NSF IceCube Upgrade Re-baselining Review Charge

April 26-28, 2022 (Virtual)

Program Officers:
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Introduction, Panel's Scope and Goals:
This review panel is charged with evaluating the IceCube Upgrade current plans to complete the scope that was proposed to NSF (PHY-1719277) and subsequently awarded. The review panel is not asked to re-review the project as a whole, but rather to focus upon elements relevant for project completion and those elements modified in response to deviations in cost and schedule. The panel is asked to actively participate during the presentations to identify key issues, seek answers to questions posed within this charge, and raise further questions. At the conclusion of the review, the panel will present to NSF and to the project an initial set of key findings, comments, and recommendations. The review panel will firm up its assessment with a final report to NSF within ~2-3 weeks of the review.

The project is currently in project year 4 (PY4) with on-ice work at the South Pole suspended over the last two years due to restrictions imposed by the COVID-19 pandemic. A Logistics Review was held in November 2021 to examine the management of and the logistical needs for the project given the two years of suspended on-ice work. In addition, the project has worked with the NSF/OPP Antarctic Infrastructure and Logistics (AIL) team, which has identified a path forward to support the project: one more season with no on-ice work (FY23, austral 2022-23 Summer) followed by three seasons of on-ice work in FY24, FY25, and FY26. With this significant change to the overall project schedule and an anticipated change in total project costs, a re-baseline review is needed to assess the project's plan from FY23 to the completion of the project.

The re-baseline review will assess the project's updated technical status, cost, schedule, risks, logistics, and project management, focusing mainly on the scope of remaining work and project management as supported by NSF. The goals of the review are to provide NSF with an evaluation of the likelihood that the remaining project scope as proposed can be delivered within the parameters defined in the project's re-baseline definition, including the adequacy of cost contingency, schedule contingency, and risk and scope management plans, and to provide the project with key recommendations that will improve and increase the likelihood of project success.

Upgrade Project's Science and Technical Status (ST):
The review will hear a succinct description of the science and broader impacts to be enabled or augmented by the IceCube Upgrade and how those goals flow down to the technical requirements. The review will also hear an overview of the technical status of the major components and systems for the entire project (NSF and international partners) in terms of the work that has been completed and the work left to do. This overview will be organized by WBS items. The focus of this review is to evaluate the adequacy of the updated plans to deliver the remaining scope supported through NSF funding with an understanding that there are significant international contributions vital to the project.

- **ST1**: *Does the panel find areas of concern regarding the definition and completeness of the technical scope as it flows down from the science goals of the upgrade?*
- **ST2***: Are the updated milestones associated within each WBS element clearly defined and do they aid the overall project management?*

- ***ST3****: Which components have the greatest technical risk and uncertainty? What level is that risk and uncertainty, and are mitigation plans in place to reduce possible impacts?*
- ***ST4:*** *Are the number of spares and associated level of supplies appropriate for each of the systems?*
- ***ST5:*** *Are the interfaces and overall system level engineering adequate for project success?*
- ***ST6:*** *Are the project's updated plans and processes for ensuring technical readiness in place and adequate?*
    - ***ST6a*****:** *For the refurbishment of the hot water drill, setting up the drill camp, and main drilling.*
    - ***ST6b*****:** *For the communications, power, and timing systems.*
    - ***ST6c*****:** *For characterization and calibration systems. Is the project on track to achieve requirements for an improvement in the precision of pointing to cosmic sources?*
    - ***ST6d*****:** *For the M&O data integration systems. Are there concerns with future data transmittal?*
- ***ST7:*** *Is the project office adequately monitoring technical contributions from non-NSF funded partners and integrating those into the revised schedule?*

Costs (C):
The review panel is asked to review the estimate to complete the project. This will include an understanding of scope that has been completed and what work is remaining and assessing whether the proposed costs, contingency and key assumptions are well documented, comprehensive and in alignment with the project Cost Estimating Plan (CEP). Particular attention should be paid to the calculation of contingency and its planned use.

- **C1:** *Evaluate the appropriateness of the estimating method employed and the degree to which the estimates and their accompanying justifications (BOEs) to determine if the budget is comprehensive and traceable.*
- **C2:** *Are key assumptions well-documented, comprehensive, and current?*
- **C3:** *Assess the appropriateness of the major level of effort components of the WBS, especially in the project office, as a proportion of the total budget needed to complete the project.*
- **C4:** *Are full time equivalent levels of labor well documented and justified, and is the labor mix appropriate?*
- **C5:** *Is the requested budget as it deviates from the original award understandable? Are there large cost deviations beyond a reasonable level of inefficiency during the COVID-19 pandemic periods?*
- **C6:** *Are the cost estimating methods and project management in place to cover risks should they materialize and ensure that risk materializing is captured appropriately with contingency?*
- **C7:** *Are the costs associated with in-kind contributions and subawards estimated, well documented, and mapped to the work breakdown structure?*
- **C8:** *Are project resources effectively allocated to all personnel tasks, activities, and equipment and material and supply costs and are these well-defined and reasonably estimated.*

Schedule (S):
The review panel is asked to assess the soundness of the proposed schedule and to examine in depth the staffing plan and alignment with a resource-loaded schedule.

- **S1:** *Has the project developed a comprehensive resource-loaded schedule with logically sequenced activities of appropriate durations, clearly identified interdependencies, milestones, Antarctic contractor activities and resources, and a valid critical path? Does the schedule adhere to the GAO Schedule Assessment Guide – comprehensive, well-constructed, credible, and controlled?*
- **S2:** *Will the revised schedule allow the project team to create reliable earned value data to monitor progress against plans, forecast completion, and maintain the performance measurement baseline? Do the overall schedule and major milestones appear reasonable given the unique environmental and logistical considerations? Does the schedule include adequate float and contingency?*
- **S3:** *Are there plans for cost-efficient use of personnel in FY23 (no-ice work) considering "standing army" costs and the need to have a fully prepared team working towards Field Season 1?*
- **S4:** *Is the critical path schedule defined for completion of the project? How vulnerable is the critical path to risk and uncertainty, and are there appropriate risk mitigation plans? Are schedule dependencies related to in-kind contributions clearly identified?*
- **S5:** *Is the revised project completion clear and well defined? Are the updated plans and commitments adequate for post-project activities such as moving retrograde equipment and cargo north.*

Logistics (L):
The review panel is asked to assess the maturity of the project's plan to adhere to the allocation of available USAP support.

- **L1:** *Has the project responded adequately to the recommendations made by the Logistics Review Committee for the review held in November 2021 into the project plan and schedule, or adequately explained why a recommendation will not be implemented?*

In particular:

- **L2:** *Does the proposed cargo schedule align with NSF capabilities as provided to the project?*
- **L3:** *Does the proposed project on-ice labor effort align with NSF capabilities as provided?*
- **L4:** *Are the logical links between the cargo movement schedule and on-ice labor reasonable and clearly stated?*
- **L5:** *Is UW's proposed schedule "traceable" – does it flow down from NSF logistical capabilities to project needs for logistical support, and then to adjustments that include risk mitigation? Does it define what needs to be where, and when, and does it define storage requirements (e.g. Do Not Deep Freeze) or other considerations that drive the schedule?*
- **L6:** *Does the proposed project on-ice staffing plan support all the project tasks? Does the project have an appropriate level of redundancy in skillset, given the population limits at the station?*
- **L7:** *Are the methods used to estimate the labor effort and overall schedule reasonable?*
- **L8:** *Does the project clearly delineate the support activities needed of the Antarctic Support Contractor? Is this support included in the project schedule?*

Risk Management (R):
The review panel is charged to evaluate the project's risk management, especially as it pertains to scope, cost and schedule and associated contingencies. If certain risks are realized, the project may necessarily descope and the review panel is charged to identify the extent to which various science goals might be impacted if various levels of risks are realized.

- **R1:** *Is there an updated risk register with risk management plan that identifies risks and quantifies impacts and likelihood of their occurrence? Has the project adequately developed cost, schedule and scope contingency plans and are the associated costs robust, complete, and justified?*
- **R2:** *Are there avoidance and mitigation strategies with a proper balance between proposed resources needed for mitigating certain risks and acceptance of those risks not easily mitigated?*
- **R3:** *Does the project's scope management plan include a time-phased estimate of available budget and or time from de-scoping options, based on key decision points?*
- **R4:** *Does the project appropriately consider budget and schedule impacts from in-kind contributions or partner performance risks?*
- **R5:** *Is the logic model supporting the cargo sequence and labor needs able to confidently estimate revised costs and scheduling, if needed, to replan completion of the project if surprises are encountered during the earlier part of the program? Can the team run the necessary scenarios in the required time?*
- **R6:** *Is there a mechanism for timely identification to take advantage of both challenges and opportunities that might arise during the project execution?*

Project Management (M):
Provide the NSF with an overall assessment of the panel's confidence that the project management team can deliver the proposed scope within the proposed budget and schedule.

- **M1:** *Are there any specific roles or teams that appear understaffed, overstaffed, or missing? Is the project management structure and the range of skills of key staff appropriate to confidently complete the project? Are there cognizant Control Account Managers (CAMs) identified for each work package?*
- **M2:** *Does the project have an adequate set of objectively measurable milestones for use by the PMO to measure and report progress, and to manage and recover variances if needed?*
- **M3:** *Does the project employ adequate quality assurance practices?*
- **M4:** *Is there evidence that the Project's Earned Value Management System (EVMS) is adequate to inform project performance and progress fordecision-making.*
- **M5:** *Is there an appropriate culture of safety with proper procedures in place for work performed under hazards?*

Summary:
In summary, we would like the panel to respond to the overall question:

Considering the IceCube Upgrade project's performance to date and the execution plan for the future, including technical scope, cost, schedule, and the risk management and mitigation plans, is there a high degree of confidence that the facility scope as now proposed can be delivered within the parameters defined in the project's re-baseline definition, including the adequacy of cost contingency, schedule contingency, and risk and scope management plans?