

# Arctic Atmospheric Measurements Using Manned and Unmanned Aircraft, Tethered Balloons, and Ground-Based Systems at U.S. DOE Atmospheric Radiation Measurement (ARM) Program Facilities on the North Slope Of Alaska

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Barrow  
1997 - present



Atqasuk  
1999 - 2010

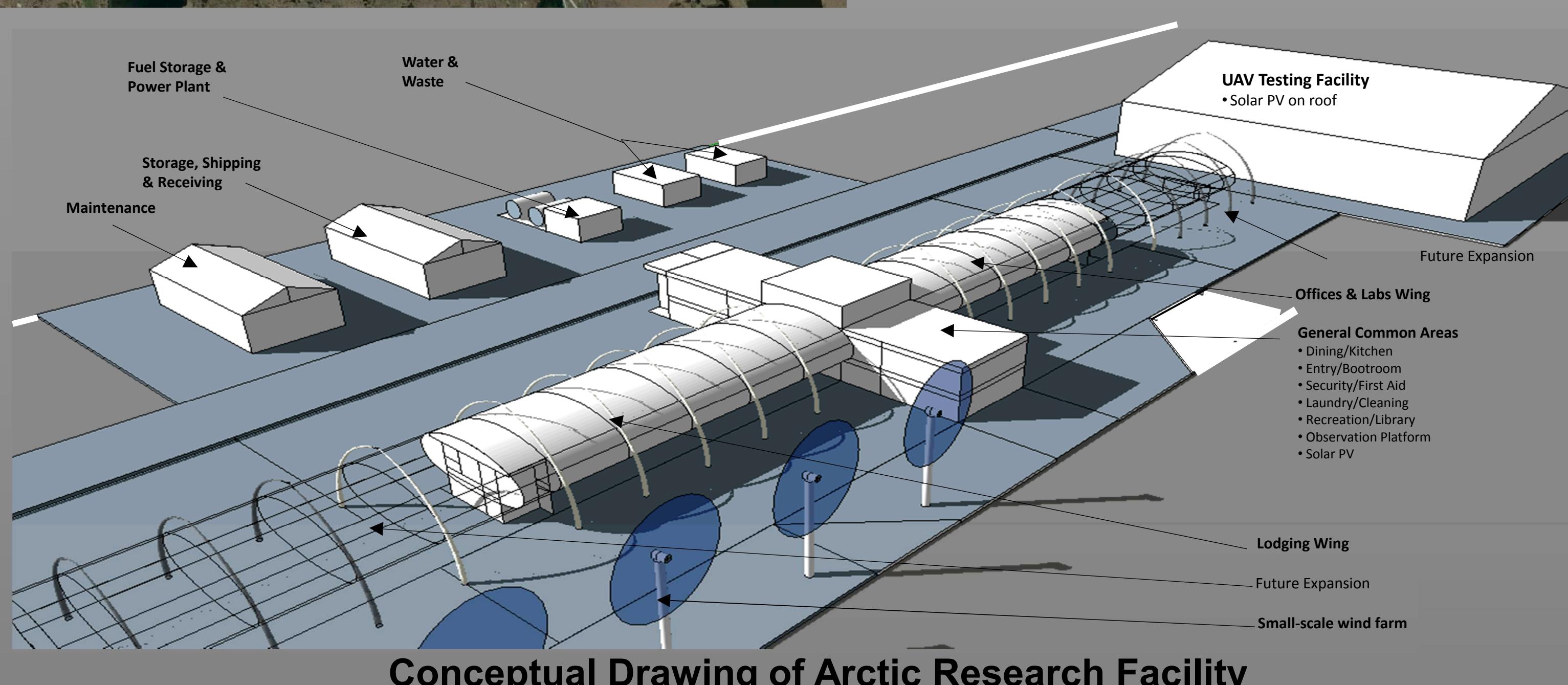
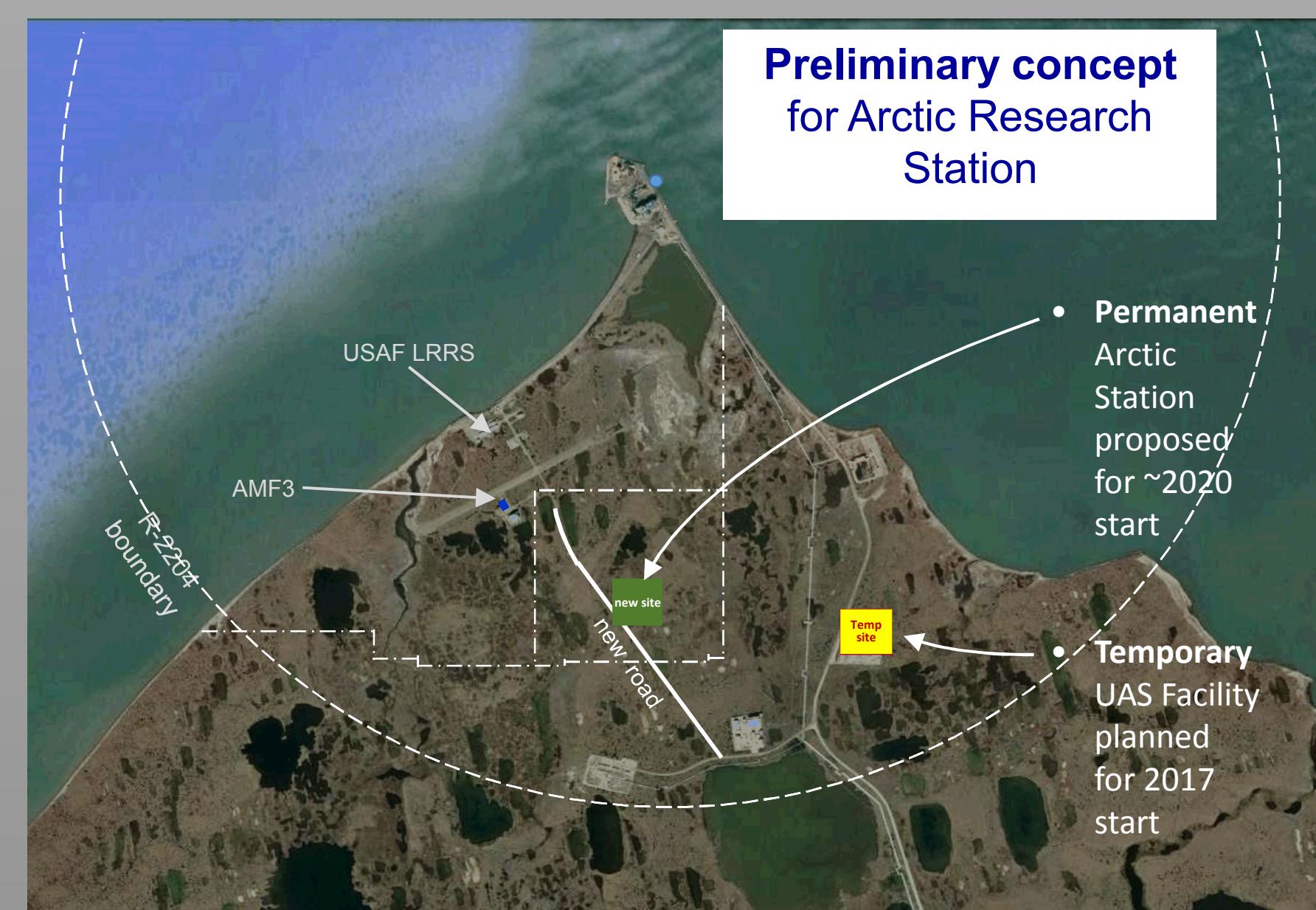


Oliktok (AMF3)  
2013 - present



The U.S. Department of Energy (DOE) provides scientific infrastructure and data to the international Arctic research community via research sites located on the North Slope of Alaska and an open data archive maintained by the ARM program. Sandia National Laboratories manages these research facilities for DOE. In 2016, DOE continued investments in improvements to facilities and infrastructure at Oliktok Point Alaska to support operations of ground-based facilities and unmanned aerial systems for science missions in the Arctic. The Third ARM Mobile Facility, AMF3, now deployed at Oliktok Point, was further expanded in 2016. Tethered instrumented balloons were used at Oliktok to make measurements of clouds in the boundary layer including mixed-phase clouds and to compare measurements with those from the ground and from unmanned aircraft operating in the airspace above AMF3.

Many organizations supported the US Coast Guard Arctic Shield 2015 Search and Rescue Exercise in the Beaufort Sea ~20 miles north of Oliktok Pt. Boeing (InSitu) operated a ScanEagle UAS from ground stations at Oliktok.

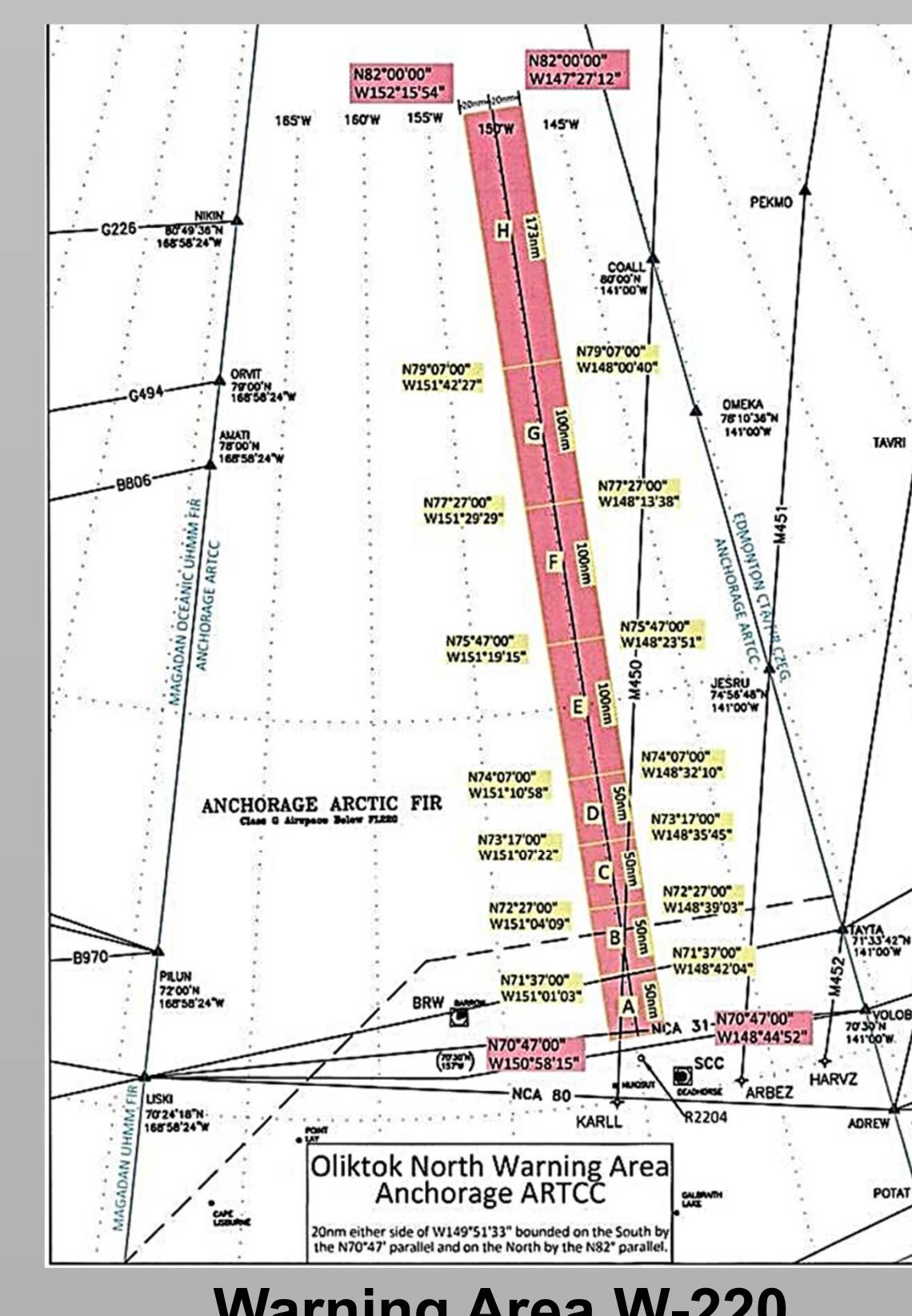


Conceptual Drawing of Arctic Research Facility

Sandia National Labs (SNL) and University of Alaska Fairbanks (UAF) are collaborating to support Arctic research and innovation. The Oliktok Point Research Station and Unmanned Aircraft System (UAS) Facility will provide:

- **Location:** 1 km from the Arctic Ocean; with road access to the lower 48 states
- **Controlled Airspace:** Access to airspace at Oliktok Point and 700 miles across the Arctic Ocean
- **Research Support:** Lab space, logistics/operations support, UAS facilities and test equipment
- **Collaboration:** Stakeholder space; e.g. federal and local agencies, industry and universities
- **Ocean Access:** A road from the Station to the shore
- **Shared Use:** On-site equipment, UAS hangar, real-time observations and meteorological data

AMF3 Controlled Airspaces



Warning Area W-220



Restricted Area R-2204



The ARM facility at Oliktok Point includes Special Use Airspace. Restricted Area R-2204 is located at Oliktok Point. Roughly 4 nautical miles in diameter, it facilitates operations of tethered balloons and unmanned aircraft. R-2204 and Warning Area W-220 north of Oliktok are managed by Sandia National Laboratories for DOE Office of Science/BER. These Special Use Airspaces have been successfully used to launch and operate unmanned aircraft over the Arctic Ocean and in international airspace north of Oliktok Point.

Unmanned Aerial Systems (UAS) & Tethered Balloon Systems (TBS)

• Tethered Balloon Systems

- Can operate in clouds
- Enclosed winch or launch platform
- 35 m<sup>3</sup> helikites
  - 30 lb payload, up to 2,000' AGL
  - #28 Skydoc aerostat and launcher
    - 80 lb payload, up to 6,000' AGL
- Limitations:
  - crew availability
  - ice loading
  - helium/gas diffusion
  - sensor battery life in cold
  - launch/retrieval sustained surface – winds <30 mph
  - need Restricted Airspace or FAA waiver to operate TBS >150' AGL
  - must have emergency deflation device on balloon

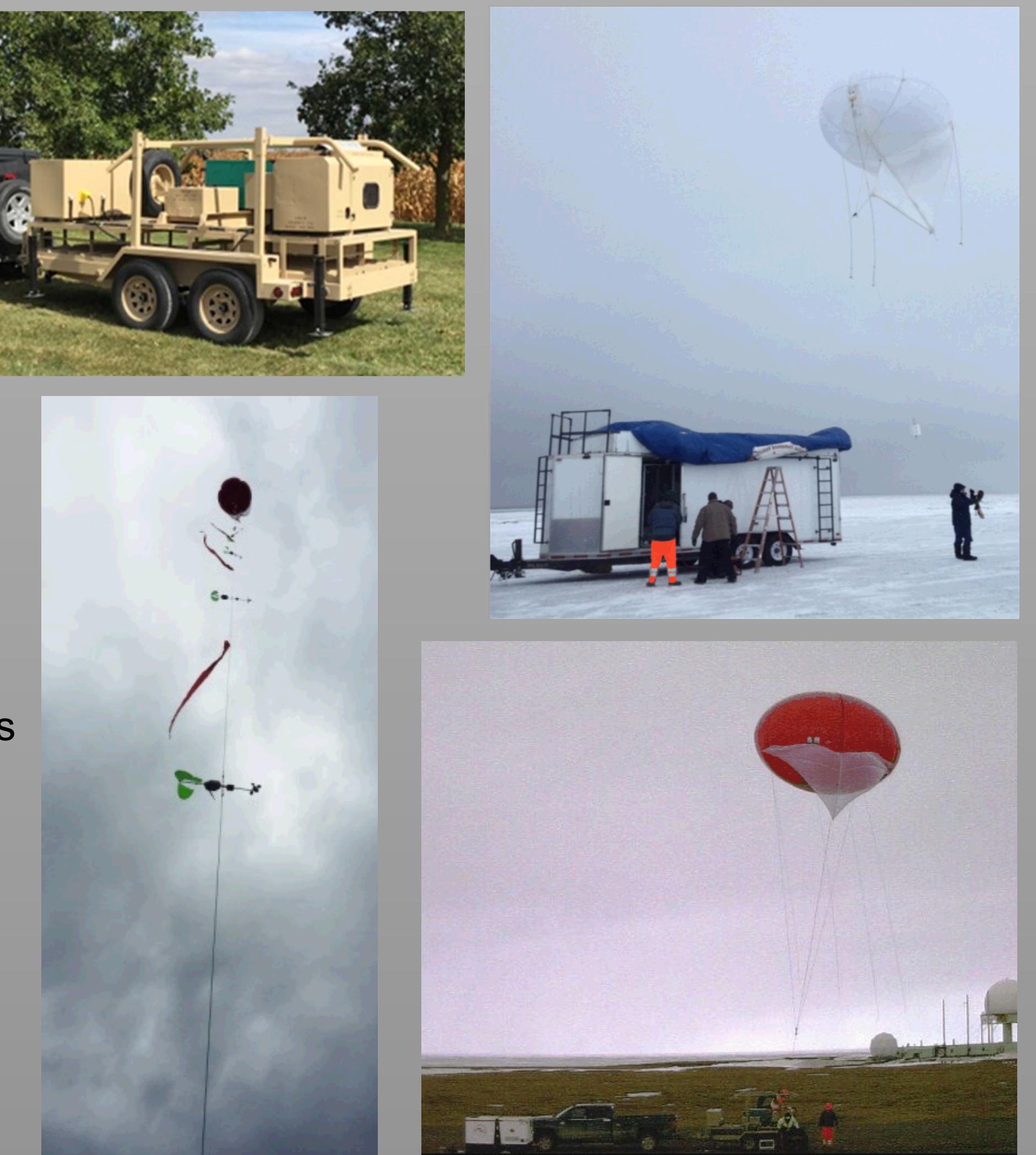


Image of tethered balloon taken at Oliktok Point by camera on the DataHawk UAS while both were in flight

Examples of UAS, tethered, and free-flight balloon platforms and operations supported by the US DOE ARM Program in Alaska.



Sandia National Laboratories