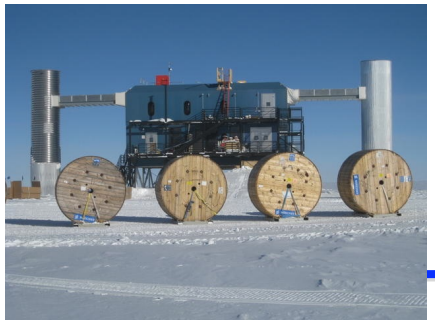
Construction Completion & Initial Operations Update

Jim Yeck
IceCube Project Director
University of Wisconsin

Science Advisory Committee
May 20, 2009



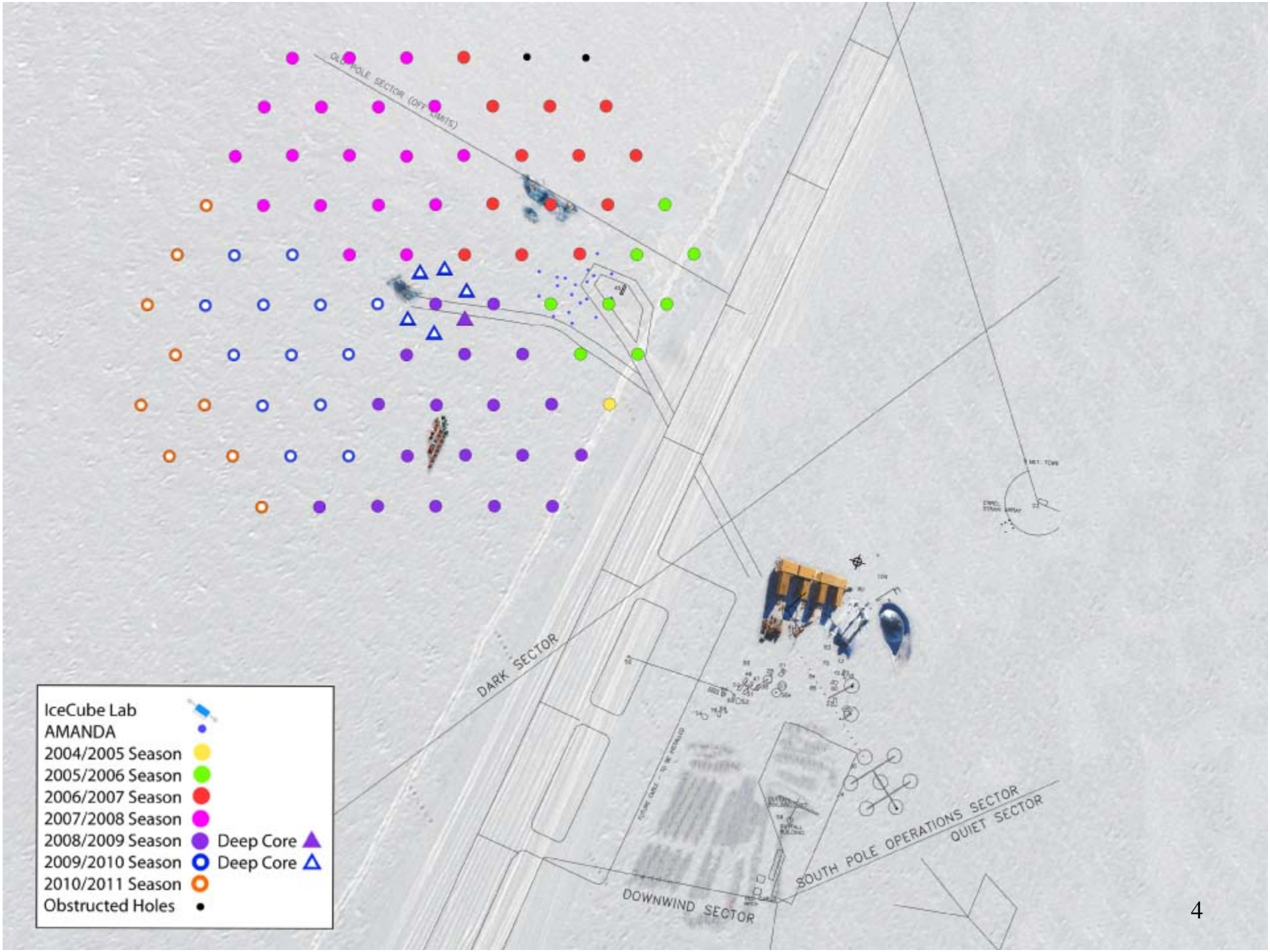
2008/09 Season

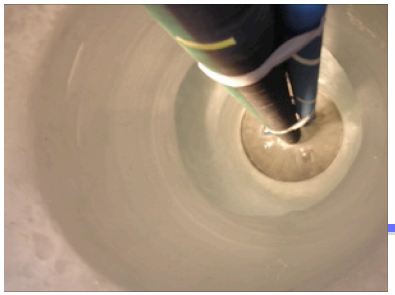
- Excellent Plan Responsive to Constrained Support
  - Support plan reduced due to NSF budget constraints
  - Shared commitment by all parties to maximize # of strings
  - Achieved 3 additional strings, 19 total, above support plan!
- No Reportable Injuries
- Improvement Opportunities – Annual Driller Surveys
  - Continuity of personnel is a major factor in success
  - Improve safety and drilling/deployment training for new staff
  - Reduce uncertainty in seasonal installation plans with 20 strings/season the optimum stretch goal

Fuel Savings

Significant improvement in drilling efficiency resulted in considerable fuel savings and reduced future support requirements.

	2008/09 Season		2009/10 Season
	Support Plan	Actual	Support Plan
Number of Holes	**16**	**19**	**20**
Deep Drilling, per-hole	6,000 gal	4,810 gal	5,500 gal
Base	18,000 gal	20,830 gal	20,000 gal
Seasonal Total	**114,000 gal**	**112,220 gal**	**130,000 gal**


GEOGRAPHIC POLE SECTOR (OFF LIMITS)
DARK SECTOR
DOWNWIND SECTOR
SOUTH POLE OPERATIONS SECTOR
QUIET SECTOR
IceCube Lab
AMANDA
2004/2005 Season
2005/2006 Season
2006/2007 Season
2007/2008 Season
2008/2009 Season
Deep Core
2009/2010 Season
Deep Core
2010/2011 Season
Obstructed Holes

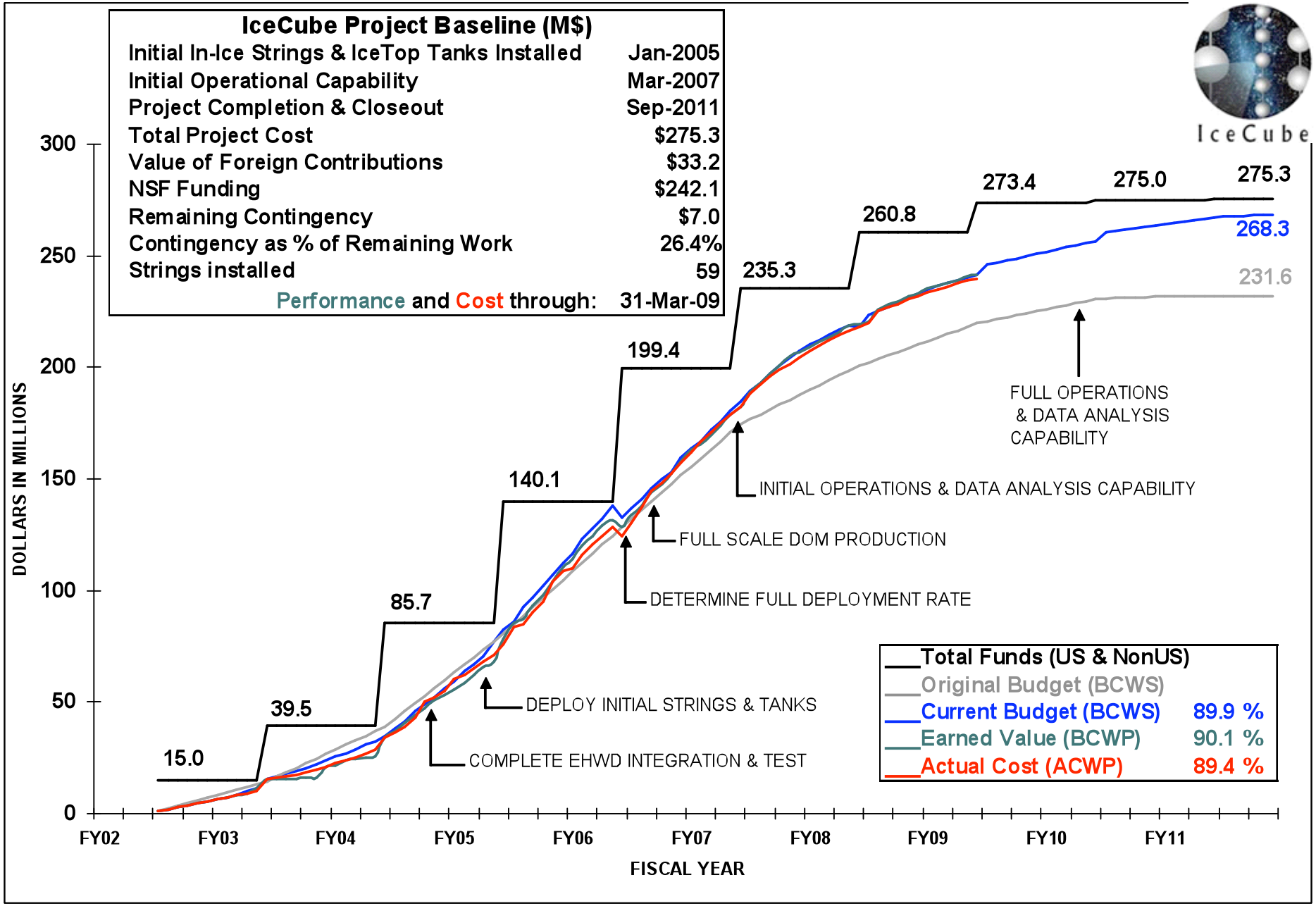


String and IceTop Installation

Strings (*Actual* & Plan)	*04/05*	*05/06*	*06/07*	*07/08*	08/09	09/10	10/11
Annual Baseline	*1*	*8*	*13*	*18*	*19*†	18†	9
Cumulative	*1*	*9*	*22*	*40*	*59*	77	86

†**Deep Core Proposed** (***Actual*** **& Plan)**	***1***	**5**
†**Cumulative**	***1***	**6**

IceTop Stations (*Actual*/Plan)	*04/05*	*05/06*	*06/07*	*07/08*	08/09	09/10	10/11
Annual Baseline	*4*	*12*	*10*	*14*	*19*	14	7
Cumulative	*4*	*16*	*26*	*40*	*59*	73	80


IceCube Project Baseline (M$)
Initial In-Ice Strings & IceTop Tanks Installed Jan-2005
Initial Operational Capability Mar-2007
Project Completion & Closeout Sep-2011
Total Project Cost $275.3
Value of Foreign Contributions $33.2
NSF Funding $242.1
Remaining Contingency $7.0
Contingency as % of Remaining Work 26.4%
Strings installed 59
Performance and Cost through: 31-Mar-09
IceCube
DOLLARS IN MILLIONS
300
250
200
150
100
50
0
15.0
39.5
85.7
140.1
199.4
235.3
260.8
273.4
275.0
275.3
268.3
231.6
FULL OPERATIONS & DATA ANALYSIS CAPABILITY
INITIAL OPERATIONS & DATA ANALYSIS CAPABILITY
FULL SCALE DOM PRODUCTION
DETERMINE FULL DEPLOYMENT RATE
DEPLOY INITIAL STRINGS & TANKS
COMPLETE EHWD INTEGRATION & TEST
Total Funds (US & NonUS)
Original Budget (BCWS)
Current Budget (BCWS) 89.9 %
Earned Value (BCWP) 90.1 %
Actual Cost (ACWP) 89.4 %
FY02
FY03
FY04
FY05
FY06
FY07
FY08
FY09
FY10
FY11
FISCAL YEAR

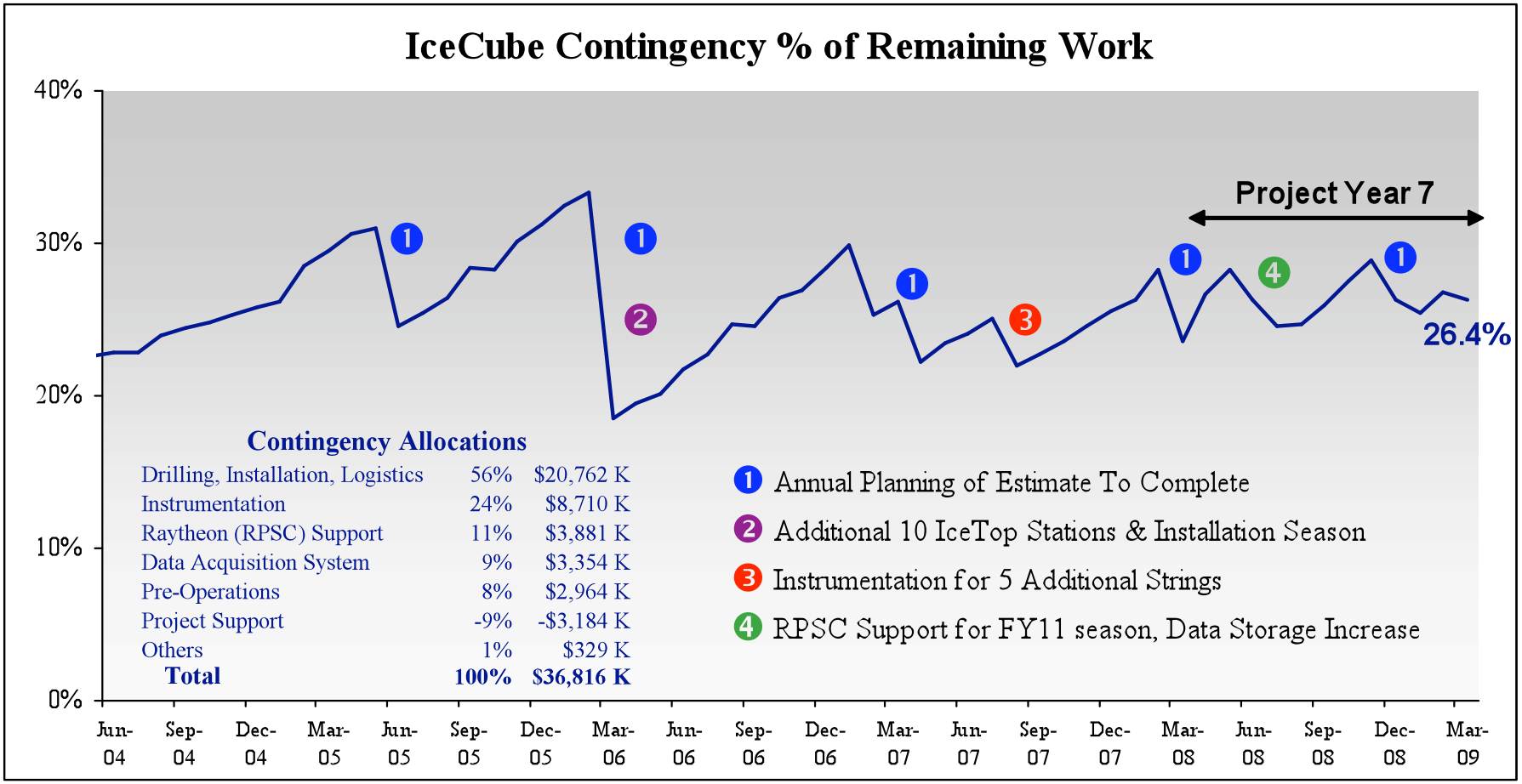
Cost & Schedule Baseline

		Baseline (Hartill 02/04)	Current (Hartill 05/09)	
Cost	**TPC**	**$271.8 million**	**$275.3 million**	
	NSF	**$242.1 million**	**$242.1 million**	***unchanged***
	Foreign	**$ 29.7 million**	**$ 33.2 million**	
Earned Value			**$241.6 million**	***90% complete***
Contingency		**$ 43.8 million (23%)**	**$ 7.0 million**	

Majority of the Technical Risk is Retired

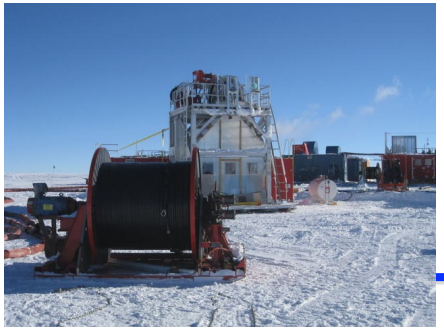
Completion	**4th Quarter, 2010**	**2nd Quarter, 2011**

Contingency Tracking

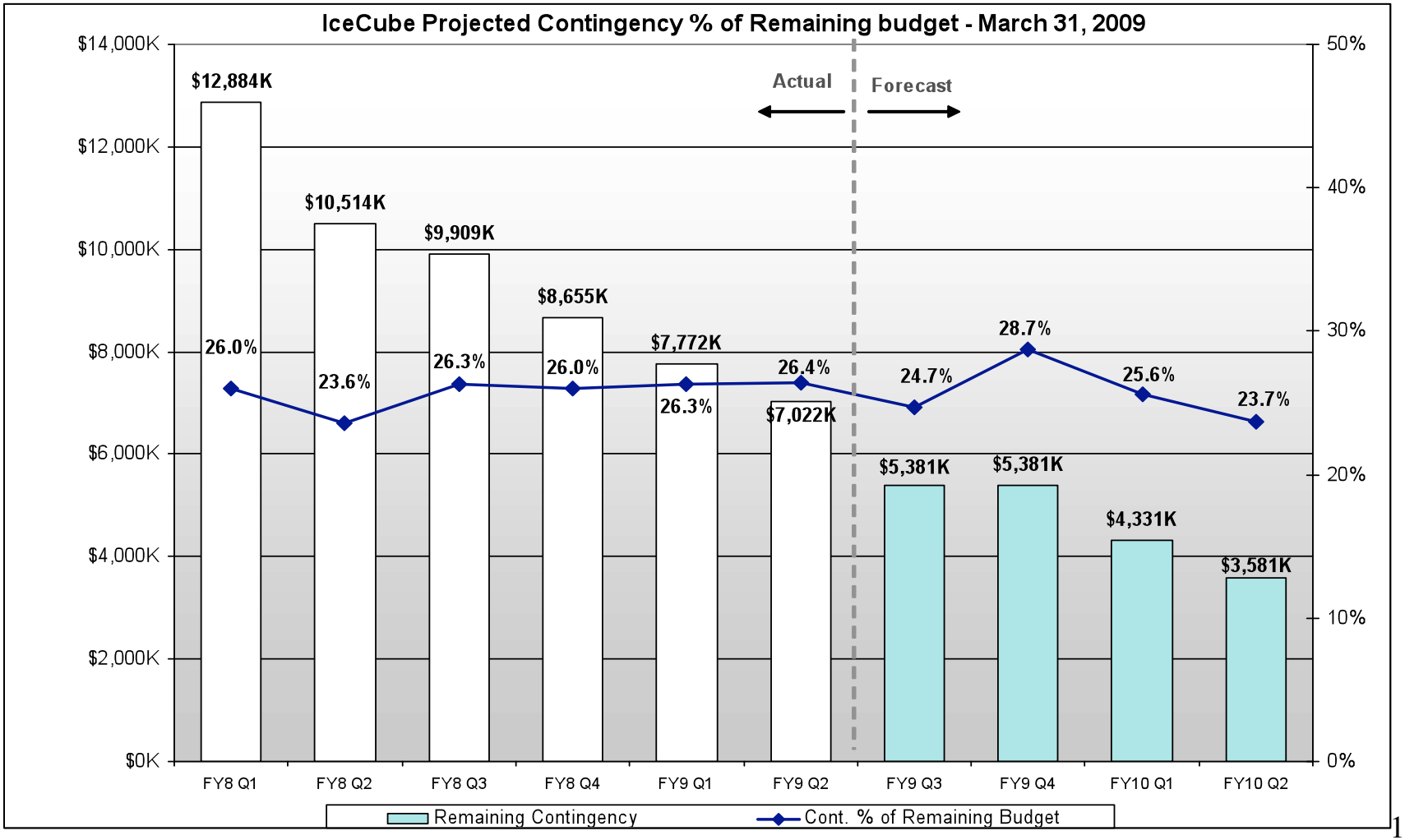


Risk Assessment and Potential Contingency Assignments

	Estimate ($k)
Bottoms-up Risk Assessment - Maximum Exposure	2,097
Additional Pre-Operations Exposure	1,000
RPSC Revised Plan (fuel savings, etc.)	-750
Remaining Cost to Instrument 86 Strings	1,350
Incremental Cost to Install Strings 81 - 86	1,340
Saving from Closeout of Prior Year Accounts	-300
Estimated Maximum Cost to Retro Equipment in FY12	1,050
Cost to Ensure Experienced Staff for Last Two Seasons	700
Potential Additional Fuel Cost Exposure (Last Season)	450
	6,937
Available Contingency (February 2008)	**7,022**

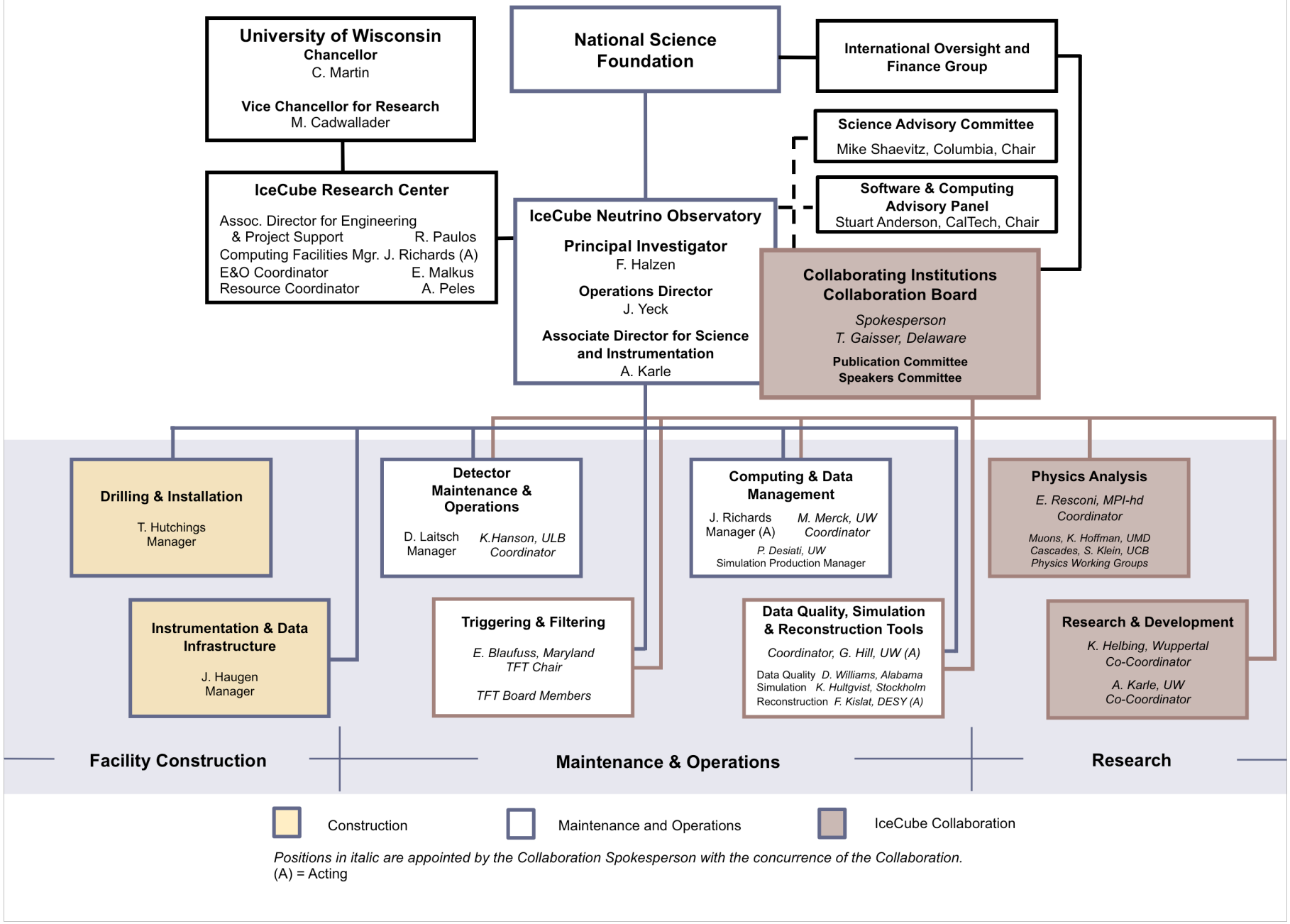


Contingency Forecast



Organization Changes

- Software & Computing Advisory Panel Established
  - Internal panel advising UW and Collaboration
  - Stuart Anderson, CalTech (LIGO); Sridhara Dasu, UW (CMS); Michael Ernst, BNL (RHIC/ATLAS); Tom Paul, Northeastern (Auger); John Pretz, LANL (Milagro)
- Consolidated Remaining Construction Activities
- Integrated Collaboration and UW Host Institution
- M&O Task Categories Aligned with the Integrated Organizational Approach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Vice Chancellor for Research
M. Cadwallader
National Science Foundation
International Oversight and Finance Group
Science Advisory Committee
Mike Shaevitz, Columbia, Chair
Software & Computing Advisory Panel
Stuart Anderson, CalTech, Chair
IceCube Research Center
Assoc. Director for Engineering & Project Support R. Paulos
Computing Facilities Mgr. J. Richards (A)
E&O Coordinator E. Malkus
Resource Coordinator A. Peles
IceCube Neutrino Observatory
Principal Investigator
F. Halzen
Operations Director
J. Yeck
Associate Director for Science and Instrumentation
A. Karle
Collaborating Institutions Collaboration Board
Spokesperson
T. Gaisser, Delaware
Publication Committee
Speakers Committee
Drilling & Installation
T. Hutchings
Manager
Detector Maintenance & Operations
D. Laitsch Manager
K.Hanson, ULB Coordinator
Computing & Data Management
J. Richards Manager (A)
M. Merck, UW Coordinator
P. Desiati, UW
Simulation Production Manager
Physics Analysis
E. Resconi, MPI-hd Coordinator
Muons, K. Hoffman, UMD
Cascades, S. Klein, UCB
Physics Working Groups
Instrumentation & Data Infrastructure
J. Haugen
Manager
Triggering & Filtering
E. Blaufuss, Maryland
TFT Chair
TFT Board Members
Data Quality, Simulation & Reconstruction Tools
Coordinator, G. Hill, UW (A)
Data Quality D. Williams, Alabama
Simulation K. Hultgvist, Stockholm
Reconstruction F. Kislat, DESY (A)
Research & Development
K. Helbing, Wuppertal
Co-Coordinator
A. Karle, UW
Co-Coordinator
Facility Construction
Maintenance & Operations
Research
Construction
Maintenance and Operations
IceCube Collaboration
Positions in italic are appointed by the Collaboration Spokesperson with the concurrence of the Collaboration.
(A) = Acting

M&O Program Overview

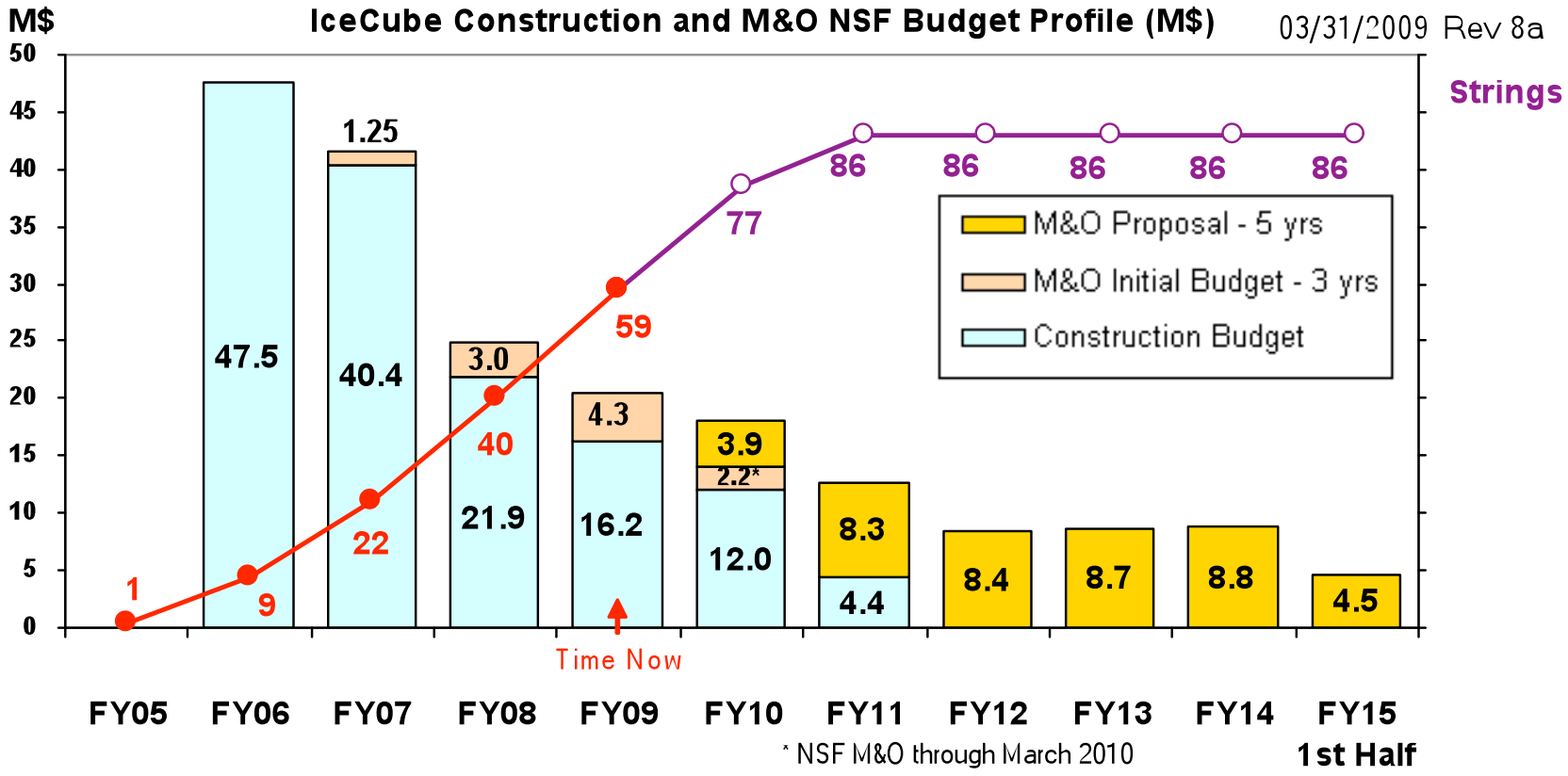
- Initial M&O Funding (April 1, 2007 – March 31, 2010)
  - Funding plans in place for initial 3-year operations period
  - Initial M&O support enables early physics and a better understanding of what is needed to support efficient post-construction operations
  - Encouraged to pursue a more distributed effort model
- M&O Proposal (April 1, 2010 – March 31, 2015)
  - Comprehensive plan from data to publications
  - Detailed task definition and accounting
  - Integrated organization structure, UW and Collaboration

M&O Experience

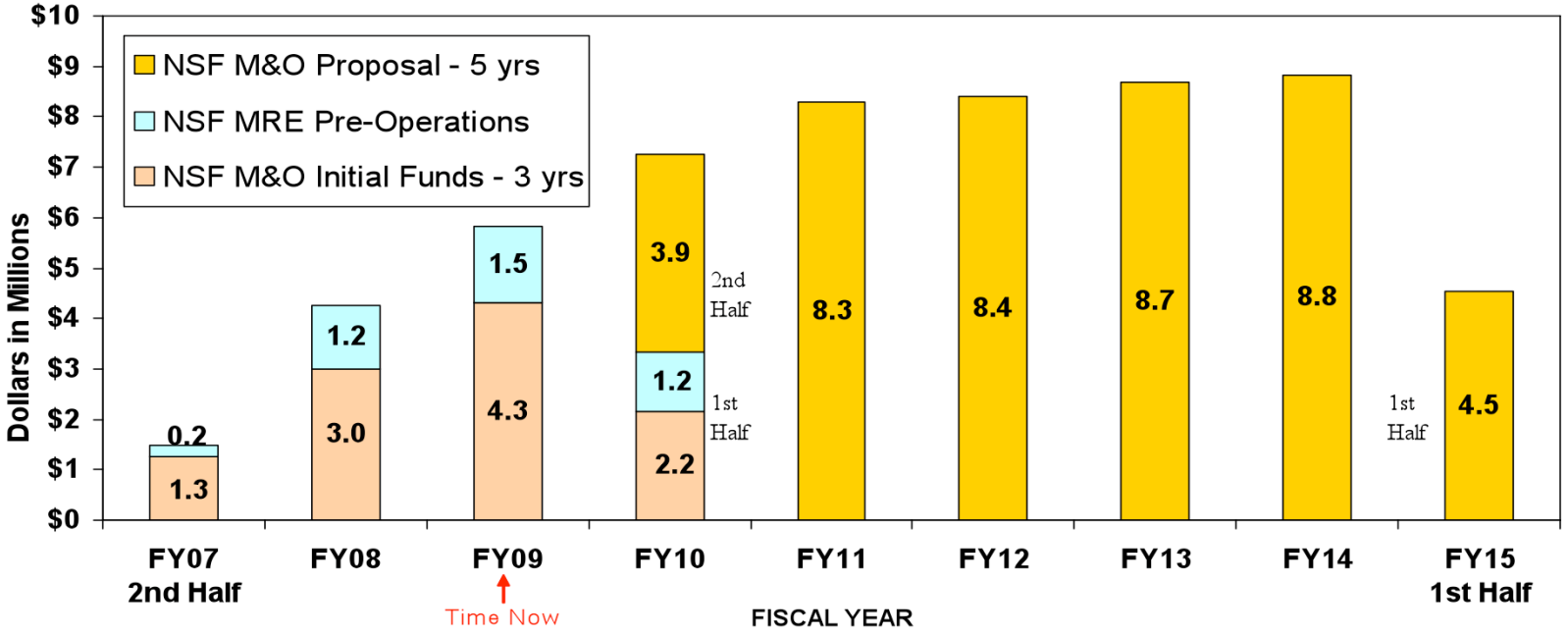
- Experience
  - Initial M&O requirements exceeded support
  - Increased Pre-Operations (construction) support required
  - Significant UW contributions also required

- Planning for the Future
  - M&O Lessons-Learned Meeting (February 3-4)
  - M&O Planning Workshop (February 23-26)
  - Software & Computing Advisory Panel Meeting (March 24-25)
  - 5-Year M&O Proposal is based on experience and benefits from external critique (External and Internal)

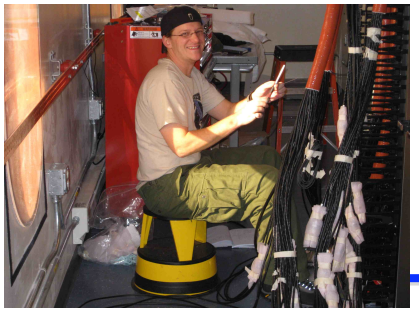
Construction – M&O Transition



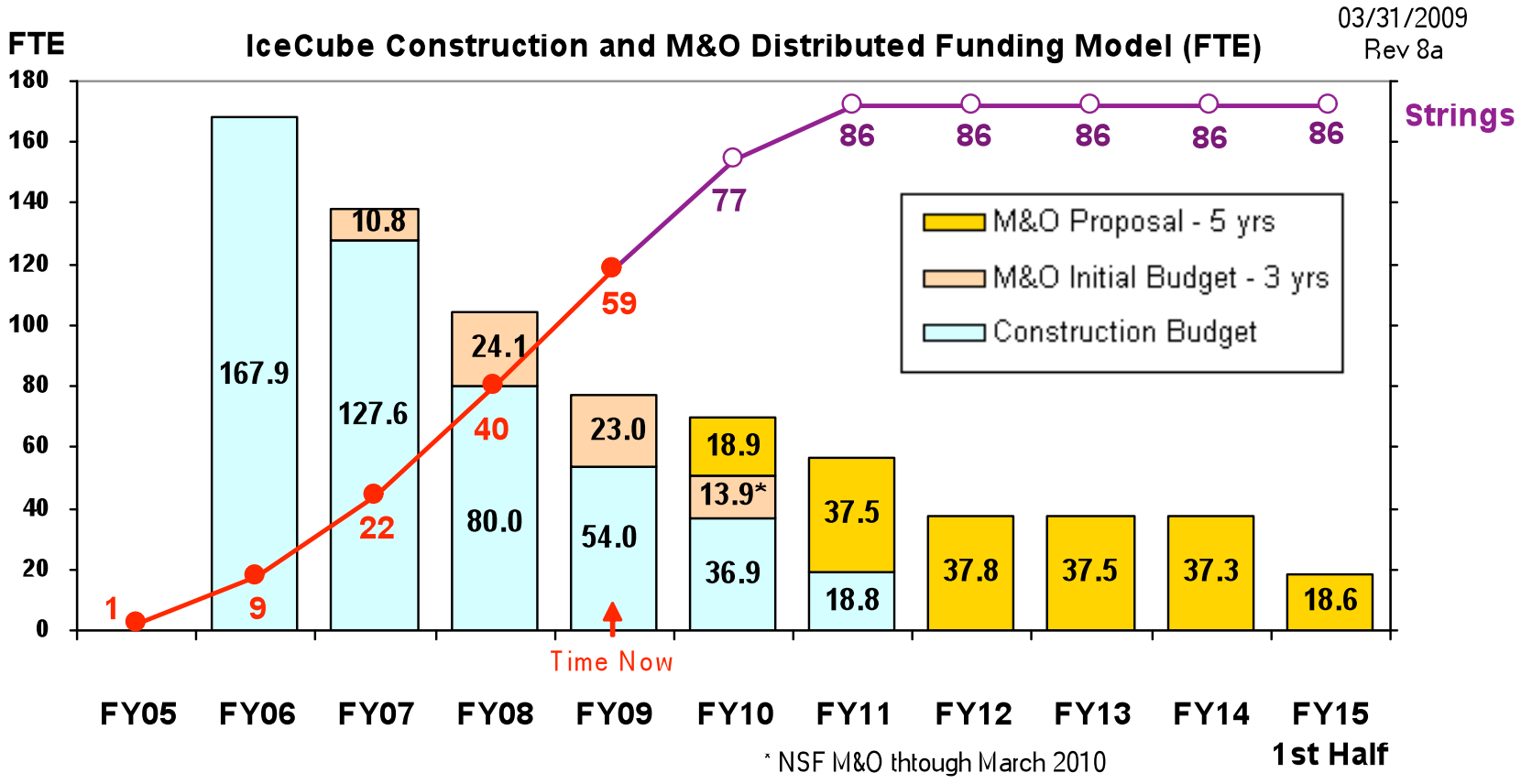
M&O Annual Profile



Funds Request	2nd Half FY10	FY11	FY12	FY13	FY14	1st Half FY15
NSF M&O Proposal	3,921	8,278	8,397	8,678	8,833	4,537
Euro & Asia/Pacific CF *	321	642	642	642	642	321
NSF MRE Pre-Operations	0	0	0	0	0	0
Total MAO Core Funds	**4,241**	**8,919**	**9,039**	**9,319**	**9,475**	**4,858**



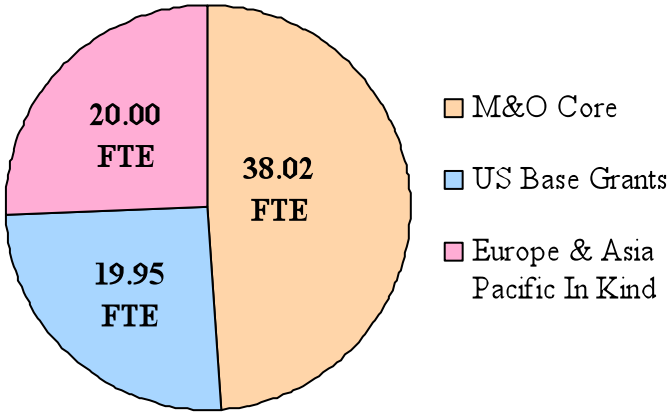
Labor Transition



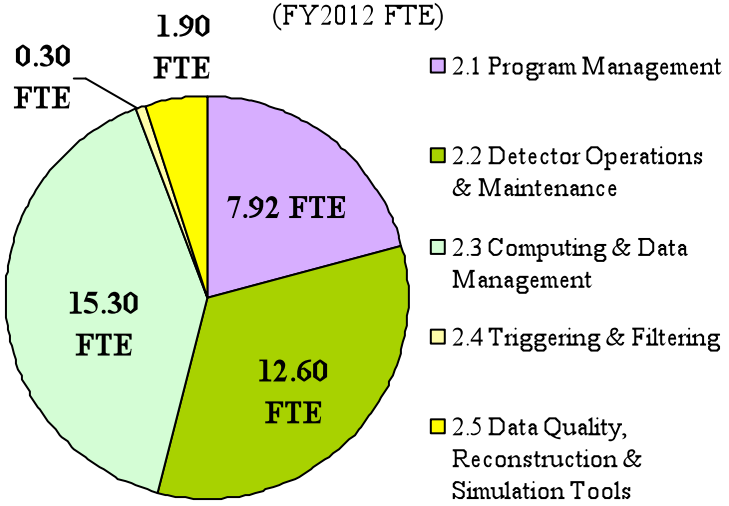
M&O Distribution

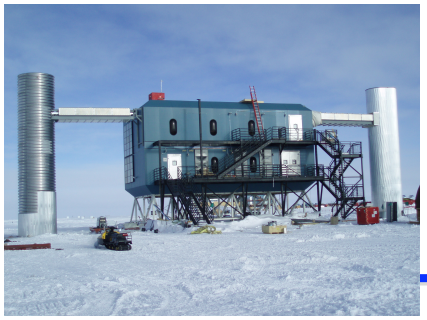
	US (FTE)		Europe & Asia Pacific (FTE)	In-kind Totals (FTE)
	Core	Base Grants		
2.1 Program Management	7.92	3.38	3.00	6.38
2.2 Detector Operations & Maintenance	12.60	4.20	2.41	6.61
2.3 Computing & Data Management	15.30	1.95	6.05	8.00
2.4 Triggering & Filtering	0.30	3.90	2.75	6.65
2.5 Data Quality, Reconstruction & Simulation Tools	1.90	6.05	5.25	11.30
In-kind effort still to be distributed		0.47	0.54	1.01
Totals	**38.02**	**19.95**	**20.00**	**39.95**

IceCube M&O Distributed Management and Funding Model (FY2012 FTE)



IceCube M&O Core Labor by WBS L2
(FY2012 FTE)





Summary

- Construction Project on Track for Successful Completion
  - Confident in the drilling plan for final two seasons
  - Costs well understood with adequate contingency for 86 strings, including the deep core strings
  - Continuous attention to safety and quality assurance needed
- Operations Program Informed by Experience
  - Committed to excellent M&O performance w/ timely data analysis
  - Initial success due to M&O Core support, research grant support, UW subsidies, and the MREFC foundation (particularly Pre-Ops)
  - Future M&O requirements are described in a detailed proposal

Backup Slides

Contingency Use by Major Categories

Major Category	($M)	%	Description of Changes
Cost Changes by WBS	**(24.4)**	**66.3%**	
WBS 1.1 Project Support	3.7		Reduction in engineering, systems engineering, and project management services
WBS 1.2 Implementation	(16.4)		Enhancements and reliability improvements to the Enhanced Hot Water Drill, new Firn drill, hose replacement, new drill cables and repairs, ICL design support, drilling test bed, and increase in drilling crew staff from 22 people (2 shifts) to 30 (3 shifts) for all future seasons
WBS 1.3 Instrumentation, DAQ	(8.7)		Replace 1 Surface to DOM cable, additional IceTop Cables, additional DOR card development and delays, 3 production Dark Freezer Laboratories, higher labor rates, and additional DAQ SW labor to support the transition to final production DAQ
WBS 1.4 Data Systems	(1.0)		Enhancements to the computing infrastructure to support increased data rates and volumes
WBS 1.5 Comm. & Verification	1.0		Reduction in MREFC supported data verification work
WBS 1.9 Pre Operations	(3.0)		Transition to full scale operations: South Pole System enhancements, Data Warehouse enhancements, additional disk arrays and CPU, replace South Pole tape system. Additional effort to reprocess taped data, develop the IceCube Live monitoring system, and finalize the DAQ software
Scope Changes by WBS	**(7.1)**	**19.3%**	
WBS 1.2 Implementation	(0.2)		Logistics and storage
WBS 1.3 Instrumentation, DAQ	(4.4)		DOM production, Cables to 75+ strings, Ice Top stations and Main Boards to 80.
WBS 1.6 RPSC Support	(2.4)		RPSC Support to 80 strings (Including Fuel cost growth from 1.5 $/gal to 2.56 $/gal)
Additional Installation Season	**(5.9)**	**15.9%**	Additional installation season (drilling/deployment, DOM testing and DAQ support, logistics, data systems, and commissioning)
RPSC Support	**(0.7)**	**2.0%**	Increased in number of deployments per season and total on-ice days to support larger drill crews. Fuel cost growth from 1.5 $/gal to 2.56 $/gal impacted FY08-9 budget.
Early Cost Reductions	**1.3**	**-3.5%**	Reduction in baseline budgets for travel and other multipliers on baseline labor.
Contingency Usage to Date	**(36.8)**	**100%**	