# ANSI and SPRING Singapore Services Conference

## Technology in Transition

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ASTM F38 Committee on UAS
TriVector Services
NOAA UAS Program

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***Dangerous, Dirty, Dull, Denied***
***Efficient, Effective, Economical and Environmentally Friendly***

# NOAA: America's Environmental Intelligence Agency: Priorities

MONITORING MODELING

Support


OBSERVATIONS ASSESSMENT FORECAST & PRODUCTS

Provide information and services to make communities more resilient

Evolve the Weather Service

Invest in observational infrastructure

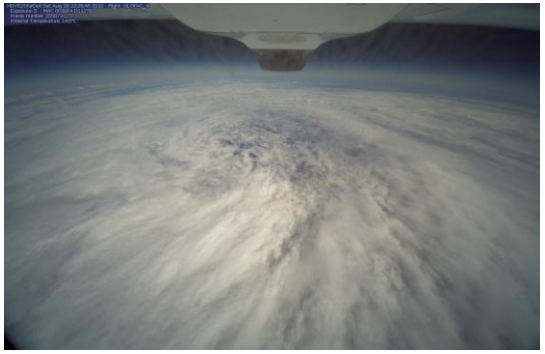
Achieve organizational excellence

# Missions for UAS

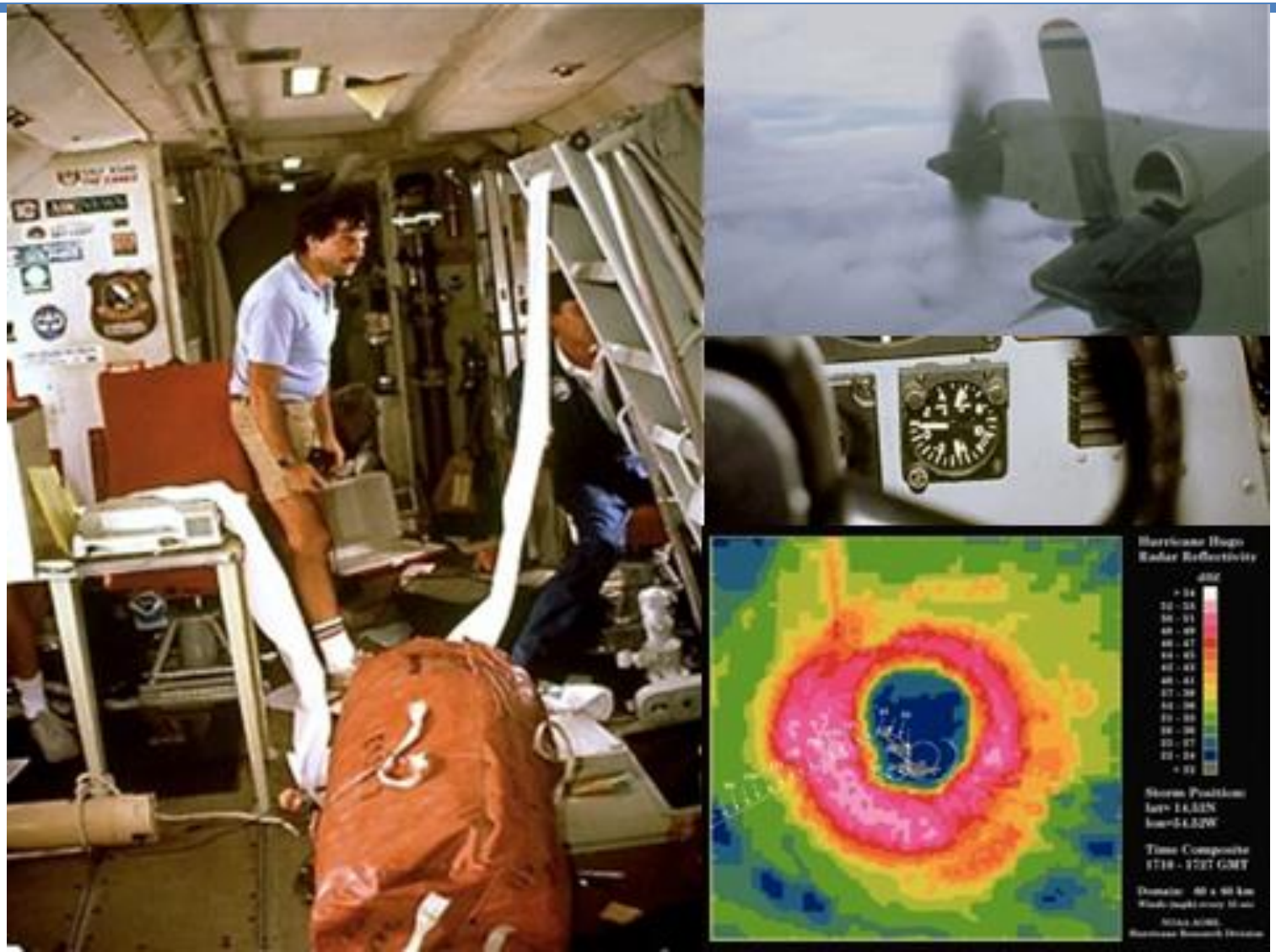
- **Goal to evaluate utility of UAS for NOAA operations and research**
- **Three focus areas**
  - **High-impact weather**
  - **Marine monitoring**
  - **Polar research**
- ***End State: Transition to Operations***

  ***Need access to Airspace***
  - ***Airworthiness***
  - ***Operational Procedures***
  - ***Trained personnel***

***Technology Solutions/ Regulation/Standards***

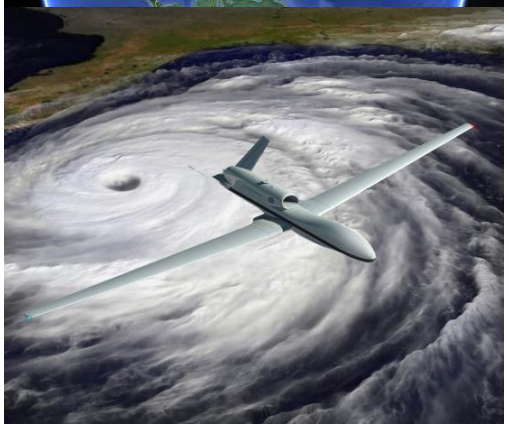


# Hurricane Ops



# NASA Global Hawk
## Sensing Hazards with Operational Unmanned Technology (SHOUT)

- **NOAA Flight Level: ~ 55-63,000 ft**
- **Duration: ~26 hr**
- **Range: 11,000 nm**
- **Payload: 1,500+ lbs**
- **Deployment Sites:**
  - ***NASA Wallops Flight Facility (Wallops Island, VA)***
  - ***NASA Armstrong Flight Research Center (Edwards AFB)***
- **Payloads-over 30 approved**
  - ***Dropsondes – in situ vertical temperature, moisture, winds***
  - ***Remote Sensors – vertical temperature, moisture, winds***
  - ***Remote Sensors – ocean surface wind speed and cloud structures***



# Coyote UAS

Six Coyote UAS launched into Hurricane Maria Sept 22-23 to collect Low Altitude Observations – where we don't like to fly manned aircraft

# GRAV-D Project Redefinition of Vertical Datum
# Support a New Vertical Datum

- DA-42MPP Aircraft from Diamond Aviation Centaur OPA
- With Aurora Designed Conversion Kit to Enable OPA Capability

**Up to 16 hours unmanned** (payload dependent)

**3 Modes of operation: Manned, Unmanned, Augmented (UAS ops in NAS)**

**Up to 800lbs useful load**

**Multi-payload Capability: Bathymetry, LiDAR, Hyperspectral, Gravity, EO/IR, SAR ++**

# Project Challenges

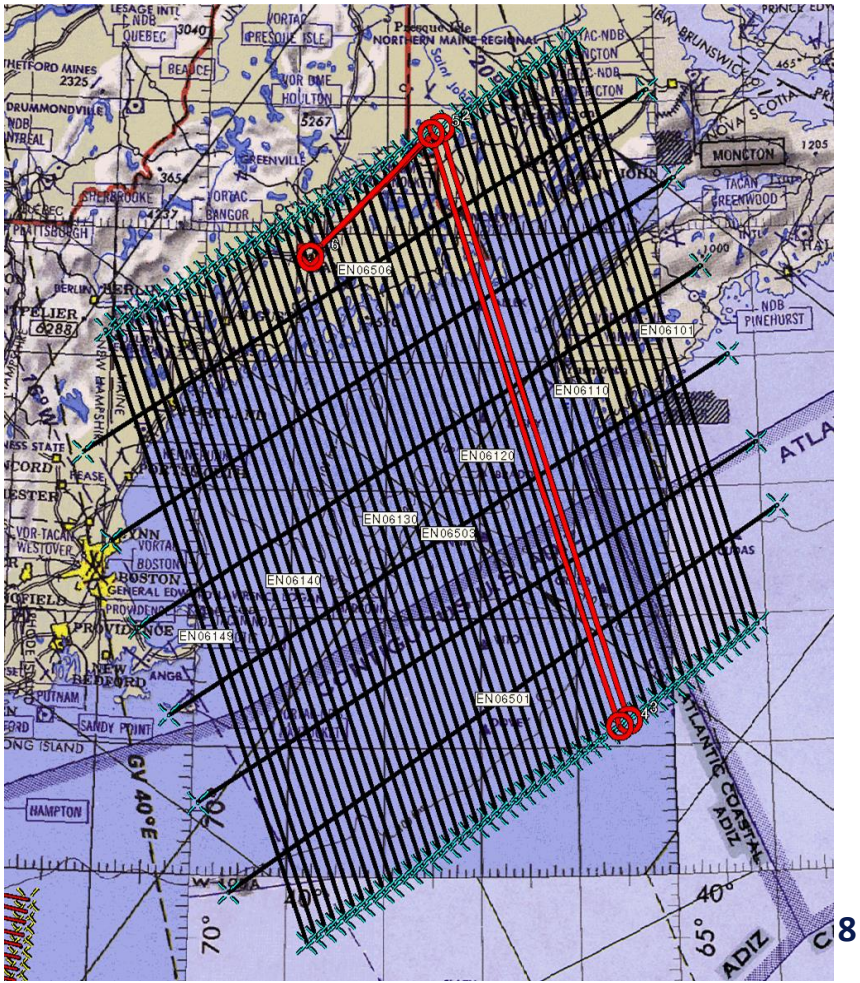
**Operational**

- Long, boring flights-Dull
- Large area to cover with some long distances (Aleutians, Pacific Islands)
- Aircraft stability critical for good data

**Management**

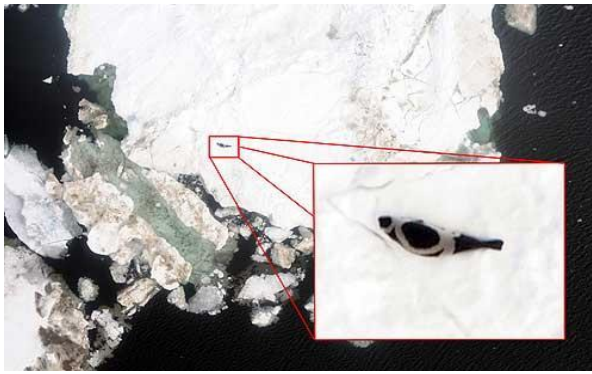
- Efficiently covering the entire country in terms of cost and time

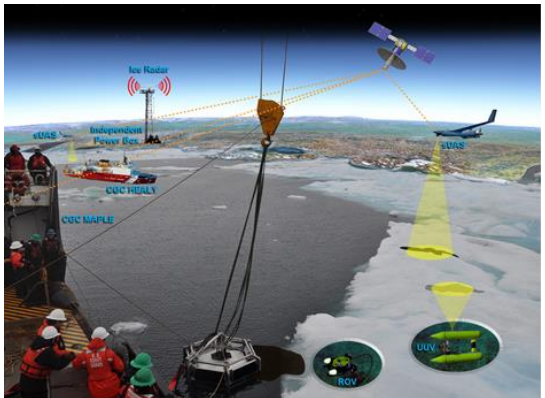
*First operational gravity survey on a UAS*



# sUAS
# Marine Monitoring

- Living Marine Resources
- Coast Mapping
- Ice Detection and mapping
- Oil Spill Response
- Marine Debris
- Ecosystem/Habitat Assessment
- Sea and Air Quality Studies (Norway)
- Arctic, Antarctic, US Coastal Waters






# Whale Breathalyzer

## Early Days

# Breathalyzer Phase Two

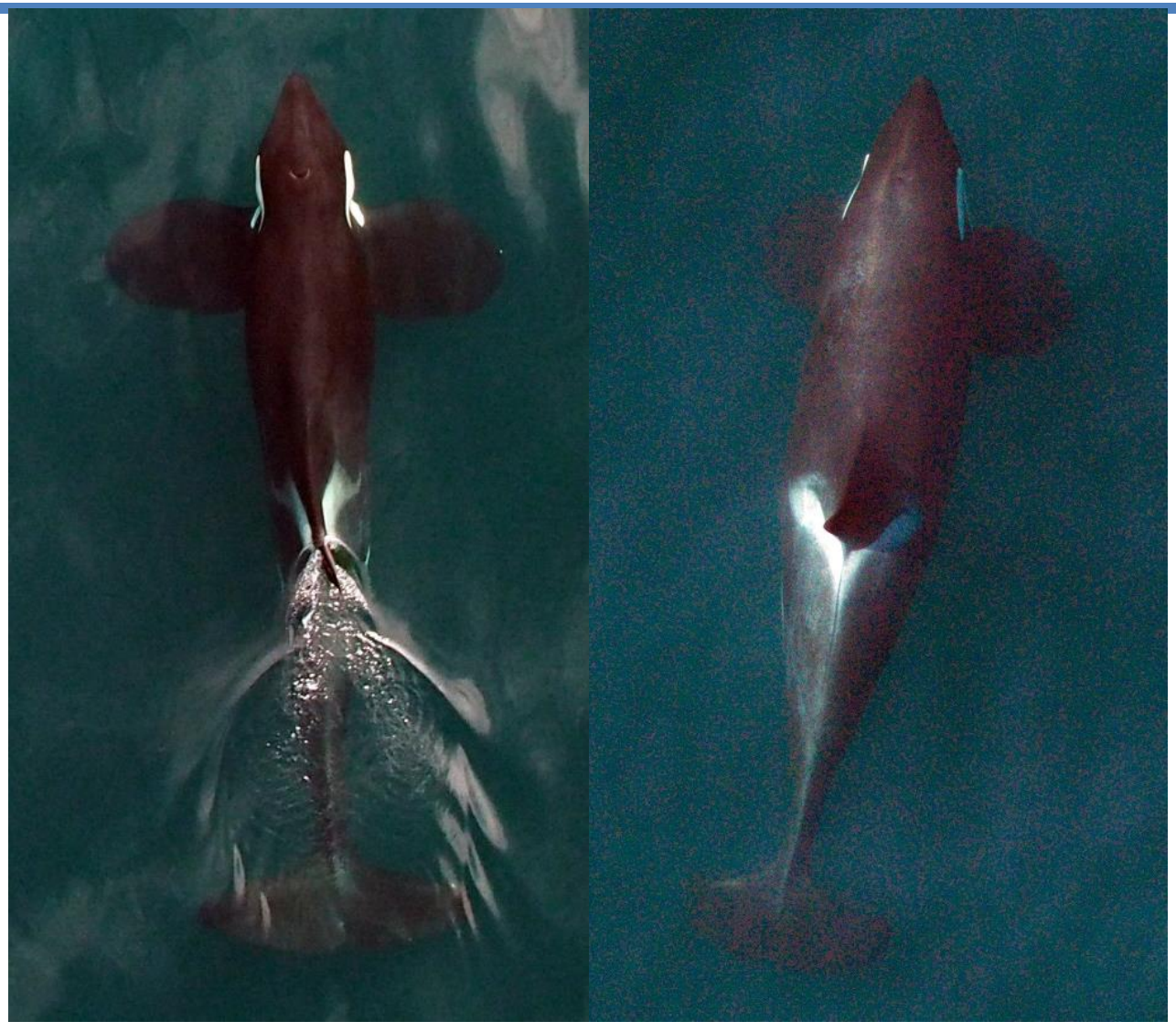
# Dangerous

# NOAA's UAS SNOTBOT



Photo: NMFS Southwest Fisheries Science Center in collaboration with WHOI.

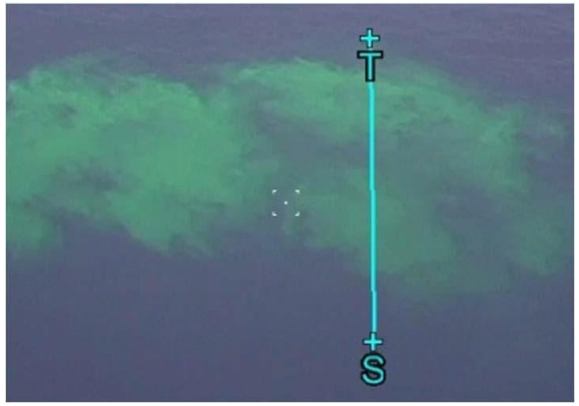
# *Comparative body condition*

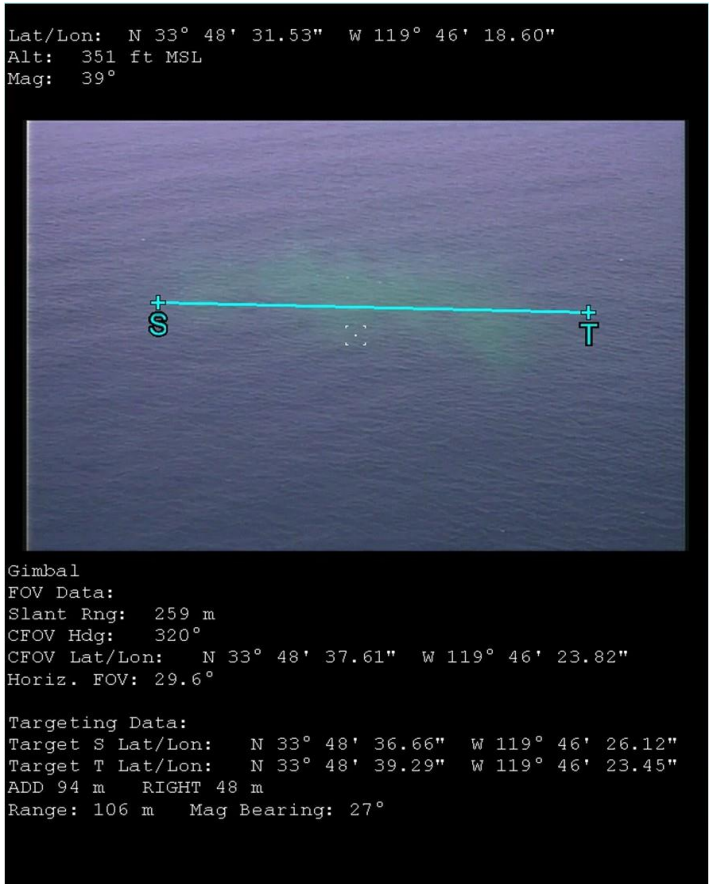


# Oil Spill Response

# Emergency Response & Oil Spill Simulation

Coast Guard UAS partnership study of oil spill monitoring in Santa Barbara channel



# Arctic Shield ISR Missions
# Oil Spill & SAR
## USCG/NOAA/Industry Partnership

- ✓Sea ice ridge detection/monitoring
- ✓Marine and marine mammal monitoring
- ✓Usefulness in search and rescue scenarios
- ✓Detection and monitoring of oil spilled from ship
- ✓Detection and monitoring of marine debris from ship


# May 2015:
# Refugio oil spill

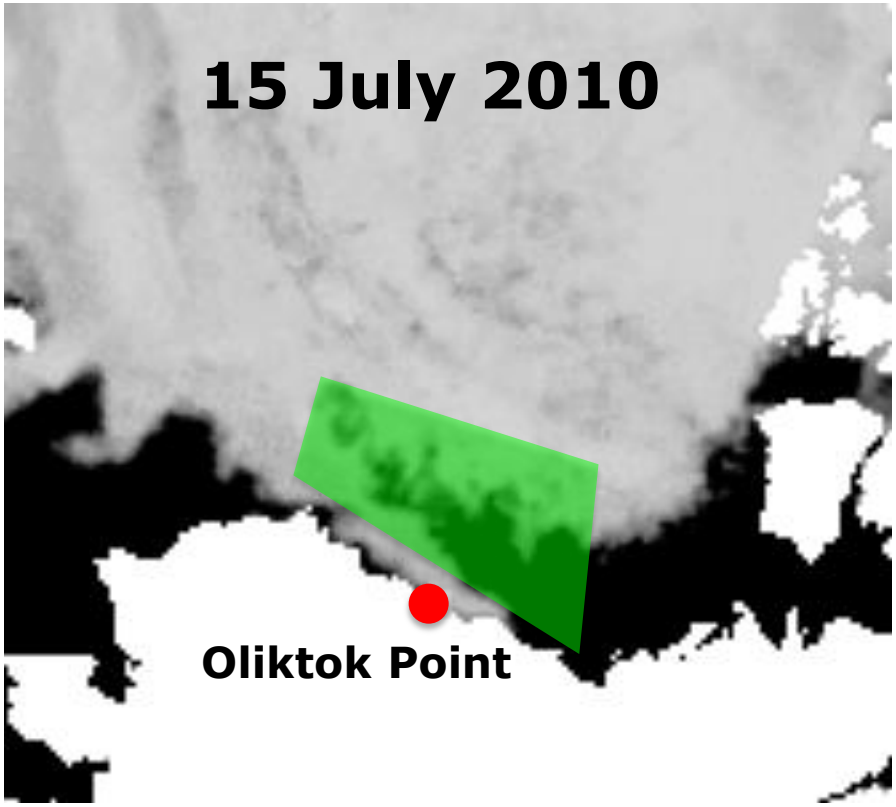
- Requested by NOAA Damage Assessment Program
- Tasked by Incident command
- Supported NRDA data collection.
- Safe integration and concurrent operations with two manned helicopters
- Flew standard payload from shore and from NOAA R/V Shearwater.
- Collected high-resolution data from shore with nadir mapping camera.
- Produced stitched ortho-rectified image of Refugio bay at 2.5 cm per pixel.
- Learned quite a bit about how to integrate into Incident Command and oil spills.
- Data ingested into ERMA

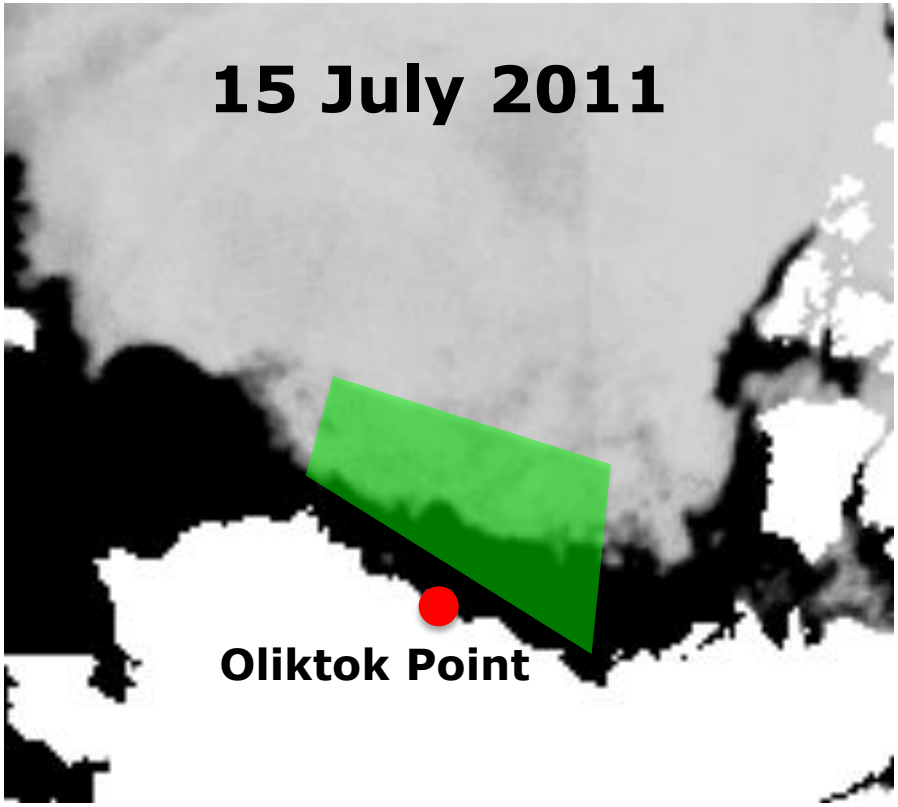
# Refugio Oil Spill

## Shoreline Cleanup and Assessment Technique (SCAT)

# Marginal Ice Zone Experiment (MIZOPEX) Overview 12 July – 9 August 2013

***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. Determine the accuracy of satellite-derived temperatures.**



# 2013 MIZOPEX
# UAS Platforms


**NASA Sierra**

**UAF Scan Eagle**

**CU Data Hawk**

# Lessons Learned

**Global Hawk flies 3x's longer than most manned aircraft**

- 3'x the crew /3 times deployment costs
- Increase manpower and footprint over manned aircraft

**Autonomy to Reduce Costs and Increase Mission Effectiveness**

- Routine operation and monitoring functions need to be autonomous
- Virtual or telepresence of mission science or instrument teams from labs, office or homes.

**sUAS**

- Sense and Avoid challenges
- Airspace/regulation
- Extend Range with BVLOS-Beyond Visual Line of Sight
- Safety and reliability –training, education

*Working with regulators to develop rules & policies to allow the technology to be deployed and utilized in safe, relevant and useful ways*

# Unmanned? GH Operations Center

## Fully Staffed During a Hurricane

# Collaboration
# Key to Success

# Contact Information

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