Multi-Discipline/Multi-Stakeholder Arctic Laboratory Design for Arctic Science/Engineering R&D

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Background/Objectives. The US. has strategic global, national, and regional interests in the Arctic. Rising temperatures, thawing permafrost, melting sea ice, and changing ecosystems create widespread environmental effects impacting the social, economic, geopolitical, and national security *status quo*. These changes and the growth of human activities associated with Arctic energy production, shipping, and tourism have expanded the need for relevant, problem-solving R&D. With broad changing perspectives, purposeful socio-economic-technical R&D can be neither defined nor solved by any single approach or discipline. The Arctic both underscores this perspective and creates a unique R&D platform for climate science and energy technology. Acceptance, development, and deployment of Arctic energy technologies demands inclusive, cross-cultural, and cross-disciplinary R&D. It also requires supportive R&D laboratory infrastructure assisting broad stakeholder collaboration.

In collaboration with an Arctic University and a National Laboratory, Merrick & Company explored the diverse priorities, risks, and opportunities of an Arctic research laboratory capable of addressing climate, marine, terrestrial, Arctic engineering, and energy technologies R&D. The broad idea was to bring together R&D and local communities; and to generate international scientific/engineering collaborations toward complex Arctic problems. Local communities were to share and participate in R&D success. The lab would provide community education and outreach as well as provide training, internships, and jobs. The objective was conceptual design for an agreed s laboratory infrastructure sensitive and responsive to multi-stakeholder perspectives and supportive of meaningful and practical cross-discipline Arctic R&D.

Approach/Activities. As an architectural and engineering firm familiar with polar laboratory infrastructure, Merrick, in concert with the University and National Lab, explored the specifics of multi-discipline and multi-stakeholder Arctic lab infrastructure. Interviews, surveys, and conferences assisted conceptual assessment and led to identification of a diverse set of stakeholders. User and stakeholder interaction was facilitated by communication and shared input *via* regular periodic face-to-face and teleconferenced meetings. A laboratory conceptual path forward was reviewed, assessed, and ultimately rated.

Results/Lessons Learned. Definitive, inclusive stakeholder characterization and identification were an unexpected first challenge. Institutions, groups, and individuals' perspectives proved barriers to finalizing the stakeholder list. Also, R&D participants have ideas about how their laboratories should be structured; but few have been involved in actual design. Most users, influenced by personal history, directly convey present-day lab specifics into design mandates for new facilities. Overcoming this familiarity-bias expands the design effort. investigation surfaced history and levels of mistrust among the stakeholder community. Responding to idiosyncratic priorities, stakeholder politics appeared to work quite naturally at cross-purposes. Potential sponsorship from the third-party private sector was met with indifference and mistrust. Among stakeholders, even the ethics, purpose, efficacy of R&D itself was brought into question.

The effort towards a stakeholder-driven conceptual design assigned to *establishing agreement* on sustainable cross-discipline Arctic R&D laboratory design was underestimated. Informed input towards a harmonized and coherent starting-point for design was difficult to normalize. Sensitive design response to the set of multi-stakeholder perspectives requires specific and abundant planning, strategy, tactics, and resources.