Deep Underground Science and Engineering Laboratory

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UC Berkeley and Lawrence Berkeley National Laboratory
13 June 2007

DBD07
Osaka Japan

Outline of Presentation

1. The US National Science Foundation's Deep Underground Science and Engineering Laboratory (DUSEL) Progress and Process

2. Assessment of Site-independent Assessment DUSEL Criteria &Needs (S-1 Report)

3. Progress at Homestake

The Vetting of DUSEL

2000 2005 2010

NuSAG 2005, 2006
Dark Matter SAG 2006
EPP2010
HEPAP 2006
S-1 Complete
CDRs Review
EarthScope 2005
Physics of the Universe 2004
S-2 Awards
1st S-1 Workshop
Neutrino Matrix 2004
NSF DUSEL Reorganization 2004
DOE Facilities 2003
EarthLab 2003, HEPAP LRP 2003
Neutrino Facilities Report 2003 (SNOLab Presented)
NeSS 2002
NP LRP 2002
Quarks to the Cosmos 2002
SNOWMASS July 2001
Bahcall Committee report, March 2001
Nuclear Science Advisory Committee, March 2001
Oakland DNP Town Meeting, Oct. 2000
Working Group on Underground Science
Seattle Neutrino Pre-Town Meeting, Sept 2000
Working Group on Underground Science

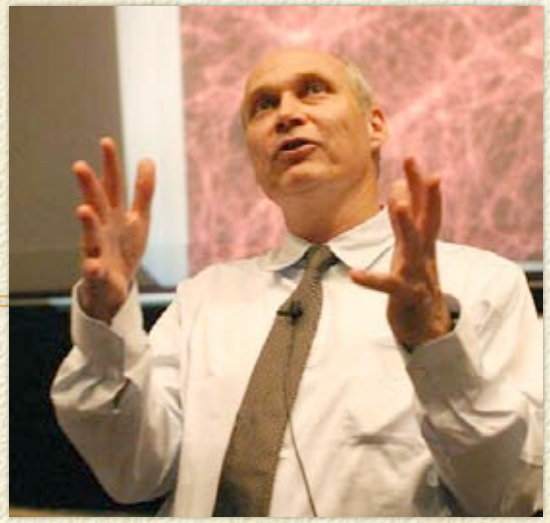
Homestake/DUSEL History

- 2001 Bahcall Committee selected Homestake: fastest time to science, lower capital outlay, strong beneficial local impact, lower risks

  - 2002 Davis awarded Nobel Prize for his Chlorine Experiment at Homestake's 4850L

- May 2003 NSF's independent panel selected Homestake as DUSEL site
- Spring 2003 Barrick closed, capped and sealed Homestake mine
- Jan 2004 "Agreement in Principle" between Barrick and South Dakota to transfer Homestake
- Feb 2004 South Dakota legislature enacts legislation to effectuate the transfer and satisfy "Agreement" provisions
  - Created Authority with $100M bonding ability
  - Enacted State Indemnity and Immunity Statutes
  - Funded $14.3M (+ $10M from HUD action)
- Process to create DUSEL at Homestake "stalls" in Washington

New NSF Process: March 2004 in DC



- Turner DUSEL-Process Defined
  - ☑ S-1: site-independent science case for DUSEL
    - ☑ Sadoulet leading this effort
  - ☑ S-2: site dependent projection on different sites (Conceptual Design Report)
    - ☑ Homestake and Henderson received awards
  - S-3: Technical Design Report solicitation *by invitation*
    - Funding in *FY09* for DUSEL construction

DUSEL Process & Progress

- S-1 Awarded to Bernard Sadoulet,UC Berkeley with Hamish Robertson, U.W.; Gene Beier, U. Penn; Charles Fairhurst, U. Minnesota; T.C. Onstott, Princeton; James Tiedje, Michigan State
  - Conducted extensive workshops, information gathering, discussions with the agencies, foreign laboratories, etc.
- S-1 Report Released: www.dusel.org - Deep Science
- S-2 8 Candidate sites, 2 awards
  - July 2006 Henderson and Homestake

Current NSF Timetable

- **August 06** non-competitive review of two CDRs → comments to the teams about CDR strengths and weaknesses by an anonymous panel
- **September 06** S-3 solicitation announced, funds to be provided to develop Preliminary Design, this Report will be the basis for case for DUSEL in the subsequent reviews
- **Fall 06** NSF and DOE announce call for proposals for DUSEL R&D (Jointly reviewed between DOE and NSF)- 50 responses
- **9 January 07** Responses to S-3 Solicitation due at NSF
- **9-13 March 07** Review of 4 sites, including site visits

NSF Time Table *continued*

- ☑ **19-22 April 07**, reverse site visits by 4 sites
- **Spring 07** funding for a single effort (single site) to develop advanced plan for DUSEL (old "S-3"): Preliminary Design
- **Spring/Summer 07** Call for **Initial Suite Experiments** by NSF (iterative process)
- **~ October 07** baselined DUSEL plan ready for NSF review
- **~ March 08** presentation to NSF, MREFC Panel, …, Development of Final Design FY08, FY09
- **FY10 DUSEL funding**, to include Experiments and Facility
  - Recent NSF Statements: Experiments to be > 50% of the ~$500M MRE

S-1 Findings & Recommendations

www.dusel.org

Findings:

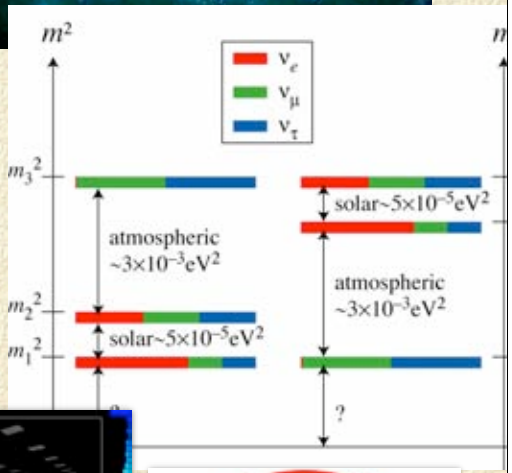
- Deep underground science is an essential component of research at the frontier
  - Disciplines in transformation
- Benefits to society
  - Worldwide need for underground space
- Need for a U.S. world-class deep multidisciplinary facility

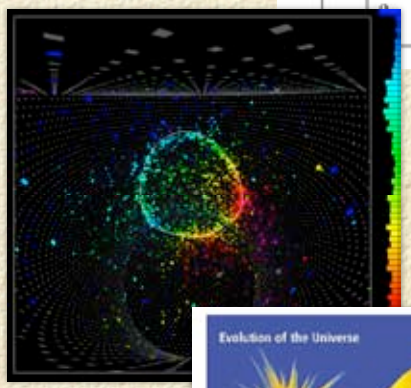
Recommendations:

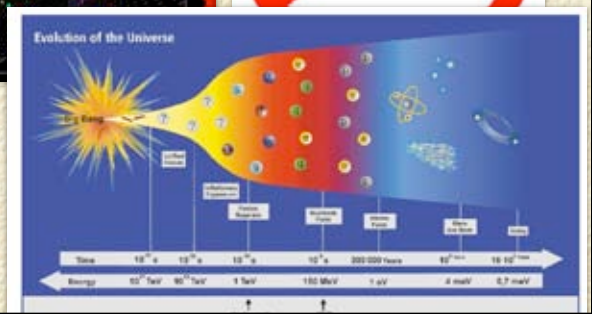
- Strong support for deep underground science
- A cross agency Deep Science Initiative
  - A Deep Underground Science and Engineering Laboratory (6000 mwe, 3000 mwe, 30 to 50 years, ASAP)

Deep Science Questions

- What is the universe made of?
- What is dark matter?
- What are neutrinos telling us?
- What happened to the antimatter?
- Are protons unstable?
- How did the universe evolve?

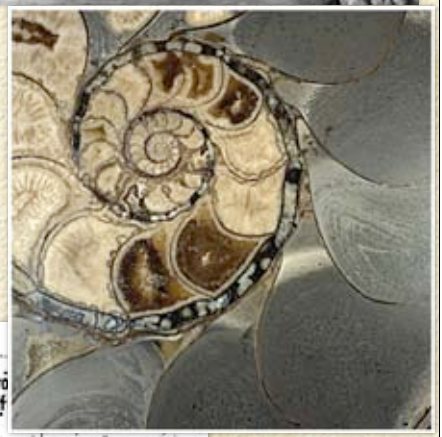


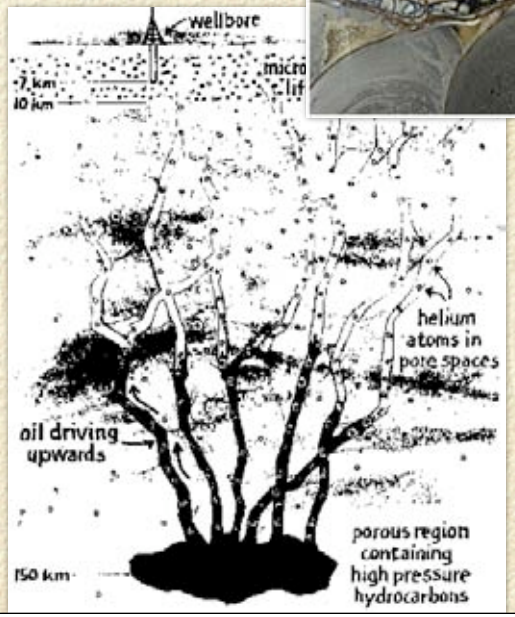




Deep Science Questions

- How do biology and geology interact to shape the world underground?
- How does subsurface microbial life evolve in isolation?
- Did life on earth originate beneath the surface?
- Is there life underground as we don't know it?





Deep Science Questions

- What are the interactions among subsurface processes?
- Are underground resources of drinking water safe and secure?
- Can we reliably predict and control earthquakes?
- Can we make the earth “transparent” and observe underground processes in action?

Deep Science Questions

- What are the mechanical properties of rock?

- What lies between the boreholes?

- How does rock respond to human activity?
- How does water flow deep underground?

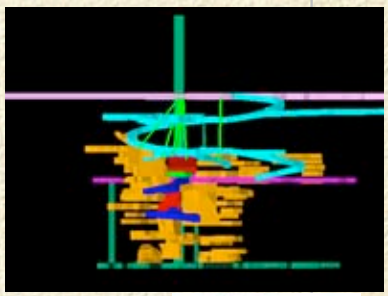
- How can technology lead to a safer underground?

DUSEL the Big Picture

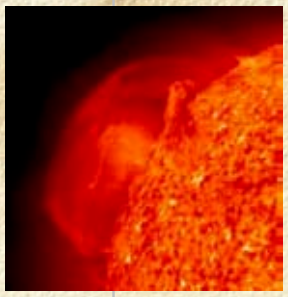
Dark Matter
Cosmology
Astrophysics
Neutron Oscillation

Education & Public Outreach

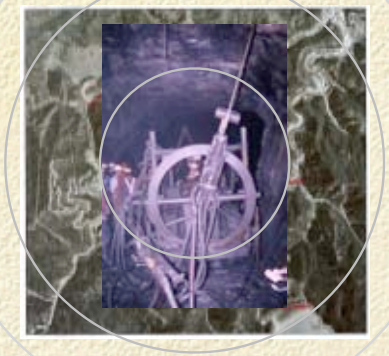
Geo-Database
Geo Modeling



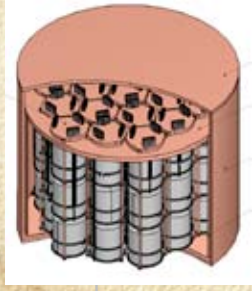
Geophysics
Seismology
Fracture Study



Solar Neutrinos
Geoneutrinos
Underground Accelerator for Astrophysics
Gravity Waves



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



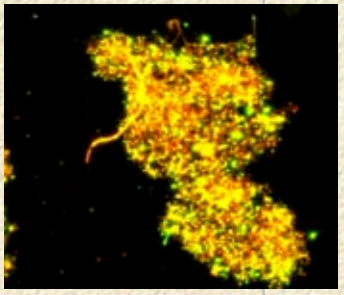
Neutrinoless ββ Decay
U/G Manufacturing
Low Background Counting

Geomicrobiology
Bioprospecting
Life at Extreme Conditions

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

Underground Engineering

Geochemistry
Ecology
Environmental Studies



Homeland Security

Progress at Homestake

- [x] October 2005, State Legislature approves additional $20M funding for Homestake, total of $46M from state controlled sources. Rehab plan: $15M, Indemnification fund: $10M, Operations: $15M (initialization + 5 years of EIP), Contingency: $3.5M, Insurance: $2.5M
- [x] 1 November 2005 - First call for Letters of Interest for Homestake - 85 letters received by February 2006
- [x] Property Donation Agreement Completed 14 April 2006, Property formally transfers to S.D. at end of May 2006, SDSTA hiring staff now to oversee and operate Homestake
- [x] CDR due 23 June 2006, TDR expected FY07 ~($3M), some possible R&D funds in FY07 for Physics
- [x] January 2007 Rehab work initiated
- [ ] Early Implementation Program at Homestake 2008 - 2012
- [ ] DUSEL funding anticipated in FY10 - FY11

Progress at Homestake

- ☑ June 2006 announced Sanford Gift to Homestake, $70M to establish the laboratory

- T. Denny Sanford, banker and Financier, operations of credit card and bank from S.D.

- History of donations to hospitals, universities, educational and children's causes

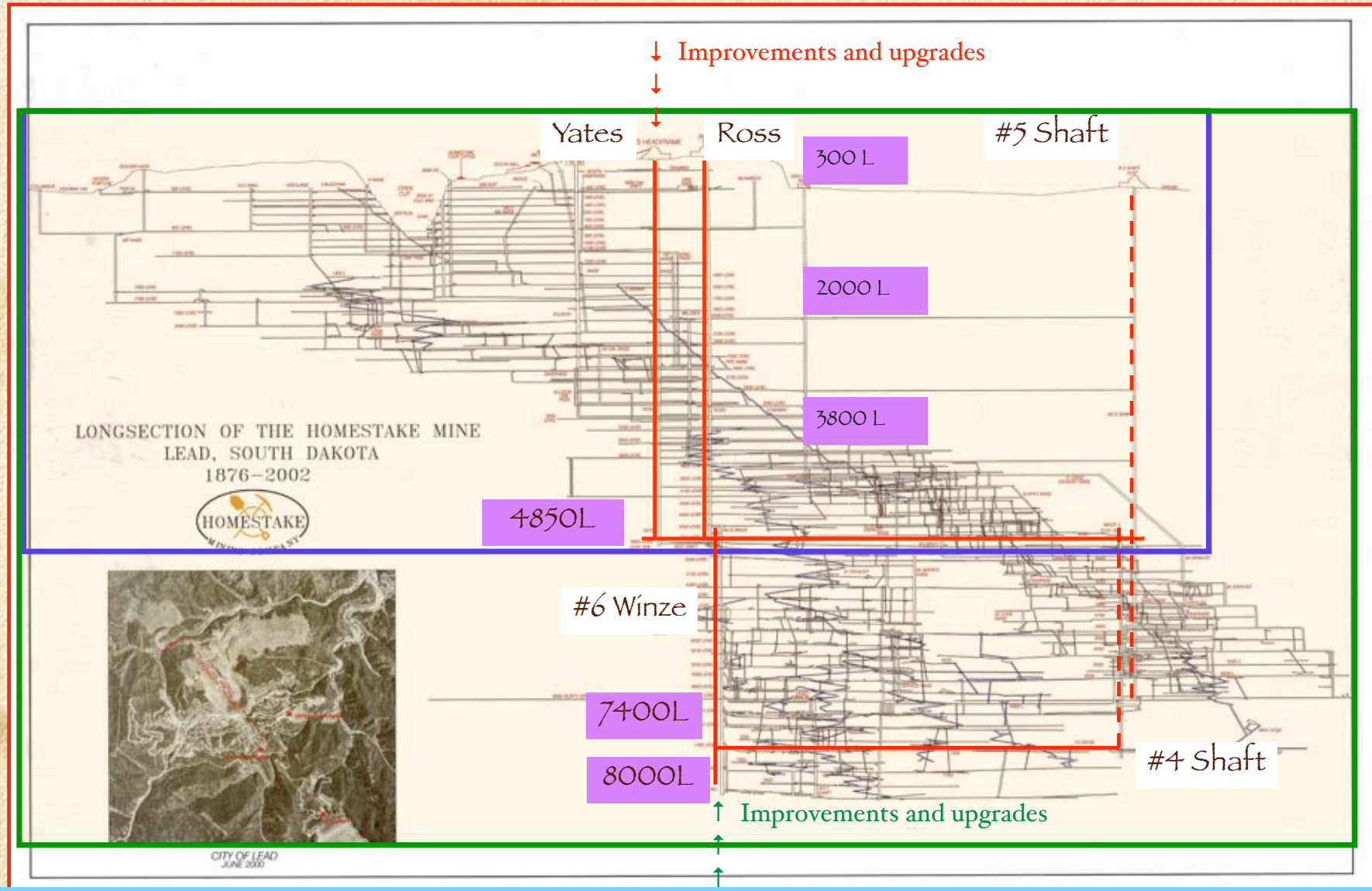
- Sets a new stage for private funding for science (physics) projects

Homestake's Plans & Progress

- Near Term 3 phase rehabilitation of Ross shaft and Pumping
  - Φ1 - Surface work, buildings hoists, ventilation equipment: December 06 - April 07
    - ☑ Video inspection of Shafts
    - ☑ Both Hoists operational 22 March
    - ☑ Ventilation fans installed and operations (100-120kcfm)
    - ☑ First water samples from u/g

  - Φ2 - Underground work, including shaft and pumping, April 07 - August 07. Secures 4850L with pumps at 5300L, expels ~ 500 gpm steady state
  - Φ3 - Operation of equipment August 07 - May 08

Phased approach to building DUSEL at Homestake



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

300L R&D, E&O

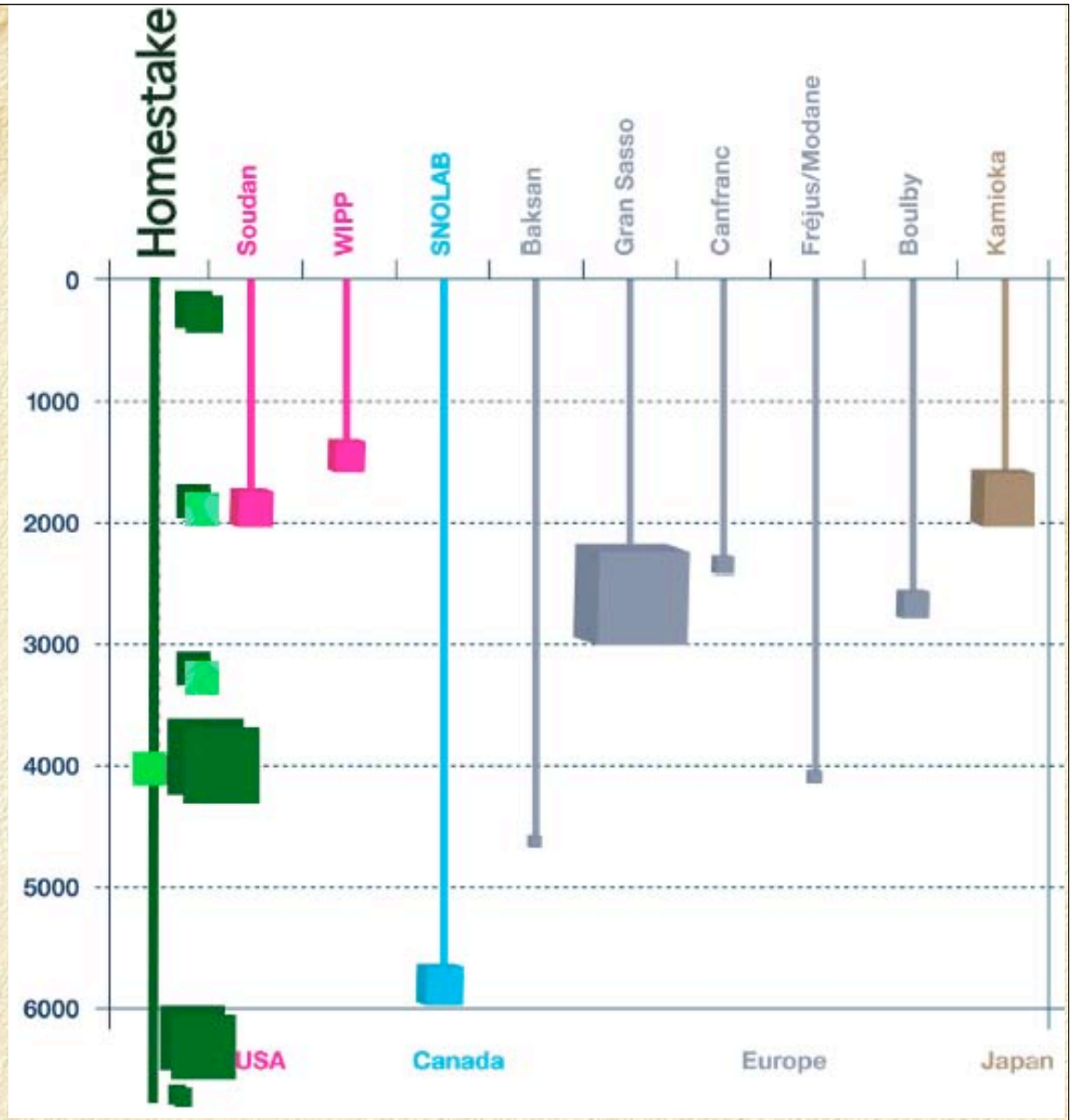
2000L Geo Level

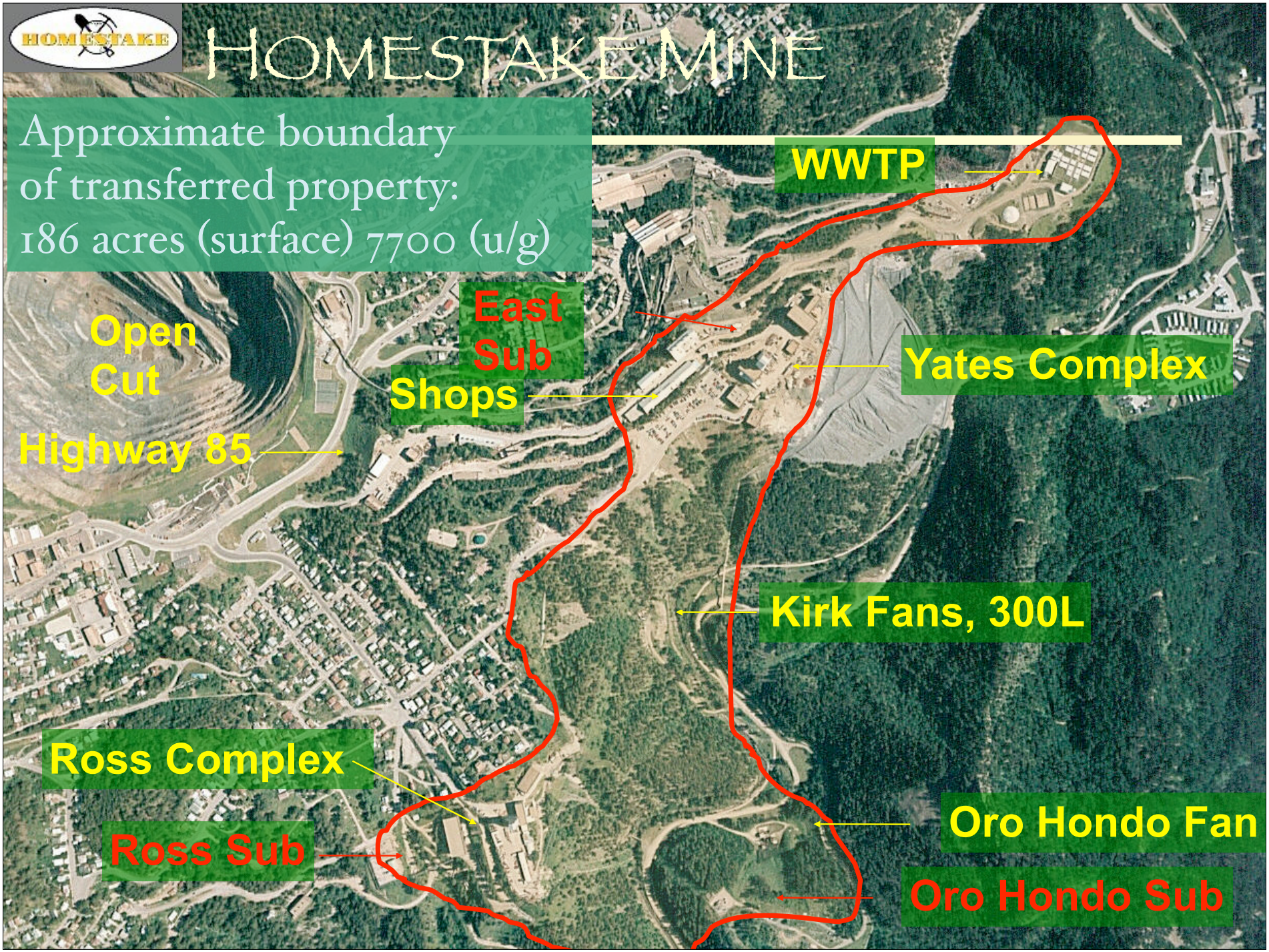
3800L Geo Level

4850L Major Campus

7400L Major Campus

8000L Geo Lab




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

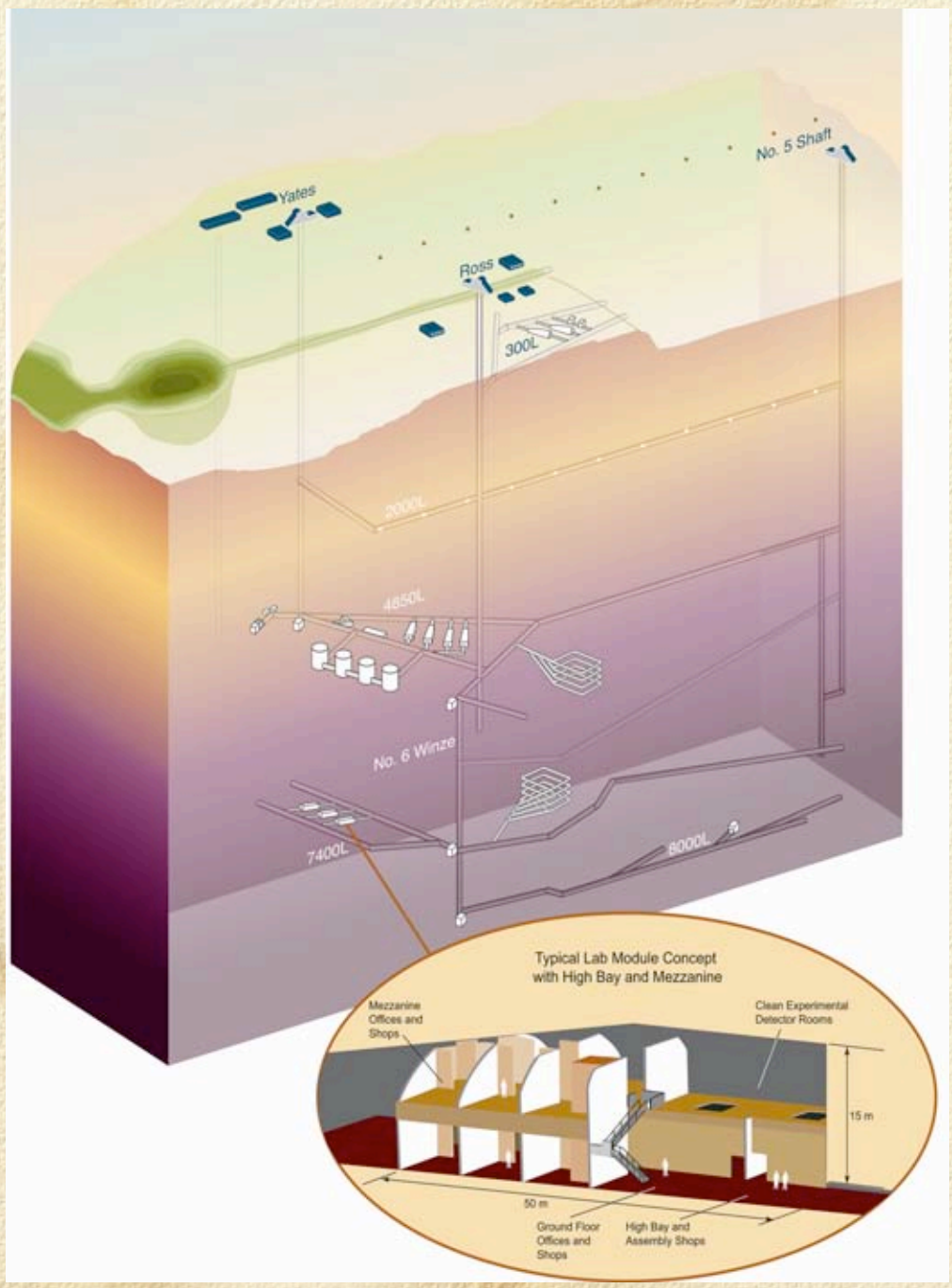
Homestake's Early Implementation Program

- Foremost purpose was to preserve Homestake for DUSEL
- Taking advantage of State funded laboratory: 2007 - 2012
- **300 L**, **4850 L**, and other levels, e.g. **2000 L, 3800 L**
- Ross and Yates Shafts refurbished, safe and operating cages
- Basic operations including Safety, Utilities, & Services
- Upgrades and enhancements as budget permits
- International Call for Letters of Interest
- Established Program Advisory Committee

Homestake Schedule - Early Implementation Program

Homestake Interim Lab and DUSEL Summary of Development of Space and Availability (Underground Space Fully Outfitted and Ready for Detector Installation)	Labs, Shops, Offices Usable Floor Area		Excavation Volume (including access drifts)		Construction Schedule	
	sq. ft.	sq. m.	cu. yd.	cu. m.	Start	Finish
4850 Level Subtotal	**107,351**	**9,973**	**111,115**	**84,903**		
Ross Shops for Construction Staging	12,469	1,158	5,738	4,385	Apr-08	Dec-08
Davis Lab, Sanford Lab, and Bio-Geo Lab	15,738	1,462	13,543	10,348	Sep-08	Jul-09
Lab Module #1 and Common Facilities	26,464	2,459	25,155	19,221	Oct-10	Sep-12
Lab Module #2	17,560	1,631	21,433	16,377	May-11	Apr-13
Lab Module #3	17,560	1,631	23,121	17,667	Sep-13	Jul-15
Lab Module #4 (excavation only, without lab outfitting)	17,560	1,631	22,125	16,906	Aug-14	Jul-15
7400 Level Subtotal	**63,588**	**5,907**	**98,477**	**75,246**		
Lab Module #1 and Common Facilities	28,468	2,645	29,594	22,613	Jan-12	Mar-14
Lab Modules #2 and #3 (excavation only, without lab outfitting)	35,120	3,263	68,883	52,633	Dec-12	Jan-14
300 Level Subtotal	**8,668**	**805**	**14,007**	**10,703**		
Lab #1, Shops, and E&O Rooms	8,668	805	14,007	10,703	Nov-10	Nov-11
Surface Subtotal	**98,000**	**9,104**				
DUSEL Offices and User Support Areas,Phase 1	10,000	929			Dec-10	Jun-12
Sanford Clean Room and Assembly Shop	6,000	557			Dec-10	Jun-12
DUSEL Offices and User Support Areas,Phase 2	32,000	2,973			Jul-11	Jun-13
Sanford Center for Science Education	50,000	4,645			Sep-09	Sep-11
Total	**277,607**	**25,790**	**223,599**	**170,852**		
		0.0929 m^2/ft^2		**0.7641 m^3/yd^3**		

September 2007 - September 2008: design, engineering, review, contracts, proposals, usw.



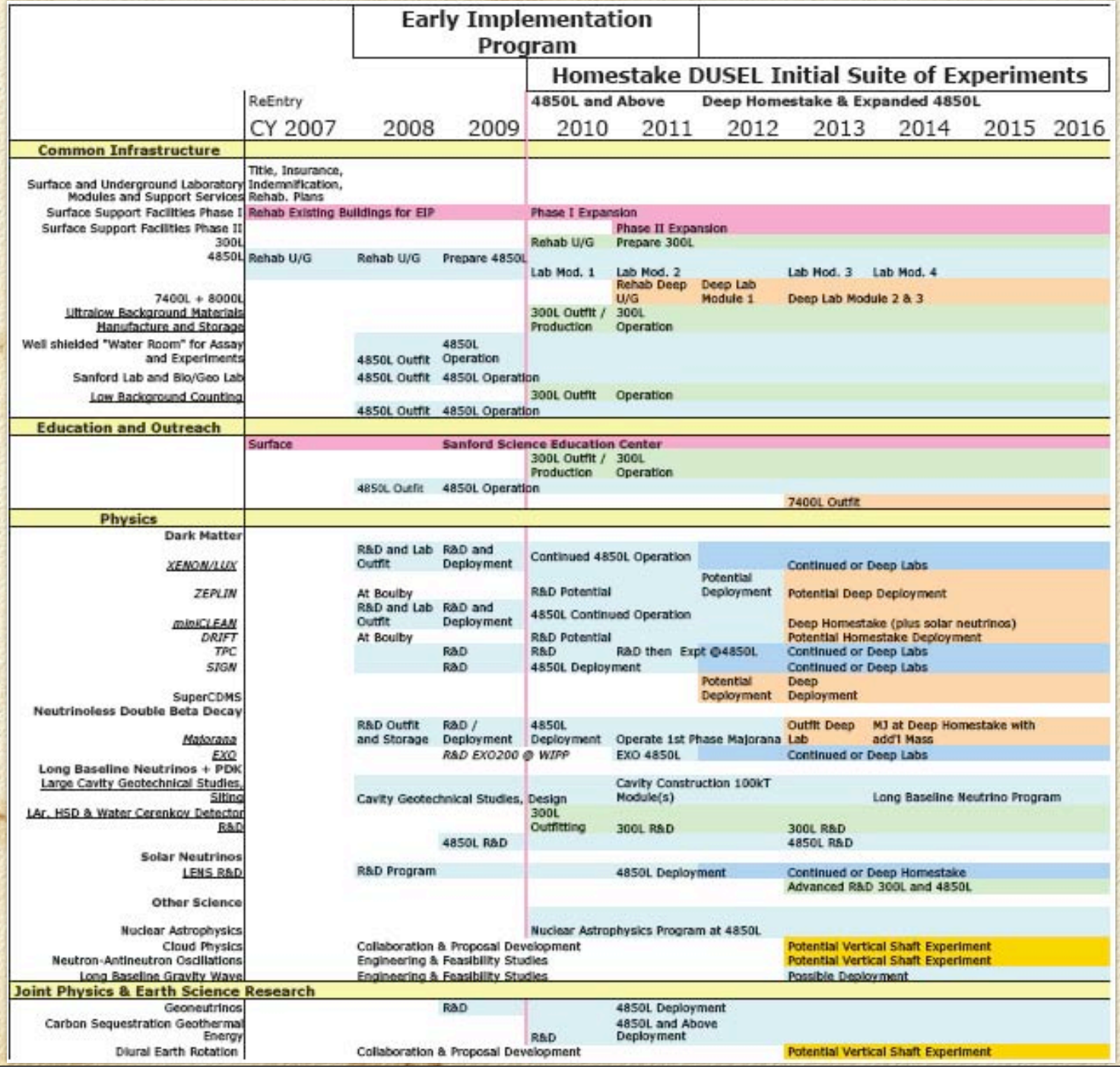
Surface Support

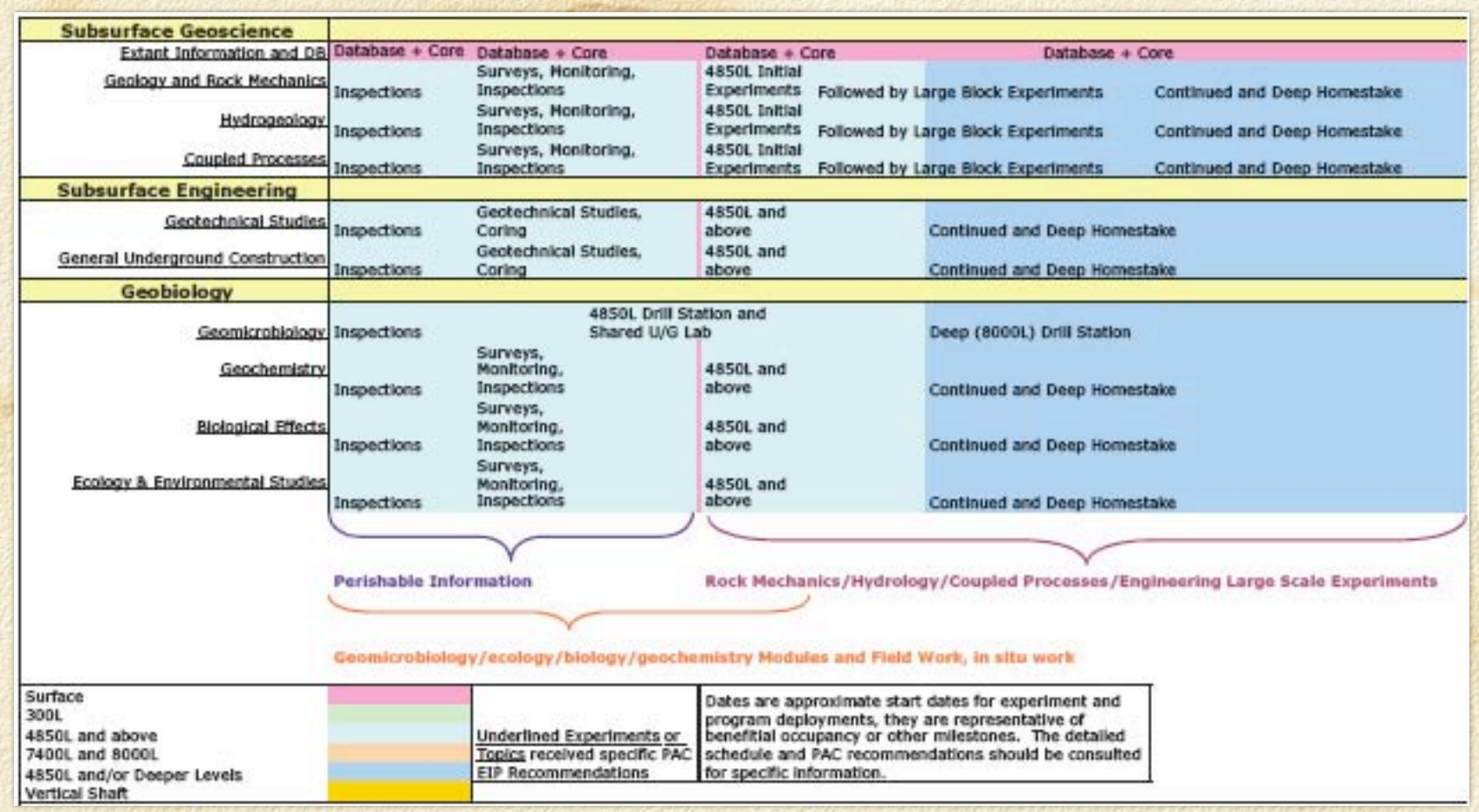
300L Drive-in Campus

4850L Major Campus

7400L Deep Campus

8000L Very Deep Campus


Early Implementation Program
Homestake DUSEL Initial Suite of Experiments
ReEntry
4850L and Above
Deep Homestake & Expanded 4850L
CY 2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Common Infrastructure
Surface and Underground Laboratory Modules and Support Services
Title, Insurance, Indemnification, Rehab. Plans
Surface Support Facilities Phase I
Rehab Existing Buildings for EIP
Phase I Expansion
Surface Support Facilities Phase II
Phase II Expansion
300L
Rehab U/G
Prepare 300L
4850L
Rehab U/G
Rehab U/G
Prepare 4850L
Lab Mod. 1
Lab Mod. 2
Lab Mod. 3
Lab Mod. 4
7400L + 8000L
Rehab Deep U/G
Deep Lab Module 1
Deep Lab Module 2 & 3
Ultralow Background Materials Manufacture and Storage
300L Outfit / Production
300L Operation
Well shielded "Water Room" for Assay and Experiments
4850L Outfit
4850L Operation
Sanford Lab and Bio/Geo Lab
4850L Outfit
4850L Operation
Low Background Counting
300L Outfit
Operation
4850L Outfit
4850L Operation
Education and Outreach
Surface
Sanford Science Education Center
300L Outfit / Production
300L Operation
4850L Outfit
4850L Operation
7400L Outfit
Physics
Dark Matter
XENON/LUX
R&D and Lab Outfit
R&D and Deployment
Continued 4850L Operation
Continued or Deep Labs
ZEPLIN
At Boulby
R&D Potential
Potential Deployment
Potential Deep Deployment
miniCLEAN
R&D and Lab Outfit
R&D and Deployment
4850L Continued Operation
Deep Homestake (plus solar neutrinos)
DRIFT
At Boulby
R&D Potential
Potential Homestake Deployment
TPC
R&D
R&D
R&D then Expt @4850L
Continued or Deep Labs
SIGN
R&D
4850L Deployment
Continued or Deep Labs
SuperCDMS
Potential Deployment
Deep Deployment
Neutrinoless Double Beta Decay
Majorana
R&D Outfit and Storage
R&D / Deployment
4850L Deployment
Operate 1st Phase Majorana
Outfit Deep Lab
MJ at Deep Homestake with add'l Mass
EXO
R&D EXO200 @ WIPP
EXO 4850L
Continued or Deep Labs
Long Baseline Neutrinos + PDK
Large Cavity Geotechnical Studies, Siting
Cavity Geotechnical Studies, Design
Cavity Construction 100kT Module(s)
Long Baseline Neutrino Program
LAr, HSD & Water Cerenkov Detector R&D
300L Outfitting
300L R&D
300L R&D
4850L R&D
4850L R&D
Solar Neutrinos
LENS R&D
R&D Program
4850L Deployment
Continued or Deep Homestake
Advanced R&D 300L and 4850L
Other Science
Nuclear Astrophysics
Nuclear Astrophysics Program at 4850L
Cloud Physics
Collaboration & Proposal Development
Potential Vertical Shaft Experiment
Neutron-Antineutron Oscillations
Engineering & Feasibility Studies
Potential Vertical Shaft Experiment
Long Baseline Gravity Wave
Engineering & Feasibility Studies
Possible Deployment
Joint Physics & Earth Science Research
Geoneutrinos
R&D
4850L Deployment
Carbon Sequestration Geothermal Energy
4850L and Above Deployment
R&D
Diural Earth Rotation
Collaboration & Proposal Development
Potential Vertical Shaft Experiment


Subsurface Geoscience
Extant Information and DB
Database + Core
Database + Core
Database + Core
Database + Core
Geology and Rock Mechanics
Inspections
Surveys, Monitoring, Inspections
4850L Initial Experiments
Followed by Large Block Experiments
Continued and Deep Homestake
Hydrogeology
Inspections
Surveys, Monitoring, Inspections
4850L Initial Experiments
Followed by Large Block Experiments
Continued and Deep Homestake
Coupled Processes
Inspections
Surveys, Monitoring, Inspections
4850L Initial Experiments
Followed by Large Block Experiments
Continued and Deep Homestake
Subsurface Engineering
Geotechnical Studies
Inspections
Geotechnical Studies, Coring
4850L and above
Continued and Deep Homestake
General Underground Construction
Inspections
Geotechnical Studies, Coring
4850L and above
Continued and Deep Homestake
Geobiology
Geomicrobiology
Inspections
4850L Drill Station and Shared U/G Lab
Deep (8000L) Drill Station
Geochemistry
Inspections
Surveys, Monitoring, Inspections
4850L and above
Continued and Deep Homestake
Biological Effects
Inspections
Surveys, Monitoring, Inspections
4850L and above
Continued and Deep Homestake
Ecology & Environmental Studies
Inspections
Surveys, Monitoring, Inspections
4850L and above
Continued and Deep Homestake
Perishable Information
Rock Mechanics/Hydrology/Coupled Processes/Engineering Large Scale Experiments
Geomicrobiology/ecology/biology/geochemistry Modules and Field Work, in situ work
Surface
300L
4850L and above
7400L and 8000L
4850L and/or Deeper Levels
Vertical Shaft
Underlined Experiments or Topics received specific PAC EIP Recommendations
Dates are approximate start dates for experiment and program deployments, they are representative of benefitial occupancy or other milestones. The detailed schedule and PAC recommendations should be consulted for specific information.

Homestake is advancing LOIs into MOUs to design the laboratory for the EIP

- To obtain specifics from collaborations for infrastructure needs and facility requirements
- Provide infrastructure as required by experiments and uses
- Satisfy the SDSTA and Sanford's requirement in defining the occupants
- ☑ Workshop March 26-29 to prepare requirements data base
- Waiting for the NSF "phone call"
- New call for LOIs this fall

Homestake PIs, Senior Personnel & Coordinators

- Michael Barnett, LBNL (E+O)
- Yuen-dat Chan, LBNL (Other uses)
- Milind Diwan, BNL (lbl, pdk)
- Reyco Henning, LBNL (ονdbd, 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, LBNL (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 Controls

Liz Exter, Dave Plate, Project Engineering

Mark Laurenti, Mining Engineer

Syd DeVries, Mining Engineer

Dave Snyder, SDSTA Exec. Director

Trudy Severson, SDSTA

SDSTA Engineering and Safety Personnel

Ms. Melissa Barclay & Jeanne Miller

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

Homestake DUSEL Project Timeline and Major Milestones for Laboratory Development and Initial Operations

Project Phases	Lead Organization	Start	Fiscal Year 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Homestake Interim Laboratory (HIL) and Early Implementation Program (EIP)		**Aug-05**										
Phase 1: HIL Mining-to-Labs Conversion and Re-entry to Mid-Levels	**SDSTA**											
Milestones:												
Homestake Ownership Transfer to SDSTA ✔		**May-06**	X									
Initiate Conversion Project Detailed Engineering and Infrastructure Rehabiltation ✔		**May-06**	X									
Begin Detailed Engineering for Deep Levels Re-entry, Dewatering, and Rehabilitation		**Apr-07**		X								
Gain access to 4850L, Restore Mid-level pumping and ventilation systems		**Sep-07**			X							
Mid Levels Beneficial Occupancy to initiate construction for Early Implementation Program experiments		**Sep-08**				X						
Phase 2: Pre-construction planning and research program development	**UC Berkeley**											
Milestones:												
Issue Request for Letters of Interest for EIP experiments ✔		**Nov-05**	X									
Submit Proposals for EIP early experiments and R&D funding ✔		**Sep-06**		X								
Submit Homestake DUSEL Conceptual Design Report ✔		**Jan-07**		X								
Homestake Site Selection for DUSEL, initiate Preliminary Design		**Apr-07**		X								
Submit Homestake DUSEL Preliminary Design Package		**Dec-07**			X							
National Science Board Recommendation to construct DUSEL, and SDSTA decision to continue HIL operations and development of interim lab for EIP		**Mar-08**			X							
Detailed Design Review and authorization to proceed with DUSEL Construction Project		**Mar-10**					X					
Homestake DUSEL Construction Project (MREFC)		**Apr-10**										
Phase 3: DUSEL Infrastructure Rehabilitation, U/G Excavation and Construction	**SDSTA**											
Milestones:												
DUSEL Beneficial Occupancy and Facility Infrastructure Construction Start		**Apr-10**					X					
Excavation and construction for labs at 4850L, 300L, and 7400L		**Oct-10**										
DUSEL excavation and lab infrastructure construction complete		**Apr-14**									X	
Phase 4: DUSEL Science and Engineering Program Development	**UC Berkeley**											
Milestones:												
Begin R&D and research program implementation for Initial Suite of Experiments		**Apr-10**					X					
Detailed design, construction, and installation for initial experiments		**Oct-10**										
Installation complete for initial experiments		**Sep-15**										X

2/23/07

4850L Lab Modules, Shops, and Common Facilities Phased Development Plan

Existing Neutrino Chamber: Davis Experiment 56' x 30' x 26'

Yates Shaft

#1 Excavation in FY 2007
Yates & Davis Labs
Bio- & Geo-sciences Lab
Construction Shops

#2 Excavation in FY 2008-9
Common Facilities
Lab Modules #1 and #2

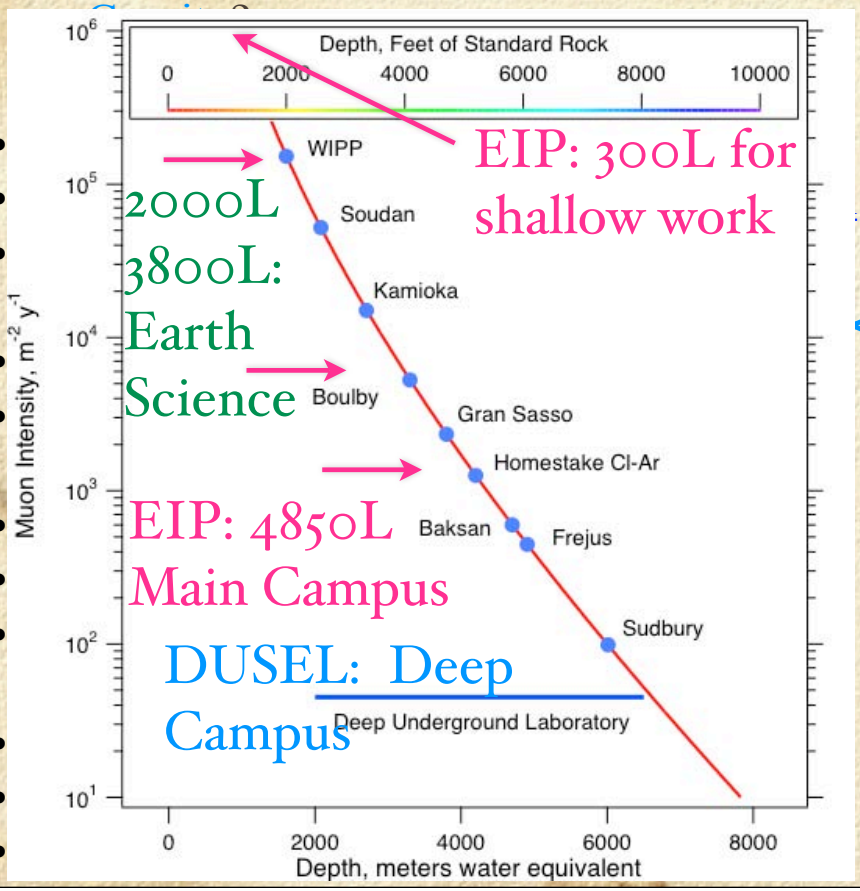
#3 Excavation in FY 2009-10
Lab Modules #3 and #4

Ross Shaft

Total excavated space for labs, shops, and common facilities at 4850L: > 6,000 m^2 (65,000 SF)

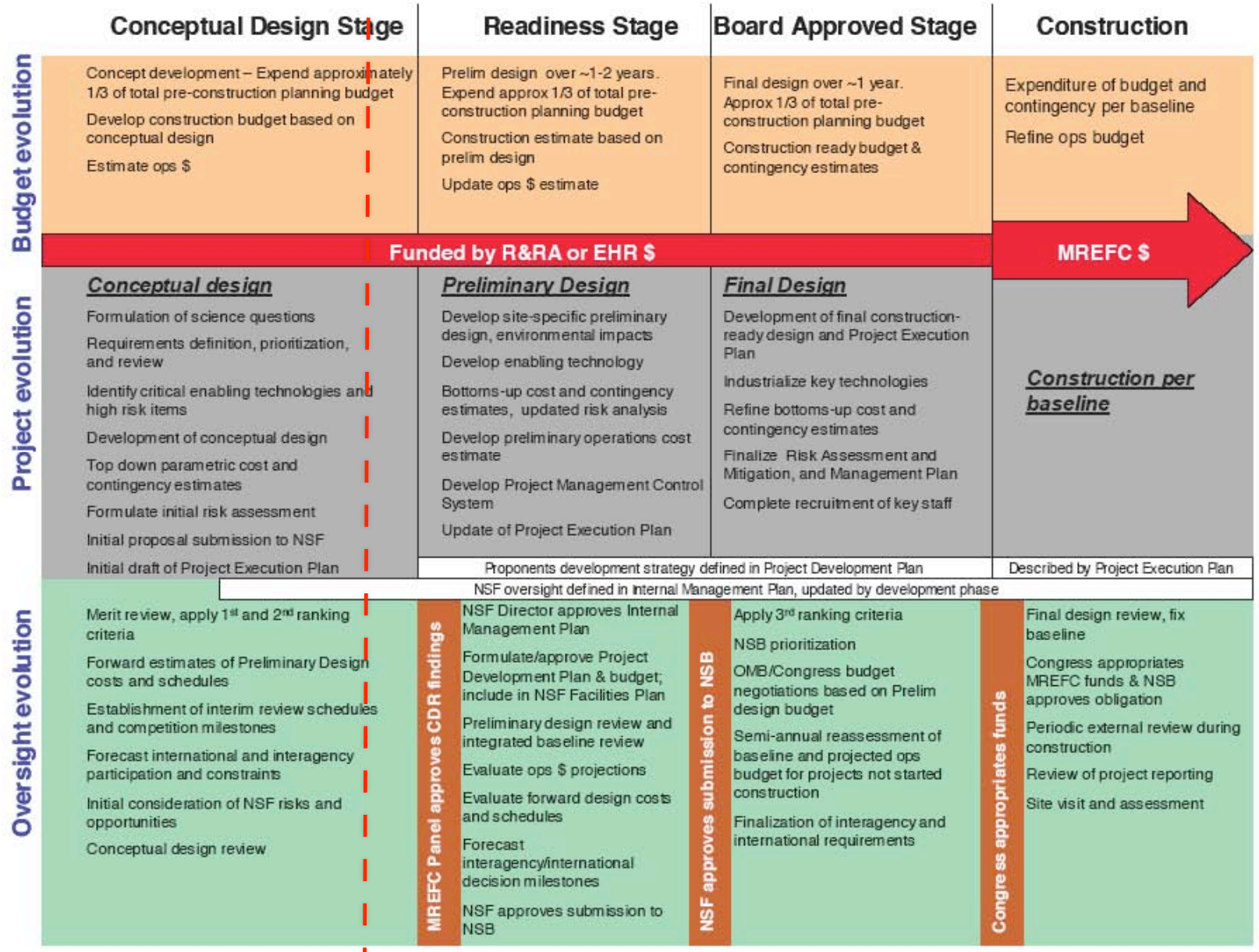
Physics Programs at Homestake

- National Academy **Quarks to Cosmos**
  1. What is the Dark Matter?
  2. What are the masses of the Neutrinos, ...?
  5. Are Protons unstable?
  7. Did Einstein have the last word on



- Dark Matter
- Neutrinoless Double Beta Decay
  - ν mass
  - mass hierarchy
  - Dirac vs Majorana
- Solar Neutrinos
  - tests of oscillations, solar physics
  - sterile ν
  - MNSP matrix (12 and 13)
- Geoneutrinos
  - supernovae ν
  - p-e-p solar ν
- Long Baseline Neutrinos
  - CP violation
  - Mass hierarchy
  - MNSP Matrix elements (13)
  - atmospheric ν, MNSP Matrix (23)
- Nucleon Decay
- Nuclear Astrophysics
- Others
  - n-nbar (requires vertical shaft)
  - cloud physics (requires vertical shaft)
  - gravity wave experiments (requires long drift)

Figure 1: *Summary of the pre-construction planning and development process for candidate MREFC projects.*



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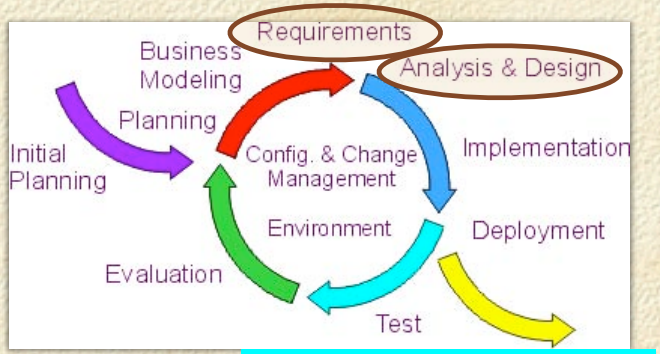
Homestake Strategies

4850-lab ➢ DUSEL

- **Homestake Collaboration** Developing the NSF solicitation process responses: S-1, S-2 (Conceptual Design), *S-3 (Preliminary & Final)*, establishing scientific roadmaps and expanding the network of potential users and uses.
- **South Dakota Science and Technology Authority** (SDSTA) working with South Dakota resources to preserve Homestake for DUSEL and establishing an interim laboratory option with state controlled funding, developed conversion plan to preserve Homestake
  - obtain title to the facility
  - regain access and deal with water
  - preserve site and open it in advance of DUSEL

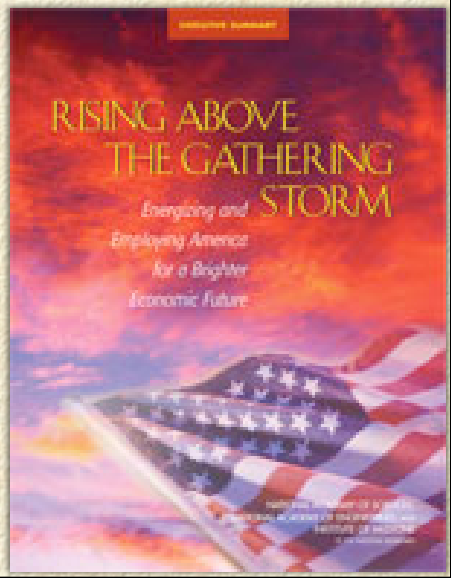


Initial Uses in 2007

Expanded Uses in 2010 as DUSEL

Sanford Gift: $70M

- Gift 1: $35M to be made in two installments
  - Gift 1 Part 1: $15M by December 2007
  - Gift 1 Part 2: $20M by December 2008
  - For 4850L laboratory and infrastructure: i.e. lifts, access, custom space, operations, surface space, radon-reduced air, …
- Gift 2: $20M
  - $20M by December 2009
  - Establish the Sanford Science Center (E&O)
- Gift 3: $15M
  - between January 2010 - December 2012
  - For going deep, 7400 level lab



Triggers for the Gift

- Gift 1 - $35M 2007 - 2008
  - NSF selects Homestake as sole candidate site for DUSEL
  - Laboratory is named Sanford Underground Science and Engineering Laboratory (SUSEL-Homestake)
  - SDSTA spends their $ (rehabilitation and re-entry)
  - Significant scientific demand (defining users of EIP)
    - measured by MOUs - $10M

Triggers for the Gift

- Gift 2 - $20M 2009
  - Gift 1 triggers satisfied
  - naming rights - **Sanford Science Education Center**
  - SDSTA develops "business plan" and spends their $ on center
    - Creates ~50,000 ft² education & outreach center
- Gift 3 - $15M 2010-2012
  - Gift 1 and 2 conditions satisfied
  - National funding for the laboratory (NSF, DOE, etc.) to the tune of $15M
  - SDSTA spend their $