E. Laubach** – Texas, Austin – geosciences
- **Ann Nelson** – Washington – particle physics
- **Rene A. Ong** – UCLA – particle astrophysics
- **Frank J. Sciulli (NAS)** – Columbia – particle physics
- **Marjorie Shapiro** – Berkeley – particle physics
- **James M. Tiedje (NAS)** – Michigan State – microbiology
- **David Wark (UK, Royal Society)** – Imperial College – particle physics

# **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

Shortly after NSB decision  
not to provide bridge funding.

- **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)

# 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)

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- **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**



# Summary

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- **Deep Underground Science & Engineering Laboratory**
  - **Conceived for research in physics and other sciences & engineering**
  - **Project under development for many years – in PDR development now**
- **Science goals studied & documented in many past reports**
- **NRC charged with independent assessment of:**
  - **Major physics questions**
  - **Impact of infrastructure on research in other fields**
  - **Impact of program on stewardship of research communities**
  - **Need to develop such a program in the U.S., in international context**
  - **Broader impacts**
- **Report status**
  - **Entered review in mid-April, on expedited basis**
  - **Last review received in late May**
  - **Review is a valuable step in process of report preparation**
    - **Independent critique by academy members & distinguished scientists**
    - **Led to many useful clarifications**
  - **Response to review is nearly complete**
  - **Target – release of report by ~ July 12**