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Peace Engineering in the Arctic: Accommodating diverse interests in a changing environment.

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Extended Abstract

Peace Engineering is the application of science and engineering principles and technology to promote and support peace [1]. This emerging discipline brings together the systems engineering community in academia, industry, and government with practitioners and researchers in the peacemaking, peacebuilding, peacekeeping, security and development communities to explore the role of technologies in removing conflict drivers and barriers to peace, and to support environments in which human potential and well-being can flourish. Practitioners of peace engineering must assess how technical solutions impact the peace and security values and trade-space relative to the systems of individuals, local communities, and societies within which the solutions are deployed.

The peace research literature often refers to the work of Johan Galtung, who founded the Peace Research Institute in Oslo (PRIO) in 1959 and pioneered the concepts of *negative and positive peace* in the early 1960s [2]. Galtung conceived of negative peace as the “non-use of violence and its delegitimation” and positive peace as “the use of harmony and its legitimation”. Both negative and positive peace frameworks recognize that peace does not mean the total absence of any conflict. Instead, it can be understood as a process or a state of stability or dynamic equilibrium *emerging* from multiple system interactions in a community landscape of a specific context and scale that draw on both positive and negative peace concepts to advance human security [3]. That state is necessary for human and economic development to unfold. Furthermore, it unfolds in community landscapes consisting of multiple interdependent and interconnected systems (social, economic, financial, security, technical and environmental) and their nested subsystems, and involves multiple adaptive actors. The landscape represents a space of possibilities or an environment (stable or in conflict) subject to a wide range of enabling and constraining factors and barriers.

The Arctic provides a timely and relevant case study for applying peace engineering principles at multiple scales to address complex issues emerging from competing commercial, security, and community interests in response to climate change. With the retreat of Arctic sea ice, increasing access to the Arctic’s vast energy, mineral, and living resources, and other

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commercial interests is growing. At the same time, competing geo-strategic security interests among Arctic nations intensify, often overlooking the interests of the indigenous communities [4,5,6]. No single agency or nation has the sovereignty, capacity, or control over resources necessary to meet all emerging challenges in the Arctic. To date, the Arctic Council has been successful in promoting cooperation, coordination and interaction between Arctic countries and Indigenous Peoples organizations, as well as the interests of non-Arctic states. However, the Arctic Council is organized at the level of nation states, rather than being community-driven, and mostly excludes national security issues from its scope. In addition, the Arctic is increasingly being viewed by some observers as a potential emerging security issue. Some of the Arctic coastal states have taken actions to enhance their military presence in the high north. This has prompted other nations to pay more attention to the region in their planning and operations [6].

This applied research engages diverse Arctic researchers, practitioners, and stakeholders in building a dynamic, systems-level understanding of interdependencies between Arctic activities motivated by "negative peace" goals and concerns (e.g., deterring, detecting and responding to environmental and security risks); and "positive peace" goals and concerns (e. g, leveraging technological advances and economic incentives, providing robust emergency response capabilities, building indigenous community resilience, and providing individuals and communities in the Arctic a measure of fate control) in a context of changing geopolitical, economic, and environmental conditions. In such a rapidly morphing environment, there is a large benefit in recognizing the intertwined risks and their evolving consequences – and how to work together to overcome development and implementation delays for effective mitigation/response.

At the highest level, the key stakeholders considered in our research are the military/security organizations of Arctic nations, commercial industries, and indigenous communities. (Figure 1). In this simple model, interests of commercial industries are represented by increased resource extraction and associated shipping activity. Interests of indigenous communities are represented by food security and participation in sustainable resource development, as described by Inuit Circumpolar Council-Alaska [7]. Security interests of Arctic nations are represented by military and constabulary activities. To date, we have developed a high-level causal loop diagram to explore how endogenous feedback loops between security, commercial, and community activities might be managed to promote overall system stability vis-a-vis peace engineering goals in the Arctic; and the impact of different sequencing, resourcing, and deployment scenarios on tipping points under a variety of environmental, geopolitical, and community-based scenarios. For example, in Figure 1, there are many unknowns regarding how the changing climate, as represented by increased ocean access, may impact the food availability of the Inuit. There may be synergies between investments made by commercial and military interests in technology development and emergency response and the monitoring needs of the Inuit for better understanding of how their food sources are responding to changes in the environment. In return, the knowledge shared by the Inuit with the commercial and military parties may aid in the development of effective technologies and systems for the Arctic environment.

Developing the model requires dialogue between stakeholders, practitioners, and researchers. Stakeholders and researchers in the U.S. include US Coast Guard, the Inuit Circumpolar Council-Alaska, Alaska Federation of Natives, and the Department of Homeland Security Arctic

Domain Awareness Center [8]. Further model development will be a group activity involving researchers in Arctic science and security, peace engineering, indigenous community development, and geopolitical drivers in the Arctic. The goal is to demonstrate a prototype simulation model with key stakeholders for collaboratively driven, decision-making framework for designing and managing Arctic activities to achieve dual goals and objectives of peace and security. Examples of research activities include unmanned sensing for maritime search and rescue response; communications, logistics and monitoring support to indigenous communities; earth systems modeling to identify critical transitions in sea ice and permafrost and the potential effects on infrastructure and the environment; monitoring systems for national security; scalable and resilient energy sources and power supplies. Other examples from the indigenous communities are in development.

Ultimately, the model will be used to identify transformational opportunities to bring together “negative” and “positive” peace agendas and explore potential impacts of uncertainties on system-level outcomes of activities as a whole. With this understanding, stakeholders can collaboratively develop a framework for prioritizing and managing the sequencing, resourcing, and staging of key current and future activities. In so doing, we hope to establish a mechanism of addressing conflicts in the Arctic before they reach a point of contention, in order to maintain the Arctic as a zone of peace.

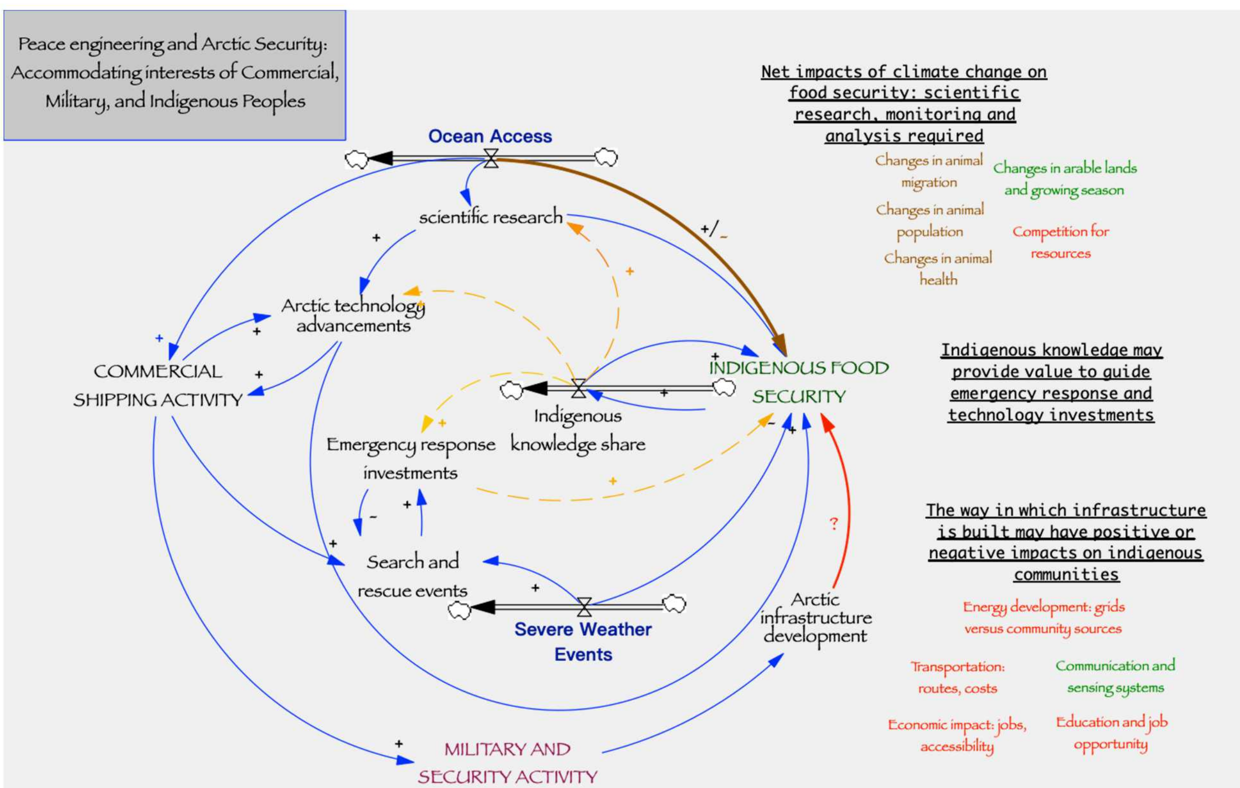

Figure 1 Peace engineering framework for assessing and managing Arctic security. Uncertainties in dynamics induced by climate change and increased infrastructure development can be reduced through collaborative exploration of the model to develop appropriate balancing and reinforcing feedback loops. Robust mechanisms to increase knowledge sharing feedback loops between indigenous communities, commercial industries, and military activities will also be explored.

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