ICU Re-baselining Review Panel
Close Out Report
28 April 2022

The panel has high confidence that the scope of the project can be delivered, provided the manageable concerns reflected in this summary are addressed in a timely fashion.

SCIENCE AND TECHNICAL STATUS

- The project demonstrates clearly-defined goals and technical understanding.
- The three years of project delay due to COVID-19 have led to further maturing of the technical scope, including understanding limitations of current datasets and refinements in calibration strategies.
- The science team is experienced at all levels and continues to demonstrate vast institutional knowledge, teamwork and dedication. The addition of a Project Director has improved team performance. Most of the technical staff, particularly the L2s, have had extensive experience in the Gen 1 program including multiple deployments to Antarctica. The presentations were complete and showed a high degree of competence and dedication to project success.
- Collaborating institutions appear well-integrated as part of the overall project team, and the majority of their in-kind contributions are ahead of schedule. Specifically, a large fraction of the work for sensors (WBS 1.3) is contributed by uncosted international and university partners. In many cases the hardware deliverables are either completed, in production, or well-advanced. However, the impact of possible loss of in-kind labor contributed by key personnel (e.g. mainboard electrical engineers, software simulation experts, etc.) should be covered by appropriate risk register entries.
- The Drill Control System is all new, potentially a critical path item, a significant cost item, and is a source for a number of identified risks. The current implementation plan defines a structured path for implementation. However, consider further acceleration of the software development and bench testing off-continent to debug and optimize before deployment.
- The majority of ICU technical elements (WBS 1.3-1.6) are at a high level of maturity. Flowdowns, interface definitions, verification & validation tests are documented and clearly capture the design and methods to ensure that performance goals are met.

PROJECT MANAGEMENT

- The Project Director and Project Manager brought extensive experience from their leadership roles on large projects prior to joining ICU.

- The Project Office urgently needs a Project Controls person / Master Scheduler with EVMS experience. This person needs appropriate authority and support from the Project Office.
- Project management tools are not well integrated.

COSTS

- High level drill-down was performed on BOEs and focused on PMO BOE.
- Estimates are generally comprehensive and support the scope of work. The Key Assumptions and BOE documents would benefit from some general scrubbing.
- Minor omissions in the BOEs were detected and pointed out to the project team.
- The Panel expressed concern about the early downsizing of PM staff near the end of the project. The project responded with historical precedence (Gen 1) supporting the outyear downsizing and their assessment that the staff task loading was reasonable. The Panel suggests revisiting the early downsizing of the PM staff.
- Inefficiencies caused by COVID-19 impacted multiple cost and schedule drivers. COVID-19 caused on-ice cancellations and delays, led to a closing/slow down in the University of Wisconsin's Physical Science Laboratory (PSL), led to parts delays and unavailability, and increased staff turnover. Those actions had a profound effect on IceCube.
- The project team's past experience has significantly increased the project's technical maturity and reduced the risk of cost growth due to non-logistics factors.
- Field Project drilling staffing (28 field staff, with 14 experienced) may be particularly challenging in the current labor environment and represents a challenge to both cost and schedule control.

SCHEDULE

- The project schedule includes all the project scope, resources and costs. Comprehensive scope is reflected in the WBS, each WBS node has a clear owner, and the WBS dictionary is complete. Resource loading is evident and histograms of resource forecasts were produced. Significant improvement in the schedule was observed by Panelists with historical perspective on this project.
- Many links between activities are missing -- the schedule logic needs significant work to implement the missing logic such that schedule predictions are credible.
- General capabilities of the Integrated Master Schedule are currently managed in at least three separate tools (Schedule, Cost, and Resource spreadsheets). When schedule information is updated and forecast dates are adjusted, the forecast resource usage and cost information have to be updated separately and manually. This is a weakness that should be addressed.

- The lack of tight logic in the schedule means that the current schedule cannot be used to perform rapid and credible what-if schedule studies. This needs to be addressed.
- Given gaps in logical sequencing and disintegration of source data (schedule, resource, and cost information not automatically linked), there is risk that the time phasing of the planned value forecast could be inaccurate. A detailed monthly forecast of planned value for the remainder of the project was not provided and details were difficult to assess given the format in which the supporting information was provided (Cost Workbook and summary EV forecasts by PY).

LOGISTICS

- The project team demonstrated rigorous planning within the implementation strategy defined by NSF. Documentation for cargo movement is comprehensive and shows clear methodology.
- Installation activities and field seasons appear well-planned and adequately staffed.
- Cargo Float Tables flag items with marginal float, but do not include an explanation. A column to capture the reason and what action is being taken would be helpful.
- The float information in the Cargo Float Tables did not appear to be derived directly from the master schedule. It is important for all such schedule information to be derived directly from the latest master schedule.

RISK MANAGEMENT

- The project team is very experienced and clearly understands their risks. The team is commended for their initial analysis and should ensure that risks are regularly revisited as part of their regular management processes.
- The Risk Management Plan is best practice but would benefit from describing some of the IceCube-specific risk-related activities.
- The Risk Register contains a comprehensive set of risks but would benefit from some simplification and general scrubbing.
- Major technical risks have been identified and mitigation planning is well advanced, such as: EXT9 -- schedule impact of semiconductor supply chain disruptions on the mDOM motherboard; and TECH38 -- concerns about mechanical integrity of Main Cable Assembly prototypes from the preferred vendors.
- The risk ranking matrix should be reviewed and applied to the risk register to ensure that the top ranked risks align with the top concerns of project management.
- The risk analysis appropriately aggregates the total cost risk using a Monte Carlo technique.

- Understanding float in the highly constrained schedule is critical to project success -- significant work is needed on the schedule logic before a credible schedule risk analysis can be performed.
- The inflation risk should include uncertainty for labor as well as materials and supplies. The project should closely monitor prices given the current high levels of inflation, global logistics challenges, and geopolitical uncertainty.
- The nature of the scope of the project limits the available descope options. Descope options exist for the final field season that save some schedule but not cost, and degrade science capabilities somewhat.
- The effort for integration of calibration instruments is comprehensive and well-planned. However, this activity could benefit from further planning with regard to descope options, should the higher-risk elements of the upgrade require changes. For example, incorporate a detailed plan for which / how many instruments to deploy if the number of deployed strings are reduced.
- The main cable assembly may require an additional external load support. This is tracked as a risk. We recommend that Implementation follows this closely as it could impact install hardware and procedures.
- While drilling and installation are based on Gen1 methodologies and experience (a significant strength), ICU does introduce implementation risks (holes and strings are scaled up, new main cable assembly, revised procedures, etc). With all 7 holes to be accomplished in a single season, there is little margin to accommodate delays and procedure learning curves. This risk is mitigated by the ability to descope one or even two holes while still achieving the defined project success.