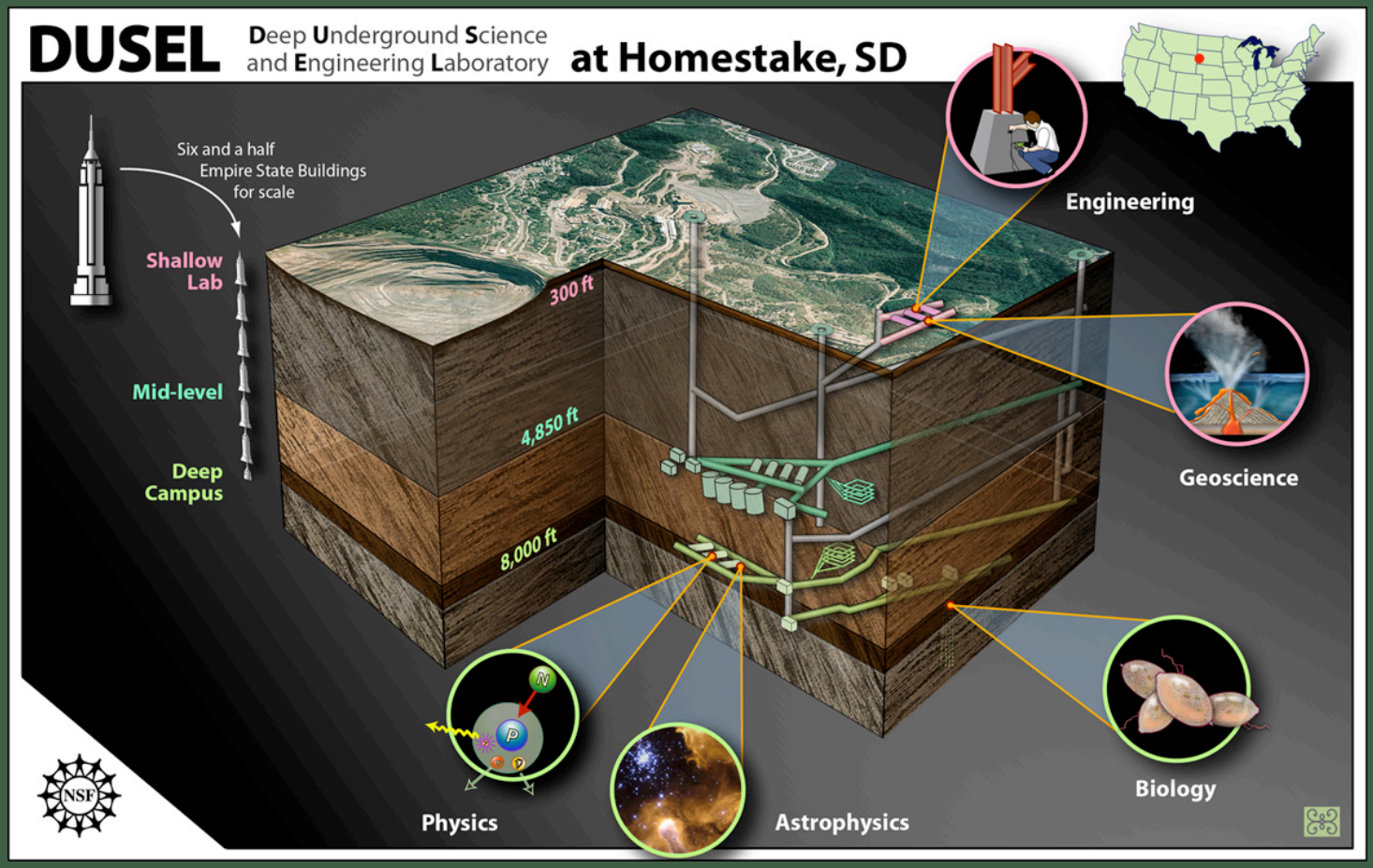
Homestake DUSEL Project
Facility Design

Overview and Status Report

October 16, 2008

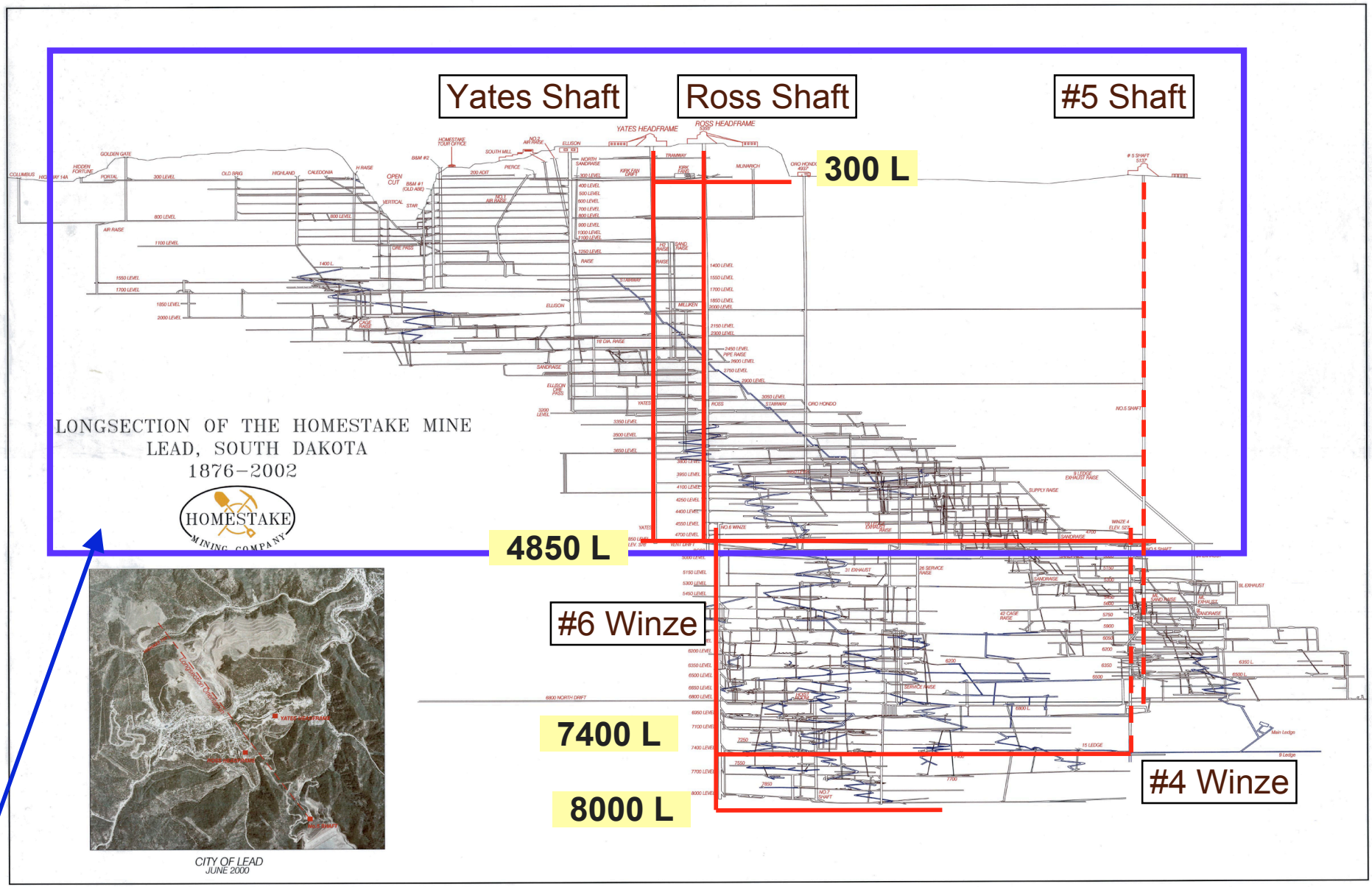
Richard DiGennaro, Project Manager



Key Dates for DUSEL MREFC

July 2007	Homestake Site Selection for proposed DUSEL
October 2009	S-4 Solicitation
January 2009	NSF Annual Review
December 2010	PDR - Preliminary Design Review Baseline Scope, Schedule, Budget
March 2011	**National Science Board Review**
October 2012	FDR - Final Design Review for Construction start in FY13
FY 2013 - 2019	Major Research Equipment and Facility Construction (MREFC) Project Proposed seven-year construction duration

SDSTA funds for Re-entry and Rehabilitation will prepare the site for DUSEL construction



Access to 4850 Level and above for early experiments and site investigations

Pumping and Water Treatment systems are operating with current dewatering rate at approximately 900 gpm

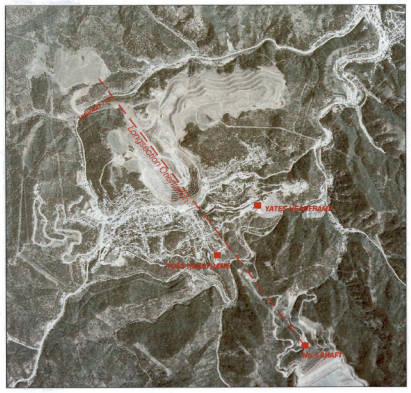
Yates Shaft

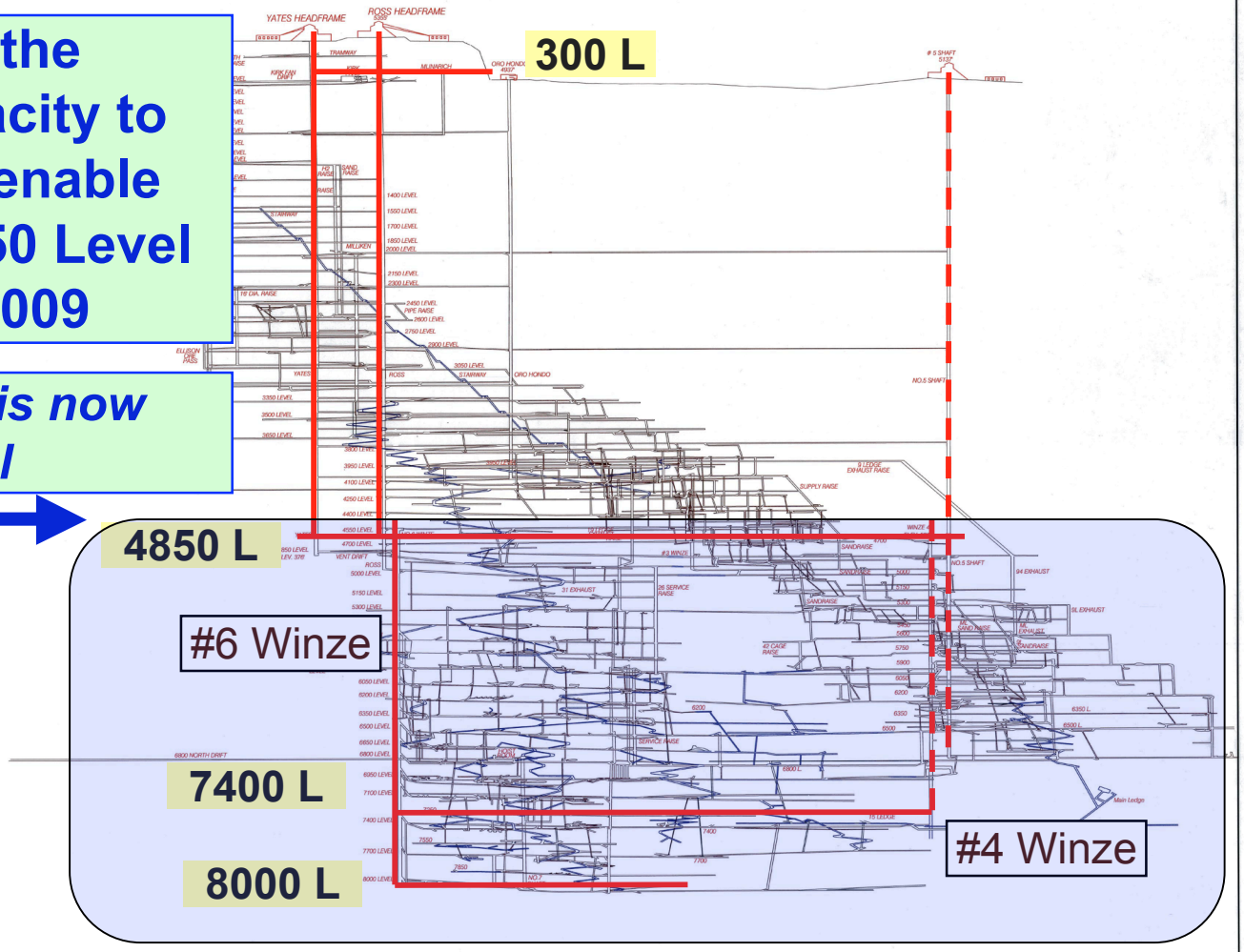
Ross Shaft

#5 Shaft

Augmenting the dewatering capacity to >1800 gpm will enable access to the 4850 Level by Summer 2009

The water elevation is now below the 4550 Level

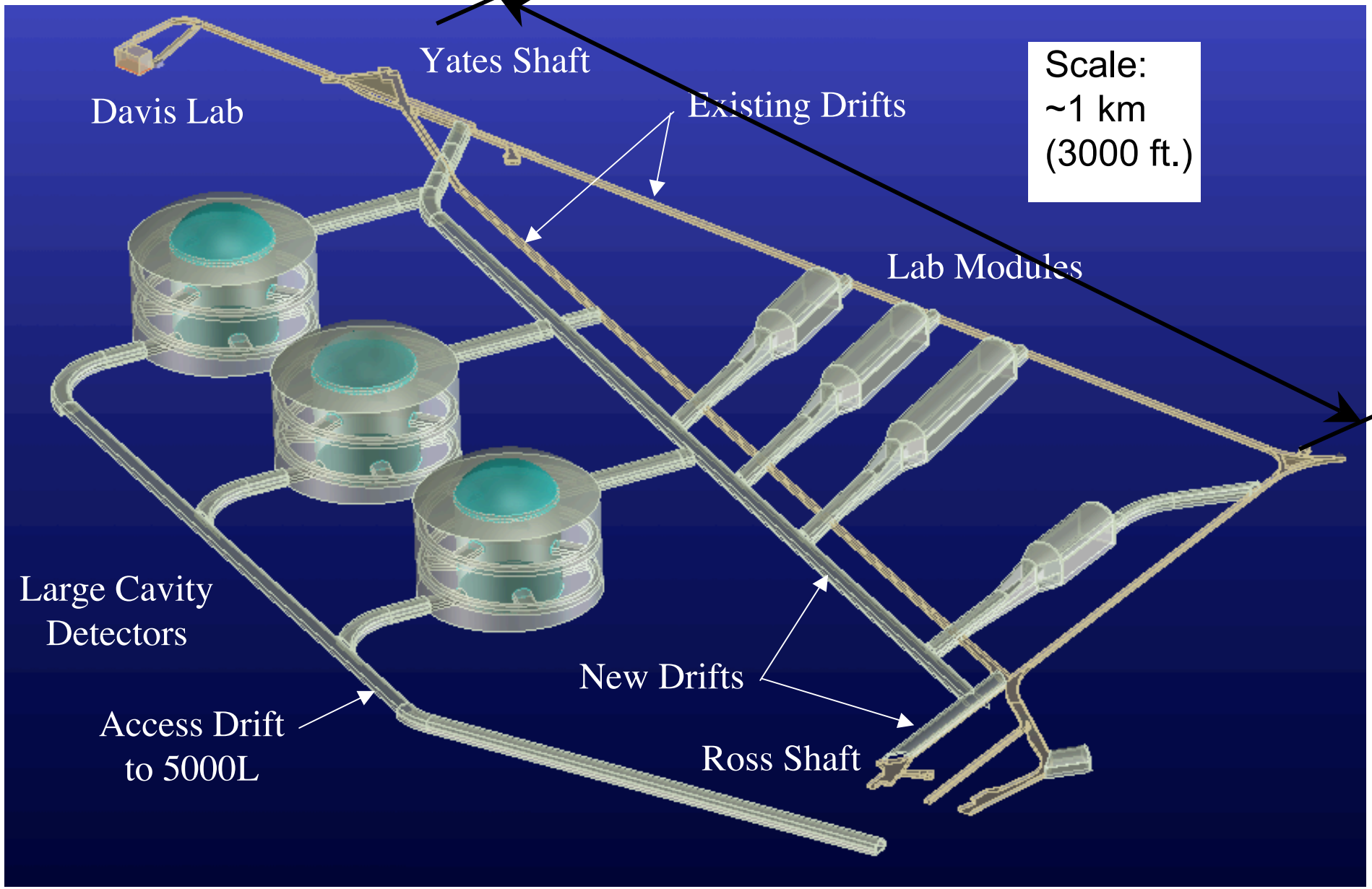




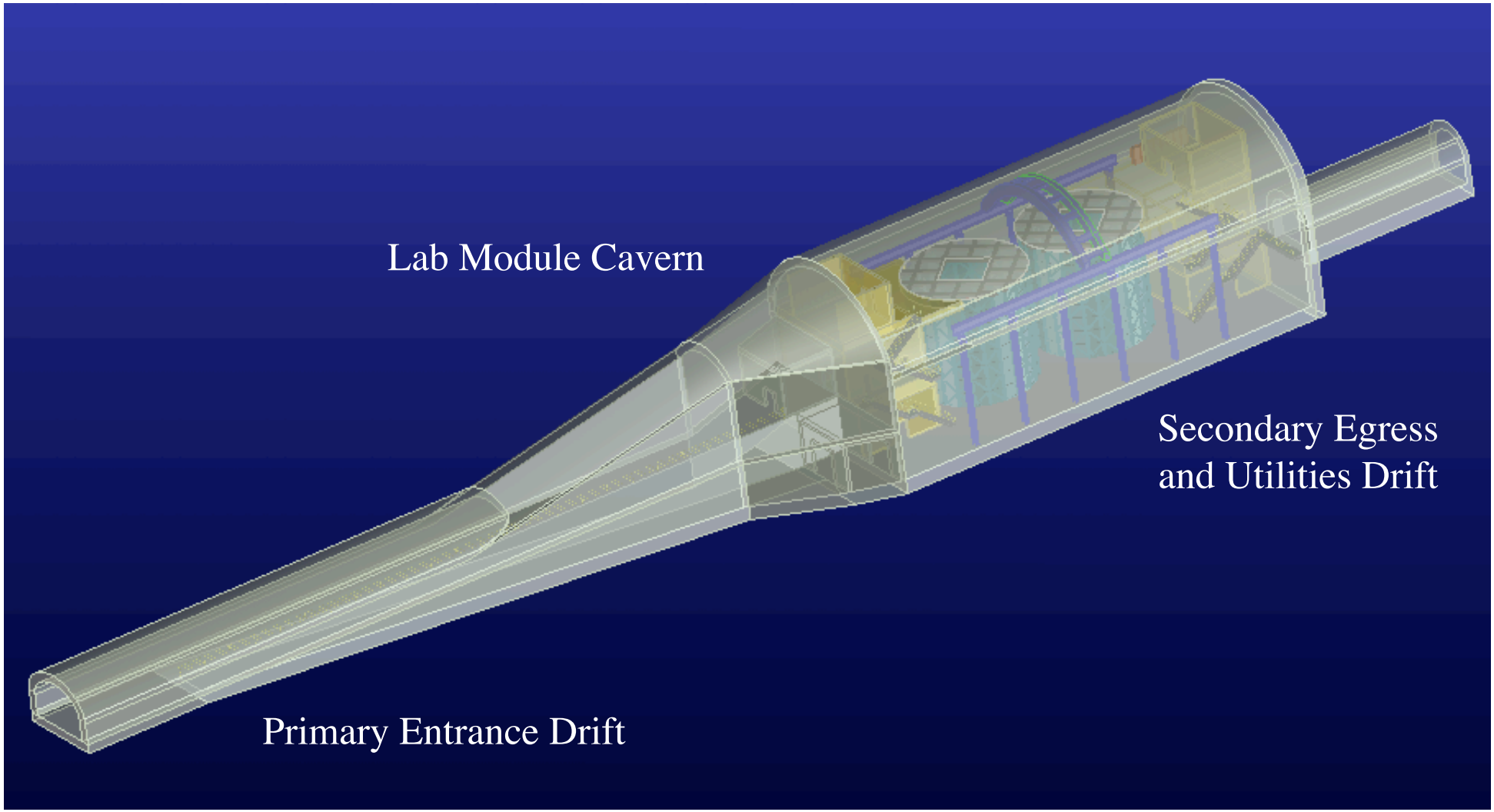
Additional levels are being evaluated to define an initial *Laboratory Footprint* for Research and Operations

Level	Justification/Comments
800L	Offers access to the north; will be useful for underground mapping educational purposes; older part of underground and may be important for geomicrobiology
2000L	Provides very wide access; will be useful for underground mapping educational purposes; will be important for geosciences; and may be important for geomicrobiology
2600L	Connects the two main areas of mineralization at depth; important for geoscience—study of mineralization; good connector throughout this depth of the underground
3800L	May be redundant to 2600L but offers access to the #5 shaft and may be useful for both geoscience and maintenance of the shaft; may be important to provide depth access (provides access between the 2600L and 4100L)
4100L	Connects the two main areas of mineralization at depth; important for geoscience—study of mineralization; good connector throughout this depth of the underground
5900L	Offers access to the #4 winze and to wide areas of the underground; midway between 4850L and 6800L
6800L	Connection to the #5 shaft; important to maintain monitoring of underground facilities
7700L	May be a useful level to drift under the 7400L experimental area for a cryogen dump and other utilities; use is speculative at this time
8000L	Required for access for deep drilling for geomicrobiology; is the location of the skip pocket for rock from the 7400L; required for pumping of water from the deepest levels

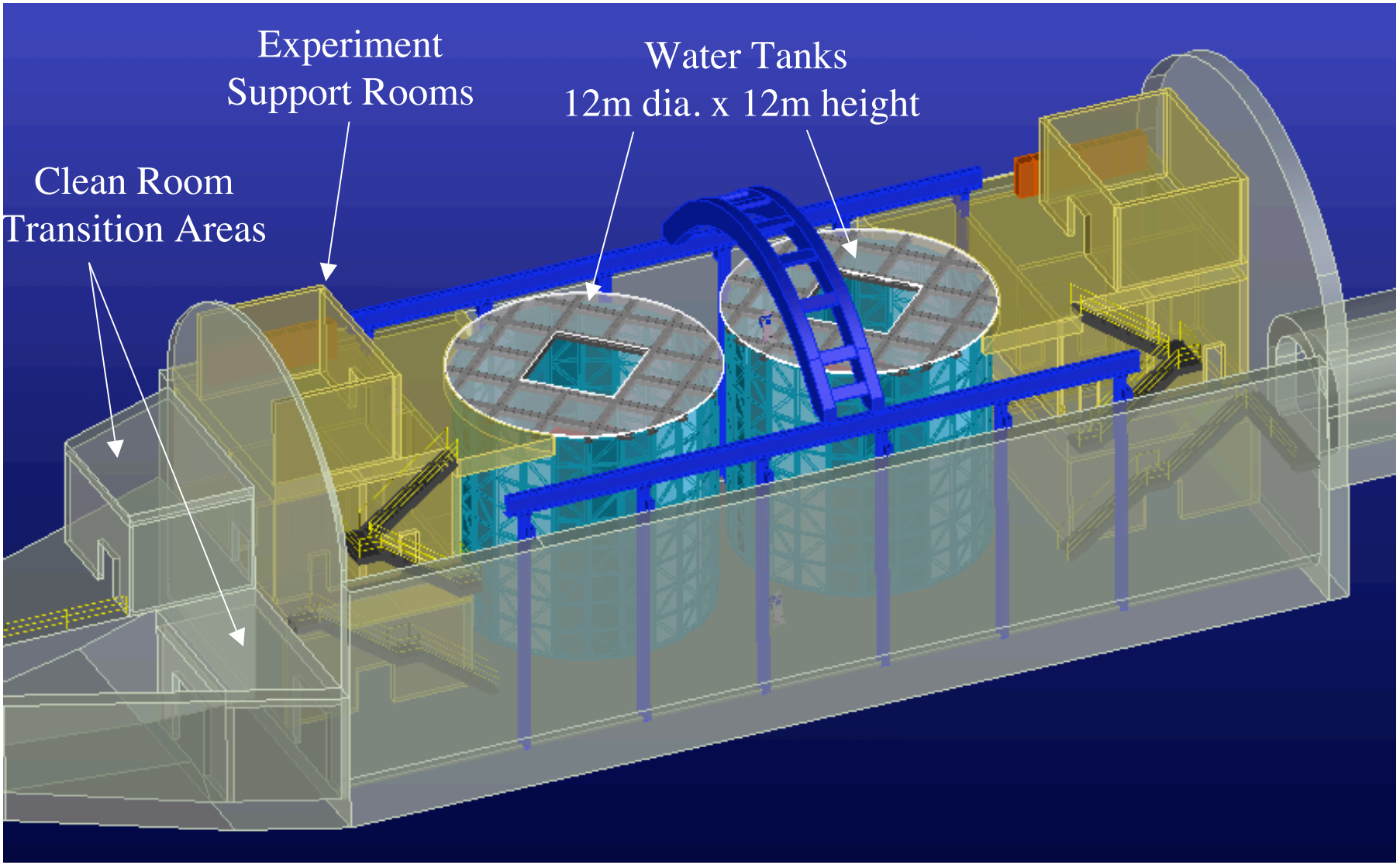
Mid-level campus design at 4850 Level: Options and planning for phased construction



Excavation and Laboratory Module Designs for Proposed Model Experiments



Proposed Laboratory Module Build-out for Model Water Shield Experiments



Proposed DUSEL Underground Development Program including Large Detector Cavities

Description	Cavity Floor Area (m2)	Build-out Floor Area (m2) factor	Excavation Volume (m3)		Build-out Floor Area (SF) factor	Excavation Volume (CY)
SUMMARY		1.5			1.5	
Lab Modules and Drifts at 300, 4850, 7400 Levels	11,729	17,178	276,587		184,912	361,978
Large Cavity Detector #1			204,920			268,185
Large Cavity Detectors #2 and #3			360,314			471,553
TOTAL	11,729	17,178	841,821		184,912	1,101,716
DETAILS						
300 Level	1,160	1,740	30,082		18,730	39,369
Access Drift and Lab Module #1	600	900	17,826		9,688	23,329
Lab Module #2	560	840	12,256		9,042	16,040
4850 Level	6,631	9,531	171,259		102,594	224,132
Ross Shops for Construction Staging	678	678			7,298	
Davis Laboratory	153	153			1,647	
Main Access Drift (Yates to Ross)			25,594			33,496
Lab Module #1	1,300	1,950	37,268		20,990	48,774
Lab Module #2	1,500	2,250	35,571		24,220	46,553
Lab Module #3	2,000	3,000	44,743		32,293	58,556
Lab Module #4	1,000	1,500	28,083		16,146	36,753
7400 Level (per CDR)	3,938	5,907	75,246		63,588	98,477
Lab Module #1 and Common Facilities	1,763	2,645	22,613		28,468	29,594
Lab Modules #2 and #3	2,175	3,263	52,633		35,120	68,883
Large Detector Cavity #1			204,920			268,185
Large Detector Cavity #2			180,157			235,777
Large Detector Cavity #3			180,157			235,777

Outsourced Services for Engineering Design and Project R&D

Timetable

Geotechnical Studies and Site Investigation for Lab Modules Excavation Design at 300 Level and 4850 Level

Sept 2008 - Contractor selected to start work by Dec 2008

Infrastructure for Underground Operations Site Assessment and Preliminary Design

Nov 2008 - RFP has been issued, Proposal are due in October 2008

Surface Buildings and Infrastructure for DUSEL operations and user support - Architectural Programming, Site Assessment, and Preliminary Design

Jan 2009 - Issue RFP

Lab Modules and Facility Infrastructure for the Initial Suite of Experiments - Architectural Programming and Preliminary Design

Spring 2009 - Issue RFP

Outsourced Services for Engineering Design and Project R&D — Deliverables

Activities, Contracts, and Project Milestones FY08	FY09	FY10	FY11	FY12
• Define Scope and Let: Geotechnical Site Investigations and Excavation Design Contract (300 and 4850L campuses)	• Geotechnical Report: Establishing Rock Properties and Basis of Design for Underground Construction			
• Define Scope and Let: Surface Infrastructure and Underground Operations Alterations and Upgrade Contract	• Infrastructure Assessment Report: Assessing Existing Conditions and Establishing Requirements Definition for Upgrades and Improvements for the Surface Facilities	• Surface and Underground Operations Upgrade Report: Detail Plans for Surface and Underground Infrastructure Upgrades	• *Draft Report* Operations Infrastructure: Prepare Construction Ready Drawings and Specifications for Surface and Underground Operations Infrastructure (end of FY)	• Operations Infrastructure Report: Prepare Construction Ready Drawings and Specifications for Surface and Underground Operations Infrastructure
• Define Scope and Let: Underground Laboratories Design Contract	• Laboratory Requirements Document: Assessing Establishing Requirements Definition for Underground Laboratories and Excavations	• Laboratory Module Design Report: Integrate Rock Properties with Instrumentation and Laboratory Requirements to Establish Laboratory Module Design	• *Draft Report* Laboratory Modules: Prepare Construction Ready Drawings and Specifications for Laboratory Modules (end of FY)	• Laboratory Module Report: Prepare Construction Ready Drawings and Specifications for Laboratory Modules
• Assess Potential Experiments and Accumulate Conceptual Experimental Requirements	• Experimental Instrumentation Requirements Document: Establishing *Preliminary* Instrumentation Requirements for the Suite of Experiments	• DUSEL Experimental Instrumentation Requirements Definition: Following Experimental Selection Establish Instrumentation Requirements and Preliminary Designs	• *Draft Report* DUSEL Instrumentation: Prepare Construction Ready Drawings and Specifications for Intrumentation (end of FY)	• DUSEL Experimental Instrumentation Report: Prepare Construction Ready Drawings and Specifications for Intrumentation
	• *Preliminary* Facility Baseline Report	• *Preliminary* Experimental Instrumentation Baseline Report		
		• Facility Baseline Report	• Facility and Instrumentation Baseline Report: Integrate Facility Design with Experimental Instrumentation (mid-FY)	

STATUS: Engineering Services for Geotechnical Studies and Excavation Design

Contract between DUSEL and RE/SPEC to initiate Geotechnical studies at 300 and 4850 Levels

- Initial bid for requested scope of work exceeds the available budget.
- Contract scope and priorities are under negotiation
  - Delay drilling at 300 Level
  - Perform Mapping studies at 300 and 4850 Levels
  - Limited coring and geotech. analyses at 4850 Level
- Initiate work at 300 Level before end of CY 2008.

Large Cavity Geotechnical Oversight Board

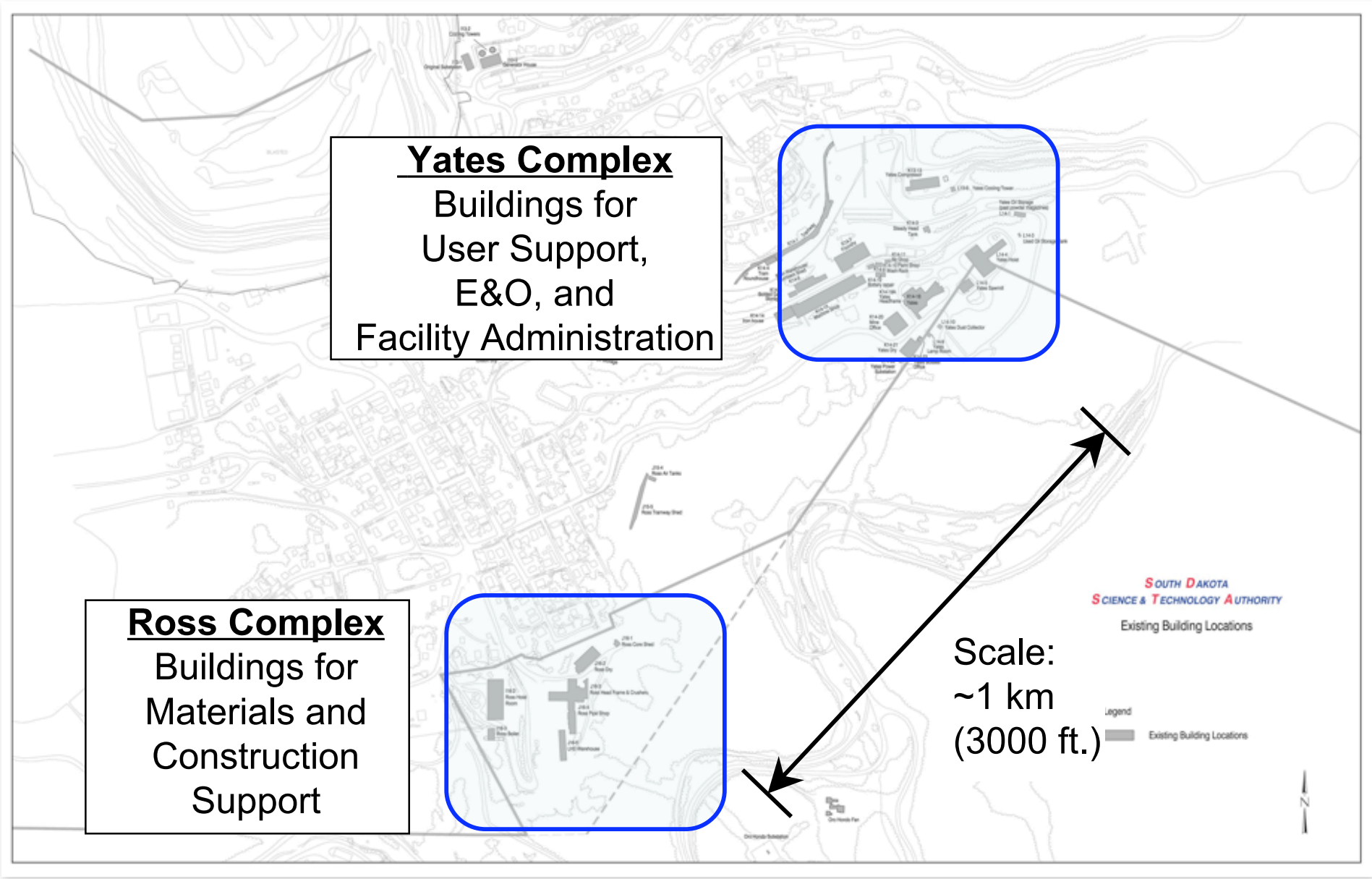
- Organized by NSF, reports to DUSEL Management
- Members are hired consultants and experts in the construction of large underground cavities.
- They will provide oversight and recommendations to the Project Management & NSF regarding:
  - Initial studies and planning prior to 4850 Level access
  - Scope Definition for coring, locations and analysis at 4850 Level
  - RFP and Scope Definition for Large Cavity excavation design

STATUS: RFP Infrastructure for Underground Construction and Operations

Provide a Site Assessment of Existing Conditions of primary systems to be developed for DUSEL (partial list):

1. Shaft Systems for Yates & Ross Shafts
2. Hoist Cages & Skips
3. Dewatering and Water Management Systems
4. Ventilation and Air Quality Management Systems
5. Electrical Distribution Systems
6. Communication and Monitoring Systems
7. Fire Prevention and Emergency Response Infrastructure
8. Access and Safety
   - Existing Drifts and Shafts (*~Lab Footprint*)
   - General: Assess existing conditions & non-compliant conditions related to life safety codes and regulations
9. Environmental Hazards

Development of the Surface Campus will utilize existing structures, as feasible and cost-effective



Candidate Surface Infrastructure to be utilized for Sanford Lab and DUSEL

Yates Shaft Complex buildings for facility administration, site services and user support:

Main Office and Administration Building
Yates Headframe and Crusher Building
Machine Shop Building
Foundry Building
Sawmill Building
Yates Safety and Dry Building
Yates Hoist Room
Main Warehouse
Yates East Substation

Ross Shaft complex buildings with minimal remodeling for construction staging and maintenance:

Ross Headframe and Crusher Building
Ross Dry Building
Ross Pipe Shop
Ross Hoist Room
Ross LHD Warehouse
Ross Substation

Other Existing Buildings and Facilities with functional infrastructure:

Water Treatment Facilities
Kirk Fans
#5 Ventilation Shaft
Surface and Sub-surface Utilities and Services
Oro Hondo Substation
Oro Hondo Fans
Roads, Parking, Rail,

STATUS: Architectural and Engineering Services for Surface Site Infrastructure Development

Preliminary Architectural Program (part 1 of 2)

- Administrative offices (23ksf) including 50 to 60 permanent offices for scientific users
- Shared Surface Assembly Facilities. (67ksf)
  - Small, Large and High Bay assembly
  - Machine shop/Electronics shop
  - Dry storage
  - Remote expt. Control room (12)
- Sanford Center for Science Education (50ksf)
- 300 ft level (40 ksf)
  - Education & Outreach module
  - Low background electroforming and assembly facility, R&D

STATUS: Architectural and Engineering Services for 4850 Level Infrastructure Development

Preliminary Architectural Program (part 2 of 2)

~Two laboratory modules

3 large detectors phased (1 proposed in MREFC)

Davis Lab,→ permananet low background counting facility (?)

Lab and User support facilities (~15ksf)

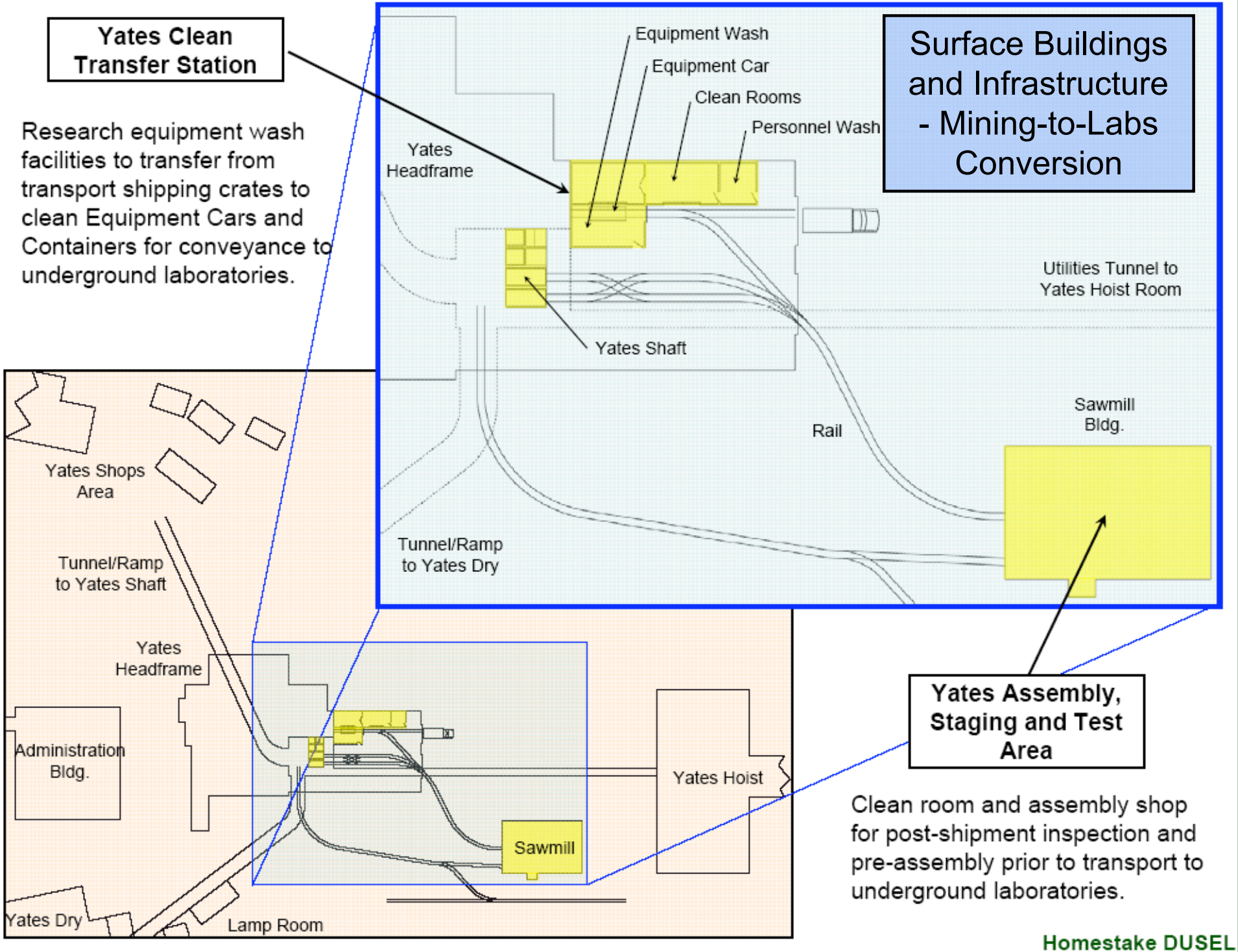
- Equipment Car Wash
- Air Filtration & Cooling room
- Electrical Facilities Substation
- Wash/Change room
- Refuge Station/ Cafeteria
- Waste Water Pre-treatment

Ross Shops for Construction and Maintenance support (4ksf)

Surface Buildings and Infrastructure - Mining-to-Labs Conversion

Yates Clean Transfer Station

Research equipment wash facilities to transfer from transport shipping crates to clean Equipment Cars and Containers for conveyance to underground laboratories.



Yates Assembly, Staging and Test Area

Clean room and assembly shop for post-shipment inspection and pre-assembly prior to transport to underground laboratories.

DUSEL Facility Development
Institutional Roles and Responsibilities

University of California, Berkeley **is the sponsoring institution for NSF Funding**

Institutional Responsibilities for DUSEL Facility pre-construction planning and development:

- ***Lawrence Berkeley National Laboratory*** - Berkeley Project Office
  - » **Integration of Research Programs and Initial Suite of Experiments**
  - » **Design of Underground Laboratories for the Initial Suite of Experiments**
  - » **Project Management and Systems Engineering**
- ***South Dakota School of Mines and Technology*** - Satellite Project Office
  - » **Design and Construction Management of conventional facilities and infrastructure, new excavation**
  - » **Planning for Maintenance and Operations.**
- ***Shared Responsibility*** for Environment, Health and Safety planning.

- South Dakota Science and Technology Authority (SDSTA)

with state funding, will develop and manage the Sanford Laboratory as an interim facility for early experiments and for Education and Outreach, and prepare for DUSEL construction

Performance Baseline and Change Control for SDSTA Re-entry and Rehabilitation Priorities

Project Scope and Performance Baseline Definition:

SDSTA and LBNL Memorandum of Understanding (May 2008)
Integrated Project Plan

DUSEL Preliminary Design Report (December 2010)

Sanford Lab - DUSEL Joint Change Control Board			
DUSEL	Sanford Lab	SDSTA	State of S.D.
PI	Lab Director	Executive Director	Governor's Representative
Co-PI	Director of Engineering	Member of Board of Directors	
Project Manager			

DUSEL & Sanford Lab Joint Change Control Board
Recent News

- The Change Control board met on 2008-Aug-29 at Lead, SD.

- Two priorities were affirmed as being the highest priority for the SDSTA activities in the coming months –
  - 1) dealing with the accumulated water and
  - 2) establishing an agreement to dispose of waste rock for DUSEL construction.

- Priorities for Actions:
  - Minimal restoration of Yates shaft. Major upgrades in the Yates were deferred until DUSEL.
  - The SDSTA will continue to pump water below the 5300 level and will focus on increasing the water pumping capacity of the Ross Shaft with a goal of maximizing the pumping of water to the limits of the existing shaft pump column.
    - Maximum capacity: 2200 gal/min, operate on average at 80% of maximum.
    - 4850 ft access in 2009-July.
    - Current capacity limited by water treatment (20-60 ppm Iron in water) to ~ 1250 gal/min. Upgrading water treatment plant (waiting for bacteria to grow…)

Sanford Lab and SDSTA-funded mining-to-labs conversion and operations - Priorities:

- Safe access to 4850 Level and above
- Preparation for dewatering and access to deep levels
- Establish operations for construction, maintenance, and support for early experiments

Integrated EH&S Management for construction and operations

- Sanford Lab operations, SDSTA obligations and responsibilities
- DUSEL planning for construction and operations

Preconstruction Planning and Development (R&RA funds)

- Readiness Stage for project baseline
- Board-approved start to prepare for construction
- (Potential overlap with Design and MREFC construction)

Complex Project Scope and Phases

DUSEL MREFC Facility component

- Construction project management
- Integration with development of Experiment and Research component
- Surface Campus, multiple buildings and site development
- Near-surface Campus at 300 Level
- Mid-level Campus at 4850 Level & Large Cavity Detector(s)
- Deep Campus at 7400 Level
- Access and Pocket-labs at other levels and ramps

(Common facilities and infrastructure, multiple lab modules)

DUSEL MREFC - Experiment and Research component

- Multi-phased development
- Distributed collaborations and development teams
- Individual research scientists and engineers

DUSEL "Pre-operations" component (R&RA funds)

- Concurrent facility operation with MREFC construction
- Transition from SDSTA to DUSEL Management & Operations

Complex Project Scope and Phases

Large Cavity Detector (Long Baseline Experiment)

- Proposed joint-agency funding (DOE and NSF)
- Possible time-phased decision-process separate from DUSEL MREFC
- Subprojects:
  - Facility excavation and infrastructure (at DUSEL)
  - Beamline (at Fermilab)
  - Detector Instrumentation
- Project Management, Integration, Commissioning and Operations

DUSEL Commissioning & User-Facility Operations

- Transition to Management and Operations
- On-going Responsibilities and Obligations of SDSTA

Education and Outreach - Facilities and Programs

- SDSTA and Sanford Lab
- Sanford Center for Science Education
- DUSEL
- Regional education, business and cultural involvement
- South Dakota interests - State and Universities

Multiple stakeholders

National Science Foundation

SDSTA, State of South Dakota, S.D. Board of Regents

University of California, Berkeley (with LBNL, SDSMT)

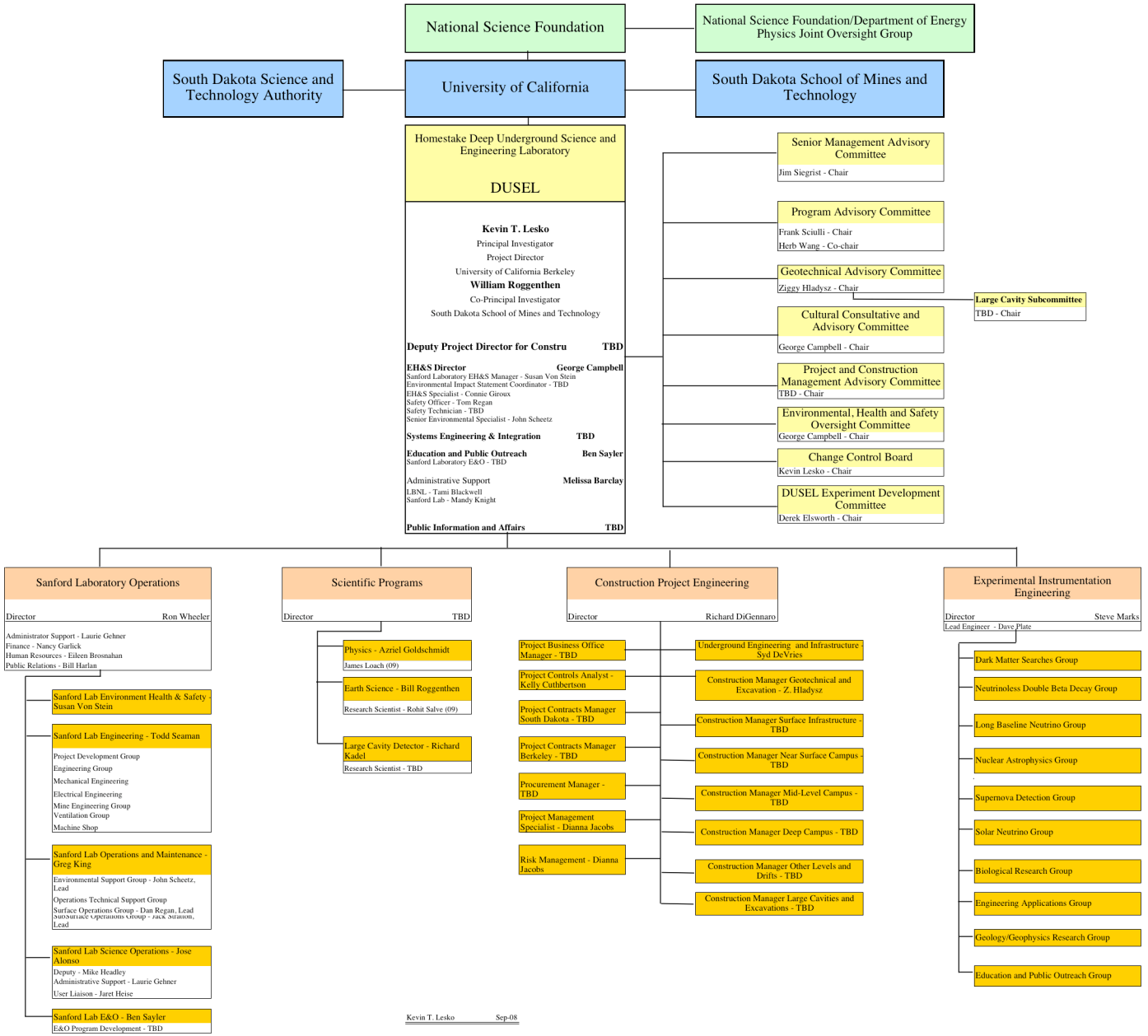
DUSEL Principal Investigator and Co-Principal Investigator

Department of Energy and DOE National Laboratories

Research Collaborations and Teams, Research Institutions

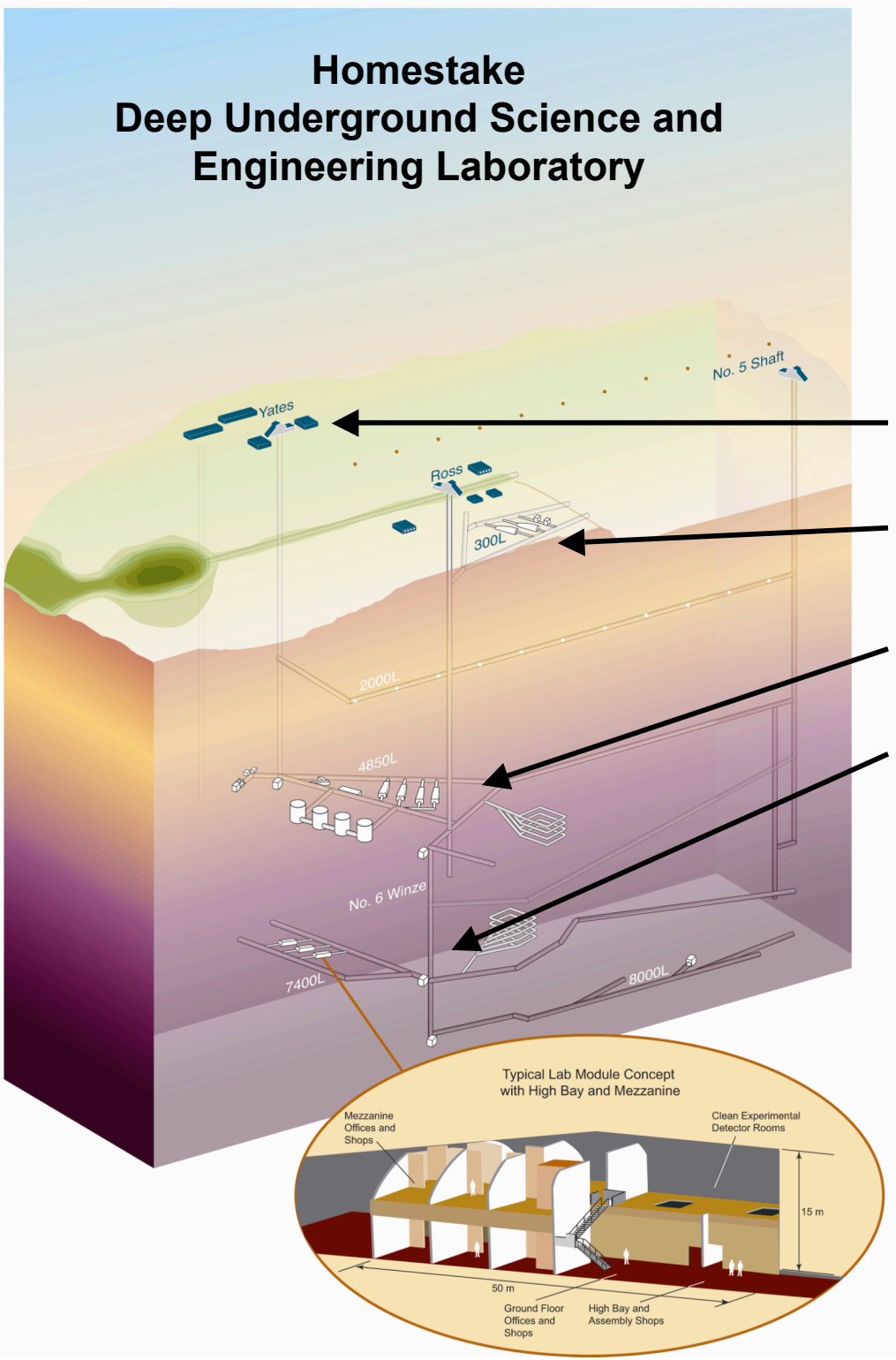
Research Scientists and Engineers

DUSEL Organization Chart



Supplementary Slides

Near-surface Campus at 300 Level Development Plans



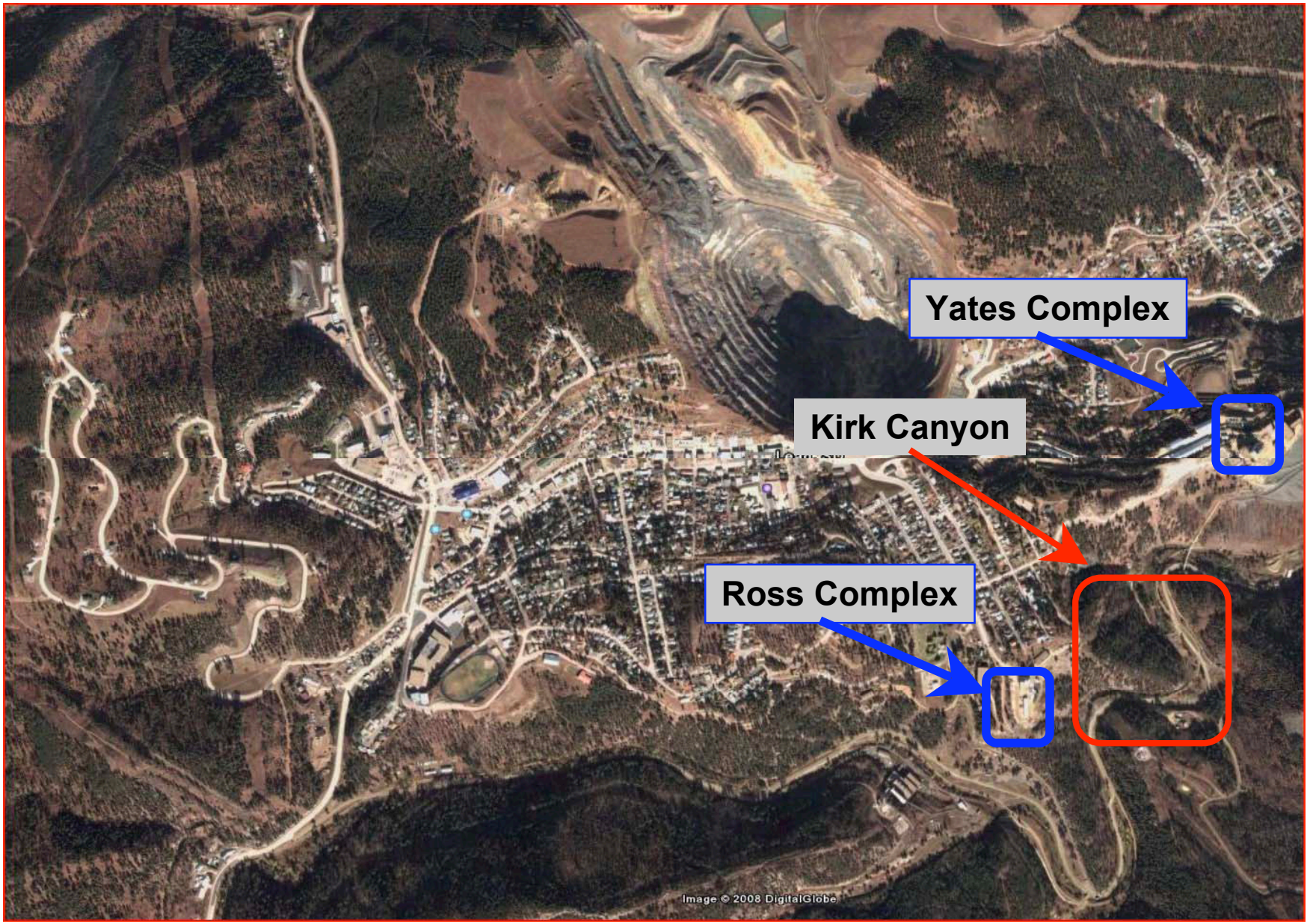
DUSEL Campus Development Summary

Plans to develop four primary campus locations for research:

- Surface campus at Yates Complex
- Near-surface campus at 300 Level
- Mid-level campus at 4850 Level
- 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.

Near-surface campus at 300 Level (Kirk Canyon Portal) for R&D, Education & Outreach, and Fabrication



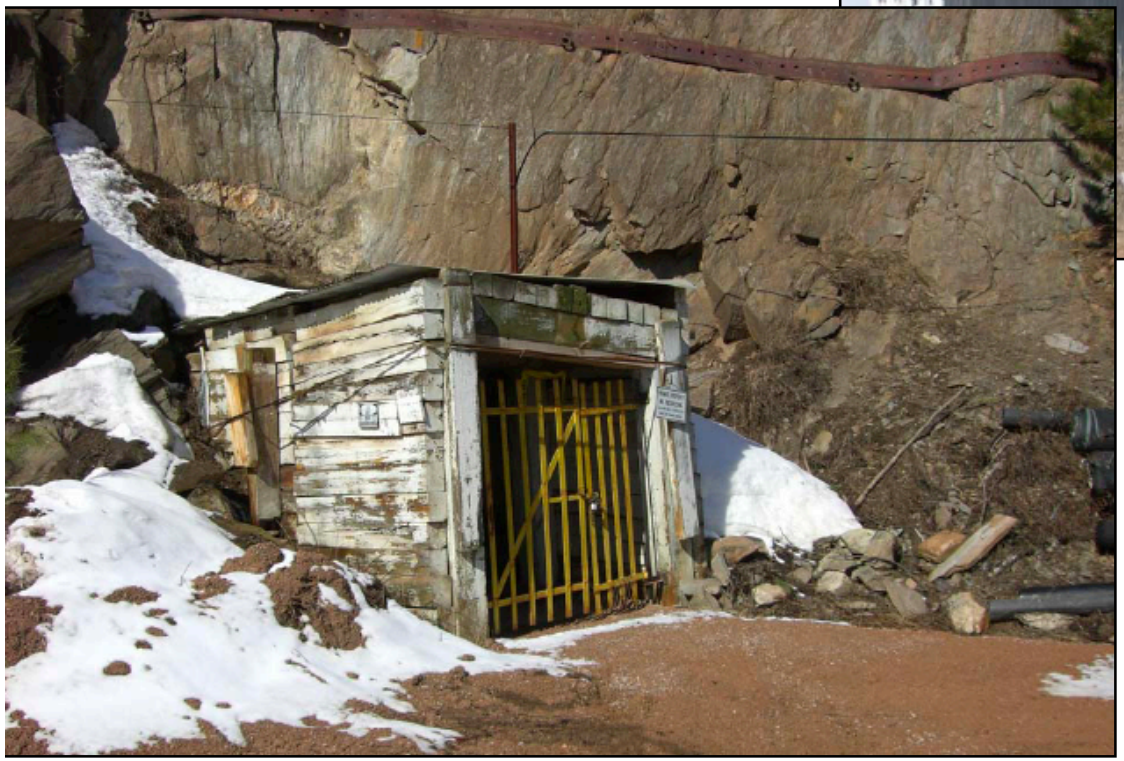
Kirk Canyon Road and Kirk Portal Area

Ziggy Hladysz, April 2008

Kirk Canyon Road

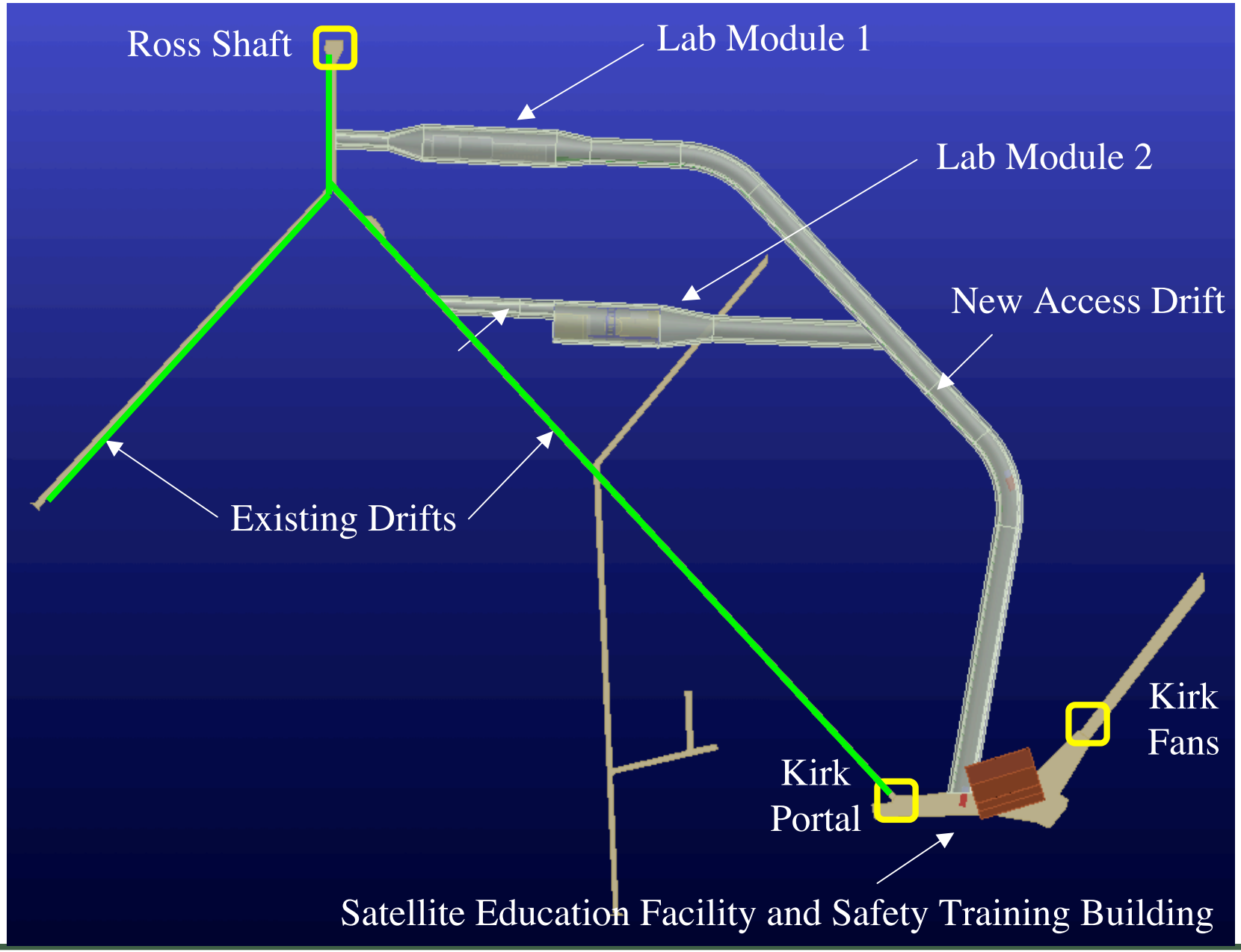
Kirk Fans and Kirk Portal

Kirk Fans

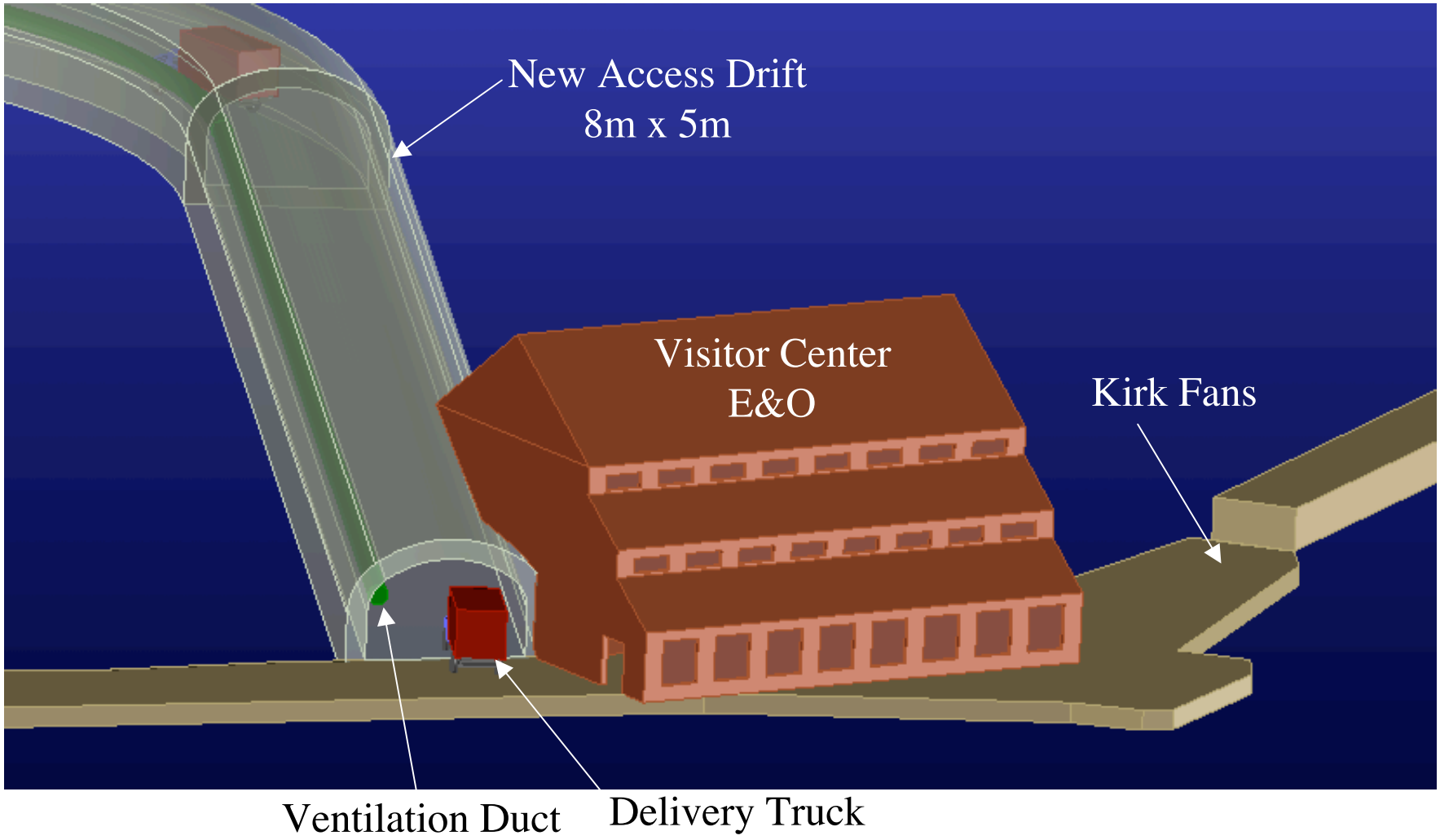


Kirk Portal

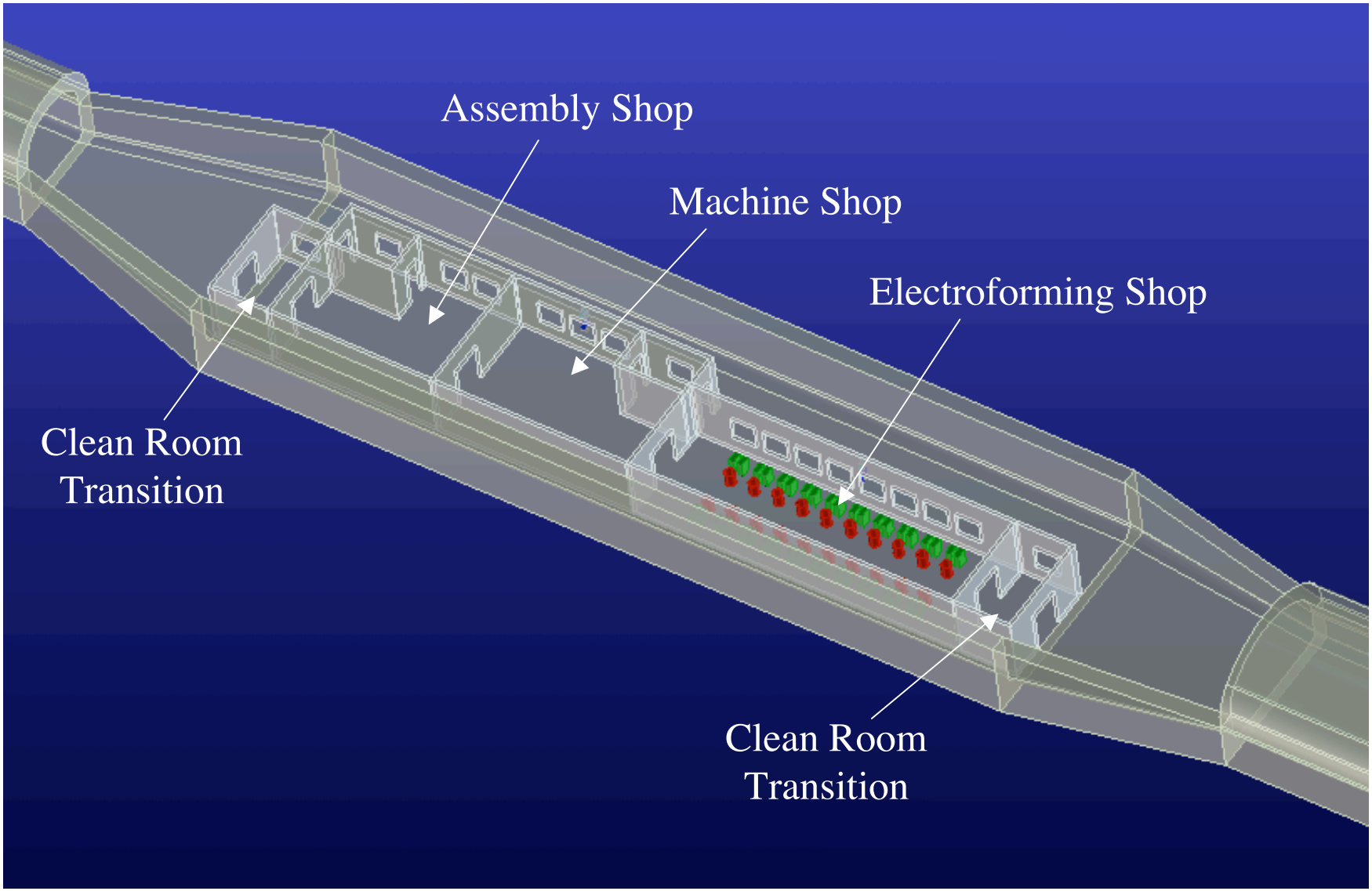
Near-surface campus design at 300 Level for R&D, Education & Outreach, and Fabrication shops

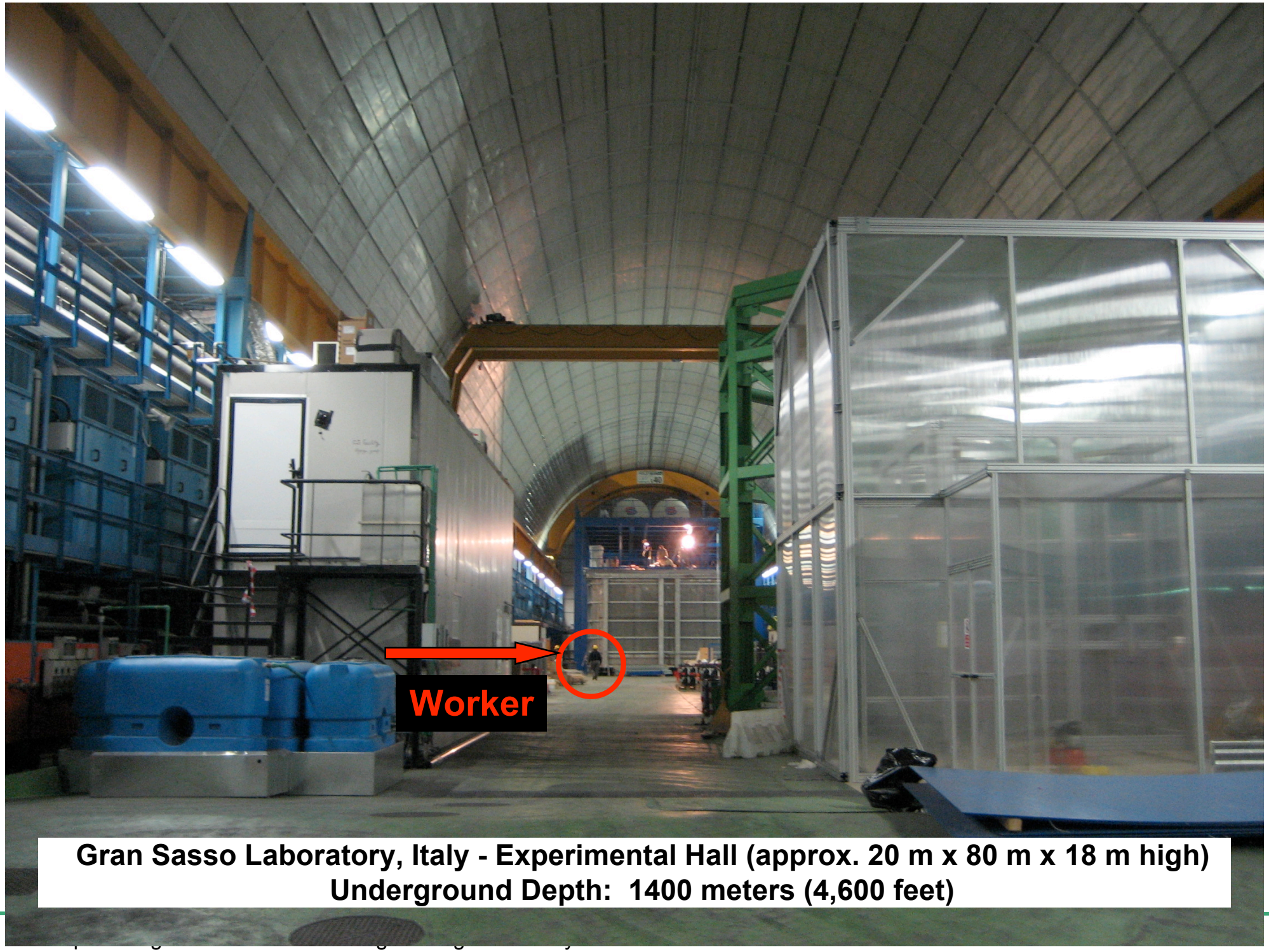


300 Level Conceptual Layout, Access Area at Kirk Portal



300 Level Proposed Lab Module 1
Electroforming, Machine & Assembly Shops





Gran Sasso Laboratory, Italy - Experimental Hall (approx. 20 m x 80 m x 18 m high)
Underground Depth: 1400 meters (4,600 feet)