



U.S. – Canada Unmanned Aircraft Systems (UAS) Arctic Initiative

***Robbie Hood
NOAA Unmanned Aircraft Systems (UAS) Program***

17 July 2013



First Steps of Unmanned Aircraft Systems (UAS) Collaboration



- Memorandum of Understanding between NOAA and Environment Canada
- NOAA-Environment Canada UAS Arctic Scoping Workshop held in Boulder, CO at the NOAA Earth System Research Laboratory in 25-26 September 2012
- Lead by:
 - *Rene Eppi*, Director of International Affairs in the NOAA Office of Oceanic and Atmospheric Research
 - *David Jackson*, Director of the EC Canadian Ice Center



UAS Collaborative Goals



- ***Overarching Goals***

- Arctic Maritime Domain Awareness
- Improved Meteorology and Sea Ice Observations and Understanding
- Coastal Mapping and Observations

- ***Near – term Goals***

- NASA-NOAA Marginal Ice Zone Experiment (MIZOPEX)
- UAS flights from U.S. Coast Guard Cutter (USCGC) Healy
- NASA-NOAA Global Hawk missions



Marginal Ice Zone Experiment (MIZOPEX) Overview



- Experiment proposal selected by NASA through peer-reviewed competition and included cost-sharing from NOAA UAS Program.
- The goal of the mission is to collect radar, lidar and imagery of the marginal ice zone using 3 different classes of UASs
- The mission will utilize 16 instruments, developed by and supporting 11 organizations /partners including: NASA, NOAA, U of Alaska (Fairbanks), U of Colorado.
- The mission will operate the NASA SIERRA, U of AK ScanEagle and U of CO Data Hawk from Oliktok Point, Alaska from 12 July – 9 August 2013.
- Flights of the SIERRA and Scan Eagle will use ground-based radar for sense and avoid in order to safely transit to international waters

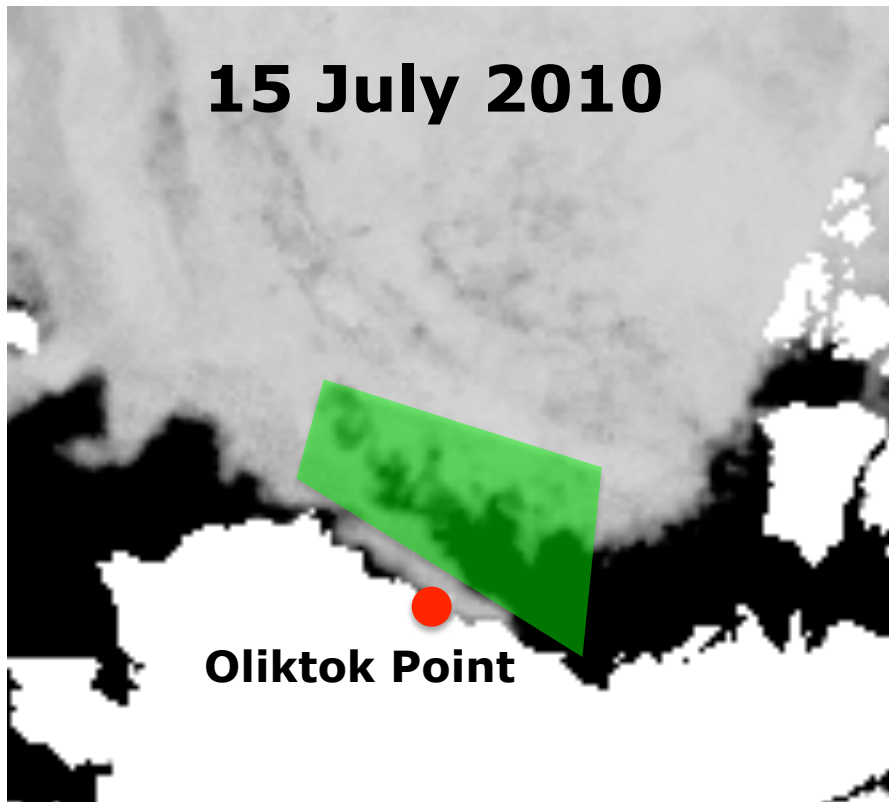


MIZOPEX Science Goal



Overarching Goal: Assess ocean and sea ice variability during the melt season within a key marginal ice zone region that has undergone major changes in recent years.

15 July 2010



15 July 2011





MIZOPEX Science Objectives



- **Quantify the spatial variability of sea surface temperature, sea surface salinity and ice conditions in and near the marginal ice zone**
- **Determine the accuracy of satellite-derived sea surface temperature and ice concentration products in the marginal ice zone region**
- **Investigate how well skin sea surface temperature measurements represent subsurface and bulk ocean temperatures under different atmospheric and ice conditions**
- **Determine how these relationships change over time and space**
- **Identify variations in ice thickness and surface characteristics and investigate what types of ice is surviving summer melt.**



MIZOPEX UAS



NASA Sierra



UAF Scan Eagle



CU Data Hawk



USCG Healy Oil Spill Drill

7-23 September 2013

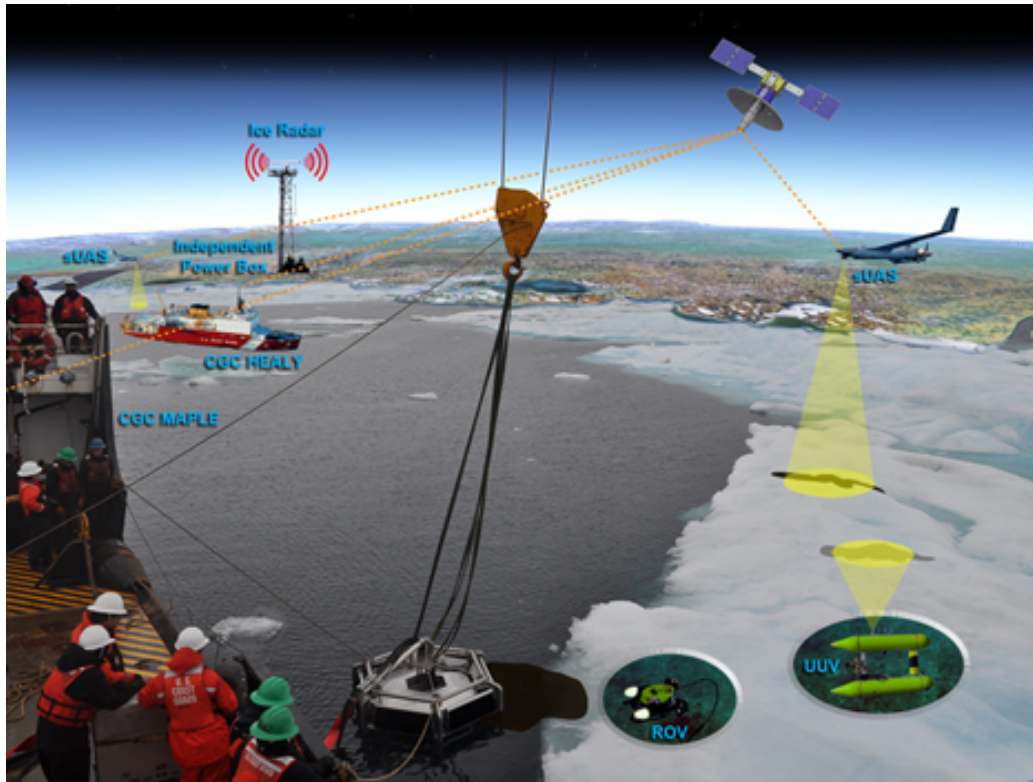


- **Demonstrate the ability to respond to oil spills in the Arctic using Commercial-Off-The-Shelf (COTS) and Government-Off-The-Shelf (GOTS) technologies**
- **Cruise to Beaufort or Chukchi Sea north of Point Barrow, AK with the Coast Guard Cutter (CGC) HEALY and a buoy tender, CGC MAPLE.**
- **NOAA and Environment Canada science observers and NOAA Puma UAS onboard**
- ***Five key process activities in oil spill response in the Arctic will be tested:***
 - **Search above and below an ice flow**
 - **Detect spilled oil**
 - **Produce data to be used to plot the safest course to the spilled oil**
 - **Deploy a brushed skimmer to recover the spilled oil**
 - **Monitor the recovery operation (above and below the ice) ensuring complete recovery**





USCGC Healy Oil Spill Drill Mission Concept of Operations



Six specific components will be evaluated including:

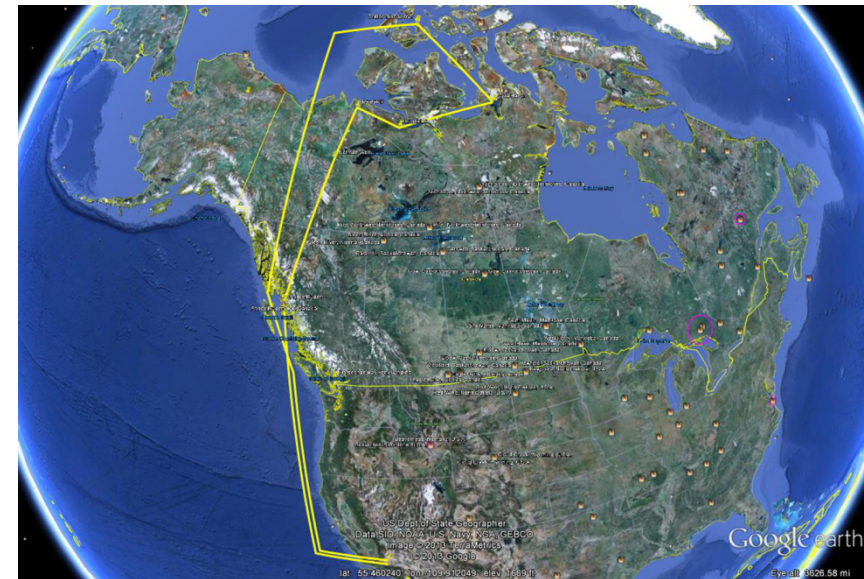
- Unmanned Aircraft System (NOAA & University of Alaska PUMA AE UAS)
- Unmanned Underwater Vehicle (Woods Hole Oceanographic Institute SeaBED UUV)
- Oil Recovery Skimmer (National Strike Force's Helix skimmer)
- Remotely Operated Vehicle (PAC Area's VideoRay Pro 4 ROV)
- Rutter Radar system (Rutter Radar)
- NOAA's Environmental Response Management Application (ERMA)



Potential Global Hawk Arctic Demonstration Flight

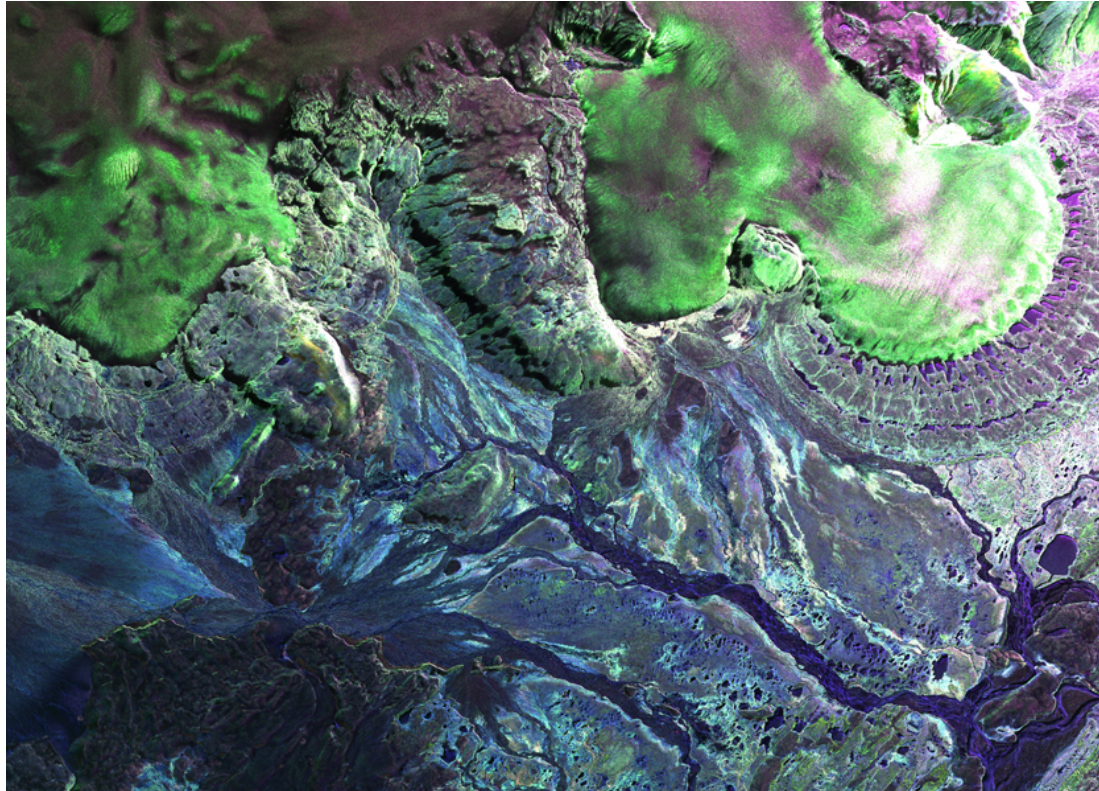


- ***NASA Dryden Flight Research Center plans to fly Global Hawk to Arctic over Canadian airspace during 2013***
 - Demonstrate ability to operate in northern areas with remote sensing payloads
 - Provide range of image types to show both security and scientific value
 - Fly to 75 degrees north
 - Cover over 7900 miles within 25 hours
- ***NOAA introduced NASA DFRC to EC partner, David Jackson***
 - Huge thanks to David Jackson, EC colleagues, and Canadian Civil Air Authority for assisting with air space approval





NASA UAVSAR Polarimetric Image Hofsjokull, Iceland 12 June 12



**The blue areas are bare ground surfaces
and the green areas are ice**

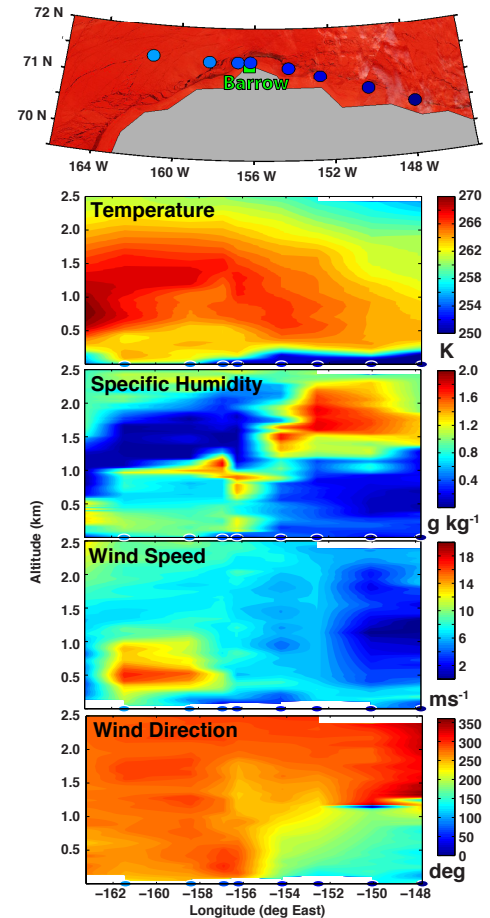
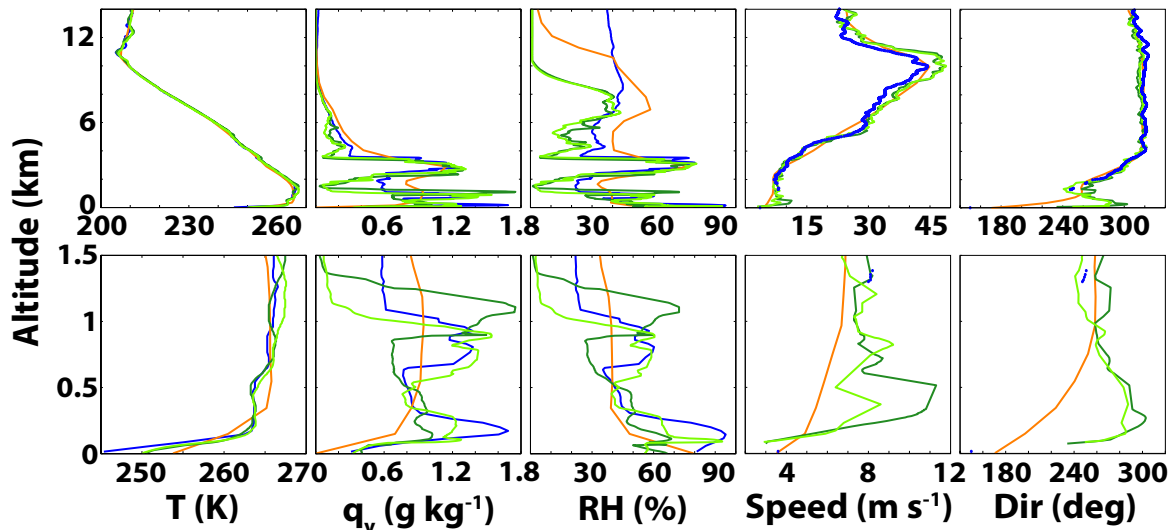


2011 NOAA Winter Storms and Pacific Atmospheric Rivers Experiment



- Dropsondes deployed from NASA Global Hawk north of Alaska coast over sizable ice lead during Arctic flight
- Results show high level of structure and variability
- Provides detailed observations in harsh, data sparse regions

1136Z Dropsonde 1138Z Dropsonde 1108Z Radiosonde ERA-Interim





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