



# Unmanned Aircraft Systems

[www.uas.noaa.gov](http://www.uas.noaa.gov)

## Bridging Information Gaps in Hazardous, Remote, and Data Sparse Regions

The Unmanned Aircraft Systems (UAS) program aims to make UAS observations an essential component of the NOAA observing system focusing on High Impact Weather, Polar and Marine Monitoring. UASs can advance NOAA's ability to monitor and understand the global environment by complementing observations from satellites, ships, aircraft, balloons, and surface-based sensors. Actionable and reliable environmental intelligence provided by unmanned systems improve forecasts, save lives, property and resources, advancing NOAA's mission goals.

### Program Highlights:

#### **High-Impact Weather Monitoring: Global Hawk provided real-time data to hurricane forecasters and the operational HWRF Model**

The NOAA UAS program launched the Sensing Hazards with Operational Unmanned Technology (SHOUT) project in 2014 with Disaster Relief Appropriations Act of 2013 funds to evaluate the use of NASA's Global Hawk, to observe high impact weather events like hurricanes. This UAS can stay aloft for over 25 hours, flying at altitudes up to 65,000 feet, and has been flown over 18 named hurricanes and tropical storms. During the 2016 season, the NOAA-led SHOUT missions for the first time provided real-time UAS sonde data from the Global Hawk directly into NOAA's operational Hurricane Weather Research and Forecast (HWRF) model to assist in the forecast of 2016 Hurricanes Gaston, Hermine & Matthew. Analysis has demonstrated that sonde data can lead to improvements in forecasts of hurricane track and intensity. SHOUT will continue through 2017.

#### **Polar Monitoring: ScanEagle UAS used to monitor wildlife and conduct atmospheric research in the Arctic**

The NOAA UAS Program Office, NMFS' Office of Science and Technology and National Marine Mammal Laboratory, Office of Naval Research, and Bureau of Ocean Energy Management continued testing of unmanned marine mammal detection and ice prediction systems from Barrow, Alaska. This multi-agency project included the collection of imagery from both the manned aircraft and UAS to evaluate the use of software to automatically detect cetaceans in the images, and calculate the basic summary statistics needed for assessing cetacean density. The test results will provide recommendations: for cetacean study objectives that may be met by UAS technology, for adaptations of analytical processes for estimating cetacean population density, and for further development of the PEMDAS UAS atmospheric sampling and ice prediction systems.

#### **Marine Monitoring: Spiral development of the Puma UAS system continues during joint operations onboard the USCGC Healy for NOAA objectives**

The NOAA UAS program collaborated with the US Coast Guard during Arctic Shield 2013-15 missions to ensure the Arctic remains a safe, secure and environmentally protected resource. The Pumas UAS was hand launched from the US Coast Guard Cutter Healy north of Alaska and used to return imagery during a Search & Rescue Exercise simulating a man in the water. This mission complemented previous operational assessments monitoring ice, simulated oil spills and marine debris in the Arctic.



NASA's Global Hawk prepared for launch from NASA Wallops Flight Facility, VA in support of the NOAA-led SHOUT 2016 mission hurricane rapid response research flights. Source: NASA



ScanEagle launches from Barrow, AK, for atmospheric and marine mammal research during the Summer 2015. Source: NOAA



Puma launches from the NOAA R/V Shearwater at the Channel Island National Marine Sanctuary for testing of the autonomous net-capture system in preparation Arctic Shield 2017. Source: NOAA



## More Program Highlights

### UAS Observations Support Flood Forecasting

With support from the Northern Gulf Institute, UASs are being flown over river basins to provide forecasters and scientists critical information to improve flood warnings. The Puma and Altavian UAS were used from 2013-17 to construct detailed maps of the Pearl River Basin and the Grand Bay National Estuarine Research Reserve.

### UAS Collaborates With Small Business Innovation Research Program

New activities funded through the Small Business Innovation Research (SBIR) program are helping NOAA explore future novel applications of UAS. Projects include development of new methods to measure the heat flux between the ocean and atmosphere with the development of a new, inexpensive air-launched UAS capable of collecting accurate moisture and temperature measurements. Another project is investigating more efficient ways of collecting highly precise gravity measurements through integration of new instrumentation on the Centaur Optionally Piloted Aircraft, and has been commercialized. Other platforms currently used within NOAA UAS demonstrations had their development partially supported through SBIR projects.



Map of the Pearl River Basin in Mississippi collected using the Altavian UAS on September 23, 2014. Source: Robert Moorhead, Mississippi State University



The Aurora Flight Sciences Centaur Optionally Piloted Aircraft was successfully tested for gravity sampling missions with SBIR funding. Source: Aurora Flight Sciences

## What's Next for UAS?

NOAA's UAS program is working to advance the technological readiness of UAS systems and build capability for their application across the agency. Several new concepts have been proposed including:

- Collecting detailed observations low in the atmosphere in support of understanding and forecasting convective continental storms
- Evaluating methods to employ UAS in the rapid response to natural disasters
- Advancing the capability of vertical take off and landing UAS for wildlife monitoring and other applications
- Employing UAS to collect detailed measurements of air quality

## Research Partnerships

The NOAA UAS program is working with a large and diverse range of partners to demonstrate the utility of the technology for the agency. The partners are composed of all the line offices across NOAA, other Federal agencies from both the civilian community and Department of Defense, numerous academic institutions, and a large number of industry representatives. These partnerships have been instrumental in achieving the results to date and will remain critical moving into the future.

### Did You Know?

- NOAA has flown Puma UAS on 500 flights for science data collection over rivers, beaches, oceans, the Arctic and Antarctic since 2012.
- Over 2500 dropsondes, an expendable atmospheric profiling tool, were successfully deployed from the Global Hawk UAS during joint NOAA/NASA science missions since 2011 with 839 during SHOUT.
- NOAA regularly conducts inter-agency UAS operations with government, industry and academic partners.
- The NOAA UAS Program has a vibrant Technology Transfer strategy which include active SBIRs and several Cooperative Research and Development Agreements (CRADA).

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