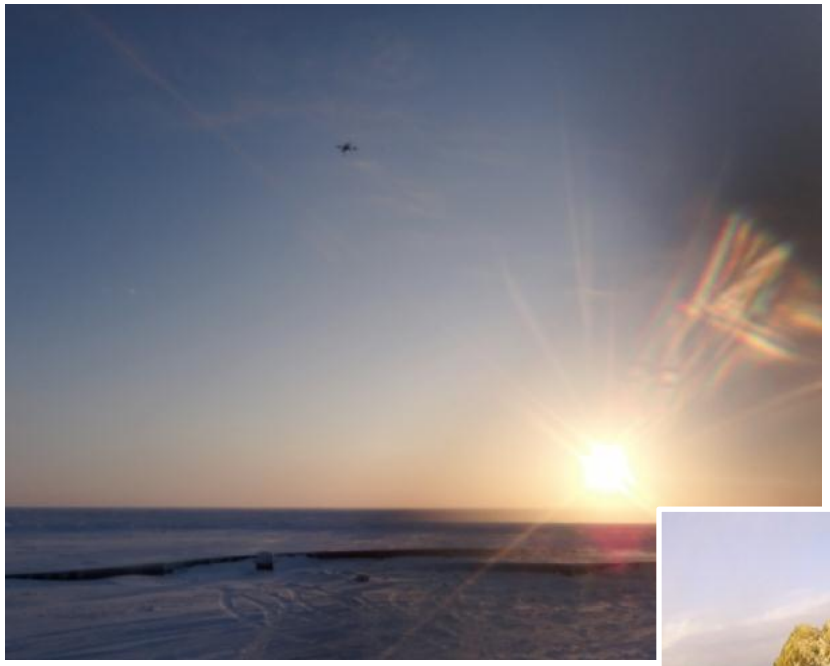
Unmanned Aircraft Systems for Alaska



Ro Bailey
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Alaska Center for Unmanned Aircraft Systems Integration
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Roadmap

- University of Alaska UAS history
  - Vision, mission, why unmanned
- Projects & why they matter to Alaska
  - Economic value
  - Science, engineering, & safety value
- FAA Test Site Proposal
- What about privacy? Law Enforcement?
- House Concurrent Resolution No. 6

UAF's History of Unmanned Aircraft

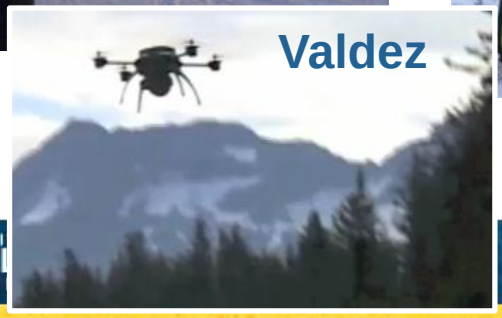
First UAF Launch

- 2001 - Partnership with New Mexico State University
  - Tasked to develop applications within the Technical Analysis and 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 with 50% loan from University Foundation
- 2007 to present - Multiple missions for science, emergency response, humanitarian needs, and engineering development
- Today our unmanned aircraft fleet is diverse and growing
  - Existing fixed wing systems
  - Existing rotor systems
  - Developing new systems

Altair "*Mariner*" Alaska July 2004

Meeting Alaska's Needs

- Research
  - Science
  - Engineering
- Public Safety / Emergency Response
- Natural Resource Management



Value to Alaska

- UAF alone has brought in over $4.5 M
- Technology
  - Three small company start-ups since 2010
  - Two aerospace companies opened/opening offices in Fairbanks—one is ARTIC, or Atkinson Robotics and Technology Integration Corporation
  - Both Alaskan and Outside companies partnering with UAF to pursue FAA Test Site
- Value to Alaska business
  - Fish & game management & protection
  - Support oil industry, mining, fisheries, others

Economic Impact in Alaska

Before Expected Impact of a Test Range Designation

Northern Embedded Solutions

Alaska-based development partners

Expected Value

- Value to Alaska
  - Better deploy wildfire fighters
  - Support disaster response
  - Assess/protect transportation routes—e.g., monitor slopes
  - Search & rescue in remote areas
  - High resolution mapping
  - Infrastructure monitoring
  - Oil spill response & monitoring
  - Counter unilateral Federal decisions with facts
  - River monitoring during breakup

Why Unmanned?

- Risky work: over remote, extreme terrain or unreachable locations in volatile weather conditions
  - Nov 1999: Helicopter crashed, two Nez Perce biologists conducting surveys seriously injured
  - Polar & distant maritime locations
- Dirty work: observations over chemical spills, volcanoes, wildfire smoke
- Dull: capturing thousands of photos to process into 3D maps is boring, repetitive work
- Other means not possible
  - Monitoring sea ice from under 1000 ft
  - Flying through volcanic ash plumes

What Alaska Offers

- Vast open airspace with little traffic
- Wild, extreme, unpopulated, diverse terrain
- Access to large military ranges with data gathering ability
- History of pioneering aviation technology
- Culture of innovative use of aviation
- Close relationship with regional FAA
- Perhaps most important, willingness to be thoughtful and methodical in potential policy decisions

Vision

Develop, test, and ultimately exploit emerging unmanned aircraft technology and its uses to create a positive economic and social benefit within the State of Alaska.

When the cost of the hardware is no longer a factor what will people do with the capability?

- **Plan today to prepare for the future**
- **Develop what is needed to support**
- **Participate in policy development for benefit and protection of Alaska & the nation**

Mission Statement

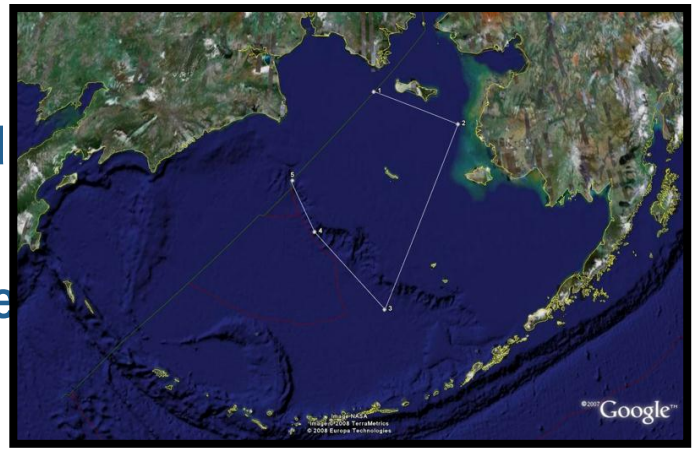
A research center for small, unmanned aircraft systems providing integration of unique payloads and supporting pathfinder missions within government and science communities, with a special emphasis on the Arctic region.

Conducted over 150 mission flight days worldwide in 2012

The Evidence:
a sample of projects

Ice Seal Population Study

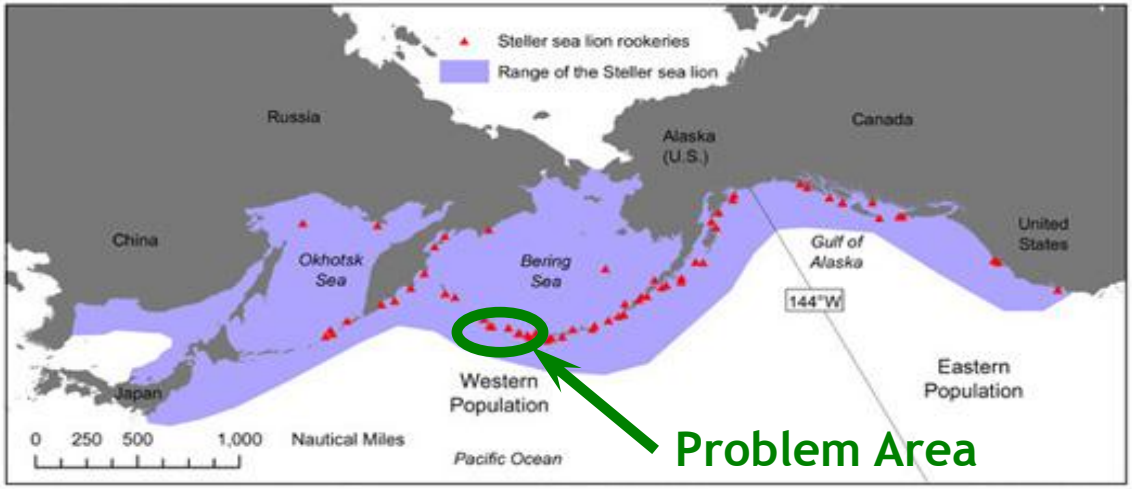
- Scientific Need
  - Marine Mammal Protection Act mandated
- Relevance
  - Large-scale, systematic ship-based surve
- Outcome
  - Safer (than manned aviation)
  - More effective (they do not startle seals)
    - vs. manned fixed wing or helicopters



2009 First Deployment
2014 Proposed Expanded Survey
Joint NOAA and US Navy Funded

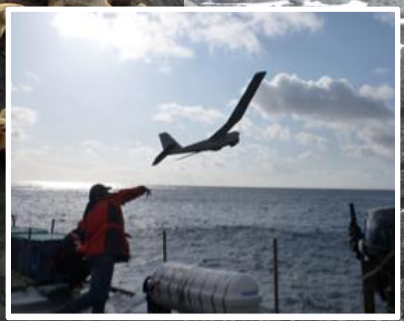
Augmenting Steller Sea Lion Surveys
Western Aleutians

- **Problem: Biological opinion, based on limited 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 through their habitat**



Steller Sea Lion Habitat Monitoring

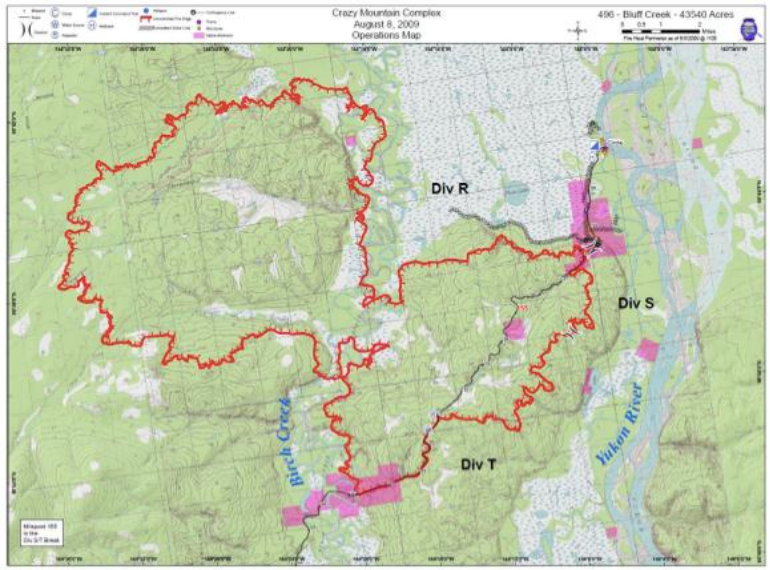
Preliminary Findings
- Migration Patterns
- Transient Killer Whales

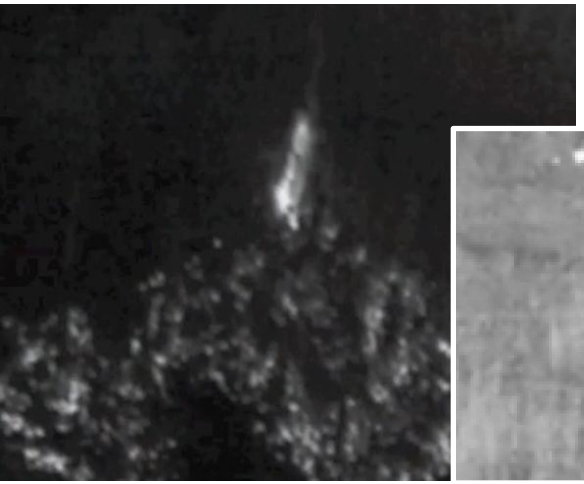


Crazy Mountain Wildfire

Alaska Fire Service Incident Command Team Support

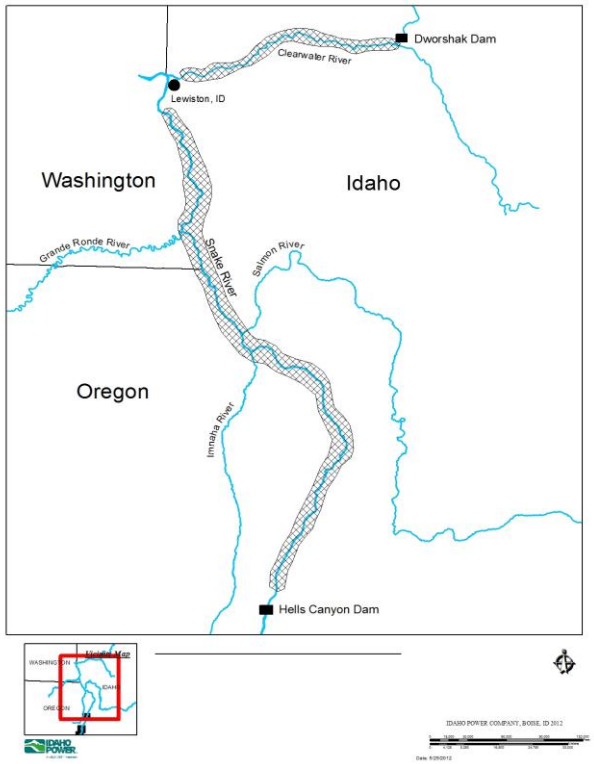
- Tasked by Alaska Fire Service Incident Command Team
- Manned aviation not flown for 5 days due to the smoke and limited visibility
- Satellite imagery (MODUS) incapable of showing critical activity





Salmon Spawning Habitat
October - December 2012

- **Mapping Fall Salmon Nests along a 162 km of the Snake and Clearwater River in Idaho, Washington, and Oregon**
- **“THREATENED” under the Endangered Species Act**

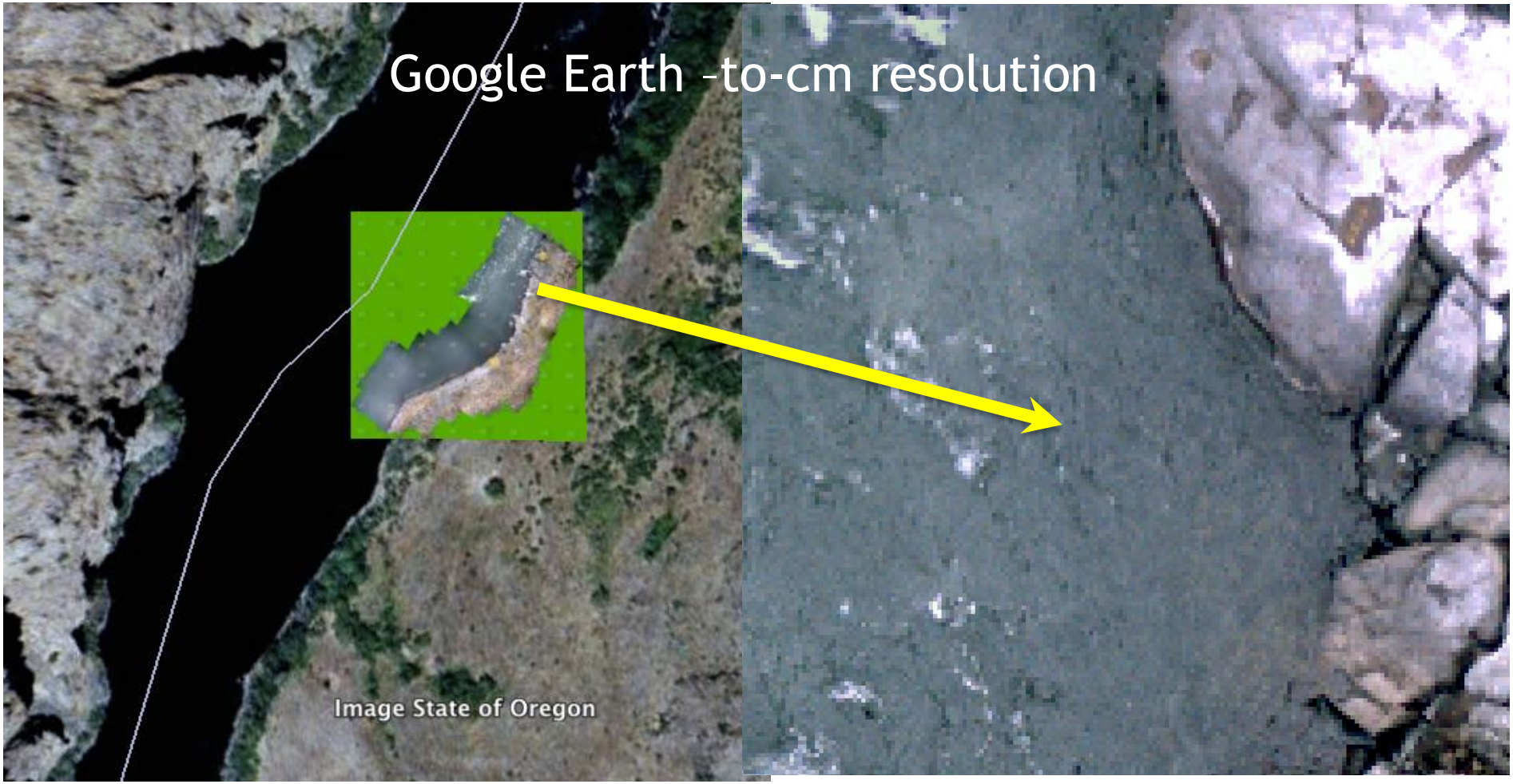



How many reds?


26
A female on each nest

Fish Habitat Data Products

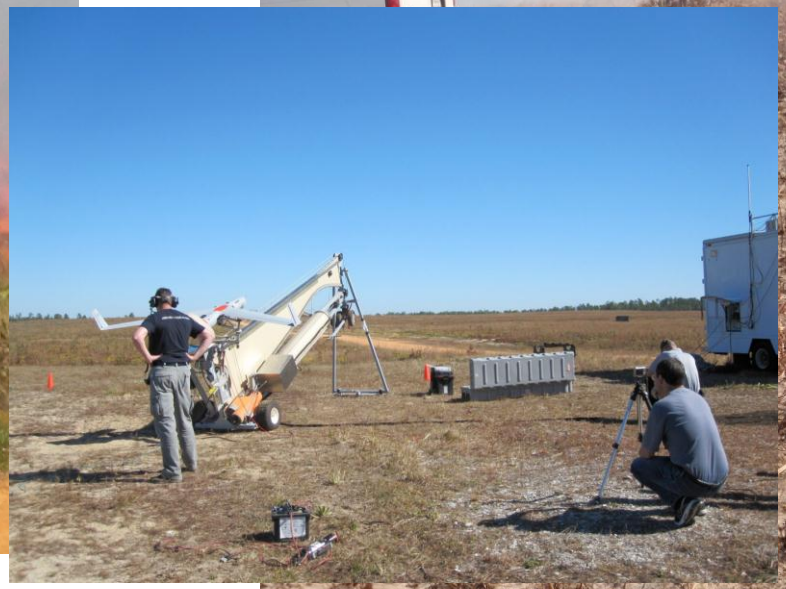
Weekly Mosaic Images of Select Sites



Rx-CADRE

Prescribed Fire Combustion and Atmospheric Dynamics Research Experiment

- October 29 – November 17 2012
- Eglin AFB Florida



Bear Bite – SAREX

Mass Casualty Exercise 7-10 February 2013

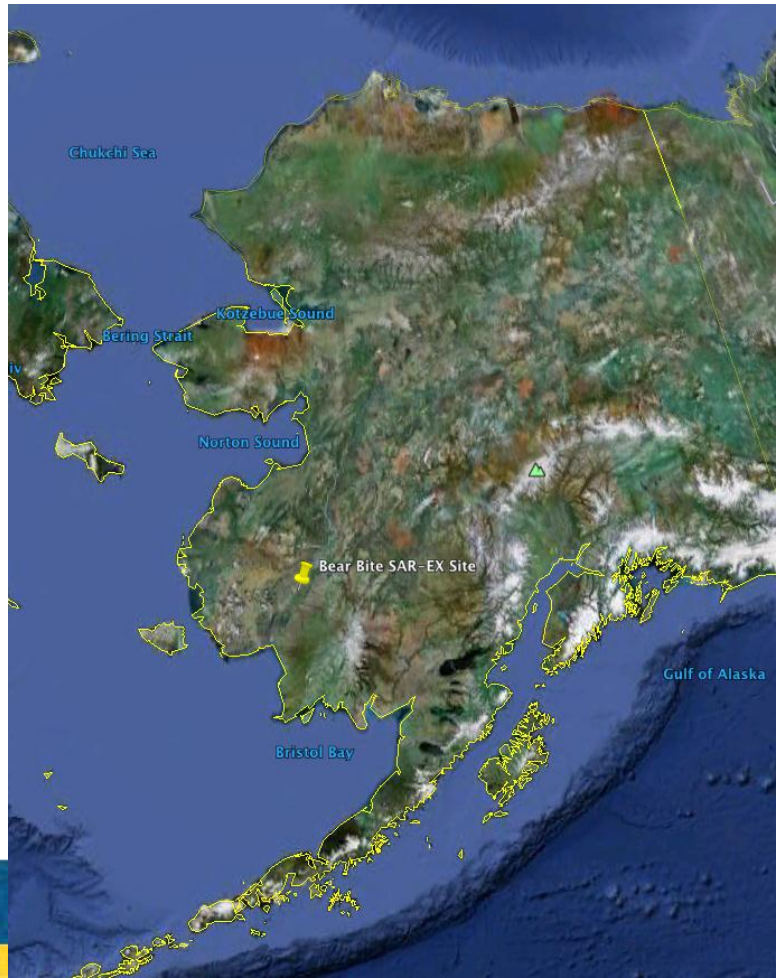
"An aircraft crashed in the tundra roughly 20 miles outside Bethel Alaska many died with some survivors"

Deployed two unmanned aircraft systems with support team

Coordinated with manned aviation on the scene

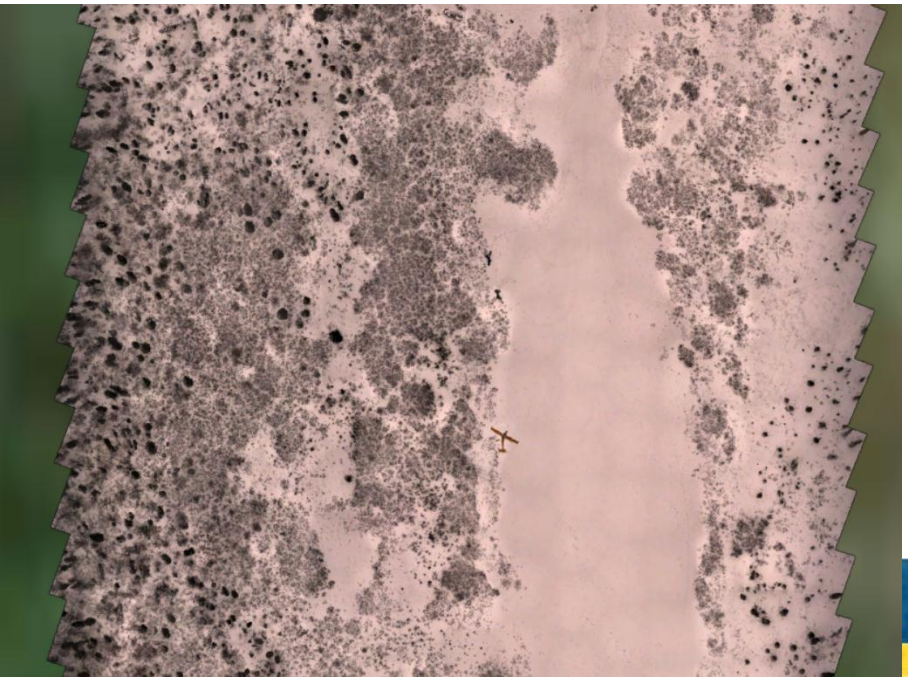
Mission:

- **Map scene for event documentation**
- **Real-time SAR response**



Bear Bite - SAREX

"I've worked with the MQ9 and the MQ1 before and when compared these products were pretty sweet" - SAR Duty Officer statement at after action review 11 Feb 2013. "Within just a couple hours imagery was collected and turned into mosaic products in the field"



Bear Bite - SAREX

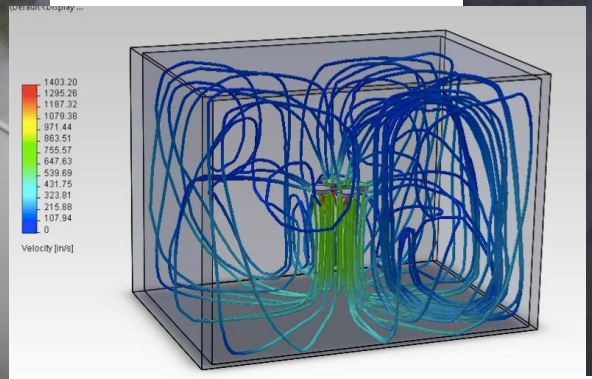
cold weather operations – our most challenging yet

Shoreline Clean-up Assessment Technique (SCAT) Evaluation

BP Exploration (Alaska) Inc. Partnership

Oil Infrastructure Monitoring Research

- Flare Stacks
- Pipelines
- Processing Facilities
- Access Roads



BP North America Partnership

BP Exploration (Alaska) Inc. Partnership

High Arctic Ship Piloting Experiments

Aboard the Canadian CCGS LOUIS S. ST. LAURENT

Phase I Research conducted by Capt Stephen Wackowski (USAF)

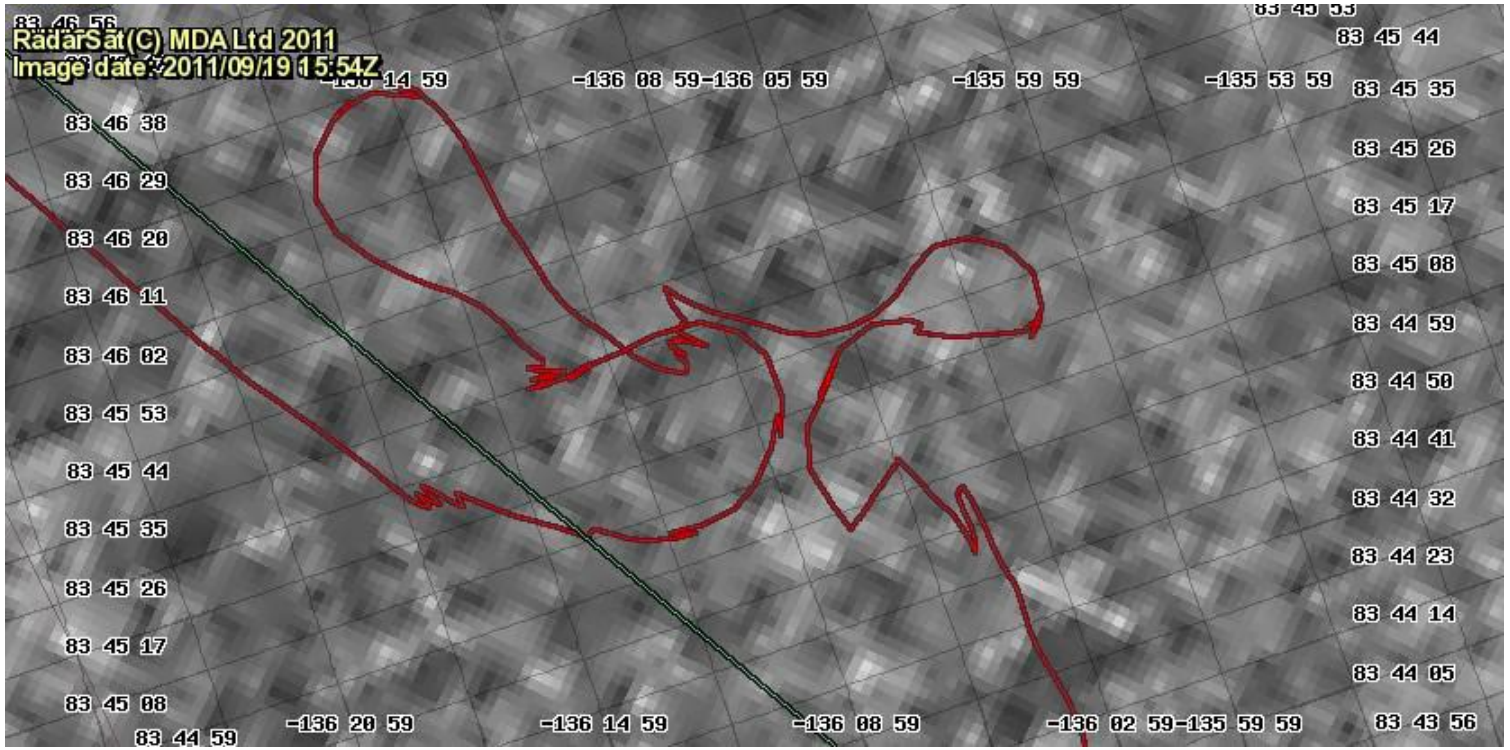
Phase II Ongoing with UAF graduate students with modified Raven systems acquisition

Imagery Used For Ship Piloting in Ice

Ship tracks superimposed (Sept 2011)

Background Image: National Ice Center highest resolution RADARSAT

- **Desired icebreaker track (green)**
- **Actual navigation track (red)**



Small UAS Imagery of Ice Ridges

IR image from RAVEN UAS (Sept 2011)

Navigating Sea Ice during the Nome Fuel Delivery

University Engagement and Decision Support

Mission

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

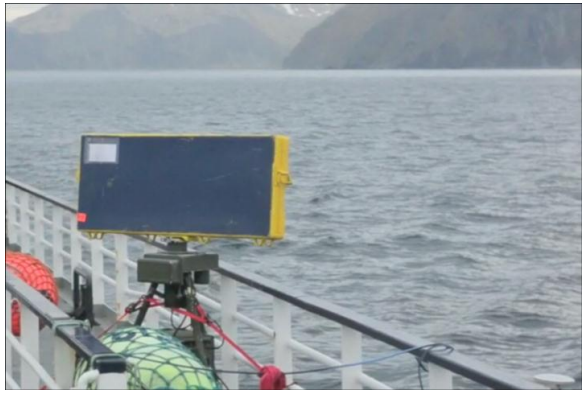
iPASS

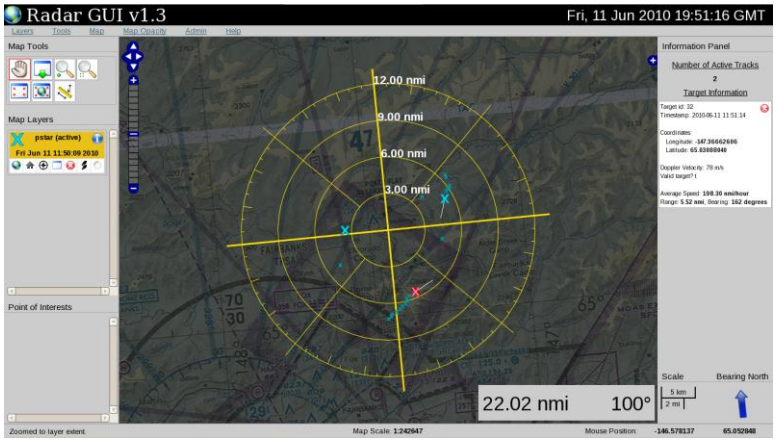
UAF's Portable Airspace Surveillance System

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

Status

Operational, used in Canada and NASA Certified





Airspace activity monitoring

Monitors airspace use patterns and validates traffic pattern assumptions

Enhanced situational awareness during aircraft or spacecraft operations

Provides real-time position and track of local airspace activity to assist in traffic avoidance

Ongoing UAS Survey of Marine Debris

Generated by 2011 Japanese Tsunami

NOAA Funded Effort

Partnering with a Wasilla Alaska based UAS Manufacturer Airborne Technologies Inc

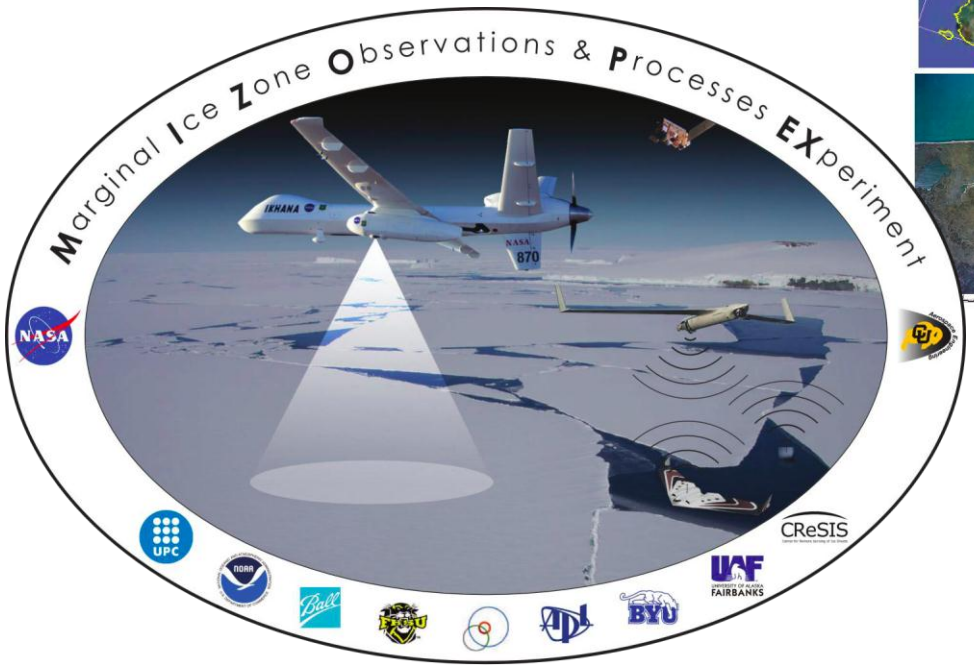
Upcoming ACUASI Projects

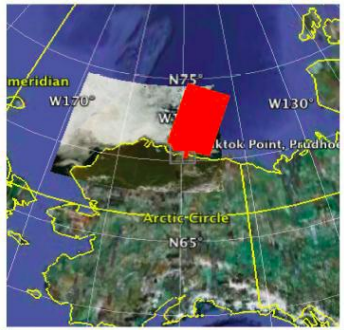
Marginal Ice Zone Ocean and Ice Observations and Processes EXperiment (MIZOPEX)

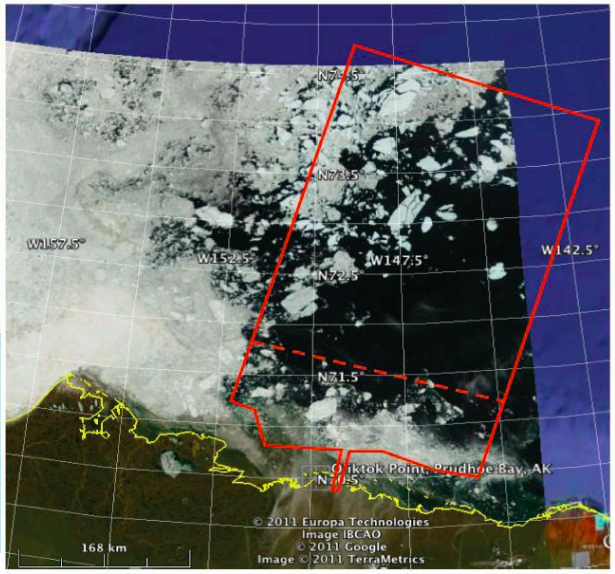
UAF deployments

NASA Exercise July 2013

Preparation May/June 2013







Multiple aircraft simultaneously

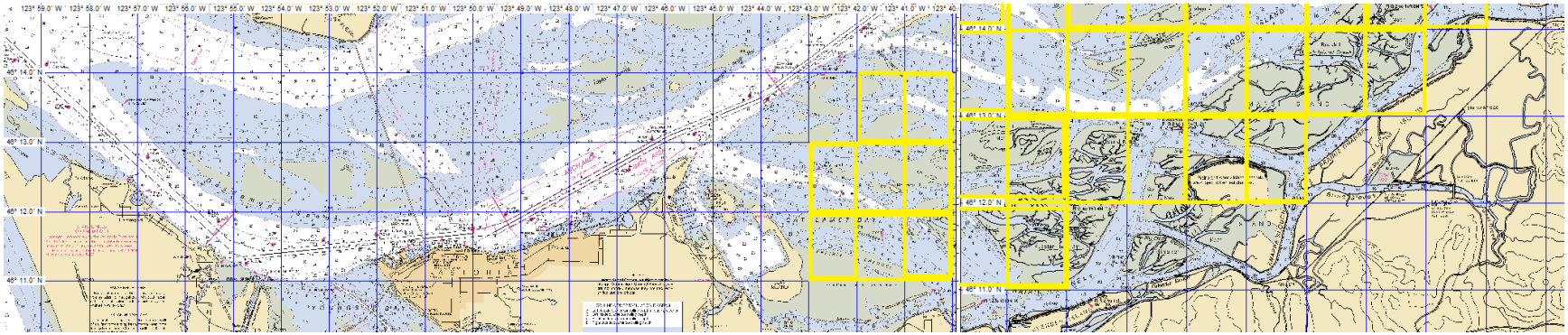
Many new scientific payloads

Alaska Department of Public Safety

- Provided demonstration of a vertical takeoff UAS
- Provided concepts in which a UAS could be used including:
  - Forensic evidence at crash or crime scene
  - Search and rescue
  - Wildlife protection
- Provide UAS subject matter expert as AST forms its concept of operations
- Possible development of UAS training package to train State troopers
- Supporting any FAA interaction needs
- Providing connections to legal experts on privacy

Most Recent ACUASI Project

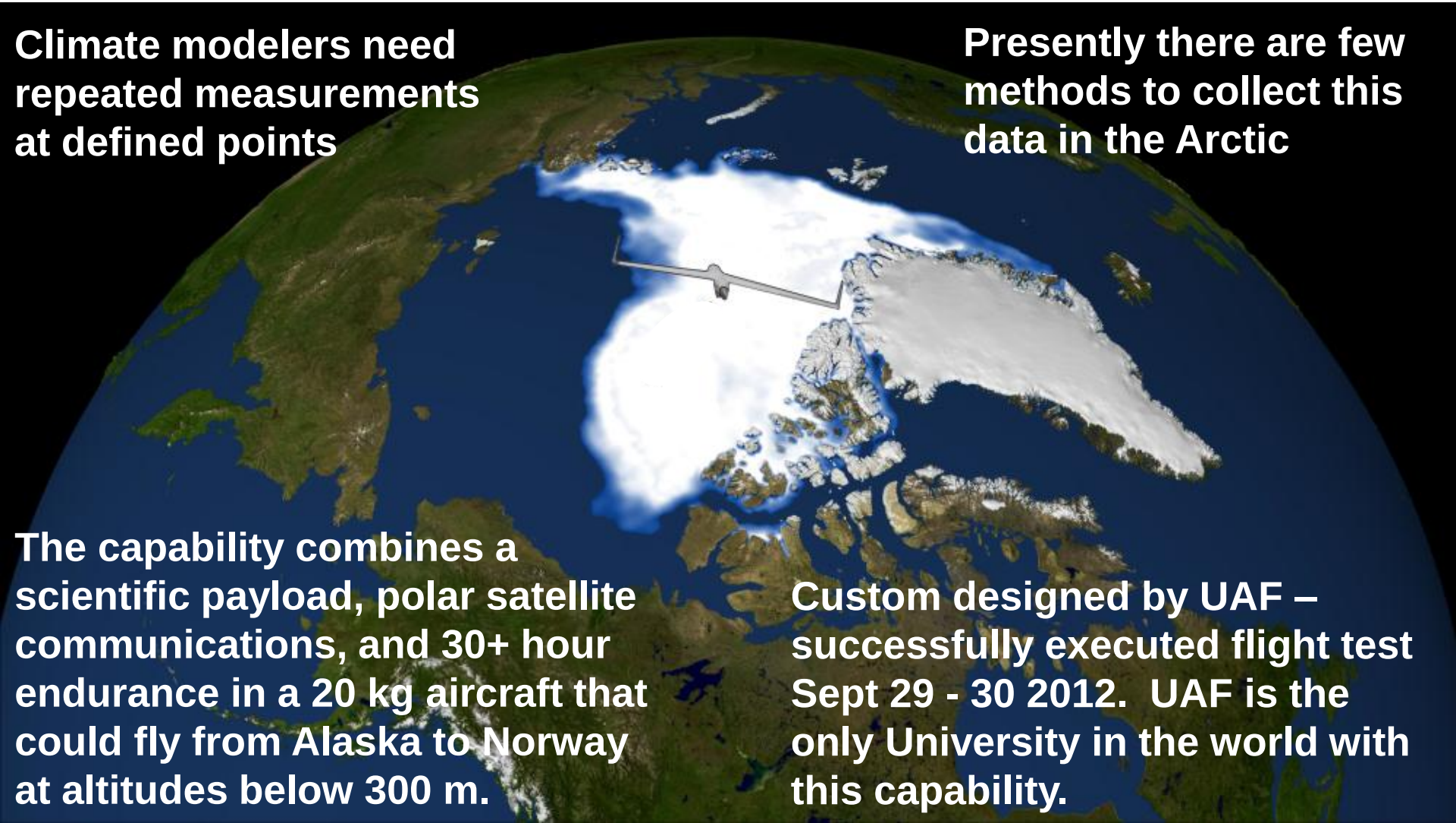
Oil Spill Response Exercise - Columbia River Estuary



- 11-13 March 2013
- Puma AE Operation

Low-altitude, over-the-pole capability

Fuel-injected, Iridium-communication-enhanced, long-endurance, small unmanned aircraft



Climate modelers need repeated measurements at defined points

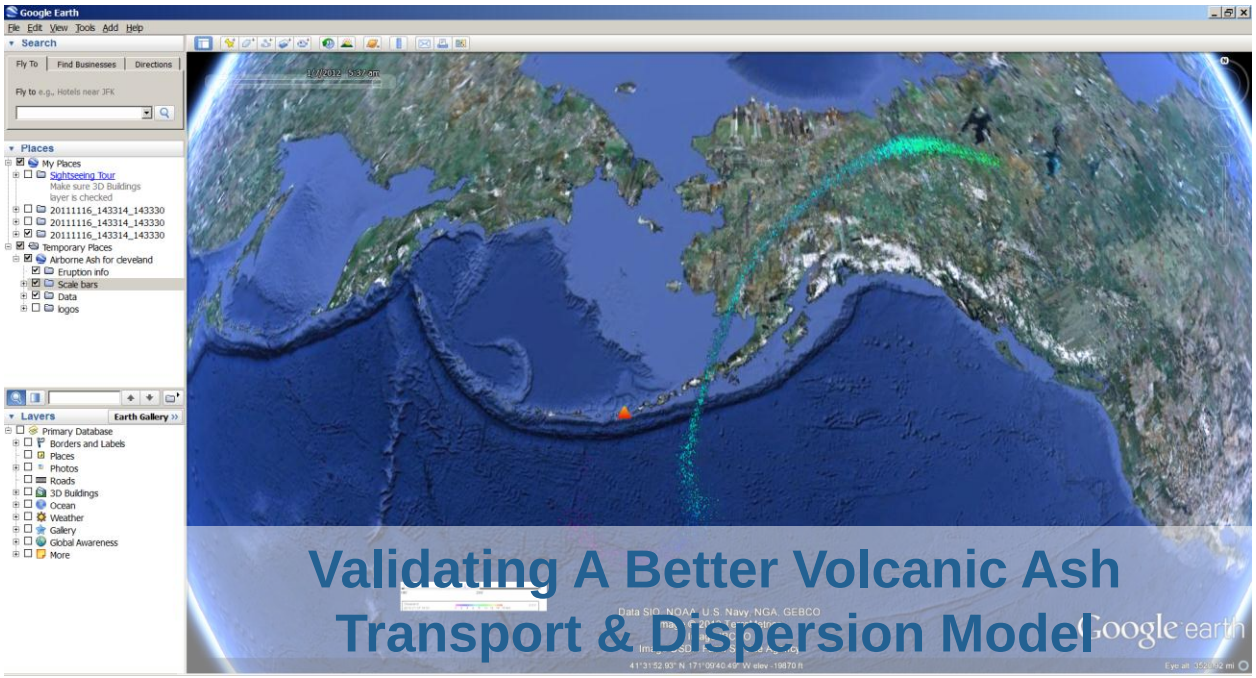
Presently there are few methods to collect this data in the Arctic

The capability combines a scientific payload, polar satellite communications, and 30+ hour endurance in a 20 kg aircraft that could fly from Alaska to Norway at altitudes below 300 m.

Custom designed by UAF – successfully executed flight test Sept 29 - 30 2012. UAF is the only University in the world with this capability.

Volcanic Ash Analysis and Detection
USAF Small Business Innovative Research

- **Collaboration between UAF researchers and new industry**
- **Opportunity to launch a business to capitalize on USAF funding with UAF Intellectual Property**



FAA Test Site

- Jan 2012: FAA Reauthorization Act directed FAA to select 6 Test Sites to research and test for safe integration of UAS into the national airspace
- Feb 14 2013: Solicitation was released
- UAF leads team for states of Alaska, Oregon, and Hawaii, plus 56 additional team members
  - Includes state agencies (DOT, DPS, Forestry of DNR, DHS&EM, National Guard
  - Universities, EDCs, corporations
- Proposals due multiple dates, last by May 6
- Selection targeted by FAA for Dec 31 2013

Pan Pacific UAS Test Range Complex

- University ACUASI is lead
- Fourteen specific spots around the three states
  - Strong link with military JPARC ranges
  - Forging links with manned aviation safety specialist
- Key questions to answer:
  - Procedures to protect manned aviation
  - Policies to protect privacy
  - Technical testing to assure control, see & avoid, lost link procedures work, etc

How is Privacy Protected?

- We're dedicated to protect privacy so beneficial uses can be obtained
- Current statutory/case law strongly protects privacy while defining legal airborne activities (manned)
  - Unmanned a new technology, but subject to same restrictions
  - DHS & National Institute for Justice have taken on task of defining specific UAS privacy rules
  - FAA committed to incorporating into Test Site and future rules once developed
  - DoD & Guard training on domestic privacy well underway

More on Privacy

- International Chiefs of Police issued guidelines for law enforcement use of UAS
  - Handout with full text available
  - The essence:
    - Follow FAA rules
    - Use strict supervisory accountability
    - Get warrants if any possibility of use for surveillance or investigation
    - Notify locals of intent to fly over them
    - Delete recordings not authorized by warrant, training use, or as required by law
- UAF working with DPS to assist with program, procedures, all to be set up before first flight

What about Weapons on UAS?

- Despite media scares, this won't happen
- The Unmanned Aircraft System community uniformly against any such use
- Small UAS incapable of carrying weapons
  - But even if they could…
- FAA prohibits weapons completely—or any dropping of objects from aircraft
- IACP advises against even considering—sees as unlikely technologically, unacceptable to public, ineffective use of UAS

HR No 6

- Thank you for a thoughtful and balanced view of the potential benefits and risks of UAS
- Recognition of UAF's work to date is gratifying—our goal always has been to benefit Alaska
  - You've seen many benefits already, but potential remains far greater
  - Military users & media treatment have created an impression of danger for domestic use
  - No violations yet; we pledge to work hard both on the task force and in the test site to craft solid, defensible policy for your consideration

Alaska Center for UAS Integration

2012 Alaska Legislature Capital Budget

Research and Development of Unmanned Aerial Systems	5,000,000	5,000,000

16 (HD 1-40)
It is the intent of the Legislature that the University of Alaska collaborate with the Federal Aviation Administration in establishing a research and development program and possible test facility for Unmanned Aerial Systems in Alaska. Unmanned Aerial Systems are already being utilized in Alaska in many ways and as the Arctic race progresses, they will become even more vital as a resource to the State and the Country.

Excerpt From DoD Training Briefing

General Principles

- Do NOT infringe on US Persons' Constitutional rights
- Protect privacy rights of US Persons
- Collect, retain, and disseminate information based on a lawfully assigned mission and function
- Employ the least intrusive lawful techniques
- Comply with all regulatory requirements