



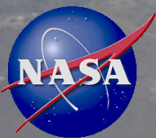
The Global Hawk Unmanned Aircraft System (UAS): A new platform for Earth science research



by

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NASA Armstrong Flight Research Center
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NORTHROP GRUMMAN



The Global Hawk Unmanned Aircraft System (UAS): A new platform for Earth science research



- The Global Hawk UAS is a remarkably powerful platform for Earth Science research.
- NASA and NOAA have already conducted major scientific campaigns to demonstrate its outstanding research potential.
- The platform represents a tradeoff between **power and complexity** and will **challenge our imagination** for years to come.

Global Hawk Unmanned Aircraft System (UAS)

NASA AFRC
March 2013



Fully autonomous operation

Duration = 30 hr @ 170 m s⁻¹

Range = 18000 km (Earth = 40000 km)

Maximum altitude = 65 kft = 19.8 km

Payload = 700 kg

Wingspan = 35.4 m (A320 = 34.1 m)

Gross wt. = 12.3 metric tonnes

Learn more: <http://www.nasa.gov/centers/armstrong/aircraft/GlobalHawk/index.html>

Global Hawk UAS: Payload Command, Control, Communication



Iridium antennas (9600 Baud)

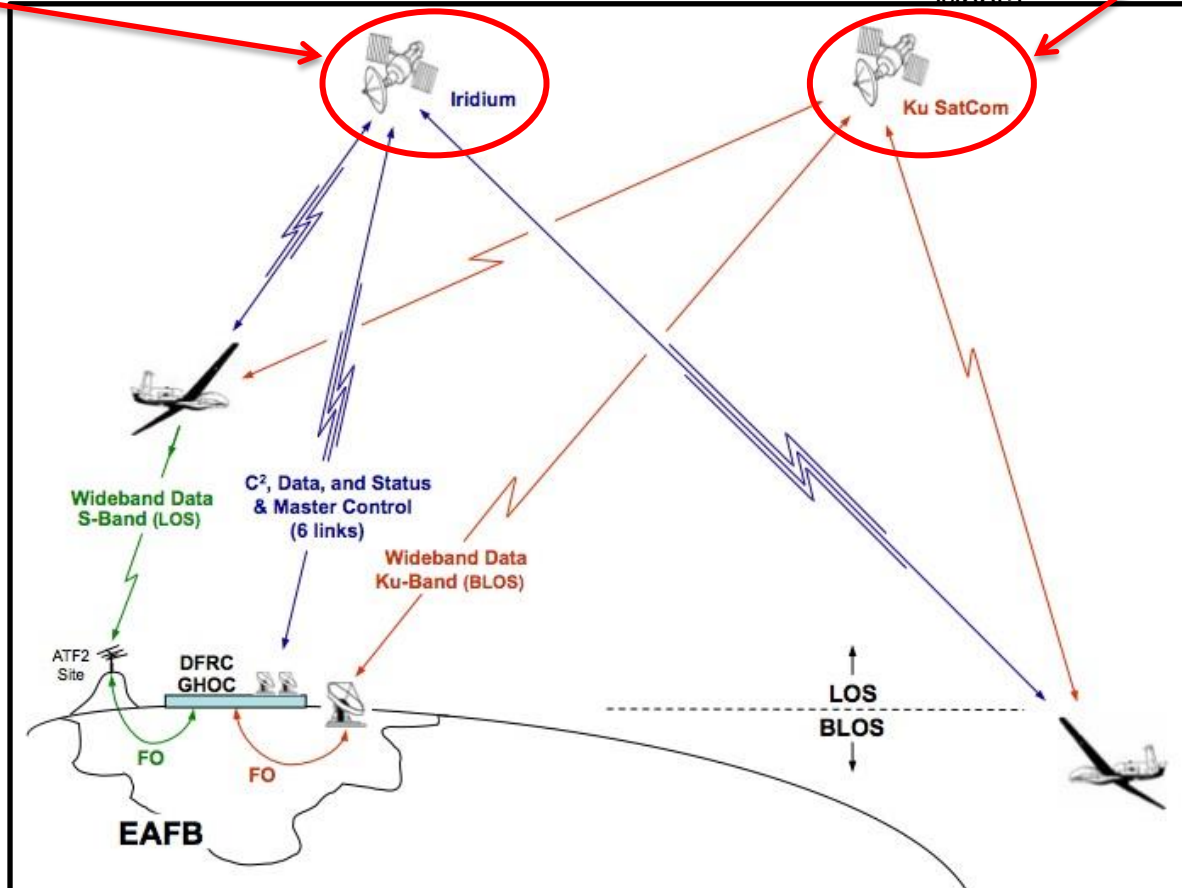


Global Hawk radome



Ku-SatCom antenna (5 Mbps)

➤ Global Hawk is an aircraft *system*.



EAFB = Edwards Air Force Base, CA

BLOS = beyond line of sight

NASA Global Hawk Operations Center (GHOC)

Flight Operations Room (FOR) (*cockpit*)



Mission Director

Pilot

Co-pilot

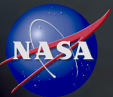
Keyboard & Mouse

➤ Pilot and co-pilot control the aircraft with only a keyboard and mouse.

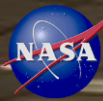
HV7575aDot Tue Aug 24 15:33:56 2010 Flight -GLOP02_4
Exposure: 19 MAC 0030F4-0112701
Frame number 151255
Infernal Temperature 42.0°C



➤ The aircraft is launched with *a click of the mouse*.



Global Hawk Operations: Autonomous Takeoff



Global Hawk Operations Center (GHOC)

Flight and payload Operations Room (FOR and POR)



- Investigators communicate with- and control instruments throughout a flight
- Power vs. complexity

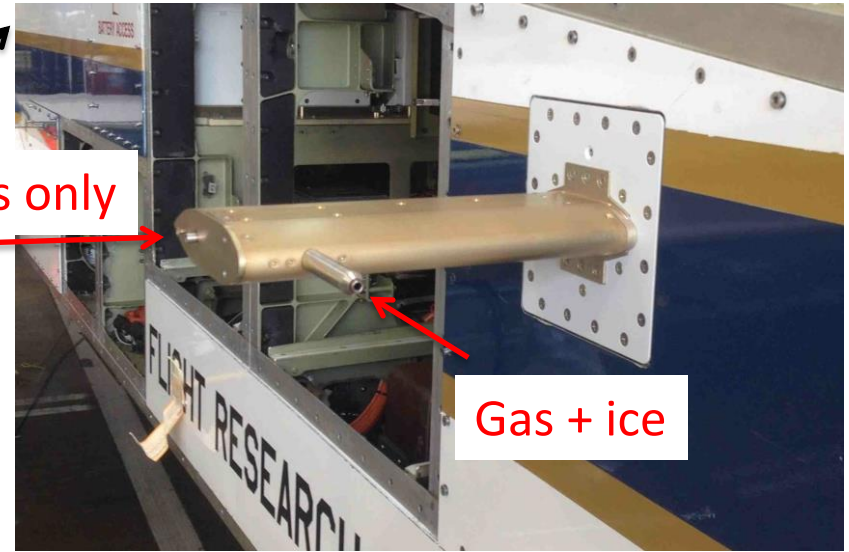


Global Hawk Operations: Autonomous Landing

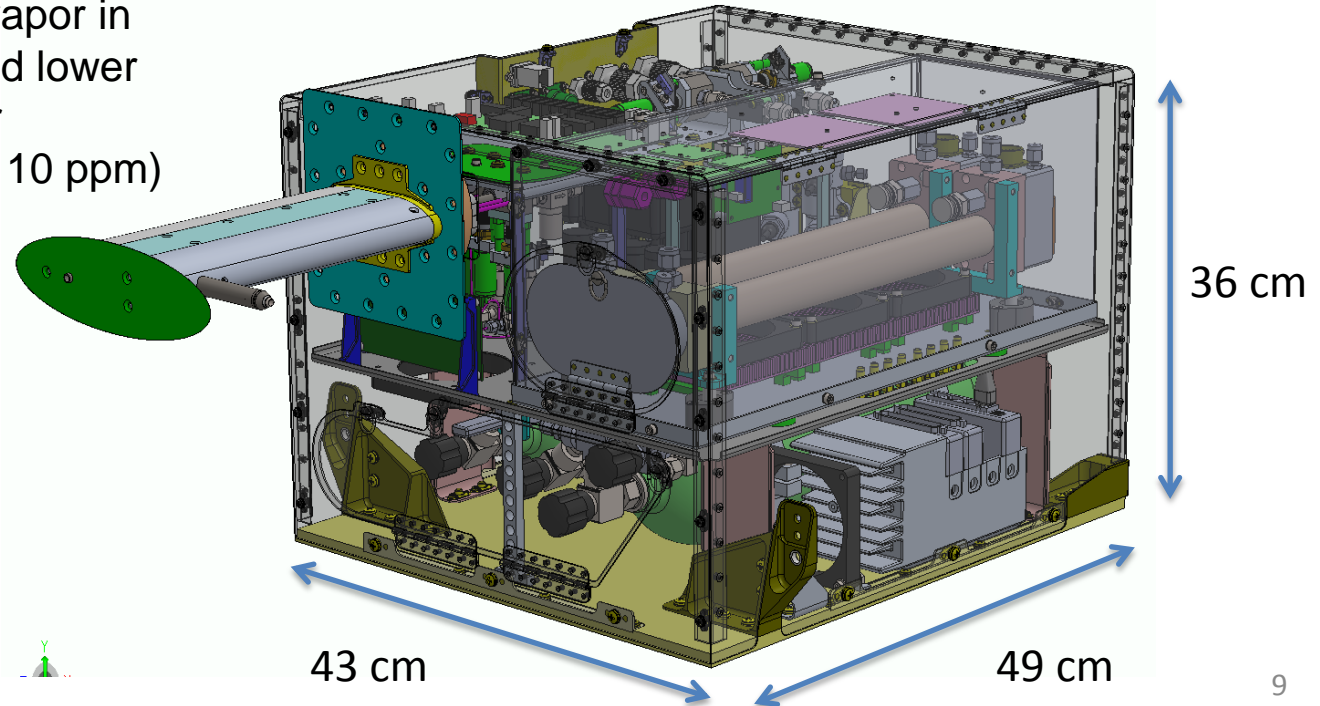


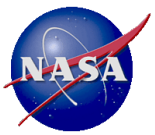
➤ Autonomous landing requires only GPS coordinates

NOAA Tunable Diode Laser (TDL) water instrument



- Provides in-flight calibrated measurements of water vapor in the upper troposphere and lower stratosphere where water abundance is very low (< 10 ppm)





NASA Earth Science Missions with the Global Hawk UAS

2011 - 2015

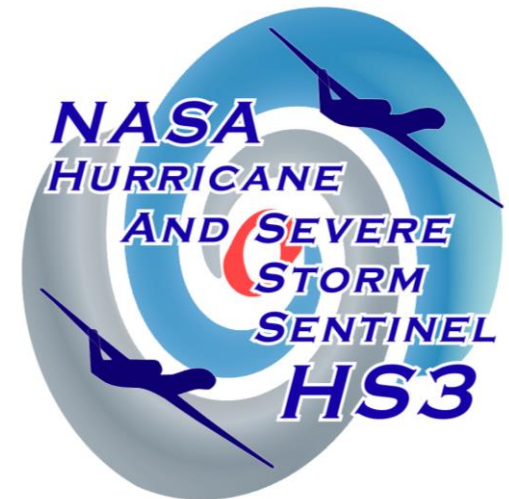
ATTREX: Airborne Tropical Tropopause Experiment

Objective: Study physical processes and chemical composition of the tropical tropopause region which controls the composition of air entering the stratosphere with a focus on water vapor and clouds.



HS3: Hurricane and Severe Storm Sentinel

Objective: Investigate the processes that underlie hurricane formation and intensity changes in the Atlantic Ocean basin in order to improve hurricane forecasts.



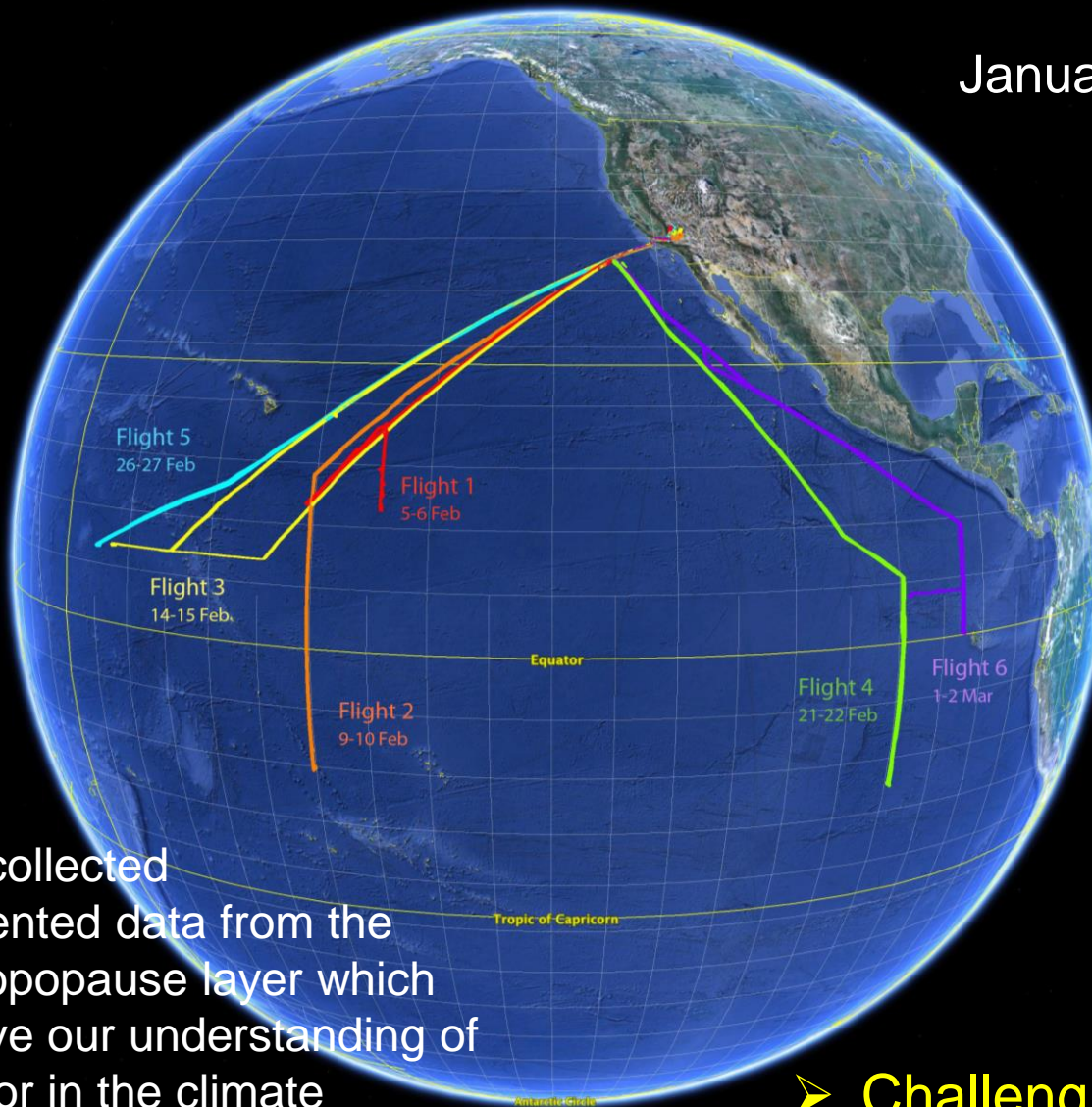


ATTREX Global Hawk UAS Flights



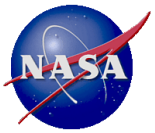
January – February 2013

Average flight:
7790 nm
14300 km
24.4 hrs



- ATTREX collected unprecedented data from the tropical tropopause layer which will improve our understanding of water vapor in the climate system.

➤ Challenging our imagination



HS3 Global Hawk UAS Flights

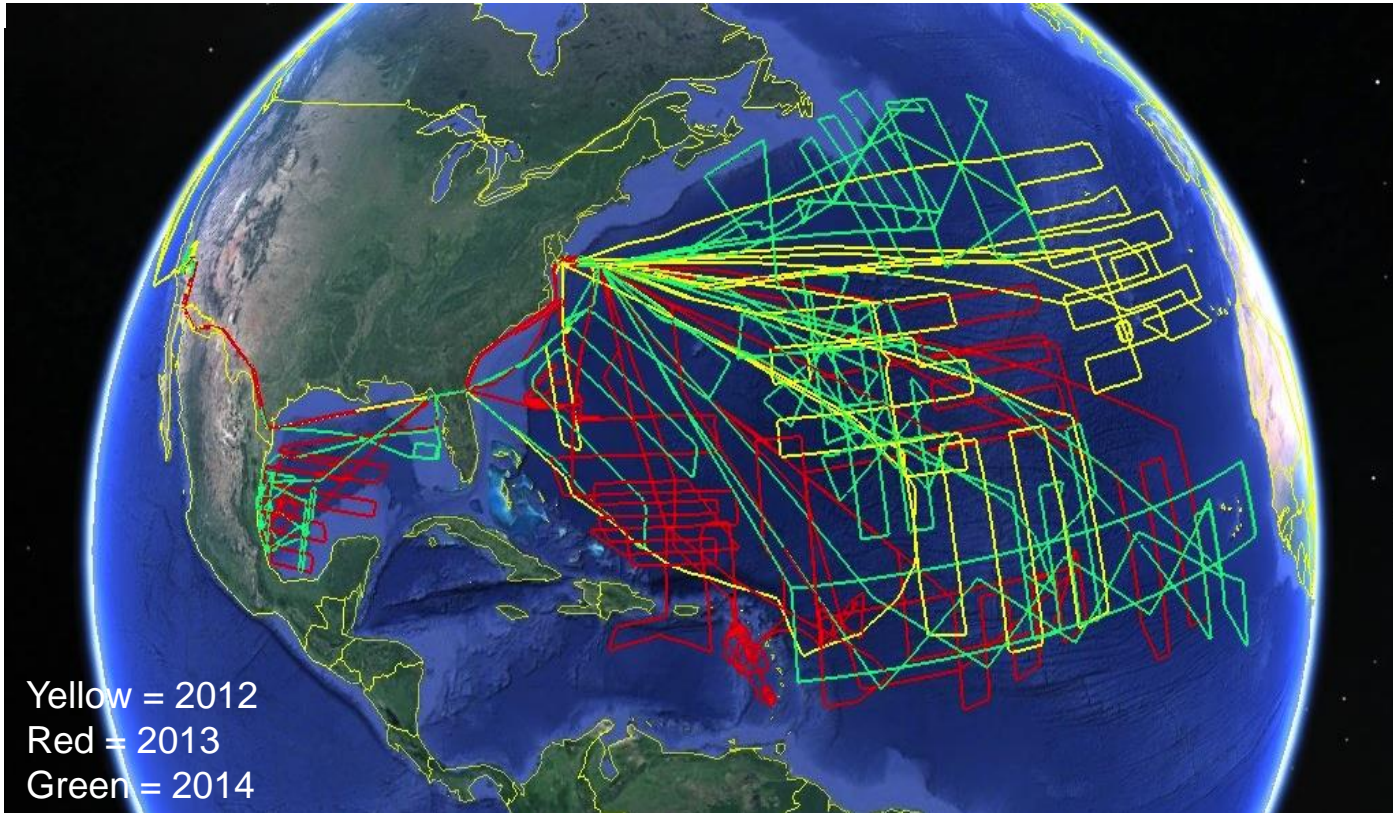
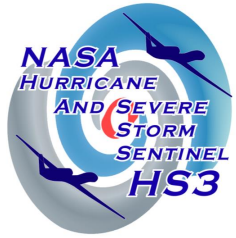
Global Hawk UAS reconnaissance flights over Atlantic hurricanes:

19 flights over 9 storms

2012: Leslie, Nadine

2013: Gabrielle, Humberto, Ingrid

2014: Cristobal, Dolly, Edouard, Gonzalo



- HS3 demonstrated the feasibility of improved hurricane reconnaissance with unprecedented data from multiple Atlantic storms.

Summary points

- The Global Hawk UAS is a unique suborbital platform for Earth science research.
- NASA missions have already demonstrated that Global Hawk can acquire unprecedented data from the remote atmosphere.
- UASs are the future of airborne science: they are challenging our imagination for use in atmospheric, ecological, and weather research on a global scale.



Thank you for your attention



ICAO UNITING AVIATION

E-GAP



ICAO Partners multiplying environmentally sustainable aviation action

Example Partners from the ATTREX project



Ames Research Center



University of Colorado Boulder



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