Accomplishments
The first hole of the season, hole #58, commenced with firn drilling on December 11th (the South Pole is 19 hours ahead of UW) and was completed on December 14th. Installation of the first string was completed on Friday, December 15th.

NSF granted conditional occupancy of the IceCube Laboratory on December 8th. IceCube personnel, with support from Raytheon, started moving equipment into the laboratory on December 9th.

IceTop installation is on schedule with six of the ten stations planned for this season now in place. The final stations will be in place by the middle of December.

Cost and Schedule Performance – The project is 65.0% complete versus the plan of 65.0% 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.
### IceCube Neutrino Observatory

**Cost Schedule Status Report**

**Reporting Period Ending:** 10/31/2006

#### OBS Structure L2

<table>
<thead>
<tr>
<th>Work</th>
<th>Budgeted Cost</th>
<th>Actual Cost</th>
<th>Variance</th>
<th>Contingency</th>
<th>Budgeted AY $</th>
<th>Latest Revised Estimate</th>
<th>Complete (%)</th>
<th>Complete (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scheduled</td>
<td>Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Performed</td>
<td>Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Support</td>
<td>19,481.1</td>
<td>19,366.7</td>
<td>19,103.3</td>
<td>-114.4</td>
<td>263.4</td>
<td>793.8</td>
<td>7.7%</td>
<td>64.4%</td>
</tr>
<tr>
<td>Implementation</td>
<td>25,283.9</td>
<td>25,370.9</td>
<td>25,446.6</td>
<td>87.0</td>
<td>-76.7</td>
<td>1,212.1</td>
<td>39.3%</td>
<td>64.5%</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>45,499.3</td>
<td>45,692.9</td>
<td>45,153.4</td>
<td>201.6</td>
<td>538.7</td>
<td>3,336.7</td>
<td>14.7%</td>
<td>64.7%</td>
</tr>
<tr>
<td>Data Acquisition</td>
<td>26,001.8</td>
<td>25,893.9</td>
<td>25,891.8</td>
<td>-107.9</td>
<td>21.1</td>
<td>755.5</td>
<td>9.3%</td>
<td>66.9%</td>
</tr>
<tr>
<td>Data Systems</td>
<td>16,523.8</td>
<td>15,964.5</td>
<td>17,393.3</td>
<td>-592.5</td>
<td>-1,426.5</td>
<td>1,776.5</td>
<td>22.3%</td>
<td>68.6%</td>
</tr>
<tr>
<td>Detector Comm. &amp; Verification</td>
<td>12,657.5</td>
<td>12,654.0</td>
<td>12,623.0</td>
<td>-3.5</td>
<td>31.0</td>
<td>1,026.7</td>
<td>14.0%</td>
<td>63.4%</td>
</tr>
</tbody>
</table>

**Subtotal**

|                   | 145,429.3 | 144,941.2 | 145,611.4 | -496.4 | -669.3 | 14,895.3 | 19.9% | 66.9% | 66.7% | 67.0% |

**RPSC SUPPORT**

|                   | 17,484.2 | 17,772.7 | 15,921.4 | 288.5 | 1,651.3 | 8,004.7 | 36.1% | 53.2% | 54.1% | 48.5% |

**NSF**

|                   | 633.8     | 633.8     | 633.8     | 0.0   | 0.0     | 166.0   | 25.4% | 50.2% | 50.2% | 50.2% |

**Total**

|                   | 163,566.6 | 163,348.7 | 162,166.7 | -207.9 | 1,182.0 | 23,060.1 | 23.6% | 65.0% | 65.0% | 64.5% |

**CONTINGENCY**

|                   | 23,228.7 | 14,909.6  | 15,619.1  | 0.0   | 0.0     | 274,655.5 | 254,655.5 | 0.0   | 65.0% | 65.0% | 64.5% |

**IceCube Total**

|                   | 163,566.6 | 163,348.7 | 162,166.7 | -207.9 | 1,182.0 | 23,060.1 | 23.6% | 65.0% | 65.0% | 64.5% |

**Notes:**
1. Incorporates approved baseline changes.
2. Total Budget at Completion includes non-US contributions 2,915 K over the amount in the post Harwell baseline + $22,658 K
3. Budgeted contingency: 26.4% of the Budgeted cost of work remaining.
4. Budgeted contingency: 23.6% 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.

### IceCube Contingency (% of Work Remaining)

- Original Baseline
- Annual Baseline Replan
- Additional Installation Seasons
- 10 IceTop Stations

**26.4%**
Change Log – IceCube Total Project Budget Baseline ($K)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Date Approved</th>
<th>Total Baseline</th>
<th>Allocated Budget</th>
<th>Allocated Budget Change</th>
<th>Budget to Complete (ETC)</th>
<th>Contingency Budget</th>
<th>Budgeted Cost of Work Remaining</th>
<th>Contingency % of Remaining Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>Status as of Sep 2006</td>
<td></td>
<td>274,686</td>
<td>251,613</td>
<td>23,072</td>
<td>102,651</td>
<td>94,088</td>
<td>24.5%</td>
<td></td>
</tr>
<tr>
<td>CR74</td>
<td>CR 0075 Implementation PY5 rebaseline correction</td>
<td>11/15/06</td>
<td>274,686</td>
<td>251,457</td>
<td>-156</td>
<td>23,229</td>
<td>97,609</td>
<td>88,108</td>
<td>26.4%</td>
</tr>
</tbody>
</table>

High Level Risk Assessment & Potential Contingency Adjustments

<table>
<thead>
<tr>
<th>Item</th>
<th>Potential Contingency Adjustments</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spares, increased number of drillers (6 to 18 seasonal drillers), increased retro and maintenance costs may drive-up implementation out-year budgets.</td>
<td>$4,500K</td>
<td>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.</td>
</tr>
<tr>
<td>Scope and higher unit pricing will increase the RPSC out-year budget baseline</td>
<td>$5,200K</td>
<td>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.</td>
</tr>
<tr>
<td>Restore 80-string configuration</td>
<td>$5,600K</td>
<td>Cost of instrumentation to restore the original 80 string configuration.</td>
</tr>
<tr>
<td>Potential draw on contingency due to a slow ramp up in operations support</td>
<td>$4,000K</td>
<td>Assigned against Commissioning. Currently working to reduce the funding requirements for operations.</td>
</tr>
</tbody>
</table>

Drill Operation and String Installation – IceCube personnel arrived at the South Pole about one week later than planned due to delays in the opening of the South Pole Station. The Station opening was delayed by weather conditions that were colder than normal. Repairs and modifications to the Enhance Hot Water Drill commenced during this time. All planned modifications and repairs were completed, with the exception of a minor RWS reconfiguration that was deemed unnecessary.

Surveying and site preparation of the Seasonal Equipment Site (SES) was completed ahead of schedule. All of the Modular Drilling Structures were relocated to the SES as planned. Cables and hoses were laid out between the modules. Testing and troubleshooting was completed. There is a general problem with air getting drawn into the fuel lines for the burners. This will be addressed by the installation of return lines taking place in parallel with ongoing drilling operations.

Following the completion of a series of readiness reviews organized by the IceCube On-Ice Lead, drilling of the first hole for the season commenced with firn drilling on December 11th at 6:30 a.m. Firn drilling was completed to a depth of 50 meters in five hours. Main hole drilling commenced at approximately 9:00 p.m. December 11th and was completed on December 14th. The first string was successfully installed by Friday morning, December 15th.
IceTop installation continues on schedule. Six trenches are complete with two tanks each and the DOMs installed. Four more IceTop locations (total of ten locations for this season) will be completed by the middle of December on schedule. The next phase includes the placement of the Surface Junction Boxes (SJB) into the trenches. This work is underway with SJBs installed in six trenches. DOM connections will be completed next week.

**Logistics** – Major shipments to the South Pole were completed after a slow start due to weather delays early in the season. There are no major cargo delivery issues at this time.

**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.

![IceCube DOM Integration PY5 (April, 2006 to March, 2007) - Plan vs. Actual](chart.png)

**DOM Testing** – A total of 21 Final Acceptance Testing (FAT) cycles have been completed at the University of Wisconsin, DESY, and Uppsala. A total of 1,113 DOMs have been tested in the 21 FAT cycles.

**Detector Commissioning and Verification** – There is good progress on efforts to automate many of the high-level commissioning tests. The automated tests should be ready for testing before the end of the deployment season. A meeting at University of Maryland is scheduled for early December to install and test software to run many verification monitoring tasks on the unfiltered data at the South Pole.

The AMANDA laser system was successfully set up and calibrated early in the South Pole season. The system is to provide *in situ* light for a study of the hole ice of IceCube string 48,
which is intentionally being deployed relatively close to AMANDA string 4. The laser system will provide light to fibers that terminate in diffuser balls at various depths along AMANDA String 4.

The upgrade of the AMANDA TWR hardware at Pole will be completed at the end of the season. The AMANDA TWR system will connect with IceCube to form a joint detector. The old AMANDA “muonDAQ” system will be decommissioned.

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 started loading and testing Main Boards and is on schedule to deliver fully tested units in early December. Delivery of Main Boards to LBNL for final test and QA was delayed by 2 weeks due to component procurement and loading issues, but the issues were resolved quickly and Main Board shipments to Integration sites will start up in 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.

All of the 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 - Following the plan to re-implement large portions of the DAQ the development team began to move the existing DAQ code to a new source code repository and to factor out dependencies on the JBoss distributed framework. The opportunity to move to a new code repository was taken due to short-term and long-term support issues with the current repository which resides at LBNL. In the short term the LBNL repository computing hardware will need a significant amount of maintenance to keep it running. In addition, it now only hosts the DAQ software repository, the other IceCube software projects having migrated some time ago to the IceCube SVN repository; therefore, a long-term goal which pre-dated the new DAQ effort was to move the code to SVN.

The JBoss distributed framework code is being factored out of the DAQ components to be replaced by a custom thin control system layered on top of XML-RPC. While JBoss offers a very rich feature set, the DAQ was only using a minimal subset the functionality of which is provided by the new control system. There is already a working version of this system in test. It also has the advantage that it is not Java-centric: Java objects are now being controlled by a central authority which is written in Python. The DAQ components, including the new StringHub component, are being outfitted with the proper software objects to operate as remotely-controllable network object in this scheme. On the timescale of 1-2 weeks we anticipate having a full set of DAQ components which will connect and flow data from DOMs to events on disk.
The complex configuration system has also seen a major overhaul. The Postgres database utilized in the older DAQ was discarded in favor of a simpler system which relies on XML files to contain the DAQ component and hardware configuration information. Again, the additional complexity of the RDBMS approach was not justified by the particular utilization and the simpler system provides equivalent functionality. The DOM configuration code, which represents by far the major portion of the configuration, is complete. The mechanism by which the configuration information is communicated to the downstream systems from the viewpoint of the DAQ requires no additional coding beyond handing an identification tag to PnF. The information that this tag represents is conveyed by a simple convention negotiated between the DAQ and online processing groups: the configuration files that bear this identifying tag are distributed to the online group in advance of their use in the DAQ. This obviates the existing problem of real-time delivery of a large set of constants from DAQ to PnF.

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

Equipment (~18 racks and associated computer equipment) for the South Pole System (SPS) that will be installed in the new IceCube Laboratory arrived at the South Pole. Equipment for the 64-bit computing South Pole Test System (SPTS-64) at the UW is online and being used for deployment testing of the South Pole software systems. Installation and upgrades 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 the South Pole of select events for transmission continued with high efficiency and reliability since June 1 with no major problems through the season. Official filtering for last season ended in late November. Continued enhancements to the online and offline database tools for IceTray were delivered in preparation for deployment to the South Pole this year. 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 major milestone in the integration of the AMANDA detector into IceCube will allow us to turn off several legacy systems on AMANDA to save power at the South Pole and to make optimal use of the available satellite bandwidth. Interfaces and system integration planning for online filter/JEB to work with the new DAQ are being deployed this season.

Simulation production with version 1.9.4 began this month. Progress is being made with the distributed production of simulation events. Several new institutions were added including non-US groups for the first time. Work continues on using GRID computing for simulation production through the GLOW cluster at UW. Planning for increased use of GRID computing is proceeding.

Progress in experiment control continues with improvements in configuration infrastructure and detector monitoring web pages. New requirements and system design planning for compatibility with new the DAQ system is being developed.
Quality Assurance and Safety – There was an accident at the South Pole on November 21st when an IceCube seasonal driller injured his finger while operating the SIMCO drill used for exploratory holes. The injured driller was treated at the South Pole and flown to New Zealand for additional medical care. He has returned to work at the IceCube drill camp and will complete the remainder of the drilling season. An accident report was prepared and modifications to the drilling equipment, procedures, and training were implemented to reduce the chances of additional injuries. The accident response and decision to resume drilling with the SIMCO drill was coordinated with NSF and RPSC management.

The monthly reports are posted at IceCube Monthly Reports. Construction Reports are posted at IceCube 2006-2007 Weekly Construction Reports.

Meetings and Events
Forecast for End of Drilling for the 2006/2007 Season
Project Advisory Panel/Science Advisory Committee Meeting
IceCube Collaboration Meeting, Lake Geneva, Wisconsin
NSF Annual Review of the IceCube Project (tentative)

January 30, 2007
March 1-2, 2007
April 24-28, 2007
May 2007

Cable Tower and Cable Bridge to the IceCube Laboratory
Alan Elcheikh, IceCube Drilling Manager, at the Completion of Firn Drilling on the First IceCube Hole of the 2006/2007 Season.