

# IceCube Project Monthly Report

## August 2007

### Accomplishments

Detector simulation achieved a major milestone in August with the release of an upgrade to the simulation production software, IceSim 2.0. IceSim 2.0 will be used to produce the Monte Carlo for IC-22 simulation over the next year. Mass production with the IceSim 2.0 began this month.

The staffing plan and installation schedule of the coming South Pole installation season is fully developed. Installers and alternates are identified and are nearing PQ completion. Material procurements are complete and shipped. IceCube submitted a revised population plan that helps ease peak population periods at the South Pole during critical periods.

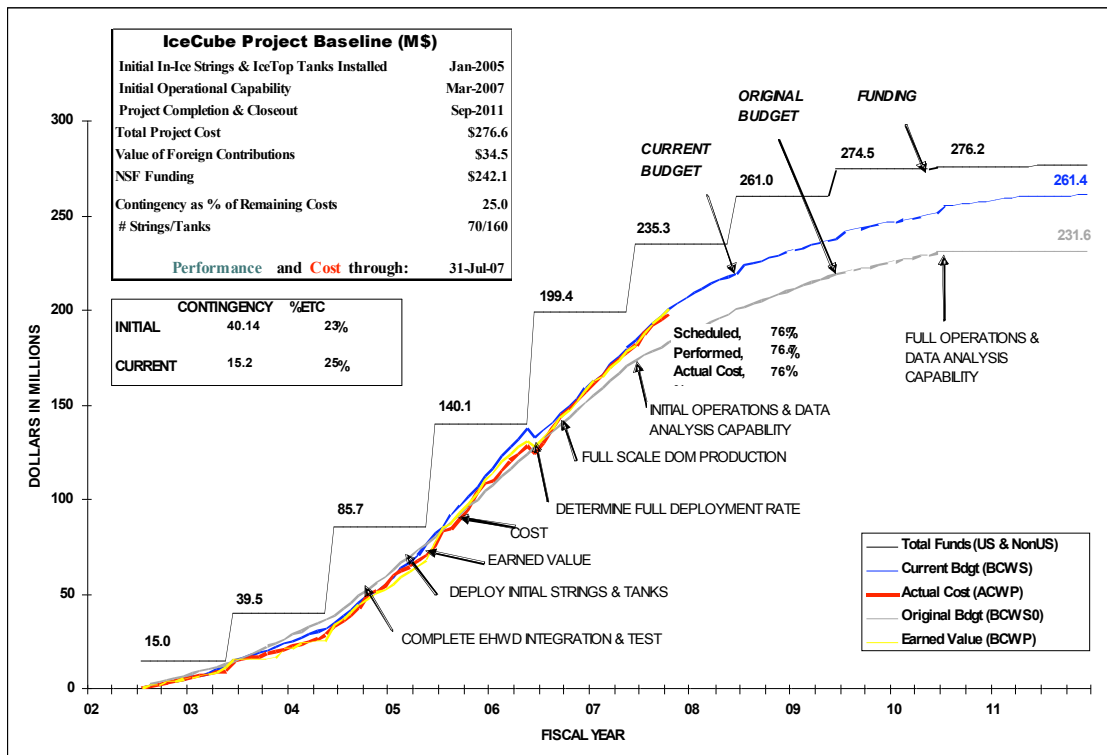
Over 20 of the 30 DOM hubs scheduled to ship this year completed testing and are packed for shipment to Pole. The remaining hubs are on schedule for use at the South Pole this year.

The IceCube DAQ uptime for August was 94.9%, roughly equivalent to the 95% goal.

A plan for early replacement of components in the South Pole tape archiving system was approved. The new drives and library system will be less susceptible to micro-dust, the likely cause of the high frequency of disk failures.

In an effort to enhance safety awareness throughout the project an Advanced Safety Audit Program will be implemented beginning in September. The audits will cover all IceCube work.

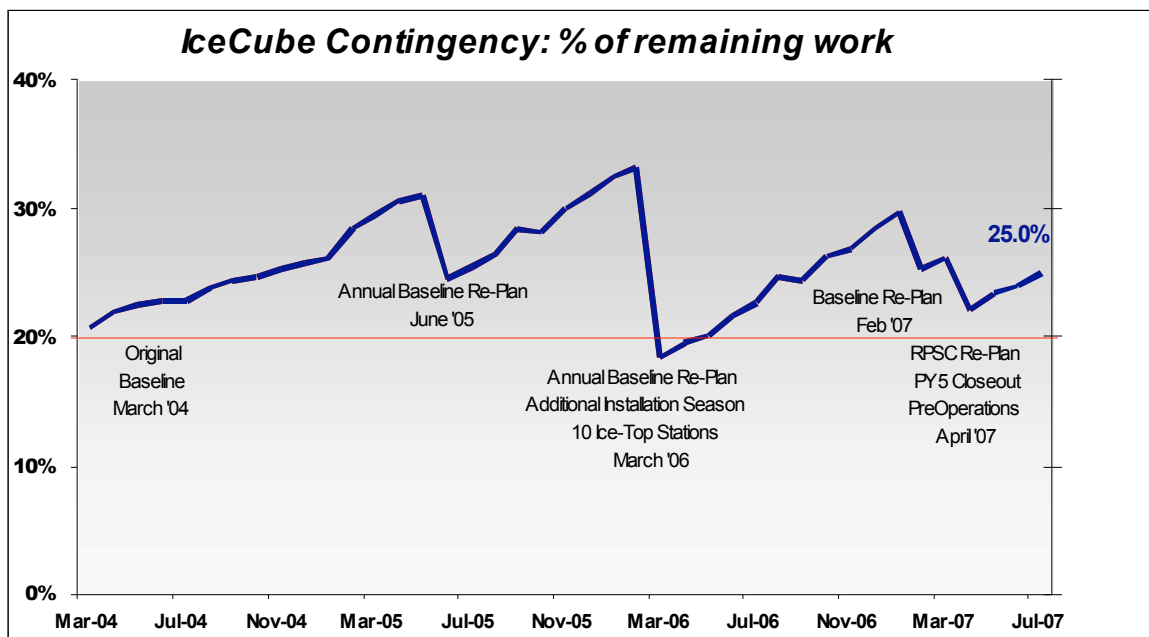
Approximately 27,000 pounds of equipment was shipped from PSL to Port Hueneme on August 23<sup>rd</sup> and 30<sup>th</sup>. Shipments will continue once per week through September.



**Cost and Schedule Performance** – The project is 76.7% complete versus the plan of 76.7% 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: 7/31/2007 <sup>Note 1</sup>													
OBS Structure L2	Cumulative To Date (AY K\$)						At Completion (AY K\$) <sup>Note 5</sup>			Complete (%)			
	Budgeted Cost <sup>2</sup>		Actual Cost of Work Performed	Variance		Contingency		Budgeted AY \$s	Latest Revised Estimate	Variance	Sched	Perf	Actl Cost
	Work Scheduled	Work Performed		Schedule	Cost	Assigned	% ETC						
Project Support	21,282.9	21,282.9	21,171.0	0.0	111.9	294.4	5.6%	27,312.0	26,420.2	891.7	77.9%	77.9%	77.5%
Implementation	30,400.8	30,506.3	30,209.7	105.5	296.6	3,036.3	19.9%	44,447.1	45,454.0	-1,006.8	68.4%	68.6%	68.0%
Instrumentation	58,683.6	59,088.2	57,504.7	404.6	1,583.5	805.6	6.5%	69,983.7	69,983.7	0.0	83.9%	84.4%	82.2%
Data Acquisition	31,700.4	31,367.8	31,529.6	-332.6	-161.7	264.0	11.6%	33,803.7	33,803.7	0.0	93.8%	92.8%	93.3%
Data Systems	20,775.5	20,670.0	20,740.0	-105.5	-69.9	267.4	4.5%	26,723.2	26,723.2	0.0	77.7%	77.3%	77.6%
Detector Comm. & Verification	15,975.0	15,953.0	16,222.2	-22.0	-269.2	509.2	8.8%	22,017.3	22,017.3	0.0	72.6%	72.5%	73.7%
Pre Operations	154.2	154.2	71.4	0.0	82.8	0.0	0.0%	533.8	533.8	0.0	28.9%	28.9%	13.4%
Subtotal	178,972.3	179,022.4	177,448.4	50.0	1,574.0	5,177.0	10.9%	224,820.8	224,935.9	-115.1	79.6%	79.6%	78.9%
RPSC SUPPORT	20,839.2	20,925.6	20,556.1	86.3	369.5	1,639.1	11.1%	35,339.9	35,339.9	0.0	59.0%	59.2%	58.2%
NSF	735.0	735.0	735.0	0.0	0.0	31.7	6.0%	1,263.0	1,263.0	0.0	58.2%	58.2%	58.2%
Total	200,546.6	200,682.9	198,739.5	136.4	1,943.4	6,847.8	10.9%	261,423.7	261,538.8	-115.1	76.7%	76.8%	76.0%
CONTINGENCY <sup>Notes 3,4</sup>								15,203.8	15,088.7	115.1			
IceCube Total <sup>Note 2</sup>	200,546.6	200,682.9	198,739.5	136.4	1,943.4	6,847.8	10.9%	276,627.5	276,627.5	0.0	76.7%	76.8%	76.0%

Notes: 1 Incorporates approved baseline changes.  
2 Total Budget at Completion includes non-US contributions 4,857 K over the amount in the post Hart III baseline of: \$29,698 K  
3 Budgeted contingency is: 25.0% of the Budgeted cost of work remaining.  
4 Budgeted contingency is: 25.0% 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.



<b>Risk Assessment &amp; Potential Contingency Adjustments</b>		
Item	Potential Contingency Adjustments	Notes
Assign contingency to mitigate technical, cost and schedule risks associated with the defined scope of work.	\$6,729K	Risk model applied at WBS-Level 4 to assess appropriate contingency as a percent of the cost of work remaining.
The cost to retro IceCube equipment/materials from the South Pole at the end of the project was not included in the baseline budget.	\$1,500K	This number represents a worst-case scenario if all drill equipment is returned after the 2010/11 drilling season. A more likely scenario would cost less than one half of this amount.
The remaining budget for spare hose segments may not fully satisfy the likely demand.	\$1,000K	The increased hose service life gained by increasing the storage temperature must still be demonstrated.
Pre-Operations activities may extend beyond the one-year currently budgeted.	\$667K	During the first three years of initial operations it may be necessary to conducting engineering runs concurrent with operations to debug software and ensure reliability of the installed equipment.
Restore 80-string configuration.	\$5,307K	This is the current estimate of restoring the array to the 80-string configuration described in the original IceCube proposal. (95.1% of \$5578K was assigned).

7/31/2  
007

### Change Log - IceCube Total Project Budget Baseline (\$K)

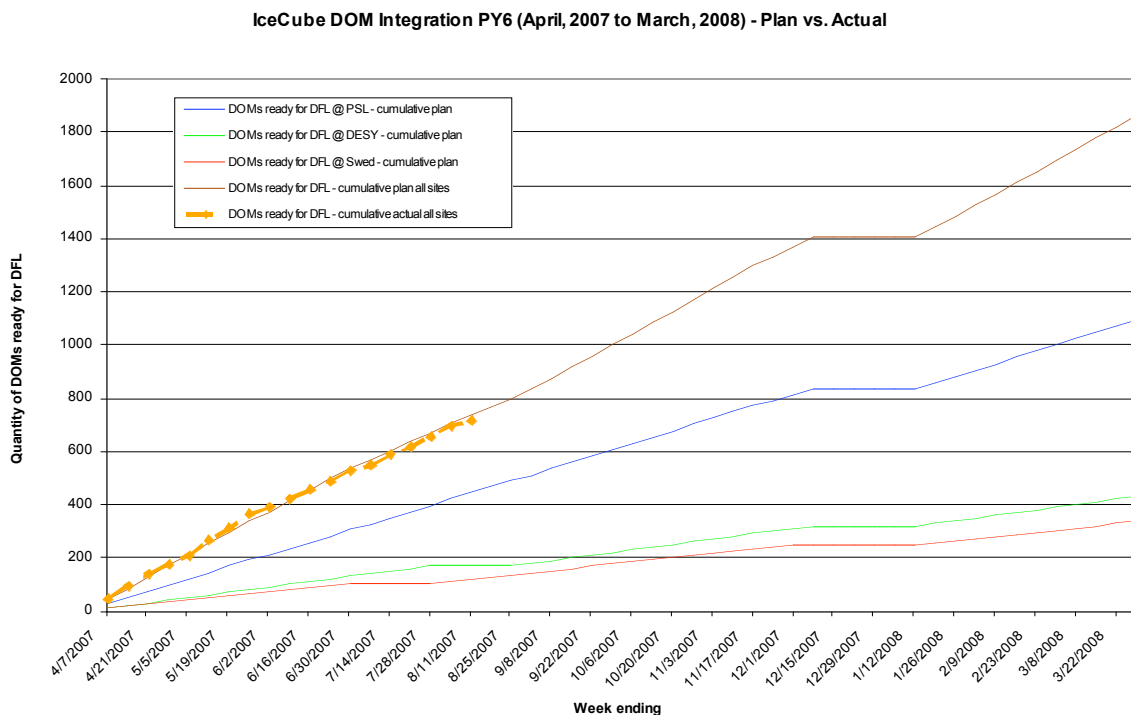
No.	Description	Date Approved	Total Baseline Budget	Allocated Budget	Allocated Budget Change	Cont. Budget	Estimate To Complete (ETC)	Budgeted Cost of Future Work	Cont. % of Future Work
NA	Status as of June 2007		276,628	261,208	0	15,420	65,193	64,179	<b>24.0%</b>
CR109	CR 0109 Enhance South Pole Tape Archiving System	08/01/07	276,628	261,424	216	15,204			
NA	Status as of July 2007		276,628	261,424	0	15,204	60,856	60,741	<b>25.0%</b>

**Drill Operation and String Installation** – A Standard Operating Procedure (SOP) for the Independent Firm Drill (IFD) is currently being developed based on the experience from last season. An SOP the examination of the hose is complete. A SOP for replacing drill hose during drilling is nearly complete. The existing Standard Operating Procedures and Hazard Analyses were distributed for review and comment. A Preventative Maintenance plan is being developed.

The staffing plan and installation schedule for the upcoming season is fully developed. Installers and alternates are identified and are nearing PQ completion. Hole-logging and special device installation plans have been drafted and are being revised for final decisions. Material procurements are complete and shipped. Logger repairs and testing are on-going.

Cargo plans for shipment to Pole are on track. 540,000 pounds of equipment will be shipped this season. The first two shipments of cargo from PSL to Port Hueneme occurred as scheduled on August 23<sup>rd</sup> and 30<sup>th</sup>.

**Digital Optical Module and Cable Production Status and Plans** - There are no major issues with instrumentation production. The plans continue to 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.



**Detector Commissioning and Verification** - The numerous high level verification plots that have been incorporated into the standard monitoring pages are in use, but the current system for transferring them to the relevant location is cumbersome. This system will be streamlined dramatically once the monitoring web pages complete their transition from being housed at UCB to being resident on disk at UW. This process should be completed by the end of September.

The current system for generating the verification plots is still being run separately from the PnF farm due to delays in implementing other elements in the farm. This will change in mid-late

September, when the verification suite is integrated into PnF. This will give verification simplified access to updated detector status and calibration information.

The automated “good run” determination algorithm will be implemented in mid September for all of the official physics data taken thus far. Thereafter, the good run list will be updated in quasi-real time as new data is acquired.

The final set of hole-ice data with the fully frozen strings is planned for mid to late September.

Work continues on the calibration of the PMT/saturation curves and on the third stage of the geometry calibration using muon tomography.

The monitoring web pages and accompanying processing software are almost completely transferred from computers at UCB to UW. Web programming expertise at UW, and centralized system administration services, will combine to make the new home for the monitoring pages an easier place to run and maintain them.

**Data Acquisition System Hardware** - The PY6 DOMHub build up commenced in August. 50 hub chassis sub-assemblies were ordered and had to be integrated with computer boards and DOR cards at SPTS and then tested using the S<sup>3</sup> facility – an array of 64 main boards that can provide a full-load test environment for DOMHubs. As of early September, 22 of the 30 hubs scheduled to ship this year have completed testing and are being packed for shipment to Pole.

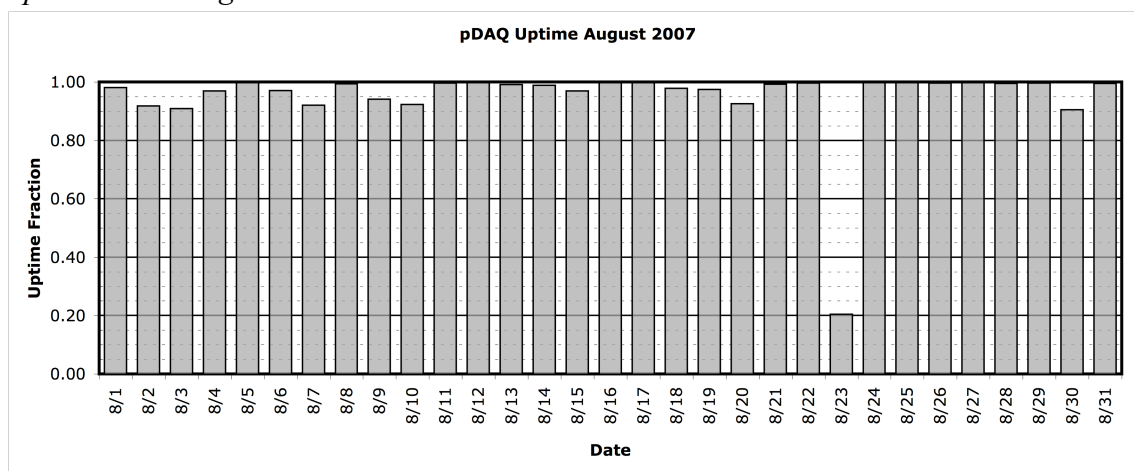
LBNL has received funding for the final production run of 570 DOM Main Boards and a fabrication contract is now in place with Sanmina-SCI. The DOM main board manufacturing process will begin at the end of September when all of the required components are expected to arrive at Sanmina. Once production begins, LBNL plans to deliver a minimum of 200 DOM main boards per month to the DOM Integration sites until the final delivery goal is met or exceeded.

**Data Acquisition Software**

Events.....1.43 billion

Live Seconds .....2.54 million

Uptime Percentage ....94.9%



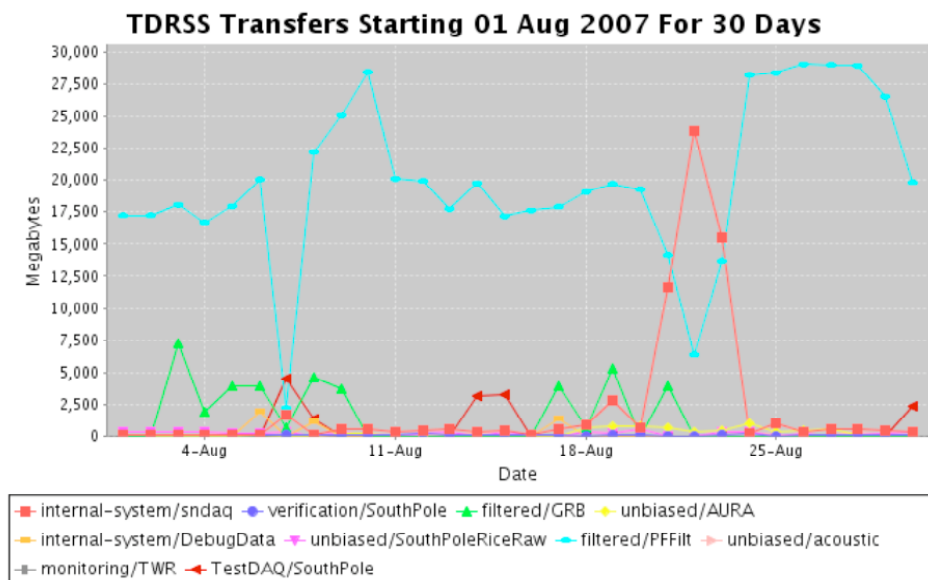
August DAQ operation was smooth, with the exception of a notable blemish on August 23<sup>rd</sup>, where most of the day's data was lost due to a complete crash of the main experiment control computer. This event exposed a vulnerability of the current system, which monitors the health of the experiment: the monitoring components only being located on this computer which will not notify operators of system failure if this node is among the affected. In general, this has brought to light a needed review and some rethinking of the current system monitoring framework. Nonetheless, the IceCube DAQ was able to almost meet the 95% uptime goal. Joint AMANDA-IceCube running was hampered by several station power outages which induced failures in the AMANDA high voltage subsystem – the combined system ran for a total of 16.8 days (54%).

Accomplishments in DAQ software development include completion of the flasher board control support (release due early September 2007), and a greater understanding of the performance of DAQ code under the load of 80 (simulated) detector strings running on string simulators at SPTS. While the system is still unable to run for long periods under the load of 80 strings, the bottleneck code has been isolated to a block within the trigger code. When this block is replaced with a proxy that contains limited functionality, but greater efficiency at moving data through itself, the simulated runs are stable. This gives the “green light” on most DAQ components and allows the development team to focus more closely on this problem block.

**Data Systems** - South Pole systems in the ICL continue normal operation. Data rates on the satellite during normal TDRSS operations are on the order of 20 GB/day with peaks approaching 30 GB/day. Figure below shows the satellite usage for the month of August.

Operation, maintenance and upgrades to the UW data center and data warehouse to keep pace with incoming engineering data from IC-22 continue. Planning for early replacement of components in the South Pole tape archiving system was completed and purchasing started. The new drives and library system will be protected against the drywall micro-dust which is the likely cause of the excessive number of disk failures we are currently experiencing.

The IC-22 online physics filtering was successfully deployed in July. JEB/PnF merging of IceCube-22 and Amanda TWR data streams continues at South Pole sending filtered data sets of approximately 20-30 GB/day over the satellite. The figure below shows the IceCube status page with filter passing rates for the individual physics filters at the bottom.



Simulation achieved a major milestone with the IceSim 2.0 production release. IceSim 2.0 will be the production version of the monte-carlo for IC-22 simulation over the next year. Mass production with the IceSim 2.0 was started in August.

The experiment control system is running at Pole and coordinating all subsystem configuration start/stop and status information for all IceCube subsystems (i.e. p-DAQ, JEB/PnF/Spade/TWR-DAQ). Final feature set and improved ease of use for operators is continuing. In particular, final planning of requirements and implementation details towards integrating the calibration flasher runs into the experiment control infrastructure was done. Work for flasher runs under EC should be completed in September and testing started.

## IceCube Detector Summary

Status as of : 2007-09-11T18:07:45Z

Date	DAQ	TWR	SN	PNF	SPADE	Run	Events
2007-09-11T18:07:45Z	Started	Started		Started		109300	1335474

Current DAQ Run		Previous DAQ Run	
Number	109300	Number	109299
Start Time	2007-09-11 17:31:10.969902	Start Time	2007-09-11 09:29:37.682830
physics	1335474 events	Stop Time	2007-09-11 17:29:50.464147
monitor	240991 events	physics	17463518 events
sn	2927070 events	monitor	2305573 events
tcal	2928381 events	sn	38354487 events
		tcal	38379418 events

Previous TWR Run		PnF Summary for Run	
Number	109299	Number	109300
physics	5502848 events	Event	1330000
		Clients	0
		Trigger Rate	609.007
		Processing Rate	712.165
		Summary Age	PT4S

PnF Physics Filter Rates			
Filter	Hz	Filter	Hz
CascadeFilter	18.0153	EHEFilter	1.40458
FilterMinBias	2.95038	I3DAQDecodeException	0
IceCubeMuonFilter	19.1985	IceTopSMT	2.82443
IceTopSMT_InIceCoincidence	2.33969	IceTopSMT_Large	0.751908
InIceSMT_IceTopCoincidence	2.74046	JAMSMuonFilter	0
LowEnergyContainedFilter	4.53817	MoonFilter	0
MuonFilter	19.1985	TWRDAQDecodeException	0

Resource Usage		
Resource	Used	Limit
EventBuilder dispatch cache	53.4 GB	1047.5 GB
Secondary builders dispatch cache	70.3 GB	222.5 GB
PnF Disk	615.9 GB	1060.6 GB

***Quality Assurance and Safety*** – In an effort to enhance safety awareness throughout the project, we have developed and will implement in September an Advanced Safety Audit Program. A takeaway from our NANA Systems training in early August, this pro-active program features peer safety assessments throughout the IceCube effort in Madison. Lessons learned this summer will be incorporated into a similar program at the Pole. Two-person audit Teams of IceCubers visit a particular area and observe the processes transpiring. After observing and preparing questions, the auditors interview the employees in the area, listening to their input insofar as their level of job safety. The auditors also seek any safety improvement feedback as well. From this information, safe behaviors are acknowledged and encouraged. Corrective Action plans are developed to eliminate or otherwise mitigate any unsafe behavior noted. Input from these assessments will be reviewed during safety meetings and other Management review meetings with the emphasis being upon enhanced safety awareness in order to prevent accidents from happening.

The monthly reports are posted at [IceCube Monthly Reports](#).

**Meetings and Events**

South Pole Readiness Review @ UW	September 25, 2007
Collaboration Meeting @ University of Gent	October 6 – 11, 2007
NSF Business Systems Review of IceCube	November 2007
Collaboration Meeting @ UW-Madison	April 29 - May 3, 2008
International Oversight and Finance Group @ UW (tbd, during Spring Collaboration Meeting)	