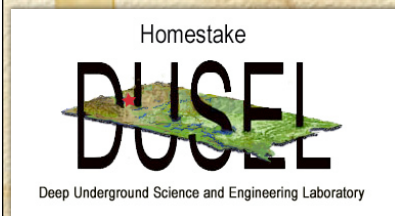


# Homestake Interim Laboratory & Homestake DUSEL

*Kevin T. Lesko  
for the Collaboration  
U.C. Berkeley and Berkeley Lab  
18 June 2006*





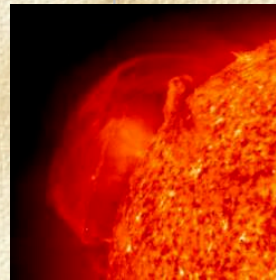
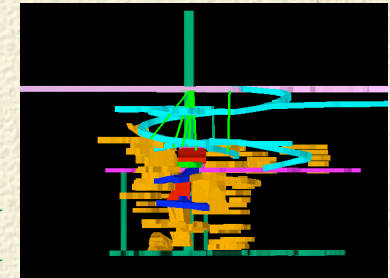
# DUSEL the Big Picture



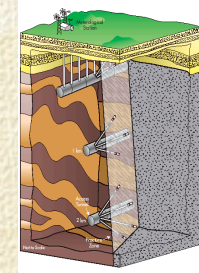
Dark Matter  
Cosmology  
Astrophysics  
Neutron Oscillation

Education & Outreach

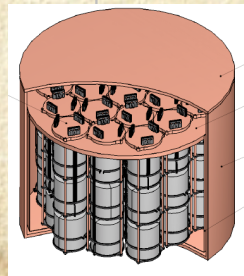
Geo-Database  
Geo Modeling  
Geophysics  
Seismology  
Fracture Study



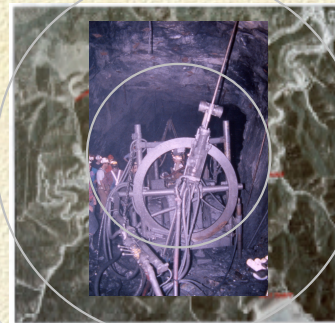
Solar Neutrinos  
Geoneutrinos  
Underground  
Accelerator for  
Astrophysics  
Gravity Waves



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



Neutrinoless  $\beta\beta$  Decay  
U/G Manufacturing  
Low Background Counting

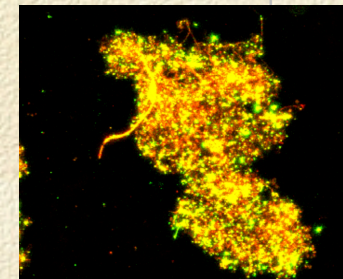


Underground  
Engineering

Geomicrobiology  
Bioprospecting  
Life at Extreme  
Conditions



Geochemistry  
Ecology  
Environmental  
Studies



Neutrino Properties  
Long-baseline  $\nu$  Oscillation  
CP violation  
MNSP Matrix  
Nucleon Decay  
Atmospheric Neutrinos

Homeland Security



# 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 **Gravity**?
11. How were the ... **elements made**?

- 2001 Bahcall report
- [The 2002 Nuclear Physics Long Range Plan](#)
- The NeSS workshop, “Neutrinos and Beyond”
- The Neutrino Facilities Report
- The Quantum Universe: The Revolution in the 21st Century Particle Physics
- The Earthlab report
- 2004 Neutrino Matrix APS report
- National Science and Technology Council Committee on Science
- The Physics of the Universe
- Facilities for Future of Science

- Dark Matter

- Neutrinoless Double Beta Decay

- $\nu$  mass
- mass hierarchy
- Dirac vs Majorana

- Solar Neutrinos

- tests of oscillations, solar physics
- sterile  $\nu$
- MNSP matrix ( $\nu_{12}$  and  $\nu_{13}$ )

- Geoneutrinos

- supernovae  $\nu$
- p-e-p solar  $\nu$

- **Long Baseline Neutrinos**

- **CP violation**
- **Mass hierarchy**
- **MNSP Matrix elements ( $\nu_{13}$ )**
- atmospheric  $\nu$ , MNSP Matrix ( $\nu_{23}$ )

- Nucleon Decay

- Nuclear Astrophysics

- Others

- **n-nbar (requires vertical shaft)**
- **cloud physics (requires vertical shaft)**
- **gravity wave experiments (requires long drift)**



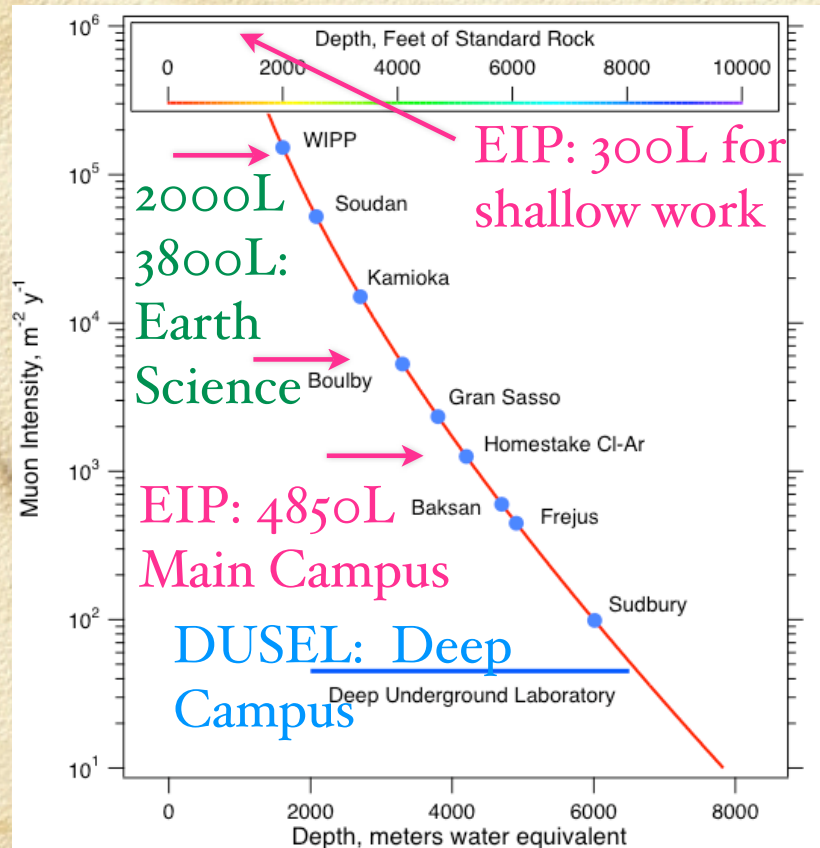
# Physics Programs at Homestake

Requires  
 $\nu$  beam

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



# Physics Programs at Homestake

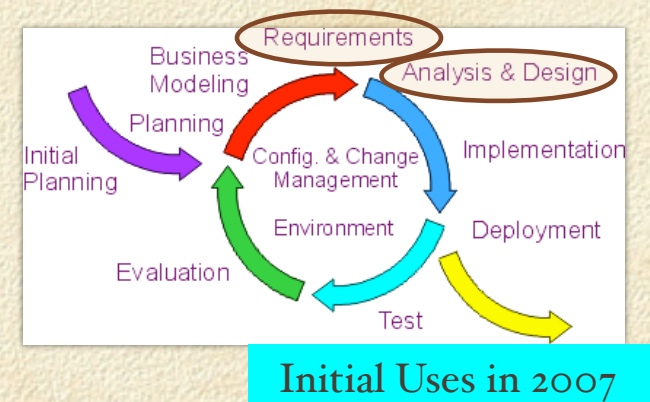


- Dark Matter
- Neutrinoless Double Beta Decay
  - $\nu$  mass
  - mass hierarchy
  - Dirac vs Majorana
- Solar Neutrinos
  - tests of oscillations, solar physics
  - sterile  $\nu$
  - MNSP matrix ( $\nu_{12}$  and  $\nu_{13}$ )
- Geoneutrinos
  - supernovae  $\nu$
  - $p\bar{e}p$  solar  $\nu$
- Long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



# Homestake Strategies: 4850-lab ➤ DUSEL

- Union of Efforts Working on the Homestake Laboratory
  - Homestake Collaboration Developing the NSF solicitation process responses: S-1, S-2 (CDR), S-3 (TDR), 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



Expanded Uses in 2009 as DUSEL



# Homestake History and Progress

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



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



- May 03 NSF's independent panel selected Homestake: prime DUSEL site
- Spring 2003 Barrick closed, capped and sealed Homestake
- Jan 2004, "Agreement in Principle" between Barrick and SDSTA 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)
- March 2004, New NSF 3-step process
- Dec 2004, SDSTA Conversion Plan Vetted, 4850 Lab concept developed
- September 2005, "Agreement" amended to 4850 lab, water permits renewed



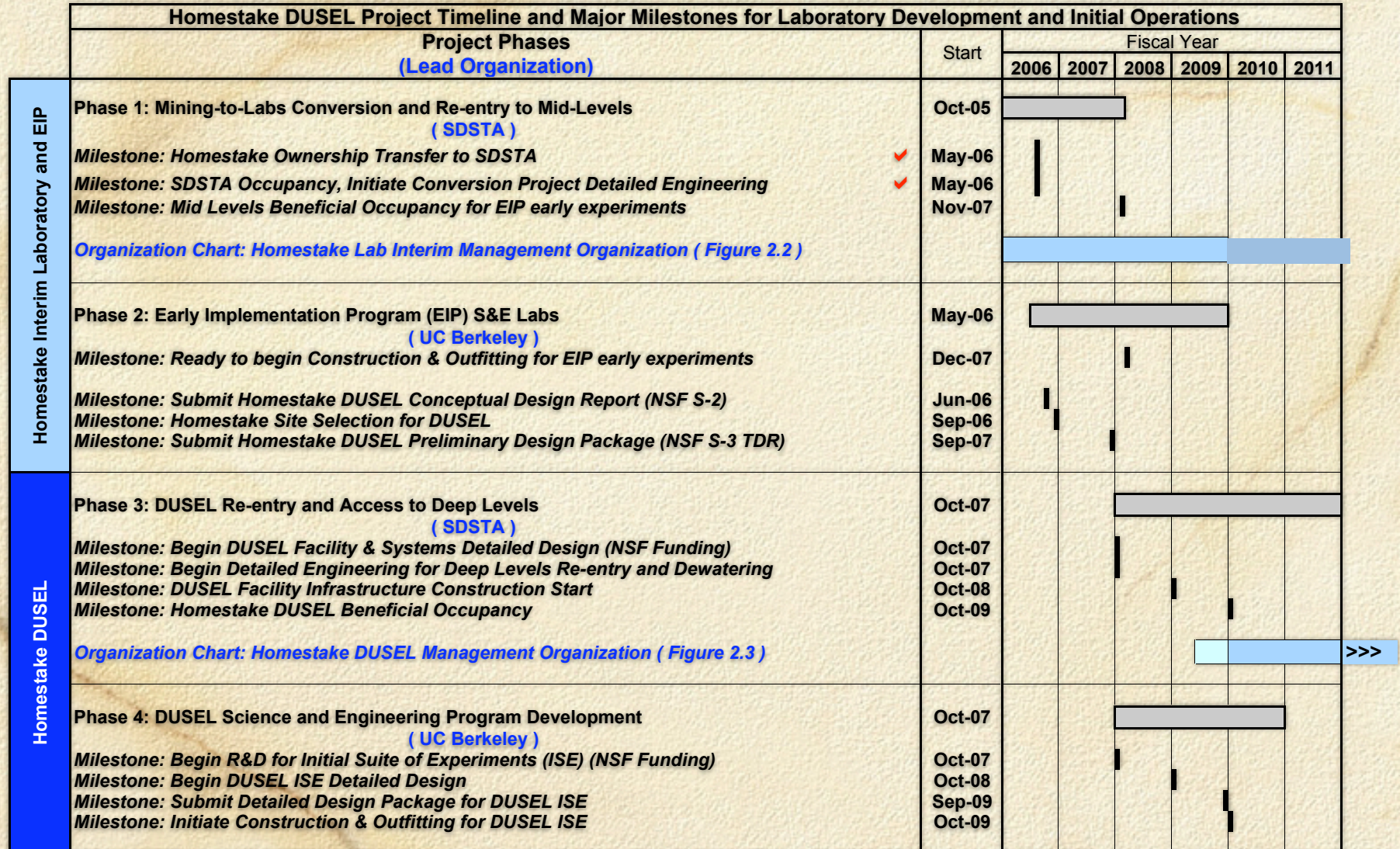
# Status of Homestake

- ❑ 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
- ❑ 1 November 2005 - First call for Letters of Interest for Homestake ~ 85 letters received by February 2006
- ❑ Property Donation Agreement Completed 14 April 2006, Property formally transfers to S.D. 12 May 2006, SDSTA hiring staff now to oversee and operate Homestake (mine engineers, safety, PM, etc.)
- ❑ CDR due 23 June 2006, TDR expected FY07 ~(\$3M), R&D funds in FY07 for Physics
- ❑ Early Implementation Program at Homestake 2007 - 2012, with SD funds
- ❑ Assumptions presented by NSF were DUSEL funding FY09, TBD



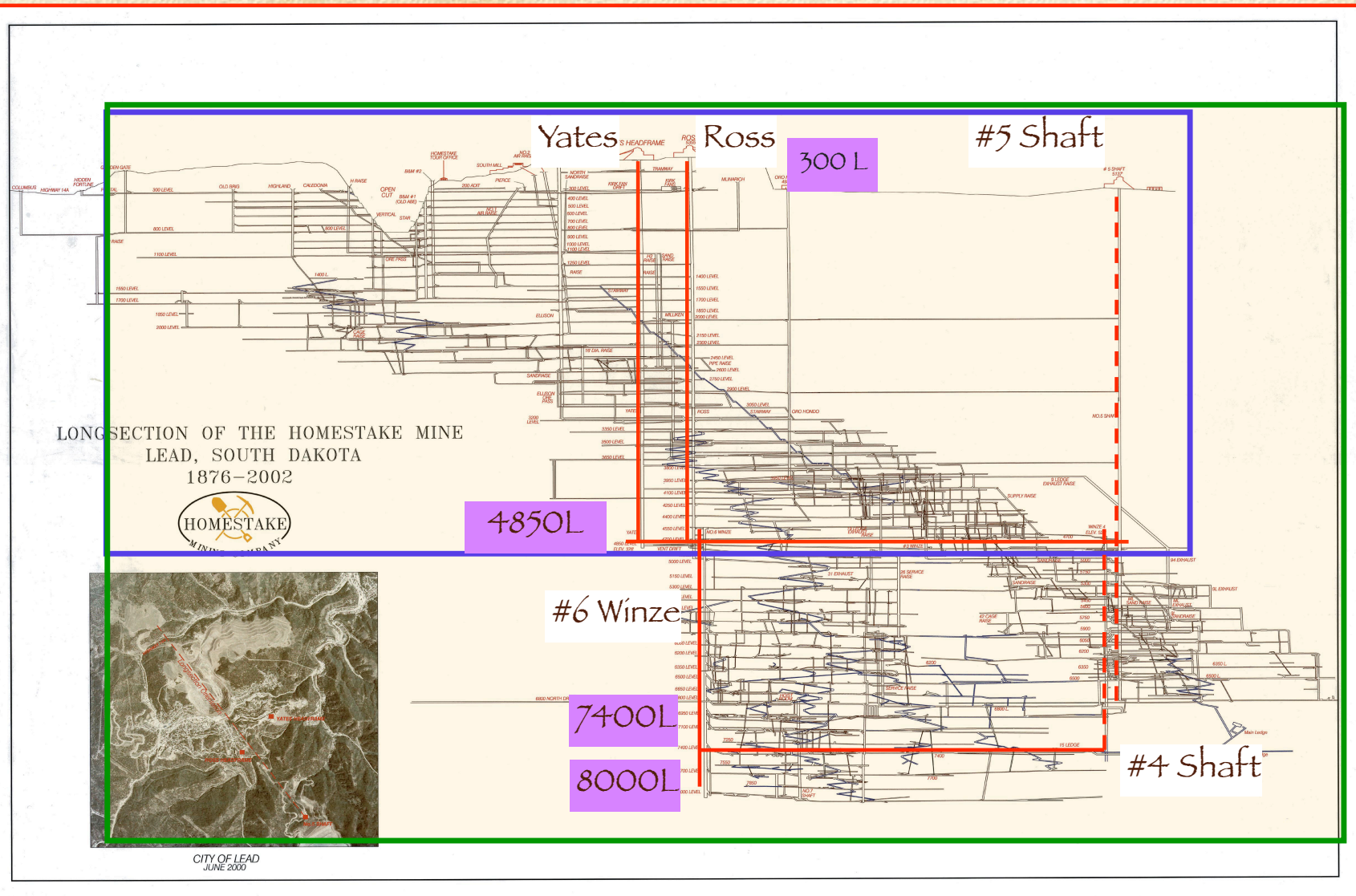


# Management and Project Execution





# Phased approach to building DUSEL at Homestake







# HOMESTAKE MINE

Approximate boundary  
of transferred property:  
186 acres (surface) 7700 (u/g)

WWTP

Open  
Cut

East  
Sub  
Shops

Yates Complex

Highway 85

Kirk Fans, 300L

Ross Complex

Ross Sub

Oro Hondo Fan

Oro Hondo Sub



# Early Implementation Program

- 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
- Basic operations, including Safety, Utilities, Services
- Upgrades and enhancements as budget permits
- International Call for Letters of Interest
- Established **Program Advisory Committee in 2005**
  - Charge was to consider the Early Implementation Program, but to be aware of longer term aspects and uses
  - Decision factored in the 5 criteria, National “issues” and Homestake “capacity”



# Letters of Interest for Homestake

~ 85 LOIs

~ 60% earth science

~ 25% physics

- dark matter
- double beta decay
- geoneutrinos
- long baseline + pdk
- low bckgrd cnting
- n-nbar, cloud phys.
- nucl. astrophysics
- solar neutrinos

~ 5% engineering

~ 5% education

~ other

interest continues to grow

#	Date Received	Title	Discipline
1	11/21/05	Time Dependent Deformation	Rock Mechanics
2	11/21/05	Scale Effects In Rock Mechanics	Rock Mechanics
3	11/21/05	Stress & Rock Properties of the Yates member of the Poorman Formation	Rock Mechanics
4	11/22/05	Mine Engineering & Management Related Activities	Mining
5	11/23/05	DUSEL Education & Conference Center	Education & Outreach
6	12/2/05	Determination of Water Levels & Stress Release during Dewatering	Geology
7	12/2/05	Search for Neutron-Antineutron Transition at Homestake	Physics
8	12/6/05	Plan for Near Future of High Energy Neutrino Physics at Homestake	Physics
9	12/8/05	Hard Rock Underground Mine Mapping & Surveying	Geology
10	12/8/05	Partitioning of CO <sub>2</sub> , H <sub>2</sub> O, gold and trace metals between synformal and antiformal fold hinges	Geology
11	12/8/05	Developing an Internet-accessible database of 3D geologic and engineering data	Geology
12	12/8/05	Hydrologic Instrumentation of the Homestake DUSEL	Geology
13	12/9/05	New Paradigms in Sensing	Engineering
14	12/9/05	Effects of Ultralow Radiation Levels on Human Cells	Microbiology
15	12/9/05	Microbial Evolution	Microbiology
16	12/9/05	Workshops	Education & Outreach
17	12/1/05	Effects of Cosmic Rays on the Soft Error Rate of Semiconductor Memory Chips at Ground Level	Engineering
18	12/2/05	Controls on World-Class Homestake Gold Mineralization	Geology
19	12/8/05	Low Radioactivity Measurement Laboratory	Low Backg. Counting
20	12/9/05	Role of Iron Formations in the Making of Giant Gold Deposits	Geology
21	12/9/05	Thermal History of Homestake Mine	Geology
22	12/9/05	Super CDMS	Physics
23	12/9/05	Determination of Diurnal changes in the rotation rate of the earth	Physics
24	12/9/05	Establishing the Physical Footprint for Future Geoscience Research	Geology
25	12/9/05	Developing a robotic sampler for underground and confined space	Engineering
26	12/10/05	Homestake Electrical Engineering Laboratory (HEEL)	Physics
27	12/10/05	Homestake Outreach Program (HOP)	Education & Outreach
28	12/10/05	Bioprospecting	Microbiology
29	12/10/05	Analysis of soil-like materials in the mine	Geology
30	12/10/05	Biological effect of low levels of radiation	Microbiology
31	12/10/05	Homestake Neutrinos	Offer to Collaborate
32	12/10/05	Establishing baseline data for microbial life in the mine after dewatering	Microbiology
33	12/12/05	Cloud physics facility and experiments	Atmospheric sciences
34	12/11/05	Fracture network characterization	Rock Mechanics
35	12/11/05	Risk Assessment of mine closure	Rock Mechanics
36	12/11/05	Hydrogeology Column Modification	Earth Sciences
37	12/11/05	Geochemistry of fluids in the Homestake hydrologic system	Earth Sciences
38	12/11/05	Ecology/geology evolution	Earth Sciences
39	12/11/05	Geophysics	Earth Sciences
40	12/11/05	Rock mechanics for excavation research	Earth Sciences
41	12/11/05	Rock experiments	Earth Sciences
42	12/11/05	Cosmic ray experiments	Earth Sciences
43	12/12/05	Characterization of faulting and rock fracture at homestake mine	Rock Mechanics
44	12/12/05	Geology with degassing of tertiary veins and dikes at Homestake	Geology
45	12/12/05	Development of a geological model of the Homestake mine area	Geology
46	12/12/05	Detailed geologic mapping of the Homestake mine area	Geology
47	12/12/05	Close range remote sensing for mapping of rock in underground excavations	Geology
48	12/12/05	ZEPLIN - a multi ton scale liquid xenon dark matter direct search program	Physics
49	12/12/05	EXO - the enriched xenon observatory for neutrino-less double-beta decay	Physics
50	12/12/05	Educational outreach support infrastructure	Education & Outreach
51	12/12/05	Low-alpha lead and the cosmic-ray equivalency factor	Physics
52	12/12/05	Study of a LANNDD of 100kTon at Homestake DUSEL	Physics
53	12/13/05	Investigation of microbial diversity in subsurface ecosystems	Microbiology
54	12/13/05	Initial low background counting facilities for Homestake	Physics
55	12/14/05	Large block (Pillar) test to study the failure of rock - rock strength and earthquake mechanics	Rock Mechanics

PAC Report Released  
[www.lbl.gov/nsd/homestake](http://www.lbl.gov/nsd/homestake)

[neutrino.lbl.gov/Homestake/FebWS](http://neutrino.lbl.gov/Homestake/FebWS)



# Homestake Program Advisory committee

## Physics

**Professor Frank Sciulli - Columbia,  
Co-chair**

Professor Ed Kearns - BU

Professor Josh Klein - UT

Dr. Bill Marciano - BNL

Professor Harry Nelson - UCSB

Professor Hank Sobel - UCI

## Earth Science and Engineering

**Professor Derek Elsworth - Penn  
State, Co-chair**

Professor Sookie Bang - SDSM&T

Mr. Derric Iles - SDGS

(Professor Thomas L. Kieft - NM Tech)

Dr. Chris Neuzil - USGS

Professor Bill Pariseau -University of Utah

## Education and Outreach

Professor Charles Ruch - SDSM&T

## Charge to the PAC

- 1) With the information provided at this initial meeting and with subsequent discussions we request that the **PAC develop of a scientific program well-suited to the Homestake Early Implementation Program (EIP)...**
- 2) The infrastructure at Homestake may be a limiting factor in hosting all of the proposed expts and uses. The **EIP** will be limited in scope, but we would like to **accommodate as many expt. and educational uses as possible.**
- 3) We are simultaneously developing the scientific roadmaps beyond the Early Implementation Program. **We are requesting the PAC to consider and advise us on longer term roadmaps for Homestake.** Several of the LOIs offer staged approaches. These may require going deeper in subsequent phases, expanding efforts, etc. The PAC should take into consideration for the EIP the implications of longer term aspects.

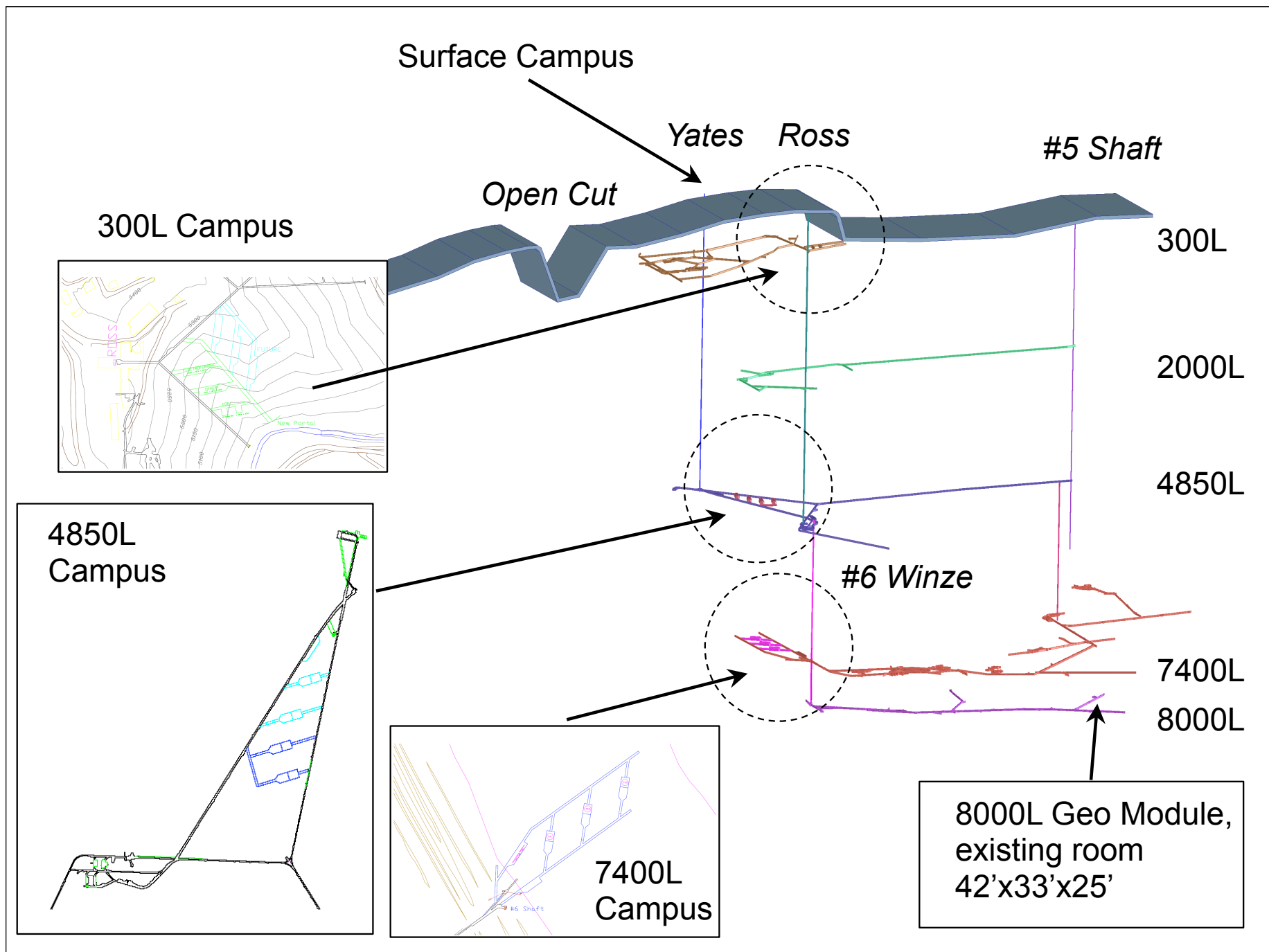


		Early Implementation Program			Homestake DUSEL Initial Suite of Experiments						
	ReEntry				4850L and Above			Deep Homestake & Expanded 4850L			
	CY 2006	2007	2008		2009	2010	2011	2012	2013	2014	2015
Common Infrastructure											
Surface and Underground Laboratory Modules and Support Services	Title, Insurance, Indemnification, Rehab. Plans										
Surface Support Facilities Phase I	Phase I Rehab Existing Buildings										
Surface Support Facilities Phase II				Phase II Expansion							
300L	Rehab U/G	Prepare 300L									
4850L	Rehab U/G	Rehab U/G	Prepare 4850L								
7400L + 8000L					Rehab Deep U/G	Prepare Deep Labs					
Ultralow Background Materials Manufacture and Storage		300L Outfit / Production	300L Operation								
Well shielded "Water Room" for Assay and Experiments			4850L Outfit		4850L Operation						
Low Background Counting		300L Outfit / Production	300L Operation								
			4850L Outfit		4850L Operation						
Education and Outreach											
	Surface										
		300L Outfit / Production	300L Operation								
					4850L Outfit	4850L Operation					
						7400L Outfit		Deep Modules Operation			
Physics											
Dark Matter											
XENON		300L Outfit R&D	R&D and Lab outfit		4850L Deployment	Continued 4850L Operation	Potential Deployment	Continued or Deep Labs			
ZEPLIN		At Boulby			R&D Potential			Potential Deep Deployment			
miniCLEAN		300L Outfit R&D	R&D and Lab outfit		4850L Deployment			Deep Homestake (plus solar neutrinos)			
DRIFT		At Boulby				R&D Potential		Potential Homestake Deployment			
TPC		300L Outfit	R&D		R&D	R&D then Expt @4850L		Continued or Deep Labs			
SIGN		300L Outfit	R&D		4850L Deployment			Continued or Deep Labs			
SuperCDMS							Potential Deployment	Deep Deployment			
Neutrinoless Double Beta Decay											
Majorana		300L Outfit and Storage	R&D and Lab outfit		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	R&D Program			300L R&D		300L R&D			
						4850L R&D		4850L R&D			
Solar Neutrinos											
LENS R&D		300L Outfitting	R&D Program					Advanced R&D			
					R&D	4850L Deployment		Continued or Deep Homestake			
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			



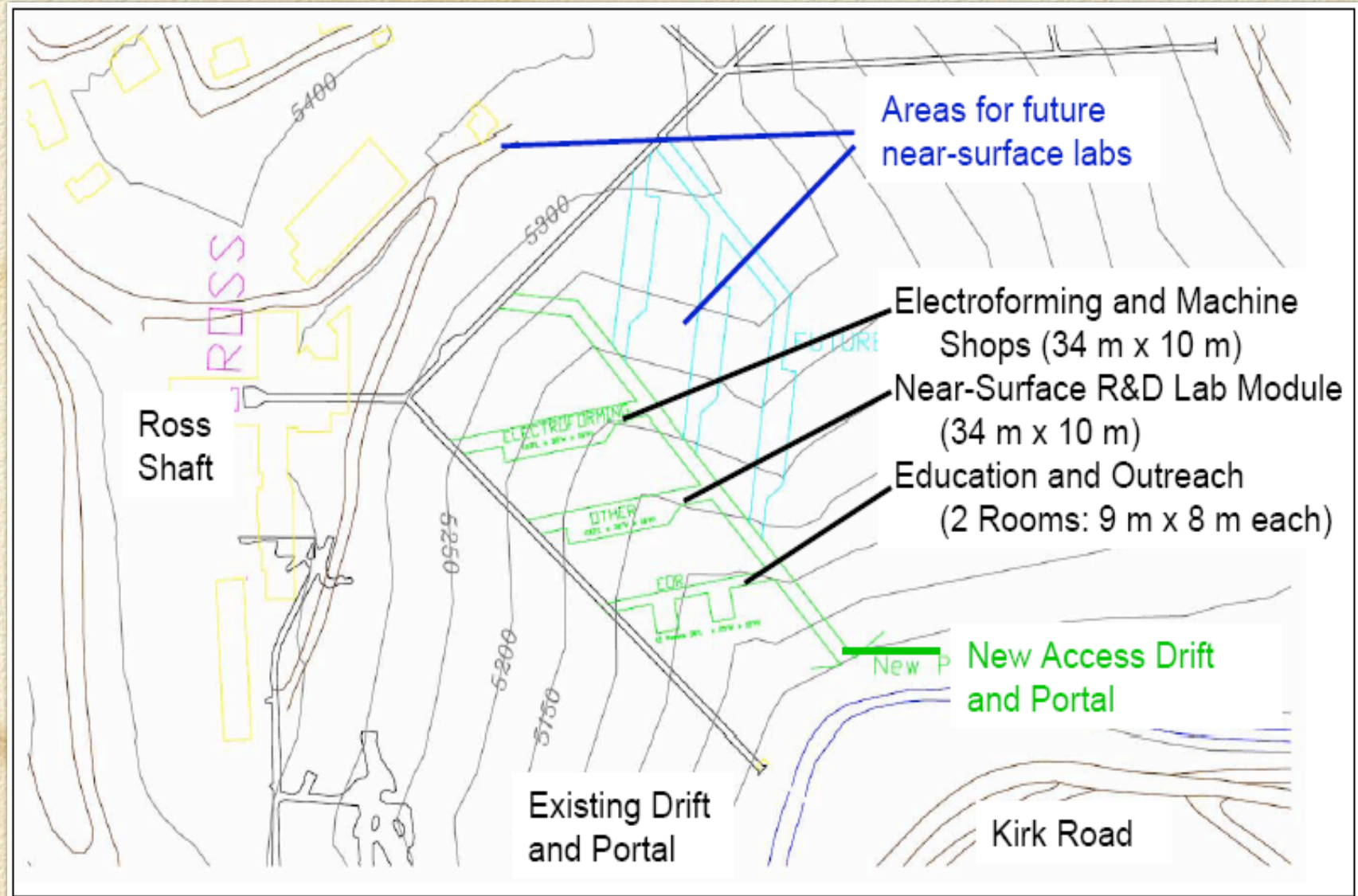
Joint Physics & Earth Science Research				
Geoneutrinos		R&D	4850L Deployment	
Carbon Sequestration			4850L and Above	
Geothermal Energy		R&D	Deployment	
Diurnal Earth Rotation		Collaboration & Proposal Development		Potential Vertical Shaft Experiment
Subsurface Geoscience				
Extant Information and DB	Database + Core	Database + Core	Database + Core	Database + Core
Geology and Rock Mechanics	Inspections	4850L Initial Experiments	Followed by Large Block Experiments	Continued and Deep Homestake
Hydrogeology	Inspections	4850L Initial Experiments	Followed by Large Block Experiments	Continued and Deep Homestake
Coupled Processes	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		4850L and above	Continued and Deep Homestake
Biological Effects	Inspections		4850L and above	Continued and Deep Homestake
Ecology & Environmental Studies	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		Underlined Experiments or Topics received specific PAC EIP Recommendations	Dates are approximate start dates for experiment and program deployments, they are representative of beneficial occupancy or other milestones. The detailed schedule and PAC recommendations should be consulted for specific information.	
300L				
4850L and above				
7400L and 8000L				
4850L and/or Deeper Levels				
Vertical Shaft				







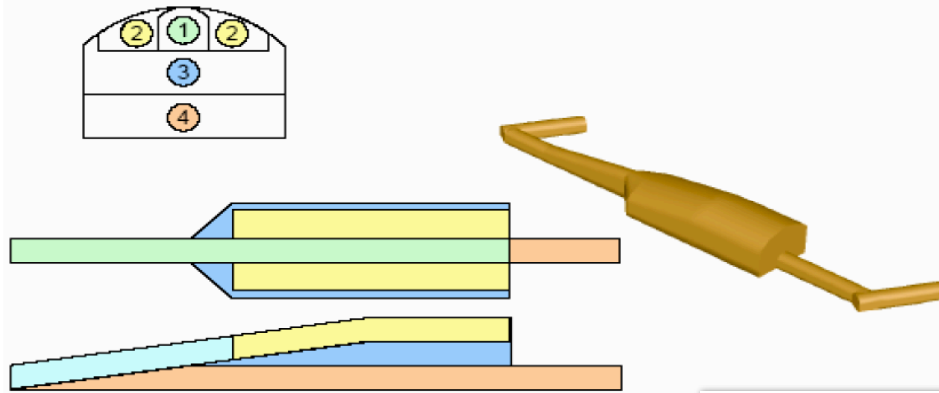
# 300L Campus



900 m<sup>2</sup> Drive-in access



### Lab Module Ramped Excavation Sequence



Laboratory Modules  
~ 50m x 20m x 15 m  
2 levels

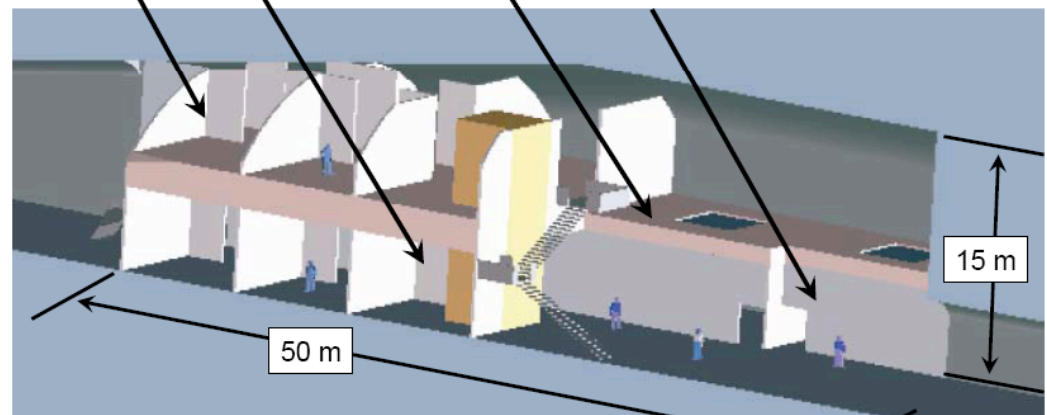
### Typical Lab Module Concept with High Bay and Mezzanine

Mezzanine Offices  
and Shops

Clean Experimental  
Detector Rooms

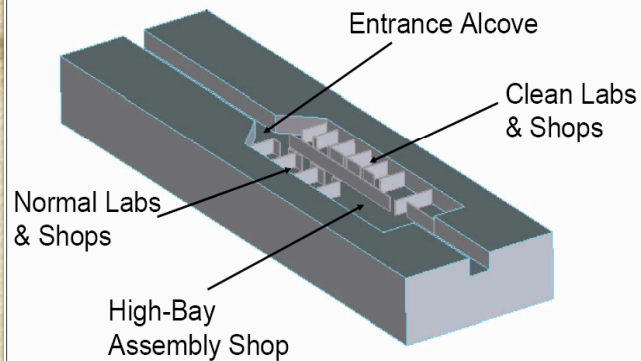
Ground Floor  
Offices and Shops

High Bay and  
Assembly Shop



1,630 m<sup>2</sup> (17,600 SF) Outfitted Floor Space

### Ground Floor Plan





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

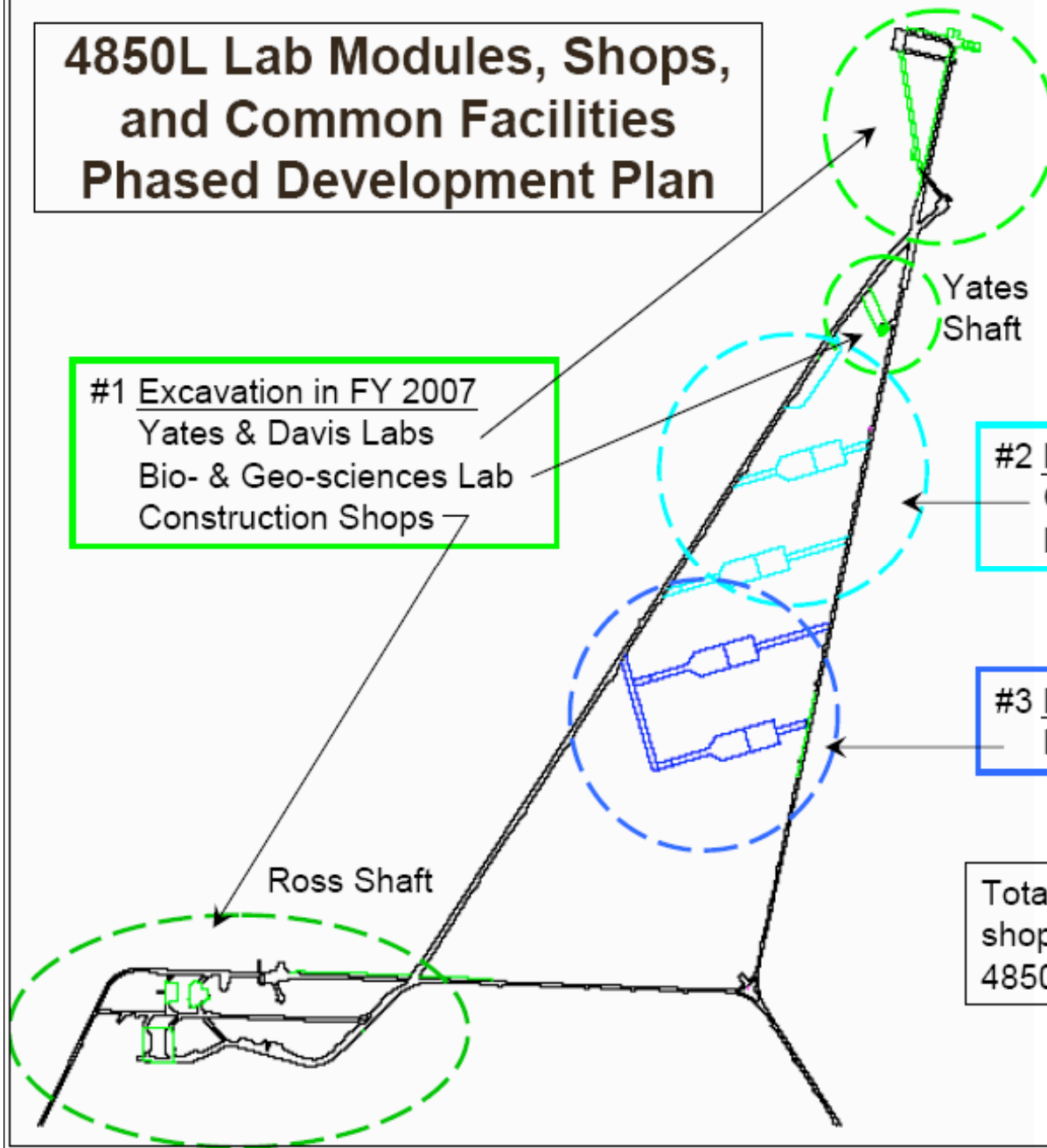
#1 Excavation in FY 2007  
Yates & Davis Labs  
Bio- & Geo-sciences Lab  
Construction Shops

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

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

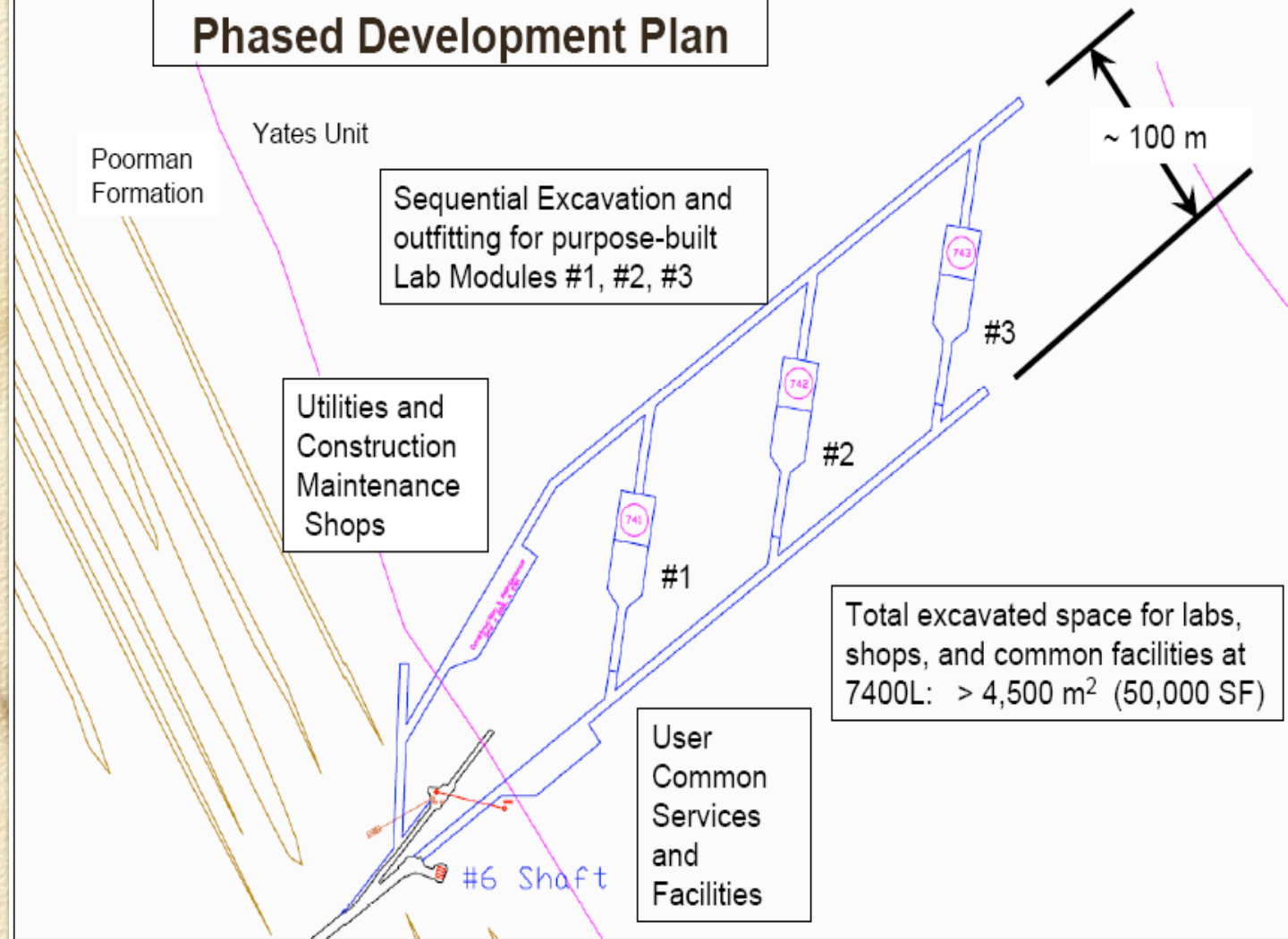
Total excavated space for labs,  
shops, and common facilities at  
4850L:  $> 6,000 \text{ m}^2$  (65,000 SF)

Existing  
Neutrino  
Chamber:  
Davis  
Experiment  
 $56' \times 30' \times 26'$





## 7400L Lab Modules, and Common Facilities Phased Development Plan





# Why Homestake?

---

- Easy of Access, **Dedicated Facility**, No competition with mining or other interests, **Ability to Support an Diverse, International, Multidisciplinary Program**
- Best Time to Science: **Early Program** being defined (PAC in place, LOIs) - phases into the NSF program, **establishes requirements and infrastructure**
- Very low and well characterized risks - **126 years of experience**
- First ~ dozen steps in establishing a lab are done: **ownership, insurance, indemnification, plan for rehabilitation, buildings, shafts, drifts, ....**
- Infrastructure, Staff, Safety, and Management Initiated in Advance of DUSEL with SD resources
- Staged approach offers advantages in essentially all aspects of establishing DUSEL



# Summary: Homestake EIP & DUSEL

- Diverse program, strong synergistic links from T=0, very broad Physics program, excellent Education opportunities:
  - Dark Matter, Neutrinoless DBD, Solar  $\nu$ , GeoVs, Long Baseline Line  $\nu$ , PDK, Nuclear Astrophysics, (Gravity waves), ...
- Ownership, Insurance, Liability Issues dealt with by SDSTA.
- **South Dakota sponsored 4850 Lab: EIP 2007 - 2012**
- **Yates Shaft inspected 10 June 2006, in good condition!**
- Early Science Program being prepared for 2006/7
  - 300L (horizontal access), 4850L (+ higher levels)
- Phasing into Initial Suite of Experiments 2008/9 then Deep Experiments down to 8000L and expanded use of other levels
- Excellent match to many problems of the highest importance
- NSF announces FY07 R&D Solicitation (\$6M for R&D + TDR)
- Anticipate down-select Fall 20XX, **Proceeding with EIP**



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  - Dark Matter, Neutrinoless DBD, Solar  $\nu$ , Geon $\nu$ s, Long Baseline Line  $\nu$ , PDK, Nuclear
- Ownership, Insurance, etc.
- **South Dakota space**
- **Yates Shaft inspected**
- Early Science Program
  - 300L (horizontal acc)
- Phasing into Initial Support Experiments down to
- Excellent match to mission
- **NSF announces FY07 R&D Solicitation (\$6M for R&D + TDR)**
- Anticipate down-select Fall 20XX, **Proceeding with EIP**





# Summary: Homestake EIP & DUSEL

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- NSF announces FY07 R&D Solicitation (\$6M for R&D + TDR)
- Anticipate down-select Fall 20XX, **Proceeding with EIP**



# Summary: Homestake EIP & DUSEL



broad

Baseline

TA.

7 - 2012

deep  
levels

ance

+ TDR)



Anticipate down-select Fall 20XX, **Proceeding with EIP**



# Homestake PIs, Senior Personnel & Coordinators

- Yuen-dat Chan, LBNL (Other uses)
- Milind Diwan, BNL (lbl, pdk)
- Reyco Henning, LBNL (ovdbd, 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 Saylor, 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

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://neutrino.lbl.gov/Homestake>

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

<http://www.dusel.org>

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