IceCube Project Monthly Report
October 2006

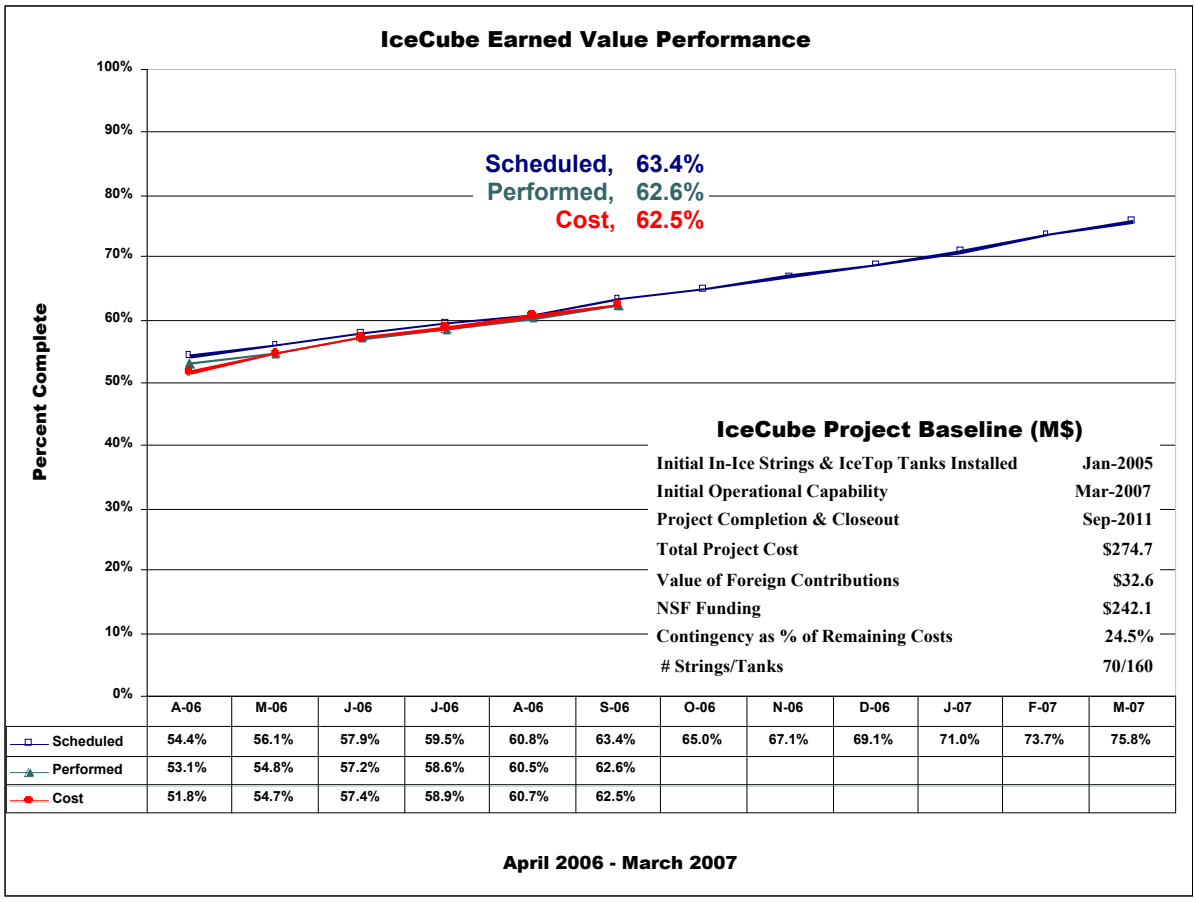
Accomplishments

About 40 IceCube personnel are now at the South Pole. Drilling is scheduled to start on December 5, 2006.

Changes to the DAQ software will be implemented this year to make the system easier to maintain and to make it more accessible to a larger group of physicists and professionals within the collaboration.

Overall progress on Data Systems remains very good. Online filtering of data at the Pole has continued with high efficiency and reliability since June 1.

Tools for detector verification continue to mature, and a full proposal for verification and calibration data taking in 2007 was submitted.



	A-06	M-06	J-06	J-06	A-06	S-06	O-06	N-06	D-06	J-07	F-07	M-07
Scheduled	54.4%	56.1%	57.9%	59.5%	60.8%	63.4%	65.0%	67.1%	69.1%	71.0%	73.7%	75.8%
Performed	53.1%	54.8%	57.2%	58.6%	60.5%	62.6%						
Cost	51.8%	54.7%	57.4%	58.9%	60.7%	62.5%						

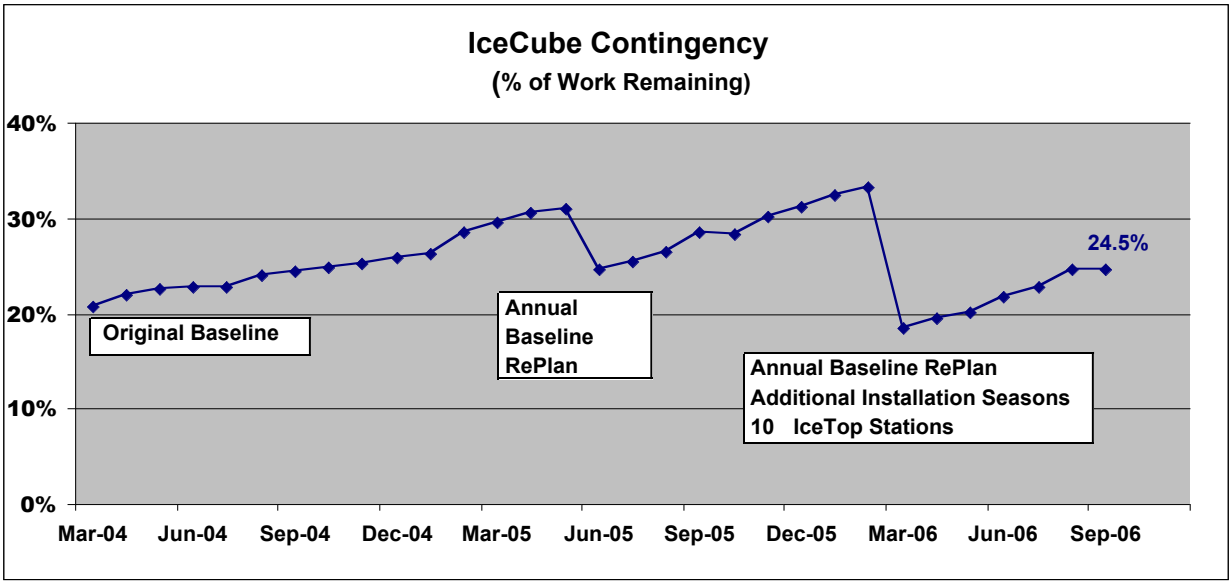
Cost and Schedule Performance – The project is 62.6% complete versus the plan of 63.4% complete, as measured using earned value techniques. The earned value measurement includes all tasks completed to date including design, development, procured materials, and the

construction of the infrastructure that supports the seasonal installation plan, e.g., the hot water drill, cargo shipments, etc.

IceCube Neutrino Observatory
Cost Schedule Status Report
Reporting Period Ending: 9/30/2006 Note 1

	Cumulative To Date (AY K$)							At Completion (AY K$) Note 5			Complete (%)		
	Budgeted Cost 2		Actual Cost of Work Performed	Variance		Contingency							
OBS Structure L2	Work Scheduled	Work Performed		Schedule	Cost	Assigned	% ETC	Budgeted AY $s	Latest Revised Estimate	Variance	Sched	Perf	Actl Cost
Project Support	19,142.5	18,971.6	18,837.4	-170.9	134.2	837.1	7.8%	30,260.8	29,503.3	757.5	63.3%	62.7%	62.3%
Implementation	25,008.9	24,309.7	24,827.3	-699.2	-517.7	6,965.2	36.8%	39,476.2	43,750.3	-4,274.1	63.4%	61.6%	62.9%
Instrumentation	43,664.8	43,447.2	42,994.9	-217.5	452.3	3,424.8	13.7%	68,426.6	68,036.3	390.3	63.8%	63.5%	62.8%
Data Acquisition	25,648.7	25,365.1	25,652.0	-283.6	-286.8	834.1	10.0%	33,998.9	33,998.9	0.0	75.4%	74.6%	75.4%
Data Systems	15,877.2	15,551.7	16,786.0	-325.5	-1,234.3	1,852.0	21.6%	25,368.9	25,368.9	0.0	62.6%	61.3%	66.2%
Detector Comm. & Verification	12,114.3	12,233.1	12,121.0	118.7	112.0	1,067.1	13.6%	19,962.4	19,962.4	0.0	60.7%	61.3%	60.7%
Subtotal	141,456.4	139,878.4	141,218.5	-1,578.0	-1,340.2	14,980.2	18.9%	217,493.9	220,620.1	-3,126.3	65.0%	64.3%	64.9%
RPSC SUPPORT	17,353.8	17,023.7	15,494.7	-330.2	1,529.0	7,936.2	35.1%	32,856.2	38,104.0	-5,247.8	52.8%	51.8%	47.2%
NSF	622.7	622.7	622.7	0.0	0.0	156.0	24.4%	1,263.0	1,263.0	0.0	49.3%	49.3%	49.3%
Total	159,432.9	157,524.8	157,336.0	-1,908.1	188.8	23,072.4	22.5%	251,613.1	259,987.1	-8,374.0	63.4%	62.6%	62.5%
CONTINGENCY Notes 3,4								23,072.4	14,698.4	8,374.0			
IceCube Total Note 2	159,432.9	157,524.8	157,336.0	-1,908.1	188.8	23,072.4	22.5%	274,685.5	274,685.5	0.0	63.4%	62.6%	62.5%

Notes: 1 Incorporates approved baseline changes.
2 Total Budget at Completion includes non-US contributions 2,915 K over the amount in the post Hartill III baseline of 29,698 K
3 Budgeted contingency is: 24.5% of the Budgeted cost of work remaining.
4 Budgeted contingency is: 22.5% of the Estimated Cost to Complete (ETC)
5 The latest revised estimate equals either the budgeted cost of work remaining divided by the historical cost performance index, or a currently proposed baseline revision.



Change Log – IceCube Total Project Budget Baseline ($K)

9/30/2006 **Change Log - IceCube Total Project Budget Baseline ($K)**

No.	Description	Date Approved	Total Baseline	Allocated Budget	Allocated Budget Change	Contingency Budget	Estimate To Complete (ETC)	Budgeted Cost of Work Remaining	Contingency % of Remaining Work
NA	Status as of Aug 2006		274,651	250,400		24,250	107,669	98,158	**24.7%**
CR70	Implementation PY5 Rebaseline a) US - 24X7 drilling and EHWD enhancement	09/20/06	274,651	251,989	1,589	22,662	103,027	94,464	**24.0%**
	b) Non-US - Driller training & increased drilling hours	09/20/06	274,686	252,024	35	22,662	103,062	94,499	**24.0%**
CR71	Accelerated Ramp Down of Project Support Staff	09/20/06	274,686	251,810	-213	22,875	102,848	94,285	**24.3%**
CR72	IceCube Laboratory Fire Suppression System Cost Reduction	09/27/06	274,686	251,613	-197	23,072	102,651	94,088	**24.5%**

Risk Assessment & Potential Contingency Adjustments

Item	Potential Contingency Adjustments	Notes
Spares, increased number of drillers (6 to 18 seasonal drillers), increased retro and maintenance costs may drive-up Implementation out-year budgets.	$4,400K	This potential change will be addressed as part of the revised plan for construction completion. The completion plan is expected to be approved by April 1, 2007, following the third installation season at the South Pole
Scope and higher unit pricing will increase the RPSC out-year budget baseline	$5,200K	This potential change will be addressed as part of the revised plan for construction completion. The completion plan is expected to be approved by April 1, 2007, following the third installation season at the South Pole
Potential draw on contingency due to a slow ramp up in operations support	TBD	Currently working to reduce the funding requirements for operations

Drill Operation and String Installation – On November 4th the early IceCube drill team arrived at the South Pole. This was four days behind schedule due to weather conditions, but the target date to begin drilling remains December 5th.

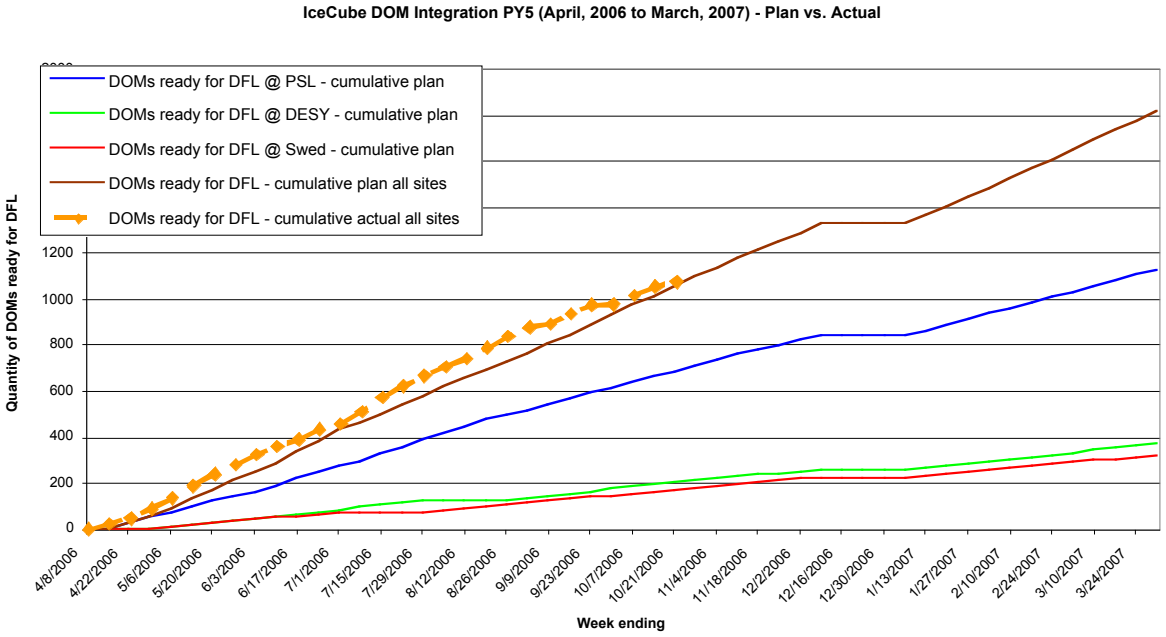
The Winter Storage Site (WSS) has been cleared of drift snow and a temporary generator was provided to power and heat seven MDS modules. The modules will be modified and upgraded at the WSS prior to being moved to the Seasonal Equipment Site (Drill Camp) across the ski way. Heaters were installed to warm the water tank interior, a snow ramp was built to allow material delivery, confined space equipment is being gathered, work permits are in place, and a meeting was held to plan the safe completion of this task. Materials and equipment are now being delivered to South Pole, and we are monitoring the schedule daily.

Replacement motors were delivered to PSL and will be shipped to the pole as planned. One motor with frame and hardware is already en route and scheduled for replacement at the SES during the early season. The rest are scheduled for replacement in January if time allows.

Logistics –An inventory of existing equipment at the South Pole is underway, including consumable items of the EHWD such as fasteners, electrical/plumbing items, and office supplies. The HardCat Inventory Asset/Stock Module was initially implemented for tracking IceCube

equipment shipping from the United States; but ICL equipment, cables, and DOMs already at the pole may be added to the HardCat inventory system during the summer season at Pole.

Digital Optical Module and Cable Production Status and Plans - There are no major issues with instrumentation production. The plans provide instrumentation well in advance of the installation dates and support the use of the least expensive shipping methods. The actual status of DOM integration is provided in the following chart.



DOM Testing – There have been a total of 14 Final Acceptance Testing (FAT) cycles completed at the three worldwide production sites. Currently, one FAT cycle is in progress at the University of Wisconsin. A total of 751 DOMs were tested in the 14 FAT cycles. None of the 751 DOMs tested had any major failures and the failed DOMs should ultimately pass upon retesting.

Detector Commissioning and Verification – Tools for verification continue to mature. A full proposal for verification and calibration data taking in 2007 has been developed and is currently under review.

Collaborators from New Zealand and Uppsala agreed to take on two calibration tasks, which up until now were unsubscribed. Suruj Seunarine from U.Canterbury will take on the task of calibrating the linearity and saturation response of the deployed DOMs. Since some of the code to do this has already been written at Penn State, Suruj will be going there in the near future for two weeks to learn the basics of IceCube software and the specifics of the existing code. Martino Olivo from Uppsala U. will take up the task of geometry calibration with downgoing muons (a.k.a. “muon tomography”). It is also the case that expertise in using muons for this kind of calibration exists at Penn State, so Martino will be making a visit there in December, and he will also learn both the basics of IceCube code and the specifics of muon fitting for use in this calibration.

Unfortunately, no savings accrues to the MRE due to U. Canterbury taking on the linearity and saturation response task. This is because additional effort in this area of calibration was needed to address issues arising from droop correction and baseline shifts. There should be a savings of about 0.1 FTE from shifting the responsibility for muon tomography from LBL to Uppsala.

A comprehensive proposal for running high-level verification monitoring tasks at Pole has been written by Carsten Rott (PSU) and is being circulated amongst the principal interested parties (e.g., Erik Blaufuss (UMd). The main idea is to increase statistics for many verification monitoring tasks by running on the unfiltered data at Pole. This will be done in the PnF framework, requiring that some new code be written, and will use existing CPU resources.

A meeting at UMd will be held in early December to install and test this system on the PnF system.

Verification tests of AMANDA/IceCube integration, with data taken earlier this year, are nearing completion. 25 minutes of TWR data and 20 minutes of IceCube data were studied with a simple muon analysis, and time residual distributions were found. Muon tracks were fit to AMANDA, and time residuals for the IceCube hits were calculated; the reverse analysis was performed as well. These data show residual distributions that fall within expectations from previous IceCube-only studies. Over an hour of data from each detector are now in the North, and are in the process of being merged for use in further verification.

A joint simulation chain for background and signal Monte Carlo has been developed for events in the joint IceCube/AMANDA detector, and has been run from particle injection through reconstruction. Large-scale simulation for joint detector neutrino events and background muons is set to begin soon. Several modules to improve the simulation chain to more closely resemble data were completed as well. Simulation studies have illuminated some unresolved TWR integration timing issues, which have been solved, too. Data-to-Monte Carlo comparisons and verification are underway.

Data Acquisition System Hardware - The primary deliverables for the DAQ hardware group are DOM Main Board Assemblies, a GPS/Master Clock Distribution system and DOM Hub Industrial Computers.

DOM Main Board production continues to progress smoothly. The DOM Main Board assembly and test vendor has received enough components to start loading more than 500 PC boards of the current build of 2500. Delivery of Main Boards to LBNL for final test and QA is on schedule to occur by mid November. Main Board shipments to Integration site should start up again by the beginning of December.

Delivery of all components of the final version of the GPS/Master Clock Distribution system, which is used to distribute time codes and system clocks to all of the DOM/Hubs in the IceCube array, to support 80 In-Ice detector strings and the IceTop detector is complete.

The complete quantity of DOM Hub computers for deployment this year have been shipped to UW. Final documentation checking is in process, and the handoff of DOM Hub production to UW should be complete by March 2007.

Data Acquisition System Software - The project adopted a recommendation by the Data Acquisition System Level 2 Manager to undertake a course correction in the DAQ system to make it simpler and more easily maintainable and accessible by a larger group of physicists and professionals within the collaboration. There was consensus that the changes proposed are worthy of an immediate redirection of effort and that the short term consequences will be outweighed by the benefits over the longer term. There is a solid foundation in place and the DAQ team is finalizing the new plan and working to minimize disruptions to data taking operations.

The changes involve a major rework of the configuration and control system which meets the basic functionality needed during the current year but requires some redesign in order to achieve the functionality required for next year and into the future. In addition, a new prototype for handling the low-level data collection was introduced which addressed some performance and stability issues with the current DAQ implementation. The higher-level components such as triggers and the event builder will be used with some adapters to fit into the new component control and configuration system.

The changes will maximize the overall likelihood of completing the data acquisition software system within the current cost projections. However, the changes are coming very late in the season and therefore there is some degree of risk associated with the new plan. The new effort will commence in earnest in November with a rapid prototyping phase to last several weeks until the DAQ developers come together for an implementation meeting in early December. After this meeting the prototyped components should be demonstrated to work and produce event data from the DOMs on the northern hemisphere test system, SPTS. Later, at the end of December, a demonstration of the new system running on a simulation of O (10) strings, also running on the test system, will be completed. During the months of January and February the new DAQ will be tested in pieces and as an integrated unit on the real array strings after they are released by the low-level commissioning group. By March 1st, 2007, the DAQ and Online systems (PnF and data movement) should be inter-operating on the full detector with simple filters passing data north.

Data Systems - Overall progress on Data Systems remains good with no major delays or cost variances.

All equipment (~18 racks and associated computer equipment) for the SPS computing to be installed in the new South Pole ICL was shipped on schedule. The equipment for the 64-bit computing South Pole Test System (SPTS-64) has gone through the final stages of assembly and final software installation. The SPTS-64 became available for systems testing this month. Installation of computing equipment for the Northern hemisphere Tier 1 Data Center and upgraded storage capacity for the Tier 0 Data Warehouse at UW continues on schedule.

Online filtering of data at Pole to select events for transmission continues with high efficiency and reliability since June 1 with no major problems. Continued enhancements to the online and offline database tools for IceTray were delivered this last month. Upgraded distribution and build tool for the IceTray online/offline software went through final testing. This upgraded system allows easier software builds for new operating systems and easier installation for users. The new system is a major step on the way for the development of "single click icon" installation of offline software/event viewer binaries for non-expert users. Continued development on the Joint-Event-Builder (JEB), which will join the IceCube and Amanda TWR data streams into the PnF IceTray framework for online filtering of the joined events from the two arrays. This is major milestone in the integration of the Amanda detector into IceCube and will allow us to turn off several legacy systems on Amanda to save power at South Pole and to make optimal use of the available satellite bandwidth. The data transmitted over satellite and ingested into the data warehouse continues to be reliably running and automatically processed by the L0 process. Final testing continues on an automated L1 reconstruction in the UW data center. The L1 process includes more advanced muon fitting using the LLH muon fitter and filtering out an enriched muon neutrino dataset. Work continues to integrate the offline production processing into the tool set used for distributed production of Monte Carlo. Significant progress has been made here in the last month and final planning for implementing the system into regular production is nearly complete.

Simulation production with version 1.9.2 continues at a steady pace and is being used for physics analysis. The next production releases of versions 1.9.4 was released on schedule. Production with Version 1.9.4 is scheduled to begin mid November. V 1.9.4 adds better modeling of the trigger and DOMs. Beta of Version 1.9.5, which adds AMANDA TWR simulation into the IceSim Monte Carlo and will include all the functionality for version 2.0.0, is under pre-release testing. After code reviews and adding more unit test to 1.9.5 we will release version 2.0, which will be a major new release for doing physics analysis with next years integrated Icecube/Amanda detector.

Progress in experiment control continues with improvements in configuration infrastructure and detector monitoring web pages.

Quality Assurance and Safety – An Emergency Response Simulation Drill is planned for late November 2006 at the South Pole, centering on "unplanned events" and the team's (UW/RPSC) response to them. The simulation is scripted and the cast is assembled. We hope the team will all learn something from this effort in terms of response improvement. Most people typically get a better understanding of how the Polar processes operate. This will help to clarify where the shortcomings may lie in order to strengthen our already solid processes.

The Hazard Analysis for the EHWD has been completed and approved. Copies are available at the South Pole and on Docushare. Approval of the welding process for the new lining of the water tanker is pending final review.

The monthly reports are posted at IceCube Monthly Reports.

Meetings and Events

Forecast for Start of Drilling for the 2006/2007 Season	December 5, 2006
Forecast for End of Drilling for the 2006/2007 Season	January 30, 2007
Project Advisory Panel/Science Advisory Committee Meeting	March 1-2, 2007
IceCube Collaboration Meeting, Lake Geneva, Wisconsin	April 24-28, 2007
NSF Annual Review of the IceCube Project (tentative)	May 2007