IceCube Project Monthly Report
February 2006

Accomplishments

The overall status of this year's 480 deep ice and 48 surface Digital Optical Modules (DOMs) is excellent. Approximately 99% of the DOMs that were deployed this year are working properly to date.

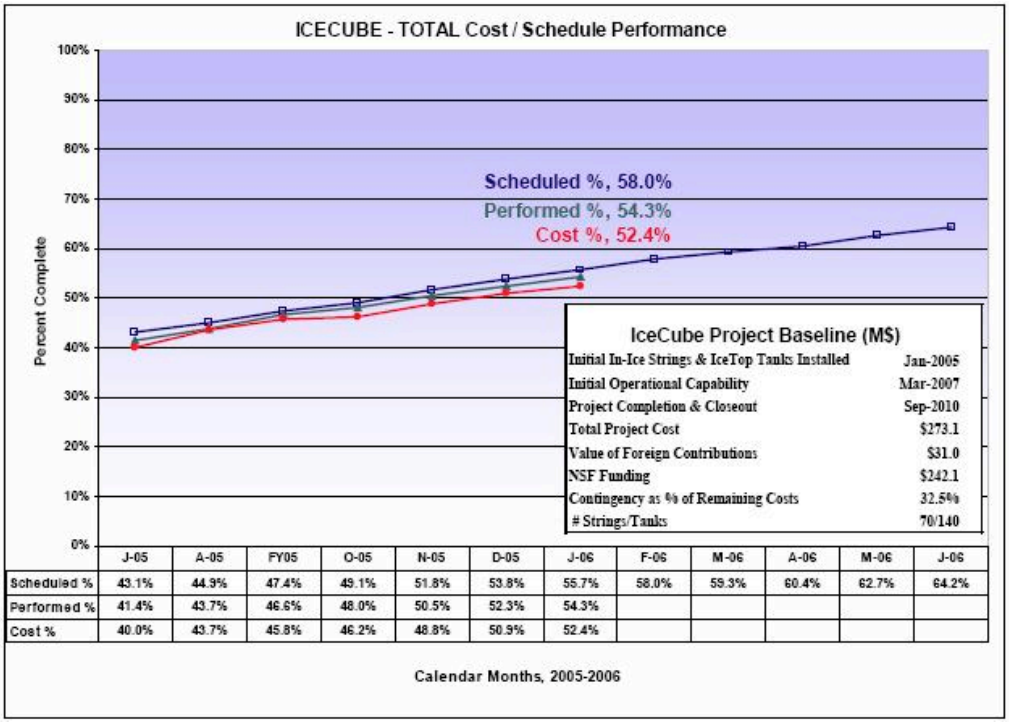
The entire IceCube detector has undergone its first runs. These runs have incorporated a total of approximately 600 DOMs.

The newly commissioned Data Acquisition System is taking data from all 9 of the deep-ice strings and 32 surface tanks.

IceCube is recording noise rates (350Hz, 50µs dead time) significantly smaller than expected. This means a higher sensitivity for supernova detection.

The NSF conducted a site visit of IceCube at the University of Wisconsin – Madison on February 23 - 24.

A series of internal planning and strategy meetings are scheduled for March 2006 and the semi-annual collaboration meeting will be held at Southern University in Baton Rouge, LA, from April 9-14, 2006.



	J-05	A-05	FY05	O-05	N-05	D-05	J-06	F-06	M-06	A-06	M-06	J-06
Scheduled %	43.1%	44.9%	47.4%	49.1%	51.8%	53.8%	55.7%	58.0%	59.3%	60.4%	62.7%	64.2%
Performed %	41.4%	43.7%	46.6%	48.0%	50.5%	52.3%	54.3%					
Cost %	40.0%	43.7%	45.8%	46.2%	48.8%	50.9%	52.4%					

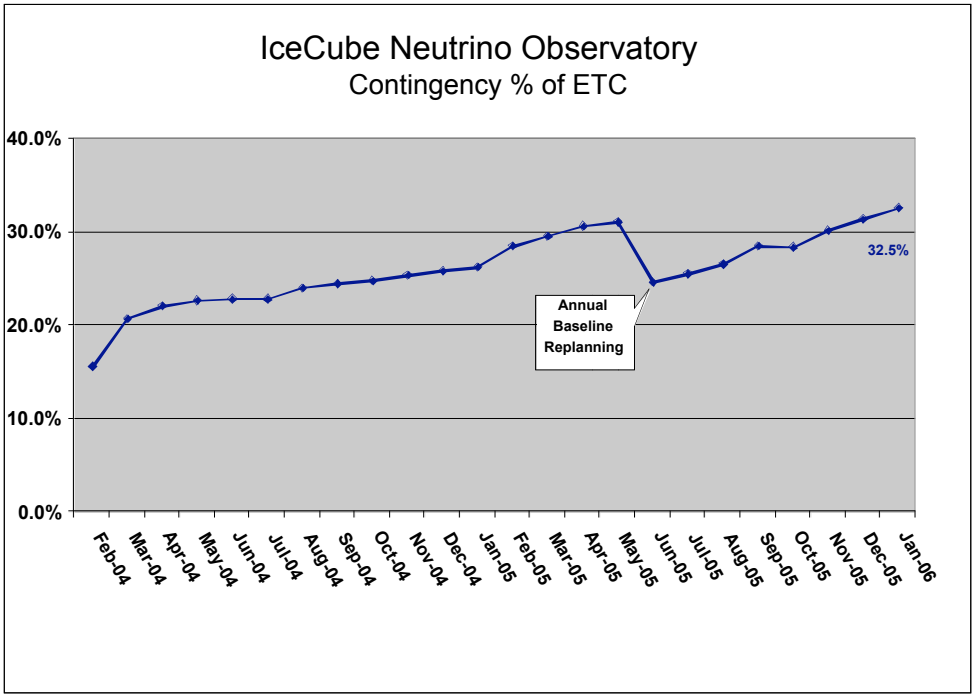
Cost and Schedule Performance – The project is 54.3% complete versus the planned performance of 58.0% complete as measured using earned value techniques. The earned value

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 32.5%, are shown in the following tables.

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

	Cumulative To Date (AY K$)					At Completion (AY K$)			Complete (%)		
	Budgeted Cost [2]		Actual Cost of Work	Variance							
OBS Structure L2	Work Scheduled	Work Performed	Performed	Schedule	Cost	Budgeted AY $s	Latest Revised Estimate	Variance	Scheduled	Performed	Actual
PROJECT SUPPORT	16755.9	16756.2	16959.3	0.4	-203.1	29904.8	30107.9	-203.1	56.0%	56.0%	56.7%
IMPLEMENTATION	20916.1	20668.4	20723.0	-247.6	-54.6	32388.6	32443.2	-54.6	64.6%	63.8%	64.0%
INSTRUMENTATION	37649.2	36872.1	36458.6	-777.1	413.5	65432.7	65019.3	413.5	57.5%	56.4%	55.7%
DATA ACQUISITION	21877.1	21903.0	21954.5	25.9	-51.6	32864.6	32916.2	-51.6	66.6%	66.6%	66.8%
DATA SYSTEMS	12018.0	11343.6	11351.2	-674.4	-7.6	25017.6	25025.2	-7.6	48.0%	45.3%	45.4%
DETECTOR COMM. & VERIFICATION	9030.6	8827.7	8438.3	-202.9	389.4	18825.0	18435.6	389.4	48.0%	46.9%	44.8%
RPSC SUPPORT	13525.6	11994.7	8033.1	-1530.9	3961.6	32022.1	28060.5	3961.6	42.2%	37.5%	25.1%
NSF	534.6	534.6	534.6	0.0	0.0	1263.0	1263.0	0.0	42.3%	42.3%	42.3%
Sub Total	132307.0	128900.3	124452.6	-3406.7	4447.6	237718.5	233270.9	4447.6	55.7%	54.2%	52.4%
Management Reserve											
Total Contingency						35,334.8	39,782.4	4,447.6			
Items Outside of Approved Baseline											
IceCube Neutrino Observatory [2]	132,307.0	128,900.3	124,452.6	-3,406.7	4,447.6	273,053.3	273,053.3	0.0	55.7%	54.2%	52.4%

Notes: 1 Incorporates approved and currently pending baseline changes.
2 Total Budget at Completion includes non-US contributions $1,283K over the amount in the post Hartill III baseline.
3 The budgeted contingency is: 32.5% of the Budgeted cost of work remaining.



Drill Operation and String Installation – The hole production rate improved dramatically by the end of the last season. The drill crew was able to produce a new hole in less than 48 hours as measured from the start of firn drilling and ending with removal of the drill head weight stack.

A lessons-learned meeting with the drilling personnel was held March 9th at the UW Physical Sciences Laboratory and a long list of improvements for next season identified. Another meeting to discuss drill shift schedules and staffing is planned for the week of March 20th. The current plan is for three shifts and continuous operation of the drill next season.

The following table provides the string installation finish dates for the current season. Installation times averaged 15 hours from the start of installation until the tie off of the cable.

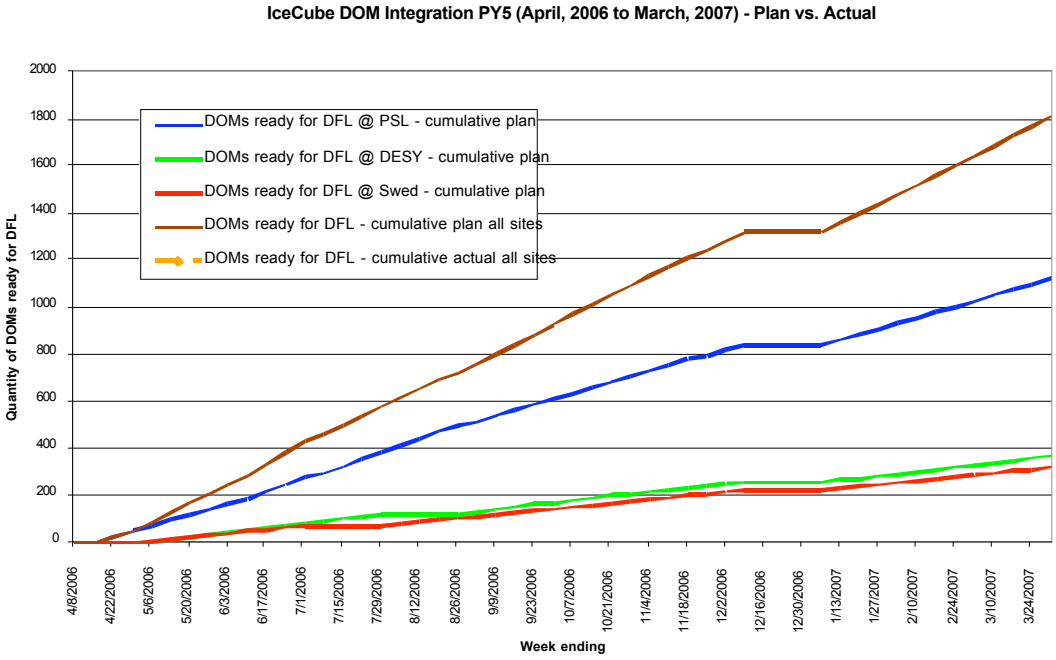
String Installation Dates			
String	Position	Finish Date	Time (days)
1	Hole # 29	12/26/05	16
2	Hole # 39	01/04/06	8
3	Hole # 38	01/09/06	5
4	Hole # 30	01/14/06	5
5	Hole # 40	01/18/06	4
6	Hole # 50	01/22/06	4
7	Hole # 59	01/26/06	4
8	Hole # 49	01/29/06	3.5

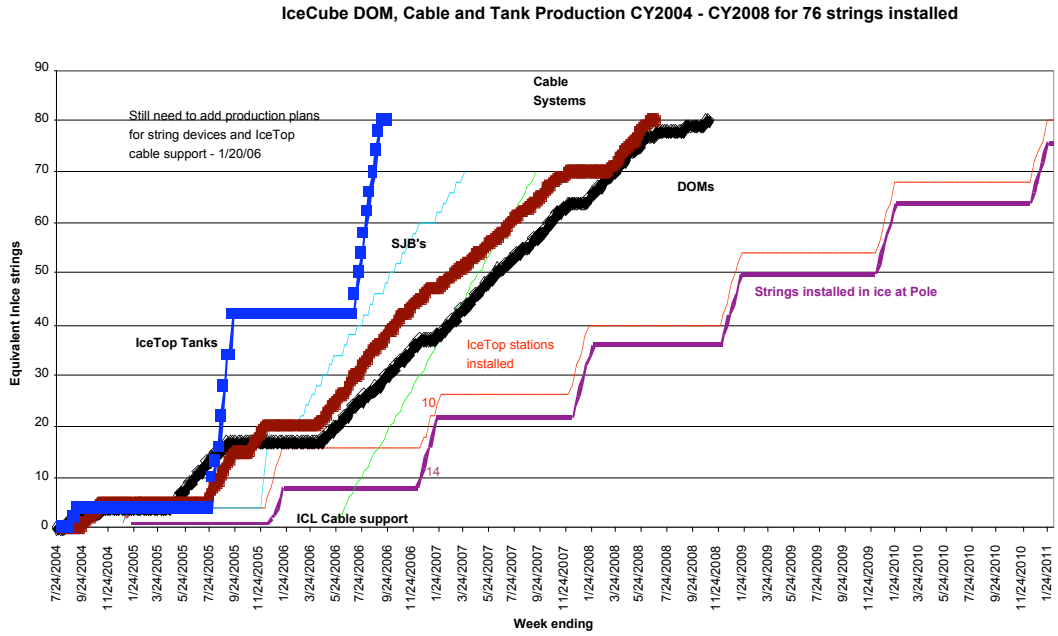
Logistics - The IceCube, RPSC, NSF season review and planning meeting for next season is scheduled for March 16th. The more detailed season planning meeting with RPSC is scheduled for April 4th and 5th in Madison (*tentative)*. The Office of Polar Program's Support Information Package (SIP) is due on April 17th. The South Pole logistics totals for the 2005/2006 are as follows:

- 740,000 lbs planned and 738,000 lbs actually shipped to the South Pole
- 104 deployments planned (IceCube people flying to Pole) and 103 actual
- ~290,000 lbs of IceCube cargo in winter storage at McMurdo for future seasons of which 210,000 lbs was delivered via the surface supply vessel)

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 the entire 2004 – 2008. There are no major issues with instrumentation production. The plans provide instrumentation well in advance of the installation need dates and support the use of the least expensive shipping methods.

DOM Testing at UW-Madison – The qualification Final Acceptance Test (FAT) cycles for the three modular dark freezer laboratories (DFLs) at the Physical Science Laboratory will be completed in April and the first FAT cycle for the new production run will be in early May. Until now, all U.S. DOM production was carried out using a single DFL. The large number of DOMs needed next season and beyond require this expanded capability.





String and IceTop Commissioning – The yield of fully functional DOM from ~~tatus of~~ this year's deployment of 480 in-ice and 48 IceTop DOMs was excellent. Approximately 99% of the DOMs that were deployed are working properly to date.

Four in-ice DOMs of the 480 deployed this past season could not be powered up after deployment. At least three of the failures appear to be related to in-ice connector, cable or penetrator failures and not a failure of the DOM internal electronics. One in-ice DOM suffered a high voltage failure soon after turn-on. There are three locations in the array where local coincidence between DOM pairs is not working properly. Two additional DOMs experience some communications problems that were addressed through workarounds.

Cold-temperature communications problems with many DOMs were encountered this season and changes were made in the software and the problem no longer affects data taking. Data can now be taken continuously with all DOMs using the testing and commissioning data acquisition system.

Remarkably, over one and a half months after it was deployed in the ice, one DOM (as of March 15) is still in water (49-55 "Fusilli"). Locations where DOMs have taken a long time to freeze in are correlated with higher drill dwell time at that depth.

A movie showing the triboluminescence wave and freeze-in for the first two weeks during the life of string 39 can be found at:
http://icecube.wisc.edu/~krasberg/sps/0506deployment/triboluminescence/

Within hours of the turn-on of the 9th string, it was possible to obtain clear multi-string events (many of the DOMs were in water at the time). An example of a downward going muon bundle which hit seven strings can be found at:
http://icecube.wisc.edu/~krasberg/sps/0506deployment/060201report/downward-muon-bundle.gif

An animation of this event can be found at:
http://icecube.wisc.edu/~krasberg/sps/0506deployment/060201report/downward-muon-bundle-animation.gif

A couple of low-level tests remain to be performed on a few DOMs that were powered up after station close. Also, low level commissioning cannot be finalized until all DOMs have frozen in, and we are still waiting for this to happen! So far, everything looks good.

Data Acquisition System – The newly commissioned IceCube DAQ is taking data from 9 deep-ice strings and 32 surface tanks. The DOMs are running in "hard local coincidence" mode that reads out data from DOMs only when there is a trigger in one or both of the neighbors. In this mode the DOMs transmit triggers at rates between 4 Hz (bottom of string) and 20 Hz (top of string) to the surface readout hubs. The hit data from the various DOMs are time calibrated, merged, and chronologically ordered for the trigger processors. These actions take place in real time as the data is readout. Currently we are triggering on hit clusters of 8 or more hits that occur within a time window of 2 us. In addition, for the purpose of monitoring the trigger logic, a "minimum bias" trigger selects every 100th hit for readout; in total, this produces approximately 140 events per second out of the DAQ (600 kB/sec data rate).

The first of several major feature enhancement releases for the DAQ has been scheduled for the

end of April. This release will include support for the readout of the supernova system and will also carry with it support for control of the DOM flasherboard. Another up-coming release will contain code to integrate the AMANDA waveform DAQ into the IceCube global trigger component.

System Testing – The South Pole Test System (SPTS), a mirror site for the South Pole System is operational in Chamberlin Hall, UW-Madison Physics Department. The SPTS is the final test bed for the data acquisition and data handling software and is used to test patches and upgrades to the software operating on the South Pole System (SPS). An additional test facility is located at the UW-Madison Physical Sciences Laboratory that includes a full-length surface to DOM cable and DOMs in portable freezers to simulate actual DOM operating conditions.

Data Systems – The temporary counting house is fully operational. The IceCube Laboratory or permanent counting house is expected to be available by December 6, 2006.

IceCube is collecting raw data from the production Data Acquisition System and verification and calibration measurements at the rate of around 25GB per day. This is reduced to 5GB per day, with an additional 1GB per day for AMANDA, for transfer over the TDRS Ku Band store forward system. All raw data is archived on magnetic tape media. Significant local computing resources are being utilized now to reduce the large amount of test data created from verification and calibration runs with light pulses from on board flasher LEDs, which can total 300GB per day of raw data. The Iridium email system is being used to send basic experiment status information to the IceCube web site every 15 mintues 24/7.
http://icecube.wisc.edu/Status/

Project Planning & Control - A two-day planning workshop for Project Year 5 (PY5, which includes 6 months each of FYs 2006 and 2007) was held in late February culminating 6-months of detailed planning and coordination. Subsequent to that meeting, UW-Madison requested release of PY5 funding.

A baseline change request to add an additional South Pole field season is in preparation. The change is based on the expectation that we will deploy an average of 14 strings per season beginning in PY6, rather than 18 as previously planned.

A self-assessment of the project control function was completed resulting in a number of planned improvements beginning in PY5 including: levels of planning and control commensureate with the complexity of the activity; additional metrics for critical activities; and, encouraging and supporting simpler planning and control tools.

Quality Assurance & Safety – There areno injuries to report; nor any significant quality assurance issues except the few new DOM failures mentioned above that are still under review.

Planning for Operations and Analysis - The proposed M&O budgets for Fiscal Years 2007 - 2011 were refined in an attempt to more properly address potential in-kind contributions, a more distributed model of computing, and to reduce costs, e.g., use of scientists and post docs whenever possible.

The transition from AMANDA to IceCube is in place. AMANDA is accumulating data for the 7th year and continues to deliver results. There is now one year of experience with the first IceCube string and the nine IceCube strings have more PMT-cathode area than entire AMANDA array. The installed IceCube strings already define a larger detector fiducial volume than AMANDA, and IceCube is on track towards completing a 1 km^3 neutrino telescope in 2011.

Nature welcomed the new instrumentation with an unusual gamma ray burst on February 18, 2006. This event occurred in a nearby galaxy (redshift of ~0.01 rather than typically 1) and IceCube should be a thousand times more sensitive. It was also an unusual event, so astronomers do not know how to model it. Fortunately we can still look and are collecting data for a blind analysis around the time of the burst using the old strings, the new strings, the combination as well as the supernova system. We have some experience at this from looking for the spectacular burst of a soft gamma ray repeater on December 27, 04. We are publishing an upper limit on its emission at TeV energies, especially relevant to those who have theorized that this source could accelerate the highest energy cosmic rays.

The monthly reports are posted at IceCube Monthly Reports.

Meetings and Events

IceTop CDR/PRR Meeting – Madison	March 15, 2006
Season Review Meeting w/ UW/RPSC/NSF – Madison	March 16-17, 2006
DOM/Cable PRR Meeting – Madison	March 21-23, 2006
Drill Advisory Panel Meeting – Madison	March 27-28, 2006
Panel Advisory Panel Meeting – Madison	March 29-30, 2006
Science Advisory Committee Meeting – Madison	March 30-31, 2006
International Oversight & Finance Group – NSF	April 7, 2006
Collaboration Meeting - Baton Rouge	April 9-14, 2006
DAQ/On-line Review – Lawrence Berkeley National Laboratory	April 25-27, 2006
NSF Annual Review – Madison	May 23-25, 2006
Summer Analysis Meeting – Penn State	June 21-25, 2006