Update on the Deep Underground Science and Engineering Laboratory (DUSEL)

• Outline
  – DUSEL overview
  – NSF process for large projects
  – Facility & experiment design
  – Timeline
  – NSF/DOE Joint Oversight Group (JOG)
  – Closing remarks

Jon Kotcher
NSF DUSEL Program Director, Physics Division
NNN09
October 8-10, 2009
Estes Park, Colorado
Overview of DUSEL Status

• Homestake site selection made only ~ 2 years ago.
• Enormous progress has been made, on all fronts.
• Project is now developing a Preliminary Design.
• Will provide basis for consideration as an NSF construction project.
• Current goal is a baseline design that lays out the community vision for DUSEL.
DUSEL Vision

• DUSEL is being envisioned as a unique, dedicated international underground research center that will support a set of potentially transformational experiments in multiple disciplines.

• The U.S. particle, nuclear, and astrophysics communities have selected DUSEL as central to their national programs.

• The engineering, geology and biology communities are proactively engaged, and are part of all aspects of DUSEL planning.
Current DUSEL Design

Yates Shaft

Ross Shaft

Davis Cavity

Lab Modules at 4850

Large Cavity

4850L

New Winze

7400L

Lab Module at 7400

#6 Winze

Deep Drilling Facility at 7400
Conceptual Design Stage:
- Concept development – Expend approximately 1/3 of total pre-construction planning budget
- Develop construction budget based on conceptual design
- Develop budget requirements for advanced planning
- Estimate ops $

Readiness Stage:
- Preliminary design
- Expend approx 1/3 of total pre-construction planning budget
- Construction estimate based on Prelim design
- Update ops $ estimate

Board Approved Stage:
- Final design over ~ 2 years
- Expend approx 1/3 of total pre-construction planning budget
- Construction-ready budget & contingency estimates

Construction:
- Expenditure of budget and contingency per baseline
- Refine ops budget

Conceptual design:
- Formulation of science questions
- Requirements definition, prioritization, and review
- Identify critical enabling technologies and high risk items
- Development of conceptual design
- Top down parametric cost and contingency estimates
- Formulate initial risk assessment
- Initial proposal submission to NSF
- Initial draft of Project Execution Plan

Preliminary Design:
- Develop site-specific preliminary design, environmental impacts
- Develop enabling technology
- Bottoms-up cost and contingency estimates, updated risk analysis
- Develop preliminary operations cost estimate
- Develop Project Management Control System
- Update of Project Execution Plan

Final Design:
- Development of final construction-ready design and Project Execution Plan
- Industrialize key technologies
- Refine bottoms-up cost and contingency estimates
- Finalize Risk Assessment and Mitigation, and Management Plan
- Complete recruitment of key staff

Merit review, apply 1st and 2nd ranking criteria
MREFC Panel briefings
Forward estimates of Preliminary Design costs and schedules
Establishment of interim review schedules and competition milestones
Forecast international and interagency participation and constraints
Initial consideration of NSF risks and opportunities
Conceptual design review

NSF Director approves Internal Management Plan
Formulate/approve Project Development Plan & budget; include in NSF Facilities Plan
Preliminary design review and integrated baseline review
Evaluate ops $ projections
Evaluate forward design costs and schedules
Forecast interagency and international decision milestones
NSF approves submission to NSB

Apply 3rd ranking criteria
NSB prioritization
OMB/Congress budget negotiations based on Prelim design budget
Semi-annual reassessment of baseline and projected ops budget for projects not started construction
Finalization of interagency and international requirements

Congress appropriates funds
Final design review, fix baseline
Congress appropriates MREFC funds & NSB approves obligation
Periodic external review during construction
Review of project reporting
Site visit and assessment

Funded by R&RA or EHR $
NSF Pre-Construction Planning Process

Science Review

CDR

Conceptual Design

PDR

Preliminary Design

FDR

Final Design

Operations Review

CD 0

Approve mission need

CD 1

Approve alternate selection and cost range

CD 2

Approve performance baseline

CD 3

Approve construction start

CD 4

Approve operations start

DOE Translation:

Approximate DUSEL Design Status

MREFC $

Renewal Review, etc.

J. Kotcher, NSF

NNN09, Estes Park, Colorado, October 8-10, 2009
DUSEL Solicitation Process

• Initiated at Town Meeting at NSF, March 2004.

• Solicitation 1 (S1):
  – Define site-independent science scope and infrastructure needs; unify the community (awarded Jan 2005).

• Solicitation 2 (S2):
  – Develop conceptual designs (8 received, 2 awarded, September 2005).

• Solicitation 3 (S3):
  – Site selection to initiate facility design for 1 potential MREFC candidate (4 received, 1 awarded – Homestake, U.C. Berkeley).
  – $15M total over three years, starting in September 2007.

• Solicitation 4 (S4):
  – Initiate technical designs for candidates for the DUSEL suite of experiments.
  – $15M total over three years, beginning in FY09.
  – 25 proposals received January 9, 2009; reviewed spring 2009.
Design of DUSEL Facility & Infrastructure

• First NSF annual review of the DUSEL Design Project held at U.C. Berkeley in January 2009.
  – 25-member multi-disciplinary expert panel.

• Recommended a proposal be submitted to NSF by UCB for funds to complete Preliminary Design.

• Proposal submitted May 2009, reviewed by NSF.

• Panel recommended to the NSF that proposal “must be funded.”

• Put forward for consideration by the National Science Board in August 2009.
Facility Design Funding Approval

• In September 2009, National Science Board approved $29M over 2 years to complete Preliminary Design.
  – Complements $18M already allotted through S3.

• Targets December 2010 Preliminary Design, project baseline.

• Goal is release of funds by November 1, via cooperative agreement.
Developing the DUSEL Experimental Program: S4

- DUSEL experimental designs being developed in parallel with that of facility.
- **Solicitation 4 (S4):** called for proposals to develop designs and pursue targeted R&D for potential candidates for the DUSEL suite of experiments.
- Proposal deadline January 9, 2009.
  - Up to $5M/year for up to 3 years.
- 25 proposals received, of which 15 were in physics.
- 300 senior researchers named, 91 institutions.
- **S4 does not represent a final down-select.**
S4 Proposal Review

• 15 physics proposals reviewed by high level panel of 12 experts at NSF on June 10-12, 2009.
• Panel recommended 9 proposals to NSF for funding.
• NSF concurred.
• Close attention paid to programmatic depth, diversity:
  – Dark matter.
  – Neutrino-less double-beta decay.
  – Large water Cerenkov detector.
  – Underground accelerator.
  – Assaying sub-facility.
• Total physics awards: $21M over 3 years.
BIO, GEO, ENG S4 Proposals

• Seven proposals from engineering and geo/geo-bio were selected for funding:
  – Fracture processes.
  – Coupled processes.
  – Subsurface imaging and sensing.
  – Fiber optic strain monitoring.
  – CO₂ sequestration.
  – Eco-hydrology & deep drilling.

NSF remains committed to a rich, diverse, and multi-disciplinary DUSEL research program.
DUSEL Target Timeline

• January ’09: NSF Project Review #1.
• January ’10: NSF Project Review #2.
• December ’10: NSF Preliminary Design Review (PDR).
  • Project baseline
• Spring ’11: Presentation of DUSEL MREFC proposal to NSB.

Above targets an October 2012 construction start.
P5 Recommendations

- The Particle Physics Project Prioritization Panel (P5) is a sub-panel of the High Energy Physics Advisory Panel (HEPAP).
- Charged in Jan 2008 by NSF and DOE with recommending a 10-year road map for particle physics.
- From Executive Summary May 2008:
  
  “The panel recommends a world-class neutrino program as a core component of the US program, with the long-term vision of a large detector in the proposed DUSEL laboratory and a high-intensity neutrino source at Fermilab.”

  “The panel endorses the importance of a deep underground laboratory to particle physics and urges NSF to make this facility a reality as rapidly as possible. Furthermore the panel recommends that DOE and NSF work together to realize the experimental particle physics program at DUSEL.”
NSF/DOE Collaboration (JOG)

- NSF/DOE agreed to establish DUSEL Physics Joint Oversight Group (JOG) immediately after release of P5 report (May ’08).
- Representation from NSF/PHY, DOE/OHEP, DOE/ONP.
- Builds on successful NSF & DOE collaboration on Large Hadron Collider (LHC) in high energy physics.
- Will jointly coordinate & oversee DUSEL experimental physics program.
- Meeting quarterly.
- Agencies consult, and participate as observers, on reviews of DUSEL and related experiments.
Inter-Agency Letter of Intent & Transmittal

• Joint Statement of Intent from DUSEL Physics JOG signed by 3 JOG co-chairs in August.
  – Director of NSF Physics Division.
  – Associate Directors for DOE OHEP & NP.
  – MoU in approximately 1 year.

• Transmittal letter to OMB signed by NSF Director and DOE Under Secretary for Science (August 3, 2009).
  – “joint-PDR.”
  – close coordination of evolving design, review process.
Note on International Involvement

• NSF interested in establishing DUSEL as a facility of intrinsically international character.
• Foundation will be actively pursuing international partnerships, and welcomes such collaborative discussions with our colleagues at any time.
• Mounting of experiments by foreign sponsors envisioned as an inherent component of the DUSEL program.
  – Design, construction, operations, data analysis.
Closing Remarks

• DUSEL project is aggressively moving toward establishing a baseline design.
• Will allow its consideration as an MREFC construction candidate.
• Research program, education & outreach, and impressive local support provide unusually strong foundation for the design of a very special facility.
• The community is now specifying their vision of what DUSEL will be.