New Arctic Research Facility Opens Door to Science Collaborations

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Highlights

- The Arctic climate is changing rapidly; long-term, in situ, well-supported atmospheric Arctic monitoring is critical to understanding current change and predicting future conditions.
- NOAA has completed construction of a large, modern Arctic research facility connected with a high-capacity fiber optic link.
- The Barrow Atmospheric Baseline Observatory (BRW), a pillar of the global Arctic research community for almost 50 years, encourages new interdisciplinary research and partnerships in Utqiaġvik.

For almost half a century, some of the most important observations of the changing Arctic climate have been captured in a temporary structure at the northernmost tip of the United States. NOAA's Barrow Atmospheric Baseline Observatory (BRW) is located 8 km northeast of the City of Utqiaġvik (formerly Barrow) and very near the northernmost point (71.325° N, 156.625° W) of the U.S. (Fig. 1). BRW was established by NOAA in January 1973, joining observatories on Mauna Loa, Hawaii, American Samoa, and at the South Pole as foundational atmospheric research observatories spanning the length of the Pacific Ocean. The observatory's mandate was, and still is today, "to measure the necessary parameters for establishing trends of trace constituents important to climate change and of those elements that can assist in apportioning the source of changes to natural or anthropogenic sources" (Miller 1974).

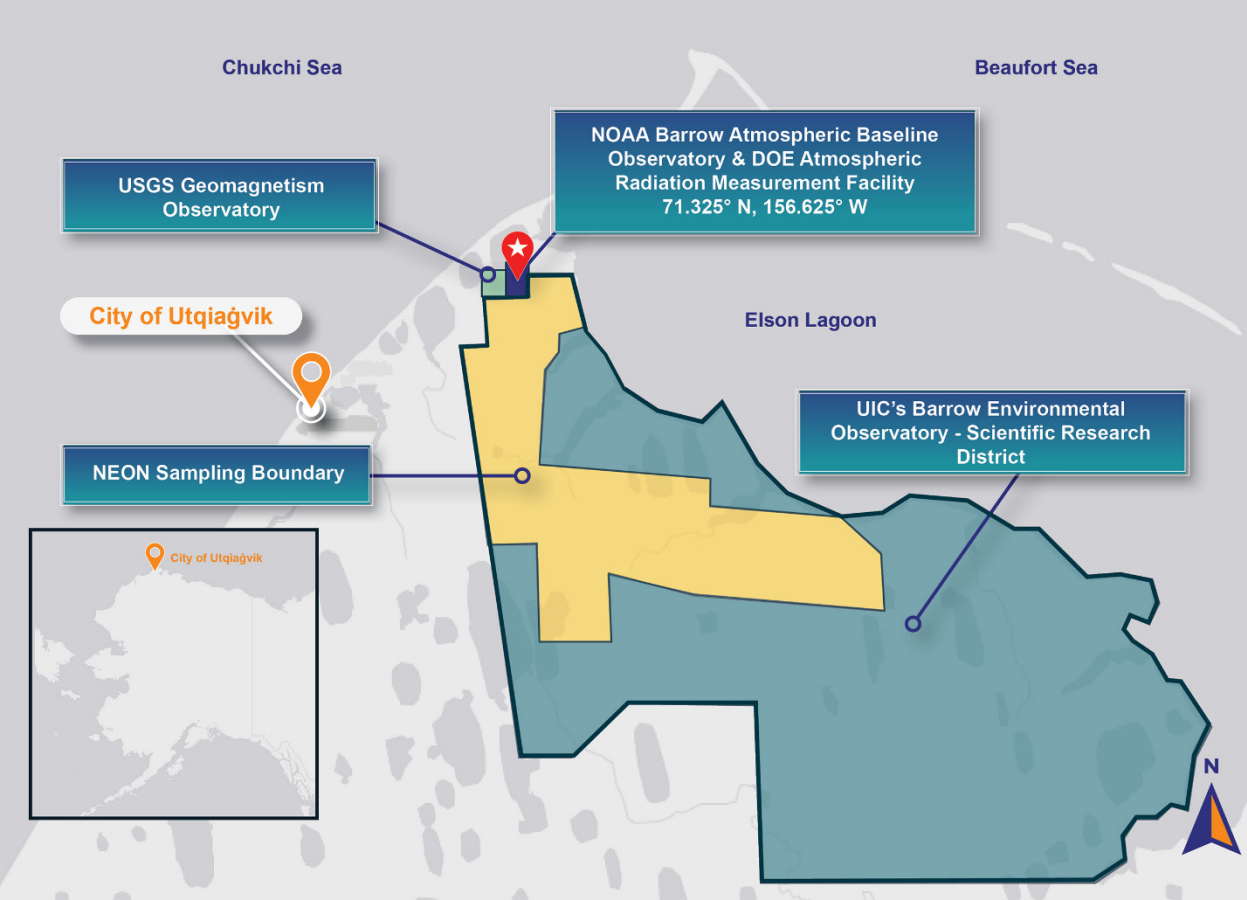

Fig. 1. NOAA Barrow Atmospheric Baseline Observatory (BRW) and surrounding partner research sites. All positions and boundaries are approximate. (Basemap provided by Esri)

Since its establishment, BRW has played an important role in Arctic research, providing long-term observations of atmospheric composition as it relates to climate change, ozone depletion, and air quality. With its unique location and ongoing, long-term data records, BRW is a critical member of multiple international observatory networks, including the World Meteorological Organization's (WMO) Global Atmospheric Watch (GAW) and the Global Cryosphere Watch (GCW) networks, that document change on a global scale. In addition, BRW is part of the International Arctic Systems for Observing the Atmosphere (IASOA), an effort to coordinate intensive long-term measurements collected across the Arctic (Uttal et al. 2016).

BRW has also hosted numerous interdisciplinary studies of the Arctic, supporting hundreds of cooperative science projects from researchers around the world. The observatory supports a NOAA Climate Reference Network (CRN) station and two NOAA/NESDIS polar-orbiting satellite antennas. In addition, NOAA has partnered with the U.S. Department of Energy (DOE) to operate an Atmospheric Radiation Measurement (ARM) facility on the observatory property, and BRW staff take regular measurements to support the U.S. Geological Survey (USGS) Magnetic Observatory nearby (Fig. 2). These projects are co-located at BRW for its access to undeveloped Arctic tundra.

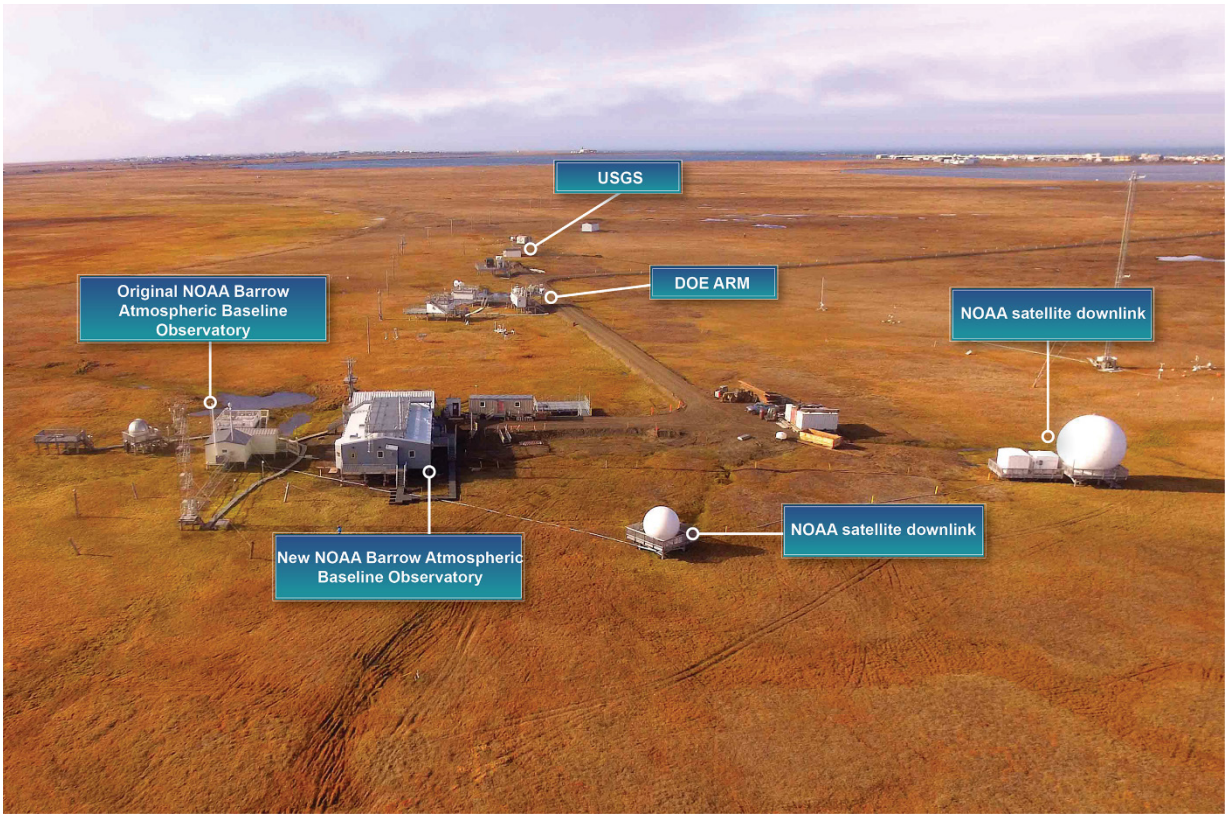

Fig. 2. Aerial view of the new BRW building alongside the original facility taken in September 2020. Also visible are the NOAA/NESDIS satellite downlink domes, the DOE ARM facilities, the USGS facilities, and the community of Utqiaġvik on the horizon. (Photo credit: NOAA)

The lengthy datasets developed from measurements captured at BRW are core elements of NOAA's responsibility for monitoring the state of, and changes in, the global atmosphere. The observatory is well-suited to sample air that is minimally influenced by local or regional air pollution sources when winds blow from the east-northeast "clean air sector", approximately half of the time. With an established "clean air sector," BRW can detect air from remote regions originating hundreds of kilometers upwind of the observatory. Situated on a land parcel over 40 hectares in size, BRW is also an ideal location to measure surface radiation over a natural landscape that will remain undisturbed in perpetuity.

The original 1973 BRW facility was just 74 m^2 and built, by the U.S. Navy, as a temporary structure for NOAA. Over the years, the number of scientific programs conducted at the BRW Observatory tripled in number until additional NOAA and cooperative programs could not be accommodated due to space, power, and safety constraints. As scientific interest in the Arctic has grown, the original observatory was simply inadequate to meet the research and monitoring needs required to improve understanding of the global climate system, and the drivers causing the Arctic to warm at a rate much faster than the lower latitudes. A National Science Foundation report examining U.S. investment in Arctic research determined that upgrading the BRW facility was the single most pressing and cost-effective means to enhance atmospheric research and monitoring within the United States Arctic (NSF 2002).

Now, 47 years after it was commissioned, the science has outgrown the original modest accommodations. The new, state-of-the-art research facility constructed on the NOAA site is poised to support the observatory's vital role furthering Arctic science for decades to come. In 2020, after years of

preparation and planning, a new 273 m^2 building to house the Barrow observatory is opening its doors to interdisciplinary scientific collaboration. The facility includes a new roof deck, a 30-meter instrument tower, a campaign science platform sized to hold two 6-m metal shipping containers, a dedicated computer server room, a high-speed fiber connection to the contiguous U.S., a plumbed bathroom and kitchenette, a garage remodel and expansion, and a permafrost temperature monitoring facility.

NOAA awarded the design/build contract to an Alaska Native Corporation, UIC Nappairit, LLC, a subsidiary of Ukpeaġvik Iñupiat Corporation (UIC). UIC designed the facility to qualify as a Leadership in Energy and Environmental Design (LEED)-certified building with the U.S. Green Building Council and has already achieved that mark. The building may still qualify for a higher level of LEED certification as the project is completed, continuing NOAA's commitment to environmental stewardship in the Arctic.

As an adaptation to the COVID-19 pandemic, NOAA worked closely with UIC to host a virtual completion inspection of the new facility; hosting this project milestone with remote participants was a first for NOAA. The BRW revitalization project also brings a fiber connection to the observatory; this new high-speed connection will enable faster data sharing and better communication with school and media outlets in exciting ways. The ability to stream live video and move large data sets out of the Arctic—from ship-borne missions, aircraft campaigns, buoys, and satellites—creates the potential to access the remote Arctic in novel ways.

Today, the BRW Observatory supports more than 200 measurements enabling critical research on changes in atmospheric composition and the Arctic region, including greenhouse gases, ozone-depleting chemicals such as chlorofluorocarbons, air pollution events from Eurasia known as Arctic Haze, stratospheric ozone depletion, and advancing snowmelt dates and lengthening of summers along Alaska's North Slope. Data acquired at BRW are available online: https://www.esrl.noaa.gov/gmd/dv/data/. Arctic modeling and satellite observations will benefit from the infrastructure and science available at BRW that allows in situ observations as part of a larger, integrated system. Increasing the number of diverse measurements at the new BRW facility will improve our knowledge of the complex Arctic environment, including the hydrology, glaciology, oceanography, terrestrial, and biological systems, as well as mechanisms related to the entire Arctic system.

The Arctic region is a vast and challenging place in which to operate. It undoubtedly still holds many keys to our collective understanding of Earth's climate, weather, and water systems. The new BRW observatory, in combination with other complementary international efforts and networks, will provide a state-of-the-art research platform where the global scientific community can gain fundamental insights into our changing Arctic.

NOAA strongly encourages cross-disciplinary science at BRW and new partnerships. Proposals for collaborative research projects hosted at the observatory may be submitted here: https://www.esrl.noaa.gov/gmd/obop.

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