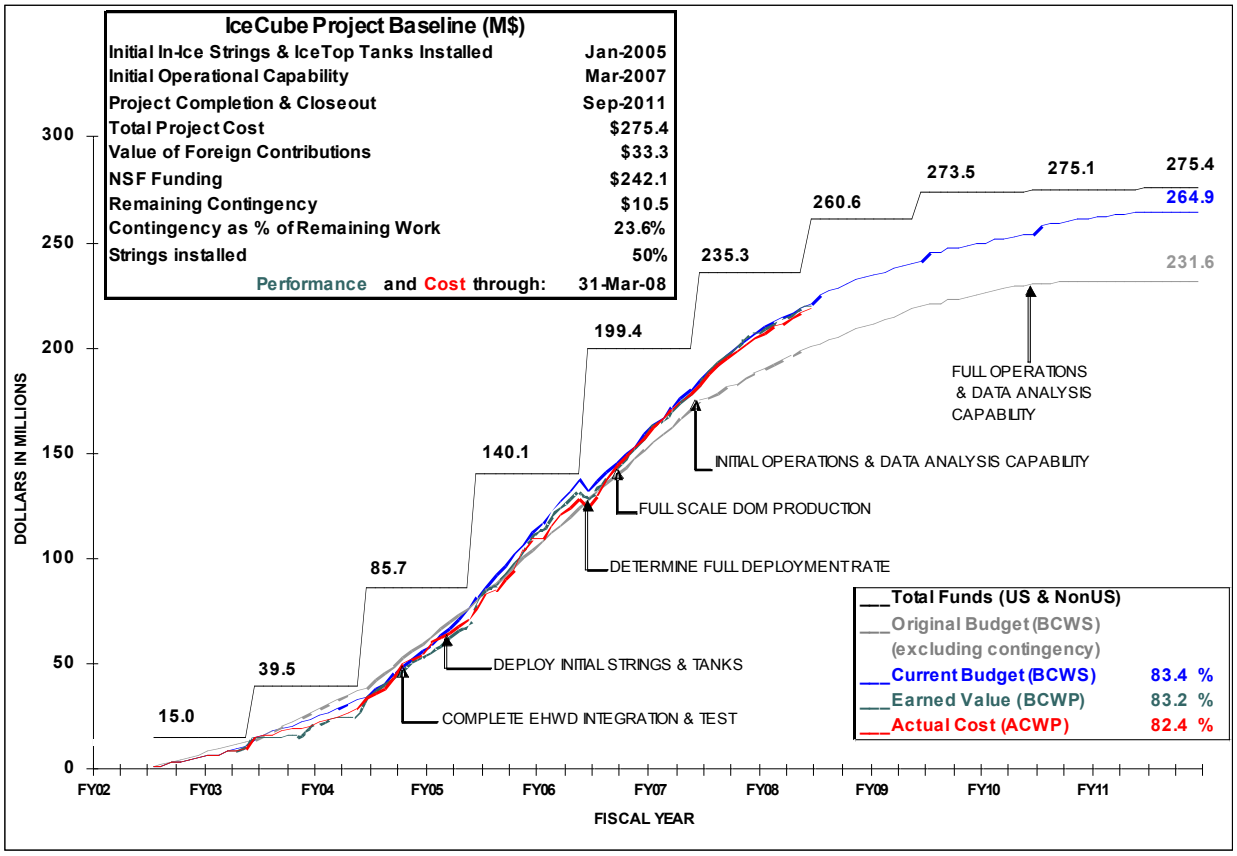
IceCube Project Monthly Report
April 2008

Accomplishments

- An IceCube collaboration meeting was held in Madison from April 29th through May 3rd.
- Commenced inspection and testing the drill cables that were used last season and shipped back from the South Pole.
- Continuing DOM integration and test at each of the three production sites worldwide.
- Planning a data challenge for the IC-40 array.
- Detector up-time for the month was 97.6 percent.
- IceCube was a featured exhibit at the annual Science Expeditions Fair on the UW-Madison campus.



Cost and Schedule Performance – The project is 83.2% complete versus the plan of 83.4% complete, as measured using earned value techniques. The contingency % of the remaining work is 23.6%. 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: 3/31/2008 Note 1

	Cumulative To Date (AY K$)							At Completion (AY K$) Note 5			Complete (%)		
	Budgeted Cost [2]		Actual Cost of Work Performed	Variance		Contingency		Budgeted AY $s	Latest Revised Estimate	Variance	Sched	Perf	Actl Cost
OBS Structure L2	Work Scheduled	Work Performed		Schedule	Cost	Assigned	% ETC						
Project Support	22,874.1	22,874.1	22,522.3	0.0	351.8	186.5	5.0%	27,184.4	26,288.4	896.0	84.1%	84.1%	82.9%
Implementation	33,648.7	33,648.7	33,954.4	0.0	-305.7	3,007.5	20.7%	46,587.9	48,501.6	-1,913.6	72.2%	72.2%	72.9%
Instrumentation	66,704.5	66,130.7	64,848.0	-573.8	1,282.7	439.2	6.0%	72,173.4	72,173.4	0.0	92.4%	91.6%	89.9%
Data Acquisition	33,324.1	33,288.7	33,153.8	-35.5	134.8	89.9	11.2%	33,954.2	33,954.2	0.0	98.1%	98.0%	97.6%
Data Systems	22,965.5	22,761.8	22,842.8	-203.7	-81.0	100.3	2.5%	26,789.4	26,789.4	0.0	85.7%	85.0%	85.3%
Detector Comm. & Verification	18,241.4	18,241.4	18,385.5	0.0	-144.1	240.4	10.8%	20,610.5	20,610.5	0.0	88.5%	88.5%	89.2%
Pre Operations	533.8	533.8	492.0	0.0	41.8	0.0	0.0%	966.0	966.0	0.0	55.3%	55.3%	50.9%
Subtotal	198,292.3	197,479.2	196,198.9	-813.0	1,280.4	4,063.9	12.3%	228,265.8	229,283.5	-1,017.7	86.9%	86.5%	86.0%
RPSC SUPPORT	21,844.8	22,049.7	21,221.4	204.9	828.3	1,526.0	10.9%	35,339.9	35,220.4	119.5	61.8%	62.4%	60.0%
NSF	826.4	826.4	826.4	0.0	0.0	26.2	6.0%	1,263.0	1,263.0	0.0	65.4%	65.4%	65.4%
Total	220,963.4	220,355.3	218,246.6	-608.1	2,108.6	5,616.1	11.8%	264,868.7	265,766.9	-898.2	83.4%	83.2%	82.4%
CONTINGENCY Notes 3,4								10,513.3	9,615.1	898.2			
IceCube Total Note 2	220,963.4	220,355.3	218,246.6	-608.1	2,108.6	5,616.1	11.8%	275,382.0	275,382.0	0.0	83.4%	83.2%	82.4%

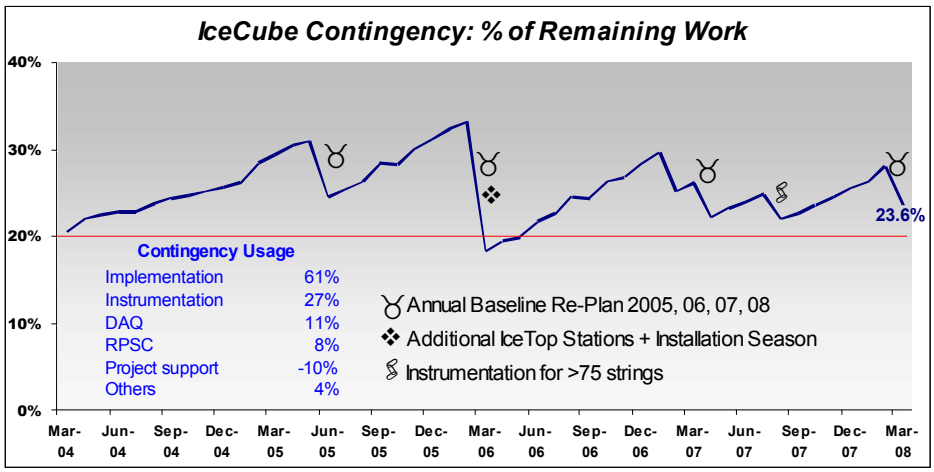
Notes: 1 Incorporates approved baseline changes.
2 Total Budget at Completion includes non-US contributions 3,611 K over the amount in the post Hartill III baseline of: $29,698 K
3 Budgeted contingency is: 23.6% of the Budgeted cost of work remaining.
4 Budgeted contingency is: 23.2% of the Estimated Cost to Complete (ETC)
5 All latest revised estimates detailed planning for PY6-10
6 Contingency is assigned to each L-2 element based on the ETC, a bottom-up risk assessment model, management judgement, and cost constraints.

03/31/08

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 February 2008		276,628	263,872	0	12,755	45,765	45,180	**28.2%**
CR119	CR 0119 PY7 Baseline Replan (US)	04/09/08	276,628	266,058	2,186	10,570			
	CR 0119 PY7 Baseline Replan NonUS	04/09/08	275,382	264,812	-1,245	10,570			
CR120	CR 0120 Ship all remaining IceTop tanks	04/23/08	275,382	264,869	56	10,513			
NA	Status as of March 2008		275,382	264,869	0	10,513	45,412	44,513	**23.6%**

Risk Assessment & Potential Contingency Adjustments[1]	
Item	Potential Contingency Use
Estimated contingency that might be required to address the cost impact of technical, cost and schedule risks identified with the defined scope of work. Risk factors were assessed at WBS-Level 4.	$3,845K
Restore 80-string configuration. This is the current estimate of the cost to restore the array to the 80-string configuration described in the original IceCube proposal.	$1,500K
RPSC FY07-FY10 Rebaseline (rev 7.0): This pending baseline change includes the support for 4 additional strings (76-80), addresses the cargo and fuel cost increases under ANG, and returns FY07 under-spent budget to contingency.	$412K
Current RPSC estimate of base cost to support the 2010/11 drilling season.	$2,260K
Pre-Operations activities may be extended beyond the two years currently budgeted to conduct engineering runs concurrent with operations and to debug software and ensure reliability of the installed equipment.	$150K
The costs of returning IceCube equipment and materials from the South Pole, e.g., the Enhanced Hot Water Drill, was not included in the baseline budget. The retro work will be planned for FY2012.	$825K
Assign contingency against major fuel price increases beyond normal inflation.	$500K
Upgrade Data Center and Data Warehouse capacity to handle data rates that are higher than originally planned.	$1,000K

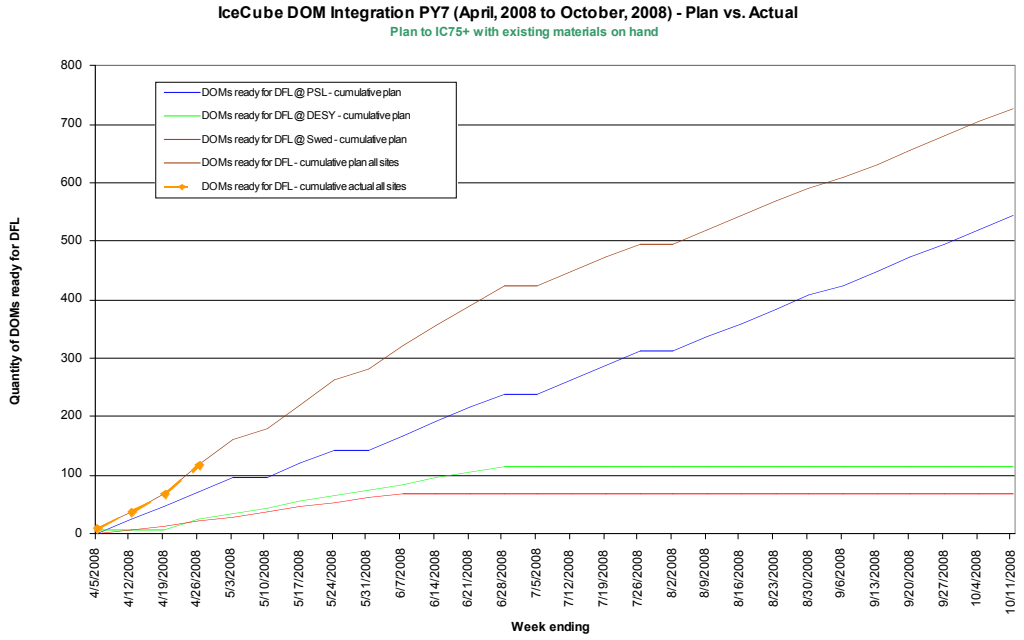


[1] IceCube is sensitive to increasing energy costs. The pump price paid for fuel to be used during the FY09 season is $2.85 per gallon (FY09 fuel was already shipped). An increase of one dollar per gallon of fuel used in FY10 would result in a total cost increase of approximately $710K. This includes fuel for drilling, cargo transport, personnel at Pole, and heavy equipment use. We included $180K for potential fuel cost increases in the WBS-Level 4 baseline risk assessment plus an additional $500K for the extraordinary current pricing.

Drill Operation and Installation – The highest priority activity during the off-season is to address the drill cable communications problem. The drill team is developing plans to build new replacement cables based on the testing and analysis effort that has started this month. All three EHWD Drill Support Cables were shipped back from the South Pole and received at PSL in April, referred to as cables 1, 2, and 3. Cable 2 has been electrically tested with a TDR and showed multiple wire breaks at about 800m from the end, making the entire cable unusable. Cable 3 has damage only to the outer jacket. The original manufacturer, Cortland Cable Co., is in the process of electrical testing and visual inspection of this cable. Once they complete their inspections, Cortland Cable Co. will quote a price for the refurbishment of Cable 3. Cable 1 is at PSL on the Drill Cable Winch. Electrical testing shows that the cable is electrically continuous after one damaged end of the cable was removed. Once placed on another spool, Cable 1 will also be sent to Cortland Cable Co. for inspection and most likely refurbishment. One entirely new Drill Support Cable will also be procured. All these activities are being closely tracked to ensure one cable will be ready to ship Sept. 1st for a ROS of Nov. 20th, 2008. One spare cable will be ready to ship on Oct. 15th for a ROS of Dec. 1st, 2008. The second spare cable should also arrive in Antarctica by Jan. 2009, but will most likely be kept in McMurdo for winter storage.

A site plan for the upcoming season has been developed and includes hole locations, drilling sequence, IceTop locations, special devices, cable trench paths and roads. The plan has been circulated to the collaboration and Raytheon Polar Services Company for review.

Digital Optical Module and Cable Production Status and Plans - DOM production is in progress at all 3 sites and is progressing smoothly. Surface to DOM cable production is normal. Procurement plans have been developed for instrumentation (primarily DOM hardware and cables) to restore IceCube to the originally planned 80 string configuration. This will include 15 surface cables and 6 surface-to-DOM cables, and associated breakouts and connectors.



Detector Commissioning and Verification - Verification has run continuously since the start of IC-40 data taking. Initial studies of high-level quantities from IC-40 running were performed. Thus far no significant problems were found. A "data challenge" will be done to determine how sensitive the various verification tests are to problems by taking some already-acquired IC-40 data, introducing a fault, writing out the faulty data to a new file, and giving that resulting file to the verification group to study.

Long-term studies of IC-22 data from 2007 have found a handful of DOMs with minor problems in their timing and charge distributions. These problems are also under investigation.

Data from the entire IC-22 dataset, from May 23, 2007 to April 5, 2008, has been evaluated for run quality. Using a set of simple criteria such as minimal run length, 94% of the acquired InIce data is labeled "good." For AMANDA, this number is 55%. Similar work is underway for IceTop data. Data analyzers will be able access this information conveniently and directly from within their analysis code by the end of May, which they can already do for individual DOMs. In the next few months, information gathered by the verification tests will be used to determine whether or not a DOM is "good" in a particular run. Initially this will be done manually. Verification criteria can also be used to determine whether a run is good or not (again, manually), although the high stability of the detector thus far suggests this may not be necessary.

The IC-22 data has also been analyzed for detector stability. An internal note will be written on detector stability.

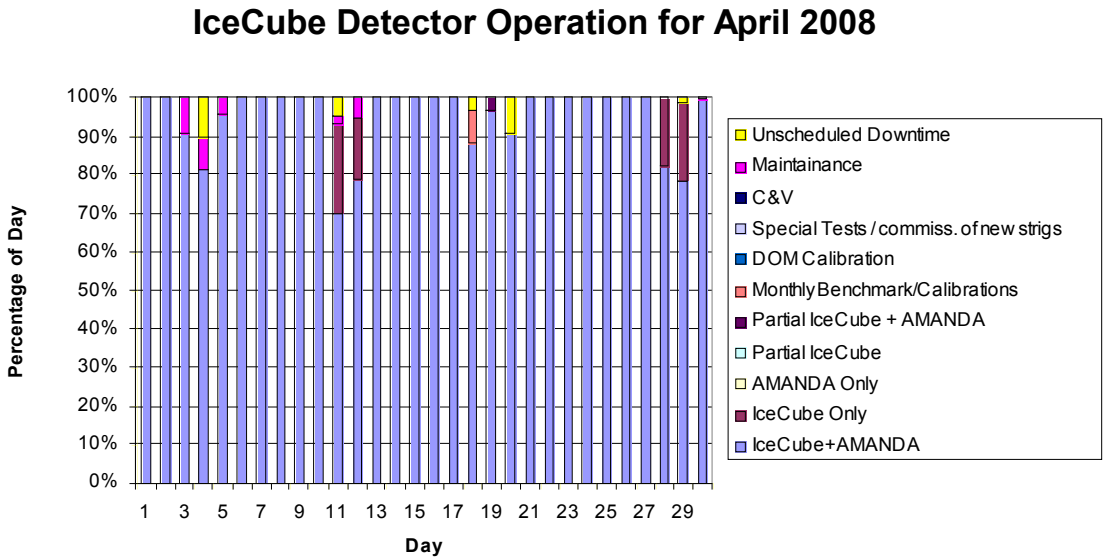
The first version of a new webpage to display the verification information and make it easier for verification experts, data analyzers and shift takers to see problems has been implemented. It is being tested and used by the verification group.

Data Acquisition Software - We have begun refurbishing 8 Rev3 hubs in preparation for a shipment of 15 hubs to South Pole towards the end of August this year. Some minor mechanical modifications must be made. The single-fused power entry modules are being replaced with double-fused assemblies suitable for the 208 VAC power used at Pole. Additionally, the ground fault circuit has been upgraded last year on the 33 UW manufactured hubs and must be retrofitted into the existing Rev3 hubs.

DAQ software has been running stably with 40 strings since April 5th. We are still running the Aqua release however the "Bay Wolf" version was released on May 5th that addresses some minor bugs. Deployment to Pole is expected during the week of May 12th.

IceCube Detector Operations

Detector Up Time	97.6%
IceCube Clean Run Up-Time not including AMANDA Array	96.7%
Unscheduled Downtime	1.0%
Events from DAQ	3.16 billion



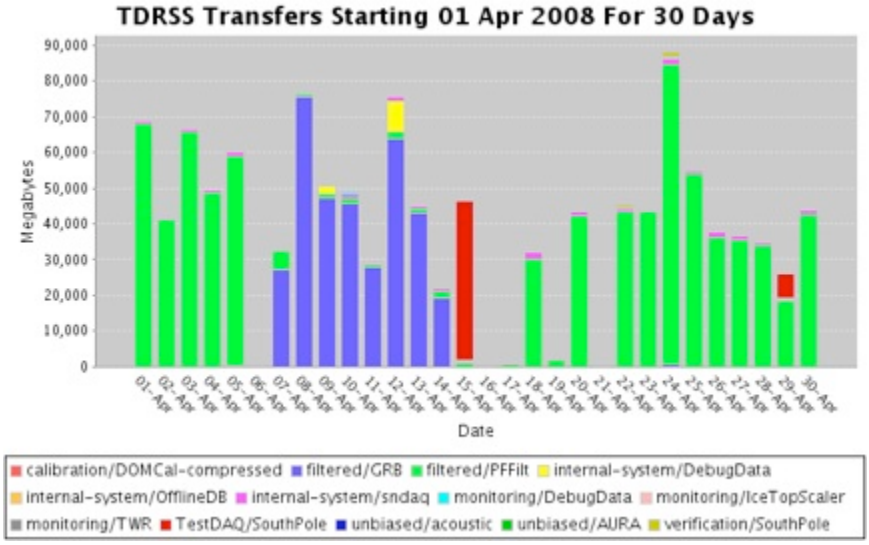
Data taking during April 2008 achieved an overall 97.6% uptime. The in-ice clean run uptime achieved 96.7%. On April 5th we formally stopped the IC-22 running season and smoothly transitioned to IC-40 operation. During the first period of IC-40 operation, until April 17th (run 110847), there was no physics filtering but the combined Joint-Event Builder (JEB) events were written to tape and will be filtered once the data arrives North at the end of the season. The in-ice DAQ configurations for IC-40 converged on April 9th. The IceTop configurations underwent major changes, including the re-inclusion of the solar physics capability, change of the gain of the low-gain DOMs and the tuning of the discriminators and local coincidence cable delays converging by April 11th. Also the AMANDA/TWR configuration was changed to add string trigger capability and to reduce the sampling in the electrical channels.

In all, it was a very successful and smooth transition to IC-40 running due to the planning and multiple test runs done in preparation for the switch. However, there is room for improvement in future years by having all necessary configurations and filtering code in place before making the actual transition.

Data Systems

Data Handling - South Pole Systems in the IceCube Laboratory (ICL) began IC-40 physics operation in April. The figure below shows the daily satellite data transfer rates. The remaining backlog of IC-22 data was cleared during April as the transition from IC-22 to IC-40 took place. The transition from IC-22 to IC-40 physics running in April went smoothly from the Data Handling standpoint. A detailed requirements document and execution plan for upgrades of disk to the data warehouse to accommodate higher data rates was finalized and reviewed. There was

significant planning for requirements in the ICL for the coming deployment season to accommodate the new strings.



Filtering and Software - Filtering of IC-40 data began on April 14, 2008, representing the full transition from running IC-22 to IC-40. The Joint-Event Builder and Processing and Filter server (JEB/PnF) merging of IceCube-40 and Amanda TWR data streams continues at the South Pole, sending filtered data sets of about 38 GB/day over the satellite. The figure below represents a snapshot of the filter rate monitoring page near the start of IC-40 physics running. The IC-40 trigger rate is approximately 1300 Hz with the filter selecting about 80 Hz of events for satellite transmission.

Previous TWR Run	
Number	110977
physics	6781440 events

PnF Summary for Run	
Number	110978
Event	21840000
Clients	0
Trigger Rate	1329.12
Processing Rate	1927.26
Summary Age	PT10S

PnF Physics Filter Rates

Filter	Hz	Filter	Hz
CascadeFilter_08	17.3571	DownGoingContained_08	14.2321
EHEFilter_08	1.25	FilterMinBias_08	0.5
I3DAQDecodeException	0	ICDownStarting_08	1.91071
ICLowEnergyContainedFilter_08	6.24107	ICMuonFilter_08	21.6429
IceTopSTA3_08	2.44643	IceTopSTA3_InIceSMT_08	2.24107
IceTopSTA8_08	0.732143	InIceSMT_IceTopCoincidence_08	1.61607
JAMSFilter_08	3.44643	LECascadeFilter_08	8.19643
LowUpFilter_08	11.9196	MoonFilter_08	0
PhysicsMinBiasTrigger_08	0.508929	TWRDAQDecodeException	0
Total	80.625		

Offline processing for IC-22 data through Level 2 was completed. This is the last offline processing step done in common for all physics topics. Higher level processing is now ongoing

by individual analysis groups using the common Level 2 data sets. Preparations have begun for offline processing on the IC-40 data as it flows north over the satellite. Testing on L0 and L1 processing has gone well, and we expect to start routine processing of L0/L1 next month, with finalizing of the Level 2 processing planned before June. This schedule is nearly six months ahead of last year's IC-22 offline processing, which was the first year it was implemented.

Simulation - Mass simulation production continues with IceSim Version 2 to produce large background and signal Monte Carlo datasets for the physics working groups to prepare for IC-22 physics analysis. The distributed production system along with better tracking and monitoring of CPU time supplied at each institution continues to monitor the production sites.

There was also a new release in April for production Monte Carlo runs to be used for the IC-40 run next year.

Quality Assurance and Safety – SafeStart training, by NANA systems, is planned for all IceCube personnel deploying during the upcoming season.

Education and Outreach – On Saturday, April 5th, over 1000 people saw the IceCube exhibit at Science Expeditions, an annual event showcasing science research on the University of Wisconsin – Madison campus. Graduate students from the IceCube project showed the extreme cold weather (ECW) gear used at the South Pole and explained the basic concepts of IceCube to people of all ages using a DOM, video, and images of the South Pole. IceCube staff from UW-Madison also visited six schools and colleges with the ECW gear in April. Mark Krasberg spoke to the Madison Astronomical Society. High School teacher Steve Stevenoski made a presentation about IceCube at the National Science Teachers Association Meeting on April 2, 2008. The April 19, 2008 issue of *New Scientist* featured an article about IceCube by Anil Ananthaswamy, who was a recipient of a grant from the National Science Foundations' Antarctic Artists and Writers Program.

The monthly reports are posted at IceCube Monthly Reports.

Meetings and Events

Neutrino 2008 @ Christchurch, NZ	May 26-31, 2008
NSF Annual Review of IceCube @ UW-Madison	June 11-12, 2008