Operations in Harsh Environments

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What is ACUASI?

- ACUASI is the University of Alaska's unmanned aircraft system (UAS) research program
- ACUASI is a key partner in the Federal Aviation Administration's Center of Excellence for UAS (ASSURE)
- ACUASI leads the Pan-Pacific UAS Test Range Complex, one of the seven FAA UAS Test Sites

ACUASI's Polar Role

ACUASI, in conjunction with the other experts at the University of Alaska Fairbanks, is playing a key role in applying UAS technology to polar, especially arctic, research

The University's expertise is being applied to protect the environment of the Arctic and Antarctic as activity increases in the regions

Therefore, we fly in harsh and remote environments

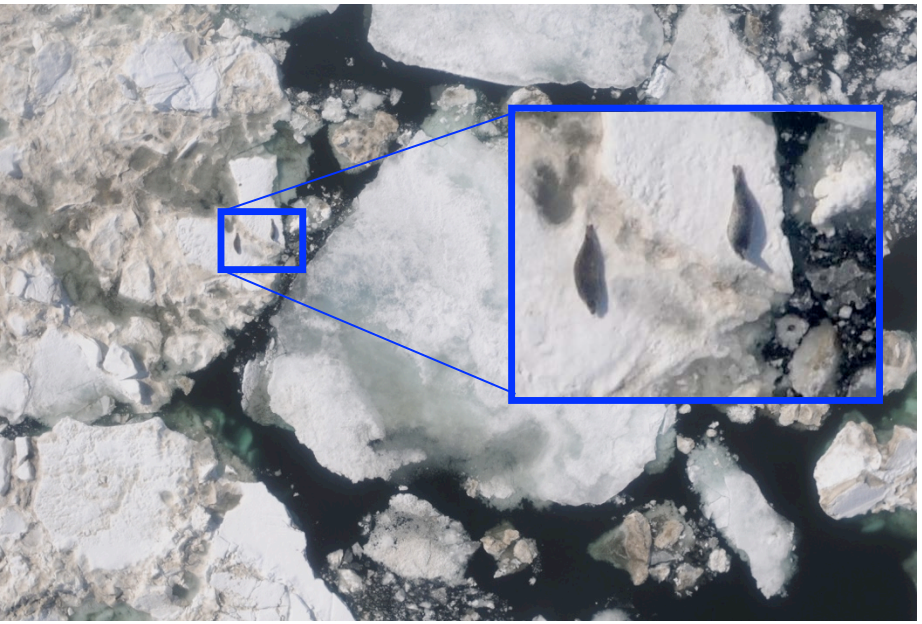
UAF's Unmanned Aircraft History

- 2001 - Partnership with New Mexico State University
  - Developed applications for the Technical Analysis & Applications Center (TAAC)
- 2003/2004 - Funded to work with USAF and USCG
  - Maritime domain awareness
  - Wildfires in the Interior of Alaska
- 2006 – Acquired first ScanEagle
- 2007 to present - Multiple missions for science, emergency response, humanitarian needs, and engineering and policy development
- 2012 - Alaska legislature funded $5M to grow program & pursue FAA Site
- 2013 – Selected as one of the six FAA test sites
- 2015 – Core member of FAA COE
  - Lead on Maritime w/MSU
  - Part of NASA's UTM project

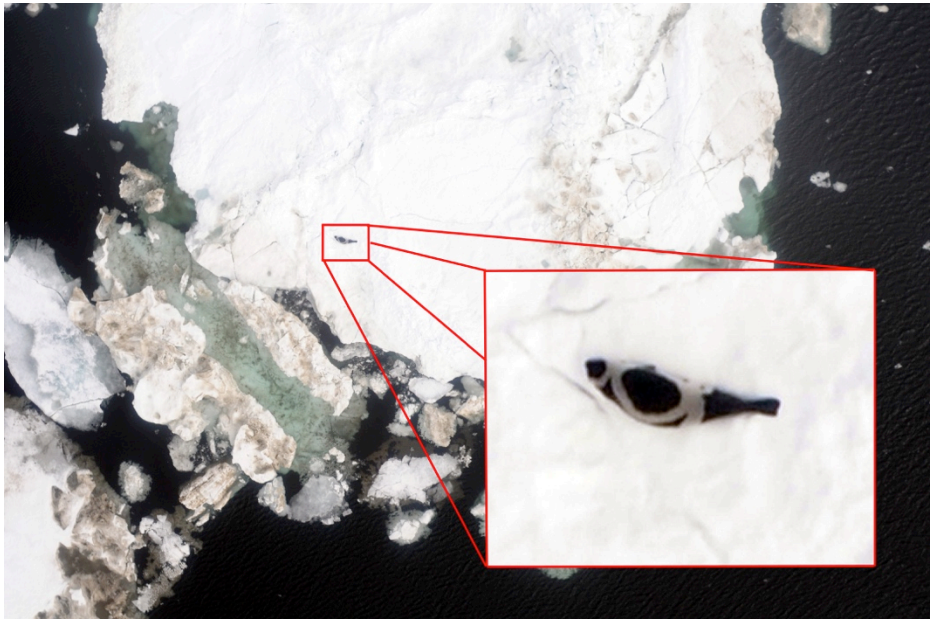
First UAF Launch

Ice Seal Survey – Bering Sea 2009

Ice Seal Survey



500 ft AGL



400 ft AGL

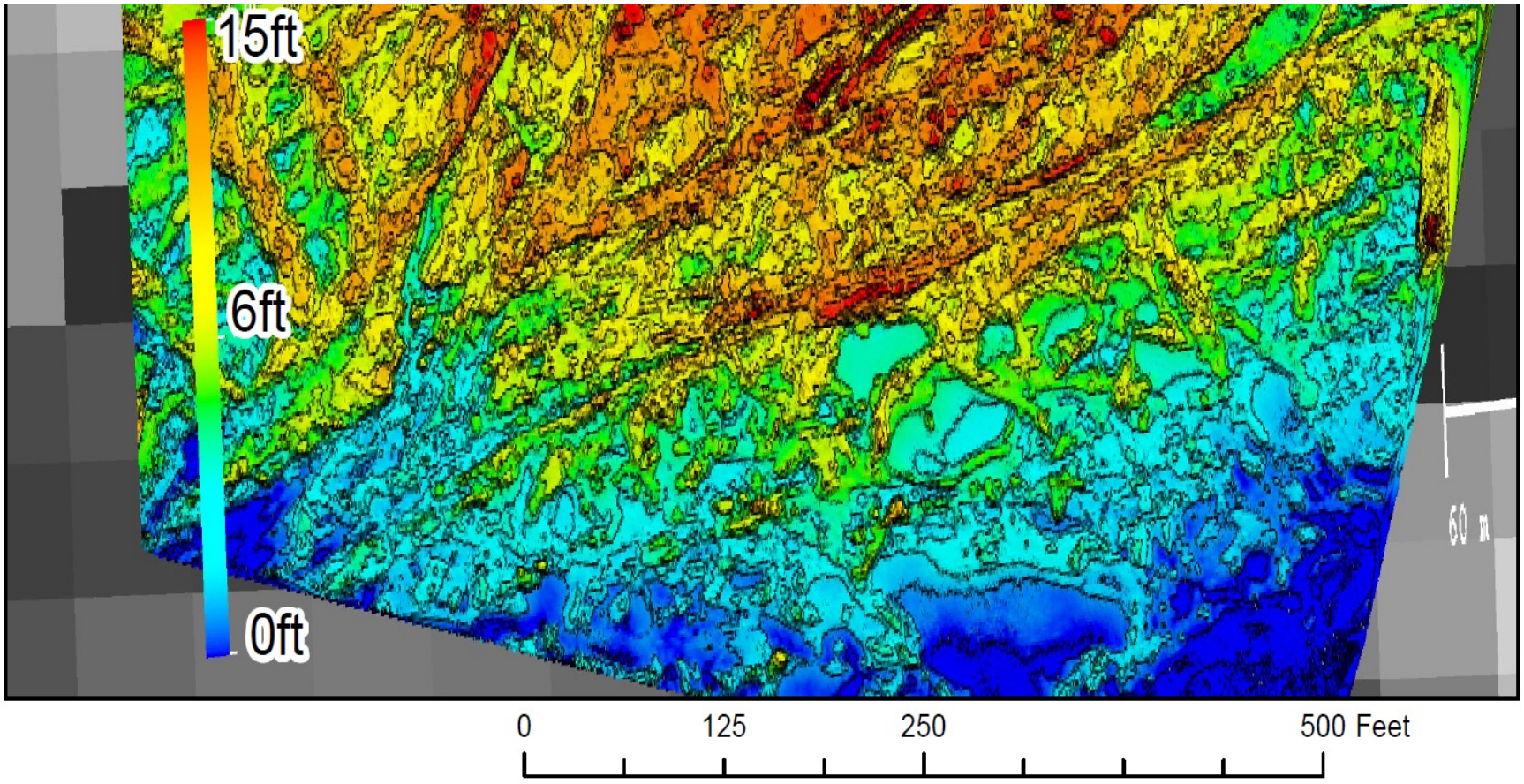
Relaxed spotted and ribbon seals
(more accurate count potential than manned aircraft)

Sea Ice Survey – Barrow (April 2015)

"Ptarmigan" UAS was used to capture ice ridge data

Previously, technology providing reduced quality imagery had been relied on to break ice trails

Sea Ice Survey - Barrow



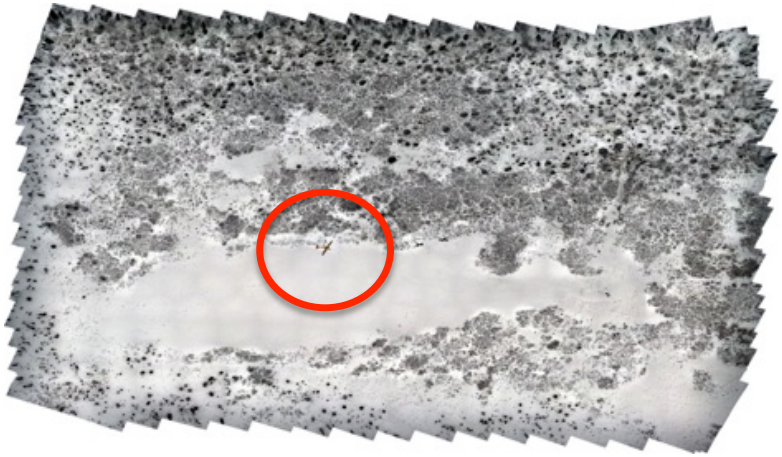
Data from the Sea Ice Survey was shared with the community. Mapped ice ridges define the area for ease of determining the best route for an ice trail for whale hunting.

Bear Bite – Search and Rescue Exercise (SAREX) Mass Casualty Exercise

"An aircraft crashed in the tundra roughly 20 miles outside Bethel Alaska many died with some survivors"

Deployed two unmanned aircraft systems with support team

Coordinated with manned aviation on the scene

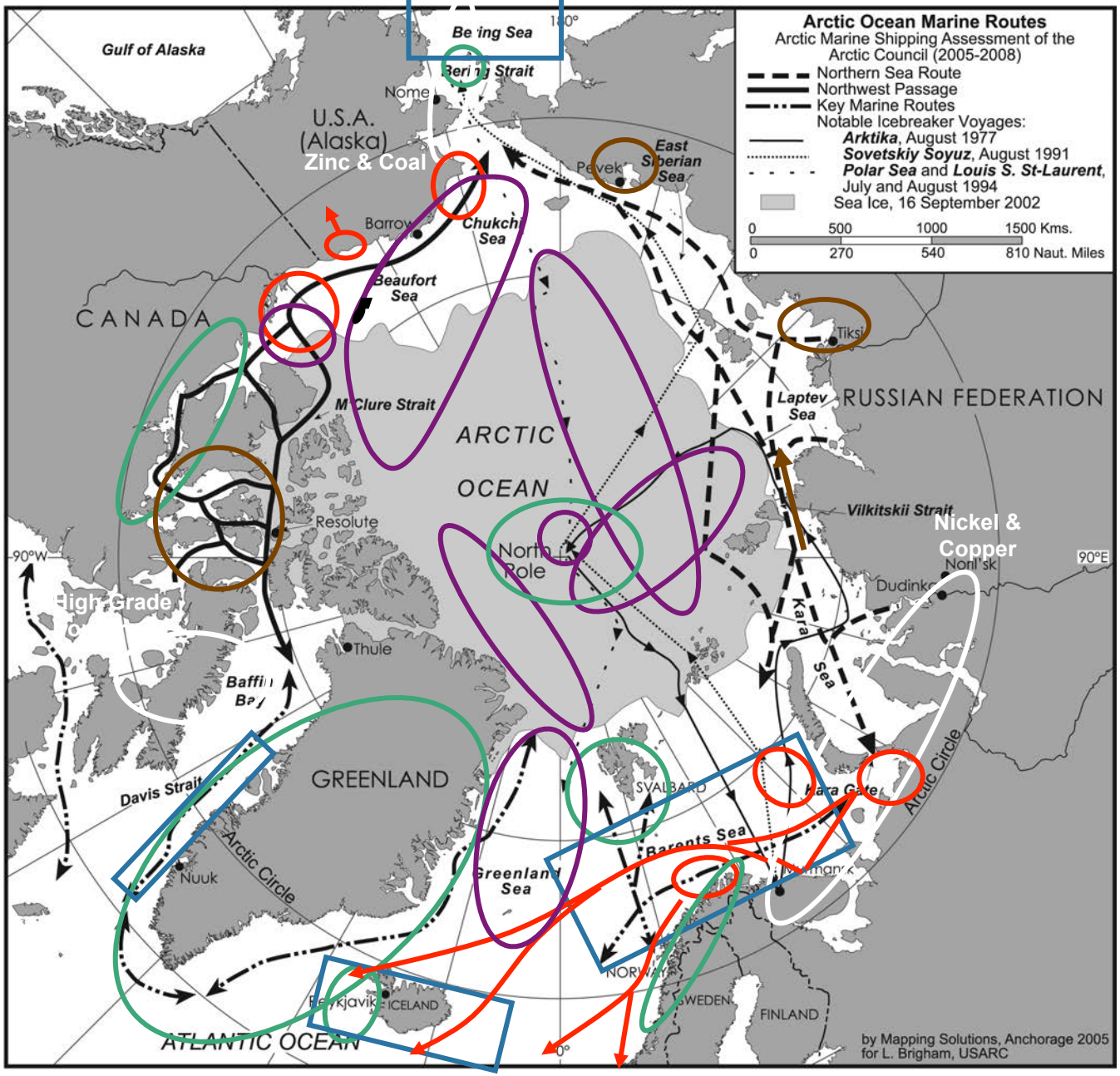


Mission:

- Map scene for event documentation
- Real-time SAR response
- Thermally identify casualties in deep snow

Cold weather operations: -35 F

Todays Arctic Marine Use



- Hard Minerals
- Marine Tourism
- Key Fisheries
- Oil & Gas
- Summer Sealift
- Exploration/Science

Challenges of Flying under Harsh or Remote Conditions

- Icing of airframes and payloads
- Exposed pilots and observers
- Expensive logistics
- Beyond-visual-line-of-sight permitting
- Winds
- Cold
- Polar bears
- Significant manned aircraft activity in surprising areas

- Lack of hardware stores
- Poor communications
- Ships that do not stop

Cold and Other Challenges

- Battery life is significantly degraded
- Aviation gas pollution
- Plastics break
- Wood glue (need I say more?)
- Navigation is difficult (GPS is a problem)
- Vessels may jam UAS frequencies
- Crashes may occur in sensitive areas
  - Environmental or historical damage
- Not always possible to get the UAS back
- Expensive logistics
- Etc.

How Do You Successfully Fly?

- Practice, practice, practice
- Many operators would like to take a commercial off the shelf (COTS) system and fly it under extreme conditions, with no experience operating it under those conditions
  - Don't do it! This will lead to accidents
- Modify your aircraft and SOPs
- Practice

Modify your Aircraft

Counter-rotating propellers, heated pitot tubes, fuel injected engines, battery-warmers, and insulation

New auto pilot and control station for communication via satellite over oceans

Harsh Environments UAS Summary

- UAS ideal for dirty, dull, and dangerous operations in harsh and remote environments
- Systems need to be hardened for extreme cold and icing conditions
- Communication between practitioners will be essential for determining best practices

Questions?