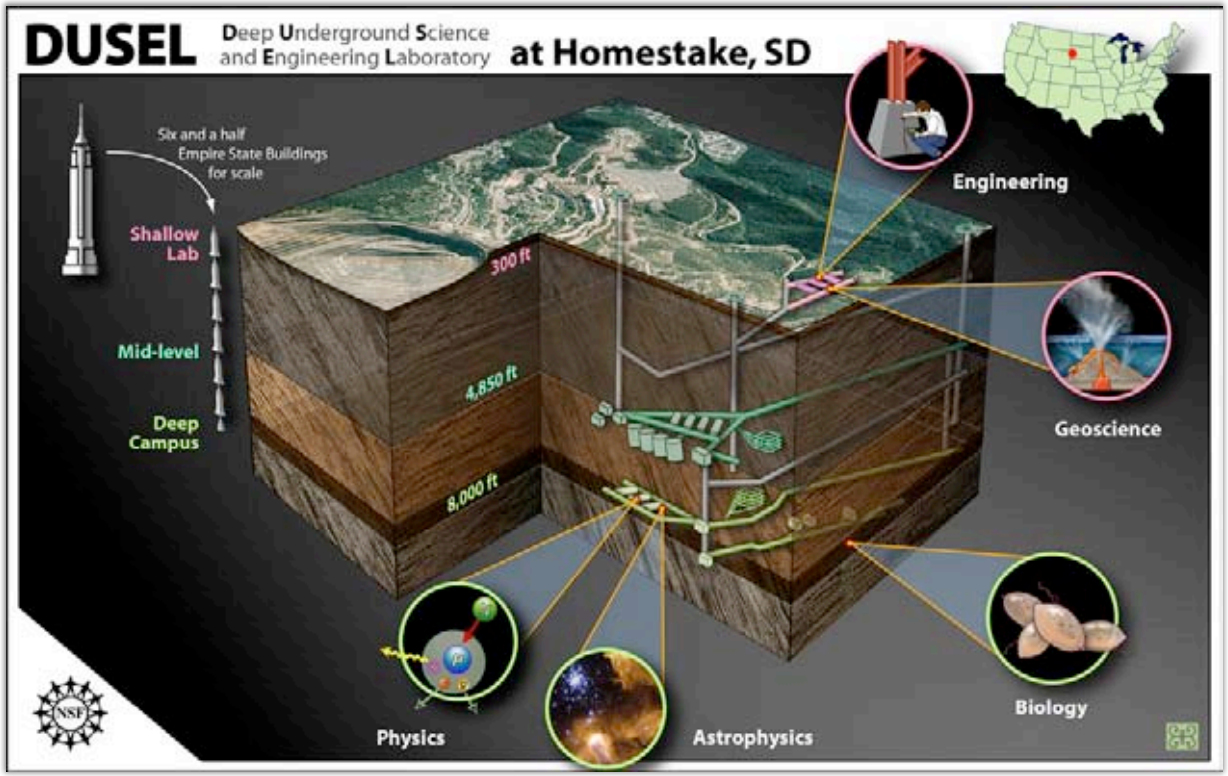
The Deep Underground Science and Engineering Laboratory



Kevin T. Lesko, PI
UC Berkeley
2 November 2007

Outline

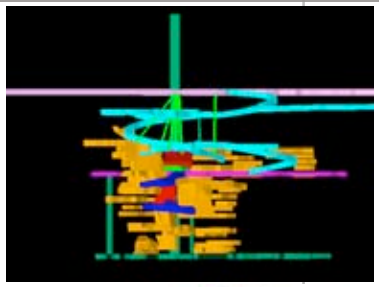
- Deep Underground Science and Engineering Laboratory (DUSEL) at Homestake
  - Global View of Homestake DUSEL Proposal
  - Initial Laboratory Criteria and Concepts
  - Approach to Creating DUSEL
    - South Dakota's Sanford Lab (**Snyder and Alonso**)
    - NSF's DUSEL
- Coupling the Science to the Facility
  - Workshops
  - Center for Underground Science

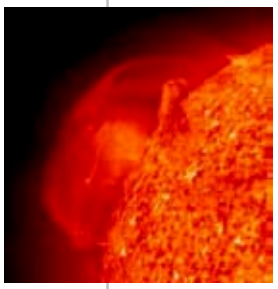
DUSEL: Multidisciplinary & Synergistic

Physics
Dark Matter
Cosmology
Astrophysics
Neutron Oscillation

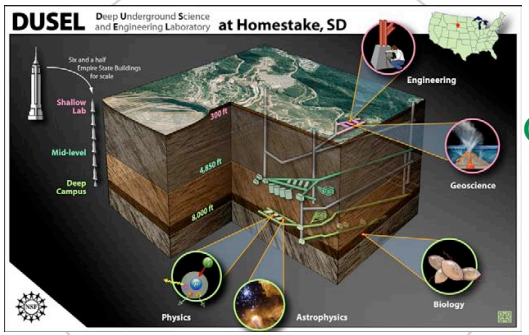
Education & Public Outreach

Earth Science
Geo-Database
Geo Modeling
Geophysics
Seismology
Fracture Study

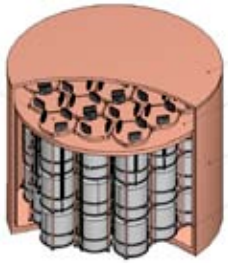




Solar Neutrinos
Geoneutrinos
Underground Accelerator for Astrophysics
Gravity Waves

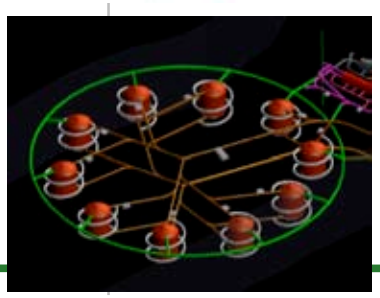


Cloud Formation
Lightning Physics
Thermal History
Coupled Processes
Rock Mechanics
Hydrology
Mineral Studies
Economic Geology



Neutrinoless ββ Decay
U/G Manufacturing
Low Background Counting

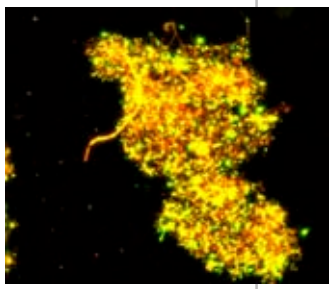
Geomicrobiology
Bioprospecting
Life at Extreme Conditions
Geochemistry
Ecology
Environmental Studies



Neutrino Properties
Long-baseline ν Oscillation
CP violation
MNSP Matrix
Nucleon Decay
Atmospheric Neutrinos

Underground Engineering

Homeland Security

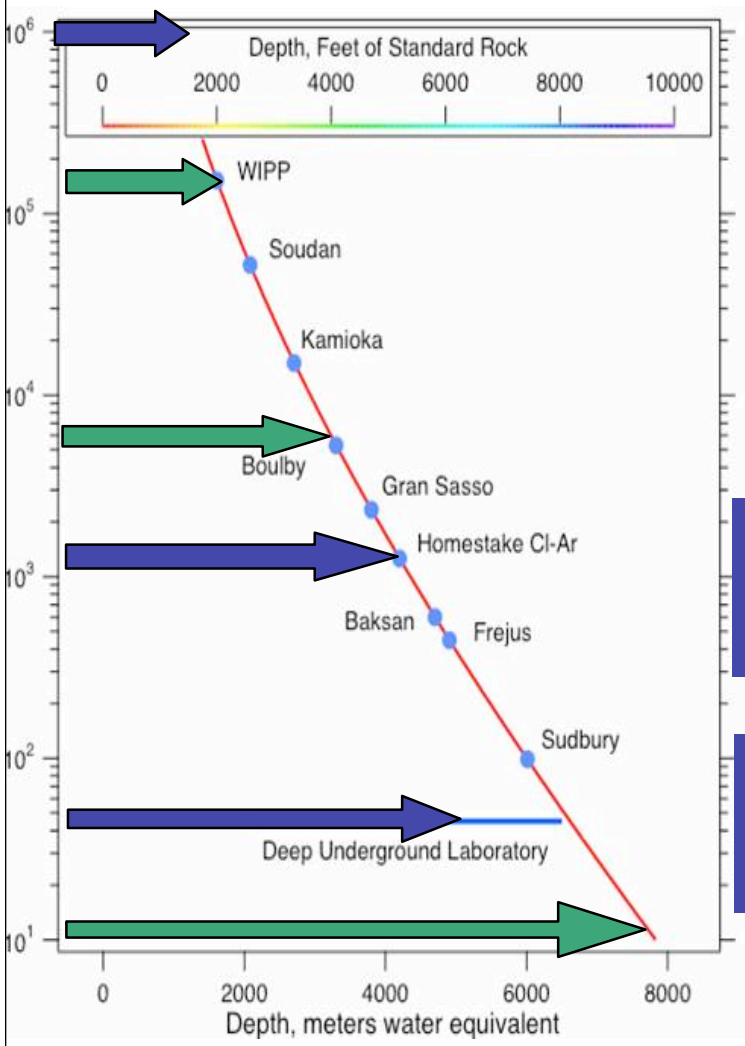


Homestake DUSEL

Facility Conceptual Plans

- Conceptual Facility Plans will be refined with community-developed Initial Suite of Experiments, this process begins at this town meeting
- To *estimate* the Initial Suite of Experiments for the Conceptual Design
  - Winter 2005-06 Call for Letters of Interest
  - Program Advisory Committee
- Used LOIs and PAC report to *estimate* Facility Requirements and Timelines; coupled this with Deep Science

DUSEL Footprints



300L R&D, E&O 10k ft^2

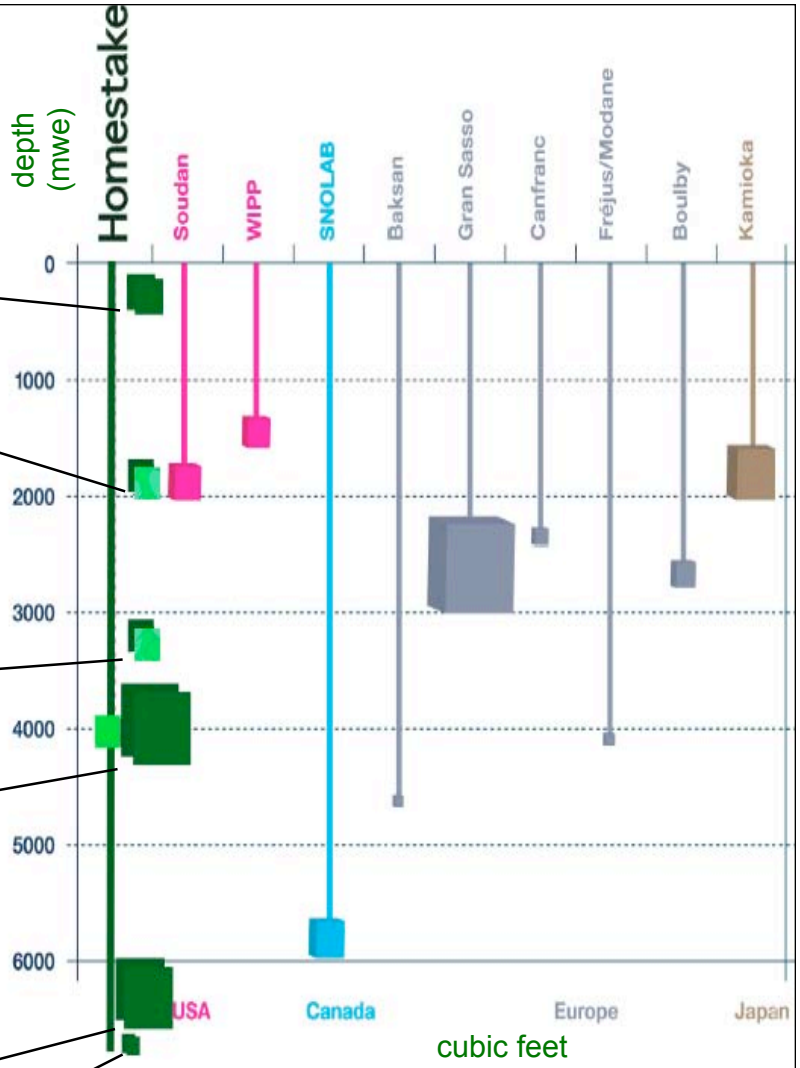
2000L Geo Level

3800L Geo Level

4850L Major Campus 100k ft^2

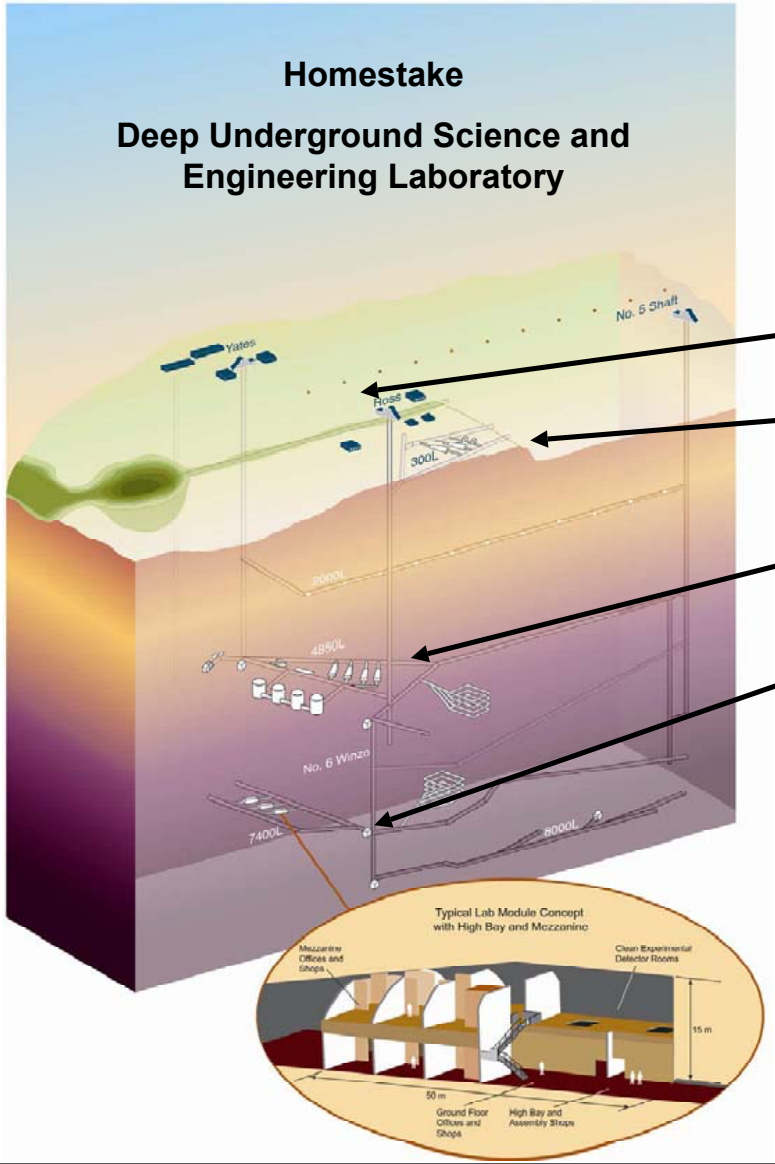
7400L Major Campus 65k ft^2

8000L Geo Lab



Estimates do not include MegaTon Detectors

DUSEL Campus Concepts

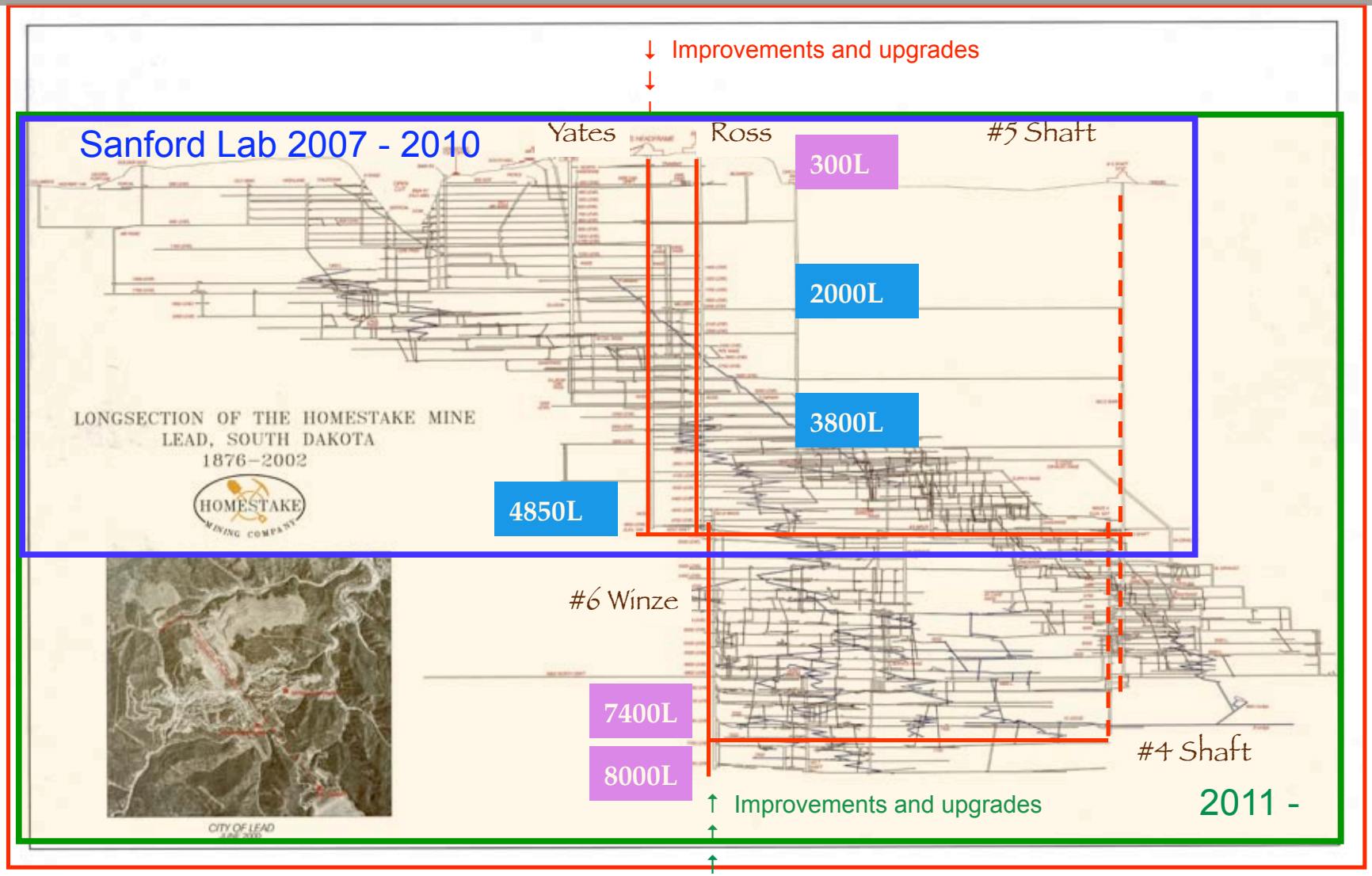


Planning to develop four primary campus locations for research:

1. Surface campus at Yates Complex
2. Near-surface campus at 300 Level
3. Mid-level campus at 4850 Level
4. Deep-level campus at 7400 Level

Infrastructure will be maintained for access to additional, selected levels for bio- and geo- sciences and for unique experiments that require specific or isolated sites.

Phased approach to building DUSEL



A dedicated science facility without competition or interference from mining, transportation, etc.

Phased Approach

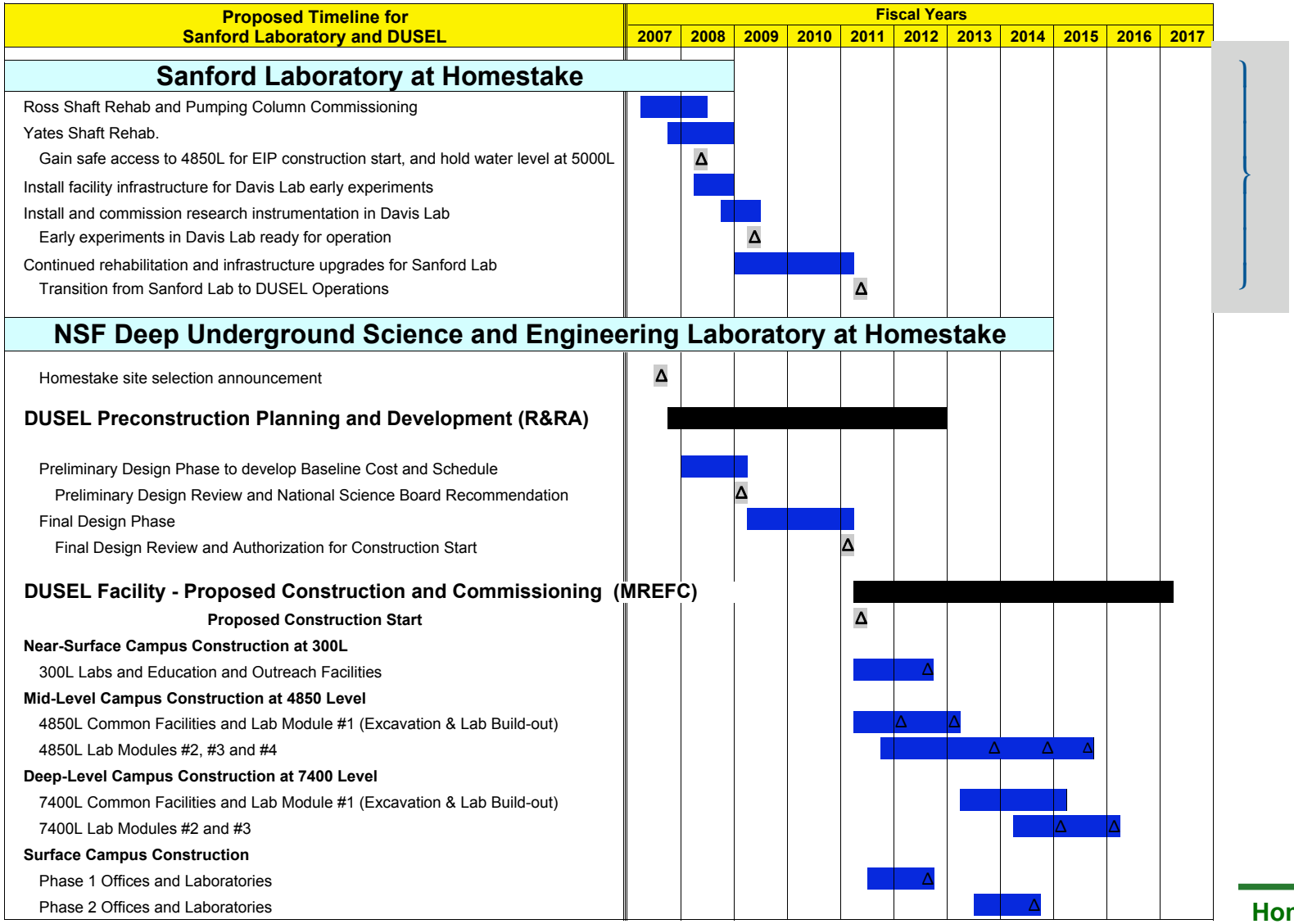
- To preserve the site for DUSEL, South Dakota initiated a program of rehabilitation and re-entry. Will sponsor a modest Science Program with these efforts
- Motivated by the desire to halt the in-flow of water into the facility
- Financed with State-controlled funds and philanthropic donations

Sanford Laboratory 2007 - 2010

- ☑ October 2005, State Legislature approves additional $20M funding for Homestake, <u>total of $46M</u> from state controlled sources.
- ☑ Property Donation Agreement Completed
  14 April 2006, Property transfered to S.D.
  May 2006, SDSTA hiring staff to oversee and operate Homestake: ~30 for rehabilitation, ~ 25 to 30 staff members
- ☑ Banker and philanthropist T. Denny Sanford pledges **<u>$70M</u>** to develop Sanford Lab
- ☑ January 2007 Rehabilitation work initiated
- ☑ October 2007 SDSTA hires Jose Alonso, Lab Director; searches for Project Managers, Project Engineers, Safety Director, other Laboratory staff
- ○ Early Implementation Program at Homestake 2007 - 2012 “The Sanford Laboratory”

HOMESTAKE MINE

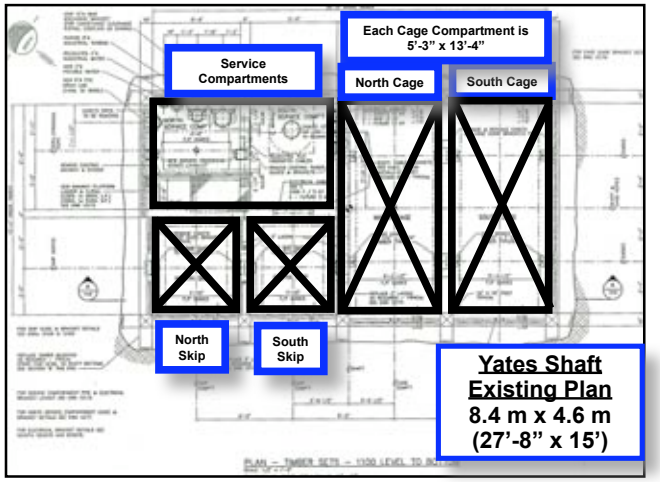
Summary Schedule

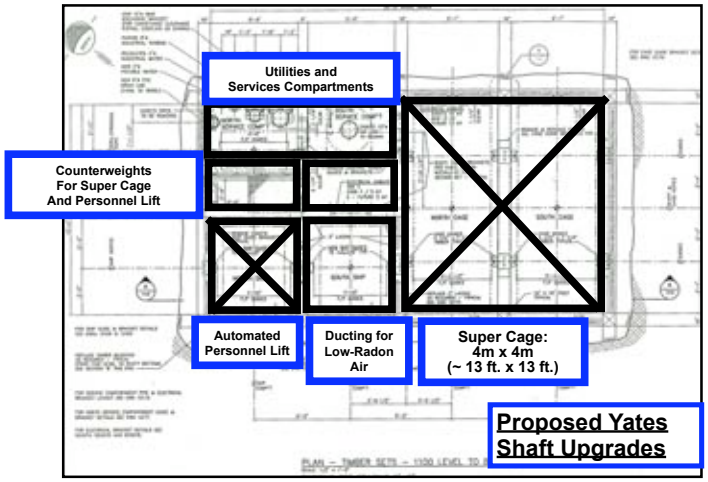


Enhanced and Customized Access

Yates Shaft Upgrade Plan

Improved access to the 4850 Level for personnel, equipment, and utilities





Sanford Lab Science Program: 2007 - 2010

Dark Matter: Gaitskell, Shutt and collaboration

Geo/seismic array: Glaser, Johnson, Roggenthen

Low Background Counting: Mei and collaboration

Dark Matter: Hime, McKinsey and collaboration

Dark Matter: Mei, Hime and collaboration

Geo/Bio Sampling: Bang, Conrad & collaboration

Neutrinoless ββ: Elliott, Wilkerson, and collaboration

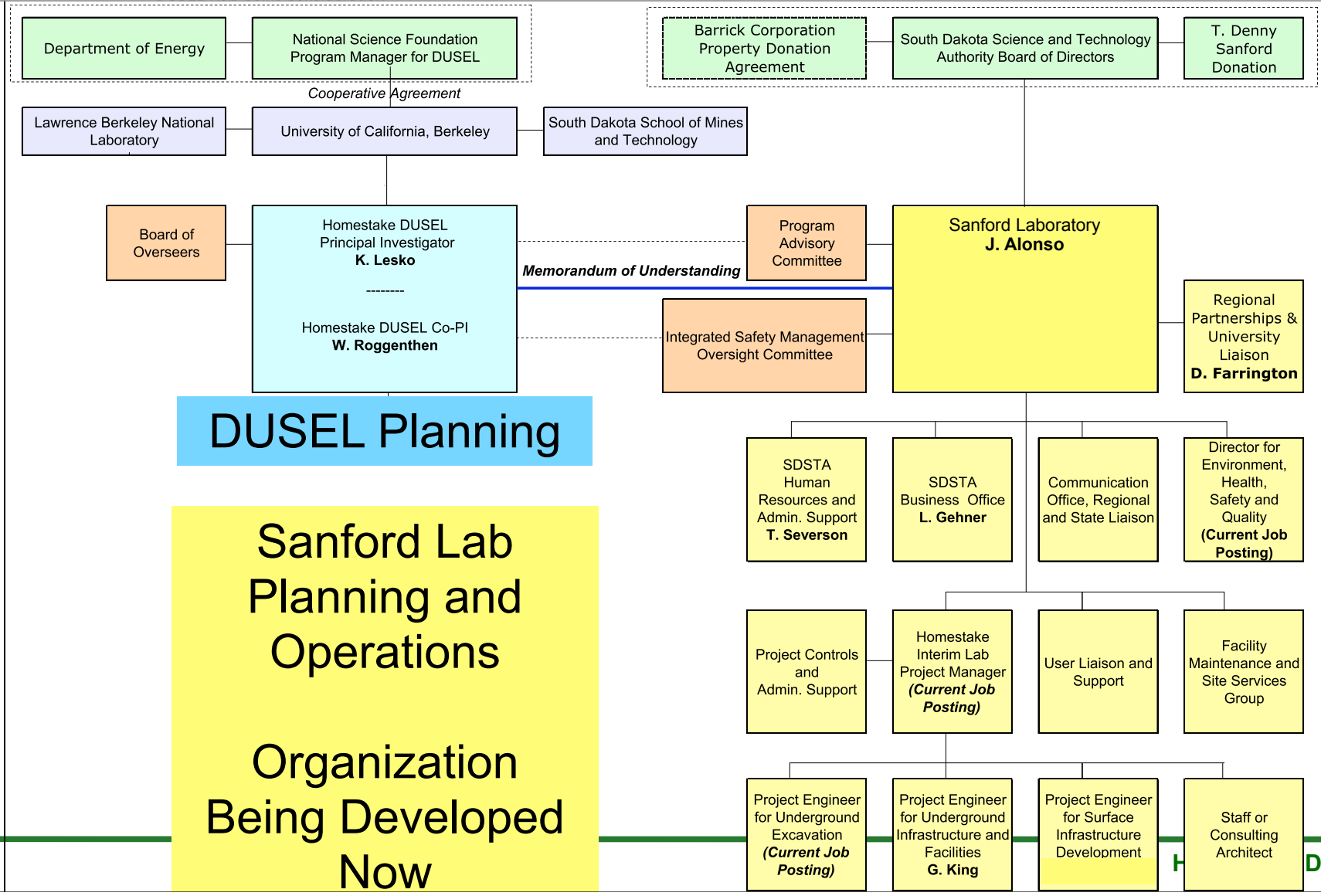
Large Cavities, LBL νs: Lande, Diwan and collaboration

Carbon Sequestration: Wang and collaboration

Organization Prior to MREFC Construction

Homestake Interim Laboratory and DUSEL Preconstruction & Development Phase: FY07 to FY10

DUSEL R&D Joint Consideration



Preconstruction Planning & Development

We are moving into the MREFC Readiness Stage to develop a <u>Preliminary Design</u> including:

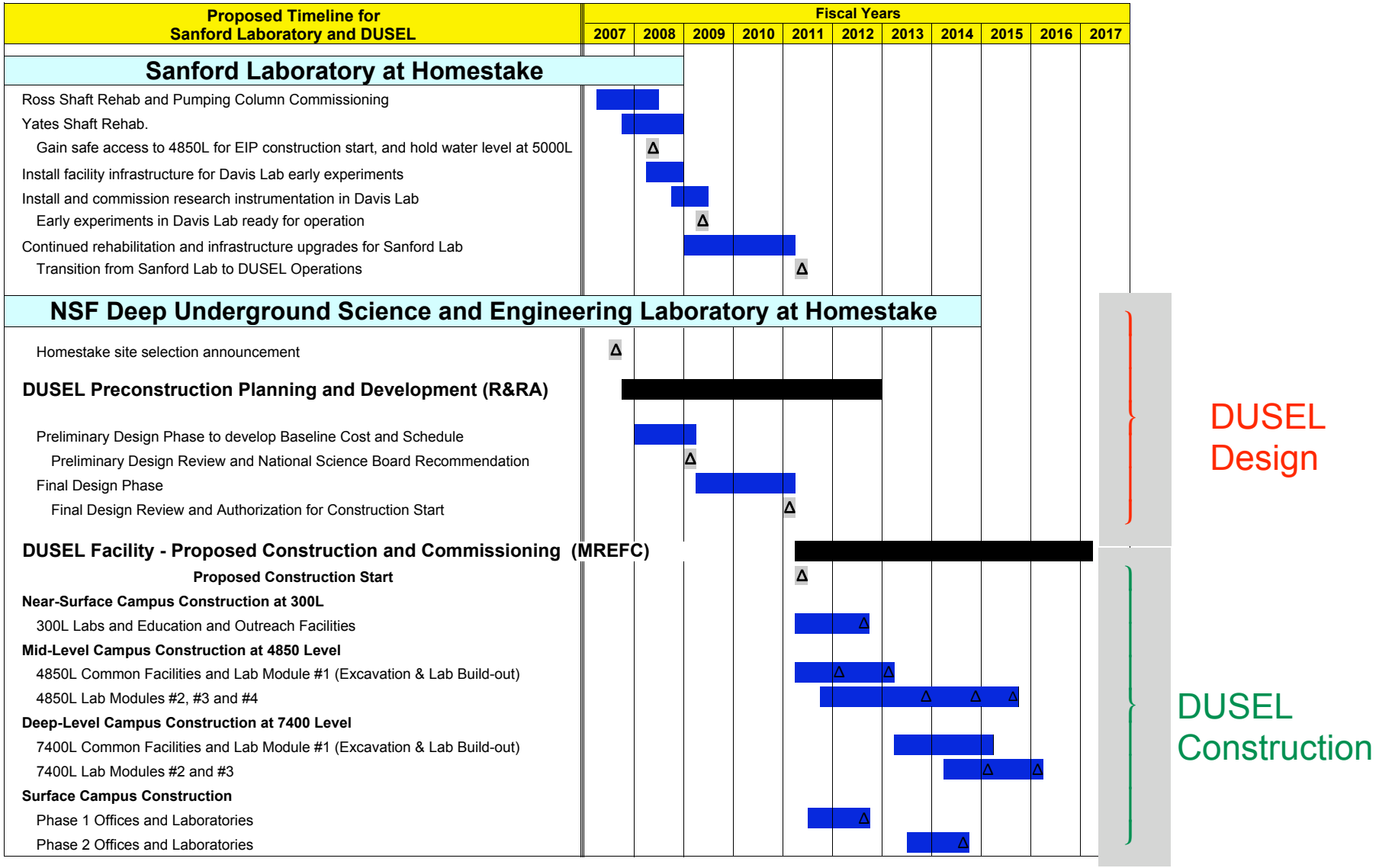
Content:

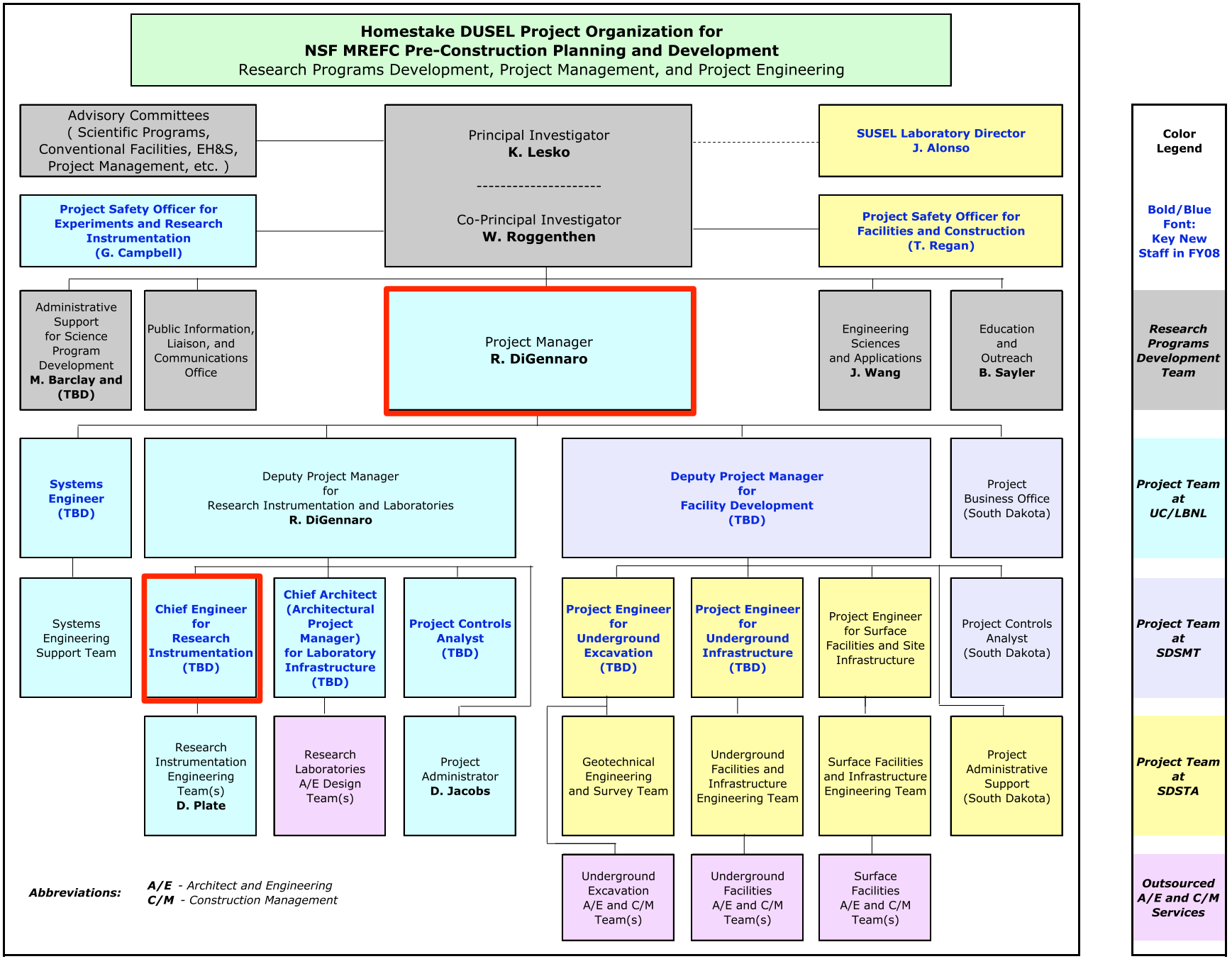
- Scientific research objectives and priorities *(to be updated to reflect ISE)*
- Site-specific preliminary design
- Resource-loaded Schedule
- Bottoms-up Preliminary Cost Estimate
- Integrated Risk Analysis and Contingency Estimates
- Preliminary Operations Cost Estimate
- Environmental Assessments

Process:

- Project Execution Plan
- Project Management Control System
- Systems Engineering

Summary Schedule




Homestake DUSEL Project Organization for
NSF MREFC Pre-Construction Planning and Development
Research Programs Development, Project Management, and Project Engineering
Advisory Committees (Scientific Programs, Conventional Facilities, EH&S, Project Management, etc.)
Principal Investigator
K. Lesko
Co-Principal Investigator
W. Roggenthen
SUSEL Laboratory Director
J. Alonso
Project Safety Officer for Experiments and Research Instrumentation (G. Campbell)
Project Safety Officer for Facilities and Construction (T. Regan)
Administrative Support for Science Program Development
M. Barclay and (TBD)
Public Information, Liaison, and Communications Office
Project Manager
R. DiGennaro
Engineering Sciences and Applications
J. Wang
Education and Outreach
B. Sayler
Systems Engineer (TBD)
Deputy Project Manager for Research Instrumentation and Laboratories
R. DiGennaro
Deputy Project Manager for Facility Development (TBD)
Project Business Office (South Dakota)
Systems Engineering Support Team
Chief Engineer for Research Instrumentation (TBD)
Chief Architect (Architectural Project Manager) for Laboratory Infrastructure (TBD)
Project Controls Analyst (TBD)
Project Engineer for Underground Excavation (TBD)
Project Engineer for Underground Infrastructure (TBD)
Project Engineer for Surface Facilities and Site Infrastructure
Project Controls Analyst (South Dakota)
Research Instrumentation Engineering Team(s)
D. Plate
Research Laboratories A/E Design Team(s)
Project Administrator
D. Jacobs
Geotechnical Engineering and Survey Team
Underground Facilities and Infrastructure Engineering Team
Surface Facilities and Infrastructure Engineering Team
Project Administrative Support (South Dakota)
Underground Excavation A/E and C/M Team(s)
Underground Facilities A/E and C/M Team(s)
Surface Facilities A/E and C/M Team(s)
Abbreviations:
A/E - Architect and Engineering
C/M - Construction Management
Color Legend
Bold/Blue Font: Key New Staff in FY08
Research Programs Development Team
Project Team at UC/LBNL
Project Team at SDSMT
Project Team at SDSTA
Outsourced A/E and C/M Services

References, Personnel, Documentation

- Michael Barnett, LBNL (E+O)
- Yuen-dat Chan, LBNL (Other uses)
- Milind Diwan, BNL (lbl, pdk)
- Reyco Henning, UNC (0vdbd, dm)
- Ken Lande, Penn (lbl, pdk, geo-neutrinos)
- Bob Lanou, Brown (neutrinos, solar neutrinos)
- Chris Laughton, FNAL (engineering)
- Kevin T. Lesko, UCB (physics) PI
- Stu Loken, LBNL (E+O)
- Hitoshi Murayama, UCB (physics theory, neutrinos)
- Tommy Phelps, ORNL (geomicro)
- Bill Roggenthen, SDSM&T (geophysics) coPI
- Ben Sayler, BHSU (E+O)
- Tom Shutt, Case Western (low backgrounds)
- Nikolai Tolich, U.W. (geonus)
- Bruce Vogelaar, Virginia Tech (solar nus)
- Herb Wang, U Wisc. (geology, rock mechanics)
- Joe Wang, LBNL (earth science, geophysics)

- Richard DiGennaro, LBNL, Project Manager and Systems Engineer

Dianna Jacobs, LBNL, Project Office

Dave Plate, LBNL, Project Engineer

- Mark Laurenti, Mining Engineer

Syd DeVries, Mining Engineer

- Dave Snyder, SDSTA Exec. Director
- Jose Alonso, Sanford Lab Director

Trudy Severson, Laurie Gehner SDSTA

SDSTA Engineering and Safety Personnel

Ms. Melissa Barclay & Cathy Thompson

http://www.lbl.gov/nsd/homestake

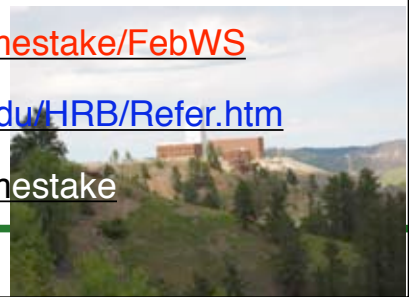
http://neutrino.lbl.gov/Homestake/LOI

http://neutrino.lbl.gov/Homestake/FebWS

http://homestake.sdsmt.edu/HRB/Refer.htm

http://neutrino.lbl.gov/Homestake

http://www.dusel.org



Workshops in South Dakota

- Homestake is arranging to host a series of comprehensive workshops at Lead, SD
- 21-28 April 2008
- Details to be forthcoming, but along the lines of our previous workshops:
  - physics
  - biology
  - earth science & engineering
  - common facilities and cross-cutting research
  - education and public outreach

Center for Underground Science

- To facilitate interactions between the Homestake Facility we are proposing a "Center" initially at Berkeley,
  - host "sabbatical leave" & short-term visits
  - develop collaborations
  - develop experimental plans
  - work with engineers to develop facility requirements and criteria for DUSEL plans
- To begin ~ January 2008, coordinate by topics
- Arranging sponsorship from various sources