

IceCube

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**IceCube Startup Project
Quarterly Report**

August 1, 2002 – October 31, 2002

Submittal Date: November 27, 2002

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This report is submitted in accordance with the reporting requirements set forth in the IceCube Startup Project Cooperative Agreement, number OPP-0236449.

Foreword

This is the initial submittal of a quarterly report under Cooperative Agreement Number OPP-0236449, and covers the three-month period beginning August 1, 2002 and concluding on October 31, 2002.

Project work and cost tracking methodologies are currently being implemented on the IceCube project. Collaboration agreements are also being established in parallel with the project start up, and operating procedures / precedents are evolving.

While every effort has been made to present status accurately, the cost data contained in this document should be considered preliminary and is subject to restatement following internal review. The funds labeled as "actual" are compiled from financial records at the University of Wisconsin - Madison and from reports provided by our subawardees. Accounting differences may result in amounts officially recorded at individual institutions being different from those collected in this summary document.

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Executive Summary

Project Manager's Assessment

Overall, the project has made substantial progress during the first three months of the start-up phase. Key staff have been hired, processes and procedures are taking shape, significant progress has been made on the Enhanced Hot Water Drill and DOM development, funding appears to be adequate to accomplish start-up phase objectives, and the effectiveness of the collaboration is growing stronger.

We have completed development of a suitable template for sub-award agreements and are working through the associated statements of work for participating institutions to ensure a common understanding of commitments and expectations. This process has identified a few inconsistencies between our planned funding allocations, our work breakdown structure, and the expectations of our partners. We are in the process of correcting these inconsistencies and will make the necessary refinements to program plans and documentation. No impacts to start-up costs or the attainment of first year objectives are anticipated.

Predictably, the ramp-up in staffing has been slower than hoped and as a result progress has been slower in some areas than planned. The impacts of these delays are manageable and do not represent major risks to the program at this time.

The development of the Enhanced Hot Water Drill is critical to this year's effort and is receiving management attention to insure that the project objectives are met. Accordingly, this activity is leading the way in establishing sound program management processes and implementing effective management tools.

Major project accomplishments during this period include the following:

Technical

- A comprehensive design review was completed for the EHWD development, 73 of 92 resulting action items have been closed, and successful "Delta Design Review" has been completed.
- Fabrication of the EHWD hose reel was completed,
- The order for the hose is ready to be placed in early November,
- Orders for the Mobile Drilling Structures (MDS) were placed in September,
- Specifications for the generators were developed in conjunction with RPSC and an RFP is ready for release,
- EHWD software requirements have been defined,
- Work has begun on the Integration, Verification and Test Plan for the EWHD,
- DOM main board requirements have been defined and design of the main board prototype has been completed,

- DOM Hub requirements have been drafted and DESY-Zeuthen has begun preliminary design of the high-speed communications channel,
- A software development environment has been constructed that can be used by the collaboration for future IceCube software development, and
- A highly qualified systems engineer has been identified and will start work on 4 November 2002.

Project Management

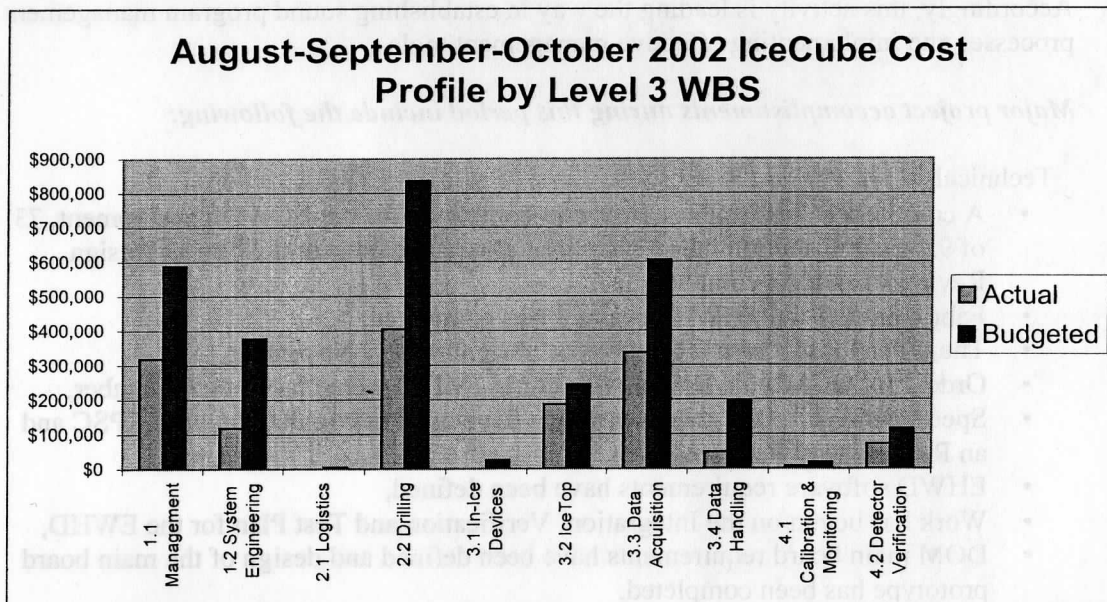
- OpenPlan and Cobra have been identified as our preferred program and financial management systems. One “seat” of OpenPlan has been ordered and will be used initially on the Enhanced Hot Water Drill effort. This will provide a demonstration of integrated cost and schedule (Earned Value) project management control systems, which will subsequently be implemented for the remainder of IceCube construction.

Collaboration

- A template for sub-awards with our collaboration partners has been defined and agreements have begun to be finalized.

Budget Summary:

Cumulative budget and cost data for the first quarter are shown by Level 3 WBS in the following graph.



These financial data are "preliminary" subject to funding allocation revisions reflecting final negotiated Statements of Work and Memorandums of Understanding with collaboration partners, internal audit of actual costs, and implementation of a formal PCMS system. Spending on the IceCube project was less than planned for the first quarter. In general, actual costs were lower than budget for three reasons: 1) staffing ramp up has gone slower than expected resulting in lower up-front labor costs, 2) acquisitions have been delayed for technical or acquisition support reasons, shifting actual costs into later months, and 3) the cash accounting method used at the University of Wisconsin - Madison does not reflect all currently committed costs of capital equipment and services. The first two reasons are manifestations of schedule rather than cost. The third reason reflects billing cycle differences rather than schedule or cost.

Section I - Status by WBS Element

The following pages in this section provide visibility into the project at Level 3 of the WBS, and are intended to provide a concise overview of the work accomplished as well as a comparison of progress to plan.

Routine task management identifies and resolves issues on a continuing basis. In situations where an issue may result in a programmatic impact, it has been flagged for additional visibility and documented in Section II of this report.

Information related to tasks that are not currently funded will be found in Section III.

1.1 Management

SUMMARY OF WORK ACCOMPLISHED

Project Office

Requirements for the PMCS were established and reviewed. Available scheduling software was evaluated, including Microsoft Project, Primavera Project Planner, and Welcom's Open Plan. Open Plan was chosen for the PMCS scheduling tool. Its companion product, Cobra, will likely be used for generating monthly financial reports. The SSEC accounting system was analyzed, and preparations are underway to transfer data into the PMCS to compare actual and planned spending.

The Project office organized and submitted the Project Execution Plan (PEP) that forms the basis for the first year effort. The PEP includes budgets, schedules, test plans, deliverables, and requirements for this year.

Subawards

Seven institutions are actively involved in various stages of the Subaward process, with current status ranging from awaiting final signatures to iterating on Statements of Work. We have established a proficient ad hoc process of completing Subaward agreements with our institutions.

The time invested in creating this process has put us nearly three weeks behind schedule; however, we anticipate that the remaining Subawards for this contract year, and future years, will benefit from our efforts. We plan to complete the Subawards in December.

We have created a web page for Subaward documents and associated electronic reporting.

MOUs

Draft MOUs are in place with the non-US institutions. Due to the uncertainty of FY04 funding, our international collaborators are reluctant to sign an MOU for a single year. We may find it necessary to forego the signed MOUs until we can demonstrate to the collaboration on-going multi-year funding.

Reviews

No major reviews were planned during this quarter.

Reliability, Quality Assurance and Safety (R/QA&S)

Hazard Analyses have been written, approved, and signed for the:

- Main Drill Hose Reel
- TOS Tower
- Mobile Drilling Structures (MDS's)
- Rodriguez Well System
- Cable Reel
- Return Water Hose Reel
- Drill Control System

The IceCube Safety Plan was signed and released, and the Preliminary Safety Design Review for the EHWD was conducted on October 4, 2002.

A Fire Safety Specification for the EHWD was written and is under review.

Drafts of the Code Waiver Form and Tracking Report were generated using examples from NSF as references. The first waiver request is planned for November 2002.

The IceCube Quality Plan has been drafted and is under review.

The IceCube Document Management Process has been drafted and is under review.

PROGRESS VS. PLANNED ACTIVITIES

Progress Reporting

Monthly financial reports for the first three quarters of the Startup project have been prepared and are being submitted at the time of this report's submission. In the future, monthly financial reports for the previous month will be submitted within 30 days of month end.

Project Management Control System

PMCS requirements have been established, and an evaluation of PMCS software packages is underway. Efforts to implement scheduling and cost-reporting software are expected to begin Dec. 11, ahead of the Jan. 16 schedule date. The early start was enabled by the rapid acquisition of software.

MOU's and Subawards

Subawards are nearly three weeks behind schedule; however, we anticipate that the remaining Subawards for this contract year, and future years, will benefit from our efforts. Planned completion of Subawards is late December.

Reliability, Quality Assurance and Safety (R/QA&S)

Hazard Analysis

- Eight of the 12 hazard analyses (HA) have been released.

- The HA for Storage Tanks was scheduled to be completed 10/11/02; this was delayed due to scheduled time off of the two principal participants. It was in sign-off at the end of the report period.
- The HA for Power Distribution was scheduled to be completed 10/4/02; this was delayed to allow additional time to better define the Power Distribution System.
- The remaining two HA's were scheduled for November 2002 completion.

Safety Plan

This activity had a scheduled finish date of 9/18/02; it was released on 9/27/02.

EHWD Preliminary Safety Design Review

This activity had a scheduled finish date of 10/21/02; it was completed ahead of schedule.

Quality Plan

This activity had a scheduled finish date of 2/26/03; it is well ahead of schedule.

Configuration Control Plan

This activity has a scheduled finish date of 11/13/02; it is on schedule.

Budget Performance

Current reporting period costs are significantly under budget due to slower than anticipated staffing ramp up and minor delays in performance of some tasks.

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$164,867	\$218,405	\$203,681	\$586,952
Actuals	\$129,425	\$80,336	\$108,357	\$318,119
Difference	\$35,442	\$138,068	\$95,323	\$268,833

1.2 System Engineering

SUMMARY OF WORK ACCOMPLISHED

Although top-level system engineering effort was impacted by staffing delays, the conduct of requirements analysis and documentation at subsystem levels benefited substantially from effort in the Quality and Software development areas. Templates have been established for requirements documentation, and configuration management processes are now defined.

PROGRESS VS. PLANNED ACTIVITIES

WBS 1.2 System Engineering tasks scheduled for start on 8/1/02 have been delayed until 11/04/02, and other portions have been conducted less formally than originally anticipated due to staffing delays. Current period costs associated with this effort have been lower than planned due to the delayed start, and will result in additional effort required in subsequent periods.

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$107,600	\$134,500	\$134,000	\$376,100
Actuals	\$39,468	\$32,931	\$45,708	\$118,107
Difference	\$68,132	\$101,569	\$88,292	\$257,993

2.1 Logistics

SUMMARY OF WORK ACCOMPLISHED

The task of the Logistics team was to anticipate the number of flights required to transport the subsystems, fuel and personnel to the South Pole for the FY04 season. The objective of the FY04 season is to transport, assemble the subsystems, and test them at the South Pole prior to loading them on the cargo berm.

The following ground rules have been established to determine the current flight manifest:

- We can transport equipment with weights greater than 10000 lbs or need a pallet marriage only after Nov 15th due to the effects of condensation trails.
- The Modified Drilling Structures arrive and can be directly placed onto available sleds. Hence cycle time can be reduced and also increase productivity.
- We transport the Optical Modules in the final phase, or even delay them to the next season, hence saving on average around 2 or 3 flights.
- Fuel needed for operation at the South Pole can be transported in flights that may be "cubed" out but not "weighted" out.

Transportation priority is as follows:

1. Hose Reel
2. Tower with cables, reels, and hoses
3. 1 Generator @225 KW and substation
4. MDS except the Seasonal Equipment Workshop and Main Heating Plant 2-4
5. Water tanks
6. Extra generator @225 KW
7. Main heating plants 2- 4
8. Seasonal Equipment Workshop
9. Drills
10. Antifreeze
11. Ethanol Tanks
12. Extra TOS and Tower
13. Extra Drill Head
14. Optical Modules
15. Hole Covers

Items 1 → 5 will facilitate a partially functional drill, and items 1 → 10 will facilitate a fully functional drill. Prioritization is given to items that need more assembly time to reduce critical path. Current requirement for personnel needed for the EHWD is 13, and three are need for science in FY04. The final cargo and personnel required are likely to change as FY04 and FY05 plans develop.

PROGRESS VS. PLANNED ACTIVITIES

Actual progress in logistics planning and liaison with NSF & RPSC is about as planned. Planning for the FY04 season now includes a more flexible approach required by the project given the unpredictable nature of seasonal weather impacts on logistics support. Actual spending does not reflect effort expended. Future actual costs will exceed budgeted amounts due to higher salary requirements of the current logistics liaison.

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$2,216	\$1,107	\$1,107	\$4,430
Actuals	\$0	\$175	\$421	\$596
Difference	\$2,216	\$932	\$687	\$3,834

2.2 *Drilling*

SUMMARY OF WORK ACCOMPLISHED

Project Management / System Design

A Delta Design Review was held in early September. Participants included staff from the NSF and Raytheon Polar Services Corporation (RPSC) along with independent reviewers John Rand and John Kumin. The purpose was to review progress and changes to the design since the November 2001 review and to assess upcoming major purchases.

The EHWD site plan was reviewed by RPSC. The site plan has been updated. It will be reviewed with RPSC again during the second week of December.

There were a total of ninety-two existing or newly created action items during the first quarter. A list was compiled and consolidated from the November 2001 Design Review, the June 2002 Status Meeting, and the September 2002 Delta Design Review. A total of seventy-three of the items have been retired. The majority of these were handled at the Delta Design Review. Of the remaining nineteen, ten are the responsibility of the UW, three the NSF, and one RPSC. The UW and NSF are jointly responsible for three, the UW and RPSC one, and all three organizations for another. It is anticipated that seven of the items will be closed during the next quarter.

Progress vs. Planned

Planned Spending:	\$82,288
Actual Spending:	\$90,722
Difference:	(\$8,434)

Spending is approximately 10% over planned. The FY02 budget plan did not include a full-time project manager. Until shortly before the IceCube Startup project began in August, this activity had been a core ICDS project, managed by ICDS. Given the amount of work to be done, the current staffing level is appropriate, so the difference between planned and actual will continue at an approximate rate of \$7k/month on average. The first quarter figures are offset by less than expected travel expenses.

Control System

The focus of work in the control system was on software system design, algorithm development, the e-stop system, and the software and hardware requirements documents.

A software development approach was defined and the system design finalized. A trade study was conducted to select an operating system and the process of selecting computer hardware has begun. Initial code has been written for most of the identified subroutines and a preliminary release is anticipated in early December. In combination with the software development, progress was made on the requirements for five of the eight control algorithms. Requirements for two of

the algorithms have been turned over for software implementation. It is projected that the requirements for the remaining six will be defined by the end of the second quarter.

Modifications to the e-stop system were implemented following the Delta Design Review including the addition of a feature to identify which emergency stop has been activated to invoke a stop. Work will continue on this through December.

Draft versions of the software and hardware documents have been reviewed and edited by the EWH staff. Approved versions are projected to be complete in December. A preliminary User Interface Document has also been developed. This document will serve to direct the development of the user interface and may be a work in progress into the spring.

Planned Spending: \$77,934
Actual Spending: \$89,962
Difference: (\$12,028)

Spending is approximately 15% over planned, but this is misleading. A correction is required to the labor charges that will reduce the control system spending by approximately \$13.5k. This update will make the actual and planned spending essentially equal.

Progress is as planned for this quarter, although the e-stop system design and sensor specification and selection has progressed slower than expected.

Power Distribution

Activity Summary

The primary activities in power distribution were writing a generator request for proposal (RFP) with RPSC and organizing purchasing documentation for the motors and drives.

Following the Delta Design Review, EHW staff worked jointly with RPSC staff to finalize the RFP. A mutually agreed upon RFP was completed on November 1st and distributed to vendors. Responses are due December 6th and an award expected by December 20th. EHW staff will participate in a proposal evaluation meeting at RPSC the week of December 9th.

Due to design considerations, the purchase of motors was divided into two purchasing efforts. The hose reel, the drill cable winch and the deployment cable winch require a TENV (totally enclosed non-ventilated) induction motor. The remaining motors in the system do not need to be TENV and may be either induction or permanent magnet. A request for bid (RFB) was advertised for the TENV induction motors. The bids were received and a motor for the hose reel has been ordered. A RFP for the remaining motors was prepared and is currently being advertised. Responses are due on December 2nd.

A request for bid was prepared for the system drives and was released in early November. Responses are due back on December 6th.

Progress vs. Planned

Planned Spending: \$153,649
Actual Spending: \$27,987
Difference \$125,662

Spending is significantly under planned. This is due to the motor and drive procurements. The budget anticipated purchases starting in October. Orders will not be placed until December with actual payments probably not occurring until January. This is later than planned, but based on lead times, this should not present a problem.

Progress in other areas of the power distribution system is proceeding as planned with the exception of the generator procurement and the electrical feeder cable selection.

Hose / Plumbing System

Activity Summary

The principal activities in the hose and plumbing system were the purchase order for the drill hose, the construction of the hose reel, the hose reel electrical system design and specifications for the system hoses (excluding the drill hose) and pumps.

A hose order was placed with IVG on November 1st. Final clarification on the drill hose specification and test reports were faxed to IVG on November 15th to clear the start of hose production. At the time of the order, IVG estimated a lead-time of thirty weeks, driven by the fabrication of the Victaulic ZX couplings. These are produced by an outside vendor. To minimize their schedule impact, a wire transfer for the amount of the couplings was made to IVG with the purchase order to allow them to place the coupling order.

Since placing the order for the construction of the hose reel, the EHWD system delivery has changed permitting a more comfortable construction schedule. The drum is currently mounted on the frame, the drum plates welded in place, the end flanges positioned, and the drive system installed (with the exception of the motor). Figure 1 shows the Hose Reel Drum as of November 7th.

The design of the hose reel electrical system is in progress. This includes the layout of control switches and the design of a universal pendant control. The pendant control will provide remote control of the hose reel and pumps in the system. By the end of the second quarter, the construction of the hose reel, the electrical system design, a hose reel brake and an enclosure should be at or near completion.

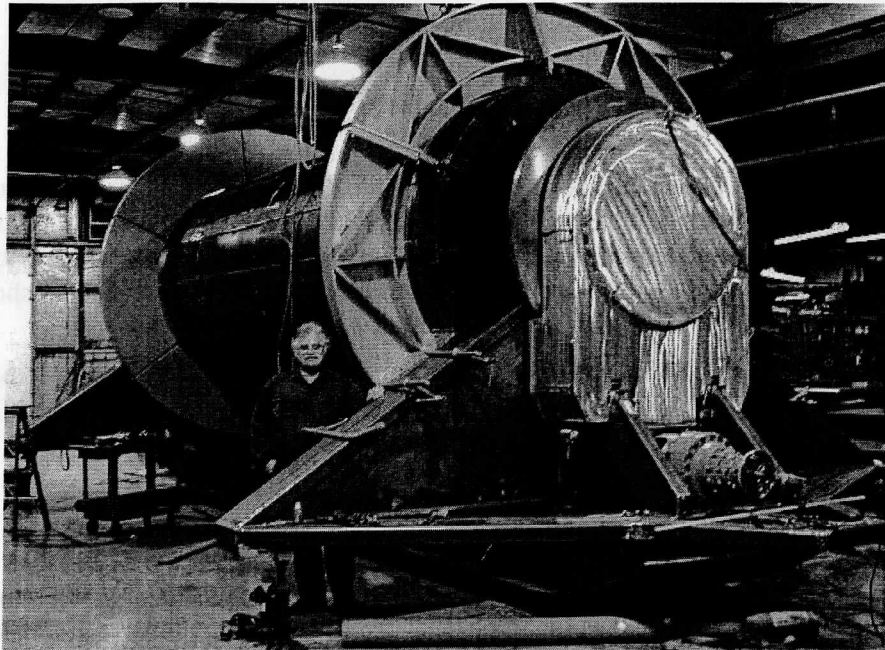


Figure 1: Hose Reel Drum, November 7th, 2002.

Specifications for all hoses, besides the drill hose, and all pumps in the system are currently being circulated for signature. Purchasing documents should be developed in December.

Progress vs. Planned

Planned Spending:	\$419,747
Actual Spending:	\$79,959
Difference	\$339,788

Actual spending is less than 20% of planned spending. This is predominately due to capital equipment and subcontract spending. The hose reel construction was much further along at the start of the project year than was estimated. A significant portion of the hose reel cost is included in the first two quarters, much of which has already been incurred. The difference in capital spending will continue into the next quarter.

Subcontract spending has been less than anticipated. Some subcontracting charges were not submitted in time to be included in the October accounting run. Initially there have been fewer tasks suited for outsourcing than anticipated in the Hose / Plumbing Subsystem. Increased subcontractor work is expected in the second quarter.

Progress is on schedule to support IV&T with the exception of the drill hose delivery and detail work on the Water Tanks.

Heating System

Activity Summary

The primary activities in the heating system were the MDS order and the main heater design.

A request for proposal for the MDSs was released in early August and responses received in September. Following a successful site visit, Sea Box, Inc. was awarded the contract. Since that time, the models have been prioritized and the design and analysis of Model 3 (High Pressure Pumps) was completed during the second week of November and approval to proceed with fabrication was given on November 18th. Construction is expected to be completed by December 18th. Because this was the first model designed, many decisions were required that affected all the models. This resulted in several iterations that will not be required on subsequent models. It is likely that the design and analysis on the remaining models will proceed much faster.

Per a request from Karl Erb at the June Status Meeting, engineering has been researching a more fuel-efficient design alternative to the current heaters in stock. Engineering has worked closely with Whitco and one of their distributors to incorporate an additional heat exchanger into the system. The design and specification are being finalized. Over the next quarter, the plan is to advertise a request for proposal, award a contract to a Whitco distributor, and place an order for a prototype heater and system heaters without the heat exchanger. The prototype will include a heat exchanger and will be put through a battery of evaluation tests. The results of the tests will be used to finalize the heat exchanger design and an order will be placed. The system heater design permits the straightforward addition of the additional heat exchangers.

Progress vs. Planned

Planned Spending:	\$21,305
Actual Spending:	\$36,741
Difference	(\$15,436)

The actual spending is approximately 75% over planned. No subcontract support was anticipated for the heating system. However, some tasks have developed that are well suited for outsourcing and fit well with the subcontractor's experience. For example, Bit7 has completed a frame support design for the Stinger heaters.

Progress has proceeded as planned, but there are three tasks being closely monitored: detailed MDS layouts, furnace and heater procurement.

The detailed layouts of the MDSs are in progress and currently only the Water Tank design is showing a potential problem as described earlier. An additional draftsman has been assigned to help on the layouts.

Both the furnace and heater procurements are near the release of a RFP. Based on preliminary lead-time estimates, the equipment should be here on time. Both are expected to be out by the end of November.

Drill Site

Activity Summary

The key areas of development during the first quarter were the TOS Tower design, the Firm Drill design, the requirements for an Autobanding System, and the Drill Head.

The TOS Tower design has evolved as requirements have changed. The requirements should be finalized by the end of November and the design in December. The tower will be fabricated at PSL. A single tower is being constructed this year.

Engineering worked on the detail design of the Firm Drill through early October. The design was put on hold while staff supported field work on another ICDS project. The final design work will be completed in December.

Requirement documents for an Autobanding System and the Drill Head were prepared. The Autobanding System Requirements have been approved and signed. Detail design of the system will start during the second quarter. The Drill Head Requirements document is currently being reviewed for signature and PSL will soon resume the detail design work. The plan is to complete the new drill head design, identify changes to the existing drill head to make it compatible with the new design and implement those changes. New drill heads are not planned as part of this year's activities.

Progress vs. Planned

Planned Spending:	\$80,241
Actual Spending:	\$75,950
Difference	\$4,291

Actual spending and progress have gone as planned.

Integration, Verification, & Test

Activity Summary

The only activity planned was the development of the IV&T plan. An initial plan was presented at the Delta Design Review and included in the Project Execution Plan. The plan is in the process of being revised. A final plan is expected in late November or early December.

Progress vs. Planned

Planned Spending:	\$0
Actual Spending:	\$1,929
Difference	(\$1,929)

There was no planned budget for the first quarter. The systems engineering support to develop the IV&T plan is budgeted under project management / system design. The actual spending was used to support some preliminary layout work by a student. Progress on the IV&T Plan has been as expected.

FY04 Drill Season

Activity Summary

No activities were planned.

Progress vs. Planned

Planned Spending: \$0
Actual Spending: \$1,911
Difference (\$1,911)

Some labor charges were mistakenly charged to the FY04 Drill Season. These charges will be transferred to Project Management / System Design during the December accounting run.

PROGRESS VS. PLANNED ACTIVITIES

The table below summarizes the EHWD system planned and actual spending.

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$242,052	\$236,827	\$356,281	\$835,160
Actuals	\$141,036	\$138,860	\$125,264	\$405,160
Difference	\$101,016	\$97,967	\$231,018	\$430,000

The schedule for EHWD activities has been updated to reflect status through the end of the reporting quarter, and is presented in the foldout on the following page.

Drill Schedule Foldout Location

Planned Spending: \$0
Actual Spending: \$1,911
Difference: (\$1,911)

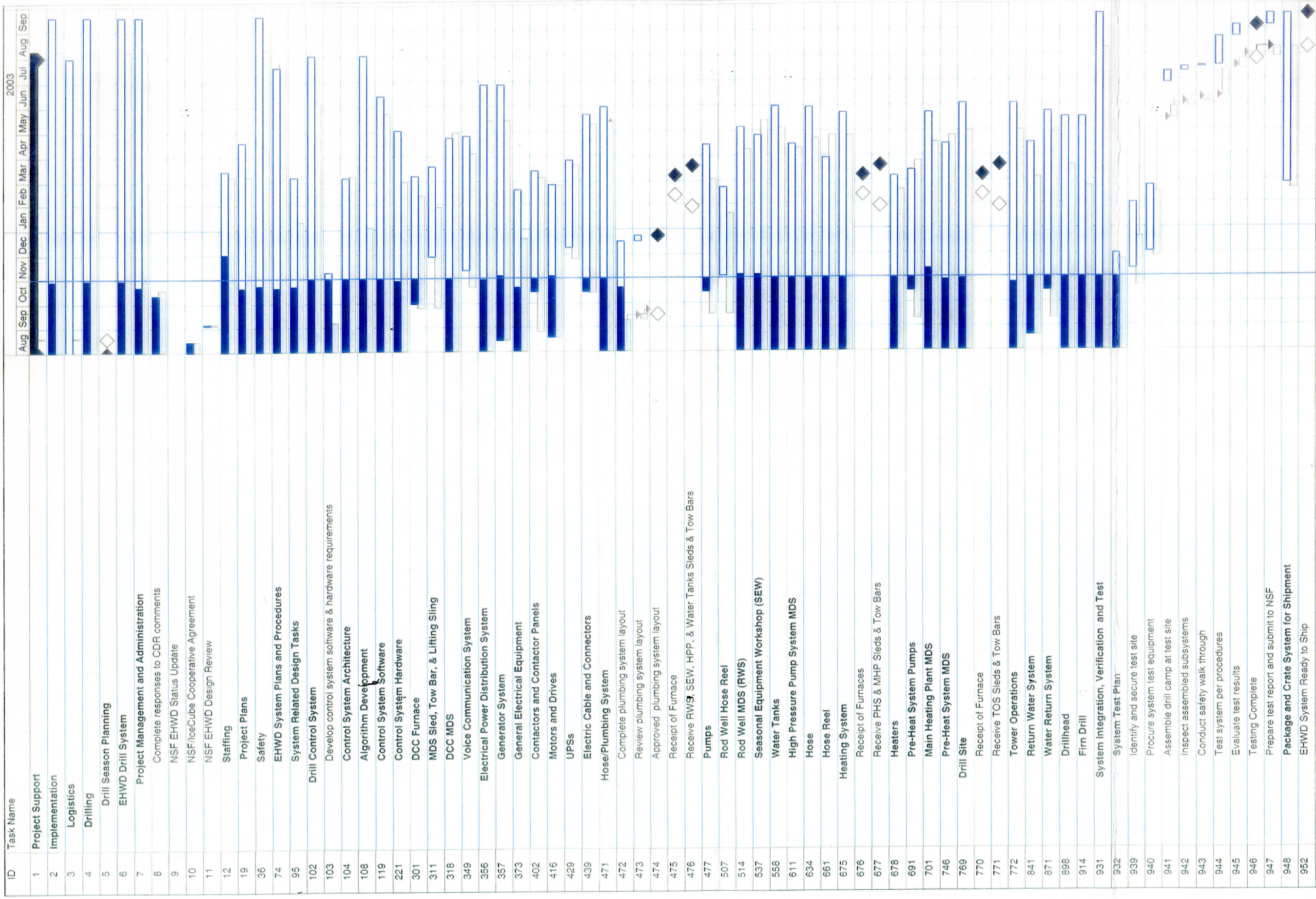
Some labor charges were manually changed to the FY04-Dall location. These changes will be recorded in Project Management System Design during the December reporting period.

PROGRESS VS. PLANNED ACTIVITIES

The table below summarizes the ESIWD system planned and actual spending.

Category	Planned	Actual
Drill Schedule	2,350,381	2,350,381
Other	213,820	213,820
Total	2,564,201	2,564,201

The schedule for ESIWD activities has been updated to reflect status through the end of the reporting quarter, and is presented in the foldout on the following page.



Project: EHW Development Skd
 Date: Tue 11/26/02

Legend:

- Baseline Milestone (diamond)
- Milestone (filled diamond)
- Baseline Summary (light blue bar)
- Task Progress (dark blue bar)
- Summary (light blue bar)
- Summary Progress (dark blue bar)

3.2 *Ice Top*

SUMMARY OF WORK ACCOMPLISHED

PEP schedule indicates three items related to the tanks:

- Preliminary tests in the lab were started during the summer and completed by Oct 31, as per PEP schedule.
- Development of measurement electronics for monitoring the freeze tests were also completed by Oct 31.
- Full-size tanks are being frozen in a commercial freezer at the Port of Wilmington, DE (POW) for two methods of making ice tanks. Preparations started in September, with anticipated fills in early November. It is anticipated that tanks will be completely frozen by end of January (PEP schedule reads Jan 15).

Cables and connectors for the POW tests were acquired.

Two AMANDA OMs were acquired for use in the POW tests, with placement due in early November.

IceTop specific engineering:

- Completed full initial drafts of Preliminary Design Document, Statement of Work and Test Plan Document. (Not scheduled).
- Began development of feature recognition algorithms for tank signals. (Scheduled for Oct 1 – Feb 15).
- Began design of DAQ system for surface data in context of IceCube. (Scheduled for Oct 1 – Jan 15).
- Began studies of thermal properties of DOM modules in South Polar surface conditions. (Unscheduled).

IceTop Detector Simulations:

- Initial simulations of signals in tanks due to electrons and muons have been made.
- Existing SPASE data and simulations were used to estimate various event rates for cosmic ray showers incident on IceTop.

PROGRESS VS. PLANNED ACTIVITIES

A comparison of the PEP budget and the actual expenditures indicates that IceTop has expended funds at a rate somewhat slower than anticipated. It is consistent that IceTop progress is also a bit behind schedule in a few categories as noted above. This is partly due to delays related to uncertainty in project funding, and partly due to changes in personnel. The effort associated with departing personnel has been reallocated to the period Nov 1 – Mar 31, such that both budget and schedule should be completed by the end of the award period.

The net effort has increased by two months of Research Scientist time. The increase in budget will be compensated by an institutional contribution to the support of one of the technical staff (2.81 months of Research Associate I).

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$130,112	\$60,096	\$52,881	\$243,090
Actuals	\$92,648	\$45,144	\$48,843	\$186,635
Difference	\$37,464	\$14,953	\$4,038	\$56,455

3.3 *Data Acquisition*

SUMMARY OF WORK ACCOMPLISHED

The principal DAQ System Deliverable for Phase I of IceCube is a set of 24 prototype main circuit boards (MB) for the Digital Optical Module (DOM) along with firmware and software sufficient to verify their functionality and performance.

Major Technical Achievements:

The requirements for the DOM MB prototype hardware have been established and the hardware design for the first prototype was 90% finished. Work on firmware has begun.

Parts procurement for the MB is in progress, and the layout of the first prototype board has begun.

The initial requirements for the DOM MB software have been established and the design of the software is well underway.

A list of tests to be performed on the DOM MB has been prepared and plans for implementation of these tests made.

Results of DAQ system design and software development appear in ten documents now available on the web.

Work on the hardware and software requirements for the DOM HUB (the "front end" of the surface DAQ that communicates with the DOM deep in the ice) has begun.

Staffing has been added to meet the projects needs.

In general, actual progress has followed planned progress with a delay of from two to four weeks (depending on the particular item). However, it appears that the main deliverable, 24 DOM Main Boards during Phase I, can be met on schedule. Details of each of the DAQ tasks are described below:

DOM Electrical Engineering, Prototype Fabrication and Test

Design of the main PCB hardware design is continuing with enhanced capabilities and design improvements. These modifications are scheduled to continue until 1/3/03. Board layout, fabrication, and assembly are scheduled for completion on 11/29/02. This task is now expected to be finished on 12/20/02. As a result, initial hardware testing that was scheduled to start on 12/2/02 is anticipated to start on 12/20/02.

Testing of one DOM in a single channel test will also slip from a scheduled 12/30/02 start to 1/15/03. Based on latest design information, the testing of two DOMs on the same twisted pair can begin as early as 2/15/02 instead of on 3/20/02, or over a month ahead of schedule.

The planned second iteration of the PCB layout, fabrication, assembly, and test is presently on schedule for completion on 3/10/03, however, the delivery of tested main boards originally scheduled for completion on 3/10/03 is anticipated to be completed on 3/31/03.

DAQ Software Architecture

The DOM Main PCB Requirements are contained in two documents - hardware and software. During this period these documents have been prepared, reviewed, and revised to accommodate reviewers' comments. The Main PCB Hardware Requirements document is undergoing further review in the Project Office. Both documents are expected to receive final approval and signatures during the early part of the next quarter.

The Hub Requirements documents were scheduled for completion on 10/18/02. These documents are in draft form and about 25% completed. Completion by 12/15/02 is anticipated. Although completion of these documents is behind schedule, this is not expected to impact delivery of the main PCB boards in March 03.

DOM Software

The DOM software design was scheduled for completion on 12/25/02 and is now anticipated to be complete on 01/15/03. This task is approximately 25% complete.

DOM HUB Software

The DOM software design was scheduled for completion on 12/25/02 is now scheduled for completion on 01/15/03. This task is approximately 30% complete.

PROGRESS VS. PLANNED ACTIVITIES

The table below shows that expenditures for the first two months were below budget, reflecting the understaffing during startup. This problem has been corrected as shown in the month of October 2002. We have gone from 3.75 FTE's in August to 8.1 FTE's in October with three additional FTE's to be added in November. We anticipate that the addition of adequate staff to meet the schedule will require spending above the budget for the next several months.

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$319,200	\$140,100	\$145,900	\$605,200
Actuals	\$104,031	\$80,268	\$151,637	\$335,936
Difference	\$215,169	\$59,832	(\$5,737)	\$269,264

3.4 Data Handling

SUMMARY OF WORK ACCOMPLISHED

The scope of the Data Handling task for this period was primarily related to the preparation for full-scale software development in the next project phase. Significant progress was made in this area during this reporting period. The Simulation software effort was limited to the organization and planning of tasks.

Version 0.9 of a prototype software development environment was released. This is a fully functional, stand-alone environment for developing Java software and is being used by the DAQ software development team. The environment integrates code development and testing with a CVS code repository. It creates files in the code repository, provides resources for running tests, building releases and reporting on the build status via a web interface.

A prototype analysis framework, FAYE, was created that allows simple analysis and visualization using the Java Analysis Studio, JAS, created by SLAC. FAYE parses AMANDA data in the F2K format and produces histograms using JAS.

The first draft of the IceCube Software Design Description document was completed in October and presented at the DAQ Software Workshop, Oct 28-30, 2002.

A draft Data Structure document for interfacing Simulation and DAQ software was completed and plans for a collaboration workshop on Simulation were initiated.

PROGRESS VS. PLANNED ACTIVITIES

System Software Architecture

Analysis of the software system architecture was completed on schedule in October 2002. The analysis has resulted in an architecture that can be described as a pipeline architecture. It has been determined that the "System Software Architecture Document" scheduled for completion on 4 Dec 2002 should be included as part of the software systems design document, "Software Design Description." This change is based on the decision to use the IEEE Std 1016-1998, "Recommended Practice for Software Design Descriptions," as the model for documenting the architecture and design. This task will no longer be reported on as a separate task from design.

Collaborative Software Development Environment

The objective of this task was to provide a development environment that would facilitate the development of software by various entities throughout the IceCube Collaboration, without sacrificing quality, maintainability and usability.

The Internet interface for the Software Development Environment was scheduled and completed by 18 Oct 2002.

A "Proposal for Software Language Use in IceCube," dated 19 August 2002 was submitted to the Technical Board for approval. "IceCube Java Code Conventions" dated 15 Oct 2002, for the primary language have also been created and posted on the LBNL website. The completion of this task was delayed by the Technical Board's discussion of the language proposal, but should not affect the rest of the project schedule.

The Code Management System based on a CVS repository has been set up on an LBNL server and is currently being used by the DAQ software development team. This task was completed ahead of schedule in order to support DAQ development. CVS will be moved to new server more capable of supporting the growing needs of IceCube software development. This server has been delivered and is being installed.

The first iteration of the Build Management system scheduled for completion 10 Jan 2003 was completed on 24 Oct 2002. This system currently provides tools for individual developers and is on schedule for completion by 10 Jan 2003. The system includes the integration of tools for creating CVS repositories, building executable code using a tool called ANT, code testing using Junit, and an automatic build tool, Cruise Control, and an Internet based build status tool, Tinderbox. A bug and issue tracking tool, Issuzilla is also part of the Build Management System. These tools have been adapted from the Open Source software development initiative. The first draft of "An Introduction to the IceCube Software Development Environment" was released on 1 Oct 2002 and has been updated several times. The Development Environment for the production code remains to be completed and is on schedule.

Software System Design

Work on the system level design for software has begun and a draft of 'The Software Design Description of "Production" IceCube Software,' last updated on 24 Oct 2002, has been started. As previously noted in the section on Software System Architecture, the documentation of the software architecture has been included in this document. As a result, this task was begun ahead of schedule and is on schedule for completion on 26 Feb 2003.

In addition, work has begun on defining requirements and a schedule for the South Pole Data Handling system. Conceptual design of the on line filtering system has begun and documented in a first draft description. This draft is on schedule for completion 31 Jan 2003.

A benchmark study of Java and C++ languages is being conducted by University of Maryland to assess the efficiency of Java and using Java in conjunction with

existing C/C++ code. This issue also affects the selection of the database storage approach for archived data and whether ROOT I/O is appropriate.

The WBS tasks at Level 3 and Level 4 are being reviewed and fine-tuned to better reflect the division of tasks among the collaboration members.

Simulation Software

The focus of the simulation software effort in Phase 1 is to plan and prepare for the overall IceCube simulation effort. This task is scheduled to end on 31 March 2003, but the simulation effort itself will continue throughout the project.

A draft data structure for the output of the DAQ systems is being formulated and a second version is being circulated for comment. The draft is on schedule for completion in January 03. This data description is necessary for the integration of simulation and DAQ software.

A collaboration-wide Simulation Workshop is being organized to better take advantage of previous experience and to develop a plan for completing the necessary IceCube Simulation Tasks.

Spending for Data Handling System Software Design and Collaborative Development Environment activities are on budget; however, the delay in the start of the Simulation and Data Analysis Tools tasks has resulted in reduced spending in these areas. We anticipate that spending in these areas will increase in the subsequent quarters as additional personnel are added to these tasks.

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$69,200	\$59,200	\$67,200	\$195,600
Actuals	\$19,721	\$10,467	\$18,099	\$48,287
Difference	\$49,479	\$48,733	\$49,101	\$147,313

4.1 Calibration & Monitoring

SUMMARY OF WORK ACCOMPLISHED

The goal for Calibration & Monitoring in Year 1 is to develop and establish a plan covering all aspects of low-level and physics calibrations of the IceCube detector, and to capture this plan in a controlled document. In Q1, work has been focused on evaluating the calibration procedures used in AMANDA, developing modifications and improvements for scaling up to IceCube, and on devising complementary calibration methods where needed. This work frequently cuts across the WBS, touching on several other L3 elements.

Specific calibration issues considered so far include:

Determining requirements for, and contributing to the design of, the in-ice flasher boards based on requirements for geometry and energy calibration.

Using AMANDA data and simulations to evaluate how methods for absolute module position calibration - based on optical data from in-situ light sources and cosmic-ray muon data, respectively - are best applied in IceCube.

The wavelength and depth dependence of the optical properties of the ice mapped with AMANDA also apply to IceCube. A plan is being made for measurements with IceCube of additional ice parameters, such as optical properties at wavelengths shorter than 300 nm and horizontal variations of the dust layers that determine both scattering and absorption. Special calibration devices will be developed for these measurements.

PROGRESS VS. PLANNED ACTIVITIES

The table below compares the resources spent in Q1 to those budgeted in the PEP. Most of the time has been spent on developing calibration techniques during the first quarter. Effort on monitoring has been delayed because it has taken more time to ramp-up this activity than planned. The effort will be increased in subsequent quarters to catch up with the development of the plan.

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$6,045	\$6,045	\$6,045	\$18,136
Actuals	\$2,015	\$2,015	\$4,030	\$8,060
Difference	\$4,030	\$4,030	\$2,015	\$10,076

4.2 *Detector Verification*

SUMMARY OF WORK ACCOMPLISHED

An analysis of the Detector Verification task showed that the WBS needed to be reorganized so that the tasks could be performed in a more streamlined manner. As a result, the initial task has been to work on these changes. The new WBS will focus responsibility for important IceCube tasks, such as simulation, in one L3 element.

Work on a detector verification planning document has started.

PROGRESS VS. PLANNED ACTIVITIES

Determination of the membership of the simulation, calibration and reconstruction working groups has been delayed by about 1 month in anticipation of changes in the WBS. Once the WBS changes have been made, creating these groups and defining their roles will take about 4 weeks. A certain amount of travel will be required to finalize these plans. We anticipate carrying over the funds left over from this quarter to pay for this travel. While the work will be more compressed, we do not believe that it will impact the completion of the verification plan.

	AUG02	SEP02	OCT02	SUM
Budgeted (PEP)	\$47,875	\$44,144	\$23,201	\$115,220
Actuals	\$28,462	\$28,462	\$14,268	\$71,192
Difference	\$19,413	\$15,682	\$8,933	\$44,028

Section II - Current or Anticipated Problem Areas

A management system has been implemented to collect, address, status and report problem areas that could result in current or future impact to the success of the IceCube project.

This report section contains:

- 1) A one page narrative summary of the overall project status;
- 2) A table that collects impact and status information for each item being reported;
- 3) Individual information sheets that provide detailed description, impact, corrective action, and responsibility information.

As this is the initial submittal, each item is listed as "New". In subsequent submittals, items will be labeled "New", "Open", or "Closed" as appropriate to reflect their status.

New	Item first introduced during the current reporting period.
Open	Previously reported item that has not yet been completely addressed.
Closed	Concerns have been addressed and the item no longer requires special attention.

Each item has also been ranked based on potential severity of impact to the project. The following categories have been defined:

Major	Failure to correct will prevent the project from achieving key cost, schedule, and /or technical performance. Items in this category will receive the highest possible level of management attention.
Moderate	Items whose impact may be significant, but for which recovery opportunities are available. Items in this category will receive high levels of management attention and corrective action plans will be closely monitored.
Minor	These items will have limited overall project impact but still require timely and effective corrective action plans. Management attention will be focused on containment and rapid closure.

Summary of Current or Anticipated Problem Areas
August 1, 2002 - October 31, 2002

At this time there are no Major problem areas identified, and only a small number of Moderate and Minor items. As frequently occurs during the start up period of any large project, these are primarily schedule delays attributable to staffing build up.

Corrective action plans are in place to deal with all currently identified problem areas, and sufficient lead-time exists to anticipate full recovery without adverse impact to the overall project.

Tracking Log

Item	Title	Impact	Status
1	Delayed Completion of Hazard Analyses and Reschedule of Final Safety Design Review	Moderate	New
2	Delayed Start of Systems Engineering Management Plan and Related Documents	Moderate	New
3	Availability of Logistics Source Data Needed to Estimate Transportation Weights and Volume (Cubes)	Minor	New
4	Delays in Completion of Specific EHWD Subsystem Specifications and Related Procurement Activities	Moderate	New
5	Delays in Development of DAQ / DOM / DOM Hub Software	Moderate	New

Topic # 1

Title: Delayed Completion of Hazard Analyses and Reschedule of Final Safety Design Review

Status: New

Impact: Moderate

Related WBS: 1.1.5

Item Description / Impact Summary:

- **Hazard Analyses** – All hazard analyses were scheduled for completion by 11/11/02. The 3 remaining hazard analyses (power distribution, fuel system, operations) will not be completed in that timeframe. They will be rescheduled for completion. The rescheduling of these activities is not expected to affect any other critical deliverables.
- **Final Safety Design Review** – The Final Safety Design Review was scheduled for completion by 12/16/02. This schedule does not allow us time to complete tasks that should be reviewed during that design review (i.e., addressing action items from the first review, making a final decision on the type of anti-freeze, completing the fire suppression plan).

Root Cause:

- **Hazard Analyses** – The remaining three hazard analyses were delayed to allow additional time to better define the subsystems they were addressing.
- **Final Safety Design Review** – The schedule for the Final Safety Design Review was premature and did not allow sufficient time to address important safety issues that need to be discussed at that review.

Corrective Action:

- **Hazard Analyses** – The hazard analyses are rescheduled for completion by 1/15/03. The Operations Hazard Analysis is scheduled last since it reviews issues that may arise through use of the system and are not linked to a specific subsystem.
- **Final Safety Design Review** – The Final Safety Design Review is being rescheduled to 3/31/03.

Responsibility:

Tom Demke; QA & Safety Manager - IceCube; UW – Madison

Closure Date:

Hazard analysis rescheduled for 1/15/03 completion, Final Safety Design Review rescheduled for 3/31/03.

Topic # 2

Title: Delayed Start of Systems Engineering Management Plan and Related Documents.
Status: New
Impact: Moderate
Related WBS: 1.2 Systems Engineering

Item Description / Impact Summary:

WBS 1.2 System Engineering tasks scheduled for start on 8/1/02 have been delayed until 11/04/02. This has resulted in delayed start of the Systems Engineering Management Plan, important revisions to the Draft Engineering Requirements Document, and other key systems related effort.

Current period impact has been to require individual element leaders to informally anticipate and address system level requirements. This leads to the possibility that portions of the lower level requirements documents now underway will need to be adjusted or refined. If uncorrected, this condition will introduce technical risk into the overall system design and delay the design review process.

Root Cause:

Delayed documentation start results from delays in staffing the IceCube Systems Engineering Level 2 Manager position.

Corrective Action:

An experienced and highly qualified individual has been identified to lead the Systems Engineering effort, and will begin work on 11/04/02. This individual will be responsible for establishing and executing a corrective action plan based on accelerated development of the delayed documents. At this time we believe it is possible to achieve the planned completion dates as well as support the balance of system engineering responsibilities without incurring unplanned costs or unrecoverable technical impact.

Responsibility:

Randall C. Iliff, IceCube System Engineering; University of Wisconsin - Madison

Closure Date:

Position staffing to be accomplished on 11/4/02

Accelerated development as required to preserve 3/5/03 Design Review schedule.

Topic # 3

Title: Availability of Logistics Source Data Needed to Estimate Transportation Weights and Volume (Cubes)
Status: New
Impact: Minor
Related WBS: 2.1 Logistics, 2.3 Deployment

Item Description / Impact Summary:

Pending completion of the overall design effort, all weight and volume estimates will be subject to significant change. Deployment concepts and schedule are also subject to significant iteration at this stage of the project. The long lead time needed to coordinate cargo flights, availability of handling equipment, storage facilities, and personnel support make it necessary to identify requirements as early as possible in the project life cycle.

Root Cause:

Serial dependency between system design progress and the ability to prepare high confidence logistics requirements.

Corrective Action:

While it is not possible to alter the serial dependency noted above, actions have been identified to minimize any delay associated with communication of the information at the earliest possible time, and also to store the data in an easily updated format. Near term coordination with RPSC to identify the availability of handling equipment at the South Pole will also reduce uncertainty.

Responsibility:

Bob Morse, University of Wisconsin - Madison

Closure Date:

Anticipated closure date is March 15, 2003.

Topic # 4

Title: Delays in Completion of Certain EHWD Subsystem Specifications and Related Procurement Activities
Status: New
Impact: Moderate
Related WBS: 2.2 Drilling

Item Description / Impact Summary:

Schedule issues for specification, design and procurement of certain elements of the Enhanced Hot Water Drill have been identified as follows:

- **E-stop** – The current plan is to have the e-stop system design complete and contactor panels fabricated for outfitting the first MDS in January. The progress to date is five weeks behind schedule.
- **Sensors Specification** – Specification and selection of system sensors is two weeks behind schedule.
- **Generators** – The generator Request For Purchase (RFP) release was approximately six weeks later than expected. It is possible that the generator may not be at the Physical Sciences Lab (PSL) for the start of testing (IV&T). The RFP requests delivery of the generator by April 30th, which would fully support IV&T.
- **Feeder Cable** – The feeder cable selection has proceeded essentially as planned; however, the delivery time may have doubled from initial estimates of six to twelve weeks. This may present a problem for IV&T.
- **Drill Hose Delivery** – IVG (drill hose supplier) is quoting a thirty-week drill hose delivery. This was an unexpected increase of ten to twelve weeks. With the order placed 11/1/02, the drill hose will arrive at PSL the last week of May, approximately one month into IV&T.
- **Water Tank** – The schedule for the detail design work of the Water Tank cover and catwalk is two weeks behind schedule.

Root Cause:

- **E-stop** – This is a resource issue, where the same engineer was working on numerous elements of the electrical system.
- **Sensors Specification** – This was a resource issue, where the same engineer was working on numerous elements of the electrical system.
- **Generators** – The amount of time required to define the generator RFP with RPSC was underestimated.
- **Feeder Cable** – The supplier presented us with a large, unanticipated increase in the delivery time.
- **Drill Hose Delivery** – The supplier presented us with a large, unanticipated increase in the delivery time.

- **Water Tank** – This is a resource issue. The design work for the tanks is in series with the detail work on all the MDSs. The Water Tanks are being designed last.

Corrective Action:

- **E-stop** – The design has been made a priority for an engineer to accelerate its development. Its progress will be closely monitored over the next few weeks. If the development continues to lag, a contingency plan has been prepared. During outfitting, the e-stop push buttons will be installed and wired to the utility closets. Space will be provided for the e-stop contactor panel and it will be installed later prior to the start of subsystem testing.
- **Sensors Specification** – Bit7, a local engineering firm, has been contracted to complete the sensor specification and selection. This work includes defining the specifications for all sensors, identifying sensors to meet the specs, developing procurement documents, and preparing sensor test plans. The work should be complete by the third week of December. This should allow time to order sensors for installation in the MDSs. Sensor testing will be conducted in parallel.
- **Generators** – Based on RPSC's experience, they feel a December 20th award date provides sufficient time to support an April 30th delivery date. If the generator fails to arrive by the start of IV&T, alternative power sources have been identified. A generator may be rented from a local distributor or line power may be available. More will be known about the delivery once the proposals have been received.
- **Feeder Cable** – Engineering is actively working with power cable representatives to finalize a cable / connector design that will meet our needs. Once the design is finalized, a firmer estimate of the lead-time will be known. In the meantime, options are being weighed to provide schedule relief. These may include some parallel testing of the cable and connector while it is being produced or finding an alternative cable to support IV&T activities while the cable is on order.
- **Drill Hose Delivery** – IVG is sensitive to our delivery needs and plans to work with us to improve delivery to the end of April. The first step towards improving delivery was the expedited wire transfer of funds to place the coupling order. IVG is planning to review their testing plans to see if some tests can be done in parallel. If it appears the hose will not arrive until late May, the test plan will be reviewed to accommodate the late arrival of the drill hose.
- **Water Tank** – To improve the progress, a draftsman has been hired temporarily to assist in the MDS detail layouts. He is expected to remain hired for two to three months. Another option being considered is to have Sea Box do the detail layout of the cover and catwalk. This decision will be made based on its status when Sea Box begins their design and analysis of the Water Tanks.

Responsibility:

Mark Mulligan; Project Manager-EHWD; University of Wisconsin - Madison

Closure Date:

Immediate initiation of corrective actions, follow up activities over the next few months as noted above.

Topic # 5

Title: Delays in Development of DAQ / DOM / DOM Hub Software
Status: New
Impact: Moderate
Related WBS: 3.3 Data Acquisition

Item Description / Impact Summary:

DOM software top-level design completion has slipped from a scheduled date of 10/16/02 to a projected completion date of mid January 2003. DOM Hub software top-level design has slipped from a scheduled date of 10/16/02 to a projected completion date of 12/25/02. Lesser delays are associated with the mid-level and low-level design.

Unless these delays are recovered, software will not be available to support integration testing of the DOM and DOM Hub components scheduled for March and April of 2003.

Root Cause:

Resource availability.

Corrective Action:

Additional resources have been identified and committed to the software development task, and an accelerated development schedule established to recover in time to avoid delays to the March 2003 delivery of DOM main boards.

Responsibility:

Dave Nygren, LBNL DAQ Level 3 Manager

Closure Date:

Corrective action has already taken place, will monitor activity described above and close by January 31, 2003.

Section III - Additional Management Information

Changes to Key Personnel:

We are pleased to report the addition of two key staff members, each of whom bring a wealth of practical experience to the IceCube team.

Randall C. Iliff - Systems Engineer

The project office has added a full time system engineer to its staff, Randall Iliff. Mr. Iliff brings over 25 years of Project Management and Systems Engineering experience gained on very large scale projects in the military, space, and commercial sectors. Projects have included the Strategic Defense Initiative, the Space Shuttle, satellite guidance systems, and telecommunications systems throughout the world. As a leading advocate of applying Systems Engineering methods outside of the traditional aerospace environment, he helped found the International Council on Systems Engineering, previously served as the Chairman of the Commercial Practices Committee for that society, and has written extensively. He holds a B.S. in Engineering from Michigan State University, an M.S. in Systems Management from the University of Southern California, and did additional graduate level study at Arizona State University.

Paul Nipko - Manager

The project office has added a half time manager to its staff, Paul Nipko. Paul has over 25 years of experience in management of system development and acquisition programs in the Air Force and National Weather Service. Projects have included mainframe and supercomputer acquisitions, all three major components of the billion dollar National Weather Service Modernization (Next Generation Severe Storm Radar, Automated Surface Observing System, and the Advanced Interactive Weather Information Processing System), and numerous Air Force system development projects (Automated Weather Distribution System, Mark IV DMSP satellite readout station, Titan III and IV, Advanced Launch System, Space Based Radar, and others). Paul holds a B.S. in Engineering Mechanics from the U.S. Air Force Academy and an M.S. in Meteorology from the University of Utah.

Progress on Unfunded Efforts:

1.3 Education and Public Outreach

SUMMARY OF WORK ACCOMPLISHED

Since it began operating, the IERC has established an organizational infrastructure, including an advisory committee, and accomplished many tasks. IERC has been within budget and on schedule with respect to its plans.

Primary among these accomplishments are:

- designed and implemented the IceCube web site, featuring Education and Outreach as a major component (<http://icecube.wisc.edu>);
- offered and evaluated the Astronomy in the Ice summer course, taught through UW-River Falls to 15 teachers in summer 2002, (see <http://icecube.wisc.edu/astronomy-in-ice/>)
- developed and produced IceCube brochure, with versions in English and Spanish, AMANDA/IceCube bookmark, and IceCube logo.
- provided the Exploratorium with resources on AMANDA for their Origins Project
- established a collaboration with the UW Space Place outreach center and began IceCube outreach initiatives through Space Place.
- arranged for Francis Halzen to present at UW-Madison Roundtable (10/16/02), and
- participated in the NRC-sponsored Neutrino and Subterranean Science Workshop.

Changes in key personnel

The IERC staff for Year 1 consists of a director, an outreach specialist and web master (August 1 – December 31, 2002) and as of January 2003 will consist of two co-directors, an outreach specialist and web master (January 1 - July 30, 2003). The shift from a single director to a “co-director for planning and administration” and a “co-director for learning and teaching” was initiated by the current director, Dr. Susan Millar, partly due to her belief that it is important for the IERC leadership to include a person with a doctorate in physics and extensive knowledge of physics education. She recommended sharing the director role with Jim Madsen, UW-River Falls Professor of Physics, IceCube scientist, and director of the Astronomy in the Ice course.

2.3 Deployment

No planned activity in year one.

3.1 *In-Ice Devices*

SUMMARY OF WORK ACCOMPLISHED

A technology workshop on In-Ice Devices was held in August. Reports on all aspects were presented and discussed, and can be found at http://icecube.wisc.edu/reviews_and_meetings/Aug2002_hardware/

Engineering requirements documents were generated for several key elements of the optical sensor including the photomultiplier (PMT), the PMT HV base board, and the flasher board. (The DOMMB is part of DAQ and will not be discussed here.) A draft test plan for In-Ice Devices was generated as part of the project execution plan.

Photomultiplier: A sample of 24 PMT consisting of three types of PMT (all from Hamamatsu) was systematically evaluated. A 10" PMT from Hamamatsu with a nominal gain of $1E8$ and 10 dynodes was recommended to the Technical Board and approved. 24 PMT have been ordered.

PMT base: Two paths are being pursued. Path 1 follows up on the prototype developed for AMANDA by ISEG Company, Germany. This approach is based on a Cockroft-Walton generator design and is assisted by University of Wuppertal. Path 2 pursues a passive design, which is an in-house development with a simple HV generator. Tests of a conceptual design are successful.

Technical Design: Detailed 3-dimensional technical drawings for the Optical Module design have been generated. A realistic model with dummy PCBs has been constructed.

Cable: The engineering requirements for the cable are well advanced. A baseline for the termination of the optical modules on one quad cable has been established.

Dark freezer laboratory: The dark freezer laboratory to be built at the Physical Sciences Laboratory (PSL) has been specified and a bid process is under way. This laboratory will be used to test up to 300 optical sensors at a time for the IceCube OM mass production. Similar facilities are planned in Germany (DESY), and Sweden (University of Stockholm).

2. Cost and schedule:

The PMT selection process, the overall technical OM design, and the PMT base are on schedule. The flasher board requirements are not finalized yet. This corresponds to a delay of 6 weeks. The delay does not delay the critical path at this point and will not result in a system delay.

All other areas are consistent with the top-level goals of a delivery of 20 OM and a system cable in the first project year.

Significant progress has been made in the assignment of roles and lead responsibilities at WBS level 4. Examples: Main Cable (A. Laundrie, engineer), PMT selection and measurements (K. Hanson), PMT HV Base (N. Kitamura), Technical design (D. Wahl), Freezer lab (J. Hoffman), Optical components (Resconi, Koepke), and In-Ice schedule (W. Stroeve).

3. Review of problem areas:

No substantial problems have been encountered. A minor problem exists with the flasher board design. The flasher board requirements and its design have been delayed more than a month to a point where increased attention and allocation of resources is needed. By better interface definition between the flasher board and the DOM MB, flasher board development is moved off of the critical path. More resources are being allocated to the definition of the flasher board and rapid advances are now being made. Two competing design approaches are maintained and results of the trade off between these alternatives will be made with a high priority on reliability and cost.

4. Changes of key personnel

One full time engineering physicist (N. Kitamura) has been added to the UW engineering staff. The PSL contribution has increased to the expected level.

4.3 *AMANDA / IceCube Integration*

No planned activity in year one.

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