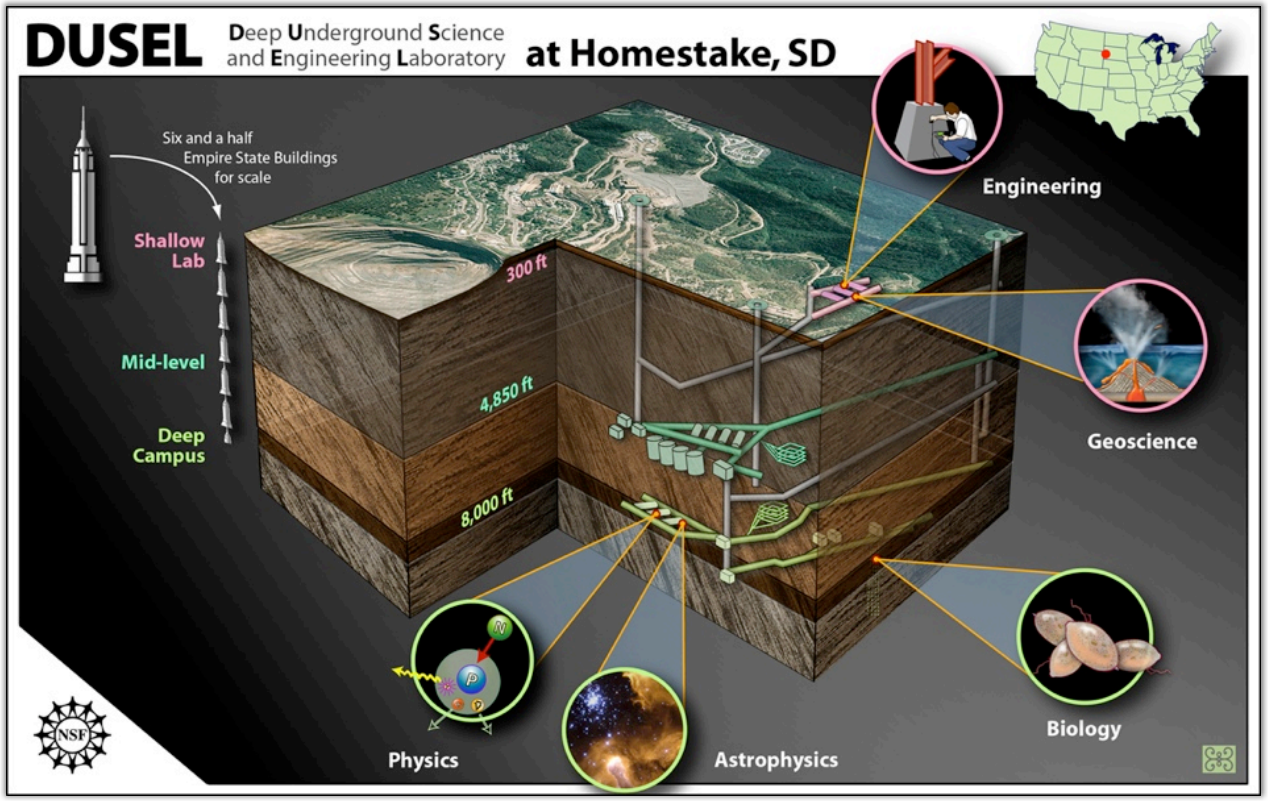
The Deep Underground Science and Engineering Laboratory



Kevin T. Lesko, PI

UC Berkeley

3 November 2007

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, Project Engineering
- Mark Laurenti, Mining Engineer

Syd DeVries, Mining Engineer

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

Trudy Severson, Laurie Gehner SDSTA

SDSTA Engineering and Safety Personnel

Ms. Melissa Barclay & Cathy Thompson

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

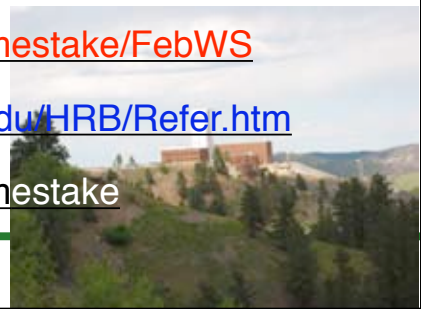
http://neutrino.lbl.gov/Homestake/LOI

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

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

http://neutrino.lbl.gov/Homestake

http://www.dusel.org



Outline

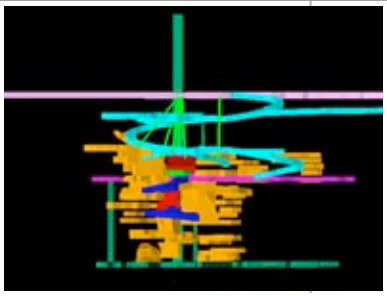
- Deep Underground Science and Engineering Laboratory (DUSEL) at Homestake
  - Global View of Homestake DUSEL Proposal
  - Initial Laboratory Criteria and Specification
  - Approach to Creating DUSEL
    - South Dakota's Sanford Lab
    - NSF's DUSEL
- Coupling the Science to the Facility
  - Workshops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

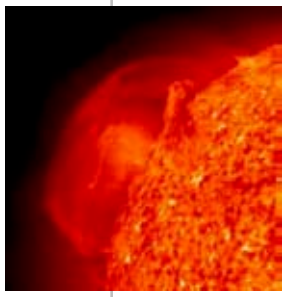
DUSEL: Multidisciplinary & Synergistic

Physics
Dark Matter
Cosmology
Astrophysics
Neutron Oscillation

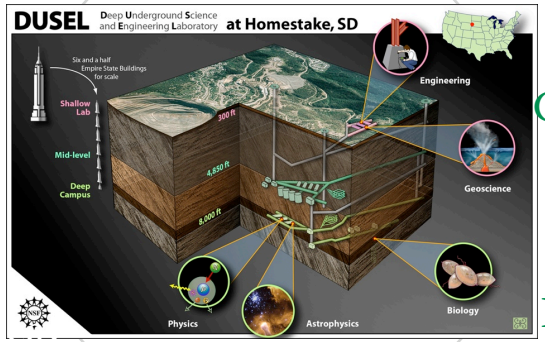
Education & Public Outreach

Earth Science
Geo-Database
Geo Modeling
Geophysics
Seismology
Fracture Study

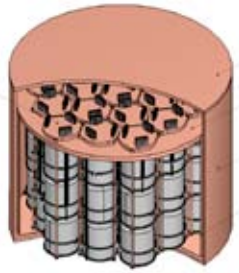




Solar Neutrinos
Geoneutrinos
Underground
Accelerator for
Astrophysics
Gravity Waves

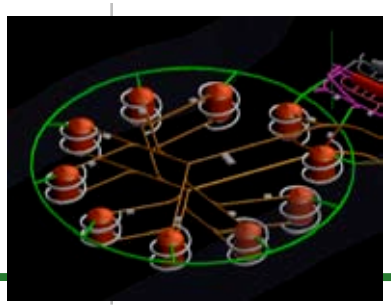


Cloud Formation
Lightning Physics
Thermal History
Coupled Processes
Rock Mechanics
Hydrology
Mineral Studies
Economic Geology



Neutrinoless ββ
U/G Manufacturing
Low Background Counting

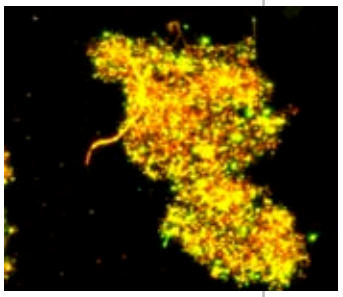
Geomicrobiology
Bioprospecting
Life at Extreme
Conditions
Geochemistry
Ecology
Environmental
Studies



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

Underground Engineering

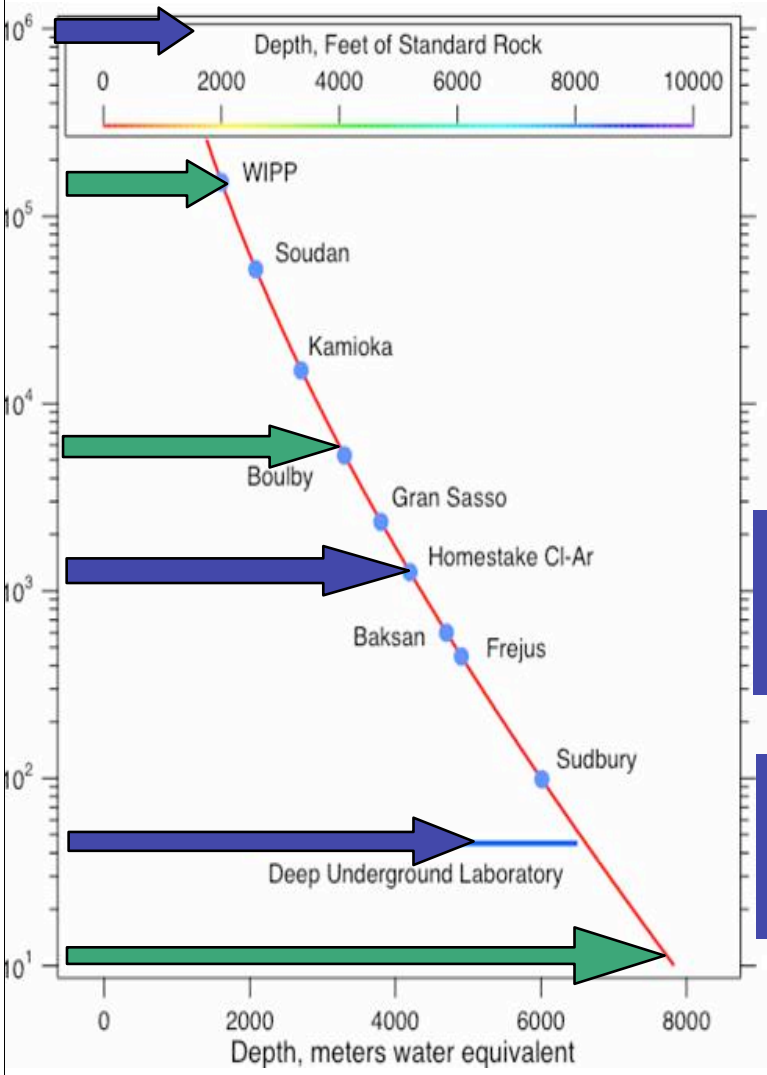
Homeland Security



Facility Conceptual Plans

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

DUSEL Campus Footprints



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

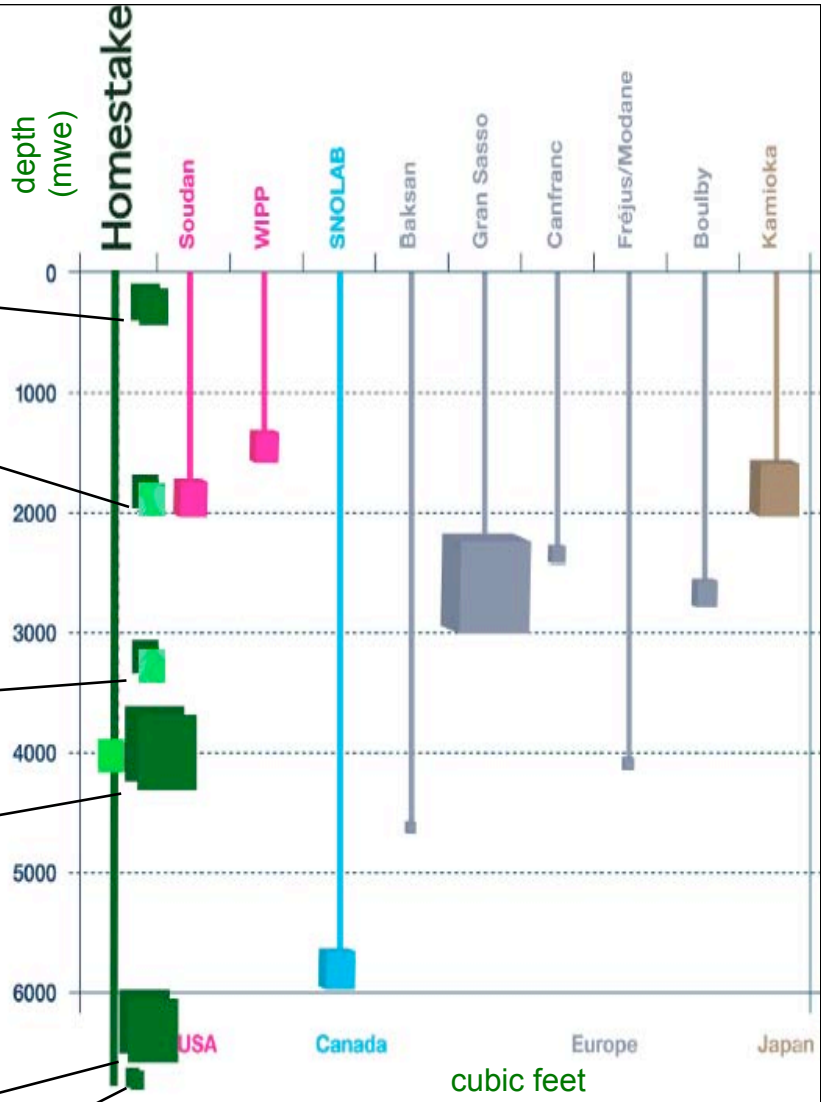
2000L Geo Level

3800L Geo Level

4850L Major Campus 100k ft^2

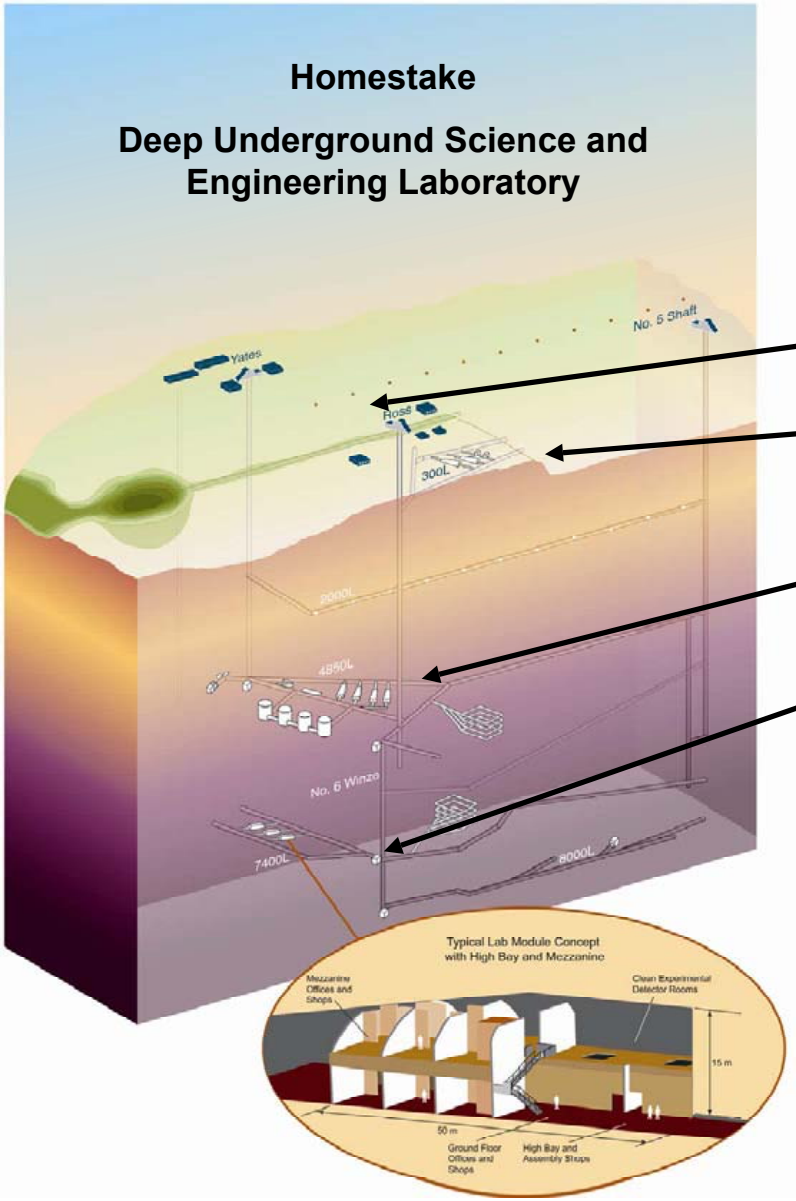
7400L Major Campus 65k ft^2

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.

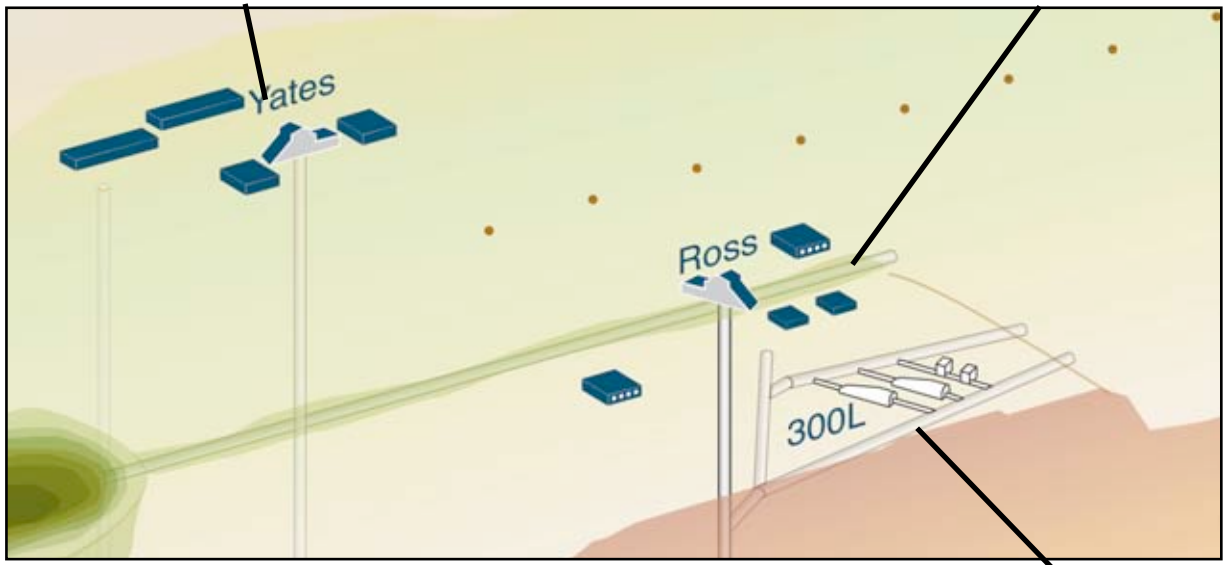
Concepts for Surface Facilities & 300 Level

Yates Complex Surface Facilities:

- Laboratory Administration Building and Training
- User Support Services: Clean Room Assembly & Fabrication Shops
- R&D Laboratories, User Offices, Meeting Rooms
- Education and Outreach: Sanford Center for Science Education
- Shipping and Receiving, Storage

Ross Complex Surface Facilities :

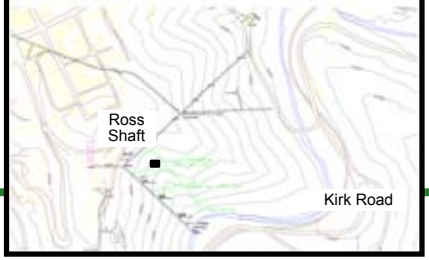
- Construction Materials and Equipment Staging
- Construction Superintendents and Contractor Offices
- Maintenance Shops
- Shipping and Receiving, Storage
- Facility Site Services and Operations



Experiments and Facilities at 300 Level:

- Education and Outreach Classroom and Laboratory
- User Support Shops: Assembly, Fabrication and Underground Storage
- Research and Development Laboratories
- Near-surface Experiments
- Low-background Counting and Calibration Facility

300 Level Campus Plan for near-surface, drive-in access



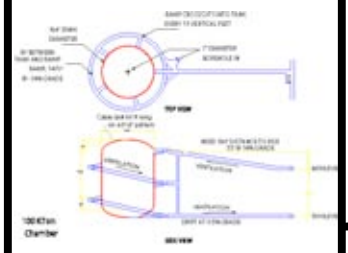
Concepts for Mid- & Deep-level Experiments

Early Implementation Program & Facility Infrastructure Development at 4850L:

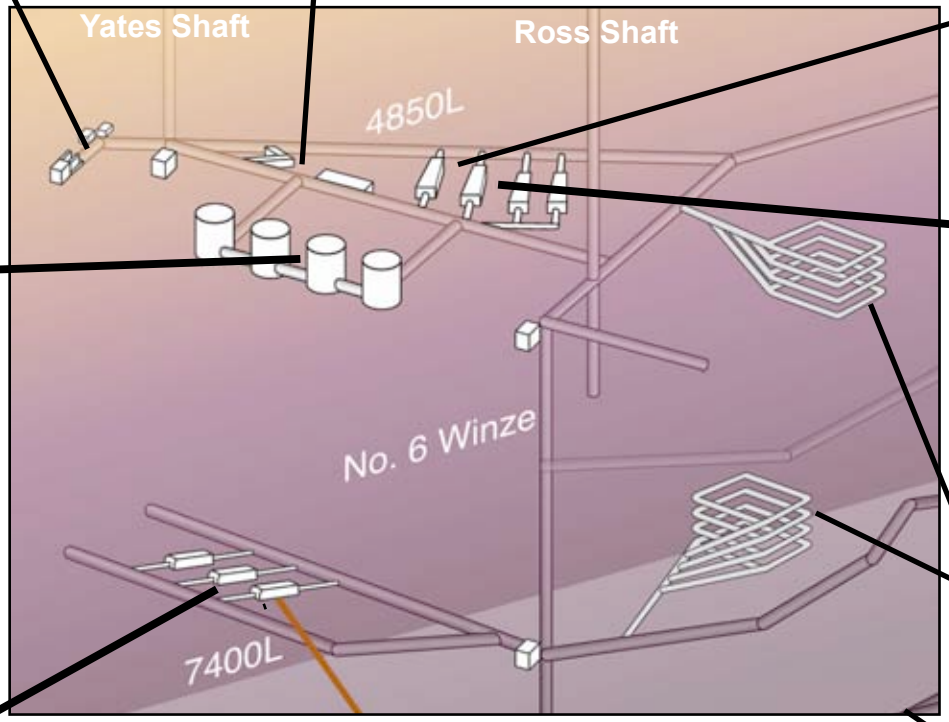
- Low-Background Counting Facility
- Neutrinoless Double Beta Decay
- Dark Matter
- Earth Sciences and Geo-microbiology Lab
- Common Facilities and Clean Room Transition
- Utility Services and Refuge Chamber

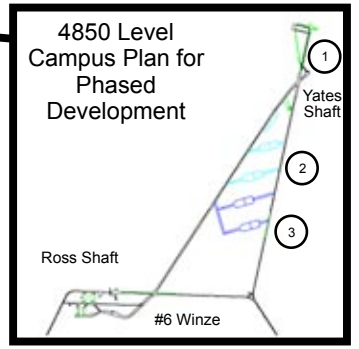
Initial Suite of Experiments at 4850 Level

- Dark Matter
- Double Beta Decay
- Nuclear Astrophysics
- Solar Neutrinos
- Geoneutrinos



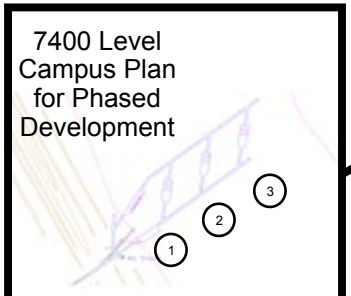
Design and Excavation concept for future, multiple 100 kTon chambers for Long Baseline Experiment





Geosciences:

Large Block Coupled Processes Experiments



Initial Suite of Experiments at 7400 Level:

- Large Double Beta Decay
- Solar Neutrinos
- Supernovae Detection
- Large Dark Matter

Geosciences:

Deep Drill Room at 8000L

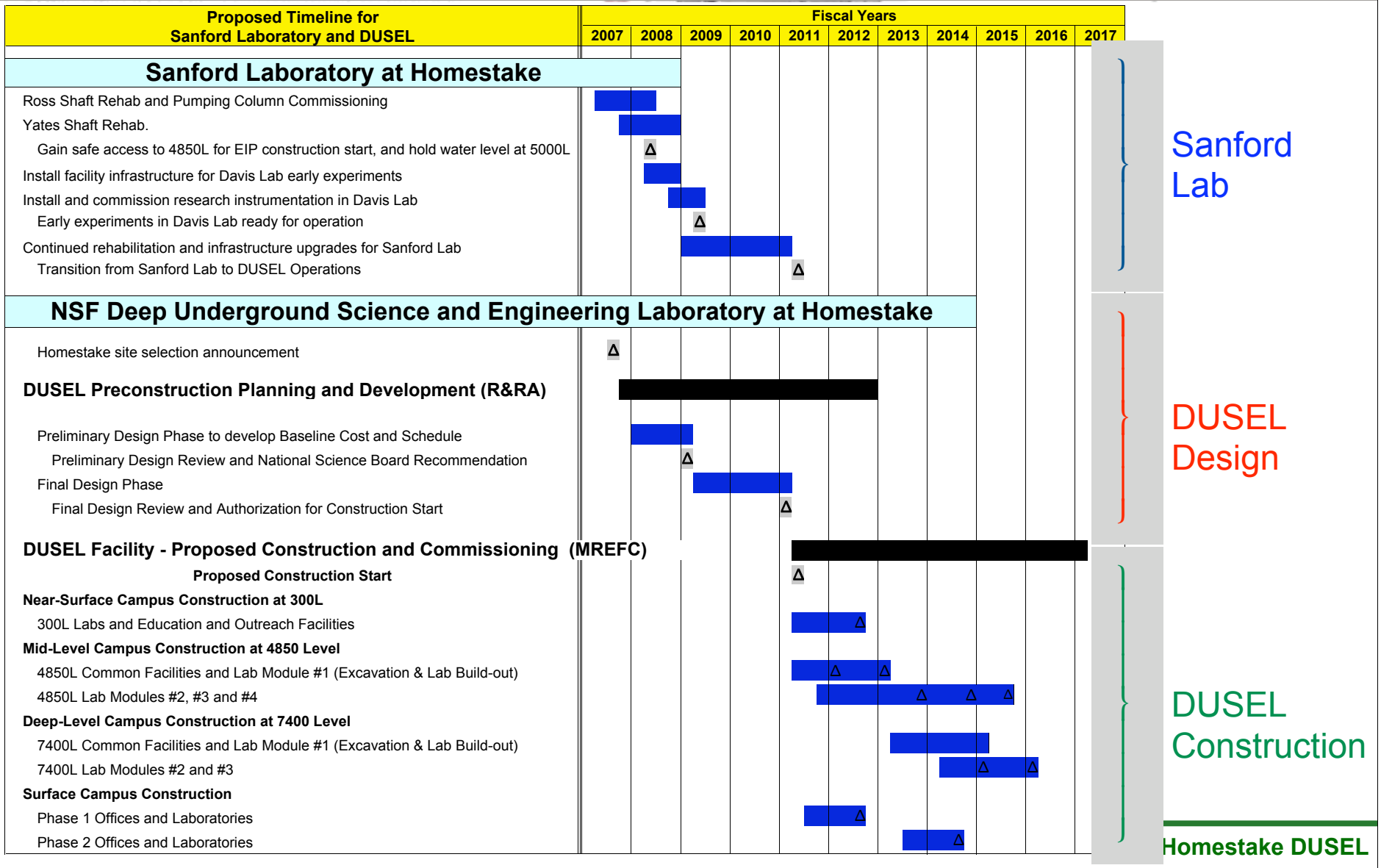
Facility Requirements

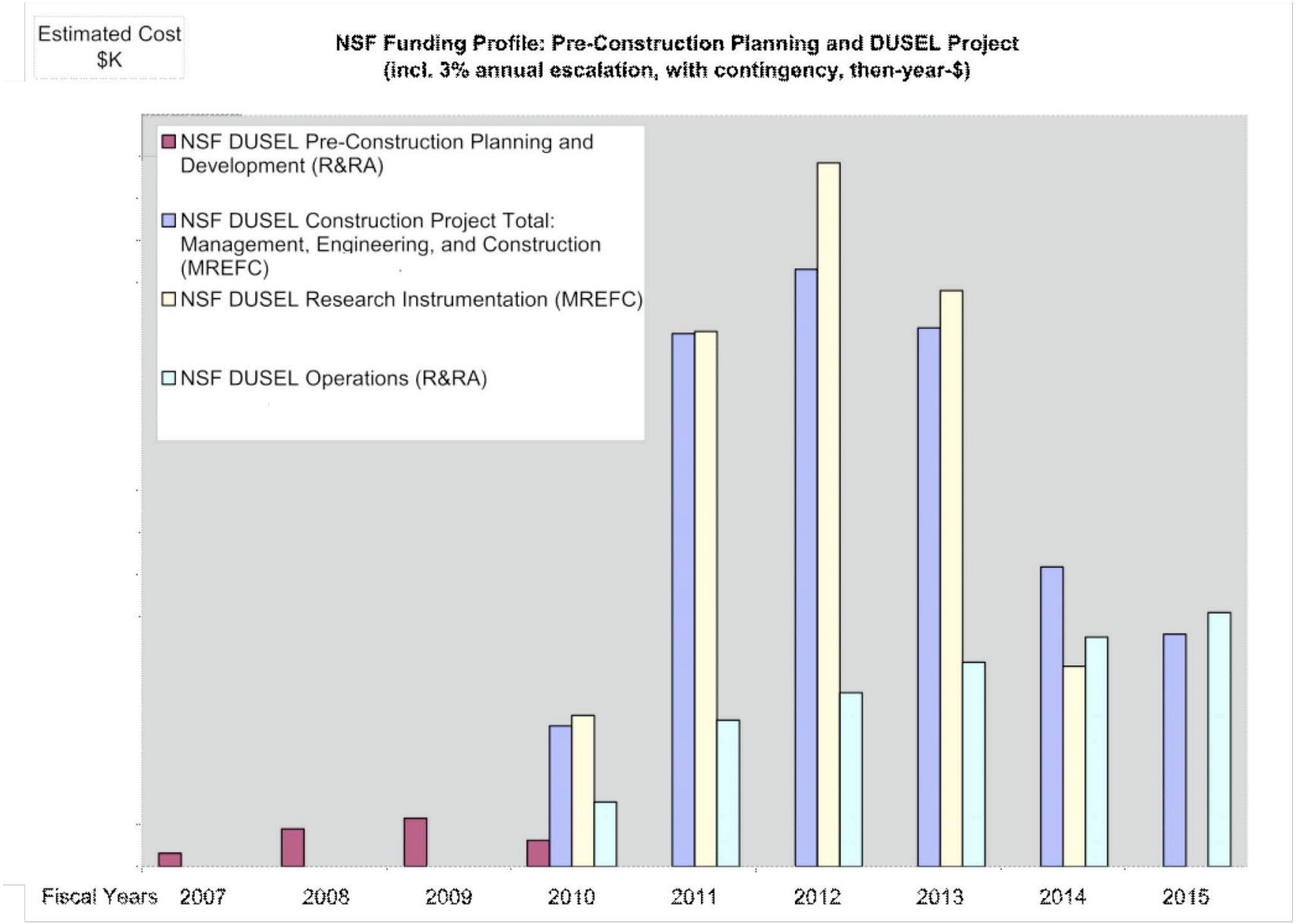
- Additional details and opportunity for discussion will be presented:
  - Facilities Session this weekend (DiGennaro and Peterson)
  - Conceptual Design Report
    - http:/www.lbl.gov/nsd/homestake
  - Encourage Participation in Subsequent Workshops and Centers

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 (~ 2007 - 2010)

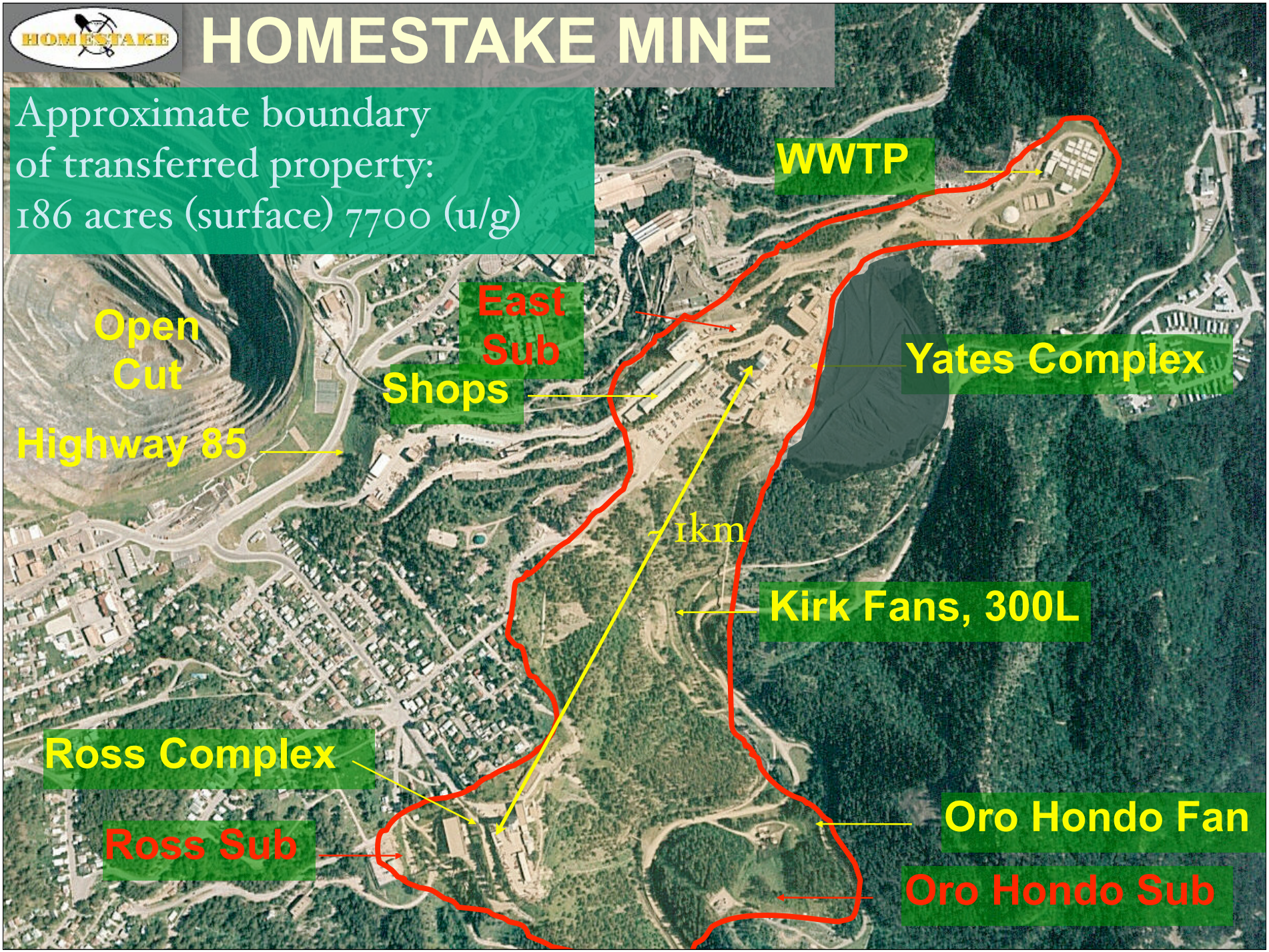
Summary Schedule



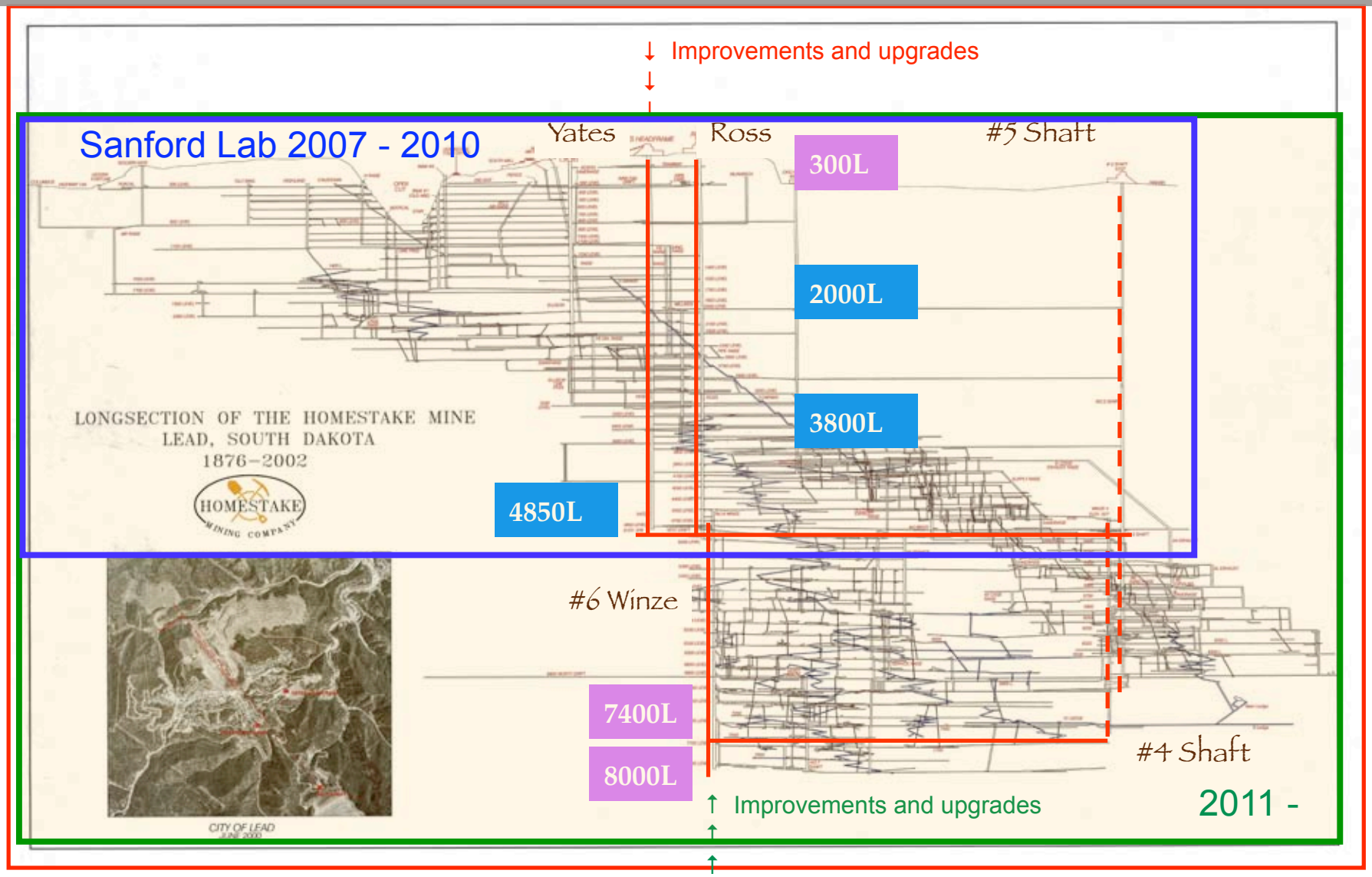

Estimated Cost
$K
NSF Funding Profile: Pre-Construction Planning and DUSEL Project
(incl. 3% annual escalation, with contingency, then-year-$)
NSF DUSEL Pre-Construction Planning and Development (R&RA)
NSF DUSEL Construction Project Total: Management, Engineering, and Construction (MREFC)
NSF DUSEL Research Instrumentation (MREFC)
NSF DUSEL Operations (R&RA)
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015

Sanford Laboratory 2007 - 2010

- October 2005, State Legislature approves additional $20M funding for Homestake, <u>total of $46M</u> from state controlled sources.
  - Rehab plan: $15M
  - Indemnification fund: $10M
  - Operations: $15M
  - Insurance: $2.5M
  - Contingency: $3.5M
- 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 at Homestake
- January 2007 Rehab work initiated
- October 2007 SDSTA hires Jose Alonso, Lab Director; active searches for Project Managers, Project Engineers, Safety Director, other Sanford Lab staff
- Early Implementation Program at Homestake 2007 - 2012 “The Sanford Laboratory”


HOMESTAKE MINE
Approximate boundary
of transferred property:
186 acres (surface) 7700 (u/g)
WWTP
East
Sub
Shops
Open
Cut
Highway 85
Yates Complex
1km
Kirk Fans, 300L
Ross Complex
Ross Sub
Oro Hondo Fan
Oro Hondo Sub

Phased approach to building DUSEL

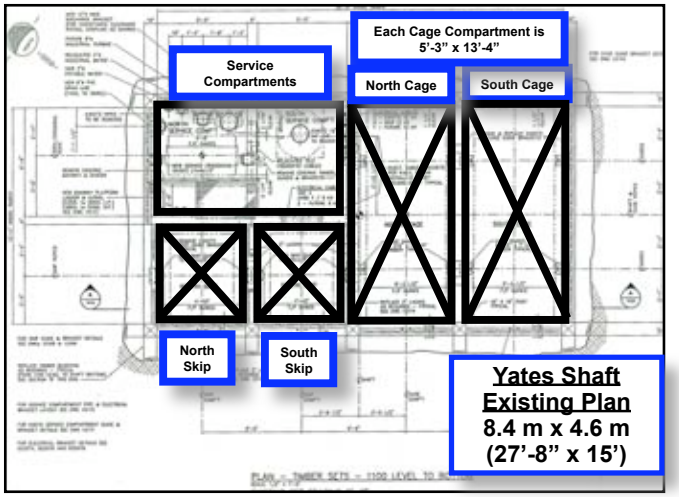


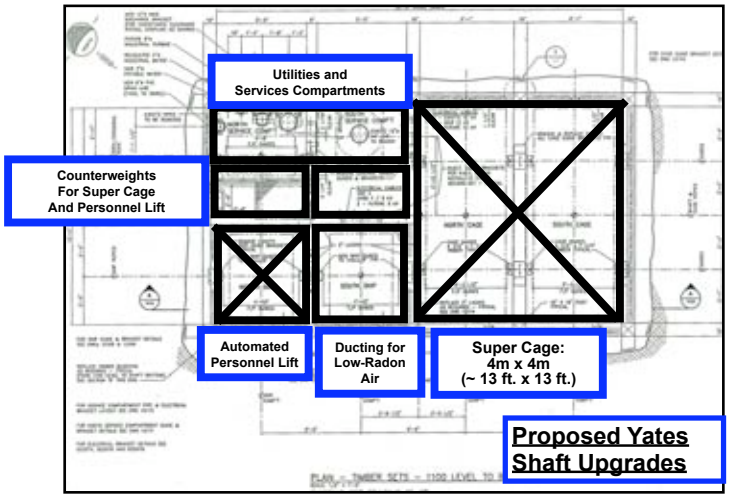
A dedicated science facility without competition or interference from mining, transportation, etc.

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

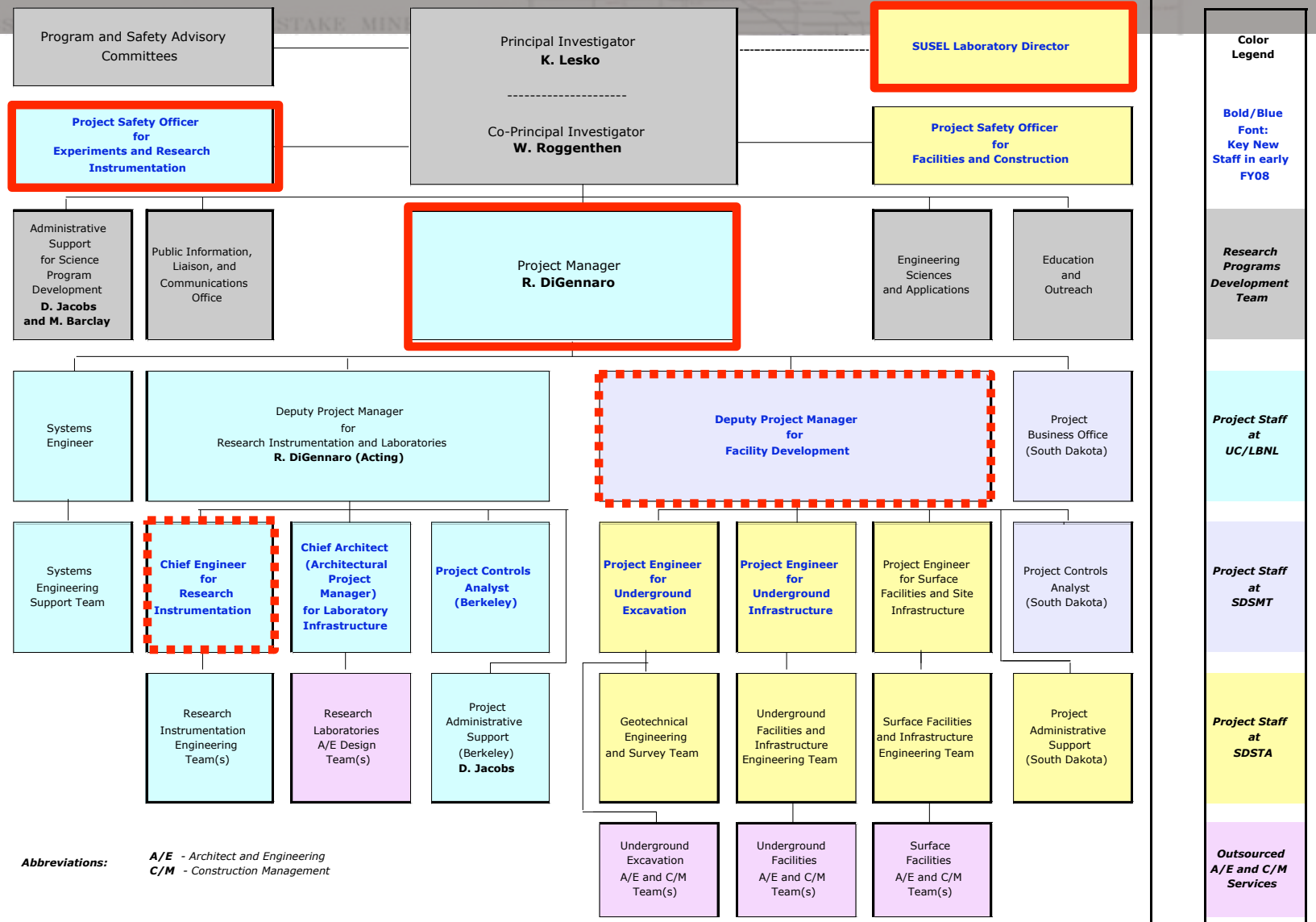
Neutrinoless ββ: Elliott, Wilkerson, and collaboration

Large Cavities, LBL νs: Lande, Diwan and collaboration

Carbon Sequestration: Wang and collaboration

DUSEL

Homestake DUSEL Project Organization for
NSF MREFC Pre-Construction Planning and Development
Research Programs Development, Project Management, and Project Engineering



Abbreviations:
A/E *- Architect and Engineering*
C/M *- Construction Management*

Color Legend

Bold/Blue Font: Key New Staff in early FY08

Research Programs Development Team

Project Staff at UC/LBNL

Project Staff at SDSMT

Project Staff at SDSTA

Outsourced A/E and C/M Services

Board of Overseers:
Baha Balantekin
Brian McPherson
Tullis Onstott
Nick Samios
John Schiffer
Nicholas Sitar

SDSTA Board of Directors:
Dave Bozied - chair
Steve Zellmer - co-chair
Casey Peterson
Pat LeBrun
Thomas Adam

DUSEL Project Team:
offers out to or hired:
Chief Instrumentation Engineer
EH&S Director
Project Controls

Program Advisory Committee:
Sookie Bang
Derek Elsworth - co-chair
Derric Iles
Ed Kearns
Josh Klein
Bill Marciano
Harry Nelson
Chris Neuzil
Bill Pariseau
Charles Ruch
Frank Sciulli - co-chair
Hank Sobel

2006-2007

Board of Overseers, PAC, and Project Team will be enlarged in the preconstruction and construction phases

Workshops in South Dakota

- 21-28 April 2008
- Homestake is arranging to host a series of comprehensive workshops at Lead, SD
- 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 with the Facility we are developing 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 among various sources: SLAC very interested, active discussions with FNAL and other laboratories

PAC and Letters of Interest (Sanford Lab)

- Letters of Interest and PAC report are posted
- Program Advisory Committee is active (Chairs, Elsworth and Sciulli are here this weekend)
- It is too early to call for <u>new</u> Letters of Interest
- It is appropriate for collaborations to revise, augment, expand existing LOIs, including enhancing participation and collaborations

Additional Information

- www.lbl.gov/nsd/homestake
  - Conceptual Design Report
  - Overview presentations
  - These presentations
- Facilities Session this weekend (DiGennaro and Peterson)
- Management Session this weekend (Berley and Lesko)

Conclusions

- Information obtained from these workshops and the DUSEL process will be used in the Preliminary and Final Design steps for the DUSEL Facility
- We will match the science roadmaps with the facility plans with your assistance and participation
- Look forward to continuing discussions concerning the Initial Suite of Experiments with the Collaborations