NASA Global Hawk Project Update and Future Plans

A New Tool for Earth Science Research

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NASA's Airborne Science Aircraft Capabilities

Altitude (ft)

Endurance (hours)

Global Hawk’s Unique Capability

Global Hawk

WB-57

ER-2

Lear 23

DC-8

B-200

S-3B

P-3B

Caravan

J-31

Ikhana

Aerosonde
**USAF Global Hawk Block Approach**

**BLOCK 0 (ACTD)**
- 7 Aircraft with ISS (EO/IR/SAR)
- First flight FY98, GWOT in FY02
- 2 Transferred to NASA for Environmental Research in FY07
- 1 USAF Test Bird at Edwards AFB

**BLOCK 10**
- 7 AF; 2 Navy aircraft
- Raytheon ISS (EO/IR/SAR Sensor)
- Operational in CENTCOM Jan 06
- Training & MCE at Beale AFB

**BLOCK 20**
- 6 USAF aircraft
- Raytheon Enhanced ISS (longer range)
- NG-ES LR-100 ELINT
- IOT&E and Fielding in 2009
NASA Space Act Agreement:
- 2008 – 2013: Share costs and system access.
- NASA focus is Earth & Atmospheric Science.
- Northrop Grumman focus is new capability developments and DoD customers.

Currently in Stand-Up Phase
- Assembled new infrastructure.
- Phase inspections and aircraft modifications.
- New ground control station completed
- Flight testing is on-going.

Flight Missions Planned
- January 2010 - Global Hawk Pacific (GloPac) Scientific Campaign.
- Summer 2010 Tropical Storms - NASA Genesis and Rapid Intensification Processes (GRIP).
- 2011 - NASA Jet Propulsion Laboratory UAVSAR.
NASA Global Hawk System

- Two USAF Pre-Production Global Hawk aircraft were transferred to NASA in September 2007. (A third aircraft arrives later this Fall)

- A combined NASA/Northrop Grumman team is maintaining, modifying, and operating the UAS through a 5-year partnership. (2008-2013)

- The first flight of the NASA Global Hawk occurred on 23 October 2009. The flight lasted 4 hours and reached 61,400 ft with no anomalies.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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<tbody>
<tr>
<td>Endurance</td>
<td>&gt; 30 hours</td>
</tr>
<tr>
<td>Range</td>
<td>&gt; 11,000 nmi</td>
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<tr>
<td>Service Ceiling</td>
<td>65,000 ft</td>
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<tr>
<td>Airspeed (55K+ ft)</td>
<td>335 KTAS</td>
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<tr>
<td>Payload</td>
<td>1,000-1,500 lb</td>
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<tr>
<td>Length</td>
<td>44 ft</td>
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<tr>
<td>Wingspan</td>
<td>116 ft</td>
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Cruise Climb from 56-65K ft (max takeoff weight)
Typical Mission Profile

- **Altitude**
  - 65,000 Ft
  - 50,000 Ft

- **Climb**
  - 200 NM Max.

- **Cruise Climb Ingress**
  - 1,200 NM

- **65,000 Ft Loiter Altitude**

- **Sensor Area Coverage**
  - 40,000 Sq Mi

- **Egress**
  - 1,200 NM

- **Descent**
  - 200 NM Max.

- **Climb 200 NM Max.**

- **Descent 200 NM Max.**

**Idle / Takeoff**
- Steady 20Kt Crosswind Component
- 5000 Ft
- 350 Ft
- 50 Ft
- 25 Min. at Ground Idle
- 5 Min. at Takeoff Thrust

**Descent / Land**
- 1 Hour Reserve Loiter at Sea Level
- Steady 20Kt Crosswind Component
- 5000 Ft

**Standard Runway**
- 8,000’ x 150’
Baseline Mission Capability

- Long-duration missions will be conducted in the Arctic, Pacific and Western Atlantic Oceans.

- The arcs represent on-station dwell times before return to base.
NASA Global Hawk Operations Overview

- UAV Runway
- Mission Staging Location
- Maintenance Hangar
- Edwards Air Force Base

NASA Dryden Flight Research Center

Operations Center
Flight Control and Air Traffic Control Communications Architecture
Payload Integration and Accommodations (cont)

On-Site Customer Accommodations

- Re-configurable work area in the hangar.
- Access to meeting room, phones, fax, copy machine, printer.
- Wireless internet.
- Shop support.
- Environmental testing support.
- NASA and Northrop Grumman Mechanics and Technicians.
- Hangar is networked to the Global Hawk Operations Center.
NASA/NOAA Partnership

NOAA and NASA Partnership
- Joint participation in science data gathering missions.
- NOAA provides scientific instrumentation to compliment NASA instrumentation.
- 3 year agreement.

CDR Phil Hall on 4 Year Detail to Dryden
- Deputy Project Manager.
- Global Hawk pilot.
- Mission planning and coordination.

Dropwindsonde Capability
- NOAA is funding the development of a dropwindsonde capability.
- NCAR/NOAA partnership.
Global Hawk Pacific Science Campaign (GloPac)

- Flights planned for Winter 2010.
- Flights will be conducted over the Pacific Ocean, and possibly over parts of the Arctic.
- 11 instruments, NASA and NOAA sponsored.

Proposed Flights

COA Boundary

Science Team
1) Airborne Compact Atmospheric Mapper (ACAM) -- Cross-track scanning spectrographs of NO₂, O₃, & aerosols.
2) Cloud Physics LIDAR (CPL) -- Backscatter LIDAR for hi-res profiling of clouds & aerosols.
3) Focused Cavity Aerosol Spectrometer (FCAS) -- Aerosol size and concentration measurements.
4) Meteorological Measurement System (MMS) -- Science quality aircraft state variable measurements.
5) Microwave Temperature Profiler (MTP) -- Passive microwave radiometer meas. of O₂ thermal emissions.
6) HiDef Video System (HDVis) -- Time-lapse nadir color digital imagery with georeferencing.
7) Nuclei-mode Aerosol Size Spectrometer (NMASS) -- Aerosol size and concentration measurements.
8) NOAA UAS Ozone (Ozone) -- Dual-beam UV photometer for accurate O₃ measurements.
9) UAS Chromatograph for Atmospheric Trace Species (UCATS) -- Dual gas chromatographs for N₂O, SF₆, H₂, CO, & CH₄ meas.
11) UAS Laser Hygrometer (ULH) -- In-situ hi-accuracy atmospheric water vapor measurements.
Science Objectives and Missions

- First demonstration of the Global Hawk unmanned aircraft system (UAS) for NASA and NOAA Earth science research and applications.

- Validation of instruments on-board the Aura satellite.

- Exploration of trace gases, aerosols, and dynamics of remote upper Troposphere / lower Stratosphere regions.

- Sample polar vortex fragments and atmospheric rivers.

- Risk reduction for future missions that will study hurricanes and atmospheric rivers.
Proposed Payloads

**UAV-SAR (JPL)**
Reconfigurable polarimetric L-band SAR designed for repeat pass deformation measurements (currently on NASA G III).

**HIWRAP (GSFC)**
Ku and Ka band radar for the measurement of wind and rain profiles.

**Dropwindsonde Dispenser (NOAA)**

**HAMSAR (JPL)**
Microwave Sounder providing 3D measurements of temperature and Water vapor content.

**HIRAD (MSFC)**
Hurricane Imaging Radiometer for high resolution measurements of ocean surface vector winds.
Future Mission Capability

With a Portable Ground Station
Summary

- NASA Dryden owns two Global Hawk aircraft, soon to be three.

- A ground control station has been constructed and certified.

- Flights within the EAFB range began in October 2009.

- Customer flights begin in 2010.
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