

# Homestake DUSEL DEDC Workshop for the ISE

## DUSEL Project Overview

**Kevin Lesko**  
**Principal Investigator**

University of California, Berkeley

Lawrence Berkeley National Laboratory

South Dakota School of Mines and Technology

Lead, South Dakota, 1 - 3 October 2009

**BIG BANG**

t	$10^{-44}$	$10^{-37}$ s
T	$10^{32}$	$10^{28}$
E	$10^{19}$	$10^{15}$

possible dark matter relics

cosmic microwave radiation visible

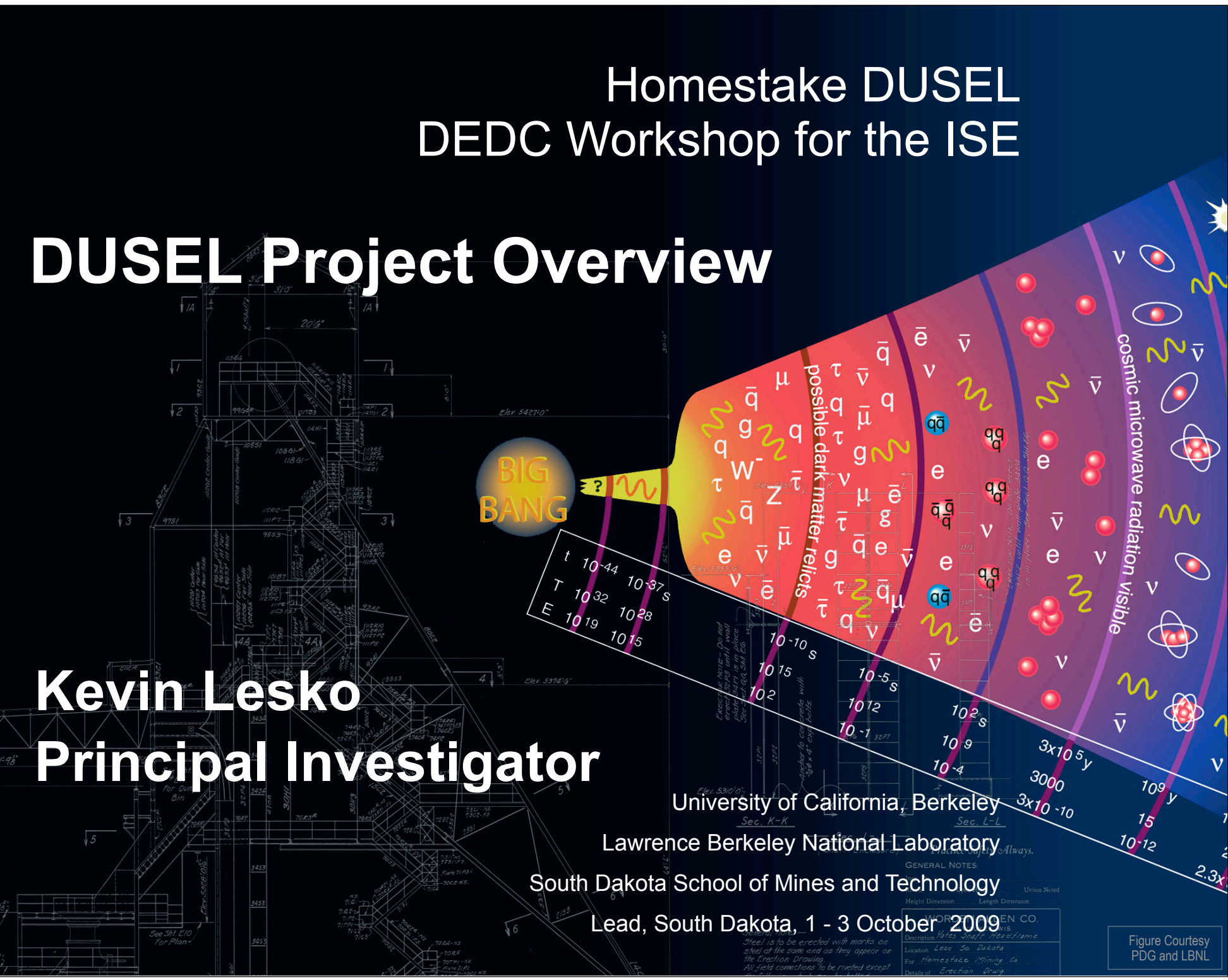
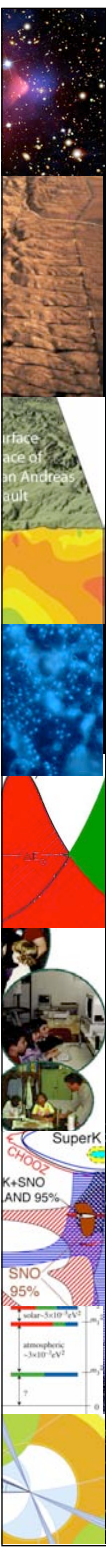
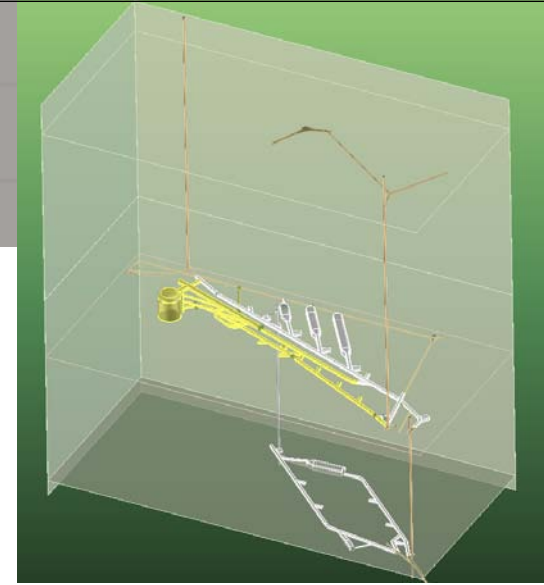


Figure Courtesy  
PDG and LBNL

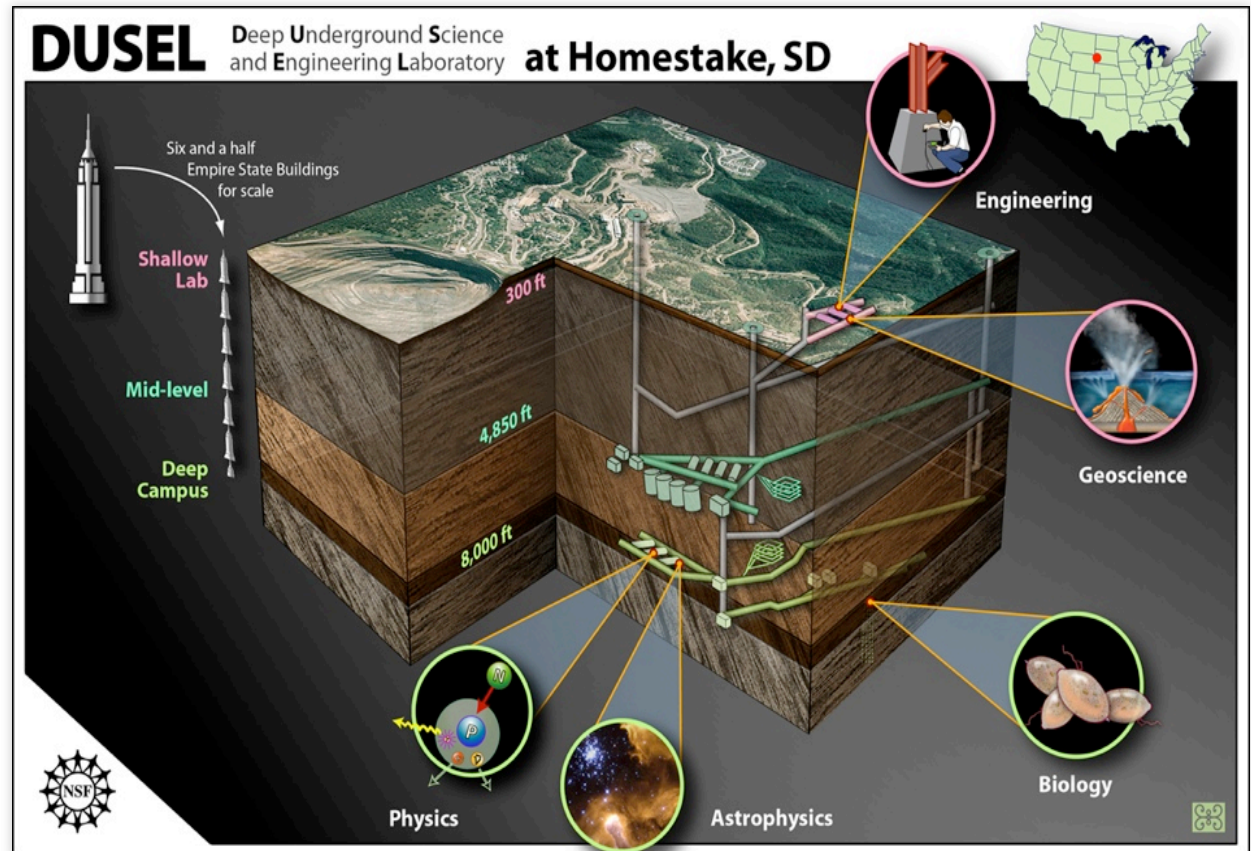
# Outline of Project Overview

- Scope and Definitions of the DUSEL Project
- Connections and Interfaces between Experiments and the DUSEL Facility
- Personnel and Organization
  - DUSEL Scientific Staff
  - DUSEL Engineering Staff
  - DUSEL Research Association
  - DUSEL Research Association Executive Committee
  - DUSEL Scientific Advisory Committee
- Facility Interfaces: Design, Integration, Requirements and Reviews (Steve Marks, Kurt Deshayes, Susan von Stein, Dave Turner)
- Goals for this Meeting



# Our Goal

*To develop a enduring international underground laboratory with a best-in-world class scientific program of research, education and outreach and do it as quickly and cost efficiently as possible*



# Why Are We Developing DUSEL?



To enable the Science and Engineering, exploit synergisms, maximize the benefits of a dedicated facility, and integrate Education and Outreach functions

- Neutrinos - discover new physics, known-unknown physics
- Dark Matter - identify ~25% of the known-unknown universe
- Dark Life - limits of life, life in extremes, life in isolation, new life
- Origin of the Elements - how, where did the elements originate
- Symmetries and High Energy Scale Physics - matter/antimatter asymmetry, the universe at extreme energies and physics of the early universe
- Natural Resources - understanding, probing, predicting
- Engineering - safer, deeper, larger, faster
- Education and Outreach - welcome, attract, excite, engage
- Energy and Carbon Research - imperative societal questions

# NSF's DUSEL Project Scope and Definition

- DUSEL will be a **Major Research Equipment and Facility Construction Project**
  - Congressional line-item, multi-year construction project (facility and a suite of experiments)
    - MREFC Funds: Facility and Instrument installation and construction, (calibration and pre-operations)
    - Does not fund Operations or Analysis: **R&RA**
  - To enter the queue for funding DUSEL requires:
    - National Science Board Approval
      - Mature, vetted, reviewed integrated design package
        - » Facility Design at ~ Preliminary
        - » Experimental Design at ~ Conceptual Level
        - » DUSEL experiments will not be selected: generic experiments

Budget evolution

Project evolution

Oversight evolution

**Conceptual Design Stage**

**Readiness Stage**

**Board Approved Stage**

**Construction**

Concept development – Expend approximately 1/3 of total pre-construction planning budget  
 Develop construction budget based on conceptual design  
 Estimate ops \$

Prelim design over ~1-2 years. Expend approx 1/3 of total pre-construction planning budget  
 Construction estimate based on prelim design  
 Update ops \$ estimate

Final design over ~1 year. Approx 1/3 of total pre-construction planning budget  
 Construction ready budget & contingency estimates

Expenditure of budget and contingency per baseline  
 Refine ops budget

Funded by R&RA or EHR \$

MREFC \$

**Conceptual design**

Formulation of science questions  
 Requirements definition, prioritization, and review  
 Identify critical enabling technologies and high risk items  
 Development of conceptual design  
 Top down parametric cost and contingency estimates  
 Formulate initial risk assessment  
 Initial proposal submission to NSF  
 Initial draft of Project Execution Plan

**Preliminary Design**

Develop site-specific preliminary design, environmental impacts  
 Develop enabling technology  
 Bottoms-up cost and contingency estimates, updated risk analysis  
 Develop preliminary operations cost estimate  
 Develop Project Management Control System  
 Update of Project Execution Plan

**Final Design**

Development of final construction-ready design and Project Execution Plan  
 Industrialize key technologies  
 Refine bottoms-up cost and contingency estimates  
 Finalize Risk Assessment and Mitigation, and Management Plan  
 Complete recruitment of key staff

**Construction per baseline**

Proponents development strategy defined in Project Development Plan

Described by Project Execution Plan

NSF oversight defined in Internal Management Plan, updated by development phase

Merit review, apply 1<sup>st</sup> and 2<sup>nd</sup> ranking criteria  
 Forward estimates of Preliminary Design costs and schedules  
 Establishment of interim review schedules and competition milestones  
 Forecast international and interagency participation and constraints  
 Initial consideration of NSF risks and opportunities  
 Conceptual design review

MREFC Panel approves CDR findings

NSF Director approves Internal Management Plan  
 Formulate/approve Project Development Plan & budget; include in NSF Facilities Plan  
 Preliminary design review and integrated baseline review  
 Evaluate ops \$ projections  
 Evaluate forward design costs and schedules  
 Forecast interagency/international decision milestones  
 NSF approves submission to NSB

NSF approves submission to NSB

Apply 3<sup>rd</sup> ranking criteria  
 NSB prioritization  
 OMB/Congress budget negotiations based on Prelim design budget  
 Semi-annual reassessment of baseline and projected ops budget for projects not started construction  
 Finalization of interagency and international requirements

Congress appropriates funds

Final design review, fix baseline  
 Congress appropriates MREFC funds & NSB approves obligation  
 Periodic external review during construction  
 Review of project reporting  
 Site visit and assessment

CD 0

CD 1

CD 2

CD 3

CD 4

Approve mission need

Approve alternate selection and cost range

Approve performance baseline

Approve construction start

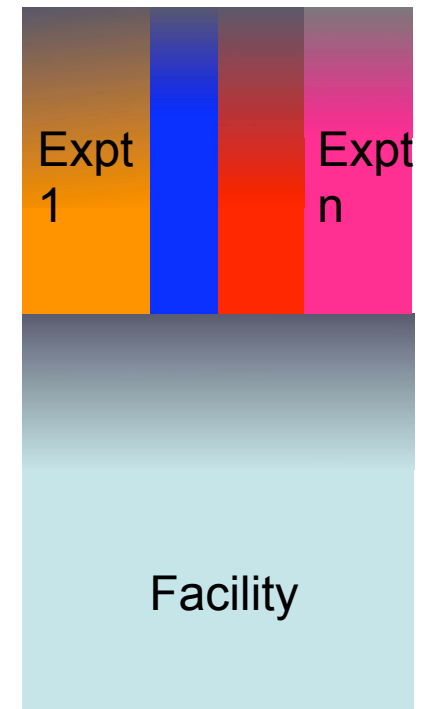
Approve operations start

# Roles in Developing the DUSEL Design

- **DUSEL Project Team (UCB, LBNL, SDSM&T, SDSTA, BHSU)**
  - Facility Design
  - Integration of the Science with the Facility
  - Oversight of the Proposals & MREFC
- **Experimental Collaborations (S-4 and others)**
  - Scientific Research, Goals, Management of the S-4 awards, Project Management for Instruments
  - Critical R&D
  - Instrument Design
  - Project Plans, Hazard Assessments, ...

# DUSEL MREFC Proposal as it will go to the National Science Board

- Facility Design ~ Preliminary Design Level
- Generic Suite of Experiments ~ Conceptual Level or Better
  - (go as far as you can)
- Single Proposal describing the Total NSF capital costs (and other components)
- Discussion of the DOE roles and contributions - important mission for the JOG





# The Preliminary Design

LONGSECTION OF THE HOMESTAKE MINE

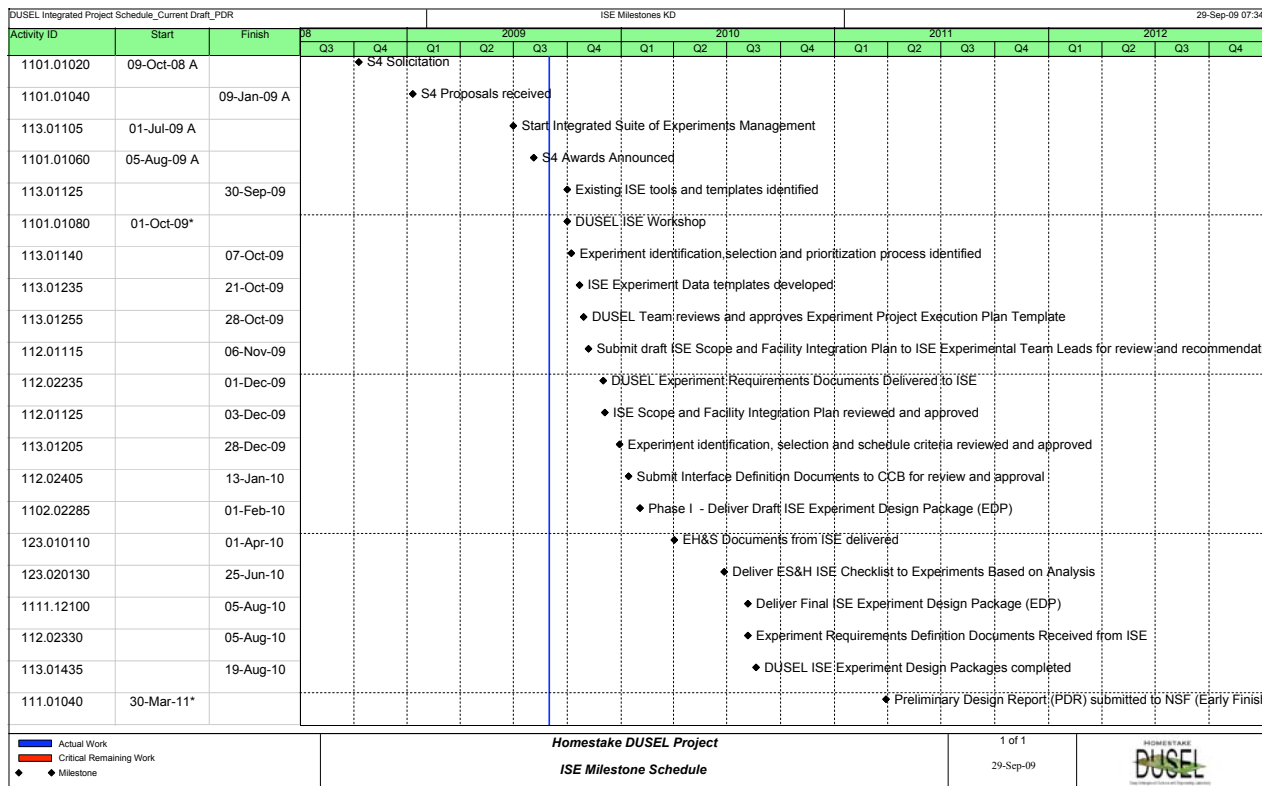


The PDR must

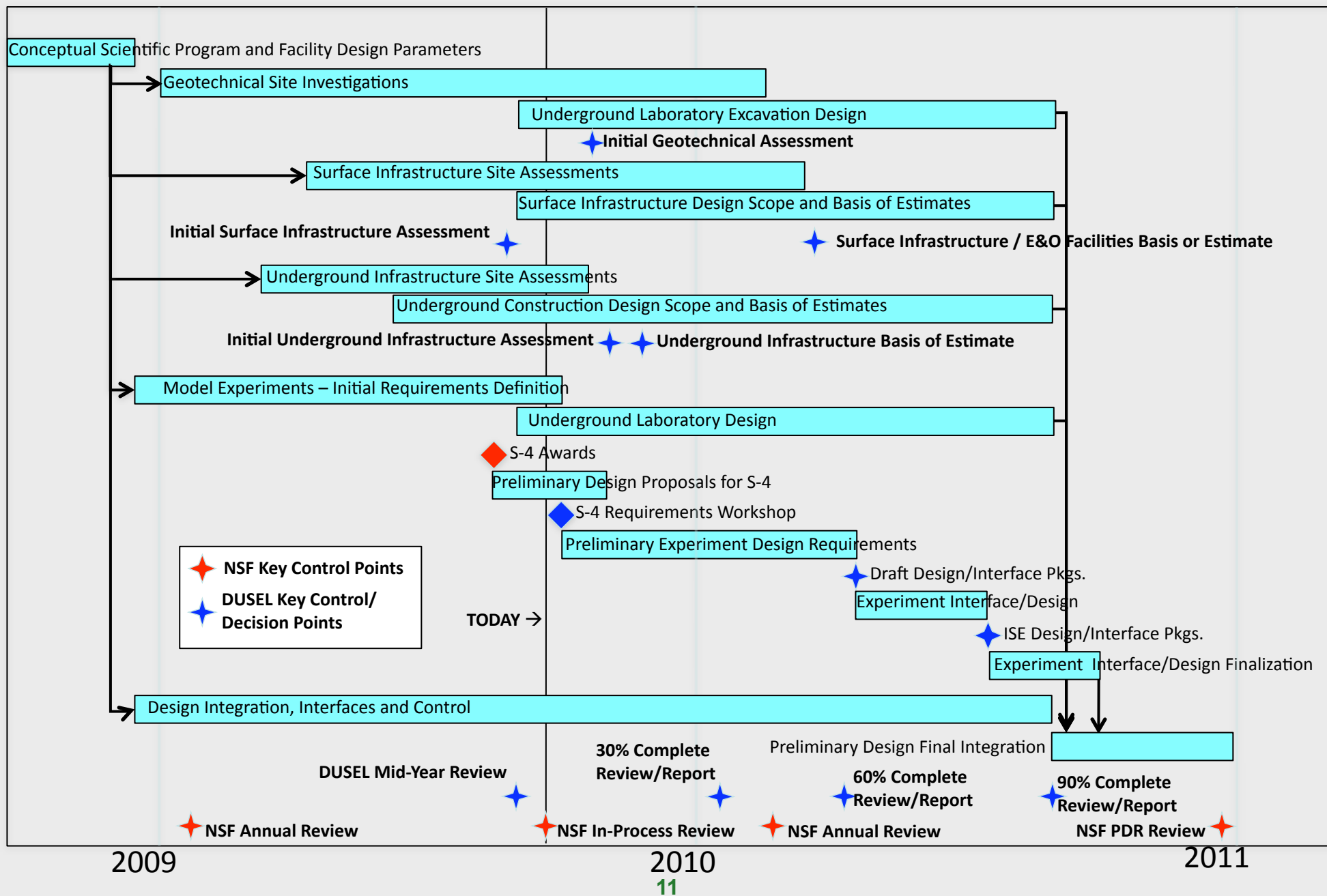
- Provide motivation
- What is needed for science goals
- What \$\$ will be needed
- When will it be done
- How it will be done
- How it will be controlled
- ...

# Aggressive Schedule to Develop the Design

- FY2013 construction start
- Spring 2011 NSB consideration
- DUSEL Design Package Assembled Summer 2010
- Input from the instruments by April 2010 (Conceptual level or better)



# DUSEL Preliminary Design Workflow / Schedule



# Roles & Responsibilities

## Project Directorate — Senior Management



- **K. Lesko: Principal Investigator / Executive Project Director**
  - Overall responsibility for the project
  - Responsible for ensuring quality of science program
  - Spokesperson for the Project



- **W. Roggenthen: Co-Principal Investigator**
  - Overall responsibility for all South Dakota project operations
  - Serves as PI in K. Lesko absence
  - Co-Spokesperson for the Project



- **K. Robinson [A]: Project Director for Design/Construction**
  - Planning and executing Preliminary Design
  - Quality of non-science components of PDR
  - Risk / Contingency Management
  - Formal communication / reporting of Project



- **M. Headley: Deputy Facility Project Manager**
  - Management of major design subcontracts
  - Management of technical scope in South Dakota

# Roles & Responsibilities

## Level 2 Managers



K. Deshayes: Project Systems & Support Manager



M. Headley [A]: Mid & Deep Campus Surface Other Ramps and Levels



S. Marks: Research Experiment Instrumentation Engineering Director



R. DiGennaro: Lead Systems Engineering



S. De Vries: Underground Infrastructure



R. Kadel: Long Baseline Neutrino Experiment Lead Scientist



S. Von Stein: EH&S Director



K. Lesko [A]: Research Experiment Instrumentation Project Deputy



B. Saylor [A]: Education and Outreach Director

# Scientific and Engineering Liaisons for Experimental Group



Steve Marks: Research  
Experiment Instrumentation  
Engineering Director



Dave Plate  
Experiment Instrumentation  
Engineering and Design



Azriel Goldschmidt  
Physics Instrumentation  
(Dark Matter)



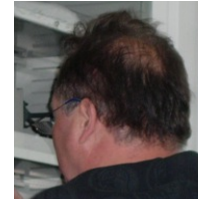
Jason Detwiler  
Physics Instrumentation  
(Double Beta Decay)



Yuen-dat Chan  
Physics Instrumentation  
(Low Background Counting)



Daniela Leitner  
Physics Instrumentation  
(Nuclear Astrophysics)



Richard Kadel  
Physics Instrumentation  
(LBNE)



Bill Roggenthen  
BGE Instrumentation  
(Fracturing, Transparent Earth,  
Optical Fiber)



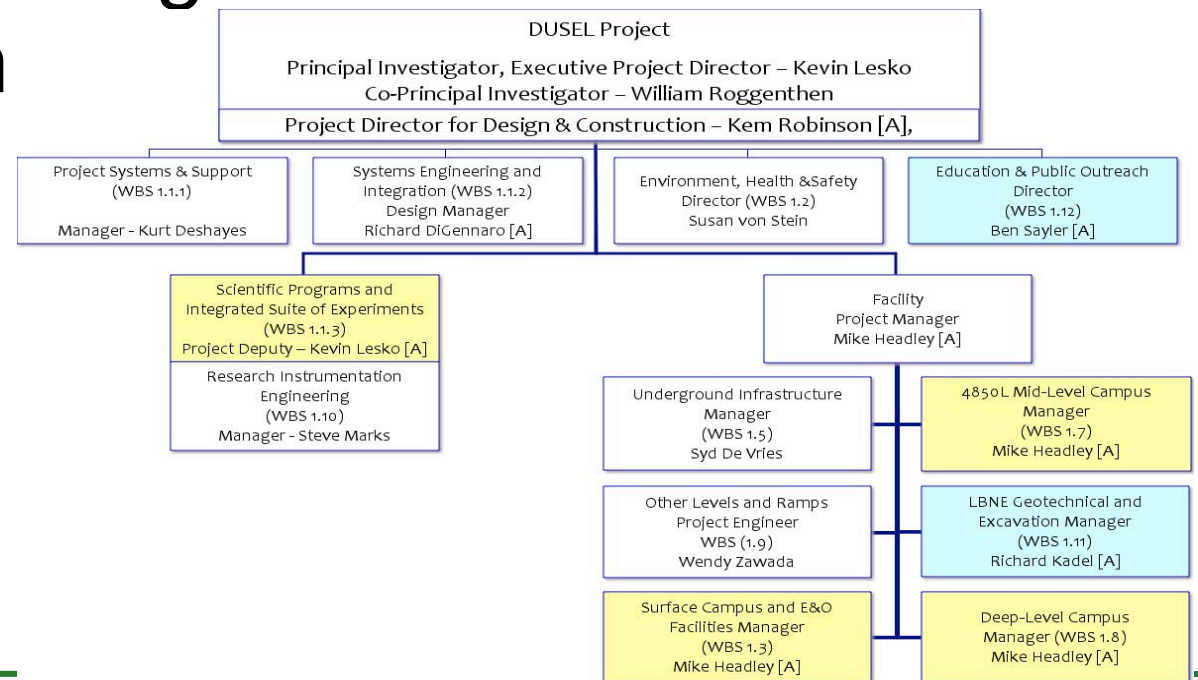
Rohit Salve  
BGE Instrumentation  
(CO<sub>2</sub>, Monitoring, EcoHydrology,  
Coupled Processes)

# What do the experimental collaborations need to produce? Who should you work with?

- Using S-4 funding:
  - Specific Science Goals, Broader Impact Goals (Science contact)
  - Project Management Plan, Roles and Responsibilities (Kurt and Steve)
  - Cost Estimates (conceptual level) (Kurt and Steve)
  - Work Breakdown Structure and Dictionary (Kurt and Steve)
  - Risk Assessments and cost and schedule impacts (Dianna Jacobs)
  - Hazard Assessment (Susan Von Stein)
  - Facility Infrastructure Requirements (Steve + Science contact)
    - location, location, location, power, ventilation,
  - Additional will be required Components later...

# DUSEL Project Responsibilities

- Facility/Experiment Definition
  - Facility Infrastructure Requirements
  - Experimental Footprint and Locations
  - Integration of the Experiments into the Design
- Scientific, Project Management and Engineering Liaison





# Selection of the ISE

- As envisioned now, the MREFC proposal will consist of a facility and a generic suite of experiments
  - permits facility design to continue
  - fixes capital budgets for the suite of experiments and the facility
- Following board approval, experiments will be reviewed and selected for construction
  - approval will follow NSF's peer-review guidelines (panel)
  - review will include significant input from the facility team
  - we anticipate DOE involvement in the process

# NSF - DOE Relationship Maturing

- **Joint Oversight Group (JOG) Established**
  - DOE: OHEP, ONP
  - NSF: Physics
- **Letter of Intent Presented to OSTP**
  - DOE and NSF would Jointly Develop DUSEL Science Programs
  - Project would undergo NSF and DOE (CD) review protocols
- **Long Baseline Neutrino Experiment**
  - FNAL (Lead Lab & Beam-lines)
  - BNL (Detector)
  - Project Coordination Group Established

# DUSEL Research Association (DuRA)

- **Model based on traditional User-facility**
  - Scientifically driven peer-based experiment selection and monitoring
  - Open Membership in a users' organization
  - Representative Leadership of the scientific collaborations to laboratory management
  - Draft Charter is included in your public folders
- **DUSEL Research Executive Committee**
  - runs the DuRA on a day-to-day basis
  - elected from the Membership of DuRA
  - propose that DEDC run DuRA for 1 year

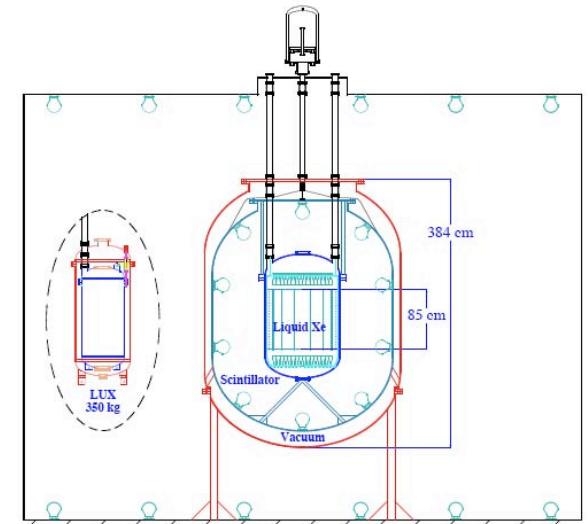
# Scientific Program Committees

- **Sanford Lab PAC**
  - will continue to oversee Sanford Science Efforts (early program)
- **DUSEL Scientific PAC**
  - to reflect the even more diverse science programs at DUSEL
  - to reflect the international participation in DUSEL
  - created to provide scientific, technical, cost, schedule and management advice to the DUSEL directorate

# S-4 (ISE) Notice of Intent to Fund - Progress in Developing ISE Candidates

- Physics

- EXO (DBD) - Gratta (Stanford)
- GE1T (DBD) - Wilkerson (UNC)
- MAX (DM) - Galbiati (Princeton)
- LZ20 (DM) - Shutt (Case Western)
- GEODM (DM) - Golwala (Caltech)
- COUPP (DM) - Collar (Chicago)
- LBNE (Long Baseline) - Svoboda (UCD)
- DIANA (Nuclear Astro) - Wiescher (Notre Dame)
- (F)AARM (Low Background) - Cushman (Minnesota)



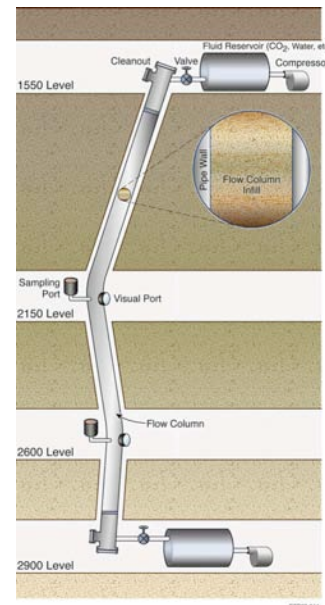
# S-4 (ISE) Notice of Intent to Fund - Progress in Developing ISE Candidates

- **Bio/Geo/Eng**

- Transparent Earth - Glaser (UCB)
- Fiber Optic Array - Wang (Wisconsin)
- Fault Rupture - Germanovich (Georgia Tech)
- THMC (coupled processes) - Sonnenthal (UC/LBNL)
- CO<sub>2</sub> (Sequestration) - Peters (Princeton)
- EcoHydro - Boutt (U. Mass)
- Monitoring - Bobet (Purdue)

- **Anticipate additional Proposals in all Disciplines**

- e.g. DOE funded efforts likely



# Scientific Program - other known efforts

## **Physics**

Long Baseline Nus (LAr)

Bonnie Fleming - Yale

N-Nbar (vertical shaft)

Yury Kamyshev - U. Tenn

Atomic Interferometry (vertical shaft)

Mark Kasevitch - Stanford

Gaseous TPCs (DM and DBD)

Dave Nygren - LBNL

Gabriella Sciolla - MIT

Dinesh Loomba - U New Mexico

CLEAN (DM + Solar nu)

Hime - LANL

## **BGE**

Seismic Arrays

Gary Pavlis - U. Indiana

## **DUSEL EIP**

Majorana Demonstrator (DBD)

Wilkerson - UNC

Elliott - LLNL

LUX (DM)

Gaitskell - Brown

Shutt - Case

LUX + Zeplin-3 -- LZS (DM)

SD 2010 - Center (u/g xtal production)

Mei - USD

Seismic Arrays

Roggenthen - SDSM&T

Glaser - UCB

Bio sampling

Anderson - BHSU

Hydrochemistry

Stetler - SDSMT

Characterization Efforts

Mei - USD

Grey - Regis

Smith - LBL

DUGL (Gravity Wave)

DeSalvo - Caltech

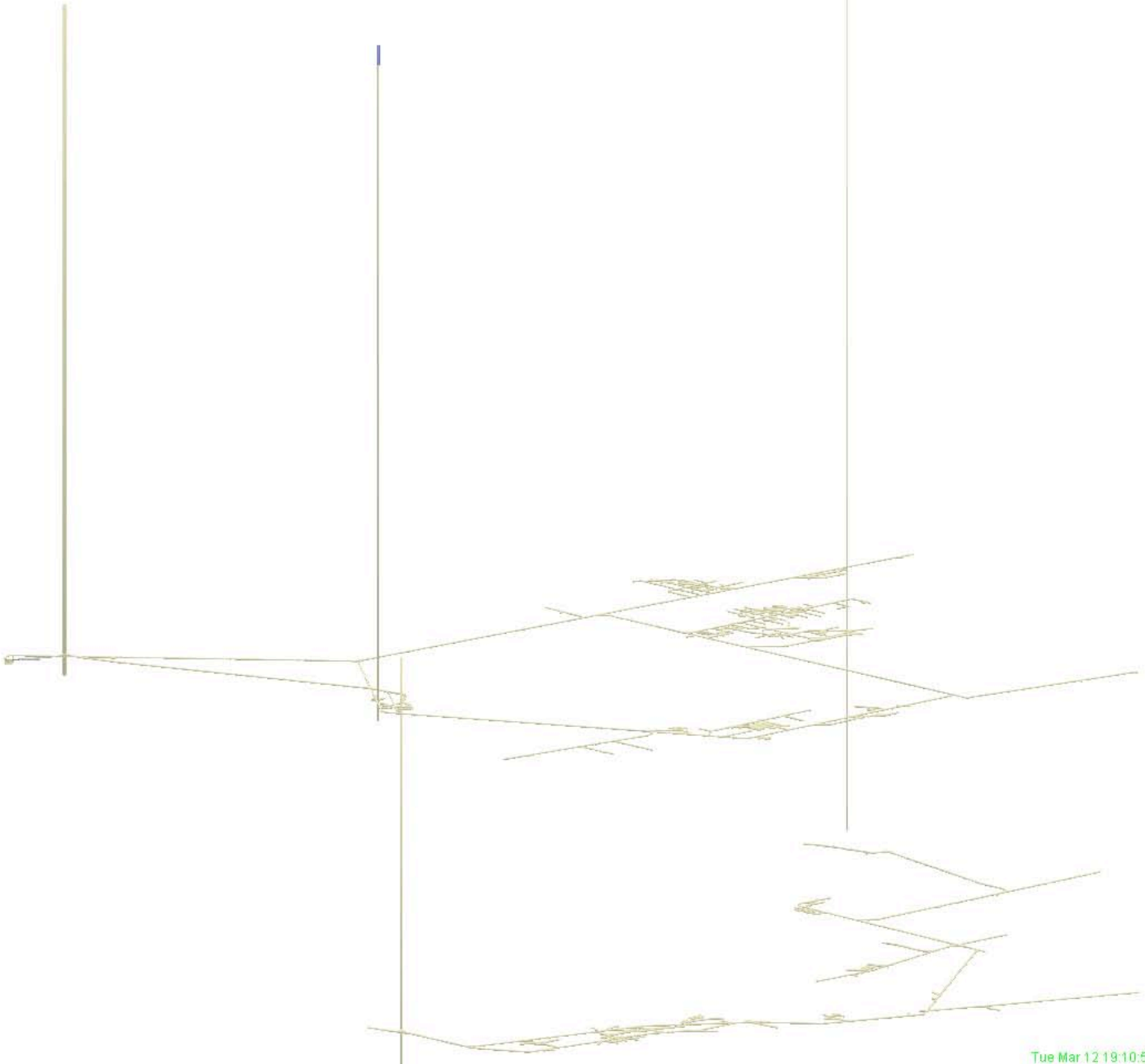
# Overview of Current Contracts

- Site assessment contracts initiated under limited funding to reduce risk
  - Selection process considered each firm's capacity perform design as well
- Three assessment contracts awarded (prime listed)
  - January 2009 – Geotechnical Engineering Services – **RESPEC**
  - March 2009 – Underground Infrastructure – **ARUP**
  - April 2009 - Surface Campus Infrastructure – **HDR CUH2A**
- Four contracts in negotiations for preliminary design; Currently adjusting scope, schedules, and deliverables to address deferred design funding
  - Underground Infrastructure – **ARUP** (amendment)
  - Surface Campus Infrastructure – **HDR CUH2A** (amendment)
  - Excavation Design – **Golder Associates** (new contract)
  - Underground Laboratory Design – **ARUP** (new contract)

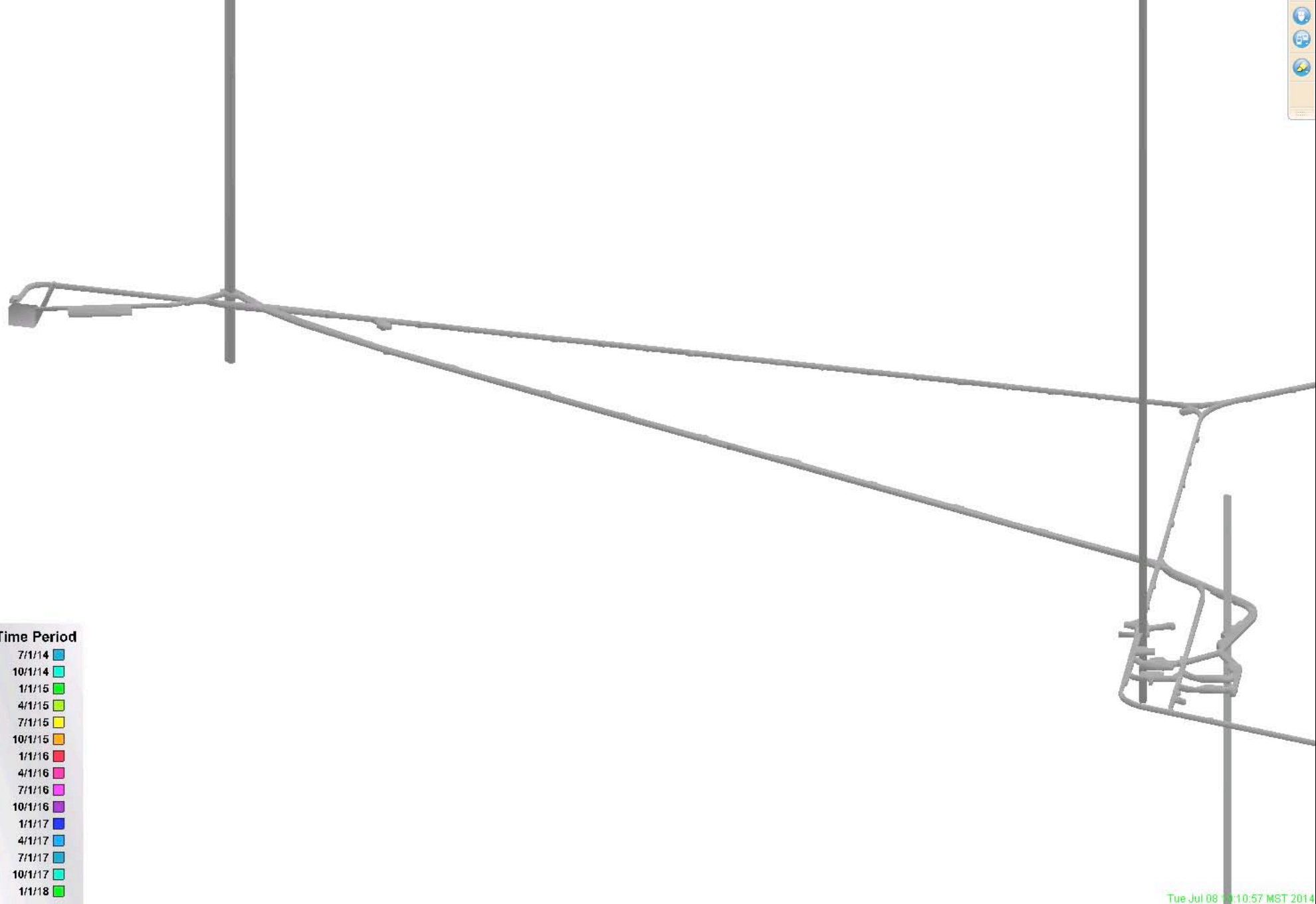
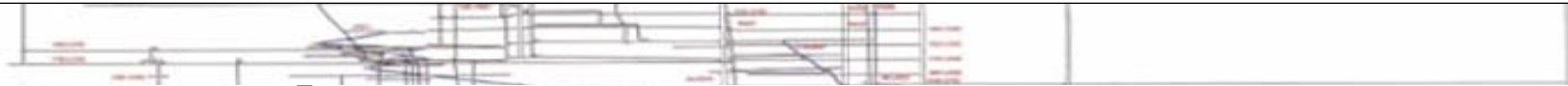




Activity Type	
Rehab Ross (RR)	Blue square
Rehab Yates (RY)	Cyan square
Rehab No 5 (R5)	Teal square
Rehab No 6 (R6)	Light blue square
Raise No 8 (R8)	Green square
Raise General (RG)	Yellow square
Slash 26X23 (S26)	Pink square
Development 26X23 (D26)	Purple square
Development 16X16 (D16)	Light grey square
Development 40X32 (D40)	Brown square
Large Cavern Benches (LCB)	Red square
Lab Module (LM)	Orange square
asbuilts (AS)	White square



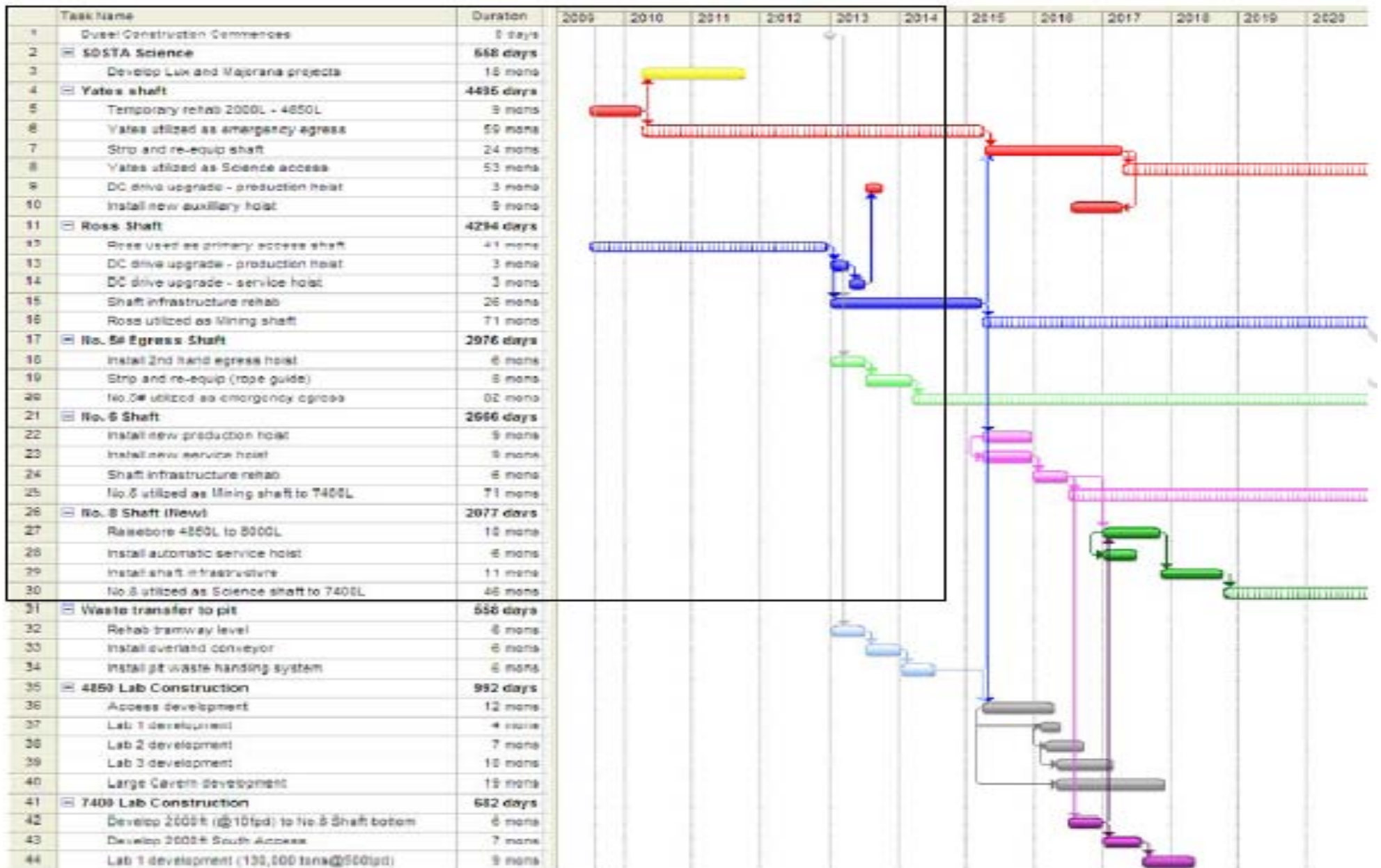
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**Time Period**

- 7/1/14 ■
- 10/1/14 ■
- 1/1/15 ■
- 4/1/15 ■
- 7/1/15 ■
- 10/1/15 ■
- 1/1/16 ■
- 4/1/16 ■
- 7/1/16 ■
- 10/1/16 ■
- 1/1/17 ■
- 4/1/17 ■
- 7/1/17 ■
- 10/1/17 ■
- 1/1/18 ■

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# Goals of the Meeting

- **Introduce timelines and process**
  - MREFC Requirements and Milestones
- **Communications**
  - among collaboration members
  - between collaborations and DUSEL team
  - introduce tools
- **Establish Fundamental Requirements**
  - who (to talk to)
  - where (in Homestake you want to deploy)
  - when (you envision being ready)
  - what (you want to deploy)
  - 10 minute summary from each WG