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HARC: High Arctic Research Center

Prudhoe Bay area infrastructure, services, domains

PRESENTED BY

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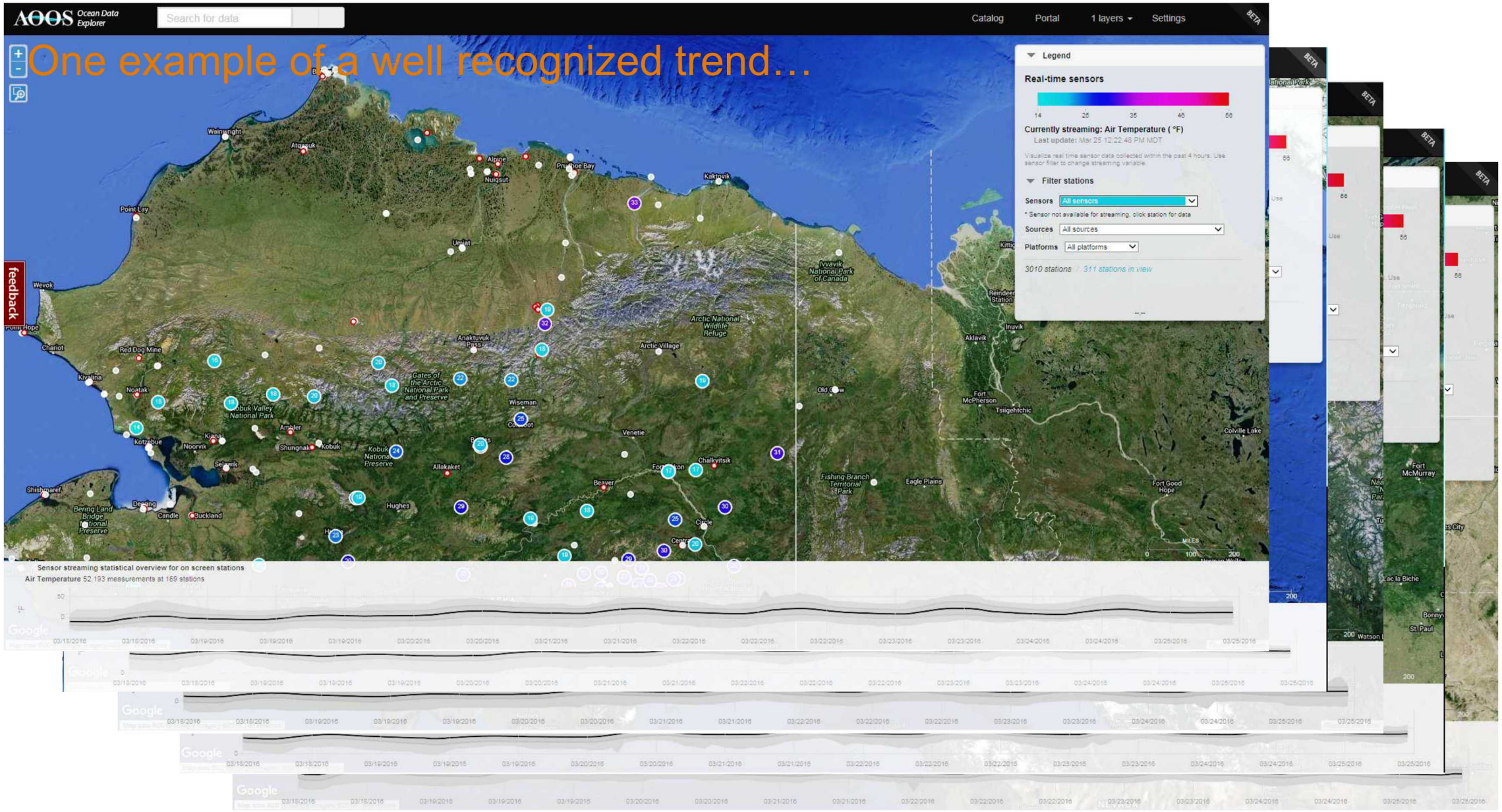
Scarce Observation Infrastructure in the High Arctic



Scarce Transportation Infrastructure in the High Arctic

Arctic Research Logistic Needs

1997 NSF Workshop Report: Logistics Recommendations for an Improved U.S. Arctic Research Capability[1]

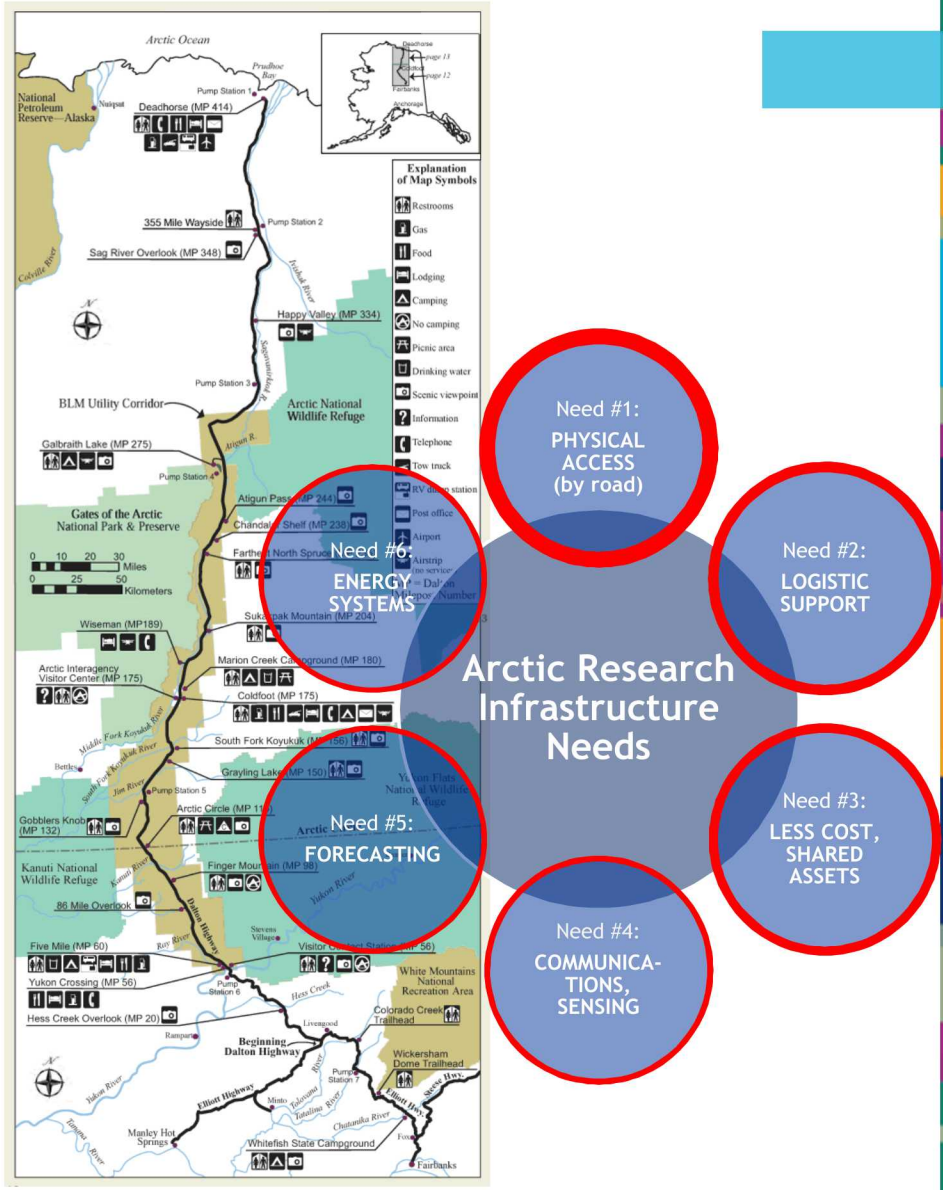
- "Ensure access to the Arctic over the entire year. Access to the Arctic requires a physical presence."
- "A remarkable outcome of … this report is the broad consensus between otherwise disparate disciplines in the needs for logistical support. All scientists working in the Arctic will benefit from improved access to research sites."
- "Multidisciplinary and experimental measures … the Long Term Ecological Research project (LTER), require the database and facilities of a large, permanent field station."

1998 NSF Workshop Report: Opportunities in Arctic Research[2]

- "A relatively meager observational infrastructure in the Arctic combined with the spatial scale and topical breadth of the research issues identified here presents the research community with new challenges."
- "While not a traditional pursuit of NSF, the undertaking of long-term observations is necessary in order to realize the full potential of a wide range of studies related to arctic change."
- "Regardless of discipline researchers share a need for access to the Arctic, including access to remote locations … including winter work."
- "Coordinated development of … facilities, each of which is equipped for on-site research into processes that span arctic science and for collection of year-round comprehensive suites of observations."

2013 NSF Workshop Report: Arctic Research Support and Logistics[3]

- "To meet the urgent demand for full access to the Arctic… plan to maintain and advance critical facilities and technologies. These resources include … terrestrial research hubs."
- "Regional and international logistics hubs remain critical."



1. P. Schlosser, W. Tucker, N. Flanders, W. Warnick (eds.) "*Logistics Recommendations for an Improved U.S. Arctic Research Capability*", ARCUS. Fairbanks, AK; 1997.
2. P. Schlosserand, J. Walsh (co-chairs), W. Warnick, A. York (eds.). "Opportunities in Arctic Research: Final Report", ARCUS. Arlington, VA; 1998.
3. J. Morison, J. Richter-Menge (co-chairs), K. Creek, P. Griffith, S. Oberbauer, S. Perdikaris, M. Shupe, C. Tweedie, and H. Wiggins (eds). "Increasing Arctic Accessibility Over the Next Twenty Years: Arctic Research Support and Logistics Workshop Report", Fairbanks, AK: ARCUS, 2014.

Intersection of Human activity and Arctic Change

"If you melt it, they will come."

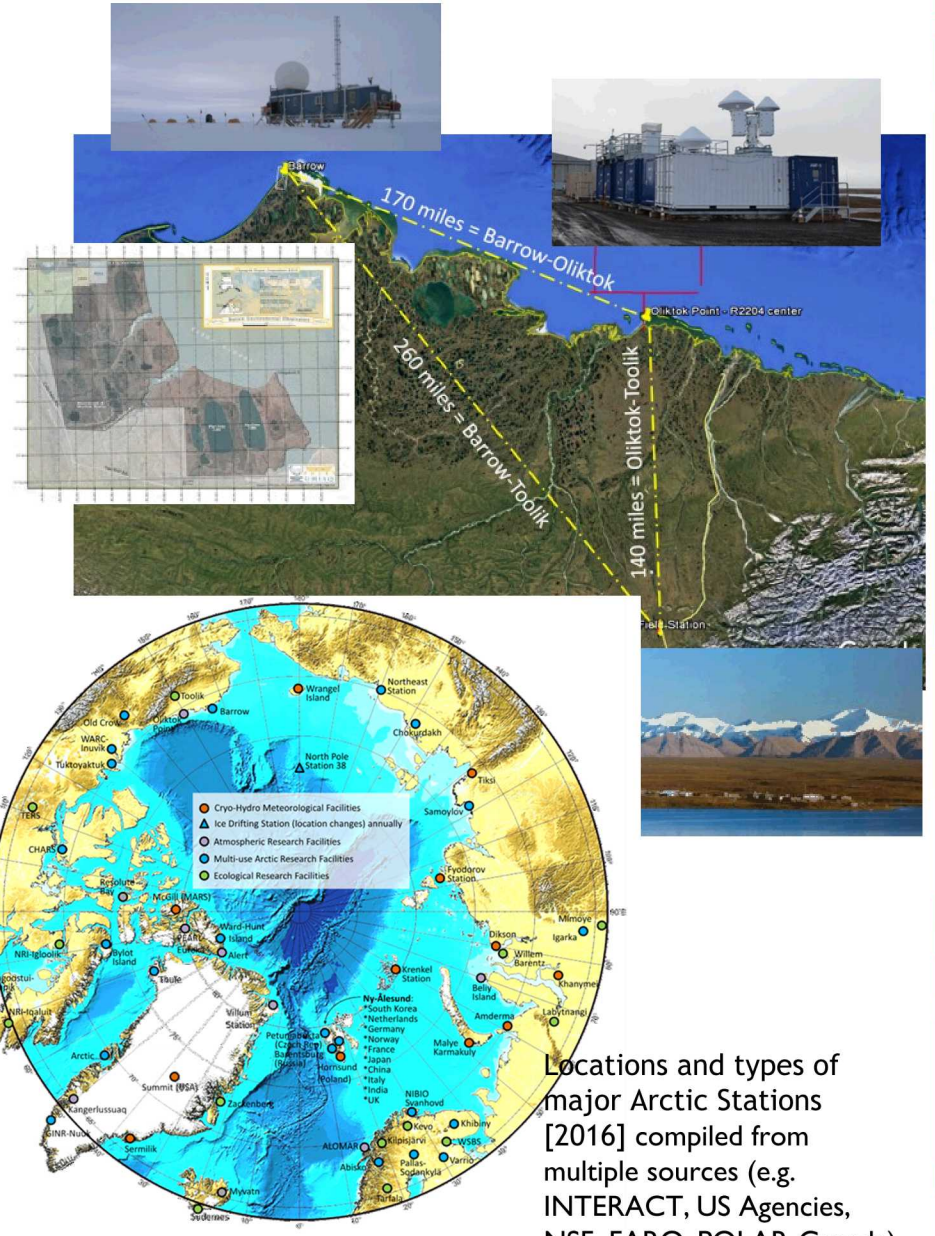
- Industry, researchers, people, tourists, invasive species, pollution, noise… "development"
- Impacts on local/Arctic communities
  - Mutual benefits of research for sustainable development
  - Gaps in research and technology
  - Integration of traditional and local knowledge with Western research
  - Community health, One health, food supply, safety
  - Protection measures (AK Clean Seas, NSB
- Impacts on the Environment
  - Physical (geology, limnology, permafrost, atmosphere, hydrology, geomorphology, marine sediment, etc.)
  - Wildlife (fish, marine mammals, terrestrial mammals, birds, etc.)
  - Ecosystems (microorganisms, benthic systems, flora/vegetation, invasive species, etc.)

Prudhoe Bay provides for research to understand how major activity can impact Arctic regions, how to balance the benefits and impacts, and learning how key natural processes are affected and development practices can be developed to minimize risk and maximize benefits.

Arctic Research Infrastructure NETWORK

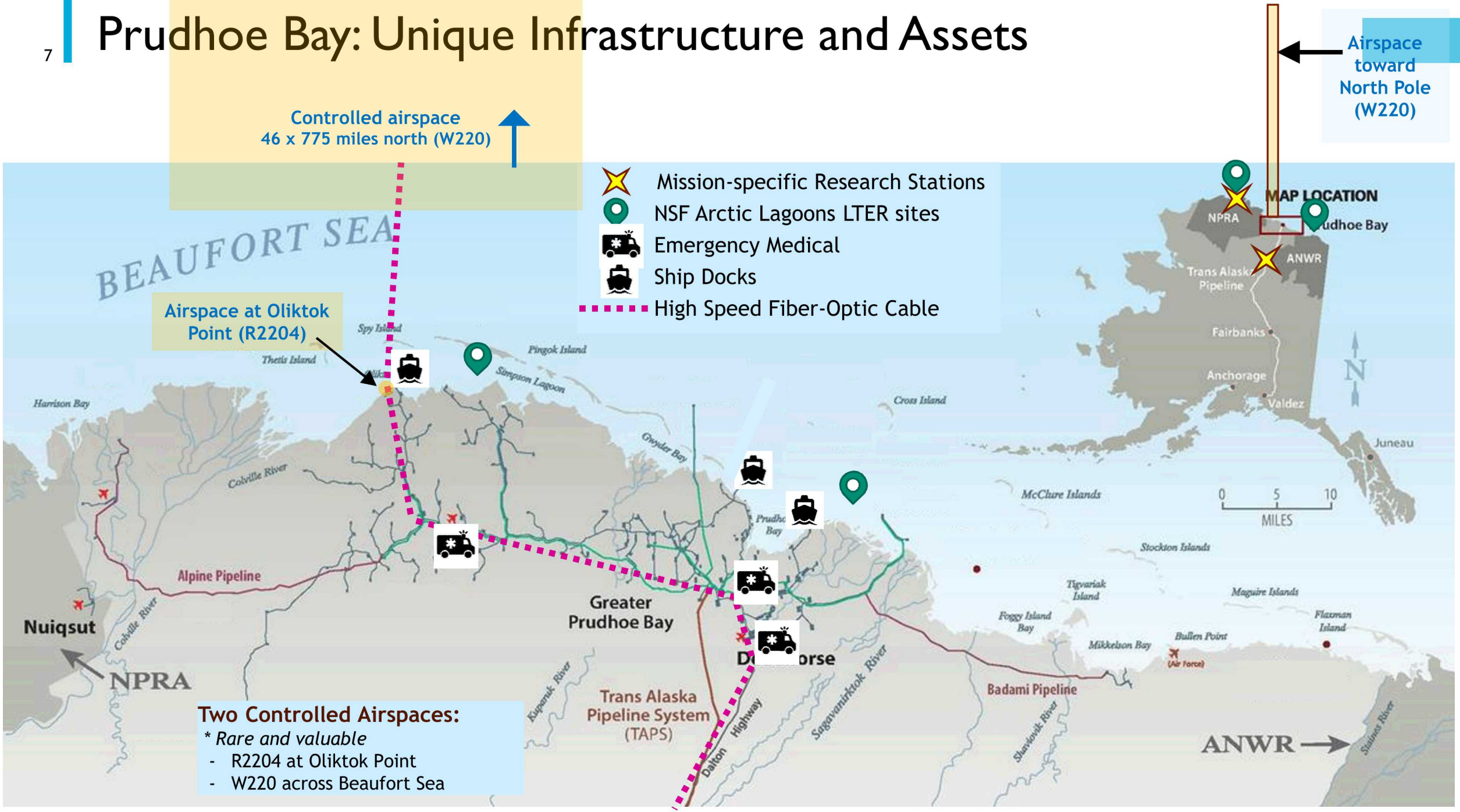
HARC would be a logistics hub, and complement the existing Arctic research facilities

- All Arctic research facilities will benefit from a robust and networked research infrastructure
  - Coordinate with Barrow Arctic Research Center, Barrow Environmental Observatory, Toolik Lake Field Station, NOAA Observatory, DOE-ARM, NGEE-Arctic (Nome and Utqiagvik), Teshekpuk Lake Observatory, and others.
- Support outreach to multiple stakeholders
  - Communities (e.g. Kaktovik Summer Oceanography Program, Collaborative Alaskan Arctic Studies Program (CAASP; marine mammal health assessment, ringed seal tagging, and surface current mapping))
  - Government (e.g. Nearshore Fish Surveys, USCG Arctic Shield (search and rescue), NSF Beaufort Lagoons LTER/Arctic LTER)
  - Industry research (e.g. ENI climate change research, AK Clean Seas response)
- International collaboration and coordinated support (e.g. with Canadian High Arctic Research Station/CHARS)



Locations and types of major Arctic Stations [2016] compiled from multiple sources (e.g. INTERACT, US Agencies, NSF, FARO, POLAR-Canada)

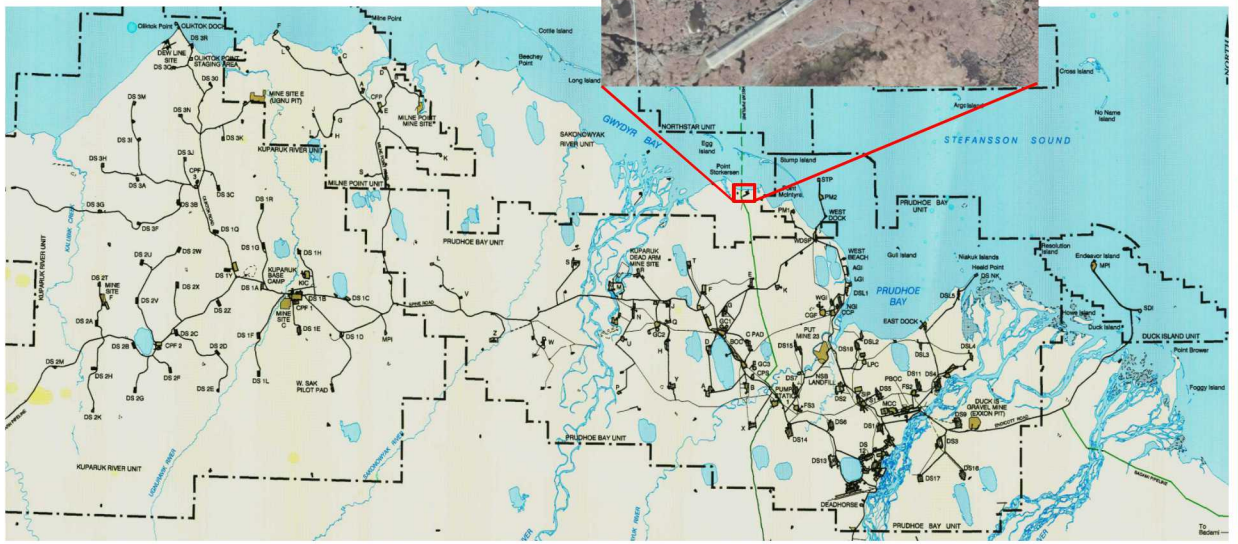
Prudhoe Bay: Unique Infrastructure and Assets



Prudhoe Bay: Unique Infrastructure and Assets

Industry-developed infrastructure could be leveraged to accommodate research infrastructure

- Transportation:
  - Roads (land access);
  - airports (flight access);
  - docks (marine access)
- Controlled airspaces (shore and ocean)
- Electrical power facilities and distribution
- Communications and high-speed fiber-optic cable
- Water and waste treatment facilities
- Fuel facilities and distribution
- Medical, Fire, and Emergency services
- Gravel pits (State of AK)
- Other support: Warehousing and storage, technical maintenance, housing, food service, shipping and supplies, etc.
- Opportunity to “jump start” HARC from agreements to use existing vacant or underutilized facilities?
  - East Dock
  - Old DewLine Station
  - Equipment and utility systems



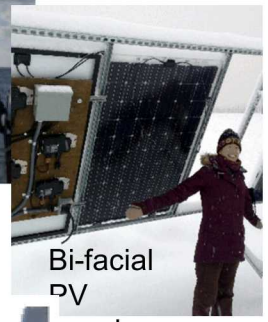
Research Capacity Building, Presence, and Opportunities

"Will they come if you build it?"

- Customers and Partners: Industry, Governments, Tech Business, NGOs?
- Technology development and testing
  - Autonomous Platforms (UAVs, AUVs, TundraBots, etc.)
  - Remote energy systems research
  - Arctic sensors and Observation systems
  - Protection measures (search and rescue, emergency response)
  - Resilient design (facilities, systems, infrastructure)
- Continuous presence and logistic support
  - Campaigns across land, sea, air, and ice
  - Training facilities and support
  - Equipment for field operations, training, and exercises
  - Forecasting and real-time updates on conditions
  - Arctic communications research
  - The Canada Polar Continental Shelf Project (PCSP) has provided logistics support for many years for scientists in a manner that could serve as a model for U.S. efforts
- Convergence research: Serving NSF Navigating the New Arctic (and beyond)
  - Define the key challenges and research imperatives facing humans and the environment in the Arctic region.
  - Public-private collaborations
  - Merging of distinct and diverse approaches into a unified whole
  - Establishing an Arctic observing **network** of mobile and fixed platforms

Photo Credit: USCG Petty Officer 2nd Class Grant DeVuyst

Arctic Shield in 2015., to provide a faster and more efficient rescue operation via coordination of government and private assets.



Bi-facial PV panels

miniSAR radar

Arctic Camps Support

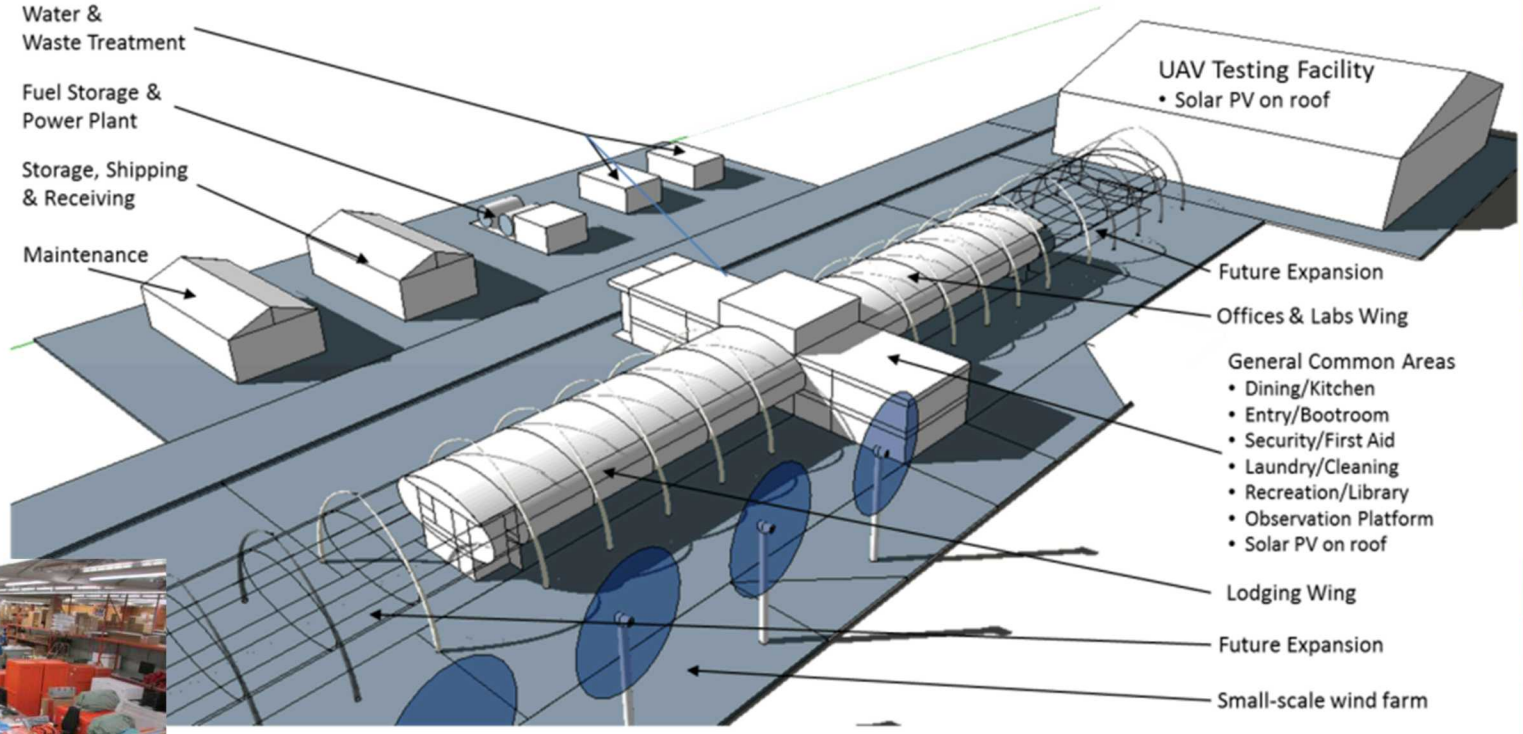
Source: Brian Glass, "NASA: Mission Ames", NASA, Posted August 5, 2014; https://blogs.nasa.gov/mission-ames/author/bglass/

Unmanned and Tethered balloon systems

Phased Development of HARC

HARC is intended to adapt and evolve through phased development. One approach is outlined below, considering seasonal constraints for Arctic construction:

- **Master Plan**: Flexible, adaptive guidance to align investments with changing needs.
- **Phase 1**: Install roads, pads, and infrastructure.
- **Phase 2**: Construct core facility for year-round capability of priority near-term operations. Update Master Plan.
- **Phase 3**: Expand facility scale, systems, and capabilities.
- **Future Phases**: Per Updated Master Plans.



High Arctic Research Center (HARC) Concept

Source: Polar Continental Shelf Program Arctic Operations Manual, Natural Resources Canada, Aug. 2016


Thank You