

**IceCube Upgrade Review of Logistical Requirements  
External Review Charge**

**Cargo Needs**

- 1) Cargo planning methodology
  - a) Are the ground rules and assumptions in IC/U's cargo planning methodology clearly stated in the cargo estimating plan?
  - b) Does the cargo planning methodology adequately address special handling requirements or constraints that will drive a specific transportation method?
- 2) Specific Cargo needs:
  - a) Are the needs for individual cargo items appropriately substantiated? Are the items well documented, i.e., adequately described for use by logistical transport planners? Is the proposed cargo prioritization well substantiated?
  - b) Has UW taken appropriate steps to verify the completeness and cross-check of accuracy of their cargo list?
- 3) Assess the adequacy of risk considerations in the cargo planning methodology:
  - a) How does the cargo plan incorporate risk mitigation planning (e.g., spare parts)? Are the risk planning methods appropriate or does the panel have suggestions for improvement?
  - b) Does the methodology appropriately consider and reasonably quantify the variables and unknowns that enable "what if" analyses to be performed?
  - c) Is the UW assessment of the fuel requirement for drilling deep ice holes well substantiated, with an appropriate level of margin to mitigate risk?
- 4) Overall, is the IC/Upgrade's cargo method for estimating its cargo needs a reasonable approach? Does it utilize methods that have been successfully used for other projects in the Antarctic? Does the panel have any concerns about the estimating methods used?

**On-Ice Labor (Individual People and FTEs) Needs**

- 1) Effort planning methodology:
  - a) Are the ground rules and assumptions for people and labor effort in each location (McMurdo, South Pole) in Antarctica clearly stated in the estimating plan? Examine the methodology used to extrapolate labor estimates from original IceCube construction experience to the IC/U and advise on their appropriateness. Was the planning done by individuals with the appropriate skills and expertise?
  - b) Do the labor estimates identify types of labor needed using the same categorization as the IceCube Cost Estimating Plan?
- 2) Specific effort needs:
  - a) Are the on-ice labor estimates appropriately substantiated and traceable to budget estimates?
  - b) Do the people requirements and the multi-year effort profile appear to be complete and accurate?
- 3) Risk considerations in the effort planning methodology:

- a) How does IceCube's labor estimate incorporate risk planning considerations? Are the risk planning methods appropriate or does the panel have suggestions for improvement?
  - b) Does the labor estimation methodology consider and reasonably quantify known risk factors other variables that enable "what if" analyses to be performed?
  - c) Advise NSF on the soundness of plan for prioritizing among labor categories if NSF must revise its capabilities to support IC/U needs.
- 4) Overall, are the effort/people estimating plan (the methodology used to estimate the number of field team members, the labor categories, and the number and types of direct support contractors) a reasonable approach? Do the used planning methods were successfully applied to other projects in the Antarctic?

**Combined Considerations in Planning Cargo + People Needs**

- 1) Advise NSF on the validity of the logic linking IC/U's requested cargo transport delivery sequence with IC/U's proposed schedule profile of people and effort needed in Antarctica (McMurdo and South Pole).
- 2) Has IceCube appropriately considered and reasonably quantified the probabilities occurrence of likely risk scenarios in its risk planning? Consider likely risk scenarios that could cause shortfalls in logistical capabilities (weather delays, shipping delays, extra material needs, aircraft availability, limited availability of key staff, etc.).
  - a) Has the IC/U team appropriately utilized the sensitivity analysis methods incorporated in the cargo and people planning to credibly forecast the contributions of the cargo and effort budgets to a Total Project Cost (TPC) with a 90% confidence level budget and schedule, given the forecast impacts of known risks. (Note, the TPC estimate will be assessed at the rebaseline review planned for Feb-March 2022.)
  - b) Is the sensitivity analysis traceable?