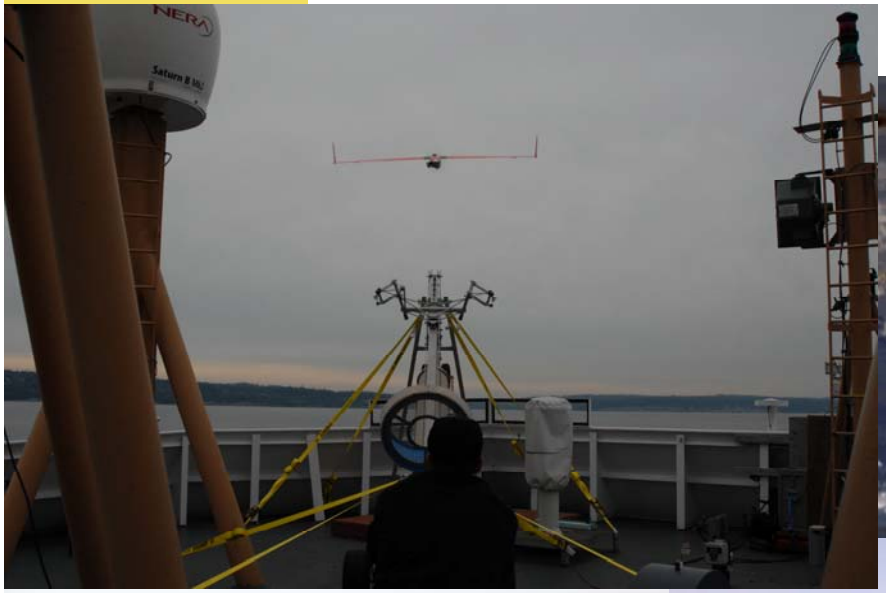
Maritime Unmanned Aircraft Experiences



Alaska Projects
System Capabilities
Experiences

UNIVERSITY OF ALASKA FAIRBANKS

Unmanned Aircraft Program Mission Objective

The technology exists -
We are researching how to use the tools.

A research center for small, unmanned aircraft systems providing integration of unique payloads and supporting pathfinder missions within government and science communities, with a special emphasis on the arctic region.

MQ-1 Predator - US Coast Guard

Logistics and Maritime Domain Awareness Project

UNIVERSITY OF ALASKA FAIRBANKS

2003 USCG / US Navy / NASA Venture

Cost Factors to Consider

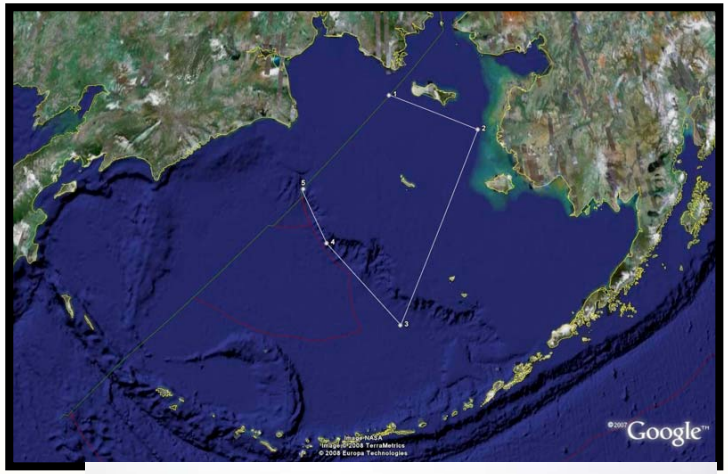
- Single Engine Manned Aircraft
  - $350/hour
  - Limited mission preparation time necessary

- Unmanned Aircraft
  - Pre-mission preparation
  - Limited airspace accessibility

The University is focusing on evaluating unmanned system operations and identifying hurdles for a new capability to become a financially feasible enterprise.

Ice Seal Population Study

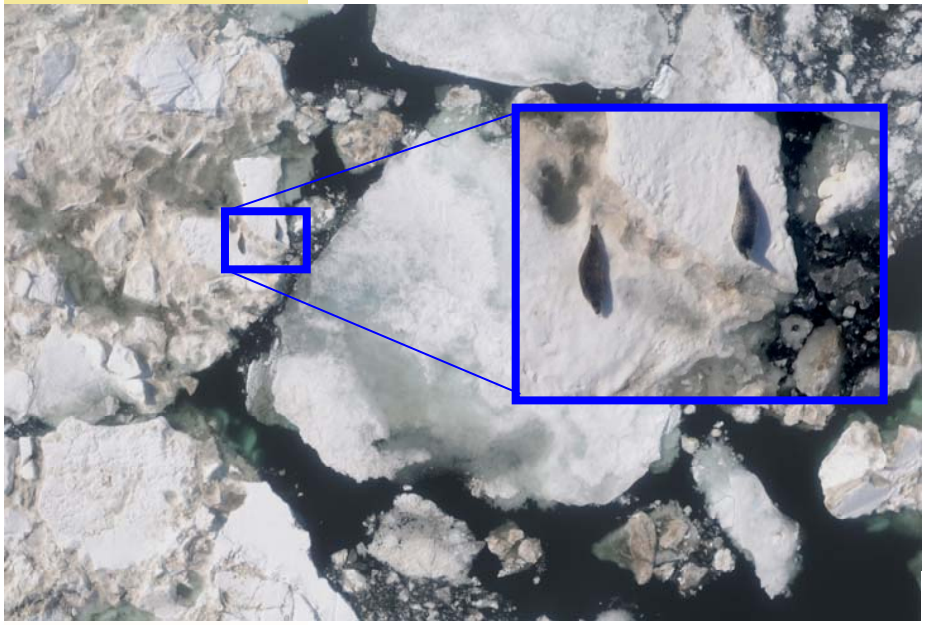
- **Scientific Need**
  - Marine Mammal Protection Act mandates
- **Relevance**
  - Are Unmanned Aircraft capable of large-scale, systematic ship-based survey?
- **Strategy**
  - Evaluate ship-based unmanned aircraft
- **Outcome**
  - Safer (than manned aviation over Bering Sea) and
  - More effective (they do not startle seals)
  - vs. manned fixed wing operations from shore
  - vs. helicopter operations from ice breakers
- **UAF performed technical execution**
- **NOAA conducted the science**



Ice Seal Survey – Bering Sea

Example Data Products

From University Built High Resolution Payload



500 ft AGL

400 ft AGL

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

Shoreline Clean-up Assessment Technique (SCAT) Evaluation

High Arctic Ship Piloting Experiments

Aboard the Canadian Cutter LOUIS S. ST. LAURENT

UNIVERSITY OF ALASKA FAIRBANKS

Phase I Research conducted by Capt. Stephen Wackowski (USAF)

Navigating Sea Ice During The Nome Fuel Delivery

University Engagement and Decision Support

1. Identify potential safety concerns for those working on the ice
2. Document the site for mission response activity
3. Collect imagery for the USCG Public Affairs Officer
   - to help satisfy the press' interest
   - reduce the potential for independent activities on the ice

Identified Potential Safety Concerns For Those Working on The Ice

This mosaic of the Renda shows the fuel headers landed on the port side of the ship marked with an orange dye

Image of harbor from height of CGC Healy Bridge

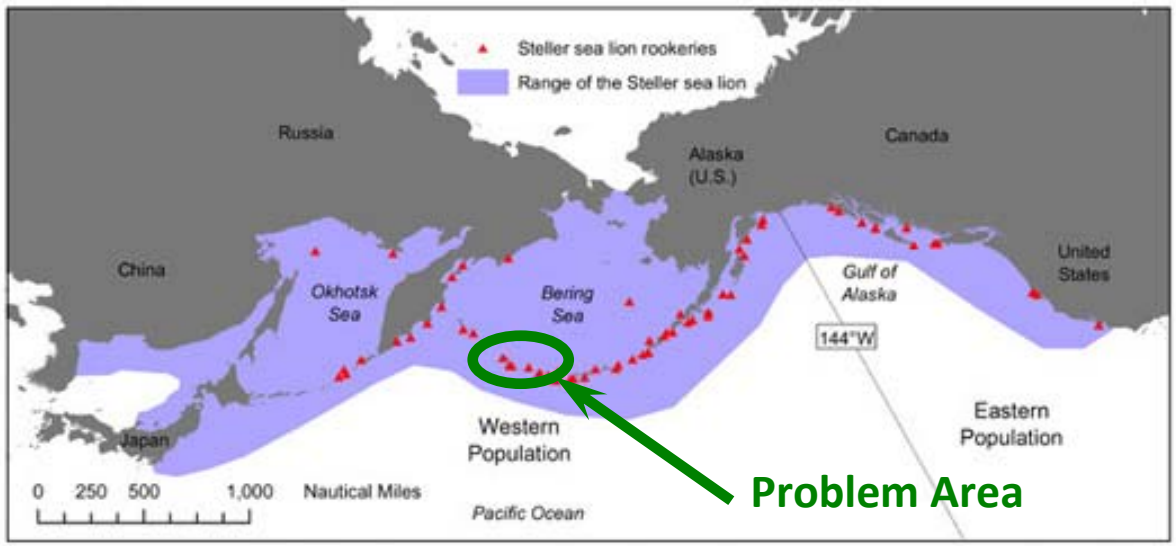
Nome 2012 Winter Fuel Delivery

Augmenting Steller Sea Lion Surveys
Western Aleutians

Problem: Biological opinion, based on few observations, eliminated a commercial fishery

Goal: Demonstrate a method to collect high quality imagery for population surveys in hard to observe areas

Possible Benefit: Improved understanding of animal use of and movement throughout their habitat



ALASKA FAIRBANKS

Steller Sea Lion Habitat Monitoring

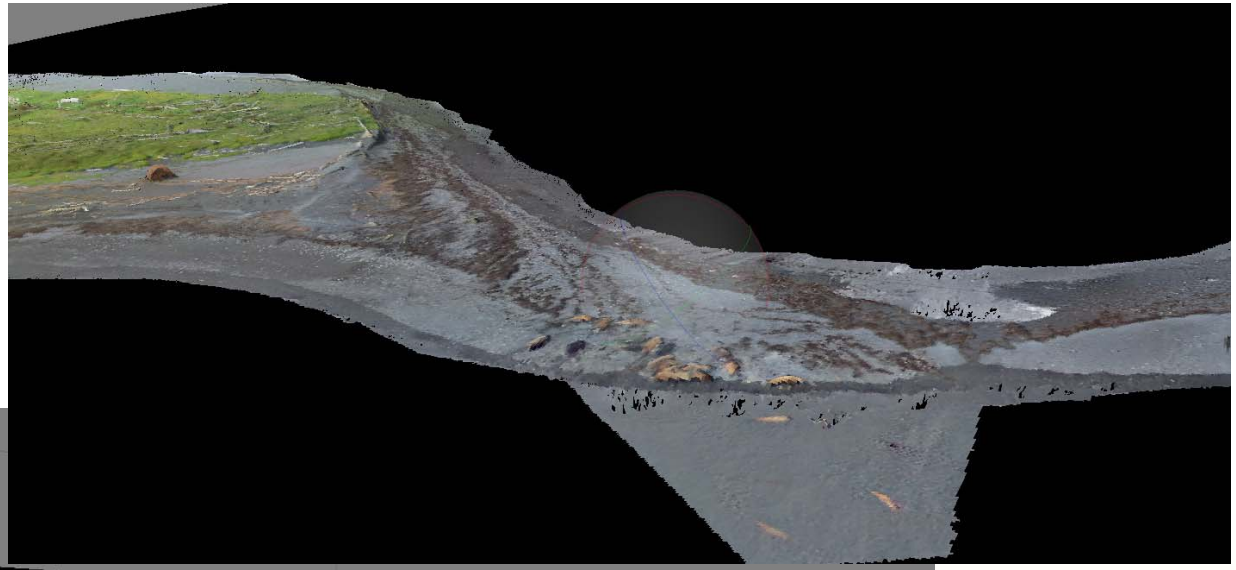
Prototyping Con-Op's – June 2011
Extended Deployment – March 2012

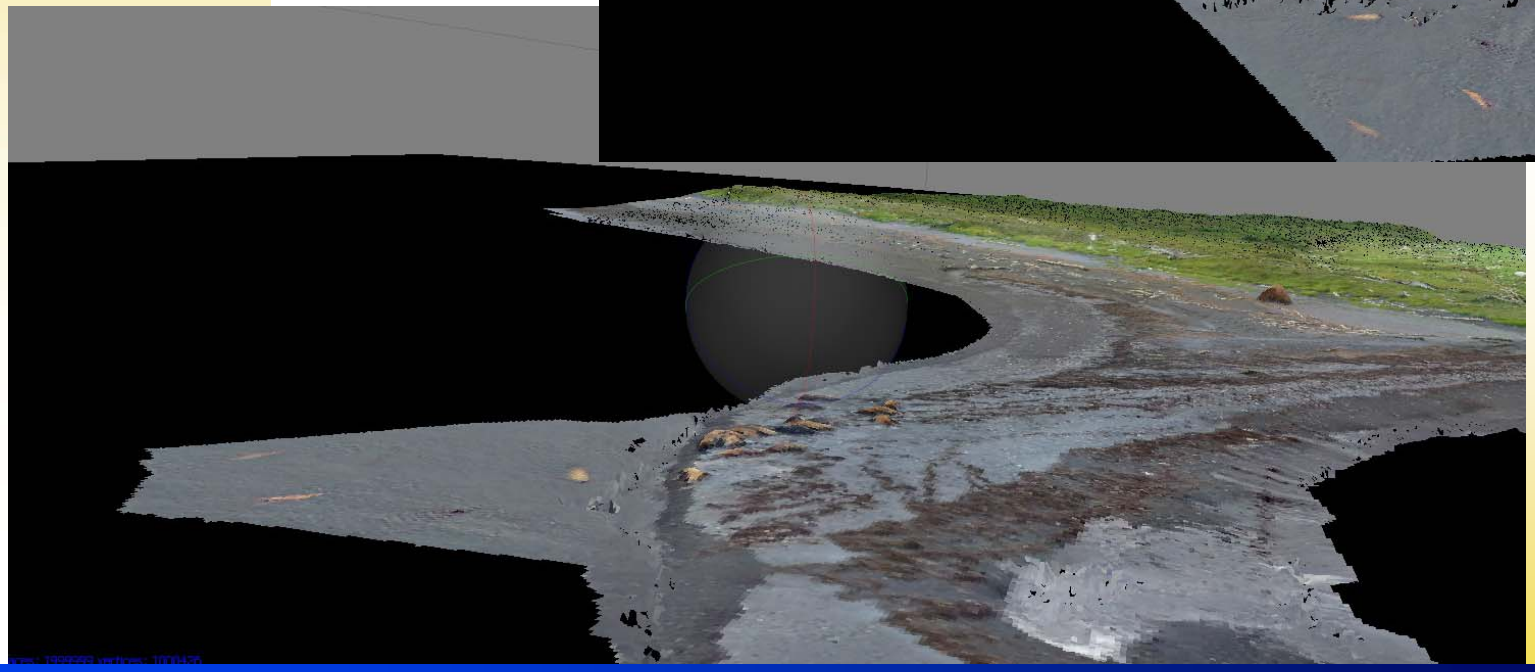
UAS Survey of Marine Debris Generated by 2011 Japanese Tsunami

PI: William Pichel – NOAA/NESDIS/Center for Satellite Applications and Research

Island Coast 3-Dimensional Imagery

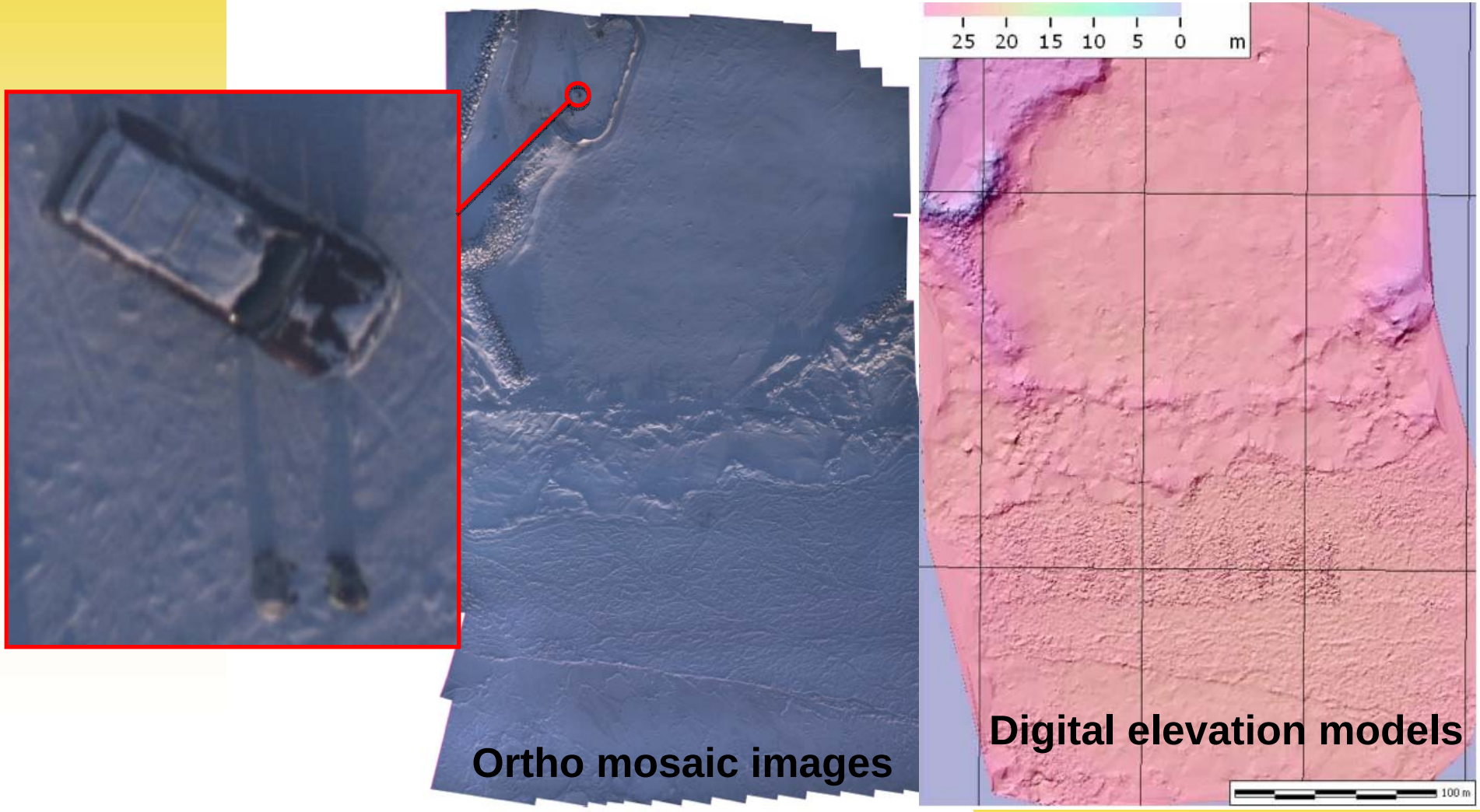
Steller sea lion haulout on Ugak Island SE of Kodiak





Sea Ice 3-Dimensional Imagery

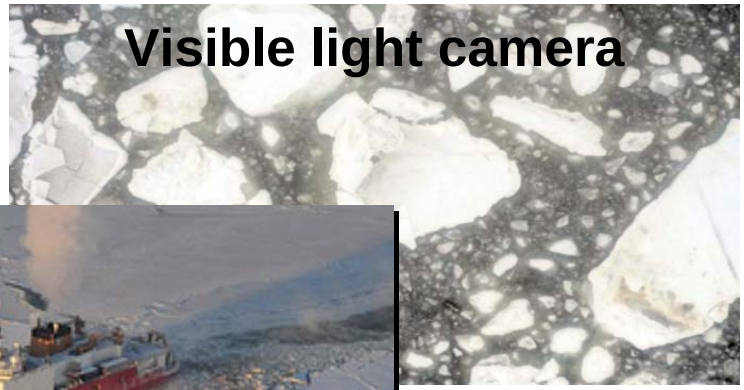
Nome 2012

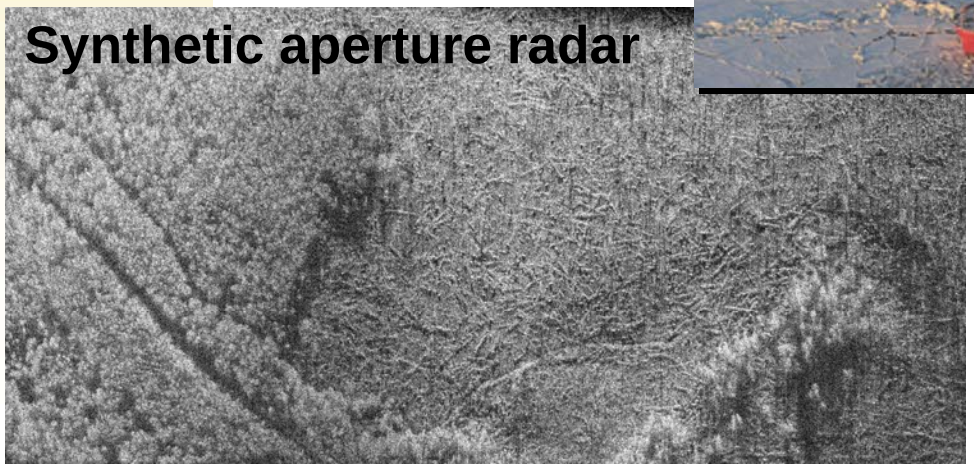


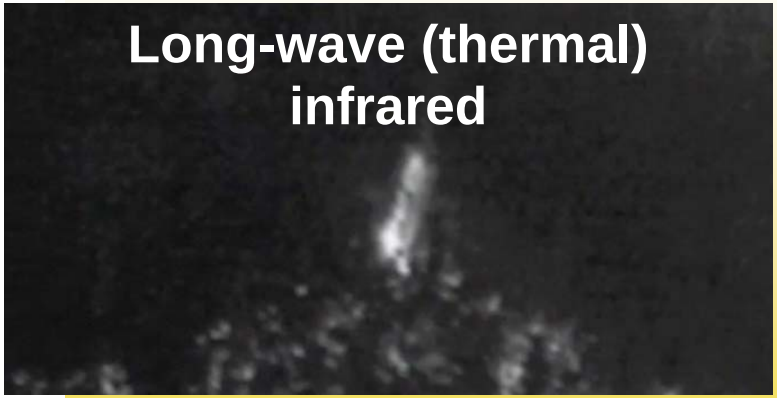
Sea Ice Studies

Ship Based - DHS/USCG
Shore Based - NASA/NOAA

- **Dedicated Ship Ice Piloting**
- **Satellite Imagery Improvement**
- **Sea Ice Studies**

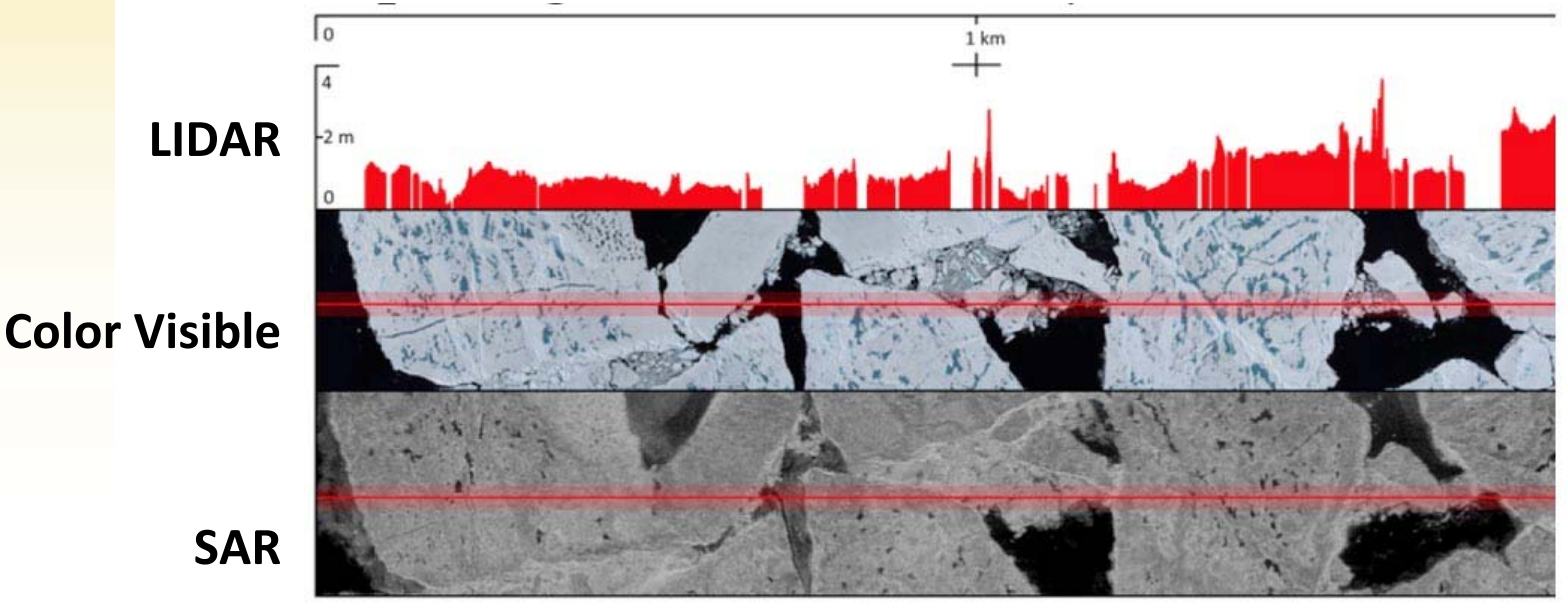






Ice Profiling LIDAR

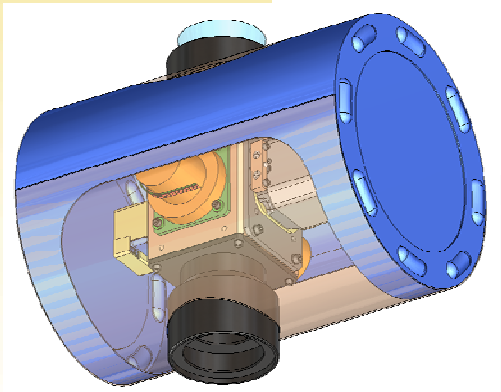
Technology deployed by NASA in Greenland and Svalbard Norway now readied for UAF ScanEagle

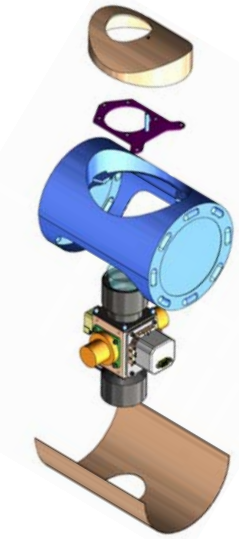


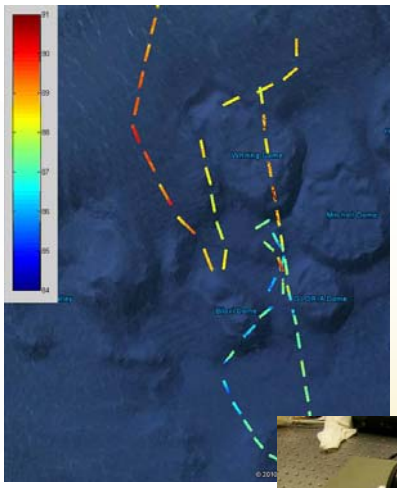
Sea Surface Temperature Measuring

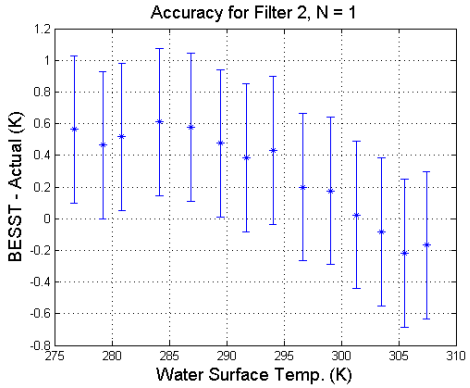
Ball Experimental Sea Surface Temperature (BESST) Radiometer

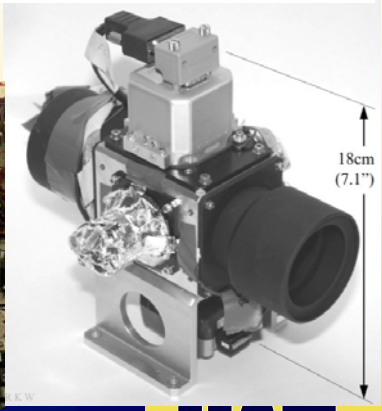
Goal: Calibrated skin SST radiometer
Packaged for a small-unmanned aircraft
Survey ocean temperatures worldwide in various seasons
Survey an area and not just a transect line







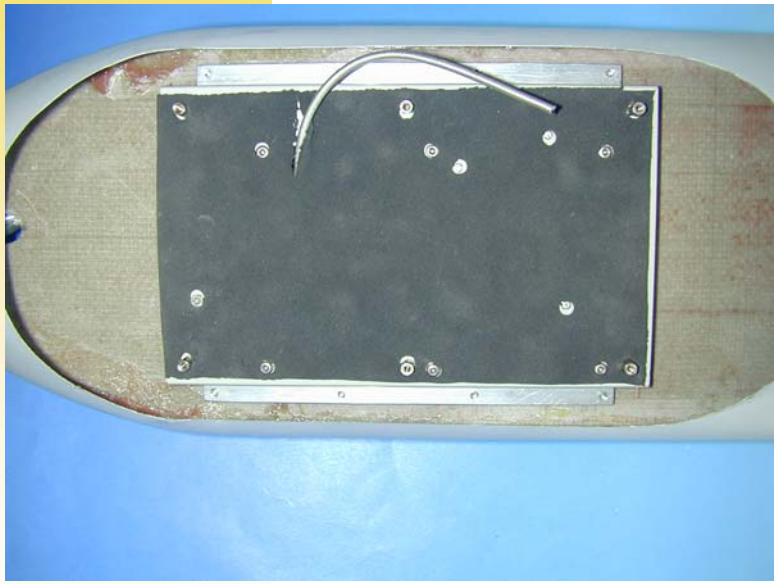




Partnerships with:

- **Ball Aerospace**
- **University of Colorado**

Surface Conductivity
ARIEL - Airborne L-Band Radiometer



Departament de Teoria del Senyal i Comunicacions

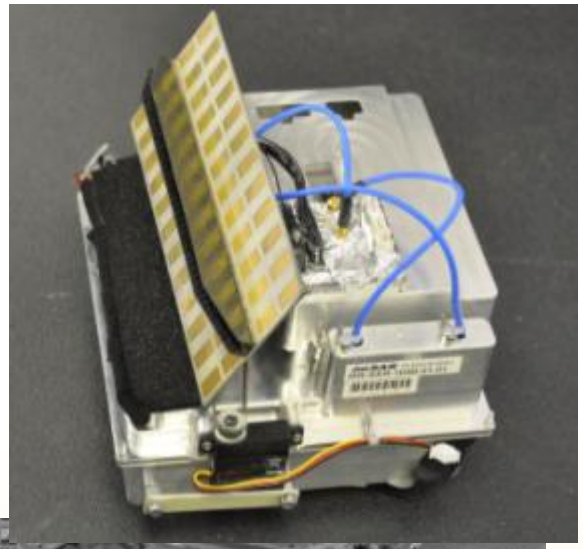
UNIVERSITAT POLITÈCNICA DE CATALUNYA

Barcelona, Spain

UNIVERSITY OF ALASKA FAIRBANKS

Miniature Synthetic Aperture Radar

- Real-time *High Resolution Digital* Imagery at Ground Processor
- 3.5 lbs, 30 W Full System
- 0.3, 0.5, 1, 2, 5 m resolutions
- Coherent Change Detection
- Geo-Location < 10 cm



Small UAS Training/Development

~160 Ravens

- Modified into ***OPEN RAVEN X*** aircraft
- Cyberphysical systems training
- Education & outreach opportunities

iPASS

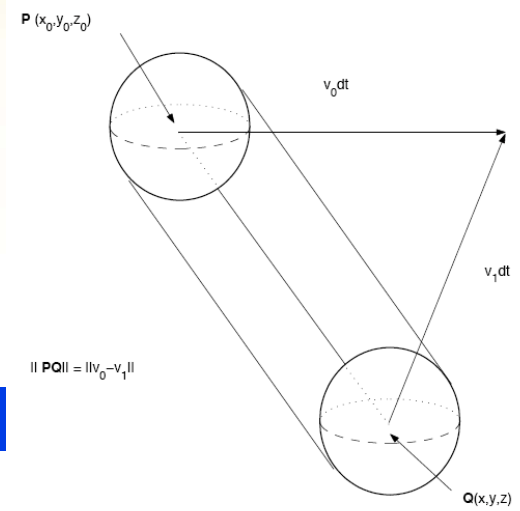
UAF's Portable Airspace Surveillance System

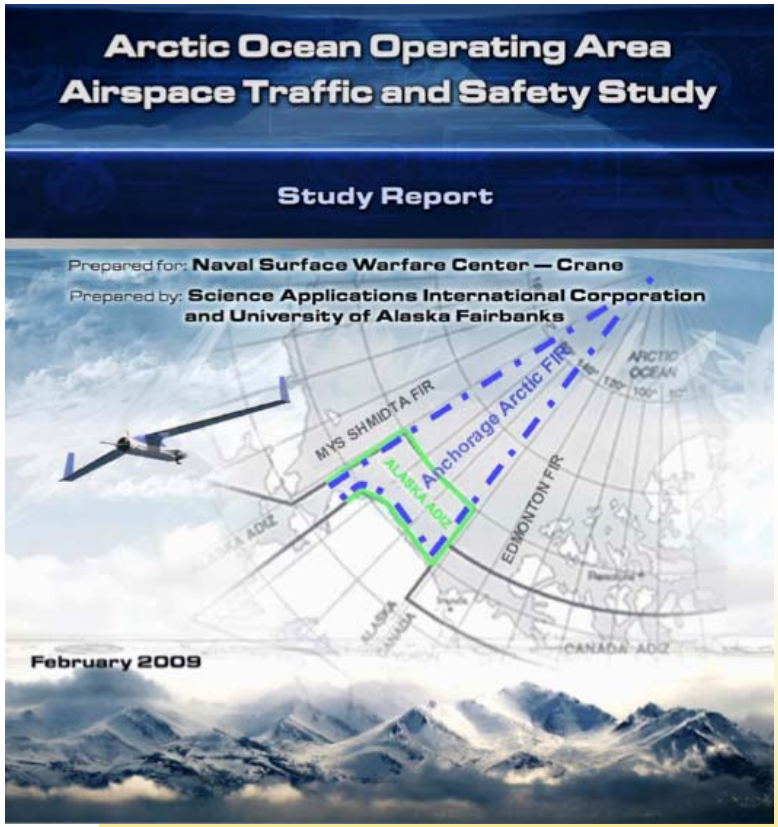
Designed and built by UAF for Alaska's airspace monitoring needs

Airspace Use Studies

A Key To Understanding Aviation Safety

- **Extensive study of aviation traffic within the Arctic Ocean and Bering Sea**
- **Necessary to validate aviation hazards models**
- **Mathematical Based Methods**





2012 FAA Modernization and Reform Act

Unmanned Aircraft Language – Permanent Arctic

"***permanent area in the Arctic where small unmanned aircraft may operate 24 hours per day for research and commercial purposes below 2,000 feet in altitude***"

Calls for a process by August 14, 2012 to facilitate safe operations over water within all the areas identified, not a single geographical location

The University is helping the FAA UAS Integration Office develop this process

2012 FAA Modernization and Reform Act

Unmanned Aircraft Language – Six Test Ranges

"*… to integrate unmanned aircraft systems into the national airspace… to provide for verification of the safety of unmanned aircraft systems and related navigation procedures…In determining the location the Administrator shall (A) take into consideration* ***geographic and climatic diversity****; (B) take into consideration the location of ground infrastructure and* ***research needs***".

- Alaska will **extend** the University pilot program with the FAA
- Alaska will **compete** for one of the six FAA test ranges.
- The University of Alaska will **lead** the Alaska team
- Alaska is investigating **partnering** with Hawaii
- Looking for suitable locations where need exists in Hawaii

Questions/Comments?