



NOAA Unmanned Aircraft Systems (UAS) Program

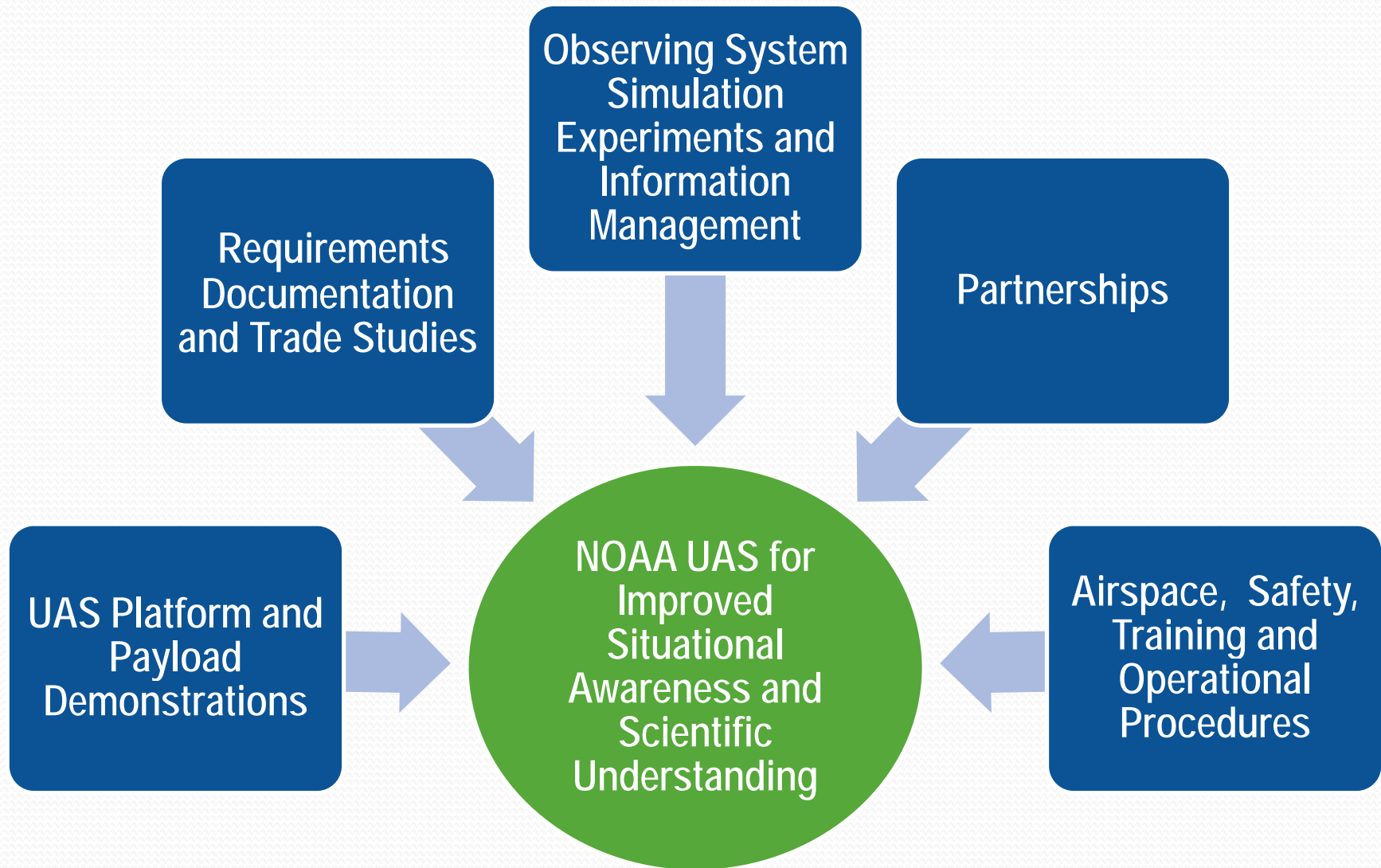
CDR Phil Hall

Office of Oceanic and Atmospheric Research

23 June 2011

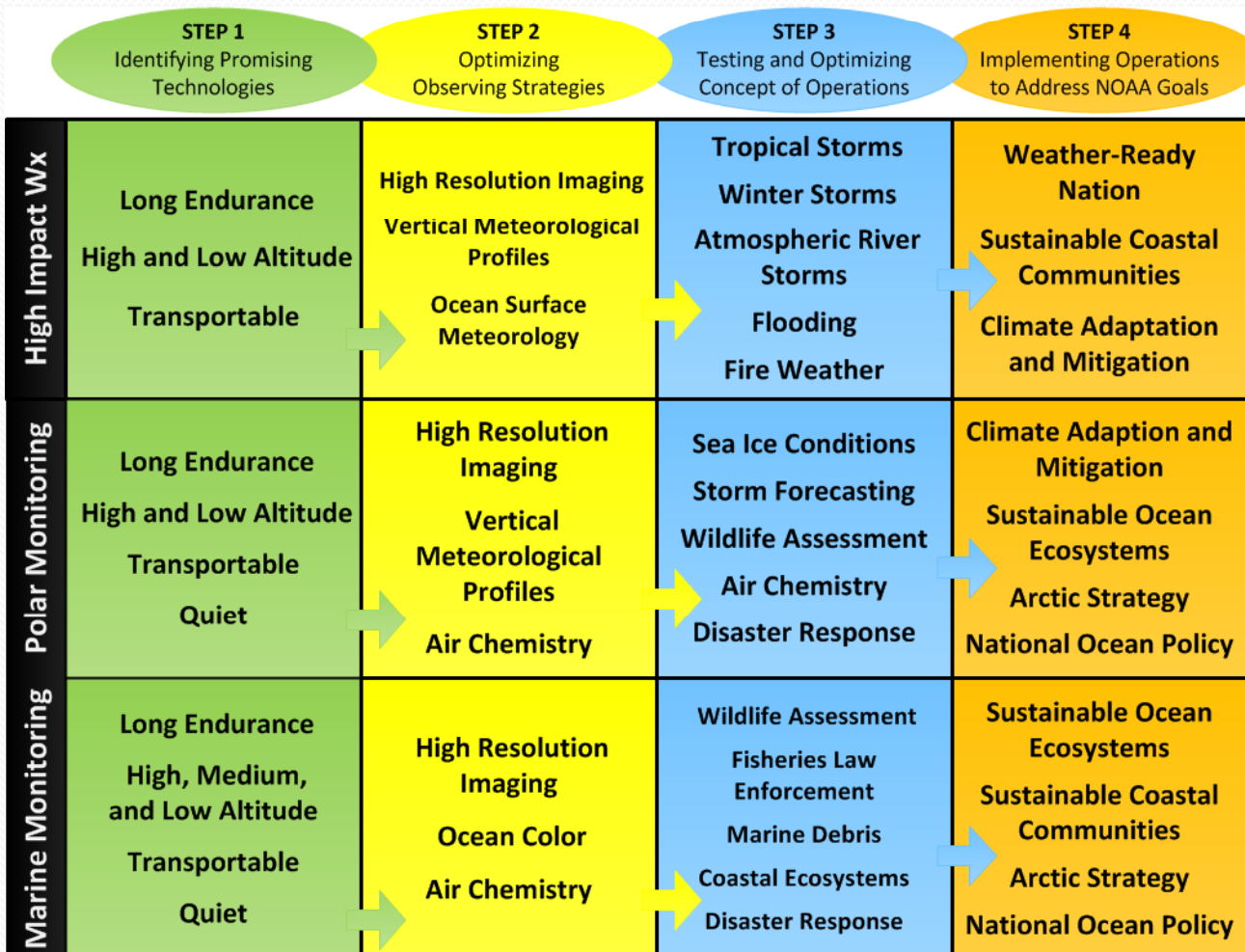


Tools for Building UAS Capacity





NOAA UAS Roadmap





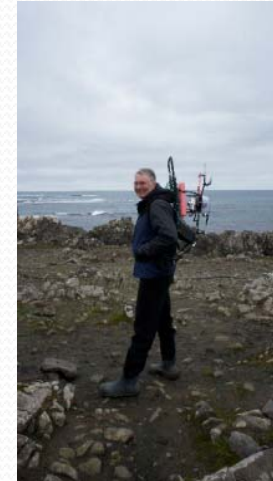
Antarctic Wildlife Assessment



Sample species on Cape Shirreff,
Antarctica



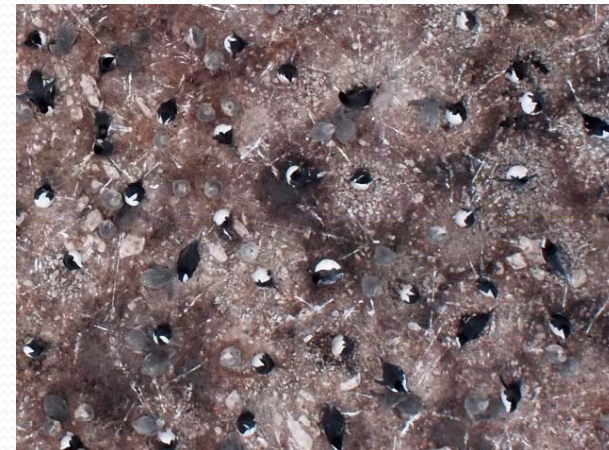
UAS with Olympus EL-1
Camera



UAS Operator with Vehicle



UAS Image Mosaic



Single UAS Image

**Project Leads: Wayne Perryman (NOAA/ SWFSC) and
LCDR Nancy Ash (NOAA/AOC)**



Polar Monitoring - Greenland Glacier and Ice Seal

Testbed Co-leads: Dr. Elizabeth Weatherhead (University of Colorado) and Dr. Robyn Angliss (NOAA/ National Marine Mammal Laboratory)

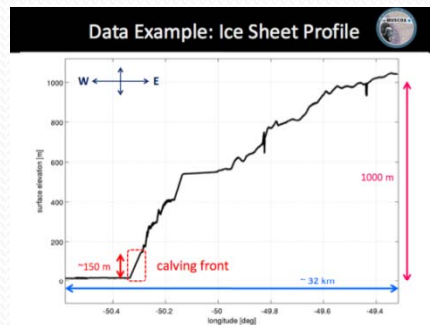
Partners: Greenland Glacier Study / University of Colorado and BAE Systems -Advanced Ceramics Research

Bering Sea Ice Seal Study / University of Alaska- Fairbanks and Boeing - Insitu

Greenland Glacier Study - 2008



Bering Sea Ice Seal Study - 2009

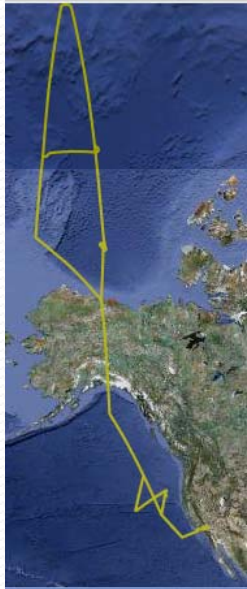


Images courtesy of James Maslanik, University of Colorado

Images courtesy of Greg Walker, University of Alaska - Fairbanks

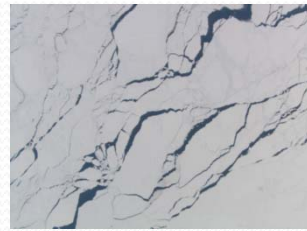
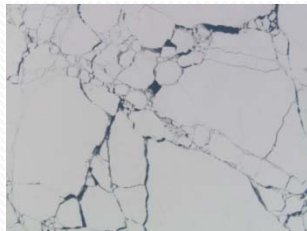


One Mission – Two Oceans

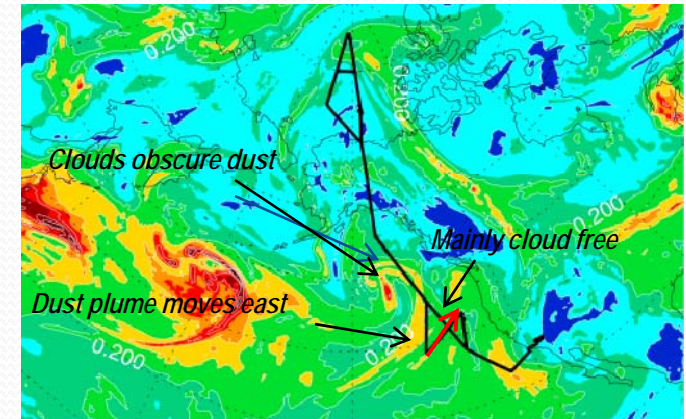


23 April 2010 Global Hawk Accomplishments

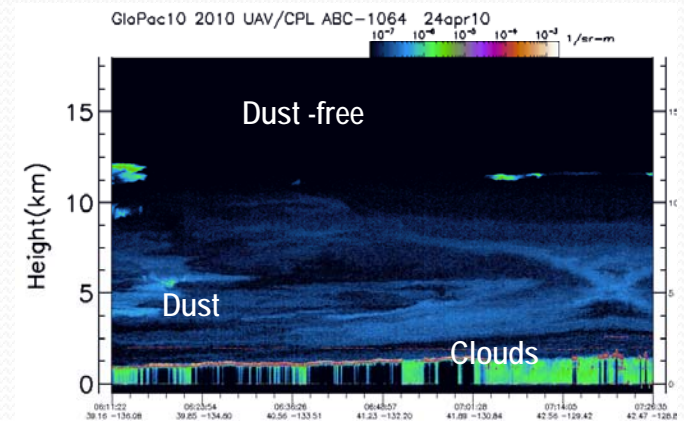
- Flight endurance – 28.6 hrs; Flight range – 9700 nm;
- Maximum altitude – 19.9km; Maximum latitude – 85N
- First time any Global Hawk has ever traveled north of 70 latitude
- Collected, recorded, and relayed real-time readings of *in situ* stratospheric ozone, water vapor, methane, carbon monoxide, nitrous oxide, hydrogen, and sulfur hexafluoride concentrations along entire flight track
- Captured high definition visible imagery of sea ice
- Cloud Physics Lidar remotely sensed dust concentrations crossing the Pacific Ocean from 31 March 2010 Gobi Desert dust storm



High definition visible images of sea ice captured by NASA Airborne Compact Atmospheric Mapper



NASA aerosol model forecast and Global Hawk flight track



Aerosol vertical profile observed by Cloud Physics Lidar along red arrow of flight track above



UAS Mission Flexibility and Profiling Capability

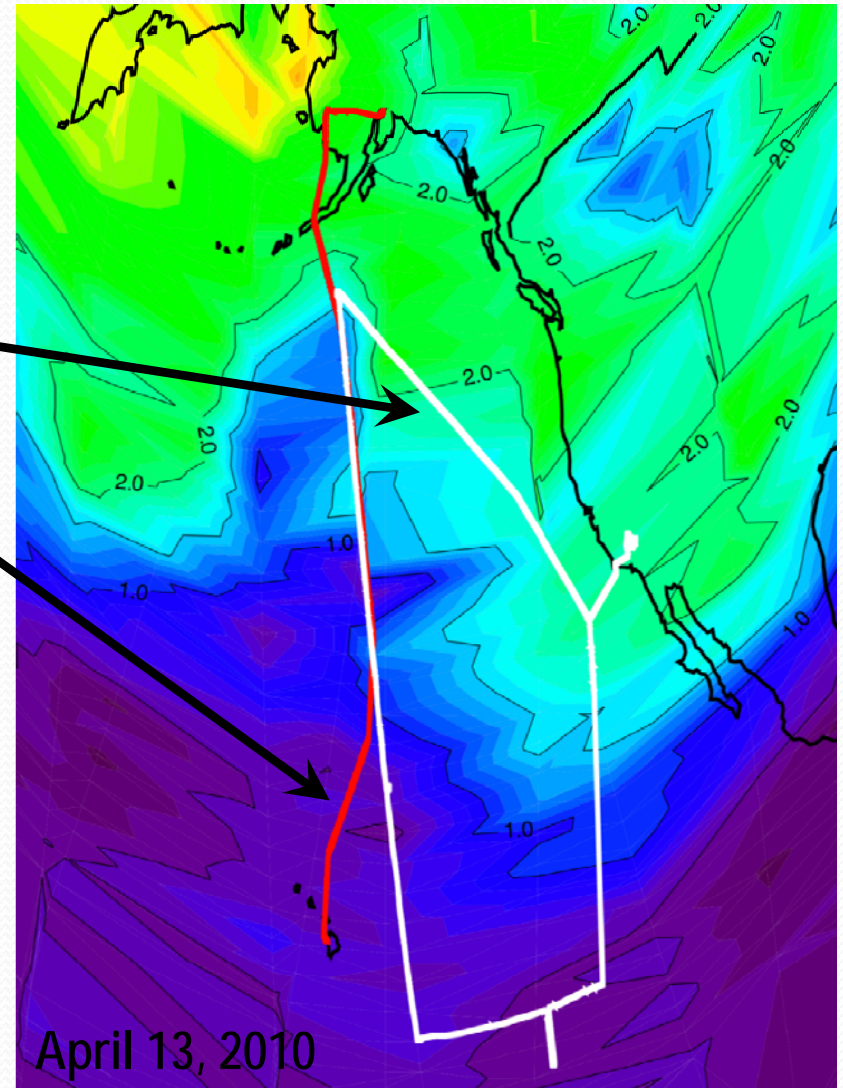
GloPac demonstration of aircraft profiling and satellite underflight

GloPac GH track in white

HIPPO NCAR GV in red

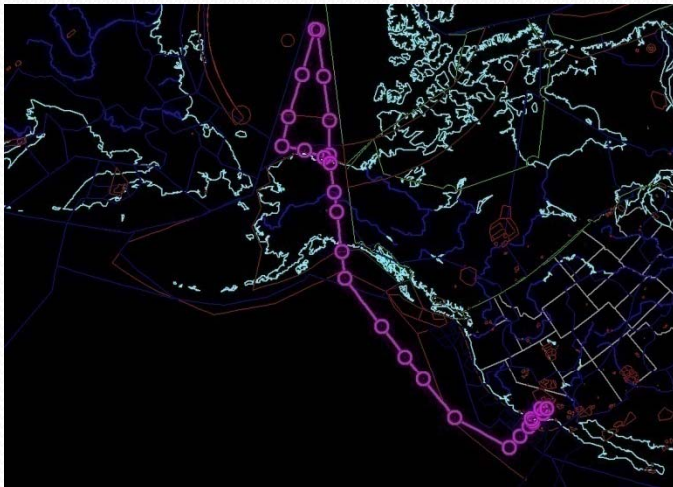
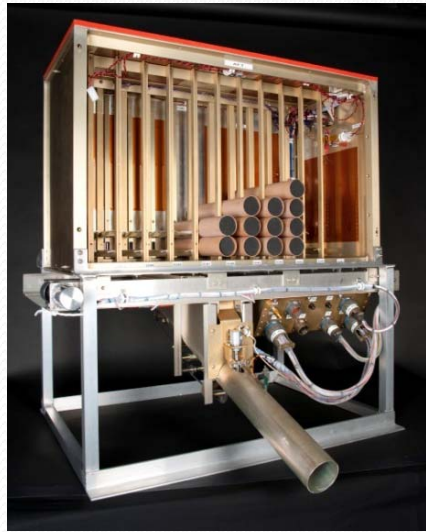
Aura satellite track follows the western side of GloPac flight

Ozone data from Microwave Limb Sounder (MLS), figure courtesy of Dr. Karen Rosenlof (NOAA)





Winter Storms and Pacific Atmospheric Rivers (WISPAR) Experiment



Mission Scientists: Gary Wick (NOAA/ESRL) and Michael Black (NOAA/AOML)

Partners: Yucheng Song (NOAA/NCEP), Janet Intrieri (NOAA/ESRL), Ryan Spackman (CU), NASA, NSF/NCAR

Dropsonde System – NCAR development / NOAA and NSF sponsorship
88 sonde total capacity

First dropsonde release from a Global Hawk



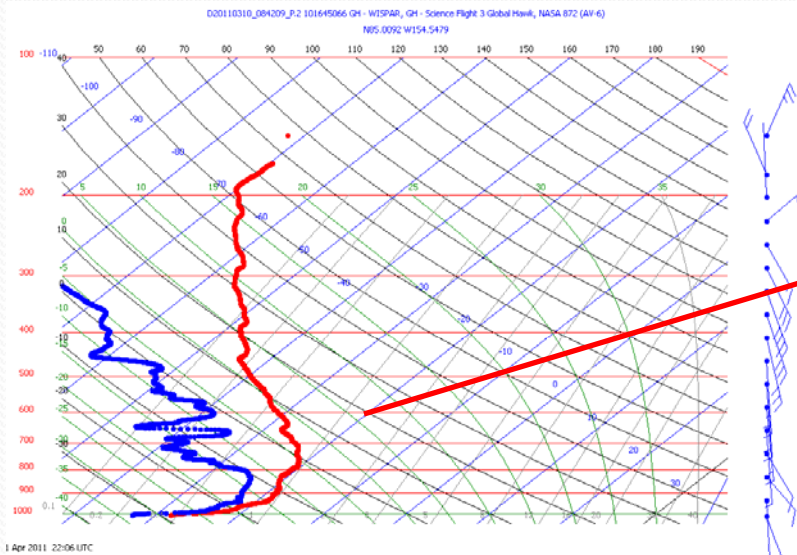
Dropsonde Release Video



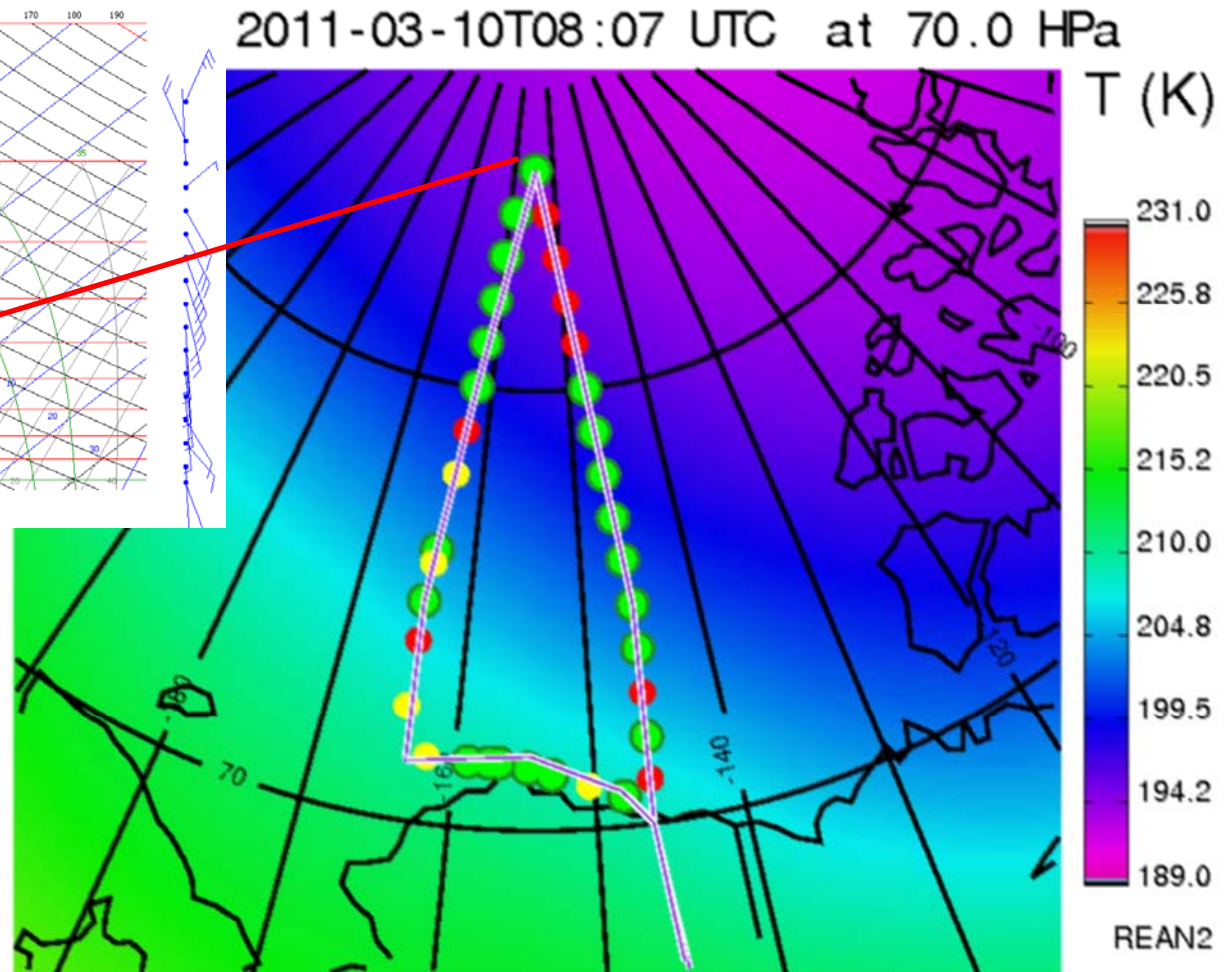


WISPAR Arctic Dropsonde Mission

9-10 March 2011



Drop locations
superimposed on 70
mb temperatures from
the NCAR/NCEP V2
reanalysis data

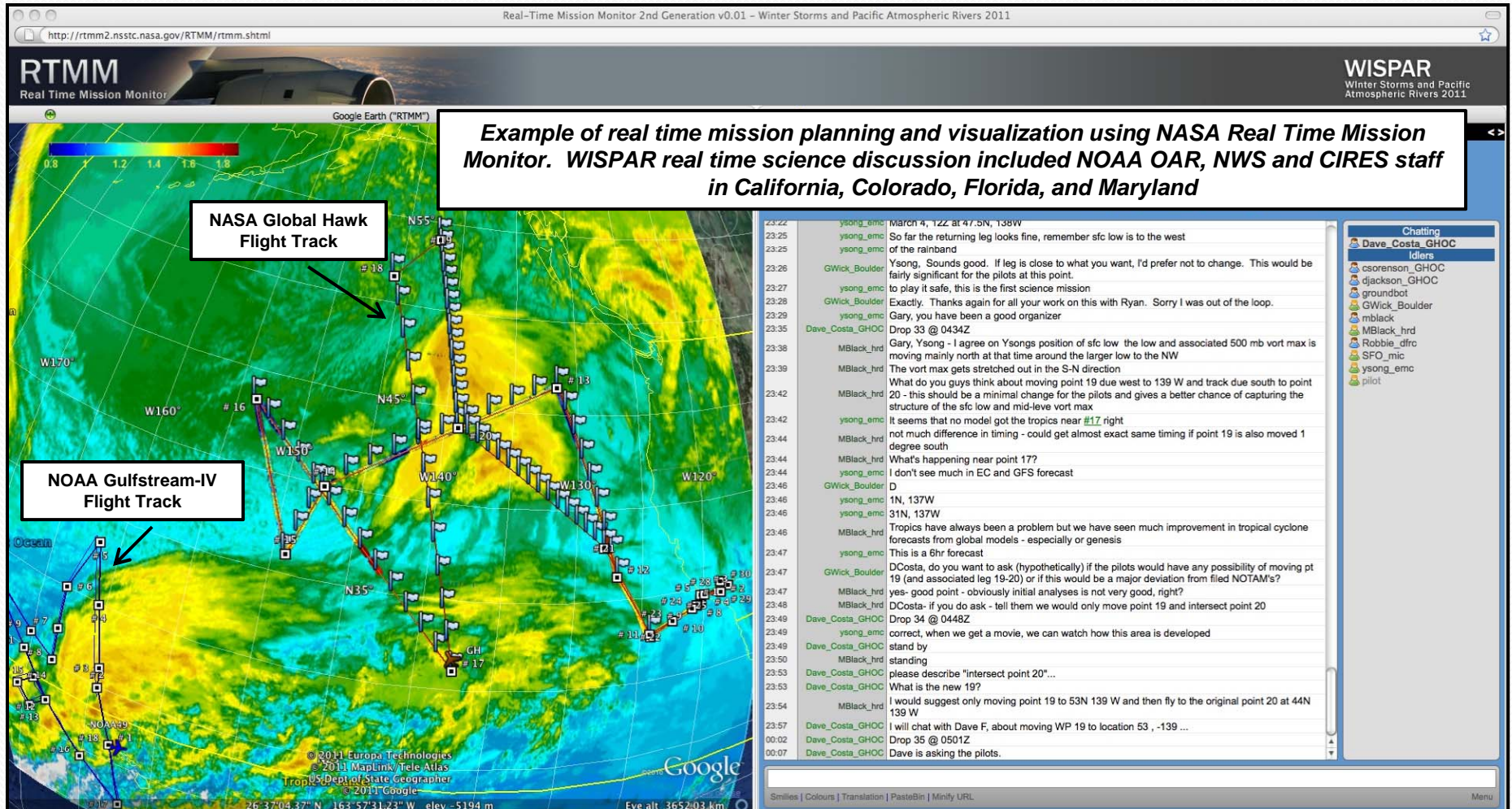


Courtesy of Leslie Lait, Paul Newman (NASA GSFC)



WISPAR Winter Storm Mission

3-4 March 2011

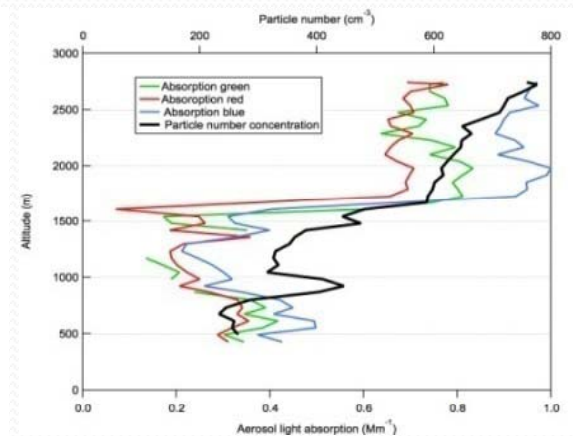
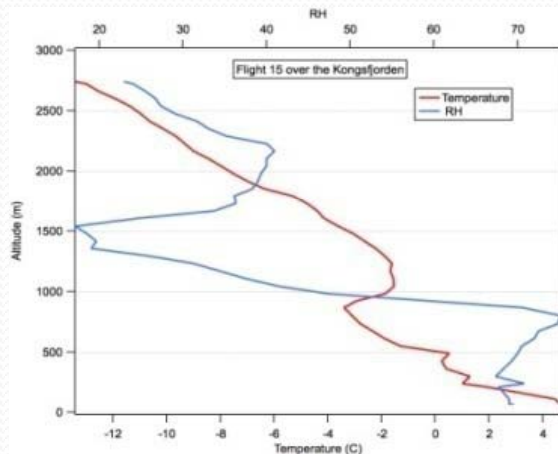
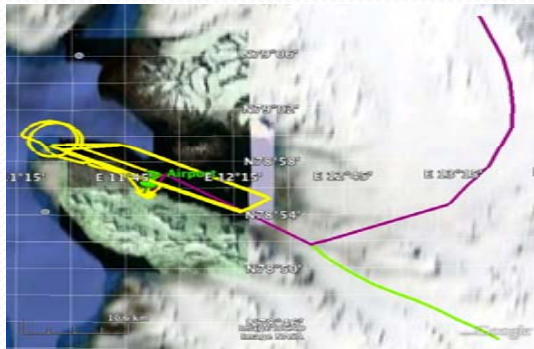
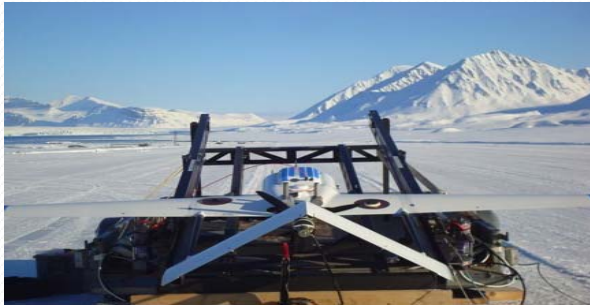


Winter storm mission flown on the eastern side by the NOAA Gulfstream-IV and on the western side by NASA Global Hawk. The Global Hawk historically released 70 dropsondes in a single flight covering 8000 nmi. The Global Hawk also remotely sensed atmospheric temperature and water vapor profiles continuously during the 24 hour mission using the NASA JPL High-Altitude Monolithic Microwave Integrated Circuit Sounding Radiometer (HAMS).



Soot Transport, Absorption, and Deposition Study (STADS)

5 April – 7 May 2011

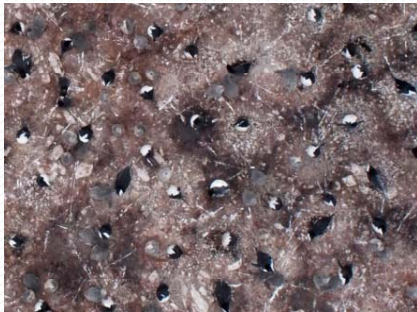


NOAA component of the Coordinated Investigation of Climate-Cryosphere Interactions (CICCI) collaboration with Norwegian and Russian scientists

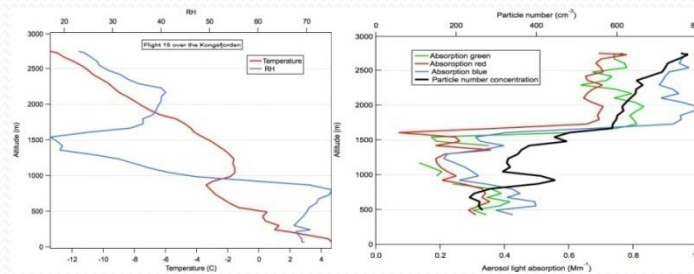
STADS Mission Scientists: Tim Bates and Patricia Quinn (NOAA/ESRL)



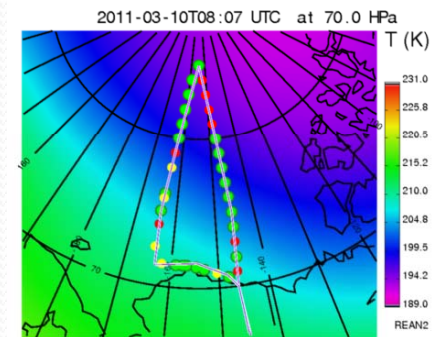
Wide Range of Innovative UAS Observing Solutions



Quiet and Easily Transportable for High Resolution Imaging



Versatile Platform and Payload Capabilities for Low Altitude Profiling

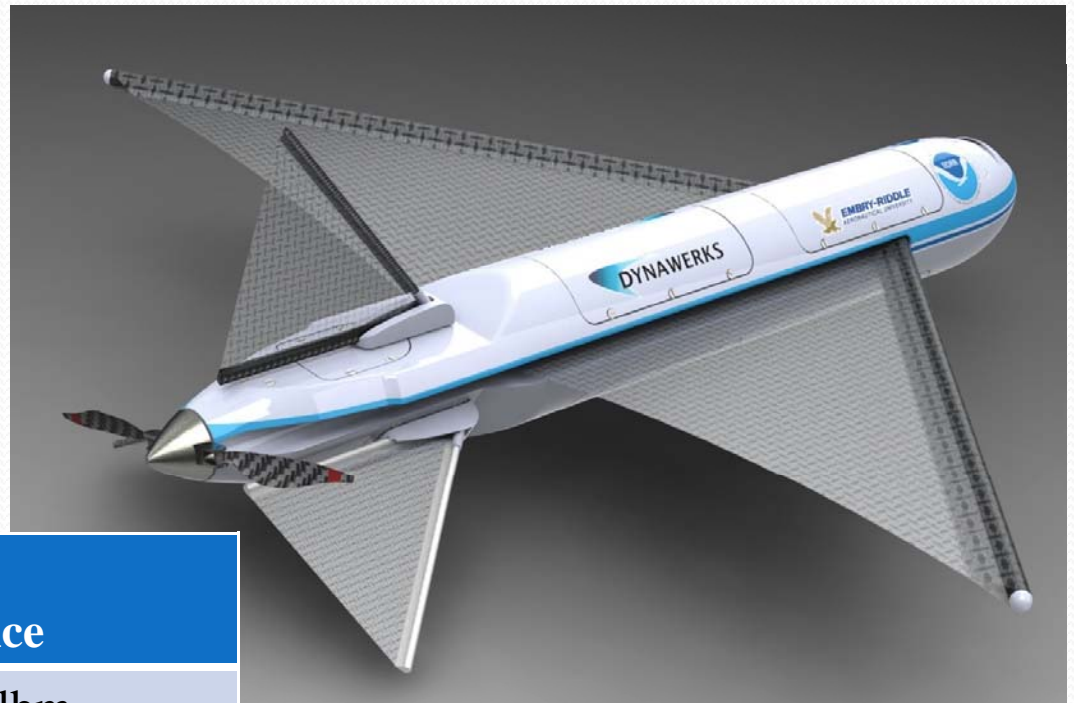


High Altitude Long Endurance for Comprehensive Imaging and Profiling



Gale UAS

July 2011



Performance Attribute	Estimated Performance
Mission Weight	8.0 lbm
Cruise Speed	42 kts
Dash Speed	110 kts
Stall Speed	22 kts
Mission Endurance	60 minutes



Future Capabilities



Vehicle: Puma AE

Manufacturer: AeroVironment

Launch: Hand Launch

Recovery: Belly

Cruise Speed (knots): 20-45

Range (nm): 56

Payload (lb): ~2

Endurance (hr): 2

Ceiling (ft): 500

BLOS C2 Capable: No

LOS C2 Range (nm): 8.1

Data Sources:

Manufacturer's Online Specification
accessed 08/30/10. Range Calculated.

2011 Partnership with Army UAS Program

Potential 2012 Missions

- Marine Debris
- National Marine
Sanctuary Surveys
- Fisheries Law
Enforcement
- Wildlife Assessments
- Beach and Shoreline
Patrols



Next Steps

- Optimizing UAS observing strategies for:
 - Sea ice information
 - Wildlife assessments
 - Air quality and atmospheric chemistry process studies
 - Oceanic meteorological information
 - Real-time data delivery
 - Fast, effective image processing
- Identifying promising UAS technologies for:
 - Methane impact studies
 - Gravity and elevation information
 - Coastal mapping
 - Inland flooding and meteorological information



Contact Information

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