Uncrewed Systems Research Transition Office

https://uxsrto.research.noaa.gov/

Supporting Development of Enhanced Capabilities to Address Critical NOAA Mission Requirements

The Uncrewed Systems Research Transition Office (UxSRTO) goal is to fully exploit uncrewed systems UxS, enabling NOAA to better meet its mission requirements of Science, Service, and Stewardship to understand and predict changes in climate, weather, oceans, and coasts. The UxSRTO is strategically moving innovative research and development (R&D) through the transition process into NOAA UxS operations, applications, and commercialization. The office invests in new concepts and technologies with an eye to the future. Broad usage of UxS across NOAA will more efficiently support mission requirements for societal and economic benefits.

Program Highlights

Disaster Response – Enabling More Efficient Capabilities to Improve Forecasts and Rapidly Provide Actionable Information

The NOAA UxSRTO in the Office of Oceanic and Atmospheric Research (OAR) is investing in R&D activities intended to improve the resiliency of communities before, during, and after disasters. With its support, NOAA's Northern Gulf Institute recently deployed long-range UAS over a historic flood event in Mississippi, providing real-time imagery of flood inundation and water levels to the NWS Lower Mississippi River Forecast Center and FEMA. Additionally, NOAA's National Severe Storms Laboratory, in collaboration with the Cooperative Institute for Mesoscale Meteorological Studies, is working on developing an uncrewed aircraft system (UAS)-based approach to better characterize high-wind damage to vegetation in rural areas to improve disaster response and recovery.

Aerial image of MSU's TigerShark XP3 UAS, as it crossed the Mississippi River during NGI's mission in October 2020 to provide maps of flood-inundated land to the NWS Lower Mississippi River Forecast Center for enhanced operations. Visible in the background is the Greenville Bridge, Mississippi and Arkansas.

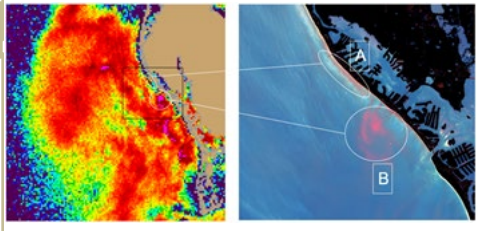
Wildlife and Habitat Monitoring – Observations of Marine Wildlife Populations and Assessment of Health and Ecosystems

The NOAA UxSRTO supports the National Marine Fisheries Service's Office of Science and Technology and Marine Mammal Laboratory as they continue the development of UAS for detection of seals, polar bears, dolphins, porpoises, gray whales, right whales, and orcas. NOAA conducts uncrewed system (UxS) abundance surveys of protected coastal marine mammal species. Enhancements of this innovative technology is essential towards monitoring and managing the species, especially as we begin to see impacts from climate change. This data is also used in ecosystem based modeling to better understand the potential mechanisms and long term ecosystem impacts. Streamlining the analysis of these surveys with artificial intelligence will allow for faster dissemination of the data to stakeholders and require less time from staff allowing them to focus on other NOAA missions.

APH-22 UAS without disturbance by close boat approach. Source: NOAA

Harmful Algal Blooms (HAB) Detection – Innovative Technologies

Certain algal blooms around the U.S. have the potential to produce biotoxins that pose significant risks to human health and marine life. In recent years, these harmful algal blooms (HABs) have resulted in unprecedented impacts on coastal communities and the tourism, recreation, and fishing businesses that support them. The NOAA UxSRTO supports the development and demonstration of small UAS, integrated with HAB sensors, to provide cost-effective, rapid near-shore water quality assessments in order to more accurately identify the location of bloom patches and inform the public.



Satellite detection of HABs in littoral waters from Sentinal-3 (left) is able to detect offshore blooms (right, B) but not nearshore blooms (right, A).

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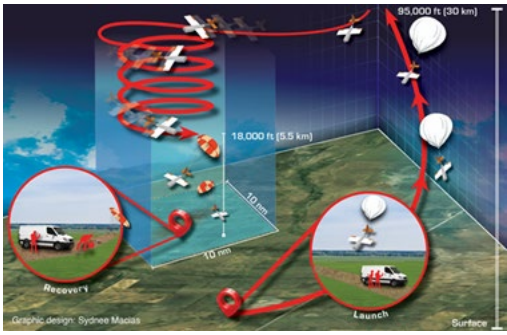
More Program Highlights

Atmospheric Observations – Stratosphere Scientific Measurements

Supported by the NOAA/OAR Uncrewed Systems Research Transition Office (UxSRTO), scientists from NOAA's Global Monitoring Laboratory (GML) and the Cooperative Institute for Research in Environmental Sciences (CIRES) successfully launched the "High-Altitude Operational Returning Uncrewed System" (HORUS). The glider reached an altitude of 75,000 feet above the mean sea level (MSL), demonstrating its ability to efficiently collect high-accuracy, high-precision data from all over the world to help improve weather and climate models.

UAS Collaborates With Small Business Innovation Research Program

New activities funded through the Small Business Innovation Research (SBIR) program are helping NOAA explore unique Uncrewed Systems (UxS) applications. This includes development of Uncrewed Maritime Systems (UMS) and Uncrewed Aircraft Systems (UAS) that can launch and recover scientific payloads from NOAA ships to measure oceanographic parameters, aerosols and atmospheric fluxes. Projects include development of new methods to measure heat fluxes—the exchange of heat between the atmosphere and the underlying ice, ocean, and land surfaces—which is a key to understanding and predicting weather and climate. Other efforts involve support to obtain measurements in the atmospheric boundary layer and other NOAA mission areas of interest.



Schematic of proposed Concept of Operations (CONOPS) plan in unrestricted airspace for operational High-altitude Operational Return Unmanned System (HORUS) flights. Photo Credit: Sydnee Macias|GML.

The L3Harris FVR-55 fixed wing hybrid quadrotor during launch and recovery exercises off NOAA Ships

What's Next for UxS?

NOAA's UxSRTO is working to advance the readiness levels of both uncrewed aircraft and maritime systems in NOAA and build capability for their application across the agency. Research areas include, but are not limited to:

- Evaluate observing strategies and address critical data gaps
- Develop innovative technologies to provide a persistent presence
- Enable BVLOS UAS operations within NOAA
- Analyze the value of high-altitude observations
- Evaluate swarmed uncrewed systems that are using artificial Intelligence and machine learning applications
- Accelerate transition of research to operations, applications, and commercialization

Partnerships

The NOAA UxSRTO works with all NOAA Line Offices and affiliated partners to research, develop, demonstrate, and transition UxS technology for the agency. Partners include NOAA Cooperative Institutes, other Federal agencies, academic institutions, and industry representatives. These partnerships have been instrumental in achieving the results to date and such collaboration will remain critical moving into the future using new innovative technologies.

Did You Know?

- Small UAS can typically operate at distances up to 1 mile away with pilot "line of sight" operations. With BVLOS operations, the amount of area covered in a single operation could be 4 to 9 times larger with only a modest increase in ranges up to 2 to 3 miles, respectively.
- UAS flight time in minutes during 2020 and 2021 were 8,744 and 18,094; and the number take-offs/landings totaled 862 and 1,526, respectively.
- The NOAA UxSRTO has a vibrant technology transfer strategy that includes SBIR and Cooperative Research and Development Agreements (CRADA)

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