Multi-Discipline & Multi-Stakeholder Arctic Laboratory Design for Science & Engineering

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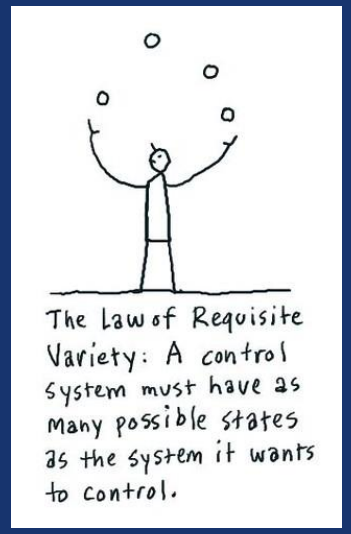
Points to Consider



- Modern, complex problems are confined neither to single disciplines, nor to simple cultural constructs.
- *Resilience problem* complexities are *systems control* complexities. They require cross-cultural, and inter-disciplinary research and innovation.
- Across any broadly-focused environmental problem, complex Stakeholder-effects figure importantly into innovation aimed at resilience.
- In the field, the effort required for harmonized Stakeholder agreement on research and innovation priorities is *easy to underestimate*. It's agreement attempting to overcome complexity.

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This is an Arctic design case study.

To date, project activity continues.

- The U.S. has strategic global, national, and regional interests in the Arctic.
- A changing Arctic natural environment complexly affects social, economic, geopolitical, and national security *status quos*.
- These effects - combined with the growth of human activity accompanying energy production, resource development, transportation, and tourism – validate the need for, and expand the scale & scope of Arctic-based, relevant, practical, and problem-solving R&D.

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Modern, complex problems require diverse cross-disciplinary solutions.

Inter-disciplinary methods are supported through lab design.

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‘It is important to note that *depth in research* is not confined to single-discipline investigations ... If science and engineering deal with *extremely complex systems, the same is true for studies of human society*. How human societies evolve, make decisions, interact, and solve problems … all … call for diverse insight. *Very fundamental questions are inherently complex.* … such questions … require collaboration across the natural sciences, social sciences, and humanities.’ *

- Acceptance, development, and deployment of R&D-based solutions and technologies demand *inclusive, cross-cultural, and inter-disciplinary methods*
- *Supportive laboratory & infrastructure* design encourages & assists broadly-diverse Stakeholder collaboration.

*_The Drivers of Interdisciplinary Research_, National Academy of Sciences, *et al.,* The National Academies Press (2005)

Stakeholder-driven Lab design

- Teaming with a University and a National Laboratory, Merrick explored Stakeholder-driven conceptual design for an Arctic research laboratory.
  - The *basis for design* was laboratory configuration responsive to multi-Stakeholder perspectives and supportive of meaningful & cross-discipline Arctic science, engineering, and R&D.
  - Additionally, the Lab sought to actively connect local communities with research & innovation relevant to Arctic living. Through local collaborations, it hoped to generate & ground solutions towards Arctic challenges.

- Through these connections & collaborations, the Lab would provide community education & outreach while providing research/technical training, internships, and jobs.

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A multi-discipline & multi-Stakeholder Lab

Lab *requirements elicitation* & conceptual design

- For the Lab, as an A&E firm familiar with polar laboratory design, Merrick initiated exploratory *requirements' elicitation* for multi-discipline & multi-Stakeholder Lab configuration.
- Interviews, surveys, and conferences informed Lab design concepts and led to an expanding and diverse set of new Lab requirements.
- Subsequently, Merrick facilitated Lab User and other Stakeholder interaction through shared input *via* regular face-to-face & teleconferenced meetings.
- In due course, Lab conceptual purpose and design were explored, proposed, assessed, and rated.

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Stakeholder identification

- Stakeholder identification proved a first challenge. In settling the Stakeholder list, broadly-diverse priorities stalled progress.
- Also, *Principal Investigators* (PIs) tend toward specific ideas about lab configuration. With professional experience, these usually trace to accepted & discipline-defined lab function.

Lab-design bias

- Few PIs consider or differentiate cross-discipline lab design. Fewer still have participated in the iterative collaboration & compromise necessary for shared lab design resolution.
- Overcoming Lab design-bias distracted and stalled design work. Substantial additional time & funding were necessary.

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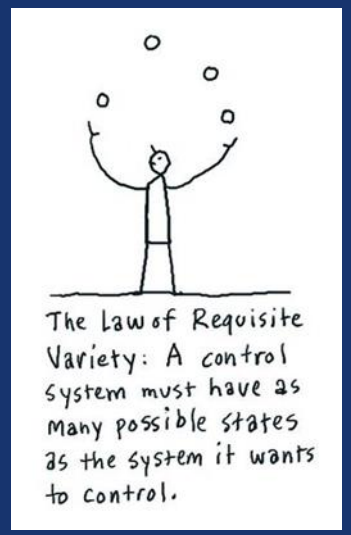
- Interviews, surveys, and Stakeholders' interaction surfaced histories of mistrust among specific Stakeholders - and within the Stakeholder community at large.
- Responding to priorities, Stakeholder Lab requirements and attendant politics often seemed to work quite naturally at cross-purposes. Proposed resource-assistance from third-party private-sector Stakeholders was met with indifference and occasionally mistrust.
- Of note, among potential and specific Arctic Lab Stakeholders, even the agenda, ethics & purpose of science and research - were brought into question.
- Stakeholders' objectives and input towards a coherent and normalized starting-point for conceptual design remained difficult to harmonize.

Points to Remember



- In the field, the effort required for harmonized Stakeholder consensus on a cross-cultural and inter-disciplinary Arctic Lab design were seriously underestimated. *It was surface communication attempting to overcome deep complexity.*
- Successful Lab design response to the set of multi-Stakeholder and/or multi-discipline perspectives requires specific and substantial planning, design and resources.
- *Substantive innovation toward resilience* is not just about technologies and systems advancement.
- To overcome the full scope of resilience problem complexity, *innovation* must address the approach/communication strategies, tactics, & tools employed to introduce technologies & systems solutions to the range of Stakeholders.

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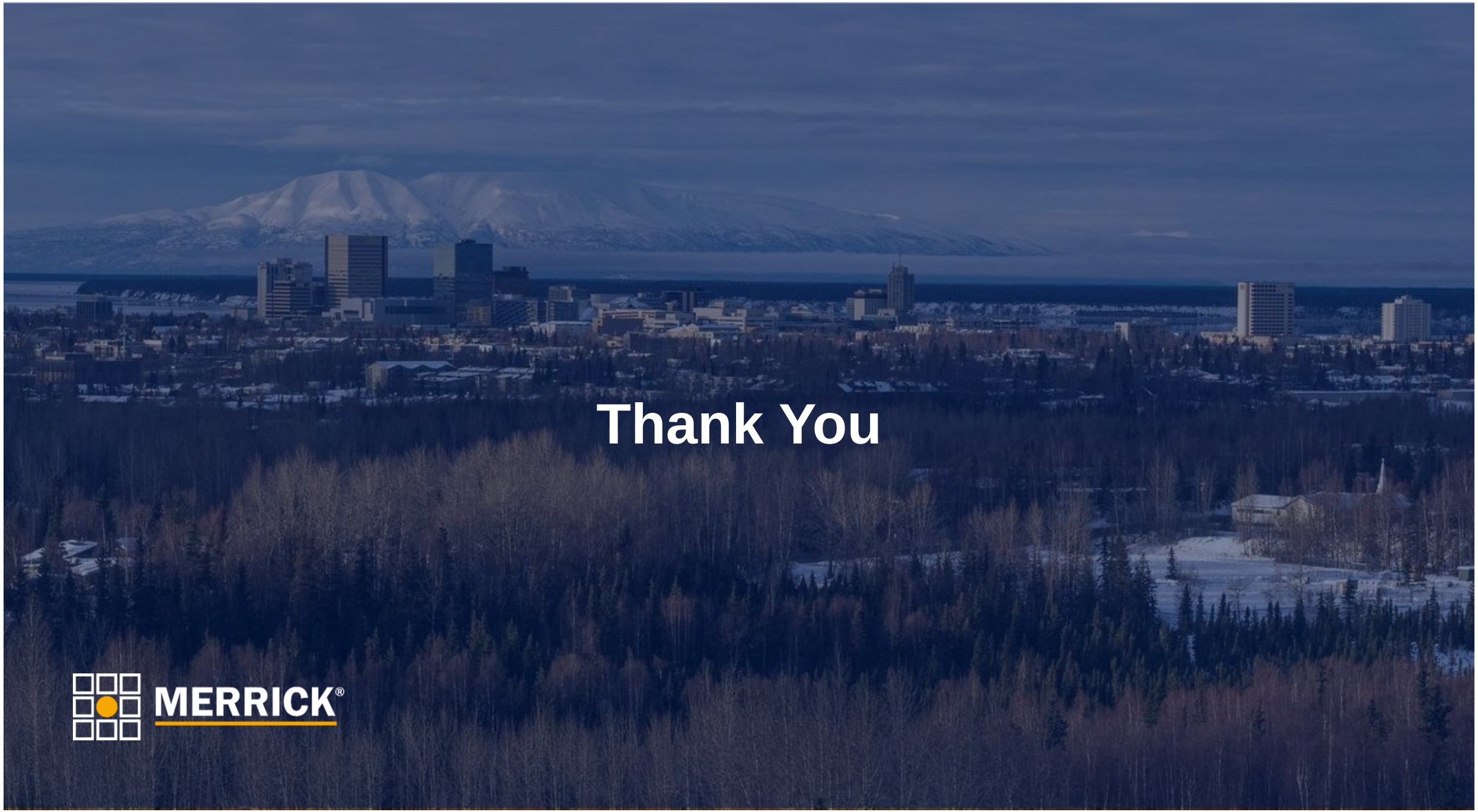
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