IceCube Project Monthly Report
April 2006

Accomplishments

A review of the IceCube data acquisition, on line, and experiment control systems was completed in April. The committee included a member of the IceCube Project Advisory Panel plus additional external experts. The report will be released prior to the NSF Annual Review.

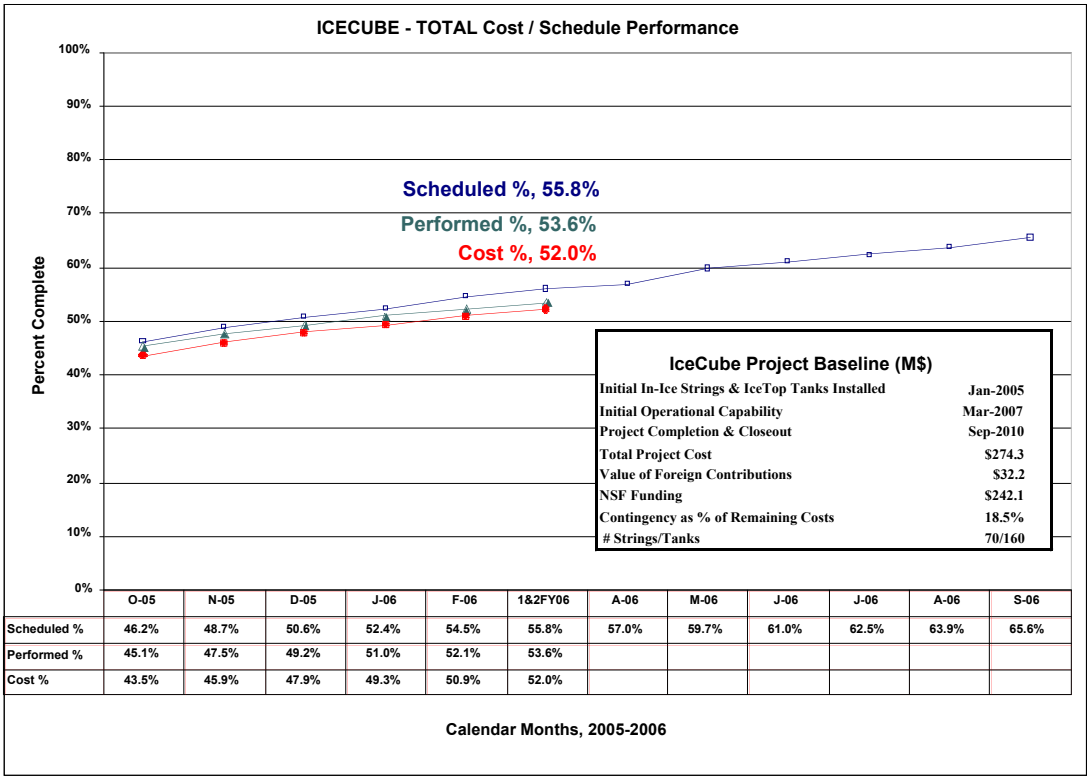
The commissioning of the first of three mini-dark freezer laboratories at the Physical Science Laboratory was successfully completed and a test cycle is now underway.

The NSF Annual Review of the IceCube Construction Project and preliminary plans for operations and analysis will be held in Madison from May 23rd through May 25th.

Preparations for a major upgrade to UW data center computing system based on 64-bit computing platforms are in progress.

The first online neutrino filters were tested and presented to the collaboration. The initial neutrino filter is planned for deployment in mid May.

Industrial safety training for drilling and installation managers, safety leads and a few other on-ice personnel will be completed in late summer.



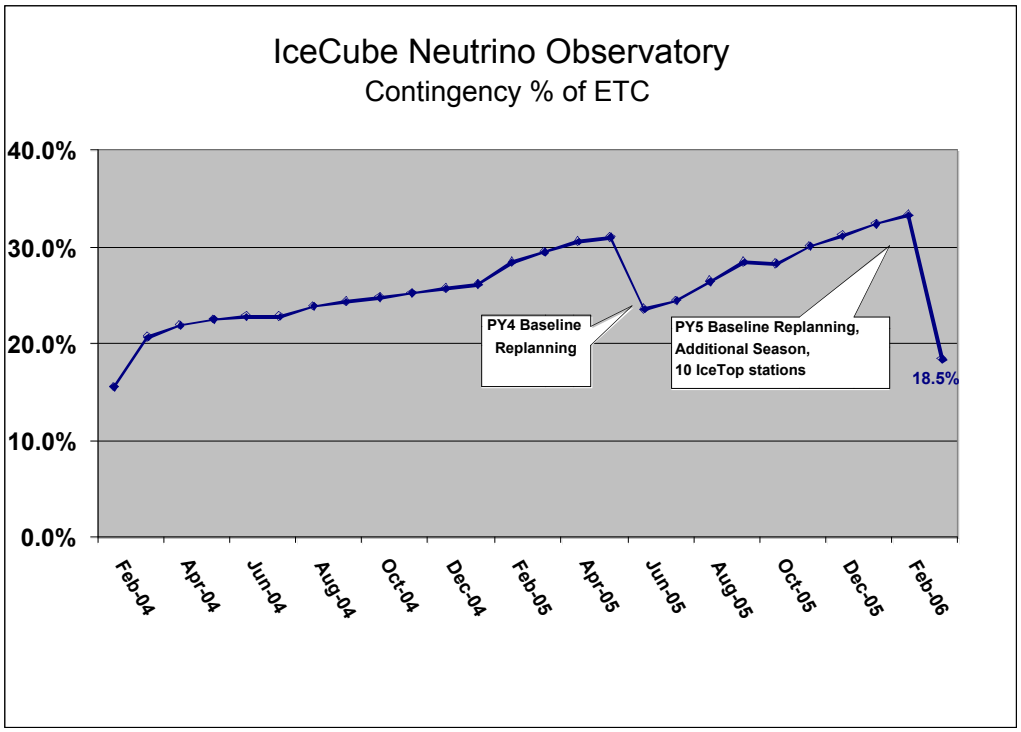
	O-05	N-05	D-05	J-06	F-06	1&2FY06	A-06	M-06	J-06	J-06	A-06	S-06
Scheduled %	46.2%	48.7%	50.6%	52.4%	54.5%	55.8%	57.0%	59.7%	61.0%	62.5%	63.9%	65.6%
Performed %	45.1%	47.5%	49.2%	51.0%	52.1%	53.6%						
Cost %	43.5%	45.9%	47.9%	49.3%	50.9%	52.0%						

Cost and Schedule Performance – The project is 53.6% complete versus the planned performance of 55.8% 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. The cost and schedule status report and total contingency percentage (contingency/cost-to-complete) as a function of time, currently roughly 18.6%, are shown in the following tables. The contingency will increase to ~20% in the next month as a result of the recently completed Project Year 4 closeout.

IceCube Neutrino Observatory
Cost Schedule Status Report
Reporting Period Ending: 3/31/2006 [1]

	Cumulative To Date (AY K$)					At Completion (AY K$)			Complete (%)		
	Budgeted Cost [2]		Actual Cost	Variance							
OBS Structure L2	Work Scheduled	Work Performed	of Work Performed	Schedule	Cost	Budgeted AY $s	Latest Revised Estimate	Variance	Scheduled	Performed	Actual
PROJECT SUPPORT	17594.2	17594.2	17380.5	0.0	213.7	30980.7	30767.0	213.7	56.8%	56.8%	56.1%
IMPLEMENTATION	21547.1	21214.8	21416.0	-332.3	-201.1	38021.0	38222.1	-201.1	56.7%	55.8%	56.3%
INSTRUMENTATION	38930.8	38867.6	38735.4	-63.2	132.2	68762.8	68630.6	132.2	56.6%	56.5%	56.3%
DATA ACQUISITION	22732.9	22631.2	23096.8	-101.7	-465.6	34132.4	34598.0	-465.6	66.6%	66.3%	67.7%
DATA SYSTEMS	13034.8	12325.9	12648.4	-708.9	-322.5	25770.0	26092.5	-322.5	50.6%	47.8%	49.1%
DETECTOR COMM. & VERIFICATION	10228.3	9840.4	9380.7	-388.0	459.7	20919.3	20459.6	459.7	48.9%	47.0%	44.8%
RPSC SUPPORT	16432.4	12396.0	8242.4	-4036.4	4153.6	32781.2	28627.7	4153.6	50.1%	37.8%	25.1%
NSF	556.2	556.2	556.2	0.0	0.0	1263.0	1263.0	0.0	44.0%	44.0%	44.0%
Sub Total	141056.6	135426.2	131456.3	-5630.4	3969.9	252630.5	248660.6	3969.9	55.8%	53.6%	52.0%
Management Reserve											
Total Contingency						21,633.0	25,602.9	3,969.9			
Items Outside of Approved Baseline											
IceCube Neutrino Observatory [2]	141,056.6	135,426.2	131,456.3	-5,630.4	3,969.9	274,263.4	274,263.4	0.0	55.8%	53.6%	52.0%

Notes: 1 Incorporates approved and currently pending baseline changes.
2 Total Budget at Completion includes non-US contributions 2,492 K over the amount in the post Hartill III baseline.
3 The budgeted contingency is: 18.5% of the Budgeted cost of work remaining.



The project has maintained a contingency percentage above twenty percent relative to the cost-to-go since approval of the original baseline in early 2004. On May 11th RPSC submitted to NSF a revised cost baseline for IceCube work. If the cost baseline proposed by NSF is approved it will result in a $6.5 million reduction in the IceCube project contingency budget and reduce the contingency percentage below twenty percent. This is a major change given that RPSC cost performance reports have historically showed positive cost variances including the most recent report of a projected $4.2 million savings. The project is now looking at options for increasing contingency including backing off on some electronics purchases that are needed to achieve more than 70 strings. The additional installation season that is now included in the baseline is needed to achieve 70 strings. A bottoms-up contingency assessment and more general risk assessment will be presented at the NSF review next week. We remain confident that the project will successfully complete the approved scope within the total approved funding plan.

The mid-year, FY06 GPRA Report, was submitted on March 14th to the NSF. The Project Execution Plan was finished and submitted to NSF on March 21st. Funding for Project Year 5 was received on April 14th.

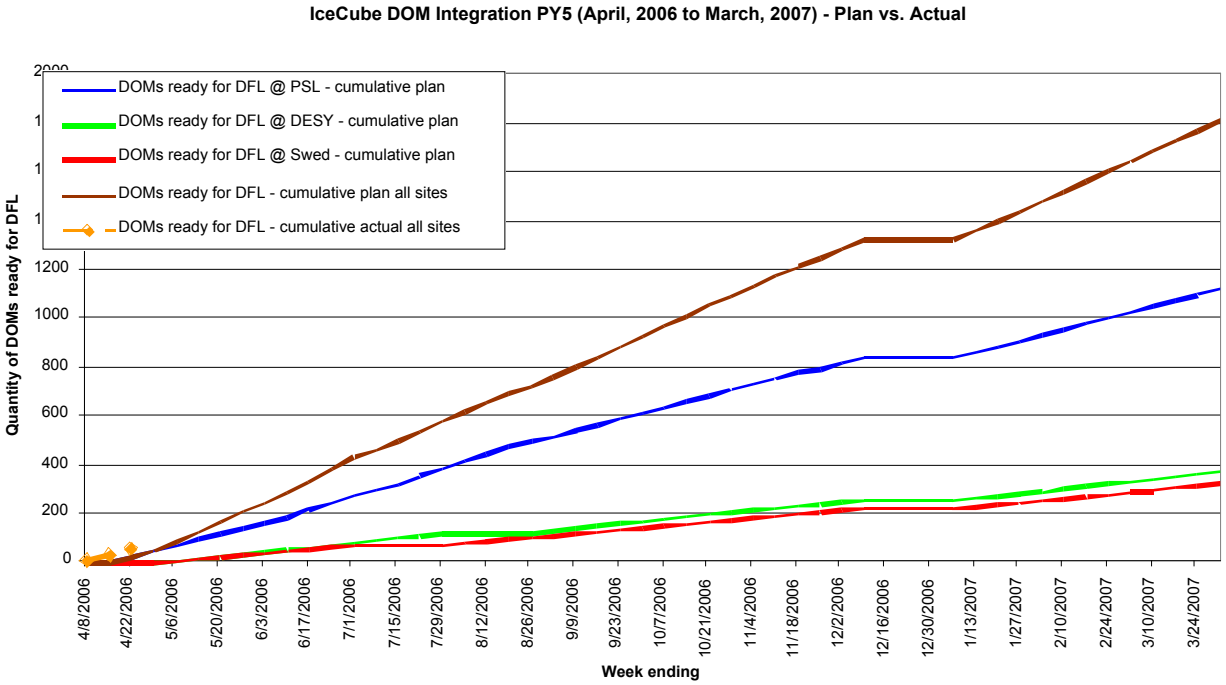
Drill Operation and String Installation – Drill and string installation equipment upgrades are underway. Shop work started on new crescents. Additional hose strain relief components are also in production. A design for DOM transportation sleds that will reduce handling and labor at Pole was developed. Additional projects are in the design and materials ordering phase. Equipment failures experienced at the South Pole last season are being reviewed through a formal Non Conforming Materials process. These issues include drill head communication failure, high pressure pump motor failure, network communication board failure and paro pressure sensor failure. Cargo and population estimates were prepared in support of the SIP process. The population estimates will continue to be tuned as the project strives to keep within the population profile already submitted to NSF and RPSC. Specification of requirements and preliminary design work started on a testing and training facility at the University of Wisconsin Physical Sciences Laboratory. This is important to enable equipment testing and operations and maintenance training now that the drill is at the South Pole. The goal is to have a preliminary system in place by the end of July for this year's driller equipment training.

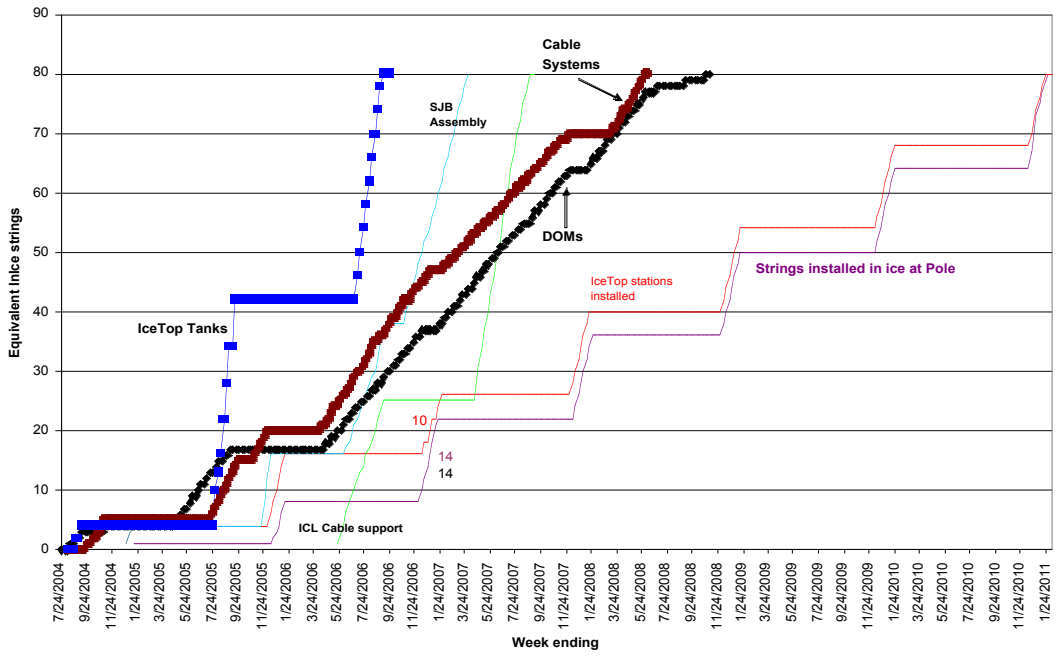
A detailed schedule of all the operations at the hole is being prepared. This schedule is being made at an hourly level of time with resource loading. The goal of this work is to better understand how to most effectively make use of manpower for parallel tasking such as operating the independent firn drill, and supporting cabling. We also hope to make progress streamlining operations at the hole to maximize effective use of equipment.

Digital Optical Module and Cable Production Status and Plans - The plan for DOM production for 2006 is provided in the chart below along with the plan for DOM, cable, and tank production plan for 2004 – 2008. 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.

DOM Testing at UW-Madison – The commissioning for the first of three mini-dark freezers (MDFL) at the Physical Science Laboratory was completed. MDFL-1 is successfully running

Final Acceptance Testing. MDFL-2 is currently in the process of being commissioned and is scheduled to start Final Acceptance Testing later this month. Until recently, all DOM production in the U.S. was carried out using a single dark freezer laboratory. IceCube is in need of expanded DOM testing capability due to the large number of DOMs that will be needed in the next and subsequent seasons.





Detector Commissioning and Verification – The verification effort tested and applied ten algorithms that perform high-level commissioning and verification tests. Data taking for this effort and the calibration effort were not completed at the Pole this past season due to other demands. We brought back about 1/3 of the data required and successfully implemented a system to acquire and analyze the remaining data at the South Pole.

To date, low level commissioning was completed on all DOMs (confirming that their basic functionality, like communication with the surface, works) and we completing high level commissioning of all but 30 DOMs (confirming that their timing resolution and stability is as expected, for instance).

The calibration effort completed the Stage 2 geometry calibration. These constants are not the final ones but are adequate for reconstructing muons and cascades. Efforts are also underway to check the gain calibration, understand the local hole ice, and work has begun on the use of the standard candle.

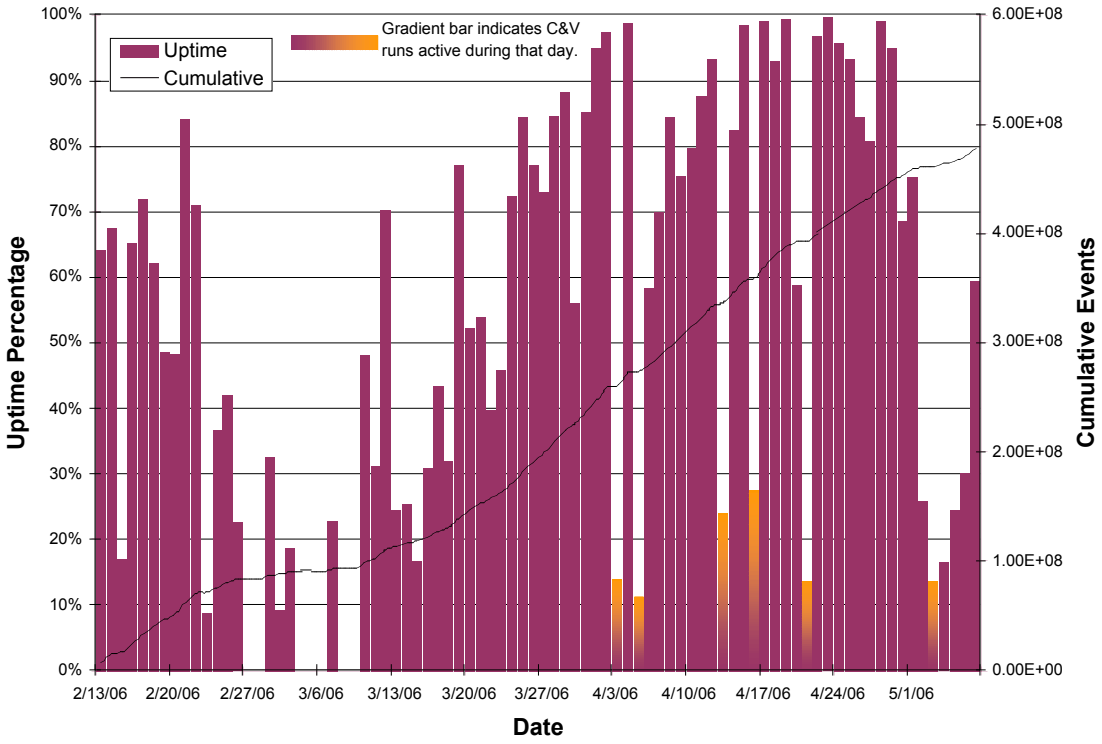
The monitoring system is being used regularly by collaborators. A plan to integrate the low level quantities monitored (e.g., PMT high voltage) with the high level quantities (e.g., the downgoing muon angular distribution) has been established and work has begun in this area.

Progress continues to be made integrating AMANDA TWR data into the IceCube software framework.

Data Acquisition System – A serious disagreement between data rates measured with the old DAQ system (TestDAQ) used during the previous year and the new DAQ was uncovered in early April. The coding flaw eventually succumbed to analysis of the data at various points along the DAQ pipeline and was traced to a few lines of code located within the HAL (hardware abstraction layer) which forms a thin interface between applications running on the DOM CPU and the FPGA firmware. This resulted from a miscommunication of the interface between CPU and FPGA and has provoked a series of code reviews within DAQ to flush out obvious interface mismatches and others of this genus. As a result of the repair which was quickly affected and then later deployed on the IceCube detector, the deep-ice array event rate has increased from 75 Hz to 140 Hz which agrees with the TestDAQ rate.

In addition, the DAQ developers have been working on a new release which adds readout of the supernova scalers implemented in the DOM firmware. The first version of this system is due in early May and after a test period of at least two weeks will be deployed at South Pole. Initially, data will simply be written to disk for post-analysis. Later this year, a real-time 'trigger' which will analyze the supernova data will be deployed which will interface to the global supernova network, SNEWS.

Finally, a DAQ implementation review was conducted during the last week of April at LBNL. This review also included reviews of the online data processing and experiment control systems. A committee report is pending.



System Testing – Laboratory space is being prepared in Chamberlin Hall, UW-Madison Physics Department, that will be used to build up and test the new South Pole computing system. All the electronic and computer equipment that is needed for the system was received and the building of the actual system will commence once the laboratory space is finished.

Ordering has been completed for the cluster that is being built to support simulation analysis. The equipment for the cluster should arrive by the end of the current month. The cluster is currently scheduled to be online sometime in June.

Data Systems - Data is continuing to flow smoothly from the detector, with about 50GB/day of raw data being archived to tape at pole and 5GB/day being transmitted over satellite to the data warehouse at UW. Significant new progress includes:

- Continuing work on detailed design specification and layout for the 17 racks to be installed in the permanent ICL next season.
- Detailed power estimates for ICL computing systems
- Preliminary layout of the IceCube ICL control room
- Preparations for major upgrade to UW data center computing system based on 64-bit computing platforms.

The Online Filter and Software systems are on schedule with no significant delays. Particular accomplishments include:

- Successful and smooth operations of the online filter server (PnF) at South Pole with continued integration of the DAQ as it progresses.

- Frozen version of online PnF data classes (DC) V2.0. Implementation on PnF server.
- First online neutrino filters have been tested using pre-scale data in the north and presented to collaboration. Initial neutrino filter planned for deployment on May 15, 2006.
- Release of the final developer's version for data classes V2.0. Offline software in place to perform reconstruction and analysis on L0 files from data warehouse.
- Official offline Level 0 process now running at UW data warehouse on files received over satellite. The L0 process is the first stage of the offline reconstruction on the data in the north data warehouse, which prepares (calibration, configuration etc…) the raw data from the satellite into the offline data format. The data from the 9 strings in the data warehouse for this season has been processed and is available for offline analysis using DC V2.0 offline software tools.

The simulation effort is slightly behind schedule with release of large production data sets of IceSim. Some accomplishments include:

- Beta release of IceSim V2.0 for verification and testing.
- Continued transition of IceSim modules into offline software version V2.0.
- Continued intervention by the L2 manager in simulation in response to ongoing issues with getting delivery of work from the assigned institutions. This is particularly a problem with the very distributed and fragmented manpower available from Non-US groups (i.e. small fractions of fte's across many institutions). The L2 manager is working on building a smaller number of concentrated efforts using US resources, and hopes to get a significant concentration at a Non-Us group as well.

Experiment control is making progress with some continued schedule delays. Progress in experiment control includes:

- Continued development and support for the core control infrastructure, which is particularly used by DAQ for configuration.
- Work with DAQ subsystem in working out bugs and in developing web based control and configuration of DAQ. The DAQ configuration at Pole currently uses the basic "JBOSS" and "Mbean" infrastructure by executing scripts at run start.
- Continued development of systems for monitoring of the detector. Web based detector status pages now mirrored in North.

Quality Assurance & Safety – The Safety Manual is scheduled to be reviewed over the summer to incorporate any lessons learned from this past Pole Season. This includes the new Safety Hierarchy at the Pole.

Industrial safety training is planned for the summer. This training session will be for Deputy Shift Leads and other on-ice organizational leaders. A consultant will come in to train Deputy Shift Leads and Management as Safety Officers. This training will focus on detecting hazards during walk-throughs, the ability to mitigate these hazards before someone gets hurt and effective Incident Reporting. Emphasis will be placed on creating a culture with a greater awareness of safety on site.

Drilling and Deployment Training has been scheduled for July 24, 2006 through August 4, 2006. Function specific safety training will be implemented into the formal Drilling and Deployment Training. IceCube will not strictly adhere to OSHA training, but will enhance and customize it for the Drill Site. Other training that will be scheduled during the summer includes first aid/CPR training, computer based snowmobile training and forklift training.

A Safety Tabletop meeting is scheduled for September 13, 2006 at RPSC in Denver. Also planned for September at RPSC is an Emergency Response Scenario Drill, which will center on "unplanned events" and UW/RPSC response to them.

The monthly reports are posted at IceCube Monthly Reports.

Meetings and Events

NSF Annual Review – Madison	May 23-25, 2006
Summer Analysis Meeting – Penn State	June 21-25, 2006
Drilling and Deployment Training – Madison	July 24-August 4, 2006
International Oversight and Finance Group Meeting - DESY	September 11, 2005
Season Confirmation Meeting – RPSC	September 12, 2006
Safety Tabletop Meeting – RPSC	September 13, 2006
IceCube Collaboration Meeting – DESY	October 6-10, 2006