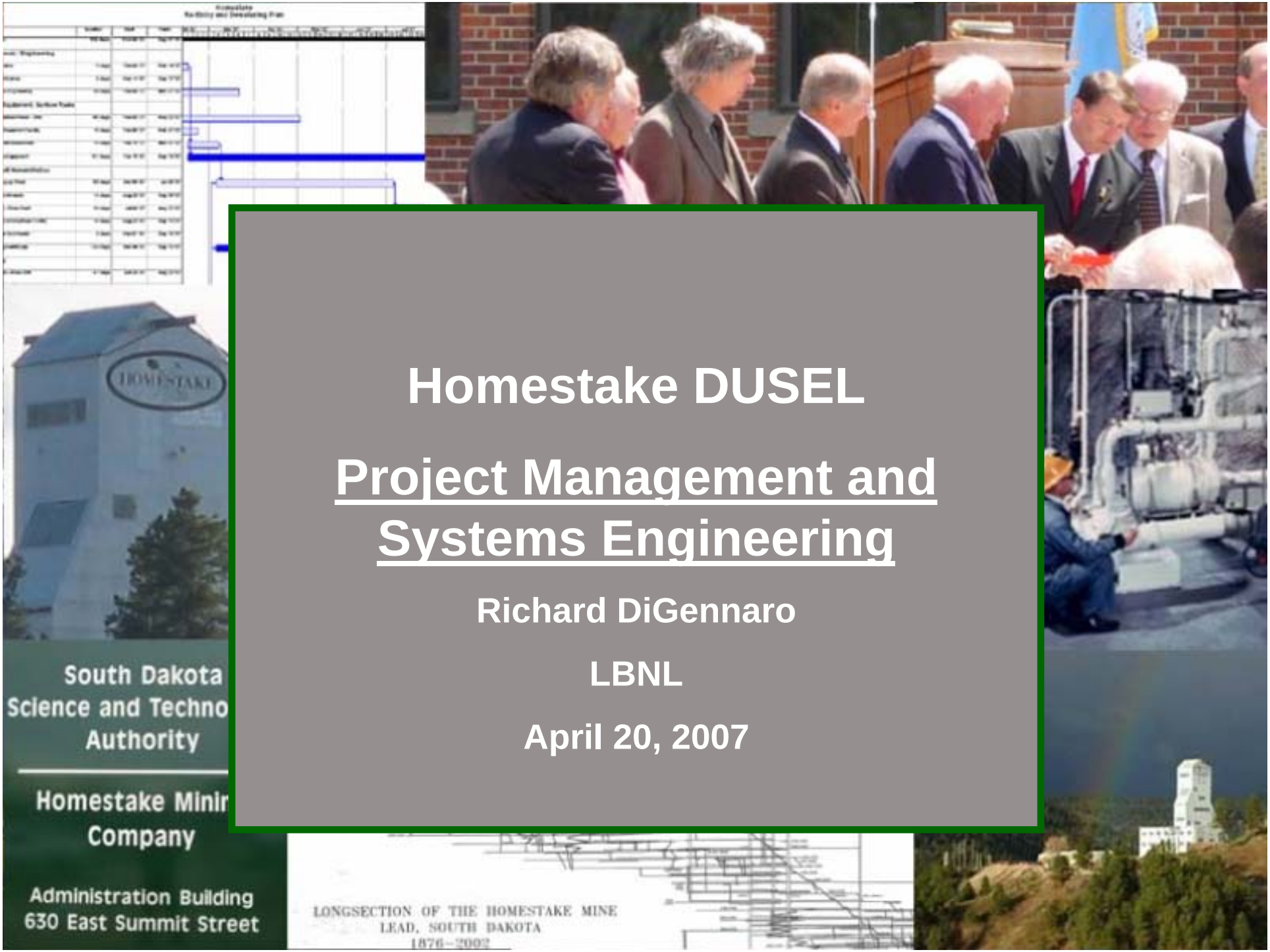


Homestake DUSEL

Project Management and Systems Engineering

Richard DiGennaro

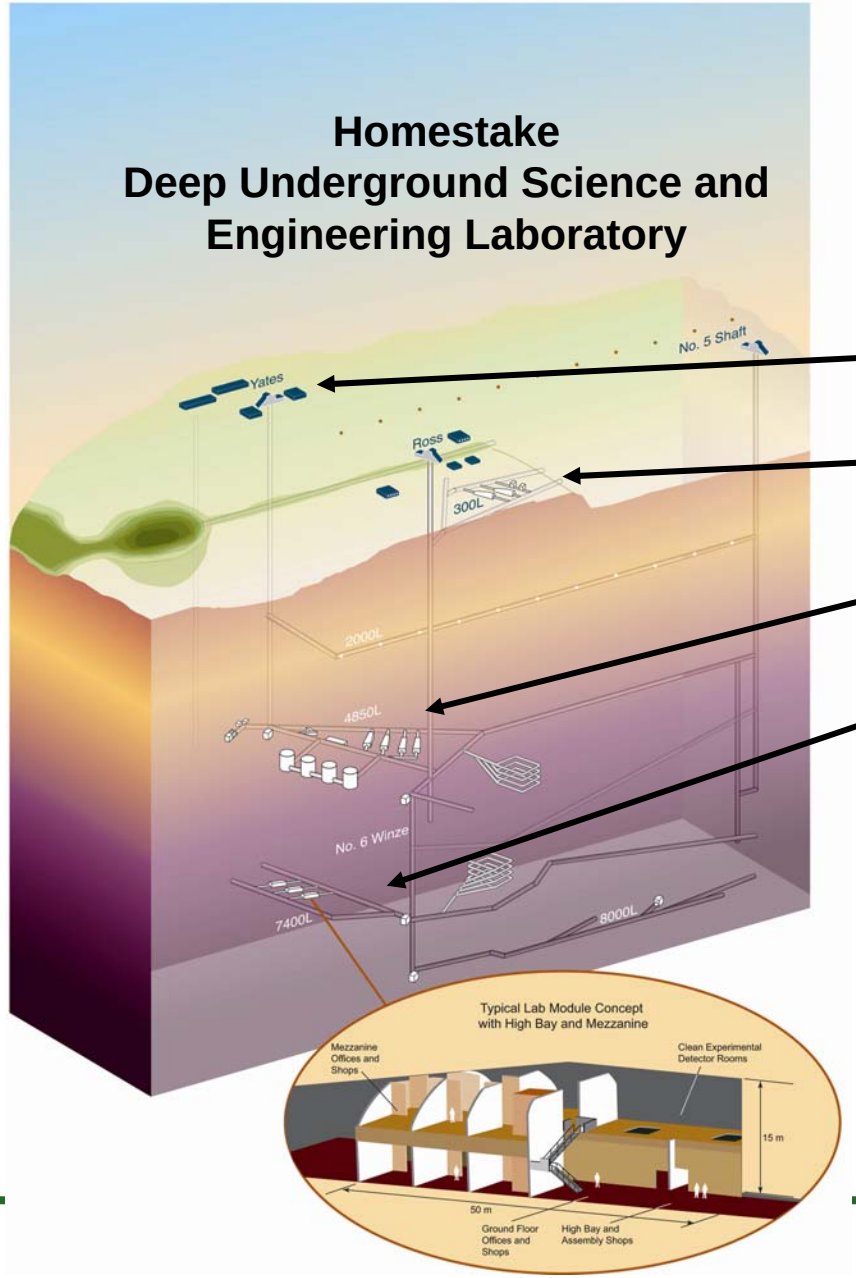
LBNL

April 20, 2007

Project Development Planning: Presentation Topics

- DUSEL Campus Development Plan
- Institutional Responsibilities and Sub-project Teams
- Basis of Estimates for the Conceptual Design
- Systems Engineering Toolkit
- Estimated Cost Summary and Scope Options
- Project and Operations Organizational Structures
- Staffing Plans

DUSEL Campus Development Summary



Conceptual plan to develop four primary campus locations for research:

1. Surface campus at Yates Complex
2. Near-surface campus at 300 Level
3. Mid-level campus at 4850 Level
4. Deep-level campus at 7400 Level

Infrastructure will be maintained for access to additional, selected levels for bio- and geo- sciences and for unique experiments that require specific or isolated sites.

Phased Development Plan

Construction during 2008 to 2010 will provide space for early experiments, followed by ~5 ½ years of phased construction for DUSEL with project completion in 2015.

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**		

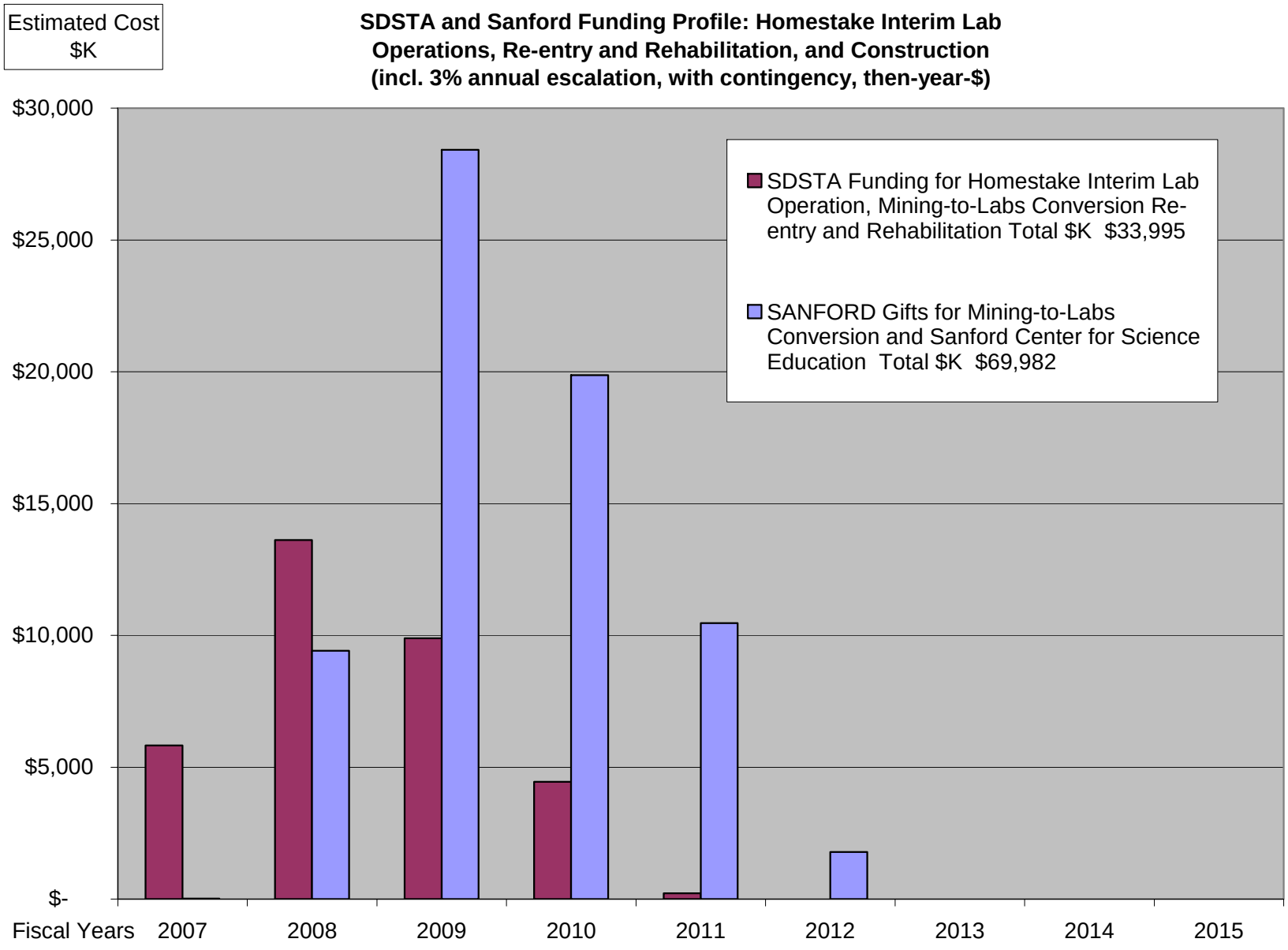
Institutional Responsibilities and Sub-project Teams

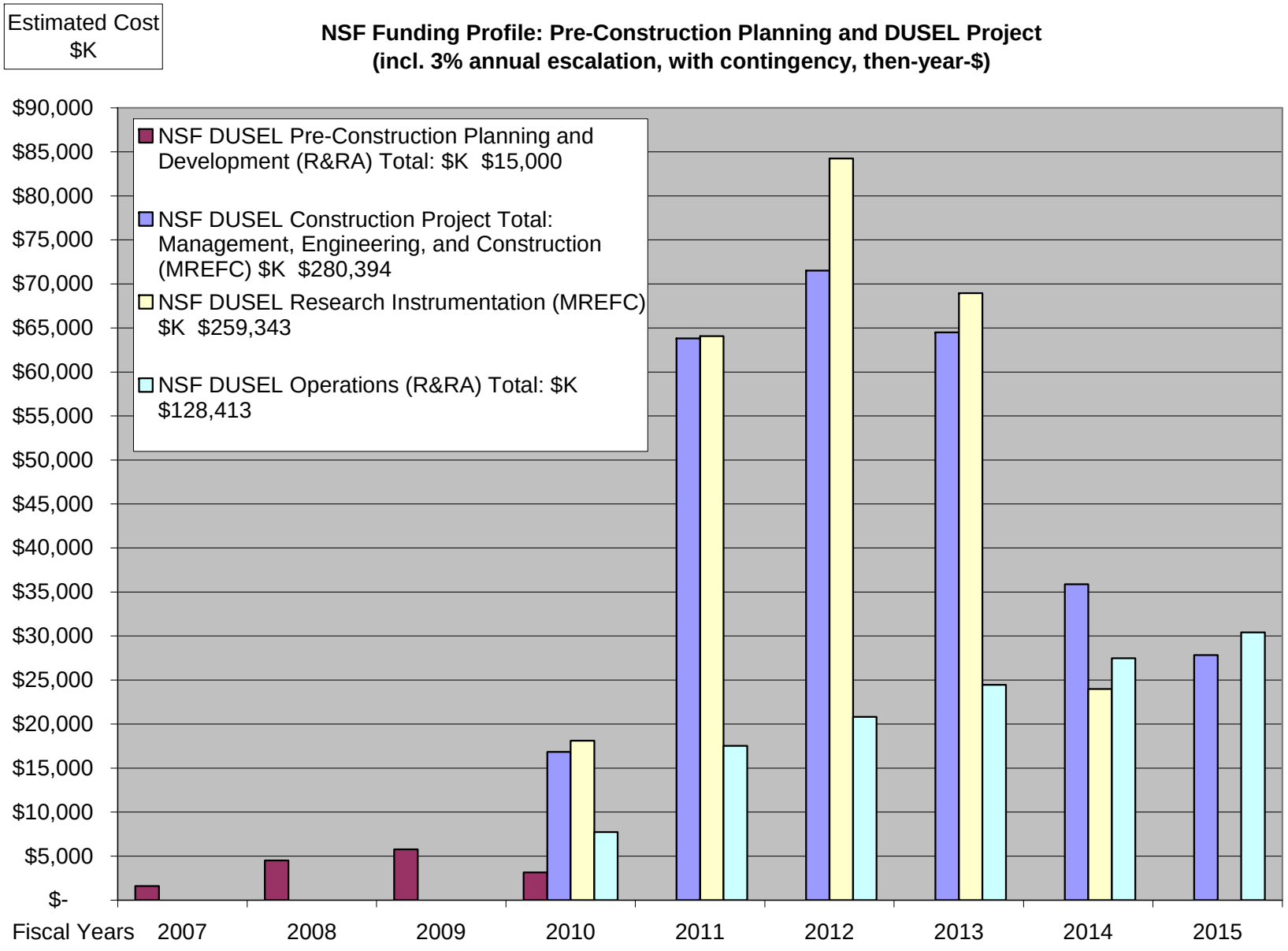
Institution	Sub-project Teams
U.C. Berkeley, Lawrence Berkeley National Laboratory, South Dakota School of Mines and Technology and Homestake Scientific Collaboration	Science and Engineering Research Program Development
	Environment, Health and Safety Oversight
	Education and Outreach Program Development
Lawrence Berkeley National Laboratory	Project Management and Project Controls
	Systems Engineering (requirements, risk and value management; interfaces and systems integration; validation)
	Underground Labs: Detailed engineering design and coordination with research program requirements
	Research Equipment and Experimental Instrumentation: engineering and design support
South Dakota Science and Technology Authority and South Dakota School of Mines and Technology	Environment, Health and Safety Management
	Facility Management, Site Services and Site Operations
	Mining-to-Labs Conversion: Re-entry and infrastructure rehabilitation
	Underground Labs: Construction management, commissioning, and installation of research instrumentation
	New excavation, underground facility infrastructure and services construction management, inspection, quality assurance, and commissioning

Basis of Estimates for the Conceptual Design

- **Re-entry and Rehabilitation for Mining-to-Labs Conversion**
  - DYNATEC Feasibility Study (Syd De Vries, mining engineer)
- **Lab Module Excavation Estimated Costs, Schedule, and Feasibility**
  - Mark Laurenti (consultant, former Homestake mining engineer)
  - Golder Associates (mining engineering consultants)
- **Surface and U/G Laboratory Infrastructure: Parametric estimates**
  - LBNL Engineering and Facilities staff
- **Project Management, Staffing, Engineering and Design, Commissioning**
  - LBNL project experience, parametric and level-of-effort estimates
- **Facility Staffing, Operating Costs, and Risk Assessment:**
  - Homestake and SDSTA experience and derived estimates
  - Golder Associates (mining engineering consultants)
- **DUSEL Research Instrumentation and Experimental Equipment**
  - Science collaboration budgetary estimates, Scope-dependent (TBD)
- **Annual Escalation:** 3% per year; **Preliminary Contingency Analysis:** Range 15% to 30%

Preliminary Cost Profiles by Funding Source	Estimated Project Total Cost (FY07-$, Without Contingency)	Contingency (%)	Estimated Project Total Cost (FY07-$, Incl. Contingency)	TOTAL Escalated Then-Year-$K
	$K	%	$K	$K
SDSTA - Homestake Interim Lab: Re-entry and Operations	$ 26,444	24%	$ 32,702	**$ 33,995**
SANFORD Gifts - Philanthropic Donations	$ 52,371	24%	$ 65,066	**$ 69,982**
SDSTA and SANFORD Gifts Subtotal	**$ 78,815**	24%	**$ 97,767**	**$ 103,977**
NSF - DUSEL Pre-construction planning and development (R&RA)	$ 12,307	16%	$ 14,271	**$ 15,000**
NSF - DUSEL Construction (MREFC)	$ 186,198	28%	$ 237,712	**$ 280,394**
NSF - DUSEL Research Instrumentation and Equipment Budget (MREFC)	$ 223,400	0%	$ 223,400	**$ 259,343**
NSF Subtotal	**$ 421,905**		**$ 475,384**	**$ 554,736**
DUSEL Project Total Estimated Cost	$ 500,720		**$ 573,151**	**$ 658,713**
NSF - DUSEL Pre-operations (R&RA)	**$ 89,680**	**20%**	**$ 107,616**	**$ 128,413**
TOTAL: Homestake Interim Lab, DUSEL PROJECT and OPERATIONS	**$ 590,400**		**$ 680,767**	**$ 787,126**
	FY07-$			Escalated Then-year-$


Estimated Cost
$K
SDSTA and Sanford Funding Profile: Homestake Interim Lab Operations, Re-entry and Rehabilitation, and Construction (incl. 3% annual escalation, with contingency, then-year-$)
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
SDSTA Funding for Homestake Interim Lab Operation, Mining-to-Labs Conversion Re-entry and Rehabilitation Total $K $33,995
SANFORD Gifts for Mining-to-Labs Conversion and Sanford Center for Science Education Total $K $69,982
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015


Estimated Cost
$K
NSF Funding Profile: Pre-Construction Planning and DUSEL Project
(incl. 3% annual escalation, with contingency, then-year-$)
NSF DUSEL Pre-Construction Planning and Development (R&RA) Total: $K $15,000
NSF DUSEL Construction Project Total: Management, Engineering, and Construction (MREFC) $K $280,394
NSF DUSEL Research Instrumentation (MREFC) $K $259,343
NSF DUSEL Operations (R&RA) Total: $K $128,413
$90,000
$85,000
$80,000
$75,000
$70,000
$65,000
$60,000
$55,000
$50,000
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
Fiscal Years
2007
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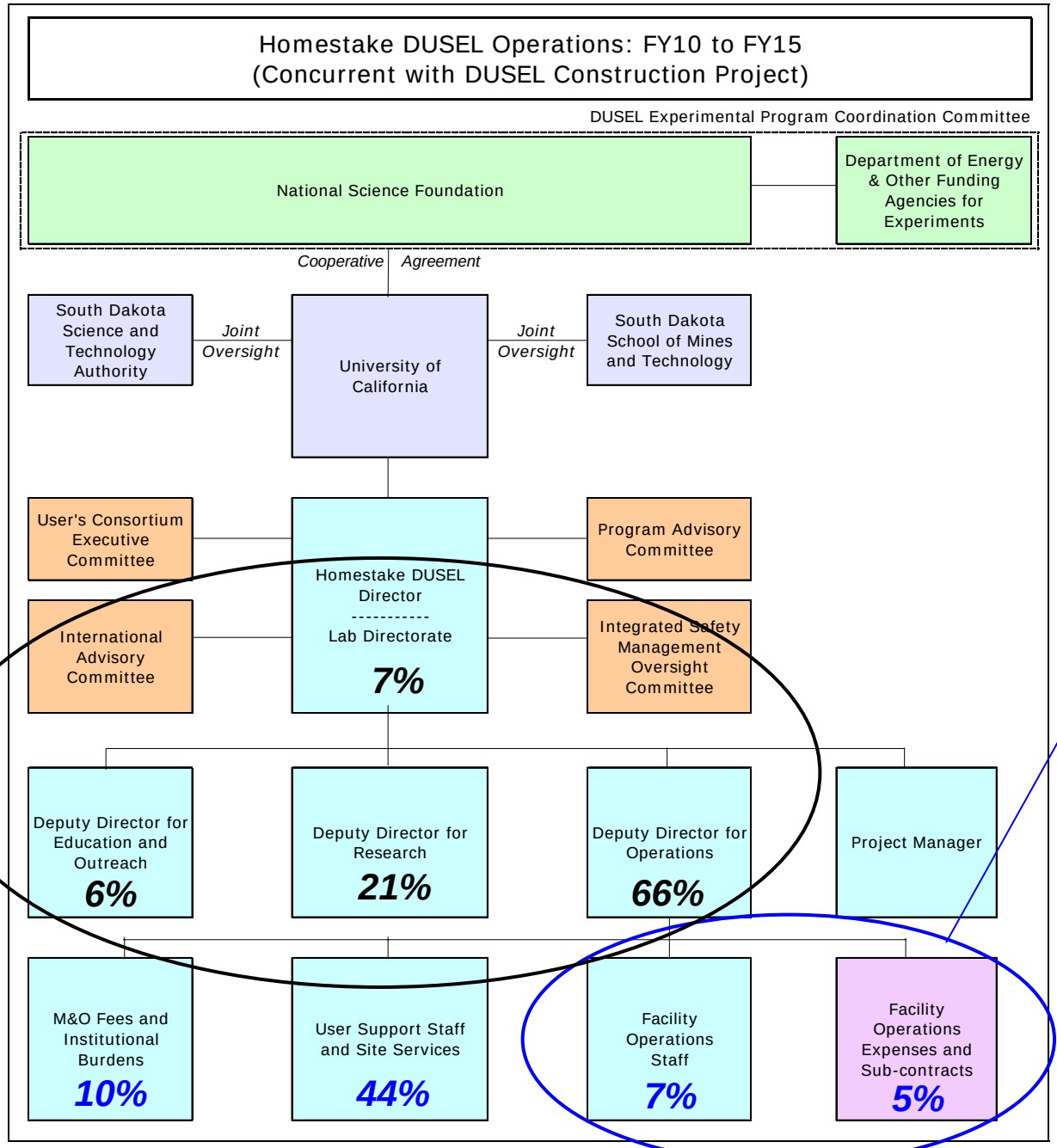
2015

Proposed DUSEL Annual Operating Budget Distribution in FY15 among four directorates



Proposed Annual Budget: ~$25M

(FY07$)

Estimated 12% of the DUSEL Operating Budget is allocated for <u>Facility Costs</u> due to the absence of shared resources with production mining.

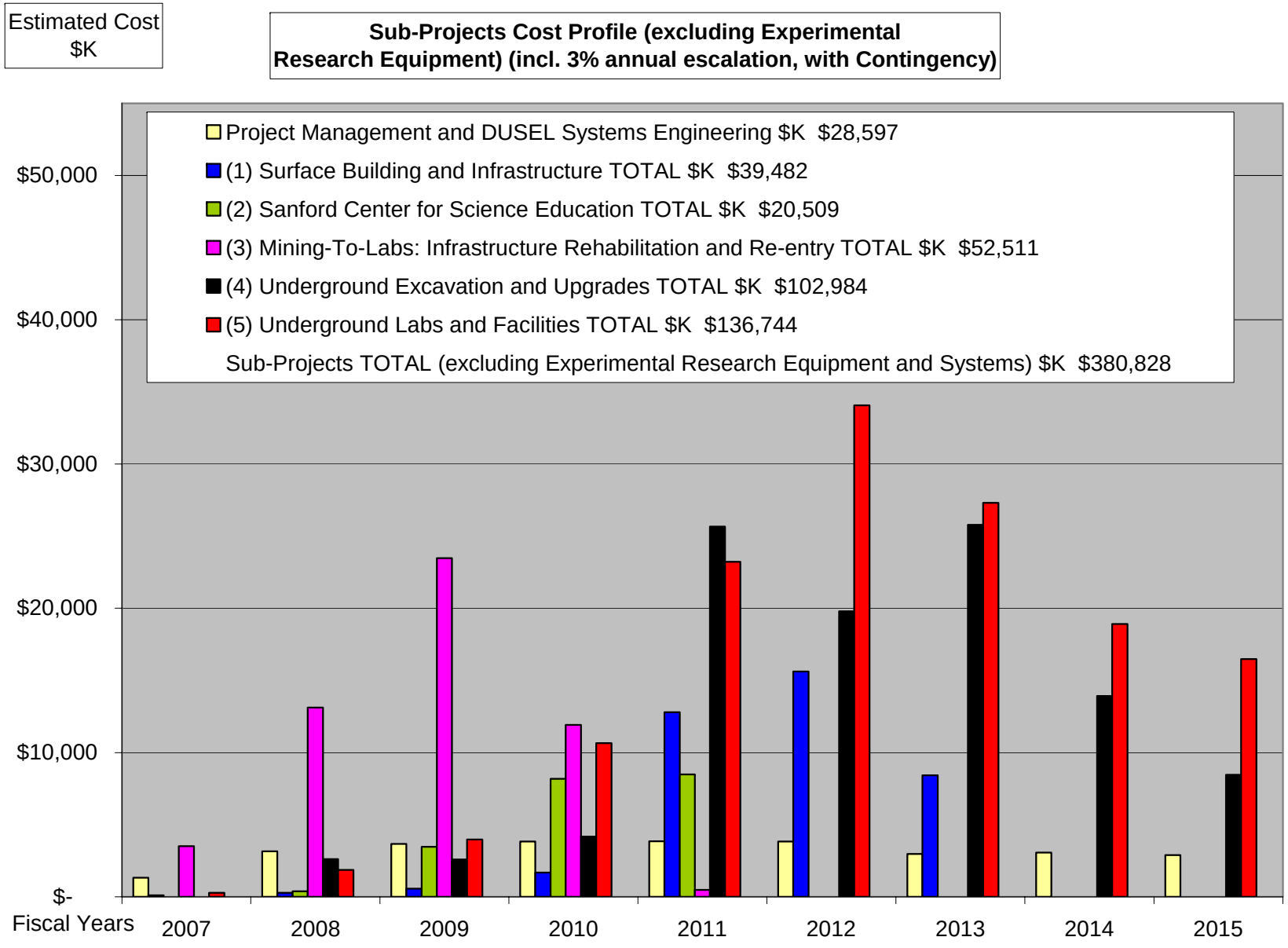
This is a relatively small premium for the advantages of a dedicated site for DUSEL.

~$2.5M - $3M

(FY07$)

	Sub-Project Teams	Organizational Responsibilities for sub-project team leadership and oversight	
		Planning Stages: Design Engineering Oversight	***Implementation Stages: Construction Management***
	HIL and DUSEL Project Management and administrative support	LBNL and SDSTA	LBNL and SDSTA
1	Mining-to-labs (MTL) Infrastructure Rehabilitation for re-entry, alterations and upgrades	SDSTA	SDSTA
2	Surface Infrastructure and Buildings alterations and upgrades for facility operations, site services, and user support	SDSTA	SDSTA
3	Sanford Gift #2: Sanford Center for Science and Education	SDSTA	SDSTA
4	U/G Excavation for development of laboratory space	SDSTA	SDSTA
5	U/G Common Facilities and Infrastructure, Experimental Laboratory Outfitting for Utilities and Services	LBNL	SDSTA
6	Science and Engineering Research Programs Development, Coordination, and Oversight	LBNL	LBNL
	Pre-Operations and Operations	SDSTA	SDSTA

Preliminary Cost Profiles by Subproject (Combined funding from all sources)	Estimated Project Total Cost (FY07-$, Without Contingency)	Contingency (%)	Estimated Project Total Cost (FY07-$, Incl. Contingency)	Cost Distribution	TOTAL Escalated Then-Year-$K
	$K	%	$K	%	$K
Homestake Interim Lab and DUSEL Subprojects					
1. Mining-to-Labs Conversion: Facility Rehabilitation, Re-entry, and Construction	$ 39,860	25%	$ 49,802	15%	**$ 52,511**
2. Surface Buildings and Infrastructure: Alterations and upgrades for facility operations, site services, and user support	$ 25,677	29%	$ 33,097	10%	**$ 39,482**
3. Sanford Center for Science Education	$ 15,562	20%	$ 18,660	6%	**$ 20,509**
4. Underground Excavation for development of laboratory space and common facilities	$ 68,319	29%	$ 88,253	27%	**$ 102,984**
5. Underground Laboratories: Facilities and Infrastructure, Utilities and Services for Research Laboratories	$ 90,995	28%	$116,846	35%	**$ 136,744**
Project Support (Management and Staff)	$ 22,315	14%	$ 25,347	8%	**$ 28,597**
Subtotal: HIL and DUSEL Subprojects	**$ 262,727**	26%	**$332,004**	**100%**	**$ 380,828**
BUDGET for Science and Engineering Research: Experimental Systems and Research Equipment Design, Construction, and Installation	$ 223,400		$223,400		**$ 259,343**
HIL and DUSEL Project Total Estimated Cost	$ 486,127		$555,404		**$ 640,171**


Estimated Cost
$K
Sub-Projects Cost Profile (excluding Experimental Research Equipment) (incl. 3% annual escalation, with Contingency)
Project Management and DUSEL Systems Engineering $K $28,597
(1) Surface Building and Infrastructure TOTAL $K $39,482
(2) Sanford Center for Science Education TOTAL $K $20,509
(3) Mining-To-Labs: Infrastructure Rehabilitation and Re-entry TOTAL $K $52,511
(4) Underground Excavation and Upgrades TOTAL $K $102,984
(5) Underground Labs and Facilities TOTAL $K $136,744
Sub-Projects TOTAL (excluding Experimental Research Equipment and Systems) $K $380,828
$50,000
$40,000
$30,000
$20,000
$10,000
$-
Fiscal Years
2007
2008
2009
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2014
2015

Scope Options for Construction

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	
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Total	**277,607**	**25,790**	**223,599**	**170,852**		

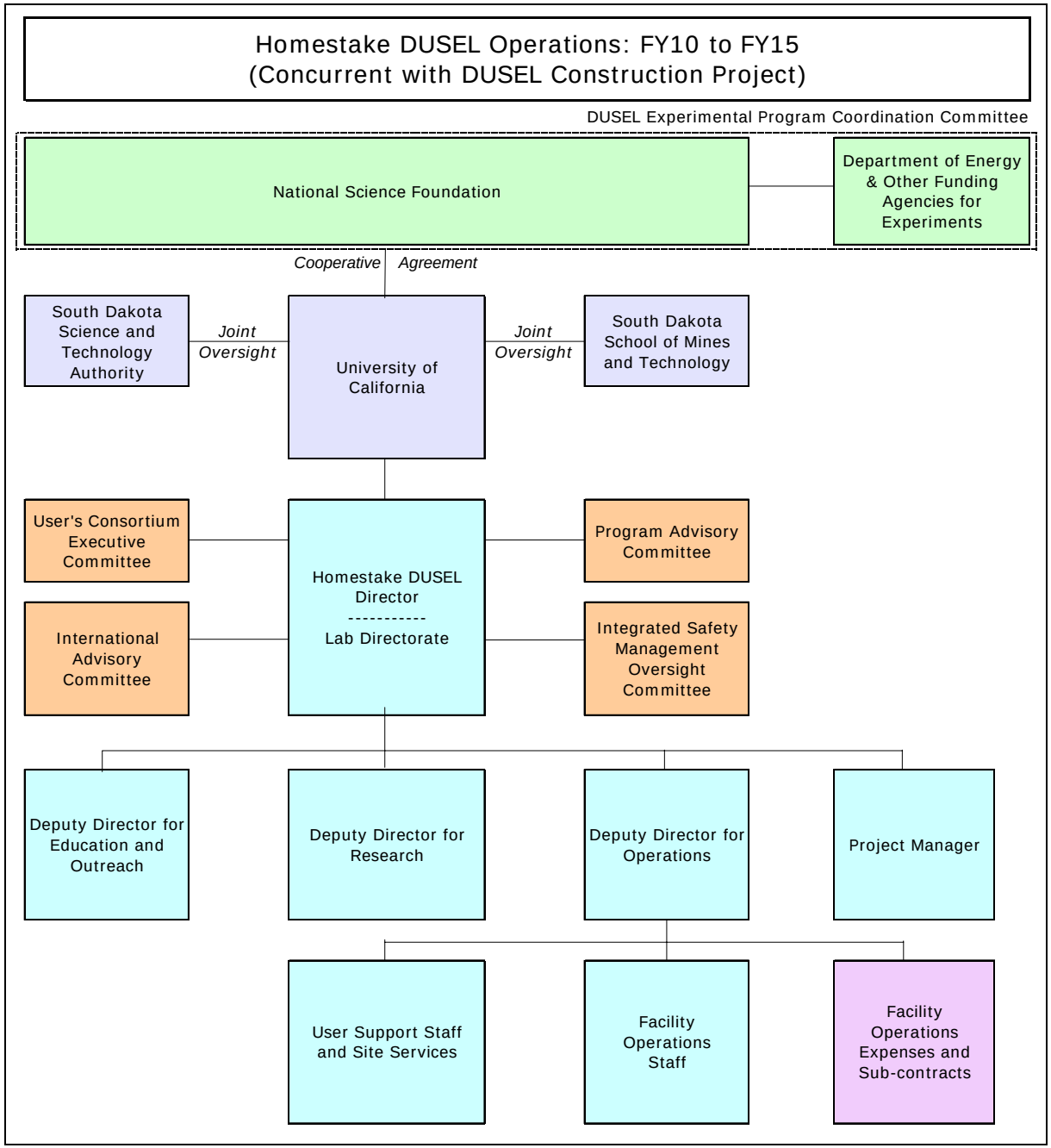
Systems Engineering Toolkit

Objective: Implement a unified approach to Systems Engineering and Project Management

- Communication
- Requirements Management Database
- Continuous Risk Management
- Work Breakdown Structure, Subsystem Interface Management
- Integrated Safety Management
- Design-Reviews, Integration, and Performance Management
- Value Management
- Configuration Management and Change Control
- Project Controls: Earned Value Management System

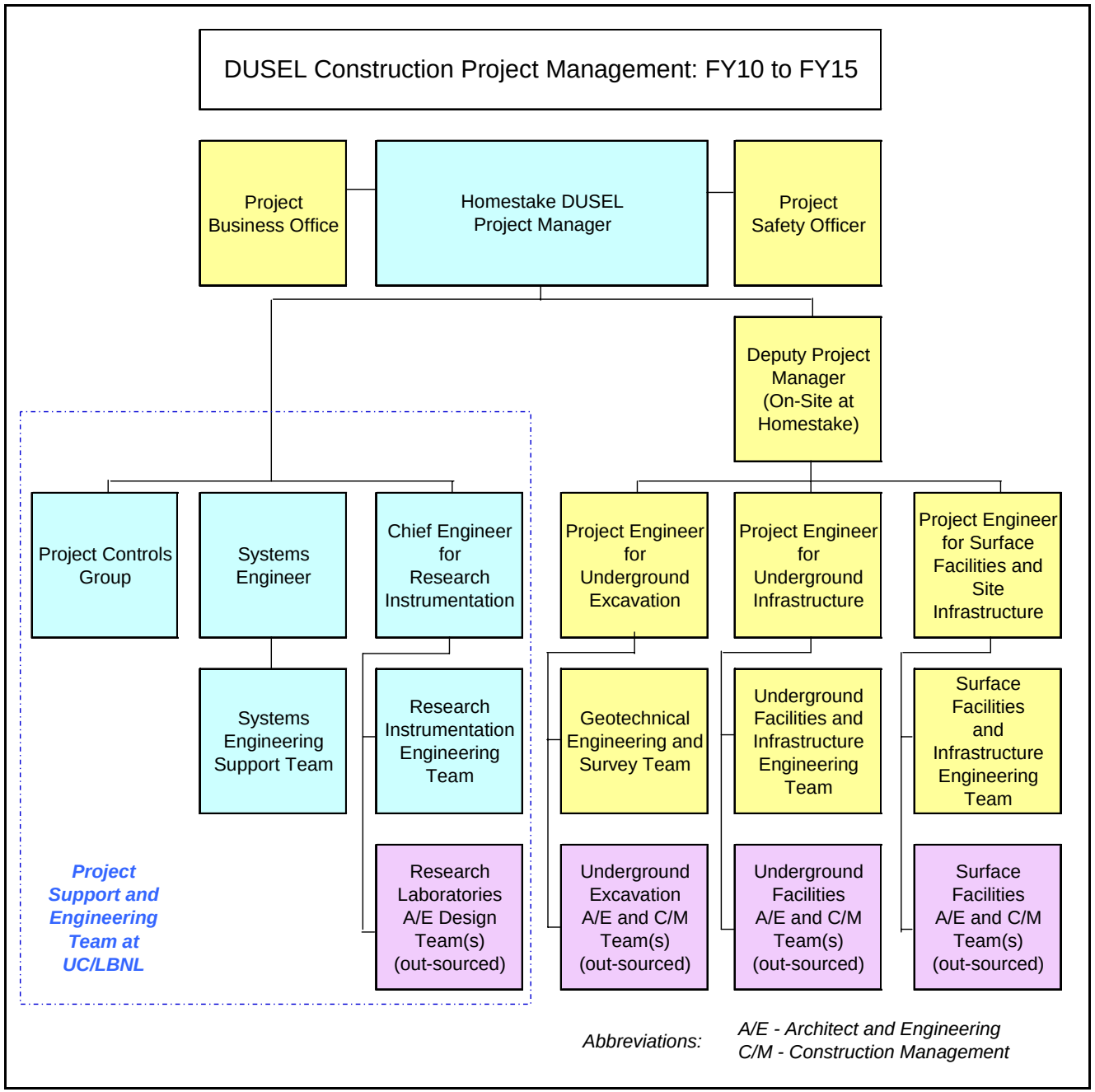
DUSEL Operations FY10 to FY15

Proposed management organizational structure

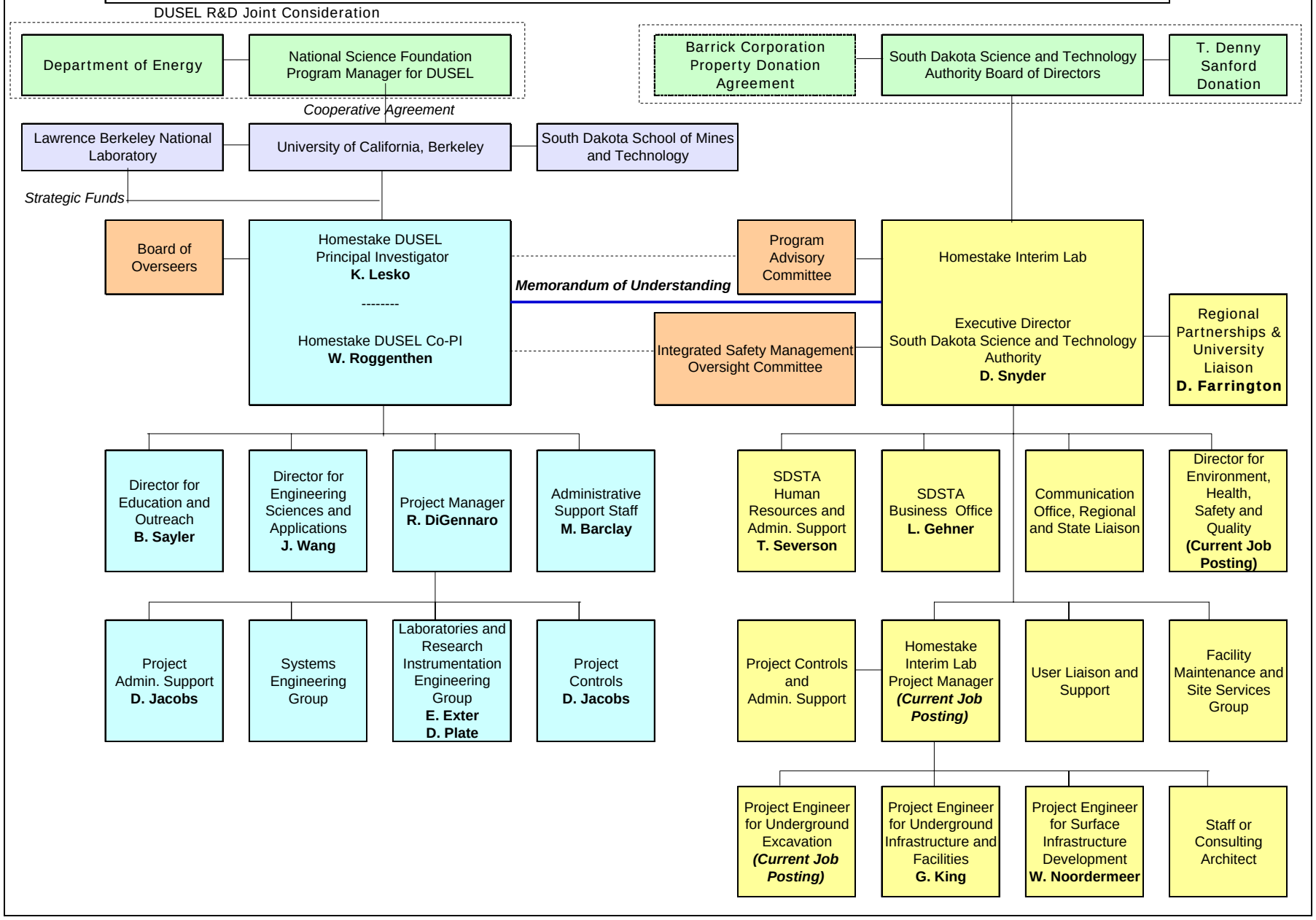


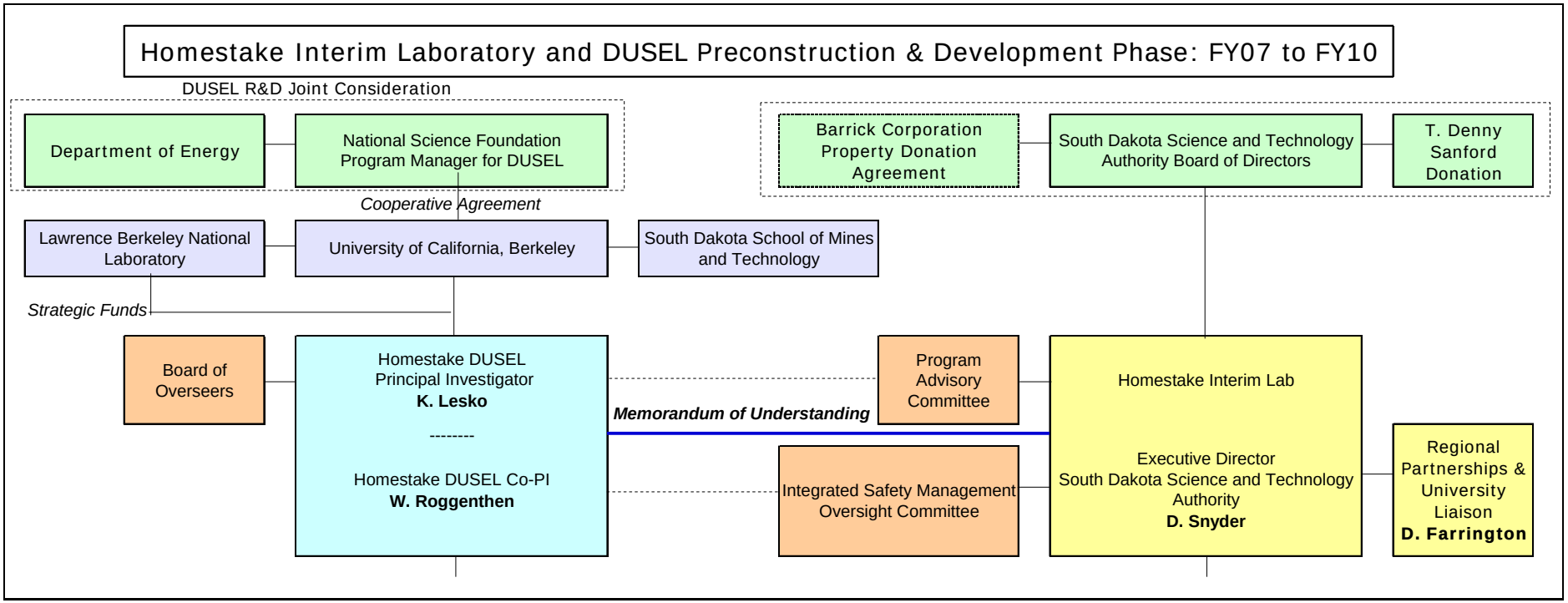
DUSEL MREFC Project FY10 to FY15

Proposed management organizational structure



Homestake Interim Laboratory and DUSEL Preconstruction & Development Phase: FY07 to FY10





SDSTA Board of Directors:

Dave Bozied (chair)
Steve Zellmer (co-chair)
Casey Peterson
Pat Lebrun
Thomas Adam

Board of Overseers:

Baha Balantekin
Brian McPherson
Tullis Onstott
Nick Samios
John Schiffer
Nicholas Sitar

Program Advisory Committee:

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

Integrated Safety Management Oversight Committee

Martha White (Chair, acting)
Zbigniew (Ziggy) Hladysz

(Additional members TBD)

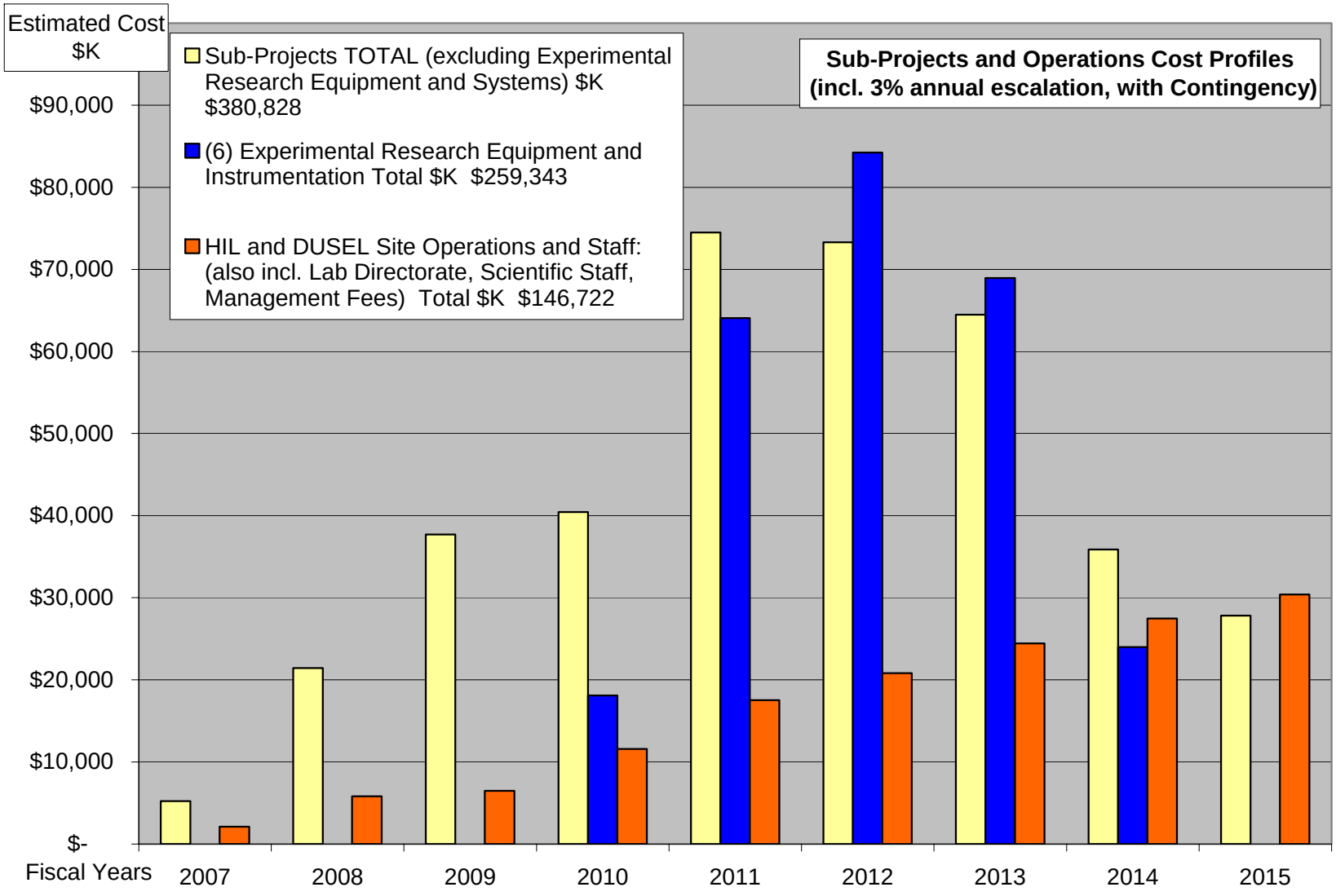
Director of EH&S (ex officio)

DUSEL Staffing Plans Summary: FY10 to FY15

	Site	FTE					
DUSEL Operations Staffing Plan (NSF - R&RA) Concurrent with on-going construction project FY10-FY15	**Homestake**	**FY10 Q3,Q4**	**FY11**	**FY12**	**FY13**	**FY14**	**FY15**
DUSEL Laboratory Directorate		2.5	4.0	5.0	6.0	7.0	8.0
Science and Engineering Research Programs		6.0	20.0	24.0	35.0	35.0	38.0
Education & Outreach, Training, and Research Partnerships		1.8	5.0	7.0	8.0	10.0	11.0
Facility Operations, User Support, and Site Services Staff		21.9	48.8	59.3	65.3	73.8	79.8
DUSEL Operations Staff FTE		**32.1**	**77.8**	**95.3**	**114.3**	**125.8**	**136.8**
DUSEL Project Staffing Plan (NSF - MREFC) FY10-FY15							
WBS 1.1 Project Management and Staff Support	UC/LBNL	2.0	4.0	4.0	3.5	3.5	3.5
	Homestake	3.0	7.0	7.0	6.0	6.0	6.0
WBS 1.2 Systems Engineering Staff	UC/LBNL	1.0	2.0	2.0	1.0	1.0	-
	Homestake	1.3	3.5	3.5	3.0	3.0	3.0
WBS 1.4 Facilities and Infrastructure Engineering Staff	Homestake	5.8	12.0	11.0	10.0	8.0	3.0
WBS 1.5 Laboratories and Research Instrumentation Engineering	UC/LBNL	3.0	7.5	9.0	9.0	9.0	7.0
WBS 1.6 Construction Management and Contract Coordination	Homestake	1.8	4.0	4.0	4.0	3.0	3.0
DUSEL Project Staff FTE		**17.8**	**40.0**	**40.5**	**36.5**	**33.5**	**25.5**
DUSEL Combined Operations and Project Staff FTE		**49.9**	**117.8**	**135.8**	**150.8**	**159.3**	**162.3**

Supplementary Slides:

Estimated Cost Profiles
Proposed Construction Schedule
Risk Management Methodology


Estimated Cost $K
Sub-Projects TOTAL (excluding Experimental Research Equipment and Systems) $K $380,828
(6) Experimental Research Equipment and Instrumentation Total $K $259,343
HIL and DUSEL Site Operations and Staff: (also incl. Lab Directorate, Scientific Staff, Management Fees) Total $K $146,722
Sub-Projects and Operations Cost Profiles (incl. 3% annual escalation, with Contingency)
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$-
Fiscal Years
2007
2008
2009
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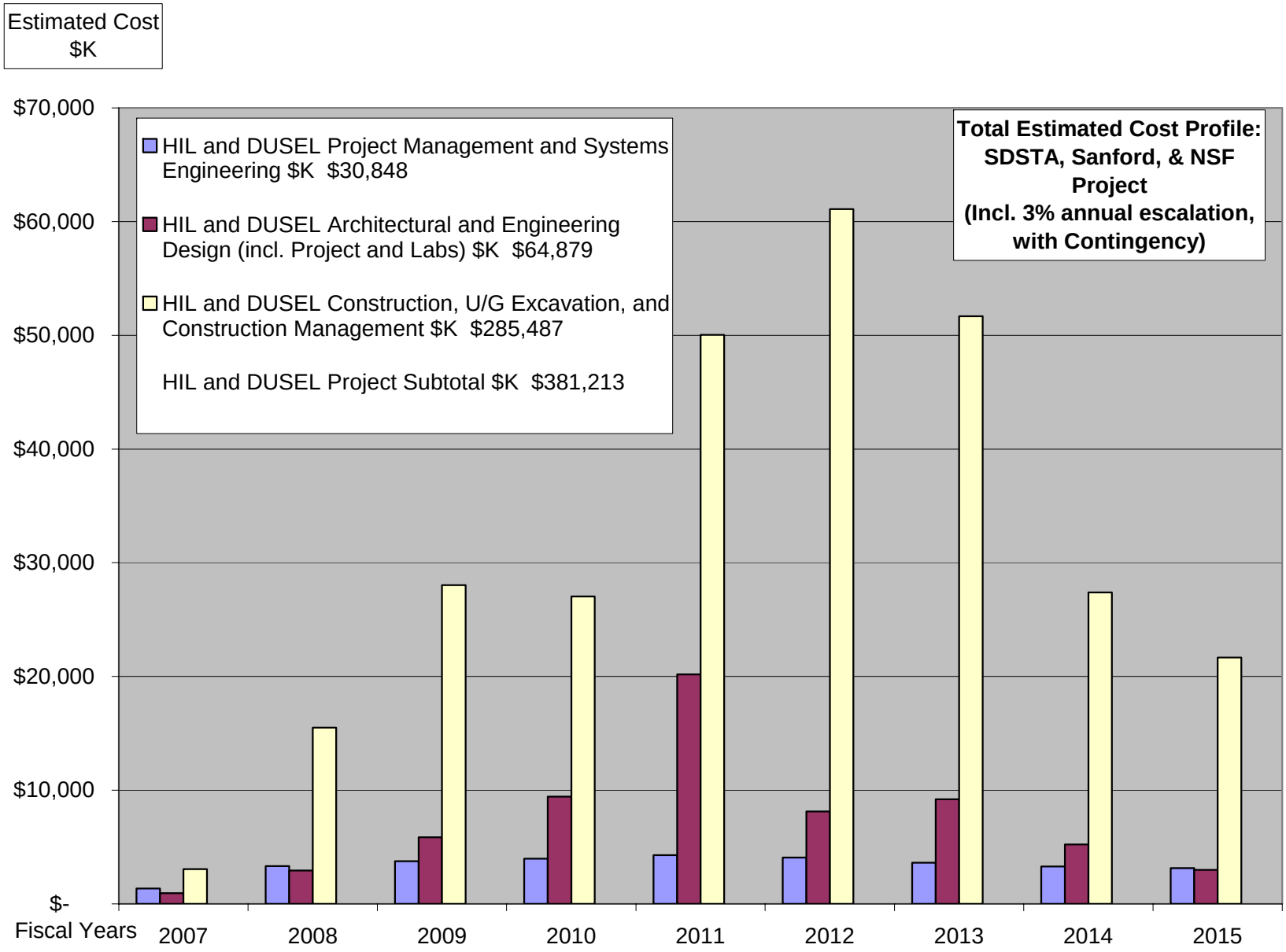
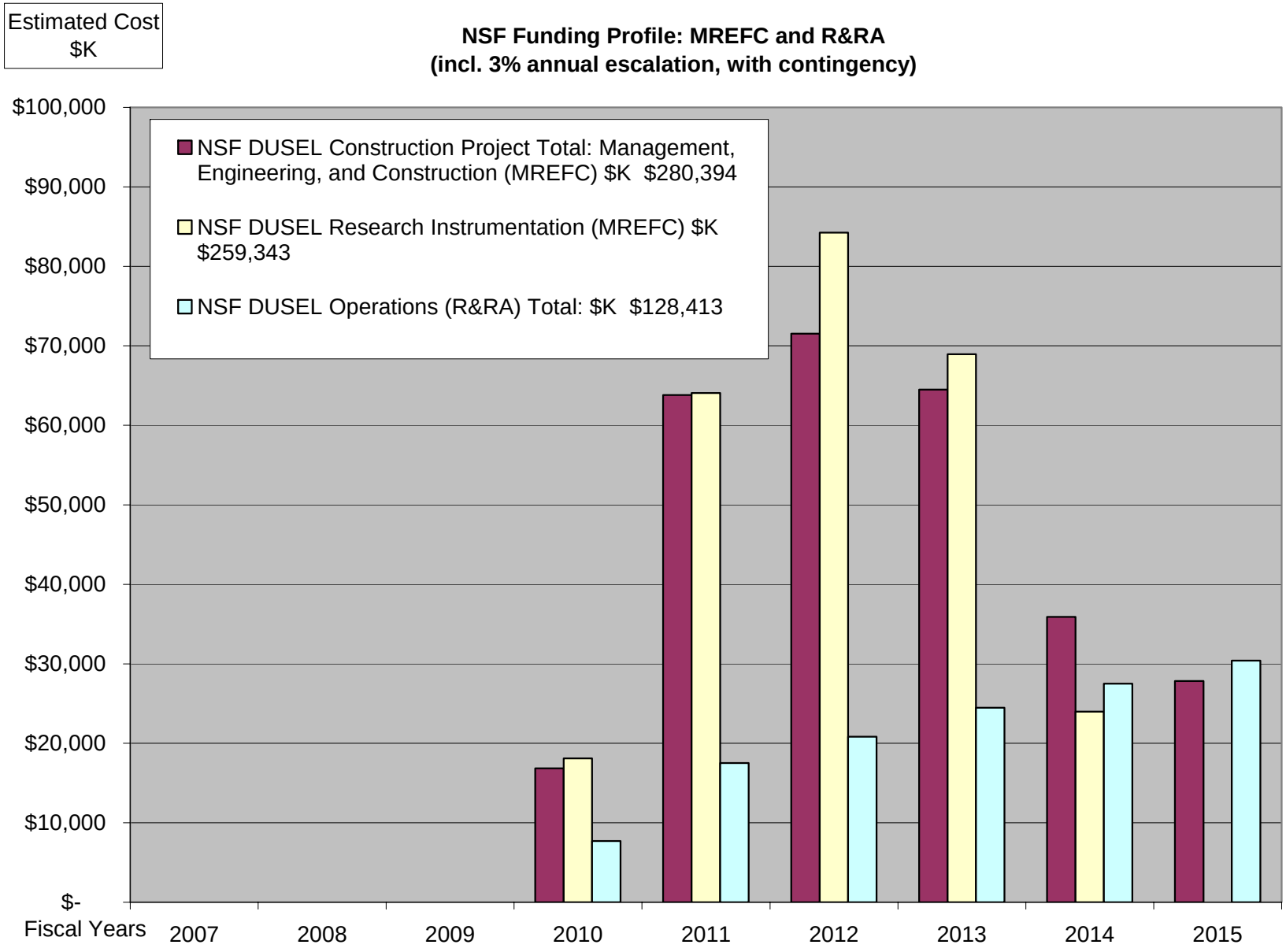

Estimated Cost
$K
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$-
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015
HIL and DUSEL Project Management and Systems Engineering $K $30,848
HIL and DUSEL Architectural and Engineering Design (incl. Project and Labs) $K $64,879
HIL and DUSEL Construction, U/G Excavation, and Construction Management $K $285,487
HIL and DUSEL Project Subtotal $K $381,213
Total Estimated Cost Profile: SDSTA, Sanford, & NSF Project
(Incl. 3% annual escalation, with Contingency)


Estimated Cost
$K
NSF Funding Profile: MREFC and R&RA
(incl. 3% annual escalation, with contingency)
$100,000
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$-
NSF DUSEL Construction Project Total: Management, Engineering, and Construction (MREFC) $K $280,394
NSF DUSEL Research Instrumentation (MREFC) $K $259,343
NSF DUSEL Operations (R&RA) Total: $K $128,413
Fiscal Years
2007
2008
2009
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2011
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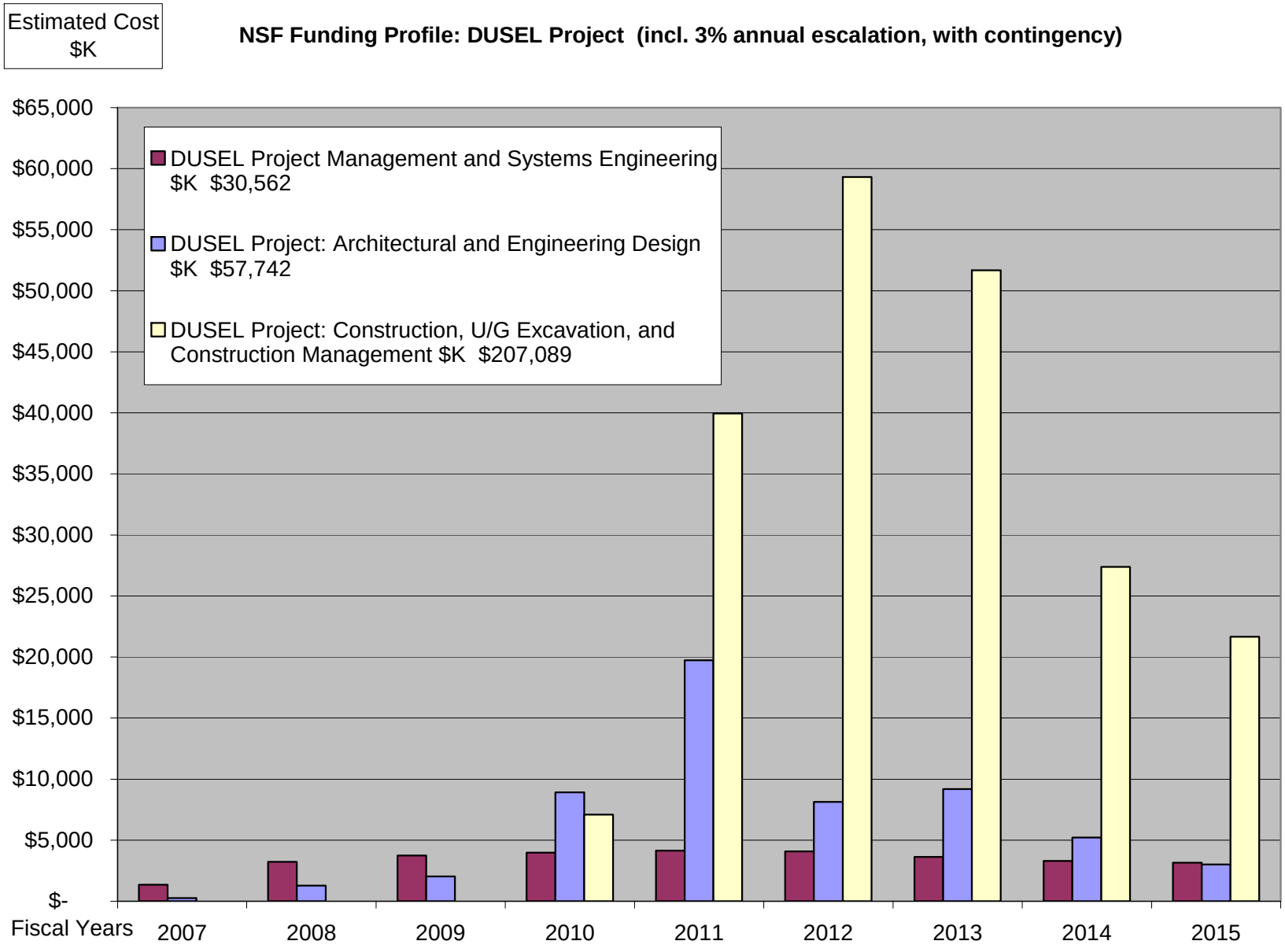
2014
2015


Estimated Cost
$K
NSF Funding Profile: DUSEL Project (incl. 3% annual escalation, with contingency)
$65,000
$60,000
$55,000
$50,000
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
DUSEL Project Management and Systems Engineering $K $30,562
DUSEL Project: Architectural and Engineering Design $K $57,742
DUSEL Project: Construction, U/G Excavation, and Construction Management $K $207,089
Fiscal Years
2007
2008
2009
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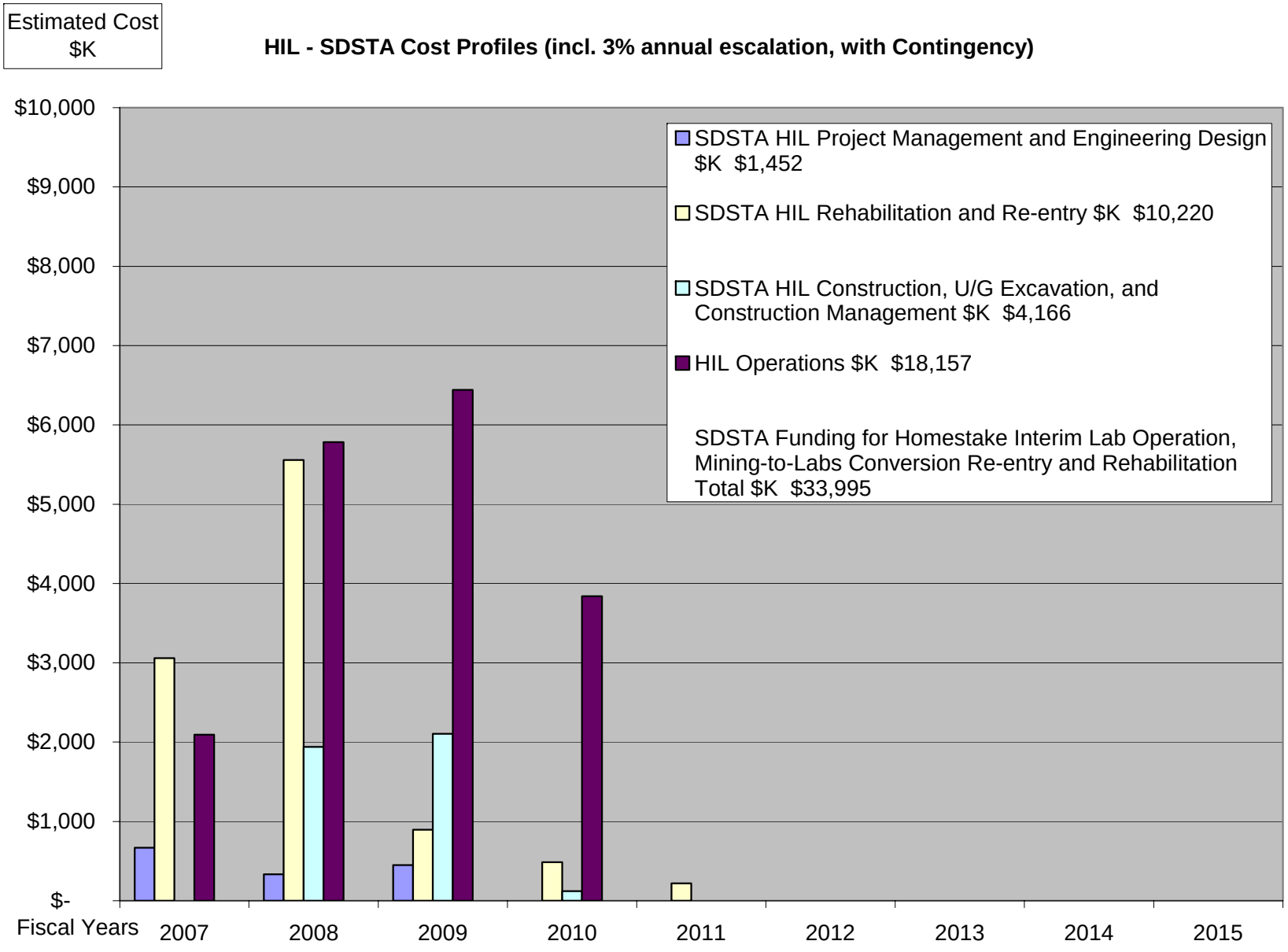
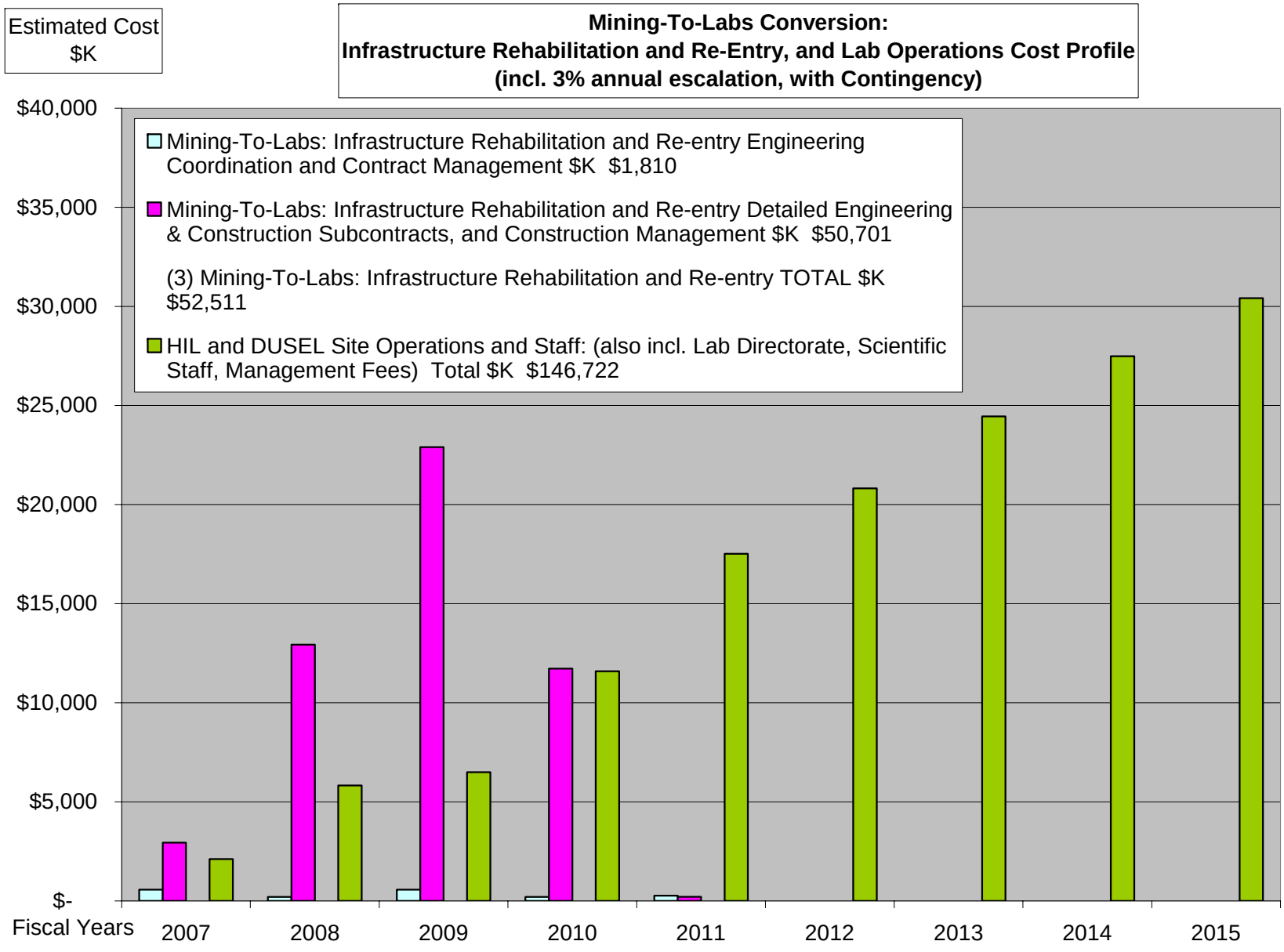
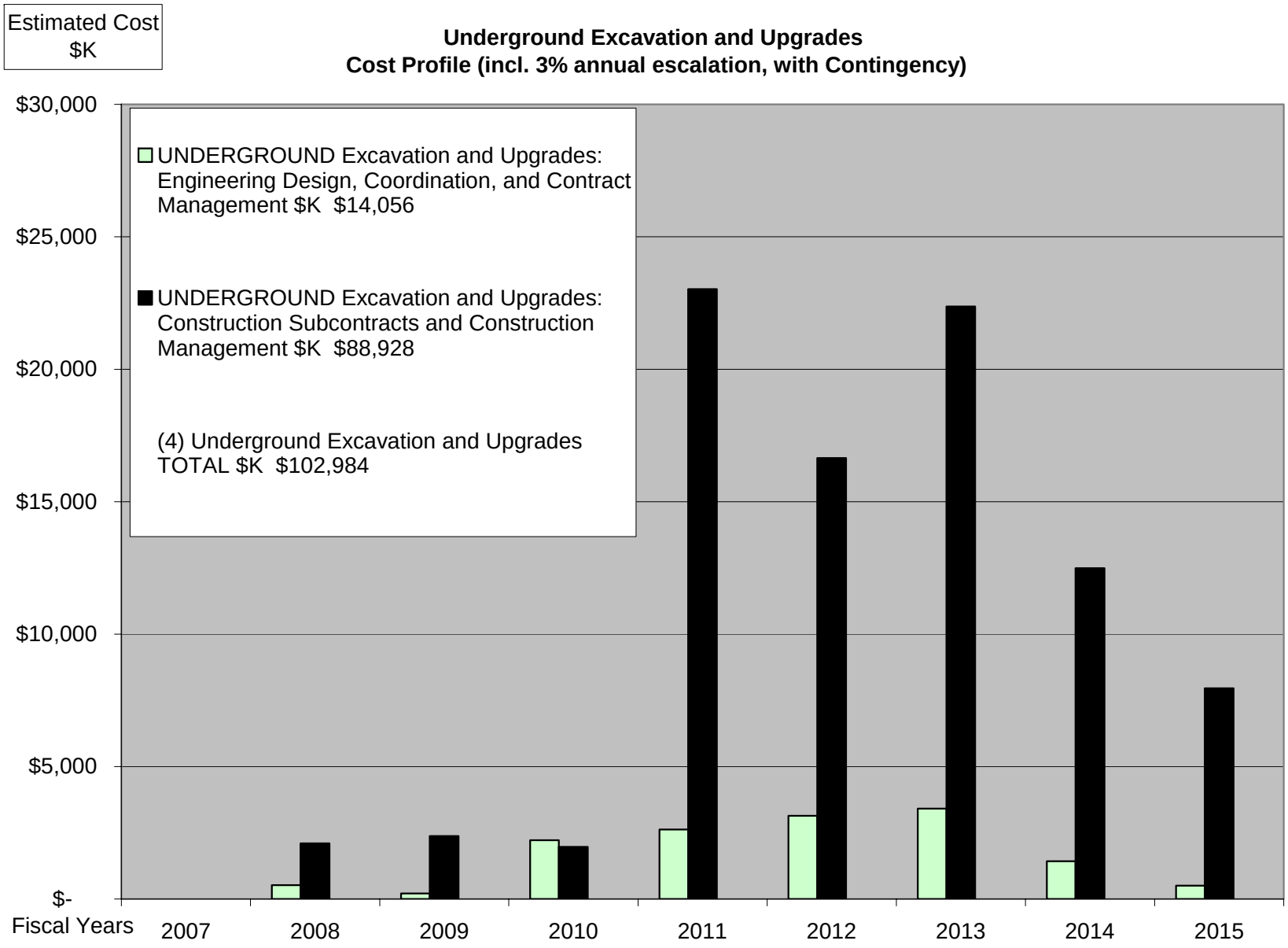
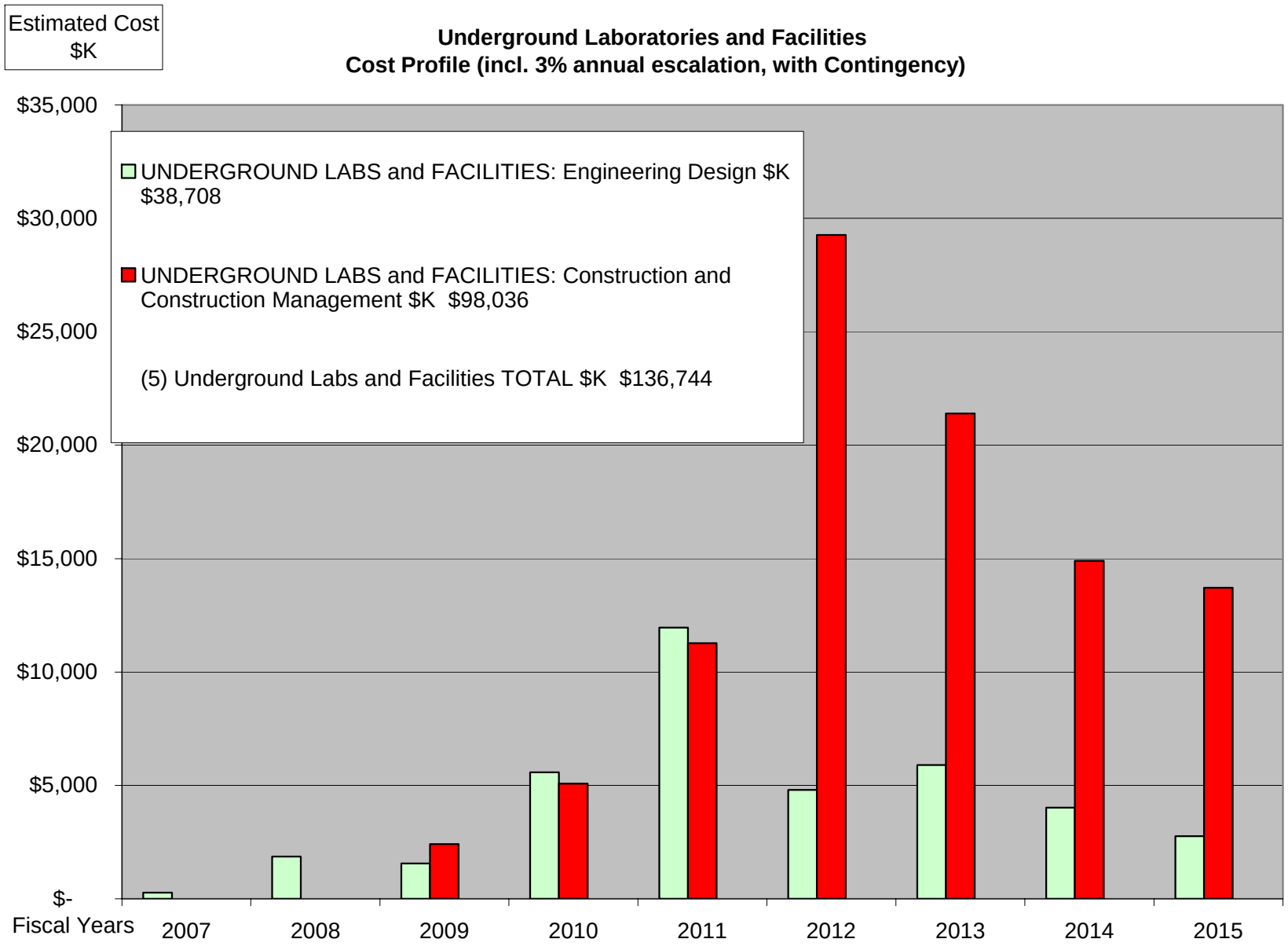
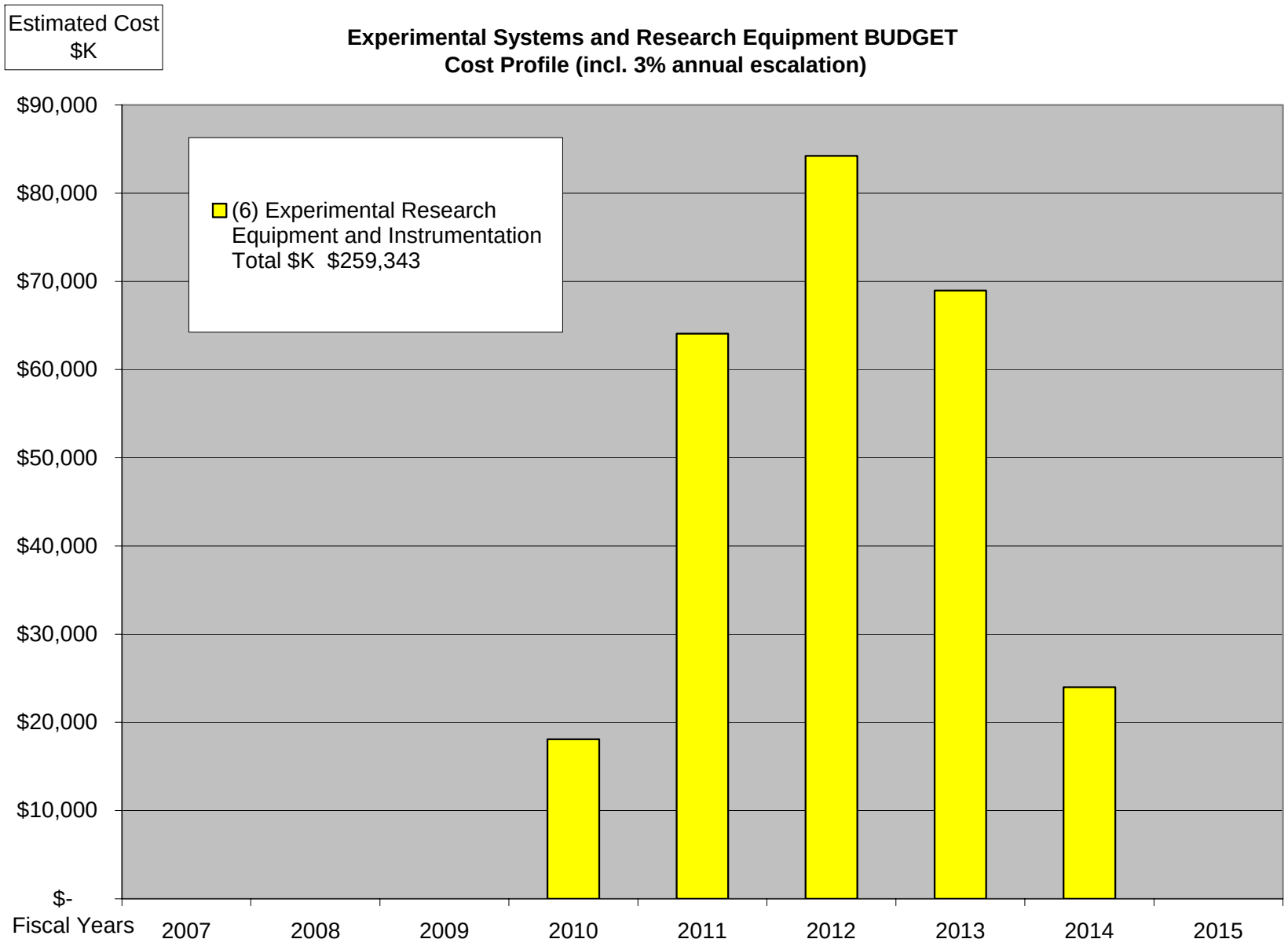
2015

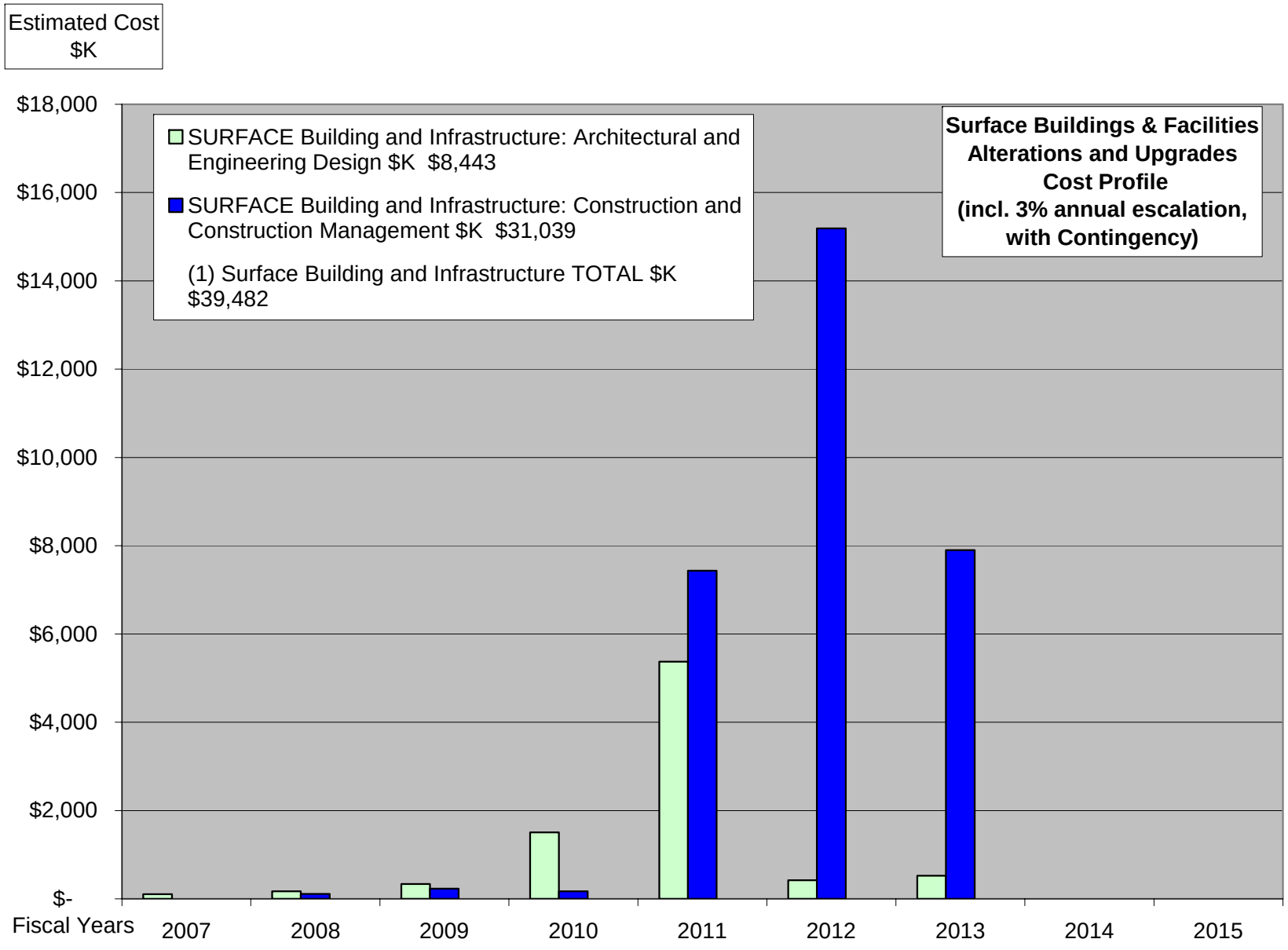

Estimated Cost
$K
HIL - SDSTA Cost Profiles (incl. 3% annual escalation, with Contingency)
$10,000
$9,000
$8,000
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$-
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015
SDSTA HIL Project Management and Engineering Design $K $1,452
SDSTA HIL Rehabilitation and Re-entry $K $10,220
SDSTA HIL Construction, U/G Excavation, and Construction Management $K $4,166
HIL Operations $K $18,157
SDSTA Funding for Homestake Interim Lab Operation, Mining-to-Labs Conversion Re-entry and Rehabilitation Total $K $33,995

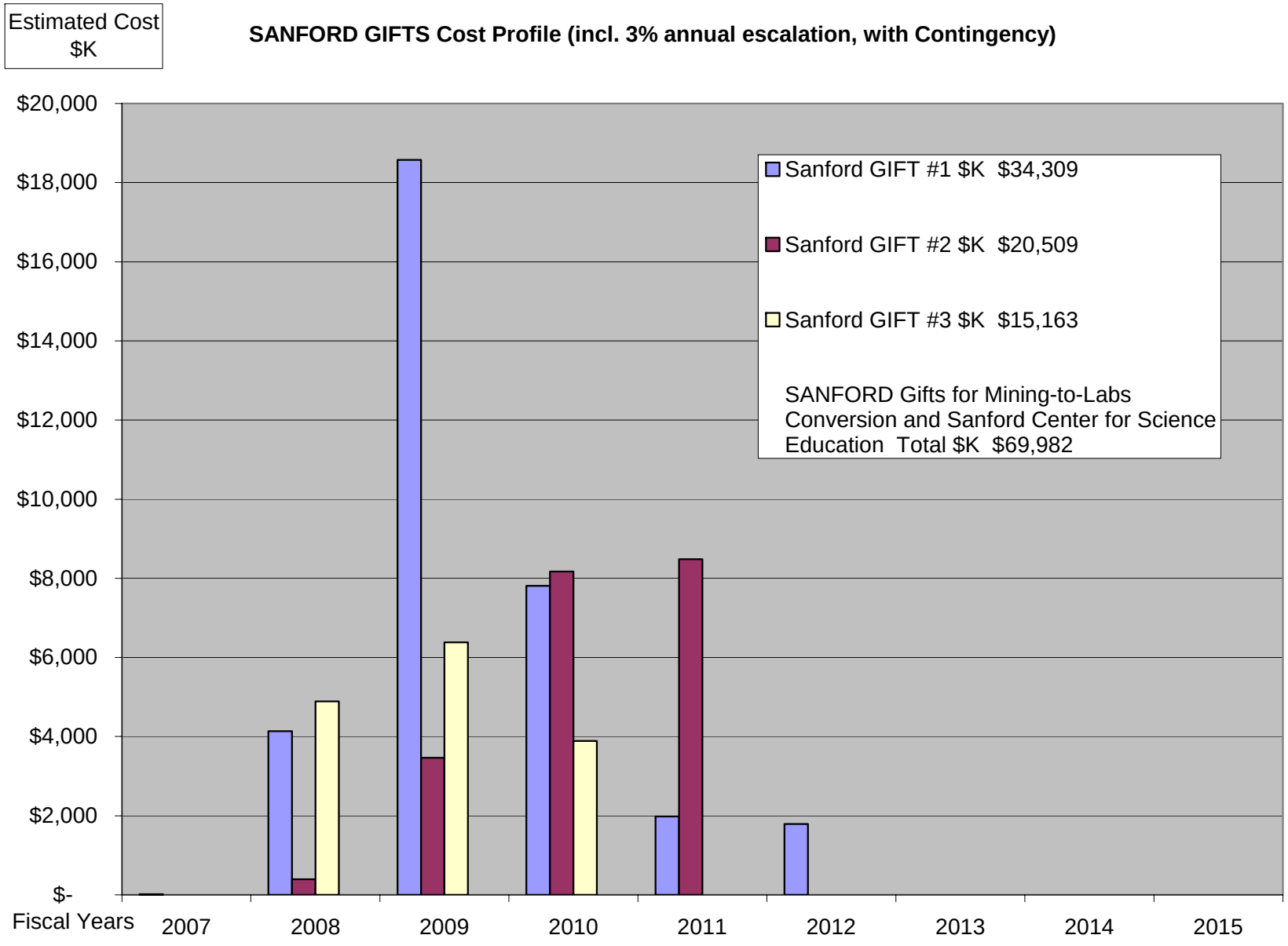

Estimated Cost
$K
Mining-To-Labs Conversion:
Infrastructure Rehabilitation and Re-Entry, and Lab Operations Cost Profile
(incl. 3% annual escalation, with Contingency)
Mining-To-Labs: Infrastructure Rehabilitation and Re-entry Engineering Coordination and Contract Management $K $1,810
Mining-To-Labs: Infrastructure Rehabilitation and Re-entry Detailed Engineering & Construction Subcontracts, and Construction Management $K $50,701
(3) Mining-To-Labs: Infrastructure Rehabilitation and Re-entry TOTAL $K $52,511
HIL and DUSEL Site Operations and Staff: (also incl. Lab Directorate, Scientific Staff, Management Fees) Total $K $146,722
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015


Estimated Cost
$K
Underground Excavation and Upgrades
Cost Profile (incl. 3% annual escalation, with Contingency)
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
UNDERGROUND Excavation and Upgrades: Engineering Design, Coordination, and Contract Management $K $14,056
UNDERGROUND Excavation and Upgrades: Construction Subcontracts and Construction Management $K $88,928
(4) Underground Excavation and Upgrades TOTAL $K $102,984
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015


Estimated Cost
$K
Underground Laboratories and Facilities
Cost Profile (incl. 3% annual escalation, with Contingency)
UNDERGROUND LABS and FACILITIES: Engineering Design $K $38,708
UNDERGROUND LABS and FACILITIES: Construction and Construction Management $K $98,036
(5) Underground Labs and Facilities TOTAL $K $136,744
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015

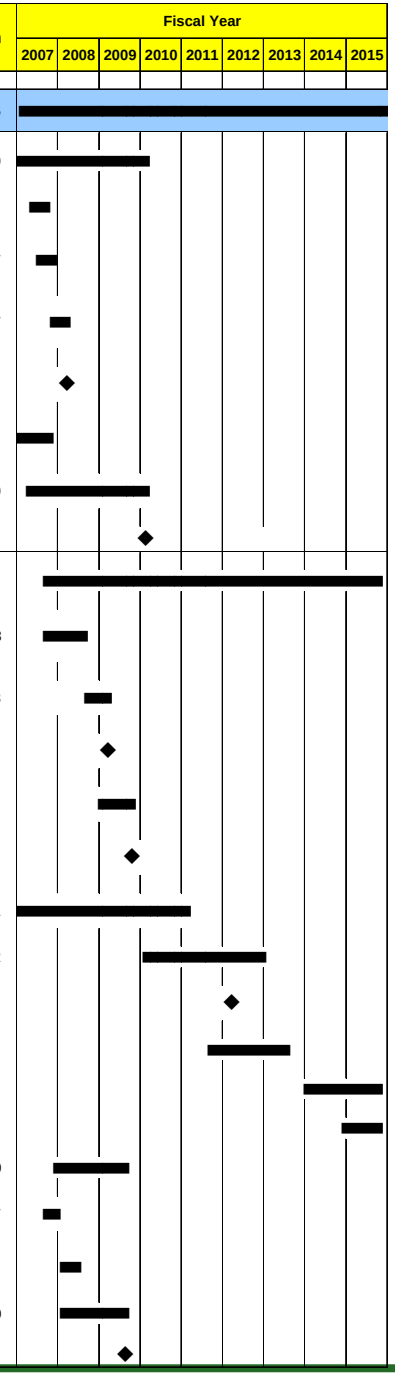

Estimated Cost
$K
Experimental Systems and Research Equipment BUDGET
Cost Profile (incl. 3% annual escalation)
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$-
(6) Experimental Research
Equipment and Instrumentation
Total $K $259,343
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015


Estimated Cost
$K
$18,000
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
SURFACE Building and Infrastructure: Architectural and Engineering Design $K $8,443
SURFACE Building and Infrastructure: Construction and Construction Management $K $31,039
(1) Surface Building and Infrastructure TOTAL $K $39,482
Surface Buildings & Facilities Alterations and Upgrades Cost Profile (incl. 3% annual escalation, with Contingency)
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015

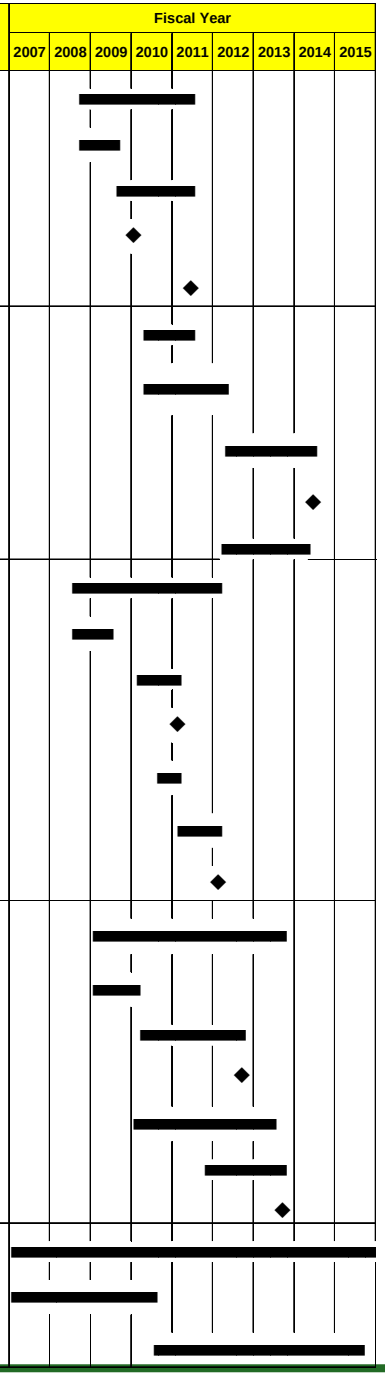

Estimated Cost $K
SANFORD GIFTS Cost Profile (incl. 3% annual escalation, with Contingency)
$20,000
$18,000
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Fiscal Years
2007
2008
2009
2010
2011
2012
2013
2014
2015
Sanford GIFT #1 $K $34,309
Sanford GIFT #2 $K $20,509
Sanford GIFT #3 $K $15,163
SANFORD Gifts for Mining-to-Labs Conversion and Sanford Center for Science Education Total $K $69,982

Homestake Interim Lab and DUSEL Project Summary Schedule and Major Milestones for Laboratory Development and Initial Operations	Start	Finish	Fiscal Year								
			2007	2008	2009	2010	2011	2012	2013	2014	2015
Major DUSEL Project Milestones and Decision-Points in Pre-construction Planning and Development Phase	May-06	Apr-10									
Homestake Ownership Transfer to SDSTA, Initiate Preliminary and Detailed Engineering for Mining-to-labs Conversion, Re-entry, and Infrastructure Rehabilitation	May-06										
Submit Homestake DUSEL Conceptual Design Report to NSF	Jan-07										
SDSTA Internal Review: Ross Shaft Re-entry Plan to install 5000L pumping; and Authorization to proceed with detailed engineering, surface infrastructure construction, and long-lead procurements	Jan-07										
NSF CDR Review Team - Homestake Site Visit	Mar-07										
NSF Report - Homestake Site Selection for DUSEL Initiate Preliminary Design for DUSEL	Apr-07										
SDSTA Internal Review: Ross Shaft Re-entry Readiness Review; and Authorization for personnel re-entry and construction to install 5000L pumping system	May-07										
Ross Shaft Pumping system is fully operable to hold the accumulated water below the 5000L	Aug-07										
SDSTA Internal Review of Detailed Engineering Plan; and Authorization to continue construction for Mid-Levels re-entry and basic infrastructure rehabilitation for safe access to 4850L and above	Aug-07										
Submit Preliminary Design Report and project baseline to NSF for MREFC Panel review	Dec-07										
MREFC Panel recommends DUSEL project to NSF Director for National Science Board approval	Mar-08										
SDSTA Authorization to continue HIL Operations to support Early Implementation Program and to prepare for DUSEL construction	Apr-08										
SDSTA Internal Review of Detailed Engineering Plan; and Authorization to proceed with Deep-levels dewatering, and construction for Mid-Levels Infrastructure rehabilitation & upgrades	Apr-08										
NSF Interim Review and Recommendations for Pre-construction Planning	Mar-09										
FY-2010 Federal Budget includes MREFC funding for DUSEL construction start	Oct-09										
NSF Detailed Design Review and Approval to proceed with DUSEL Construction	Mar-10										
DUSEL Project Construction Start: NSF Authorization and MREFC funding	Apr-10										

Homestake Interim Lab and DUSEL Project Summary Schedule and Major Milestones for Laboratory Development and Initial Operations	Start	Finish
Homestake Interim Lab and DUSEL Subprojects Summary Schedule	Oct-06	Sep-15
Mid-Levels Re-Entry and Infrastructure Rehabilitation	Oct-06	Nov-10
Mid-Levels Re-entry - Systems Design and Subsystem Detailed Engineering, Subcontract Awards	Jan-07	Jun-07
Ross Shaft Re-entry for safe access to install 5000L Pumping system	May-07	Aug-07
Yates and Ross Shafts Re-entry for safe access to 4850L: Re-establish Power and Ventilation, Shafts Inspection and Basic Refurbishment	Jul-07	Dec-07
Mid-Levels and Ramps: Begin research studies for Bio- and Geo-Sciences	Dec-07	
Mid-Levels Rehabilitation and Upgrades- System Design and Subsystem Detailed Engineering, Subcontract Awards	Oct-06	Jun-07
Mid-Levels Infrastructure Rehabilitation and Upgrades for HIL and DUSEL	Dec-07	Nov-10
Mid-Levels Infrastructure Rehabilitation Complete	Nov-10	
4850L Alterations and Upgrades	May-07	Jul-15
4850L Ross Shops and EIP Davis, Sanford, and Geo-Bio Labs System Design and Subsystem Detailed Engineering, Subcontracts Award	May-07	May-08
4850L Ross Shops Excavation and Alterations for Materials and Construction Equipment Access	May-08	Dec-08
4850L Ross Shops Construction Complete - Ready for Equipment Mobilization	Dec-08	
4850L Davis, Sanford, and Geo-Bio Labs Excavation and Outfitting Construction	Sep-08	Jul-09
4850L Davis, Sanford and Geo-Bio Labs Construction Complete - Ready to Begin Installation of Research Instrumentation for EIP	Jul-09	
4850L Common Facilities and Lab Modules - System Design and Detailed Engineering	Oct-07	Sep-11
4850L Lab Modules #1 and Common Facilities Construction	Oct-10	Sep-12
4850L Lab Modules #1 and Common Facilities Construction Complete - Ready to Begin Installation of Research Instrumentation	Sep-12	
4850L Lab Module #2 Excavation and Outfitting Construction	May-11	Apr-13
4850L Lab Module #3 Excavation and Outfitting Construction	Sep-13	Jul-15
4850L Lab Module #4 Excavation Construction	Aug-14	Jul-15
Dewatering for Re-Entry to Deep-Levels	Apr-07	May-09
Pumping Systems Detailed Design and Specifications, Subcontracts Award	Apr-07	Sep-07
Water Treatment and Cooling Tower - Detailed Design and Construction	Oct-07	Mar-08
Pumping systems Installation and Deep Levels Dewatering	Oct-07	May-09
Dewatering Complete (to 8000L)	May-09	



Homestake Interim Lab and DUSEL Project Summary Schedule and Major Milestones for Laboratory Development and Initial Operations	Start	Finish
Deep-Levels Re-Entry and Infrastructure Rehabilitation	Jun-08	Mar-11
Deep Levels Re-entry and Rehabilitation (Phase 3) System Design and Subsystem Detailed Engineering, Subcontract Awards	Jun-08	May-09
Deep Levels Re-entry and Rehabilitation (Phase 3) Construction	May-09	Mar-11
Deep Levels and Ramps: Begin Safe Access for Bio- and Geo-Sciences	Oct-09	
Deep Levels Re-Entry and Infrastructure Rehabilitation Complete: Ready for Construction Access to 8000L	Mar-11	
7400L Alterations and Upgrades	Jan-10	Mar-14
7400L Common Facilities and Labs System Design, Site Investigation, and Subsytem Detailed Engineering, Subcontracts Award	Jan-10	Jan-12
7400L Lab Module #1 and Common Facilities Excavation and Lab Outfitting	Jan-12	Mar-14
7400L Lab Module #1 Construction Complete - Ready to Install Research Instrumentation	Mar-14	
7400L Lab Modules #2 and #3 Excavation	Dec-12	Jan-14
300L Alterations and Upgrades	Apr-08	Nov-12
300L Labs and Common Facilities System Design and Subsystem Detailed Engineering for EIP	Apr-08	Mar-09
300L Labs and Common Facilities Excavation and Outfitting for EIP	Nov-10	Nov-11
300L Labs and E&O Rooms Construction Complete - Ready to Install Research Instrumentation for EIP	Nov-11	
300L Labs System Design and Subsystem Detailed Engineering for DUSEL	May-10	Nov-11
300L Labs and Research Support Excavation and Outfitting Construction for DUSEL	Nov-11	Nov-12
300L Labs Construction Complete - Ready to Install Research Instrumentation for DUSEL	Nov-12	
Surface Site Alterations and Upgrades - Surface Facilities, Infrastructure, and Buildings	Oct-09	Jun-13
Surface Facilities and Site Services System Design and Subsystem Detailed Engineering for HIL & EIP, Subcontracts Award	Oct-09	Nov-10
Surface Facilities (Phases 1) Construction and Outfitting for EIP	Dec-10	Jun-12
Surface Facilities Construction Complete for EIP	Jun-12	
Surface Facilities and Services (Phases 2) System Design and Subsystem Design Packages for DUSEL, Subcontracts Award	Oct-10	Mar-13
Surface Facilities (Phases 2) Construction and Outfitting for DUSEL	Jul-11	Jun-13
Surface Facilities Construction Complete for DUSEL	Jun-13	
Pre-Operations and Project Close-out	Apr-06	Sep-15
SDSTA Homestake Interim Lab Operations and EIP Research Programs Development	Apr-06	Apr-10
NSF-DUSEL Facility Pre-Operations and Science Programs Development	Apr-10	Sep-15



Methodology for Risk Management

- Continuous Risk Management process will be integral with Safety Management, Project Management, Systems Engineering, and Operations

- Initial steps have included Risk Identification and Preliminary Risk Analysis, with details presented in CDR and Appendices

- Risk planning has involved consultants and staff having a broad background and perspectives:

Consultants:	Syd De Vries (Risk Identification, Basis of Estimates) Mark Laurenti (Basis of Estimates, cost and schedule) Mark Nelson, S.D. DENR (Environmental issues) Golder Associates (Failure Modes and Effects Analysis)
Staff and Collaborators:	SDSTA Staff, notably Tom Regan (Site Conditions, Safety), Greg King, John Marks, Gary Lillehaug (former HMC engineers) Homestake Science Collaboration members LBNL Management (internal review) LBNL Project Team

Risk Categories for Homestake DUSEL

1. Safety
2. Environmental
3. Performance and Operations
4. Project Management

<u>High Priority and High Visibility Risk Items:</u>

- Personnel Injury
- Water Quality, Environmental Permitting
- Infrastructure Deterioration and Rehabilitation
- Underground Fire Hazards
- Underground Rock Failure, Rock Competency
- Ponded or Stored Water Release
- Availability of Subcontractors and Equipment
- Cost and Schedule Controls, Funding Profiles