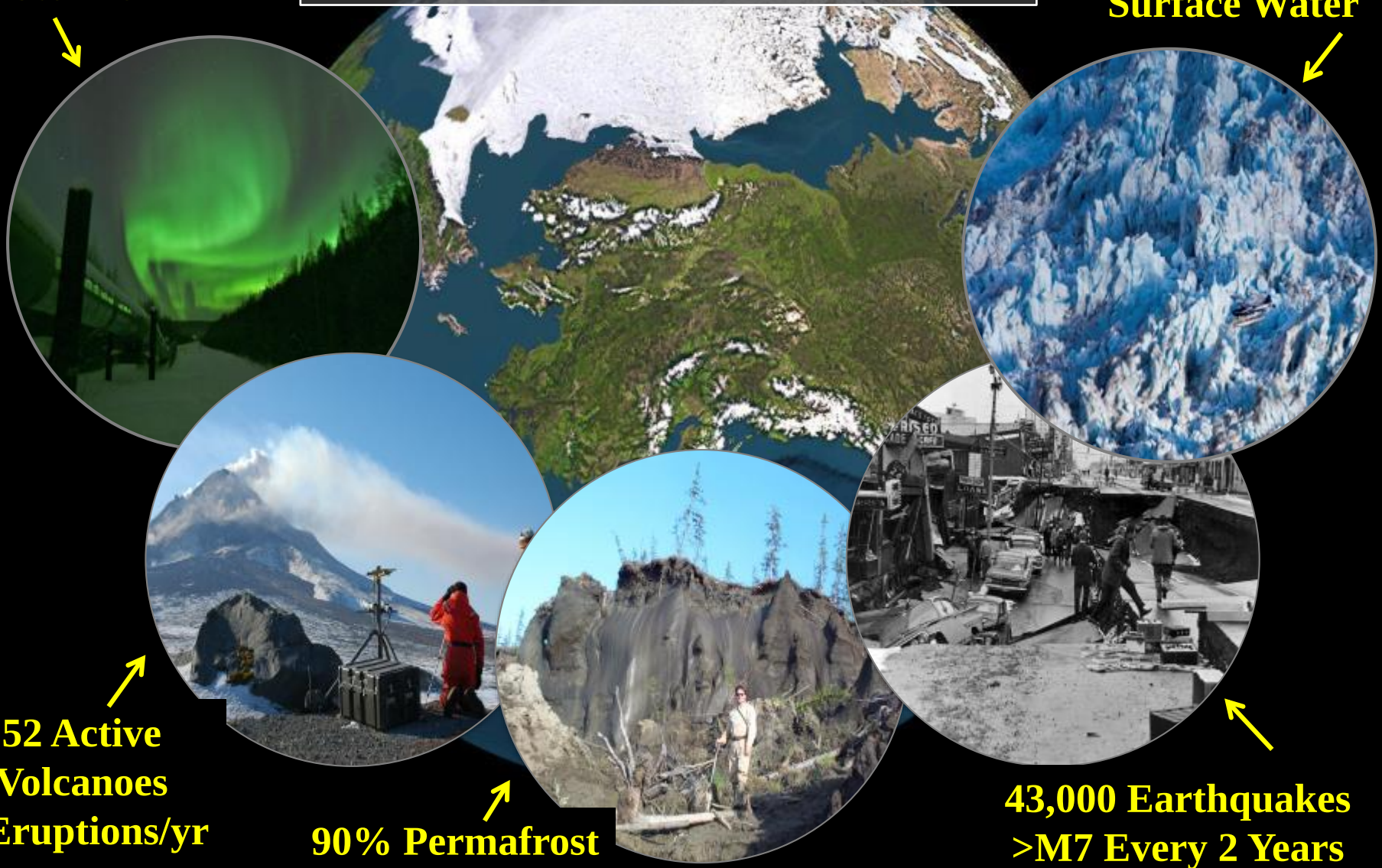
UNIVERSITY OF ALASKA FAIRBANKS

America's Arctic University

Arctic Research & Operations At the Geophysical Institute (GI)

Geophysics in Alaska



Aurora & Geomagnetic Storms

100,000 Glaciers, 60% of US Surface Water

52 Active Volcanoes 3 Eruptions/yr

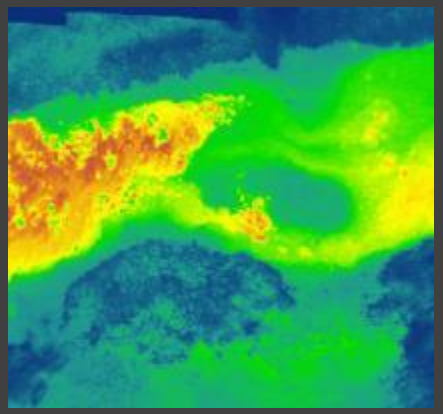
90% Permafrost

43,000 Earthquakes >M7 Every 2 Years

GEOPHYSICAL INSTITUTE

RESEARCH CONCENTRATIONS

Atmospheric Science



Remote Sensing

Seismology

Snow, Ice & Permafrost

Space Physics & Aeronomy

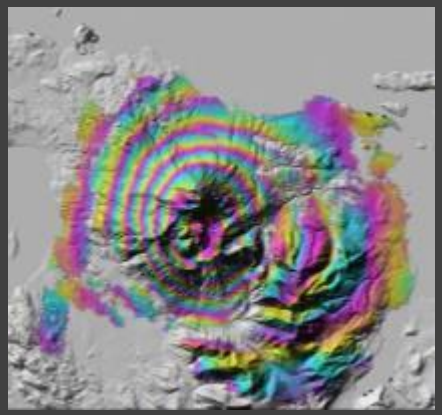
Tectonics & Sedimentation

Volcanology

UNIVERSITY OF ALASKA FAIRBANKS

GEOPHYSICAL INSTITUTE

Major Facilities/Operational Programs



Alaska Volcano Observatory

Alaska Earthquake Center

Alaska Satellite Facility

Poker Flat Research Range

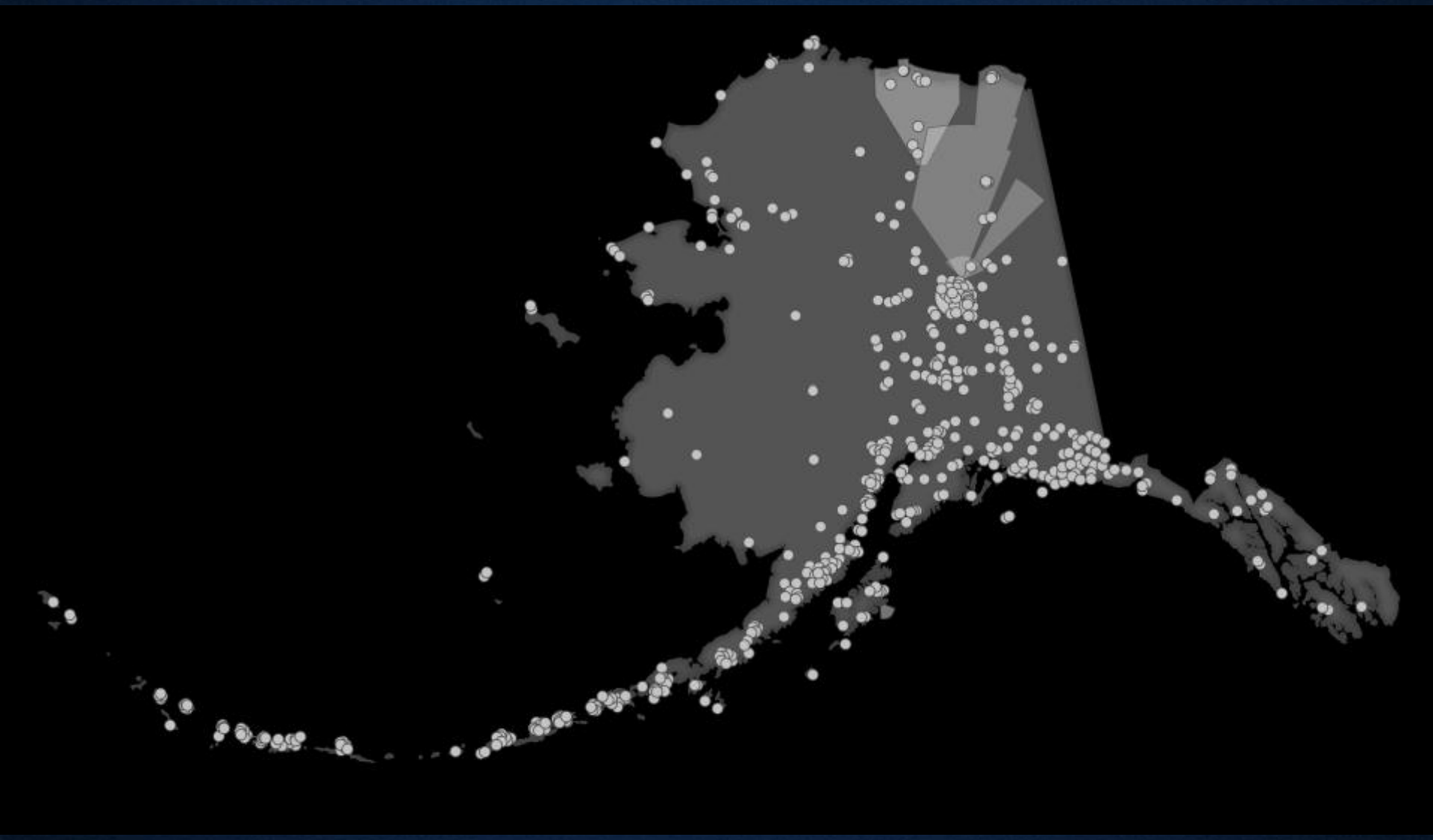
Alaska Center for Unmanned Aircraft System Integration

Research Computing Services (former DoD HPCC)

Wilson Alaska Technical Center (Infrasound)

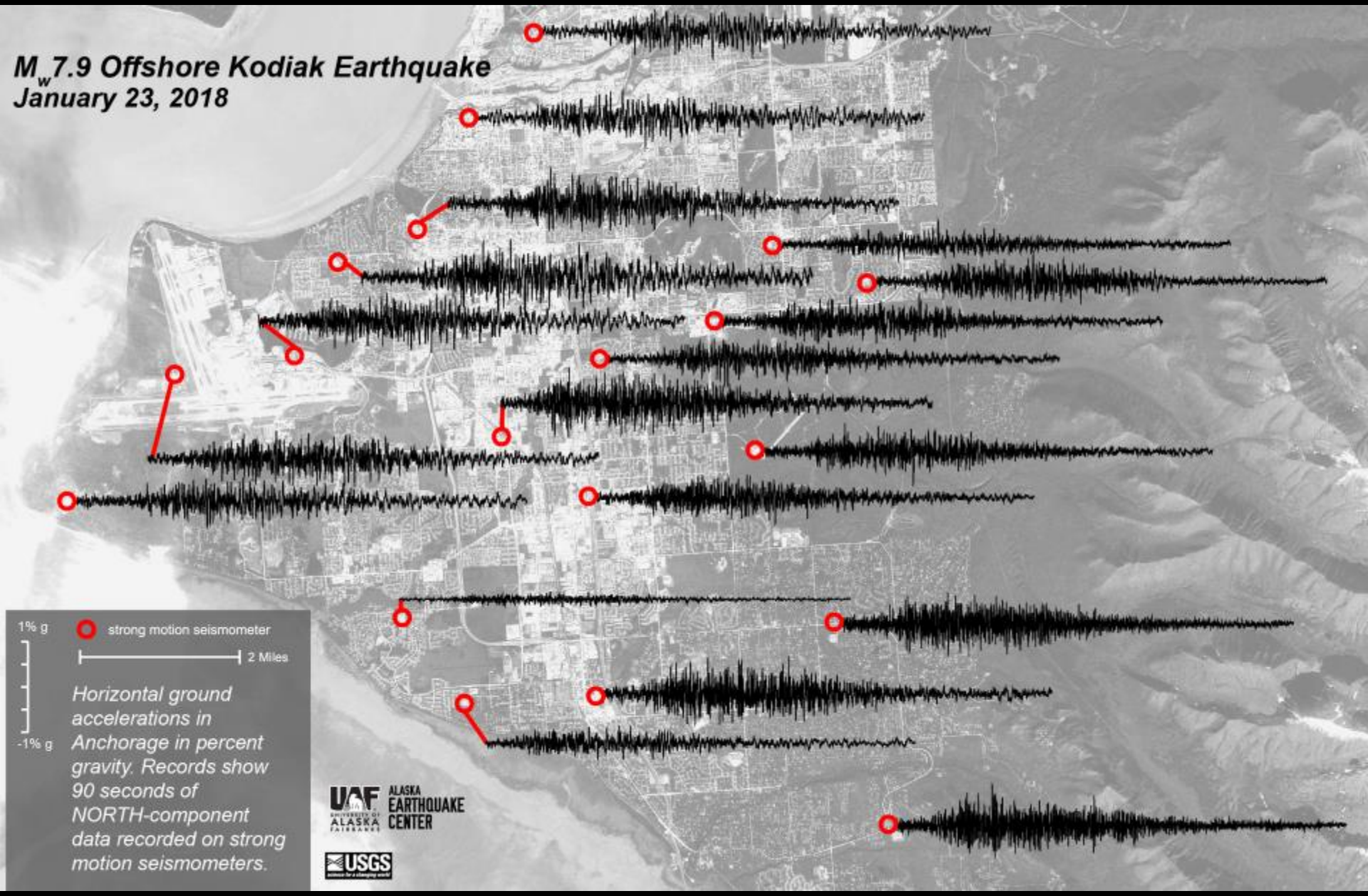
High frequency Active Auroral Research Program

GI Research Across the State



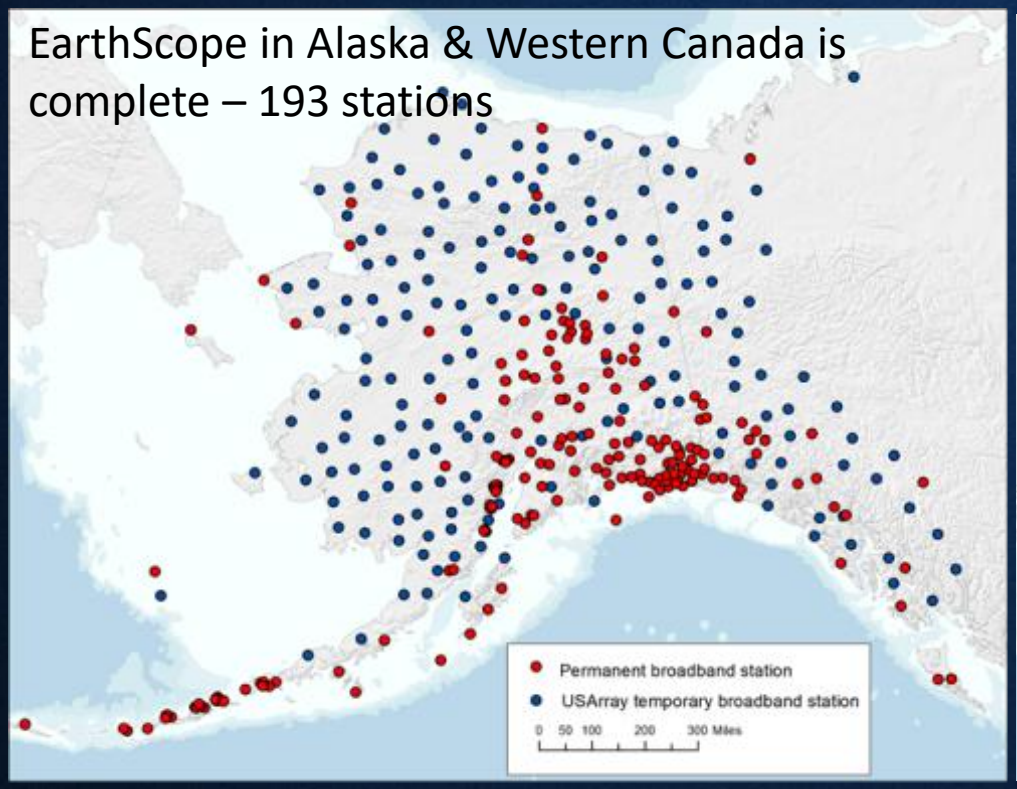
OPERATING IN ARCTIC EXTREMES

ground motion

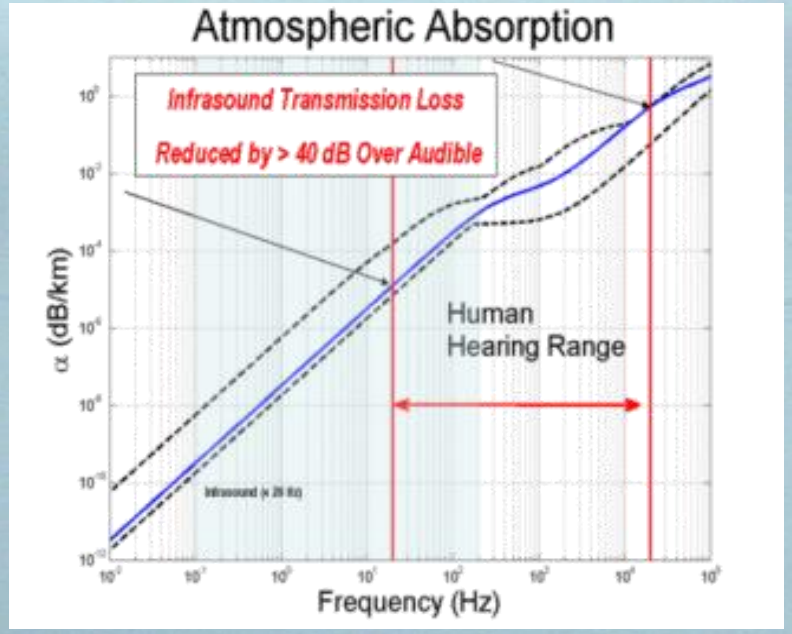


Alaska Earthquake Center (2017)

- Reported 43,000 earthquakes (new annual record)
- 50 earthquakes > M5, 6 > M6 (largest M6.7)
- Tsunami hazard maps published for 7 Alaska communities: Juneau, Kodiak, Sand Point, Chignik, Chenega, Unalaska and Akutan



Geophysical Detection of Nuclear Proliferation UARC



- **Remote Sensing of Natural Phenomena:**
  - **Volcanoes**
  - **Seismic Events**
  - **Lightning**
  - **Aurora**
- **Manmade Phenomena:**
  - **Nuclear Events**
  - **Explosions**
  - **Vehicles (cars, boats, planes, rockets)**
  - **Generators; Underground (mining) Activity**

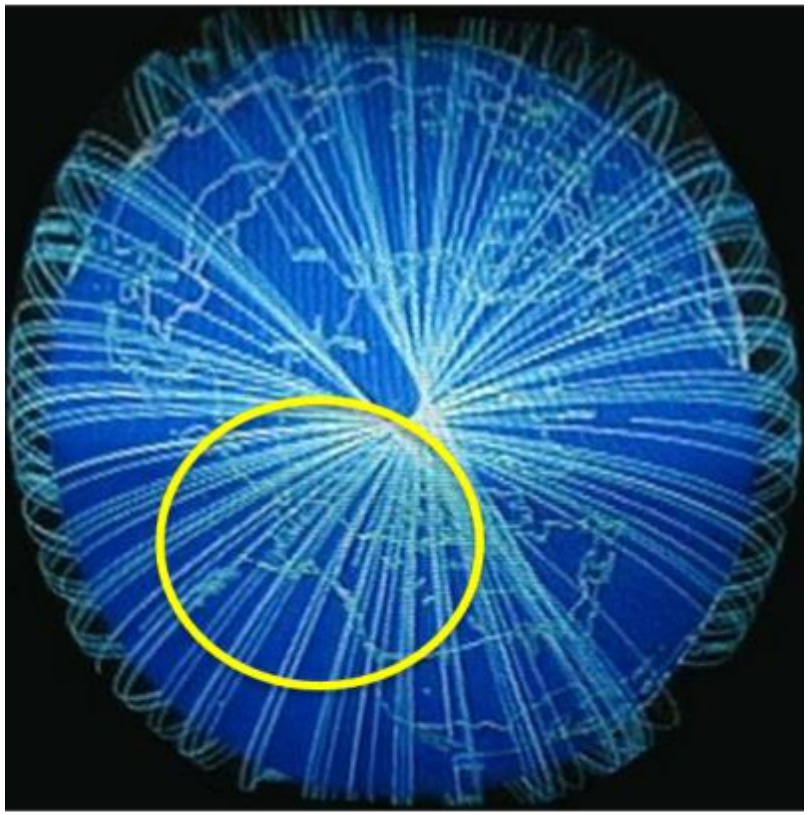
PERMAFROST 101

25% of Earth's land surface is permafrost

CLIMATE DRIVERS LEAD TO ENVIRONMENTAL EFFECTS

Alaska Satellite Facility

Polar Orbits



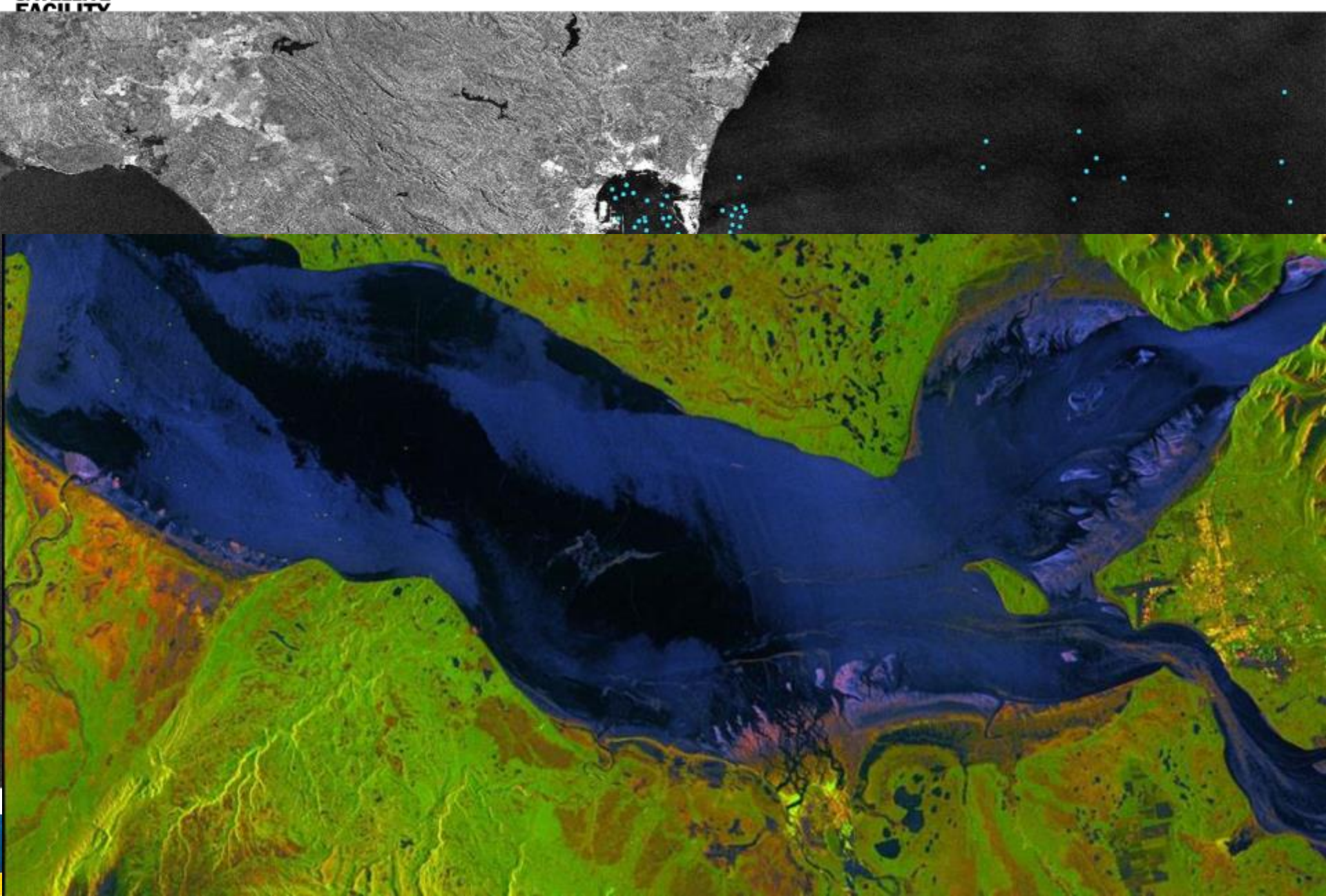
11/14 Orbits/day

F

orise

2 (9.1m)

Sentinel-1A Image



OVERVIEW

Unclassified Data Sources

- Commercial, Government (incl. NGA Source), Open Source, Scientific
- Satellite, Airborne, UAV, Terrestrial
- Imagery, DEMs, Vectors
- Social Media, OSINT

Fairbanks, AK

GeoNorth Information Systems

UAF ALASKA SATELLITE FACILITY

LOCKHEED MARTIN

Data Lake Rosetta:

- 100% automated
- Workflow management
- Data Aggregation and Normalization
- Facilitation of Analytics and Algorithm Development

Analytic Services

- Permanent civilian analyst staff
- Ready-to-go work environment
- Space for reservists to work side-by-side with Arctic SMEs
- Solve problems in related work environments
- Attracting new technology, analytic applications focused on machine learning and AI

DoD/Arctic Mission
NORTHCOM/ALCOM

Operational Support

- Search & Rescue
- Mission Planning
- Maintain/Update Foundation GEOINT (Maritime, Aeronautical, Topo, 2d/3d)
- GEOINT Services

Partner Ecosystem

Technology Development

- Algorithm Development
- New Sensor Evaluation
- Rapid Feedback/Intel Questions
- Commercial, Government, Open Source, Scientific

Domains

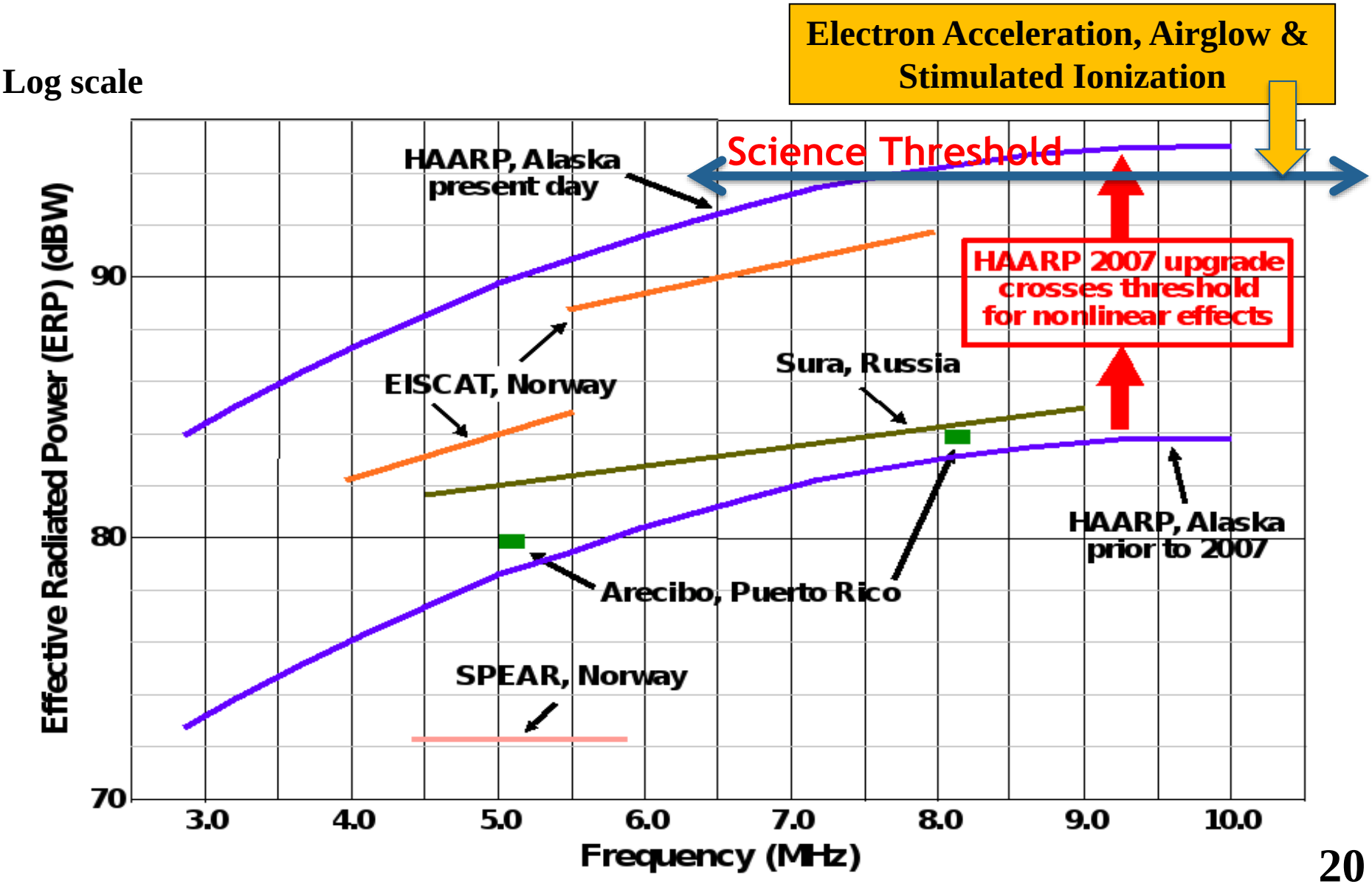
- Unclassified/Open Source
- Eventual inclusion into Classified Workflows (SIPR/JWICS)

Zayn Roohi

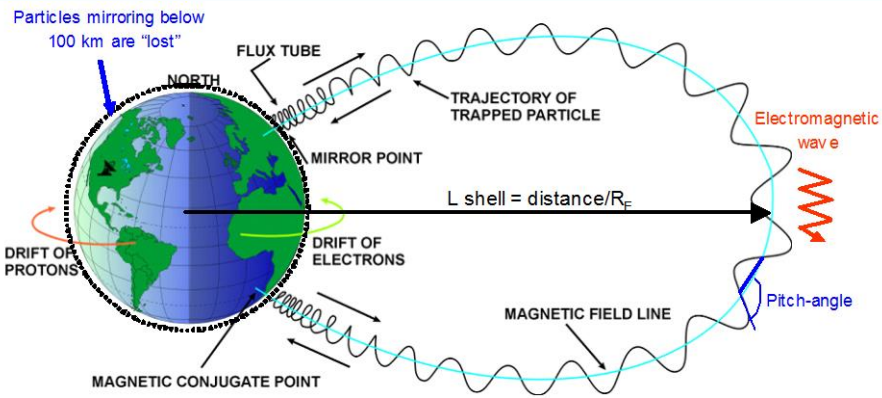
HAARP, Open for Business Under New Management

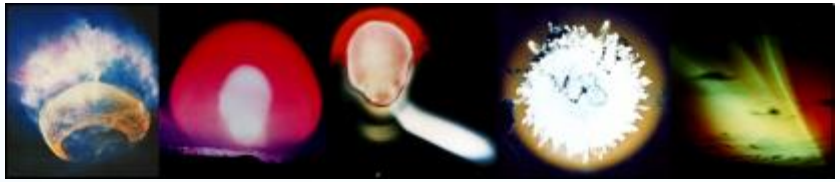
- Gakona AK - 62.39 deg, 145.15 deg (West)
- 33 acre phased HF transmitter array;
- 2.8 to 10 MHz;
- Multiple beams & transmission to 30 elevation angle
- 5 x 3600 hp diesel engines; 3.6 MW;
- $290M (half Congressional earmarks + half AFRL, ONR & DARPA)

HAARP Compared to EISCAT, Sura & Arecibo



Wave-Particle Interactions





Global Communication

Photo: Christopher Fallen/UAF

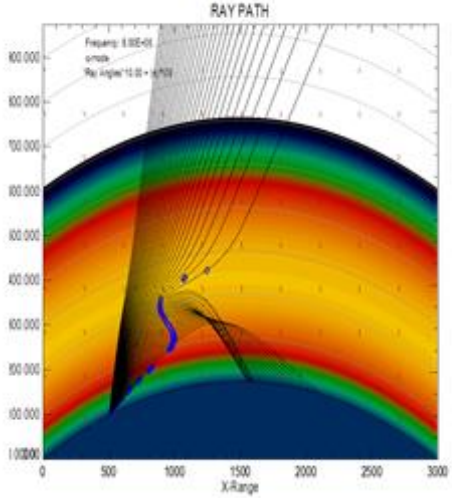
A UAF logo sent with HAARP received by an amateur radio operator in Victoria, B.C.

Photo: Christopher Fallen/UAF

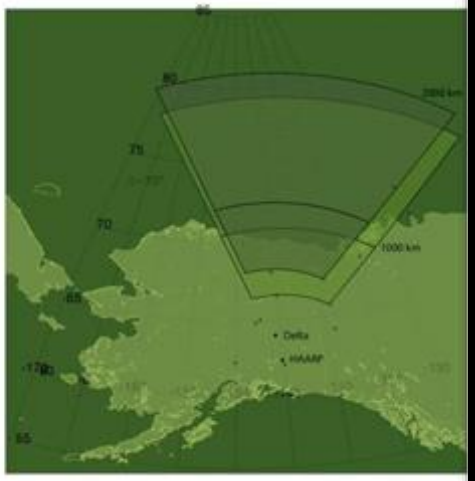
A UAF logo sent with HAARP received by an amateur radio operator in Victoria, B.C.

Over the Horizon Radar

8 MHz; Covers range of ~1100 km to ~1800 km from radar



Offset of transmitter and receiver location; 2000 km range translates to about 80° latitude

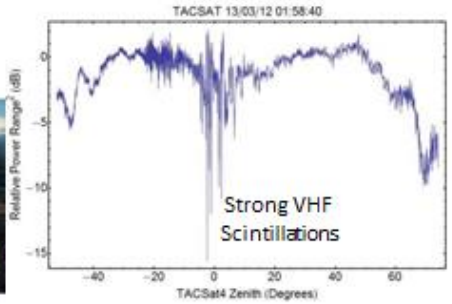


Ionospheric Effects on Comms/Nav

COMMX Working with HAARP

TACSat4 Actively Pointed to Ground Receiver

Courtesy Paul Bernhardt NRL

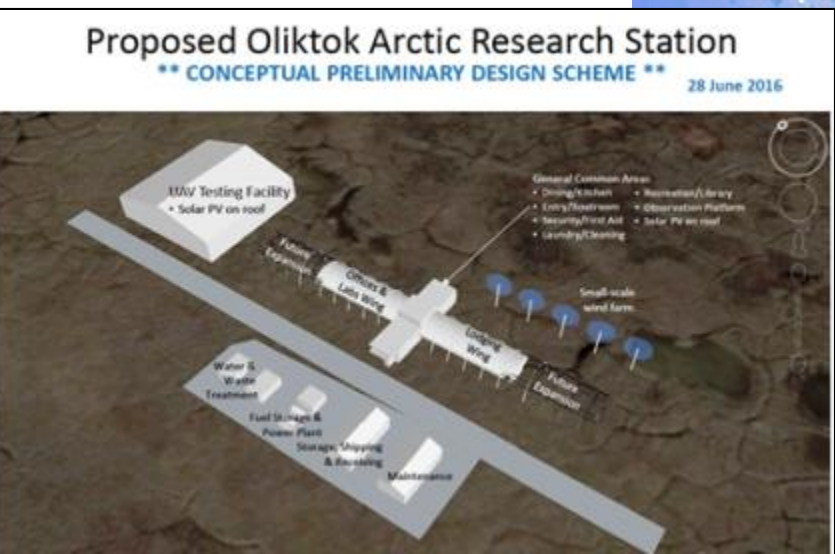


Alaska Center for UAS Integration

- Flights: 171 hours 350 operations over 180 days this year
- New Griffon Aerospace record for altitude (15,000’ with SeaHunter)
- Beyond visual line of sight in Canada
- NASA UAS Traffic Management Campaigns
- River Watch in Circle Alaska

Oliktok Point Research Station

UAF & Sandia National Laboratories



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