SCHOOL OF ARCHITECTURE

MENU

THE ARCTIC DESIGN GROUP EMBRACE TRIAL AND ERROR DURING THEIR RECENT FIELD SEASON IN ALASKA

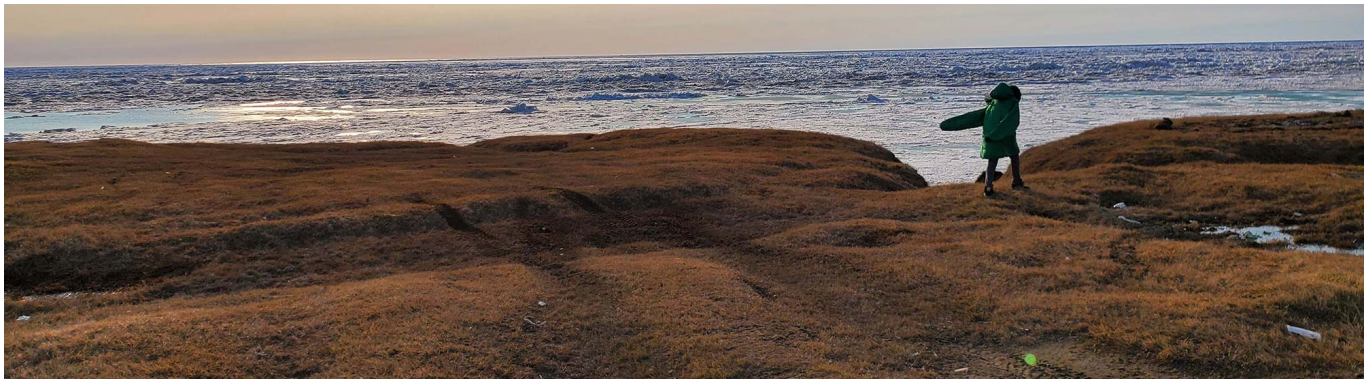
AWARD - RESEARCH

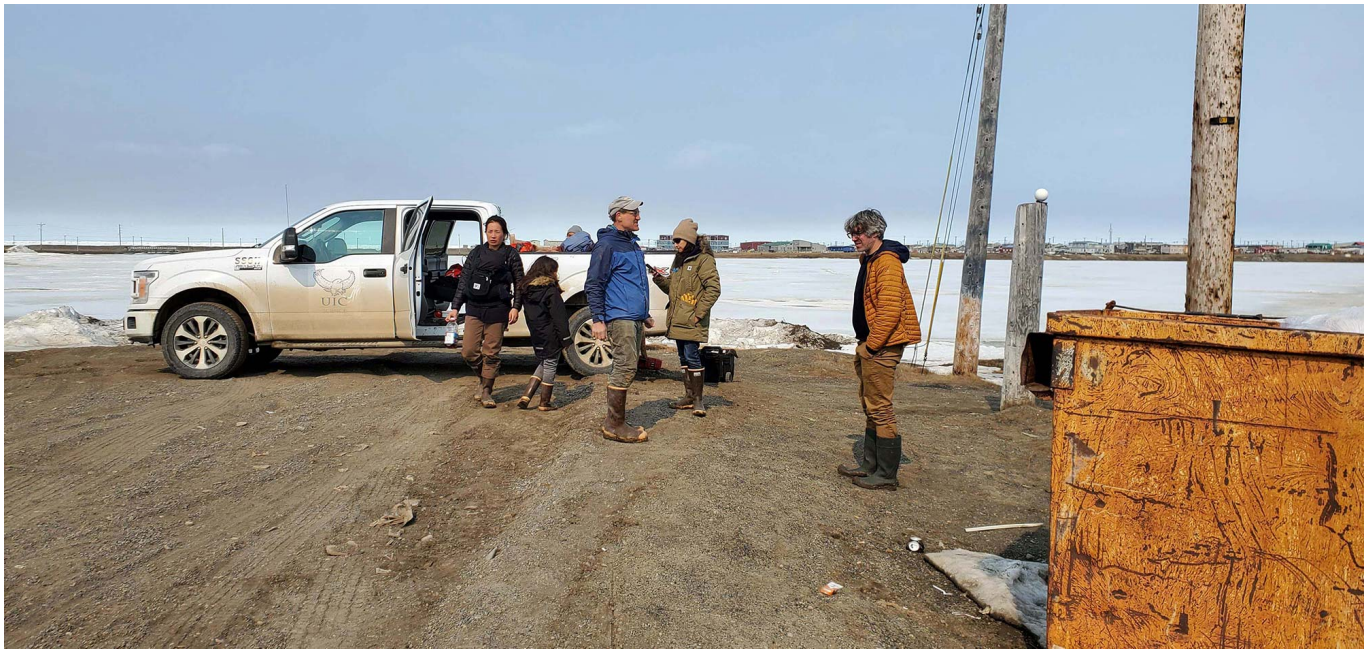
10.06.22

This summer, following several years of postponement due to the COVID-19 pandemic, University of Virginia researchers eagerly embarked on their first field season in the city of Utqiaġvik, Alaska. Their efforts are assisted by UVA's Arctic Research Center, formed in 2020, a collaboration of researchers and students who are studying everything from the environmental effects of extreme climate and climate change on Arctic ecosystems to the design of buildings, towns and cities, as well as the best ways for interdisciplinary researchers to collaborate on these goals with Arctic residents.

The Arctic Design Group's founders, Leena Cho (Assistant Professor of Landscape Architecture) and Matthew Jull (Associate Professor of Architecture) spent 10 days in early June in Utqiaġvik, home to approximately 5,000 people, with their UVA collaborators and regional and federal partners deploying and testing a network of environmental sensors. The project, *Understanding the Changing Natural-Built Landscape in an Arctic Community: An integrated sensor network in Utqiaġvik, Alaska*, is supported by the National Science Foundation's "Navigating the New Arctic" initiative through a five-year, $3 million grant.

The team's excitement and energy fueled their much-anticipated work on-site, while embracing the realities of research in the Arctic, shaped by contingency and a reliance on local knowledge.





Located north of the Arctic Circle, Utqiaġvik is built upon ice-rich permafrost that is thawing along the coast of Chukchi Sea. The team arrives in early June 2022 for their first field season for their NSF-supported project *Understanding the Changing Natural-Built Landscape in an Arctic Community: An integrated sensor network in Utqiaġvik, Alaska* after several years of postponement due to the COVID-19 pandemic. © ADG

RESEARCH IN THE NORTH SLOPE: THE NEED TO SPEED UP, THEN TO SLOW DOWN

Located north of the Arctic Circle, Utqiaġvik is the northernmost town in the United States and is roughly 1,300 miles south of the North Pole. The largest city of the North Slope Borough, its residents, a majority of whom are Iñupiat, are coping with the atmospheric and human impacts of climate change in a community built upon ice-rich permafrost that is thawing along the coast of Chukchi Sea.

The Arctic region is warming at three times the rate of the global average forcing significant adjustments to life on the North Slope, from subsistence activities such as hunting and whaling, to everyday habitation. The city's infrastructure, particularly water, sanitation, power, building and road stability, is severely endangered. In a place where the environment is so unforgiving it is also challenging to build anything. With a short construction season of less than two months a year and

with most building materials barged in only once or twice annually, the sense of urgency in is continuously felt. In more recent years, this has become even more exaggerated as the frozen ground upon which the whole of Utqiaġvik has been built on becomes increasingly unstable because of climate change.

With only 10 days in Utqiaġvik and after a long delay due to the pandemic, the research team knew there was a lot to get done and a very limited time to complete it. Bringing with them "a ton of gear," including instrumentation consisting of meteorological, aquatic, and terrestrial sensors, they arrived at the one-room airport of Utqiaġvik which is the only way to travel in and out of the town as it is geographically cut off from the rest of the state.

Enthusiastic to get the project rolling quickly, after canceled flights and travel delays, they felt their own sense of urgency in recognition of a very short field season. The team would be building upon discussions that took place during the pandemic with local community collaborators including the North Slope Borough Department of Planning and Community Services that identified possible locations to install sensors, places with known issues such as subsidence and infrastructure breakage or areas that had been identified as future development zones.

Armed this this knowledge, there were still many questions to answer in a short time, mostly focused on the logistics of installation: *How could the team streamline the process of assembling the sensors before deploying them? Can the equipment survive the harsh environmental conditions? How would the residents respond to the sensors' placement?*

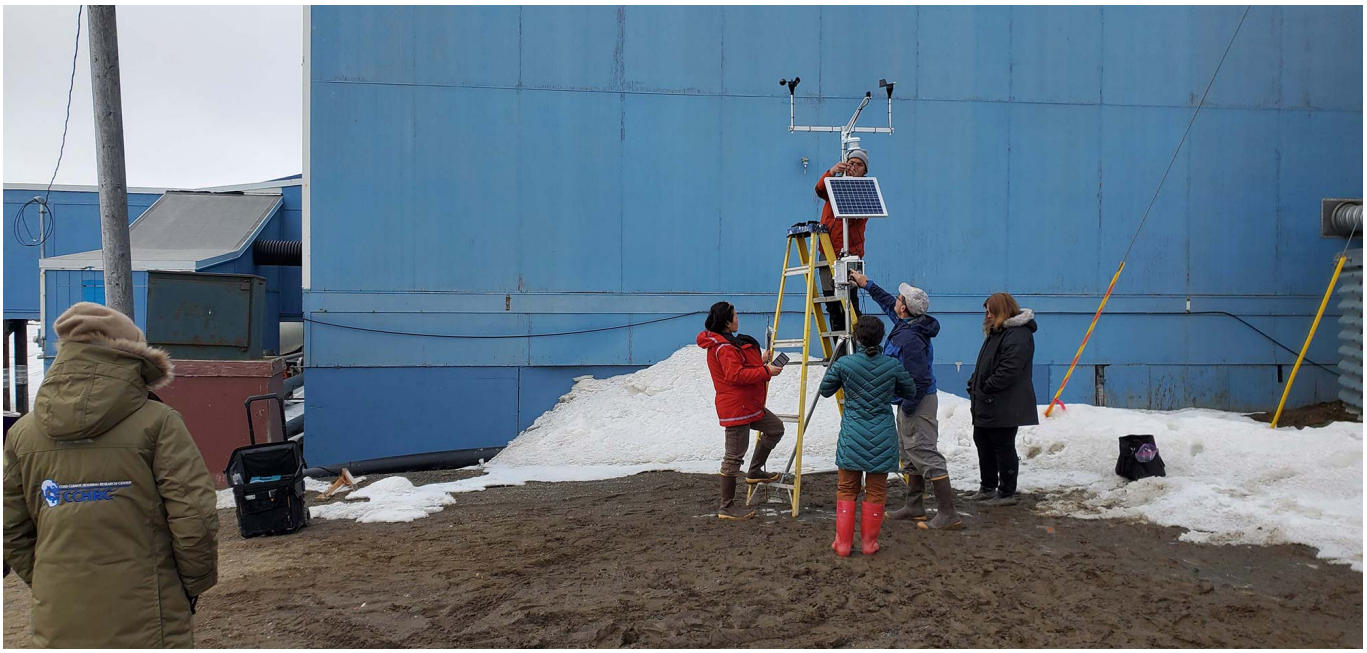
Exiting the airport's single paved road and transitioning to the dirt roads that make up the rest of the town, the research team took in the coastal city's unique, and somewhat ominous, conditions: low, thick grey clouds overhead and a frozen ocean without any of the movement that one would associate with a body of water. There was a sense of stillness, and with this, a suggestion to slow down.

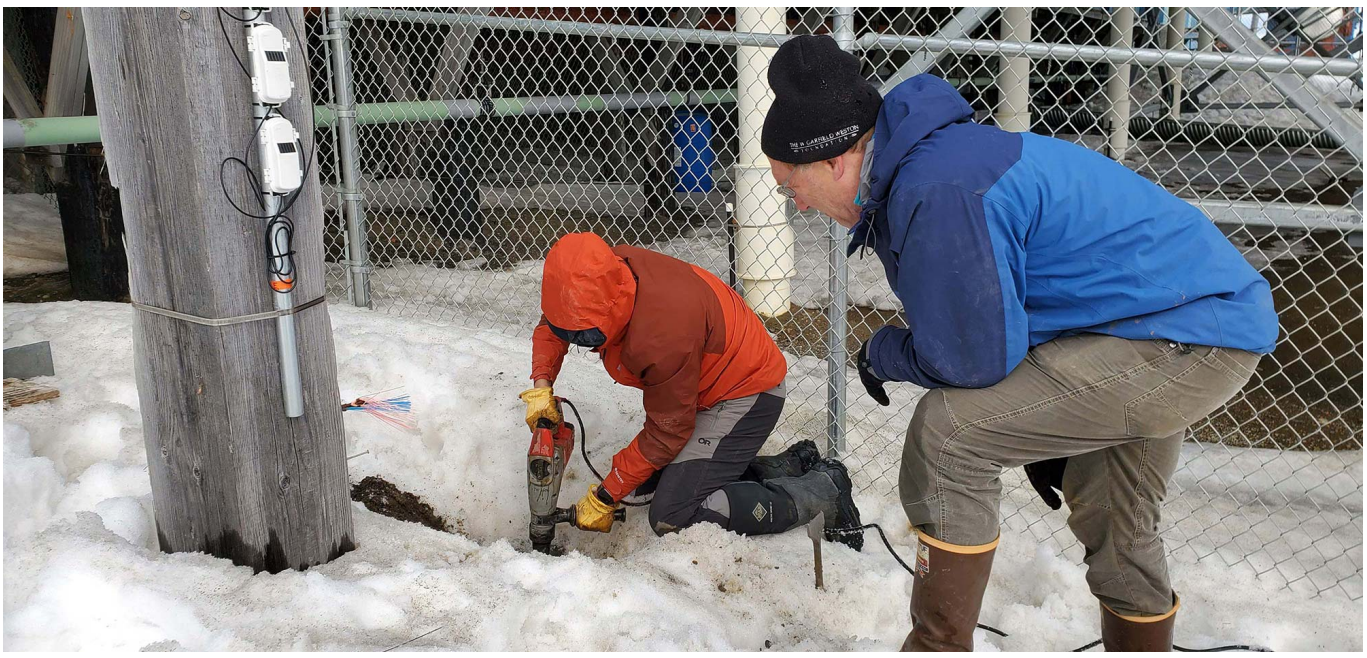
FIELD WORK IN THE ARCTIC: MESSY AND NON-LINEAR, TANGIBLE AND REWARDING

Professors Cho and Jull were joined in Alaska by research project principal investigators, Howard Epstein, Chair and Professor of Environmental Sciences, and Caitlin Wylie, Associate Professor of Science, Technology, and Society (STS) in the School of Engineering, along with PhD students MacKenzie Nelson (environmental sciences) and Mirella Shaban (environmental sciences and data science), post-doctoral researchers Claire Griffin (environmental sciences) and Hannah Bradley (anthropology), all from UVA. Partners Tobias Gerken, Assistant Professor in Atmospheric Science at James Madison University, and Georgina Davis and Chan Charoonsophonsak, both from the Fairbanks-based Cold Climate Housing Research Center, a federal research unit under the National Renewable Energy Lab (NREL) rounded out the on-site team.

The whole team came together to work around the clock to engage in the physical labor of installing environmental sensors on utility poles, inserting probes into the ground, and setting up water quality

sensors in lagoons. Working with the town to secure permits to install the instrumentation and building direct relationships with Utqiaġvik organizations and residents proved to be invaluable in their work. Research in the Arctic requires trial and error, and the team also relied on skillsets beyond their immediate disciplinary knowledge: the ability to adjust to contingencies and taking on the messiness of physical fieldwork.





The research team worked around the clock to install meteorological, aquatic, and terrestrial sensors in locations predetermined as having issues such as infrastructure failure or areas that had been identified as promising zones for future development. © ADG

“Drilling into the permafrost is similar to drilling into concrete block,” said Assistant Professor Leena Cho, “It took us about 20 minutes to go down half an inch in the beginning without the right tools in hand.” The team relied on the generosity of locals who were not only willing to give valuable time to

the project but also provided necessary equipment and tools such as a generator and a heavy-duty drill to core into frozen ground.

Despite it being in the middle of the summer, temperatures were in the 30s (F) which meant that equipment batteries drained rapidly, and human physical stamina required deliberate time to refuel. Associate Professor Matthew Jull described this, in part, as the "social aspect of the research," noting a remarkable dinner hosted by family members of research partner Chan Charoonsophonsak, a social and economic analyst for the Cold Climate Housing Research Center, who grew up Utqiaġvik. "Our work in the Arctic is not short-term. There is a long history of scientific research in this region being extractive. The indigenous peoples of Alaska and the National Science Foundation are aware of this and there is a necessary effort to centralize investment within communities through co-production and long-term community-building."

FUTURE DEVELOPMENT IN THE ARCTIC: CULTURAL INFRASTRUCTURE AND DATA SOVEREIGNTY

Four locations throughout Utqiaġvik were identified as promising for data collection: the town's main utility line, a residential complex of 100 units, the Samuel Simmonds Memorial Hospital, and a gas pipeline. Across these sites, the team's goal is to collect a variety of datasets that will provide a good picture over time of what they describe as an "increasingly unstable ground."

Utqiaġvik has been home to the Iñupiat, an indigenous Inuit ethnic group, for more than 1,500 years. For the past fifty years or so, imported building techniques have resulted in poor living conditions and health concerns resulting from low quality construction and lack of maintenance. By learning about what is happening below the surface of the ground, a better understanding of the stability or instability of structures can be revealed, and the impact of how different construction materials are altering the functionality of sites can be better determined.

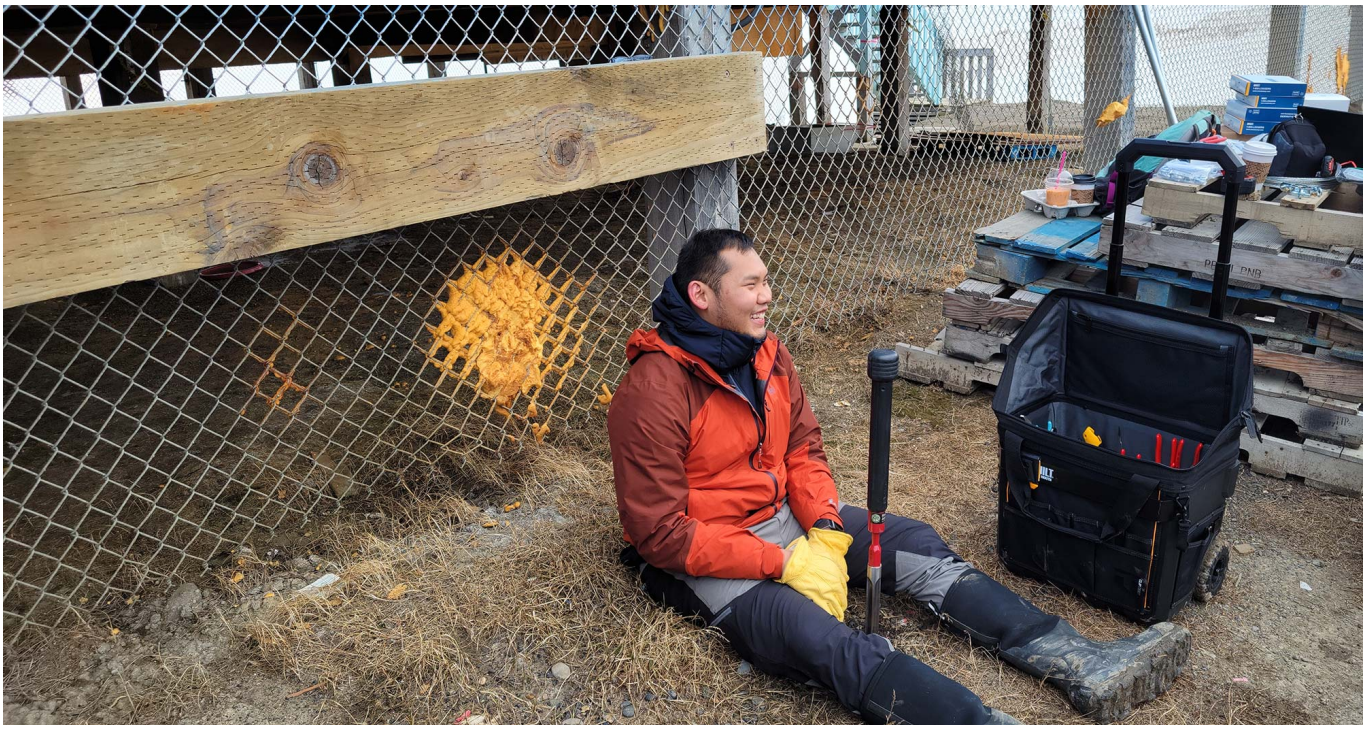
Over the five-year project period the team aims to use the data to learn more about what is below the permafrost and how it is changing, ultimately to assist the Arctic community in their future development of the town. As Cho writes in "Permafrost Politics: Toward a Relational Materiality and Design of Arctic Ground" (*Landscape Research*, 46:1, 25-250, 2021), "...permafrost is where all physical foundations of built things—pipelines, buildings, utilidors, roads, runways, etc.—must touch and interlace with [each other] in one way or another. [Permafrost] is an everyday vocabulary and matter of concern deserving care, and a critical cultural infrastructure for the arctic residents. It is also what has historically catalyzed scientific and engineering developments unique to the Arctic, which in turn dictate design parameters and expressions across scales today."

To reach their goals, the team's work is directed with data sovereignty and cultural infrastructure in mind. Sharing the data collected through their installations will lead to co-produced knowledge with local stakeholders to inform future building and infrastructural adaptations, while minimizing environmental impacts. The team is working with the local planning office, the Tagiuġmiullu

Nunamiullu Housing Authority, Boys & Girls Club of Utqiaġvik, Barrow High School, the Alaska Native Tribal Health Consortium, and the Navigating the New Arctic Community Office (NNA-CO), among others.

Community workshops, technology demonstrations and early professional development support the long-term relationship building that is at the center of this work. Following Cho and Jull's June field season, another group of their research collaborators, led by the U.S. Army Corps of Engineers' Cold Regions Research and Engineering Laboratory (CRREL) and including UVA PhD students Marantha Dawkins (constructed environment) and MacKenzie Nelson (environmental sciences), traveled to Utqiaġvik in August to conduct a geophysical survey and LiDAR scanning.

Elaborating on their long-term research goals, Jull explains, "We are supporting local knowledge. Local communities know that things are not as they were—that the environment is changing their lives and their landscapes. By helping to set up sensors, by building a three-dimensional depiction of the ground, and by using technology to learn more about this adapting environment, we are providing access to valuable data. But the data is their data."



Research team member Chan Charoonsophonsak, a social and economic analyst for the Cold Climate Housing Research Center, who grew up in Utqiaġvik takes a much-needed break from the physical labor of a typical day during the 10 day field season. © ADG

AFTERWORD

Ten days following their arrival to Utqiaġvik, Cho, Jull and their UVA research collaborators, returned to the one-room airport in anticipation of their departure. The journey back to Charlottesville would require multiple stops and result in more travel delays, but the unexpected contingencies are

nothing new for researchers committed to the long-term future of the Arctic. As the view of the town of Utqiaġvik from the airplane window grows less visible and more distanced wrapped up in heavy cloud cover and chilling temperatures, the ominous stillness remains, interrupted only by the immediate anticipation to return.

This spring 2023 semester, Cho and Jull will be co-teaching an advanced research studio funded by this NSF project. The studio allows them to travel back to the Arctic region soon, this time with School of Architecture design students who will be afforded invaluable learning opportunities by engaging in the messy realities and spirited trial-and-error of Arctic research first-hand.

The Navigating the New Arctic Initiative

Since 2017, NSF has been building a foundation for the Big Ideas through pioneering research and pilot activities. In 2019, NSF identified "10 Big Ideas" to invest $30 million in each that serve the Nation's future. The Navigating the New Arctic (NNA) Initiative is one of ten priority research topics for future investment as a nation that will push forward the frontiers of U.S. science and engineering research, and lead to new discoveries and innovations. They are, among others, the human-technology frontier, multi-messenger astrophysics, the data revolution, and quantum mechanics. NNA tackles convergent scientific challenges in the rapidly changing Arctic, that are needed to inform the economy, security and resilience of the Nation, the larger region and the globe.

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NSF GRANT FUNDING UVA RESEARCHERS' EFFORTS IN ARCTIC COMMUNITY

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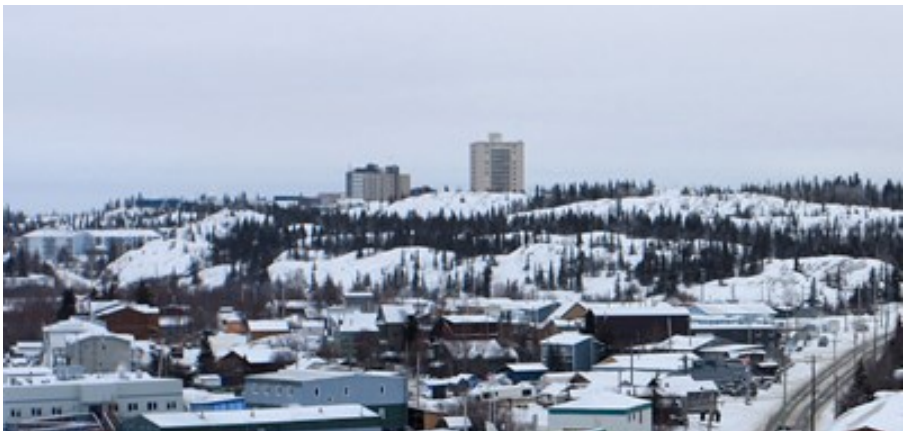

UVA'S ARCTIC DESIGN GROUP ADVANCE RESEARCH ON THE CO-DESIGN OF FUTURE ARCTIC CITIES THROUGH NSF-FUNDED GRANT

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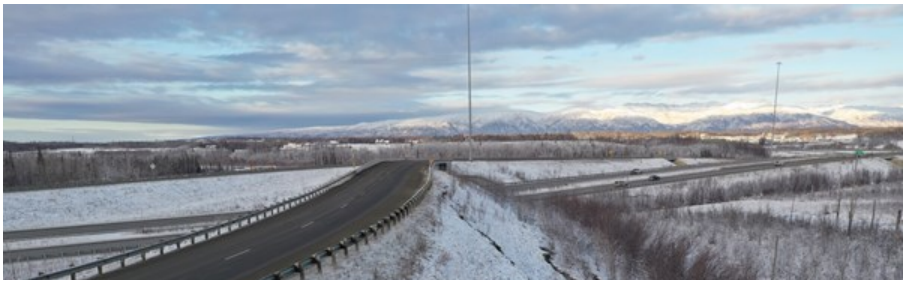

ARCTIC DESIGN GROUP AWARDED NSF GRANT IN SUPPORT OF SEISMIC RESILIENCE AND ADAPTATION OF ARCTIC INFRASTRUCTURE

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09.08.22

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