NOAA Uncrewed Aircraft Systems Report for Fiscal Year 2024

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Cover Photo: An uncrewed aircraft system sits on a launch pad before field testing to gather weather observations. Photo: NOAA/National Severe Storm Lab/Tony Segales

About the National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA), under the Department of Commerce, provides science, service, and stewardship to protect life, property, and Earth's natural resources. By collecting scientific data, NOAA provides daily weather forecasts, storm warnings, and climate monitoring; and facilitates fisheries management, marine commerce, and coastal restoration. NOAA uncrewed systems work is organized into Uncrewed Aircraft Systems (UAS) and Uncrewed Marine Systems.

About the Uncrewed Systems Executive Oversight Board

The Uncrewed Systems Executive Oversight Board provides oversight of NOAA's UAS and Uncrewed Marine Systems efforts. It assures agency-wide strategies and initiatives are developed collaboratively and implemented consistently. It was established through the Commercial Engagement through Ocean Technology Act of 2018. The Executive Oversight Board includes membership from across NOAA's line offices and reports to the NOAA Fleet Council. The Executive Oversight Board is co-chaired by the Office of Marine and Aviation Operations and Office of Oceanic and Atmospheric Research.

About the Uncrewed Systems Operations Center

The Uncrewed Systems Operations Center was established in Fiscal Year (FY) 2020, following receipt of funding to improve and expand uncrewed systems operations across NOAA. The Uncrewed Systems Operations Center sits within NOAA's Office of Marine and Aviation Operations and works to expand uncrewed systems applications, transition uncrewed systems into operational use, and provides corporate support to uncrewed systems operations. Within the Uncrewed Systems Operations Center sits the UAS Division that plays a central role in all NOAA UAS operations.

About the Annual Report

This Annual Report is an overview of the UAS work of NOAA in FY 2024. The information presented is structured to provide insight on NOAA UAS adoption, applications, and integration. This document was developed by the Uncrewed Systems Executive Oversight Board with support from the Uncrewed Systems Operations Center.

Acknowledgments

This report was crafted by Natalia Uribe Castañeda and Ashley Hann with support from Laura Dwyer, Mark Rogers, Mark Bolton, Ayden Marrullier, Grant Rawson, Maideline Sanchez, Elizabeth Smith, Christian Jones, Lance Garrison, Robyn Angliss, Jessica Cherry, Mike Sporer, John Walker, Amber Fandel, Lev Looney, John Armor, Mike Gallagher, and Lisa Nakamura.

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Foreword

Dear Readers,

On behalf of the NOAA Uncrewed Systems Executive Oversight Board, we are pleased to present NOAA's Uncrewed Aircraft Systems (UAS) Annual Report for Fiscal Year (FY) 2024. UAS enhance our ability to meet NOAA's science, service, and stewardship mission, and have grown as a valuable tool for the Agency. You can view the steady increase in use of the platforms over the last ten years in this report. NOAA is an active agent in the research and development of UAS occurring in the uncrewed systems enterprise, and regularly engages with partners from government, academia, and industry to accelerate innovation with UAS. In many instances, NOAA has transitioned UAS technologies to be a part of regular operations for the Agency. Whether conducting research and development, or transitioning platforms to operations, NOAA seeks to more efficiently, effectively, and safely gather mission-critical data through the operation of UAS.

FY 2024 was an exciting year for NOAA and innovation through UAS. Operations were conducted from the upper atmosphere to the surface of the ocean. The data gathered through this work supports disaster preparedness, protected species assessments, weather research, and more. UAS were employed in novel ways to inform the life-saving services provided by NOAA such as hazard communications in remote areas, hurricane forecasting, and severe weather damage assessments. You can read more about all these activities in this report.

Overall, NOAA flew over 37,000 flight minutes and more than 1,900 UAS flights in FY 2023. While many of these flights enhanced NOAA missions, NOAA will continue to engage in active research, development, and transitions of UAS technologies to fully realize the potential of emerging technologies.

This report highlights not only the UAS-enabled work performed by NOAA, but the corporate resources in place for NOAA to conduct such UAS work. Collectively, these efforts highlight the talented and dedicated NOAA workforce behind all UAS efforts.

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Rear Admiral Chad Cary (*on behalf of Rear Admiral Amanda Goeller*) & CAPT Bill Mowitt
NOAA Uncrewed Systems Executive Oversight Board Co-chairs

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Executive Summary

Uncrewed Aircraft Systems (UAS) are a growing asset for NOAA in providing science, service, and stewardship to protect lives, livelihoods, and natural resources. In order to do this, NOAA engages in the research and development of UAS technologies, as well as the transition of UAS technologies to operations and the routine use of UAS in gathering mission-relevant data. NOAA tackles this work through partnerships with other government, academic, and industry groups throughout the UAS enterprise.

In 2024, NOAA performed over 37,000 flight minutes spread over 2,416 flights across the United States using its fleet of 239 UAS. Over 40 platform types were utilized by NOAA in these operations, many including Department of Defense Blue UAS Cleared platforms, along with platforms in earlier stages of testing and evaluation. NOAA partnered with numerous government, academic, and industry collaborators to advance the Agency's UAS capabilities.

The UAS Annual Report is an annually produced report that provides an overview of NOAA's UAS activities. This report focuses on activities in Fiscal Year (FY) 2024 and is the fourth iteration of the report. It contextualizes NOAA's use of UAS across NOAA's six line offices:

- Office of Marine and Aviation Operations (OMAO)
- Office of Oceanic and Atmospheric Research (OAR)
- National Marine Fisheries Service (NMFS)
- National Weather Service (NWS)
- National Ocean Service (NOS)
- National Environmental Satellite Data and Information Service (NESDIS)

Stories from each line office highlighting the scope and magnitude of NOAA's UAS work can be found in this report. For example, readers can learn how UAS is a tool for marine mammal and storm damage assessments, along with the useful resources NOAA personnel are developing to increase the utility of UAS by NOAA, such as operational guidance and new trainings.

This year's report also highlights select corporate services available to NOAA to support safe and efficient UAS operations including new trainings, procurement guidance, and specialized resources to develop UAS operations in hurricanes and beyond visual line of sight UAS operations. Additional information is available on NOAA's 2024 UAS activities and inventory.

Introduction

Uncrewed Aircraft Systems (UAS) are an important resource for NOAA in gathering mission-critical data, and serve as a force multiplier to NOAA's traditional observation methods. UAS enable data collection with lower costs and increased safety. They often allow NOAA to gather data in difficult to access, or previously inaccessible, regions. In doing so, NOAA is better able to meet its missions and provide science, service, and stewardship to protect people and the environment.

In Fiscal Year (FY) 2024, NOAA UAS operators conducted more flights and flight minutes than any previous year on record (Figure 1). Flights included routine operations in support of NOAA's missions, along with efforts to advance the research and development of UAS technologies for improved data acquisition.

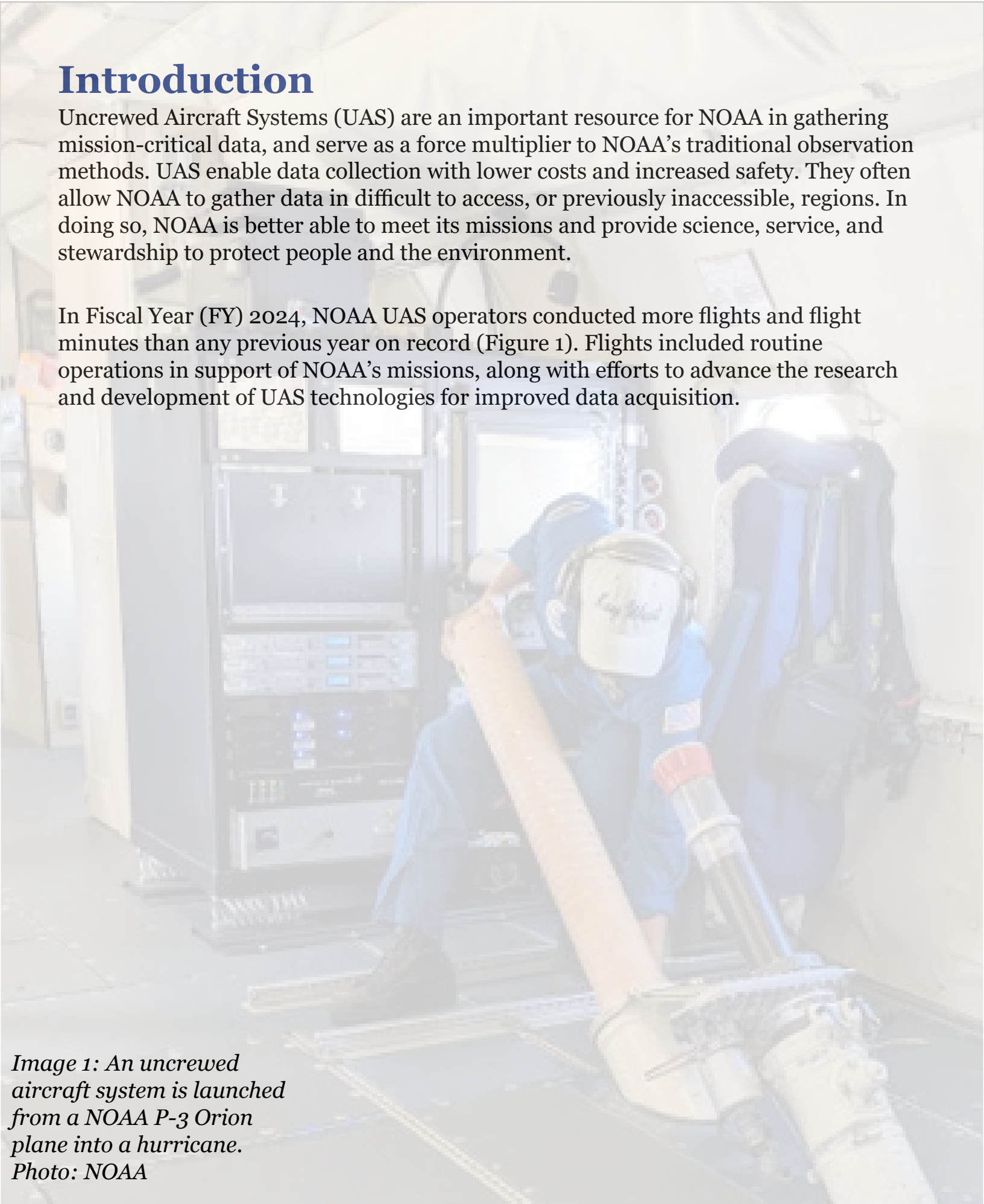

Image 1: An uncrewed aircraft system is launched from a NOAA P-3 Orion plane into a hurricane. Photo: NOAA

UAS Use and Support Across NOAA

NOAA accomplishes its diverse missions through its six line offices, all of which either use UAS for mission execution, or support UAS operations across the agency. A brief summary of each line office's role follows in table 1.

Table 1: UAS use and support within NOAA by line office.

Line Office	UAS Use and Support
Office of Marine and Aviation Operations (OMAO)	• facilitates cross-NOAA projects to enhance UAS use. • executes UAS operations to support NOAA missions. • provides technical expertise to research missions. • provides UAS platform and services to UAS users. • trains UAS operators and increases proficiency on UAS platforms. • operates UAS to evaluate platforms and integrate sensors. • tracks and manages NOAA UAS usage and resources. • transitions UAS into operational use across NOAA's broad mission space. • coordinates and ensures compliance with airspace regulations and protocol.
Office of Oceanographic and Atmospheric Research (OAR)	• supports cross-NOAA UAS research and development. • develops and utilizes UAS to gather meteorological, atmospheric, and oceanic information in research laboratories and program offices. • tests and evaluates the use of UAS platforms and architecture to collect scientific data to understand complex systems that support Earth Sciences. • gathers and transitions data into societally useful tools. • supports the transition planning process for UAS into operational use across NOAA's broad mission space through the development of transition plans, processes, tools, and resources.
National Marine Fisheries Services (NMFS)	• tests and evaluates the use of UAS platforms to assess and manage living marine resources and their habitat. • gathers data on living marine resources and incorporate it into the fisheries and protected species management processes. • deploys UAS to increase safety and efficiency, and to reduce cost of fisheries and protected species surveys. • assesses marine mammal and endangered species populations through low disturbance surveys. • assesses entanglement status and response strategy in emergency, protected species entanglement responses.

Line Office	UAS Use and Support
National Ocean Service (NOS)	• collects coastal and shoreline habitat data for incorporation into analytical tools. • supports emergency response. • performs living marine resource surveys in national marine sanctuaries. • gathers data for coastal and habitat mapping and characterization projects. • improves data models and visualization tools. • conducts surveys for marine debris and supports disentanglement efforts. • identifies and locates maritime cultural and archaeological sites. • supports enforcement efficiency in protected areas. • surveys coastal waters for harmful algal bloom detection and monitoring. • evaluates effectiveness of ecosystem restoration projects through high resolution habitat monitoring.
National Weather Service (NWS)	• demonstrates the utility of UAS for weather event surveying (tornado, flooding, ice events, etc.) and other operations. • gathers pre- and post-weather event data. • performs maintenance inspections of NOAA equipment and property. • explore the improvement of weather forecasts via UAS-gathered data.
National Environmental Satellite, Data, and Information Service (NESDIS)	• enhances acquisition of global environmental data to support the environment, security, and economic quality of life. • reduces human exposure to extreme environmental conditions. • calibrates and validates satellite derived records. • provides high-resolution and site-specific data to replace and augment satellite data. • gathers data and incorporate into predictive models, historic reconstructions, and other products.

Overview of 2024 NOAA UAS Operations

Flight Time by Year

NOAA has steadily increased its UAS usage over the last 10 years (Figure 1). In 2024, NOAA performed over 37,000 flight minutes spread over more than 2,200 UAS flights. This is more than 9,000 flight minutes flown in 2023.

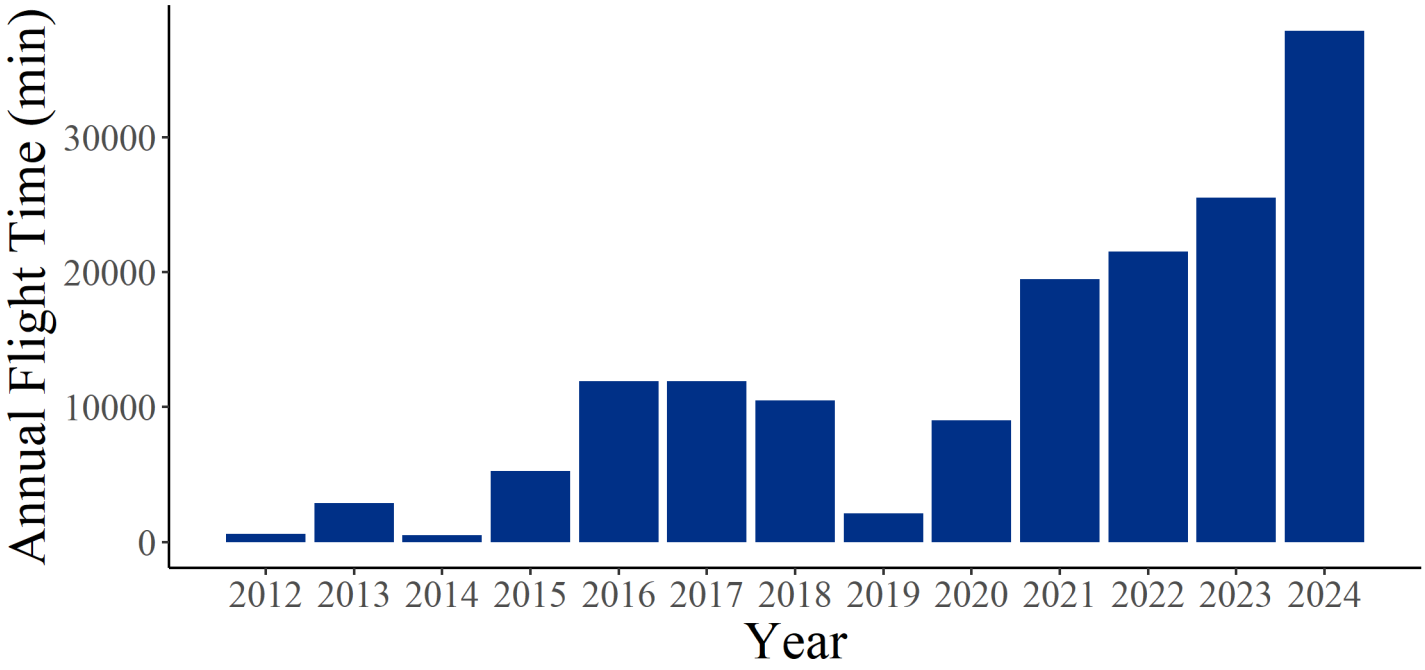

Figure 1: Flight time in minutes by NOAA UAS users from 2012 to 2024.

Flight Time by Region

NOAA conducted UAS operations across the United States in 2024, with flight time logged in 22 states (Figure 2). The highest concentration of flights were performed in California, Washington, Alaska, and Hawaii. Additional flights were performed in the Pacific Ocean, Atlantic Ocean, Arctic Ocean, and Antarctica (not depicted in Figure 2). Many of these logged UAS flight times cover remote areas that are inaccessible (due to safety, cost, or feasibility) by crewed survey methods. Increased UAS flight time in these regions is indicative of the utility of UAS in gathering mission critical data.

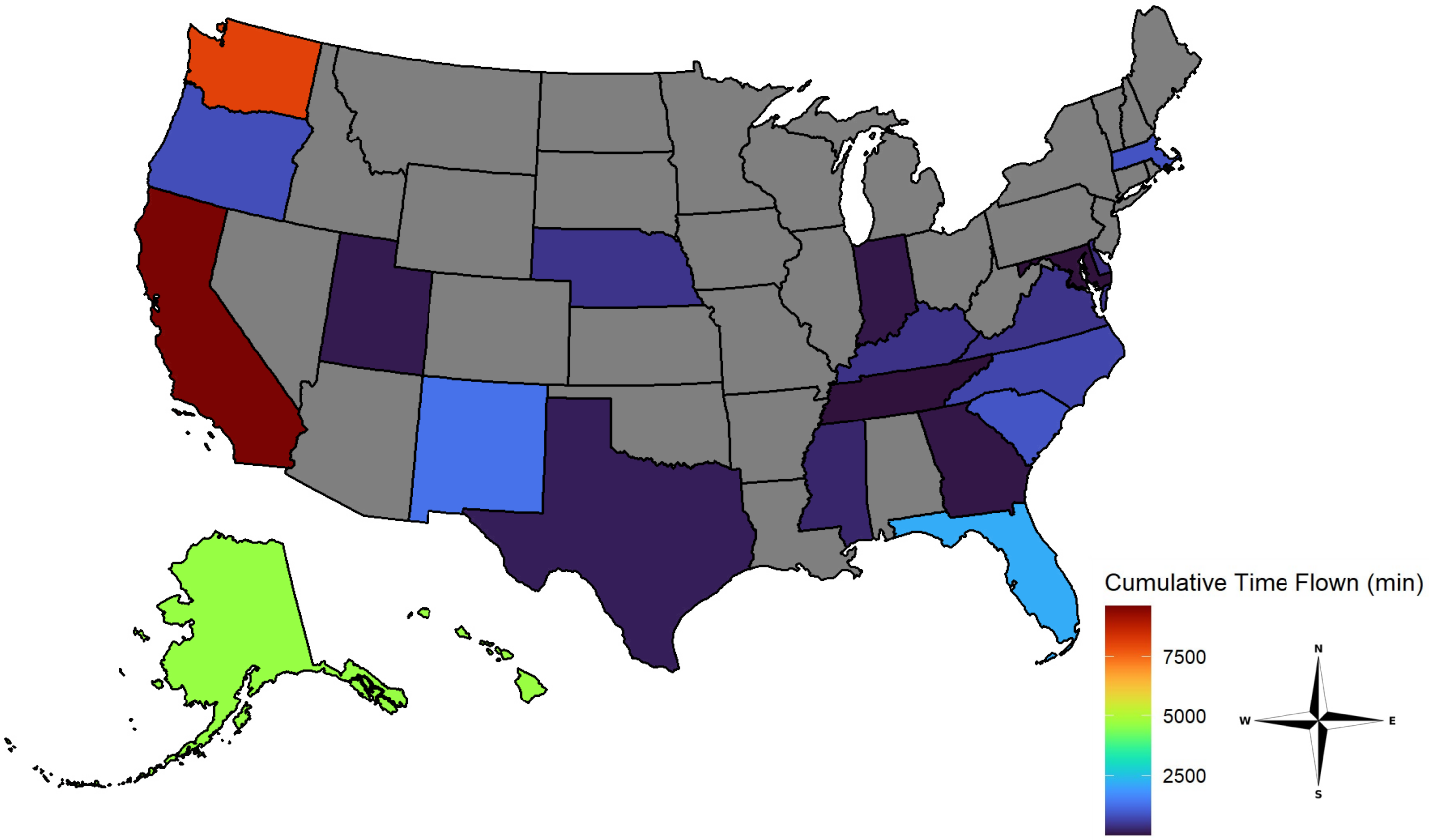

Figure 2: A map showcasing the flight time of NOAA UAS in minutes during 2024 per state. Warmer colors indicate more flight time in a region, while cooler colors indicate less flight time. Gray regions represent states where no NOAA UAS flight time was recorded.

Flight Time by NOAA Line Office

UAS were used by five of the six NOAA line offices in 2024 (Figure 3). All NOAA line offices engaged with UAS gathered data, or partnered with an entity outside of their line office (internal and external to NOAA) to operate UAS. Vignettes of how each line office and their programs used UAS to support NOAA missions can be found in the Highlights section of this report. NMFS flew more than 70 percent of NOAA UAS flights and made up more than 60 percent of UAS flight time. See a breakdown of NMFS flight time by program in the following section. While OAR conducted the second lowest number of UAS flights across line offices, they conducted the third most UAS flight minutes. This is likely due to the extended duration flights conducted by OAR laboratories within hurricanes and to advance beyond visual line of sight operations.

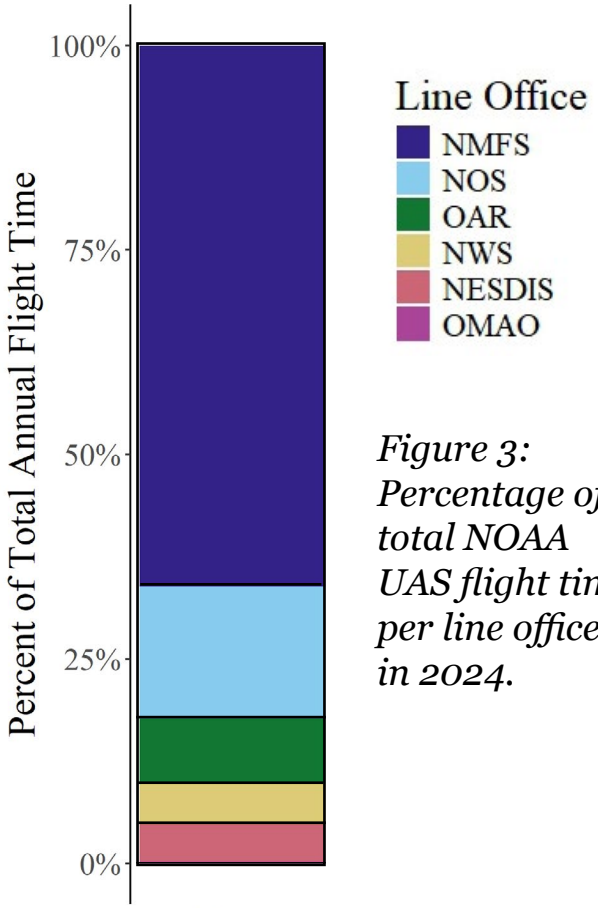

Figure 3: Percentage of total NOAA UAS flight time per line office in 2024.

Flight Time by NOAA Program

Within NOAA's line offices are a diverse suite of program offices, field offices, divisions, and operational centers. In 2024, 19 programs and divisions used UAS to complete their duties across NOAA (Figure 4).

Of those programs and divisions, NMFS Fisheries Science Centers performed a significant amount of flight time, with the Alaska Fisheries Science Center logging more time than any other NOAA program.

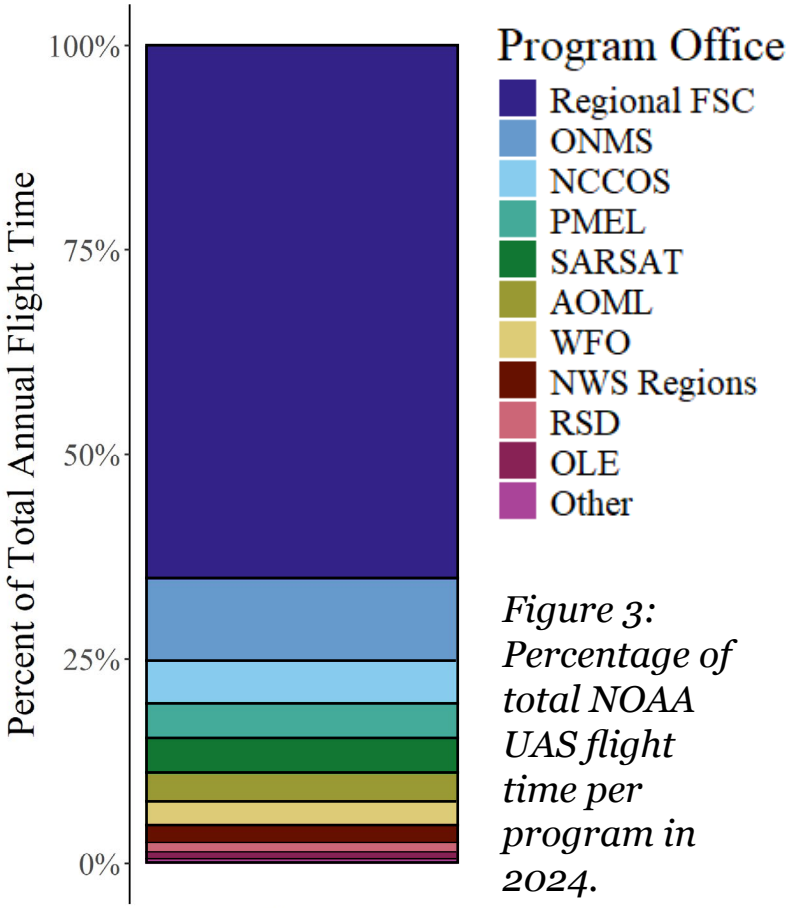

Figure 3: Percentage of total NOAA UAS flight time per program in 2024.

Acronyms: FSC—Fisheries Science Center, ONMS—Office of National Marine Sanctuary, NCCOS- National Centers for Coastal and Ocean Sciences, PMEL —Pacific Marine Environmental Laboratory, SARSAT—Search and Research Satellite Aided Tracking, AOML- Atlantic Oceanographic and Atmospheric Administration, WFO—Weather Forecast Office, NWS- National Weather Service Regions, RSD- Remote Sensing Division, OLE- Office of Law Enforcement

Flight Time by Mission

NOAA uses UAS to safely, efficiently, and effectively gather mission critical data. As a result, the Agency has operationalized UAS to meet a variety of mission requirements, and is supporting the research and development of UAS to further meet mission needs. In 2024, NOAA utilized UAS to support a wide variety of mission areas (Figure 6). A significant amount of time went to animal surveys (over 24,000 flight minutes) to manage living marine resources and monitor protected species under the Magnuson-Stevens Act, Marine Mammal Protection Act, National Marine Sanctuaries Act, and Endangered Species Act. Additional notable flight time was dedicated to weather research (3,000 flight minutes), mapping surveys (2,300 flight minutes), and training (9,438 flight minutes).

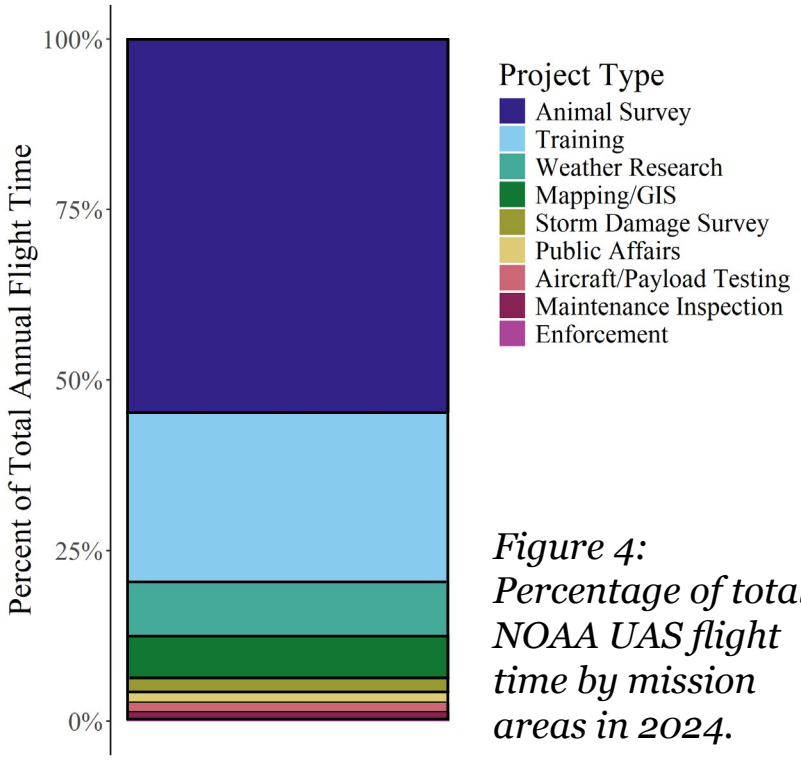

Figure 4: Percentage of total NOAA UAS flight time by mission areas in 2024.

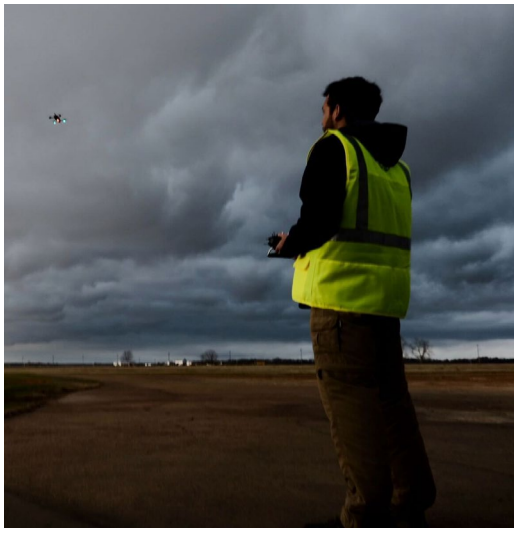

Image 2: UAS for different projects: a) gathering weather observations, b) setting up a long endurance platform, c) assessing ice damage. Photos: NOAA

NOAA UAS Inventory

NOAA owns 239 UAS across its various programs and offices. This includes over 40 unique platforms created by 26 different manufacturers (Figure 7). Platform types include quadcopters, fixed wing, and vertical takeoff and landing. Platforms also vary by size, endurance, and payload capabilities. Given NOAA's diverse mission areas, the variety of platforms allows NOAA to use UAS to meet multiple mission objectives in different environments.

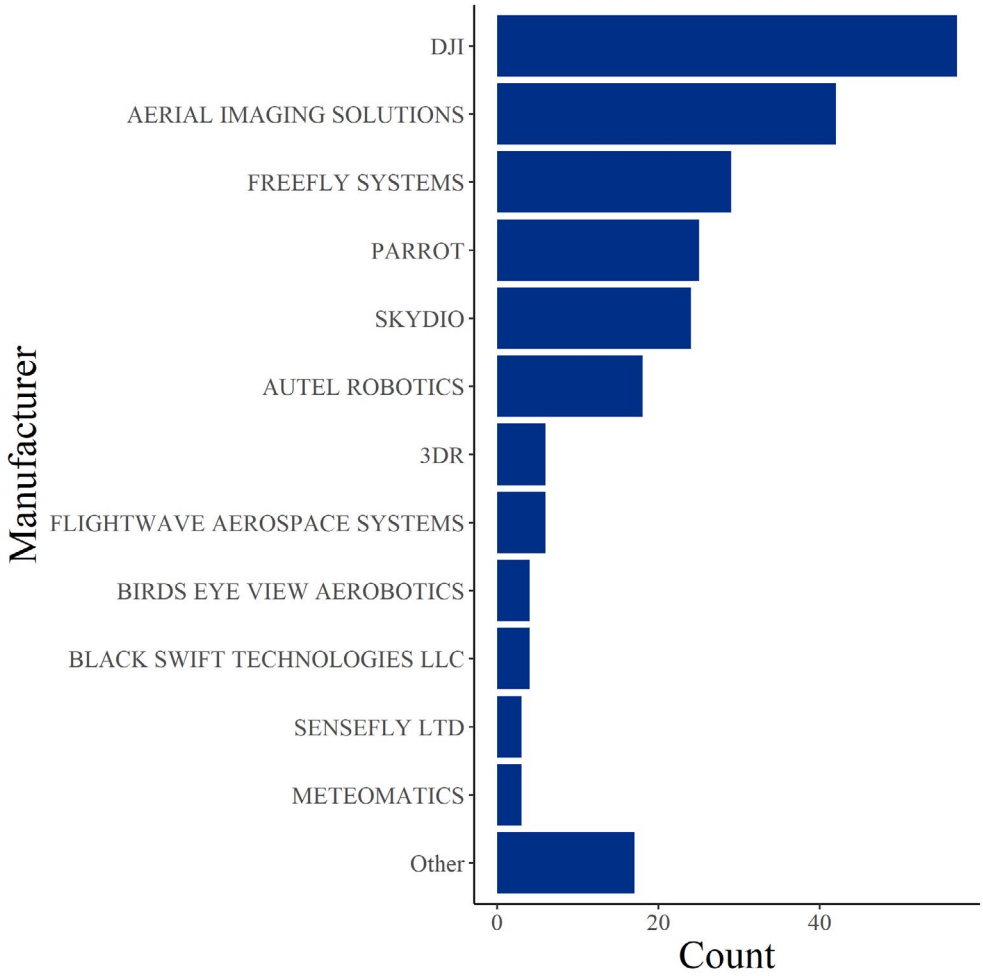

Figure 5: Number of UAS by different manufacturers owned by NOAA.

UAS Corporate Services

Operations Coordination and Training

The UAS Division oversees the operations of UAS across all six NOAA line offices. They vet all operations through standard and non-standard approval processes, which ensures adherence to federal airspace restrictions, state regulatory guidance, and NOAA internal policy. The UAS Division tracks all NOAA UAS, pilots, and maintenance. In doing so, the UAS Division can manage operators, monitor pilot qualifications and currency, recommend routine maintenance based on manufacturer requirements, and more. All UAS operations in 2024 were vetted, recorded, and approved by NOAA UAS experts in the UAS Division.

To expand UAS operations, the UAS Division provides customized training programs to develop qualified Mission Commanders and Remote Pilots in Command. These training programs include core classroom modules covering topics such as NOAA operational policies, airspace restrictions, beyond visual line of sight (BVLOS) requirements, and fleet management. Additionally, they include customized field components so users can become qualified on specific UAS platforms with hands-on training. This curriculum has been specifically developed for NOAA operations and designed to cater to the needs of the line offices, which allows the UAS Division to efficiently manage the qualification procedures of new operators while maintaining stringent safety standards.

In 2024, the UAS Division initiated a new program to further train NOAA personnel for UAS operations. The program provided new Blue UAS Cleared platforms and associated training to NOAA programs to qualify new UAS operators. In total, the UAS Division ran 14 trainings across the country, and certified 66 new pilots in command across NOAA.

Image 3: A UAS in test flights to perform weather observations. Photo: NSSL/NOAA

Safety Considerations and Airworthiness Evaluations

The UAS Division vets and clears all UAS flights in NOAA. Before granting flight authorization for operations, the UAS Division conducts Operational Risk Management assessments to identify and mitigate potential hazards. Given the diversity of UAS operations conducted by NOAA, it is important to consider the risks and means to mitigate risk of each operation. This proactive approach strengthens the decision-making process of UAS teams in the field and enhances the safety of flights.

Image 4: UAS operator training. Photo: NOAA

In 2024, the UAS Division conducted an overhaul of the NOAA airworthiness assessment process. They made the process more thorough in order to better identify, document, and validate airworthiness needs for UAS platforms and payloads. In doing so, NOAA UAS operators can be more prepared to fly when operations arise. This is particularly important for rapid response assessments conducted via UAS.

Procurement and Expanding the UAS Fleet

NOAA aims to procure the best UAS platforms to meet their mission needs. This includes considering capabilities, difficulty to operate, servicing needs, cost, and other variables. The UAS Division provides guidance to NOAA programs to direct the selection of UAS and vets UAS purchases before they are actually procured. To improve the acquisition process, the UAS Division established Indefinite Delivery, Indefinite Quantity (IDIQ) contracts with vendors of platforms on the Blue UAS List that was developed by the Department of Defense's Defense Innovation Unit to vet and scale commercial uncrewed aircraft technologies.

Image 5: UAS operator training. Photo: NOAA

Per the American Security Drone Act of 2023, as part of the National Defense Authorization Act for Fiscal Year 2024, NOAA's procurement and use of UAS, manufactured and assembled by a 'covered foreign entity', was limited. While the list of countries considered 'covered foreign entities' and full implementation of the Act has not been established, NOAA proactively restricted procurement of UAS to align with provided guidance. While procurement restrictions will impact NOAA's ability to meet its mission needs, the agency is adaptive and ensures compliance with all regulatory guidance.

Advancing Beyond Visual Line of Sight Operations

Beyond visual line of sight (BVLOS) involves operating UAS beyond the line of sight of the UAS operator or observers. Per the Federal Aviation Administration, regulations, such operations require special approval. To gain BVLOS approval; considerations such as safety, societal and environmental benefits, and the ability to mitigate risk; are taken into account. BVLOS presents an opportunity for NOAA to increase its ability to collect mission critical data.

NOAA has successfully conducted BVLOS operations in select scenarios, but is working to expand the BVLOS operations within NOAA. Examples of past BVLOS work include flights in the Antarctic to extend the surveyable area by scientists for penguin surveys, and at the edge of space to gather atmospheric samples. In 2024, the UAS Division worked with NOAA programs and external partners to further advance BVLOS capabilities. Through this, the team conducted trial operations at Vandenberg Space Force Base, and installed a new take-off/landing deck on the NOAA Ship Gordon Gunter to allow for larger UAS operations with extended flight capabilities. They are also working with Virginia Polytechnic Institute and State University and Massachusetts Institute of Technology Lincoln Labs to develop the safety case surrounding BVLOS.

Image 6: NOAA personnel prepares to utilize a UAS. Photo: NOAA

Advancing Hurricane UAS Capabilities

UAS is a growing tool for NOAA in gathering previously inaccessible data within hurricanes. This information can be utilized to inform storm situational awareness and for integration into forecast models. The Uncrewed Systems Operations Center and UAS Division worked in 2024 to develop hurricane UAS operations as an in house capability for NOAA. This includes developing a UAS hurricane expert position to liaise between scientists, aircraft operators, and industry vendors to enable safe and effective operations. Additional focus was placed on operationalizing the Black Swift SO UAS for deployment into hurricanes from the NOAA Hurricane Hunter planes. During 2024 hurricane season operations, Black Swift flights from the NOAA Hurricane Hunter planes in Hurricane Milton and Helen set records for the highest wind–speed measured by a UAS in a hurricane (240.94 miles per hour) and for the longest endurance of a UAS inside a tropical cyclone (105 min) respectively.

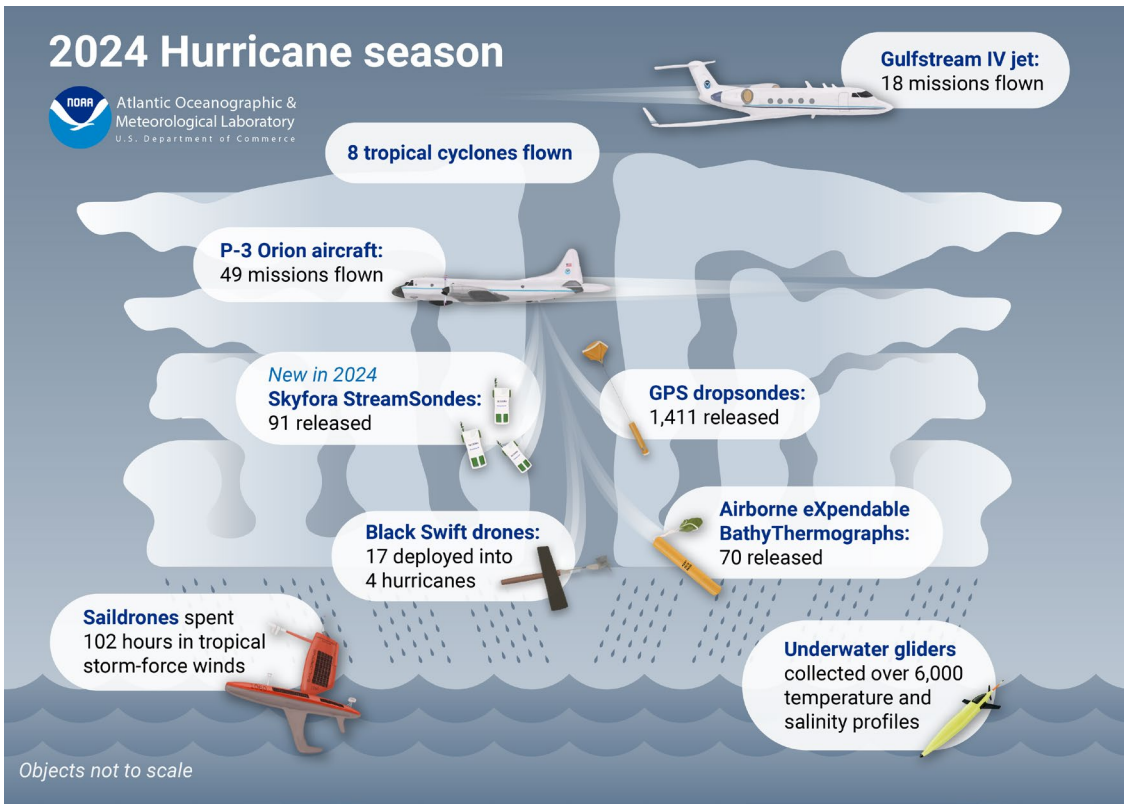

Image 7: A diagram of select instruments used in the 2024 hurricane season by NOAA. Photo: Atlantic Oceanographic and Meteorological Lab/NOAA

FY 2024 Program Highlights

Informing Hazard Communication and Digital Outreach in Alaska with UAS

Lead Personnel: Jessica Cherry- NESDIS National Centers for Environmental Information Alaska Region

UAS allows NOAA to provide key information and services in remote parts of the United States. Many regions of Alaska that play important roles in the country's maritime transportation, economy, and national security are impacted by seasonal extreme weather events. NOAA's National Centers for Environmental Information Alaska Region, NOAA's Alaska-Pacific River Forecast Center, and other partners utilize aerial imagery on UAS to serve these regions. Collaborations across NOAA, other state and federal agencies, and local groups and communities are a valuable tool when trying to reach remote parts of Alaska.

Image 8: Aerial imagery gathered of an ice jam via UAS. Photo: NOAA

UAS imagery, paired with crewed aircraft and NOAA satellite data, provides multiple levels of validation to ensure ice and flood products produced by the agency are accurate. Inclusion of UAS allows the agency to continue gathering data even if conditions prevent or obscure satellite and crewed aircraft data acquisition. On the ground, UAS data have been able to inform hazard communication and provide digital outreach across the state to protect lives and property.

In particular, NOAA has utilized UAS imagery in recent years to gather information about ice jam flooding threats. Ice jam flooding (when a build up of ice blocks the flow of a river) is one of the most common causes of state of emergency declarations in Alaska and can greatly impact the state's economy and infrastructure. UAS imagery can provide a real-time "bird's-eye view" of potential threats up- and down-river of communities to NOAA, community residents, and emergency managers. The same imagery has also been circulated via state and national media outlets to communicate the state of conditions across an even wider audience.

Beyond Visual Line of Sight UAS Advances for Marine Mammal Assessments

Lead Personnel: NMFS Southeast Fisheries Science Center

NOAA is responsible for the protection of marine mammals and other endangered species under the Marine Mammal Protection Act and Endanger Species Act. In order to do so, NOAA experts from NMFS perform surveys of marine mammals to assess individual and population health. While UAS has become a regular tool for NMFS scientists in performing marine mammal population assessments, recent work has revolutionized the use of UAS in safely and effectively surveying large whale species.

Image 9: A UAS hovers over a Rice's whale. Photo: NOAA NMFS/Ocean Alliance NMFS ESA Permit 21938

In 2024, NMFS Southeast Fisheries Science Center researchers, in partnership with Ocean Alliance and Marine Conservation Research, deployed suction cup tags on to the endangered Rice's whale using UAS. While NOAA and partners have developed and successfully trialed this field technique with other species, like the North Atlantic right whale and Sei whale, this is the first time that a Rice's whale was successfully tagged via UAS. Suction cup tags collect data about individual whale patterns and behaviors to further inform human understanding of their lives to prevent population decline. These tags were previously deployed via a person using a long pole with a tag on it on a small boat. UAS offer a safer and non-invasive means to more efficiently tag whales. NMFS researchers are continuing to explore other means of using UAS to innovatively monitor marine mammals.

Guidance for Incorporation of UAS into Disaster Response Efforts

Lead Personnel: George Graettinger, Lisa DiPinto – NOS Office of Response and Restoration

NOAA plays a key role in supporting clean and healthy coasts and economies through disaster and pollution response efforts. In support of this, NOAA's Office of Response and Restoration utilize UAS to gather data for response efforts and has produced guidance for incorporation of UAS into disaster response. In 2024, they worked with the U.S. Coast Guard to create new guidance and training to enhance the use of UAS in supporting oil spill or natural disaster response and damage assessments. While the guidance and training were produced as job aids for U.S. Coast Guard and NOAA personnel who support oil spill response efforts, they were made publicly accessible for broader use by appropriate first responders.

The developed content is meant to serve as a source of best practices for flying UAS and includes resources at every stage of response operations for shoreline and on-water oil spill response. Materials include training for Coast Guard pilots to capture UAS-based imagery, details on selecting the best equipment and sensors given response needs, and more. Guidance was also developed to outline best practices for managing data collection from UAS during such response efforts. The Office of Response and Restoration intends to maintain the resources as living documents so that they can periodically be updated to reflect revised best practices.

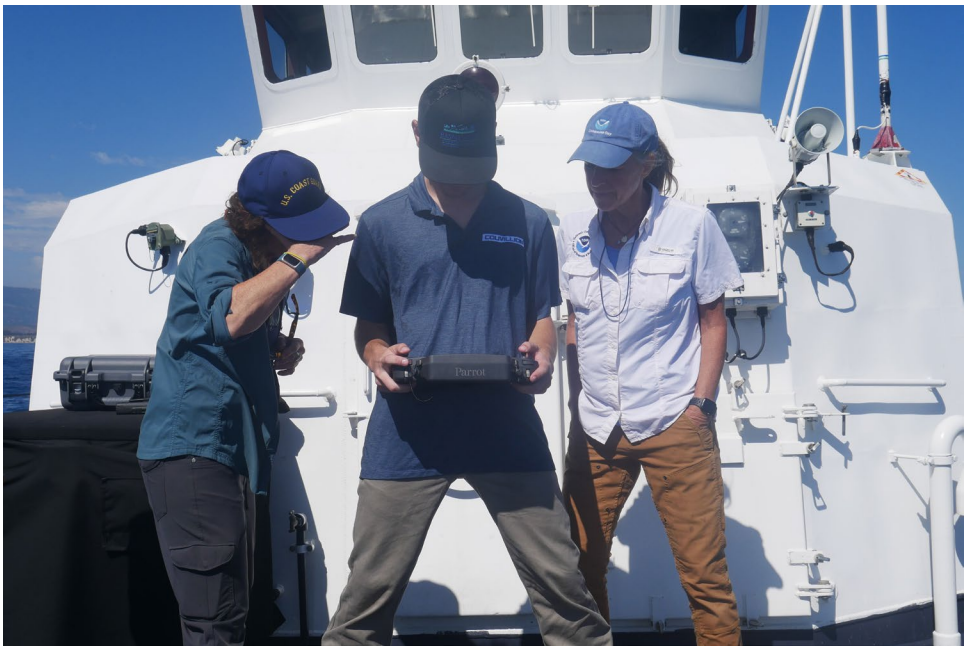

Image 10: Office of Response and Restoration Senior Scientist Lisa DiPinto (right) and U.S. Coast Guard's Director of Emergency Management Dana Tulis (left) observing a UAS pilot's flight. Photo: NOAA

UAS as a tool for Severe Weather Event Assessments

Lead Personnel: Mike Sporer – NWS Weather Forecast Office-North Platte

The NWS Weather Forecast Offices utilize UAS to improve the information and services they provide post-storm events. Initially focused on post-storm evaluations, UAS has proven to be a valuable tool for collecting aerial imagery and data that is inaccessible or challenging to access by other methods like satellites or on-foot surveys. Beyond storm damage surveys, UAS can also gather data to learn more about weather events. For example, the Weather Forecast Office in North Platte, NE used UAS surveys to distinguish between wind damage from a gustnado versus a tornado in a June 2024 wind event. This information improves the accuracy of damage assessments.

UAS allows NOAA to prioritize surveys, access remote areas, and provide better situational awareness, especially during conditions that prevent other traditional survey means (like cloudy weather when satellite data may be limited). In doing so, the agency can be more flexible and efficient in its storm event surveys and better equipped to protect communities and provide timely information in increasingly extreme weather conditions.

Image 11: Example storm damage imagery gathered via UAS. Photo: NOAA

Advancing Atmospheric Research with Coordinated UAS Efforts

Lead Personnel: Elizabeth Smith – OAR National Severe Storms Laboratory

Image 12: A UAS operator pilots a UAS as part of the mesonet network in OK. Photo: Elizabeth Spicer/ Oklahoma University/NOAA

Producing more accurate and timely weather forecasts requires more weather observations, especially in the lowest levels of the atmosphere. In September 2024, the collaborative Small-UAS Coordination for Atmospheric Low-Level Environmental Sampling (SCALES) campaign set out to, among other goals, advance atmospheric research using UAS and demonstrate the feasibility of a three-dimensional mesonet observation network with UAS. Led by the National Severe Storms Laboratory, SCALES took place in northeastern Oklahoma. NOAA collaborators from the Physical Sciences Laboratory and Air Resources Laboratory participated alongside academic and industry partners from across the nation and around the globe. The campaign was part of the International Society for Atmospheric Research using Remotely Piloted Aircraft flight week and was the final intensive period of the World Meteorological Organization UAS demonstration effort.

SCALES included an intercomparison event in which nearly all project participants flew their UAS platforms at the same site to enable unique side-by-side and reference-based evaluations, establishing weather-sensing UAS platform benchmarks. Throughout the week of SCALES, more than 1,000 coordinated flights were completed across a 10+ site mesoscale network and a dense, multi-site urban deployment. The collected data support ongoing studies of various land-atmosphere interactions, tornado dynamics, and weather prediction models. SCALES data will be publicly available, and findings will be shared with the global scientific community to advance UAS-based atmospheric research and observing methods worldwide.

The SCALES campaign represents a significant step forward in leveraging UAS technologies for real time weather observations. By refining these techniques, the NOAA and its SCALES partners are paving the way for a new era of atmospheric research and enhancing our ability to issue accurate forecasts, warnings, and protect communities from extreme weather events.

Standing Up New UAS Programs in NOAA

Lead Personnel: Ayden Marrullier, Clinton Dykes – OMAO UAS Division

In order for UAS to be a useful tool for NOAA, the agency needs airworthy UAS and certified operators to safely pilot the platforms. NOAA's UAS Division is helping to lower the barrier for NOAA programs to expand the use of UAS in support of the agency's mission through a new initiative that provides new Blue UAS Listed UAS to NOAA programs and training on these platforms to NOAA personnel.

Through a competitive selection process, the UAS Division distributed 28 new UAS and certified 70 new UAS pilots in command across the agency. Trainings were offered across the country and catered to both novice UAS pilots and experienced operators. The curriculum was tailored to focus on three distinct Blue UAS List systems that are different sizes to meet different NOAA user needs.

This initiative supports NOAA missions, such as ecosystem assessments, living marine resource surveys, post-weather event damage assessments, weather forecasting, and more across the agency. The UAS Division plans to continue to run this effort in the future to continue to build NOAA's UAS fleet and workforce.

Image 13: NOAA personnel train on a new UAS platform in AK. Photo: NOAA

FY 2025 Outlook

NOAA will continue to advance the utilization of UAS to meet NOAA mission needs in FY 2025. In FY 2025, the agency plans to focus efforts on increasing utilization of Blue UAS Listed platforms. This includes increasing exposure, training, and utilization surrounding these platforms. One way the UAS Division plans to achieve this is by continuing an initiative started in 2024 to provide new UAS and training to NOAA operators.

Additional effort will be made to expand and advance NOAA's hurricane UAS capabilities. The UAS Division will coordinate with NOAA's science experts, operational leads, and external partners to realize the potential of UAS in gathering mission critical data within hurricanes.

Image 14: A UAS on a lab bench before operations. Photo: NOAA