



Forest Service  
U.S. DEPARTMENT OF AGRICULTURE

Fire and Aviation Management

GTR# Month, 2025

# 2024 UAS ANNUAL REPORT



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## 1. BACKGROUND

### FS Mission and the Role of UAS

The United States Forest Service (USFS) is an agency of the U.S. Department of Agriculture. The agency administers the National Forest System (NFS) that includes 155 national forests and 20 national grasslands encompassing 193 million acres (780,000 km<sup>2</sup>) of land. The Forest Service protects and manages the natural resources on these lands which occupy approximately 25% of all federal lands and about 9% of the total land area in the United States. The agency is also the world's largest forest research organization and provides scientific and technical knowledge to protect and sustain forests and rangelands. Additionally, the Forest Service provides technical and financial assistance to state and local landowners in the stewardship and protection of approximately 500 million acres of non-Federal forest lands across the United States. These activities include wildland fire management and protection services as well as forest health monitoring and assistance in the control of pests and pathogens and mitigation of their impacts.

The mission of the Forest Service is to "sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations". To effectively accomplish this mission, the agency uses a variety of technologies and tools, including Unmanned Aircraft Systems (UAS). UAS fills gaps in observation capability not met by satellite, manned aircraft, or other field observations. It also provides the ability to collect data at desired schedules, improve time and/or cost efficiency, and reduce risk to personnel.

Over the past two decades, the Forest Service has conducted a deliberate approach to the adoption and use of UAS technology. Early efforts focused on partnerships with other agencies (e.g., NASA, Customs and Border Protection, etc.) to demonstrate and evaluate the use of relatively larger and longer endurance platforms for special projects and demonstrations, including tactical scale active fire mapping operations and incident management communications.

After the introduction of 14 CFR Part 107 in 2016, which provided the first operational rules for routine non-hobbyist use of small UAS (sUAS) platforms, and updates to Forest Service aviation policy and the onboarding of a UAS Program Manager in 2018, the agency, in close coordination with the Department of the Interior Office of Aviation Services and the Bureau of Land Management (BLM), has accelerated its use of sUAS and associated technologies. Over the past decade, use of the technology by the Forest Service for wildland fire management has steadily increased, including aerial ignition operations and enabling near real-time situational awareness capabilities for incident management teams (IMTs).

Since 2020, the agency has also onboarded personnel to staff national and regional UAS programs, set up acquisition vehicles to begin to acquire necessary infrastructure (aircraft, crew vehicles, etc.), and increased the number of newly trained agency pilots. Although wildland fire support is currently the primary use of the technology, numerous demonstration and evaluation projects supporting both operational and research and development initiatives for multiple resource management (non-wildland fire) use cases have been conducted in recent years. Examples of such use cases include invasive weed detection and mapping, vegetation mapping,

timber stand surveys, fuels treatment effectiveness mapping, field data inventory and mapping, animal habitat mapping and monitoring, terrestrial and aquatic habitat mapping and assessment, archaeology/paleontology surveys, erosion and event damage assessments, riparian/hydrology surveys, abandoned mine lands surveys, infrastructure inspection and assessment, and topographic surveys of recreation areas. Resource management use cases for sUAS are anticipated to significantly grow and eventually become the predominant application area for the technology in the Forest Service.

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### **Report Purpose, Organization, and Intended Audience**

This report is meant to summarize and highlight the activities of the Forest Service UAS Program in fiscal year 2024 (FY24). Notable UAS Program accomplishments for the past year are featured. Additionally, charts and associated narrative describing key metrics and main activities are presented at both the national and regional levels. These metrics and activities are accompanied by brief introductory narratives that interpret the results and highlight key points.

This report is intended to increase awareness about UAS activities within the Forest Service, including executive leadership, managers, and technical staff, and the use of this technology to support the agency mission. Additionally, this report is a component of UAS Program efforts to provide transparency and inform the public about agency UAS activities, as required by USDA and Forest Service policy.

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### **Establishment of a Baseline**

Forest Service UAS activity records for the past several years are relatively good but are not comprehensive or significantly detailed, particularly for non-wildland fire applications. These historical data are used in this report for reference and comparison to the activities of current and recent years where appropriate.

In early FY22, a new fleet management and activity tracking tool was adopted by the Forest Service UAS program. The new reporting system has enhanced the ability to collect and analyze critical data related to the UAS program. Consequently, FY22 represents the first year the agency thoroughly captured resource management activities and projects using UAS throughout the Forest Service. To accurately measure progress and performance, it is essential to maintain consistent methods and ensure the comparability of standardized data over time. For this year's report, the FY22 data and available previous years' historical data provide a baseline for comparison to FY24.

## **2. NOTABLE HIGHLIGHTS**

In the highlights section of this year's report, we outline the achievements of the UAS program in aligning with and advancing the agency's mission. It is also important to highlight the substantial growth the UAS program experienced in the past year when compared to previous years. The program's expansion has been notable, in terms of policy development, increased capacity and knowledge, technological advancements, and operational capabilities. This growth has

broadened the impact on land management, improving efficiency and effectiveness in utilizing UAS for fire and resource management. This growth signifies the program's dedication to keeping pace with evolving UAS technology and adapting to the changing landscape of land management, ensuring that the agency remains at the forefront of innovation. The UAS program has also supported the agency's strategic goals in several critical areas, including supporting the Wildfire Crisis Strategy, evaluating Priority Landscapes, and helping fulfill the objectives of recent legislative priorities such as the Great American Outdoors Act, the Bipartisan Infrastructure Law, and the Inflation Reduction Act to further the overarching mission.

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## **Growth in FY24**

FY24 has been a year of growth in almost every metric that we measure. In FY24 more fleet aircraft were onboarded and more flight hours were logged both for fire and resource management than any other year. This growth demonstrates the effort and commitment of the UAS program to make this new technology more available for efficient land management. Details are outlined in the report below, but some metrics quickly demonstrate the growth of the program:

- In FY24, 17,255 flights were recorded, up from 10,205 in FY23 and showing an increase of about 69% from the previous year. A flight is defined as operation of a UAS platform with one takeoff and one landing.
- In FY24, 4,536 flight hours were recorded, up from 2,553 in FY23 and showing an increase of about 78% from the previous year.
- In FY23, 82 new aircraft were added to the fleet for a total of 342. This means that 32% of the current fleet was brought on board in FY24.
- In FY24, 126 new pilots were trained, which brings the total of Forest Service UAS pilots to 371.

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## **Increased Prescribed and Wildland Fire Management Support**

The upward trajectory of utilizing UAS by the Forest Service for prescribed and wildland fire management activities remained consistent in FY24. These endeavors significantly reduced safety risks for agency staff while offering invaluable, real-time intelligence to Incident Management Teams (IMTs) for informed decision-making. During FY24, agency pilots dedicated approximately 855 hours to aerial ignition activities and over 1,304 hours to imagery and video acquisition in support of prescribed and wildland fire operations. Notably, these figures mark a remarkable increase of 241% for aerial ignition and 84% for imagery acquisition activities compared to the levels observed in FY23. Additionally, UAS aerial ignition activities in FY24 treated 188,986 acres and dropped 733,115 spheres.

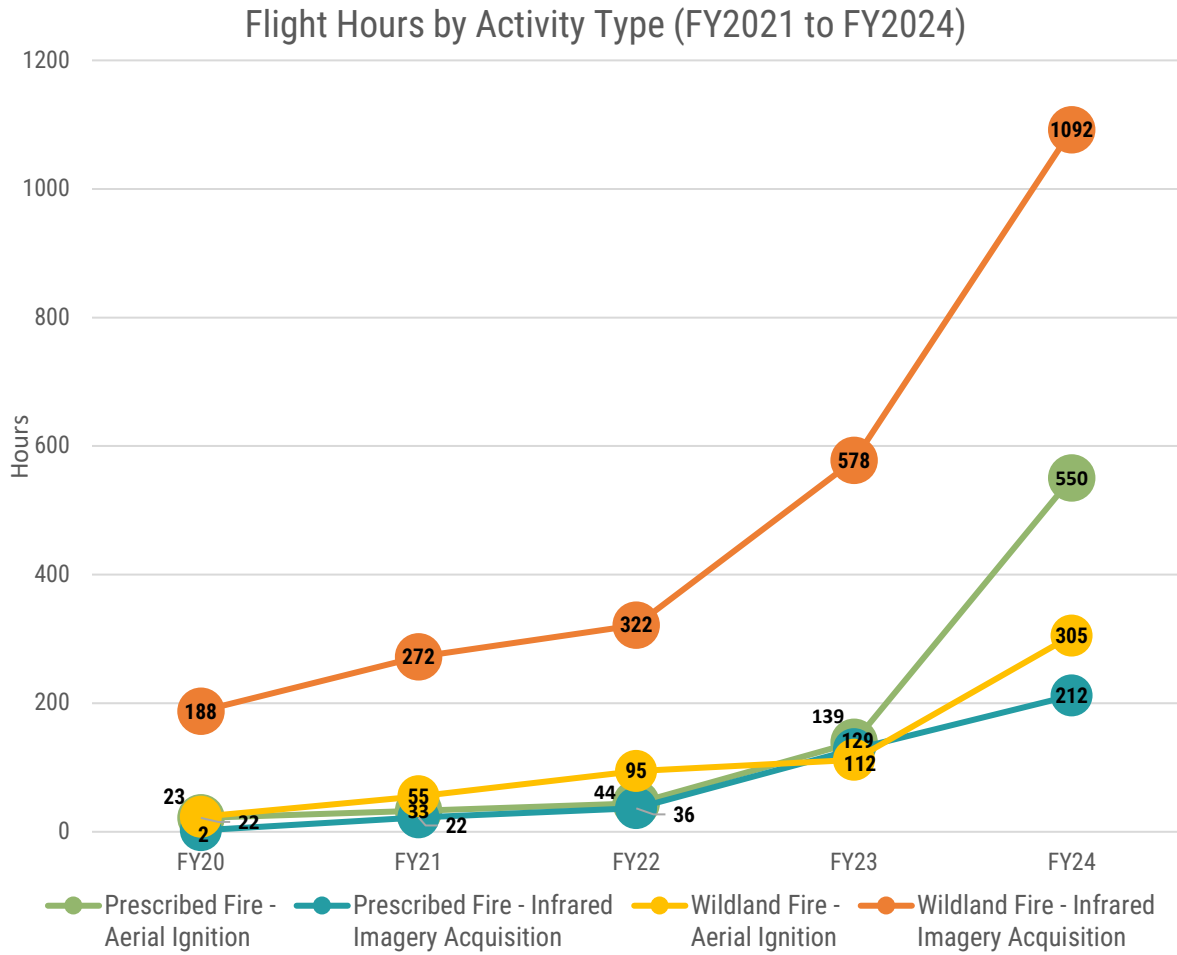


Figure 1. Flight hours by activity type within wildfires and prescribed burn from FY20 to FY24

Flight Hours by Activity Type FY20-FY24						
Activity		FY20	FY21	FY22	FY23	FY24
Prescribed Fire	Aerial Ignition	22	33	44	140	550
	Infrared Imagery Acquisition	2	22	37	129	212
Wildland Fire	Aerial Ignition	23	55	95	112	305
	Infrared Imagery Acquisition	188	272	322	578	1,092

Table 1. Table showing flight hours by wildfire activity type FY20-FY24.

## Hurricane Response Support

The UAS program continued to gain significant experience in the operational use of UAS technology to respond to severe weather and other disaster events and provide geospatial data products and other Complex Incident Management Teams (CIMT). In mid-August 2024, tropical storm Ernesto significantly impacted Puerto Rico and the El Yunque National Forest with heavy flooding and winds that damaged roads and impacted infrastructure. Region 8, Geospatial Technology and Applications Center (GTAC) UAS and El Yunque staff were mobilized to support post-storm response activities on the El Yunque National Forest. Efforts focused primarily on the collection of imagery and generation of derived products to assess areas affected by landslide and flooding and capture other impacts to infrastructure and natural resources. Imagery and products were provided to the local El Yunque IMT to support response planning and recovery efforts.

Additionally, On September 26, 2024, Hurricane Helene made landfall in the Big Bend area of Florida and continued inland for the next couple of days dropping record rainfalls across the Southern Appalachians. Numerous national forests were heavily impacted by the storm including the Savannah River Site, Chattahoochee-Oconee, Pisgah, Nantahala, Francis Marion and Sumter, George Washington and Jefferson, Cherokee, and National Forests in Florida. UAS was used during the response phase to help guide saw crews into critical infrastructure sites that needed clearing work completed, to survey damage to roads and trails, and to assess damage to critical infrastructure including communication towers, water reservoir, and treatment plants.



Figure 2.- Oblique image of a log jam affecting the Black Mountain Campground Bridge on the Pisgah NF.

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## Pilot Standards Program

The UAS program established a new comprehensive program outlining standards for training and evaluating UAS pilots. Under this new direction standards for roles and training designations are defined, training and evaluation methods are outlined, and standards for record keeping of qualifications are laid out. This initiative reflects our agency's commitment to safety, efficiency, and professionalism in utilizing UAS technology. The creation of these standards has ensured that UAS agency pilots possess knowledge, skills, and abilities consistent with the Forest Service Remote Pilot Certification, to effectively conduct missions and operate aircraft currently utilized by the agency. This achievement not only strengthens the program's operational capabilities but also aligns with industry best practices and regulatory requirements, positioning the agency as a leader in responsible UAS operations.

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## Operations Guide Development

This past year, the UAS program has also focused on the development of an updated operations guide. This first amendment to the *Forest Service Standards for UAS Operations* guide published in 2020 is set to define and standardize UAS policy and procedures across the agency, offering a cross reference between controlling UAS policy and regulation and operational standards and best practices for operations. The updated guide was released in April 2024 and signifies dedication to promoting safe, efficient, and lawful operation of UAS to support the mission of the Forest Service, including fire management and natural resource management. The guide will continue to enhance transparency, compliance, and operational efficiency. It will continue to serve as an invaluable resource, equipping UAS pilots, managers, and users with the necessary

knowledge and guidelines to make informed decisions while leveraging UAS technology for a wide range of land management activities.

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### **Agency Fleet Development – Airworthiness Program**

The USFS UAS program, the USFS Airworthiness Branch, and the National Technology and Development Program continues to benefit from the airworthiness program which was designed to test, evaluate, and eventually accept or reject new aircraft for integration into the agency fleet. This program has increased operational efficiency by eliminating the need to rely on external organizations for airworthiness approvals. Instead, new UAS aircraft models now undergo a thorough period of testing and evaluation within our agency. Upon successfully passing these assessments, they are integrated into the fleet. This not only expedites the adoption of cutting-edge UAS technology but also allows the USFS to diversify their fleet with different types of aircraft, enhancing their capability to respond effectively to a variety of land management challenges. This achievement underscores the program's commitment to staying at the forefront of UAS technology and maximizing its strengths to achieve the agency's goals.

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### **Enterprise Data Processing and Management**

In FY23, the USFS UAS Program and USFS CIO Geospatial Branch partnered with the Department of the Interior (DOI) to increase our agency's capacity to store, manage, process, and share UAS imagery, video, and derived geospatial products. This partnership resulted in further enhancements and refinements to the existing [Imagery Data Management](#) platform.

This cloud-based solution provides convenient access to UAS imagery, enabling authorized personnel to view and analyze data from a web browser. This accessibility streamlines decision-making processes, increases agency awareness of available data and supports its use for multiple applications, and fosters collaboration within the agency. IDM automates the conversion of raw UAS imagery into usable formats, saving time and reducing the need for manual data manipulation. IDM also acts as a centralized repository for UAS imagery, ensuring that data is securely stored, readily available, and searchable/discoverable for future use and reference. Collaborative features allow for secure sharing of UAS imagery among different teams and agencies. This facilitates efficient interagency cooperation and improves the coordination of land management efforts. By consolidating data processing and storage into one platform, the agency reduces computer system purchase costs, improves consistency in the generation of data products, reduces the need for multiple software solutions, and reduces the data storage footprint.

Incorporating this online platform not only improves the efficiency of operations but its mild learning curve also significantly enhances agency personnel's capacity to easily process and use UAS observations and derived products for effective land management, research, and decision-making. This achievement represents a substantial step forward in the agency's commitment to embracing cutting-edge technology for the benefit of our mission and stakeholders.

In FY24, the first Forest Service IDM trainings were conducted to teach Forest Service personnel how to upload, process, locate, and download data on IDM. As a result, several new accounts were created, and new users began uploading and processing their UAS imagery. In FY24, Forest

Service personnel uploaded and processed 467 image collections in IDM, for a total of 151,850 images and 824 gigabytes worth of data. The average collection size processed by IDM in FY24 was 325 images.

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## Regional UAS Program Highlights

Regional UAS programs across the agency continued to develop and expand through projects and capacity building activities conducted throughout FY24. Reported notable accomplishments are outlined below.

### Region 1:

- Filled four UAS Pilot positions (two at regional office and two at forest offices).
- Filled 43 of 46 UAS orders for prescribed fire or wildfire (93%).
- Supported six modules outside of the region.
- Increased total pilot numbers to 31 by adding six through training and hiring.
- Increased qualified aerial ignition pilots to 10 by adding eight new pilots, four as newly carded staff and four as hired staff.
- Carded two aerial ignition pilots from outside of Region 1.
- Qualified another staff as a UAS Module Leader (UASLs) to increase the number of UASLs in the region to six.
- Utilized various aircraft for natural resource missions throughout the field season.
- Provided UAS surveillance support for 2,375 acres of prescribed burns in Region 1.

### Region 2:

- Staffed a module for over two months in support of Region 8 prescribed burn program activities.
- Developed workflow to produce Full Motion Video (FMV) data products for both fire and resource management UAS mission use cases.
- Increased qualified aerial ignition pilots to 12 by carding seven new trainee pilots.
- Completed 11 UAS Pilot (UASP) task books.
- Carded 11 staff as qualified for Extended Line of Sight/Beyond Visual Line of Sight (ELOS/BVLOS) operations.
- Increased the number of qualified UASP staff to 23 as well as added three new trainees.
- Completed 10 instances of A-454 Small UAS Add-on Course to card staff for additional various fleet aircraft, including support to card both WO and Region 1 pilots.
- Supported testing and evaluation of the Vision Aerial Switchblade mk2.4 version logging 10 hours of flight time and related diagnostics.
- Hosted first Region 2 Remote Pilot Workshop where pilots were provided refresher training and improved collaboration amongst their pilot peers.
- Assisted with testing and evaluation of Freefly Astro logging 19 hours of flight time.
- Doubled UAS aerial ignition acres within the region, completing over 18,000 acres burned.
- National Stream and Aquatic Ecology Center supported a native fish habitat survey on the Arapaho-Roosevelt NF/Pawnee NG.
- Columbine Wildland Fire Module flew for over 100 hours in support of wildfire and prescribed fire missions.

- Arapho-Roosevelt NF fire pilots conducted their first prescribed fire utilizing aerial ignition on the Forysth 1 RX.
- The Rocky Mountain Research Station located in Fort Collins, CO:
  - Compared various SfM software packages used in the UAS community. Results indicated similar quality of results among all the software packages if parameters are appropriately tuned.
  - Evaluated the influence of flight altitude above ground level on individual tree and stand level metrics for the Switchblade with Sony RX1R.
  - Conducted pre-prescribed fire site mapping using the Switchblade equipped with the Micasense to first test tree species identification and then to evaluate individual tree fire effects.
  - Developed best practices guide for use of UAS for fuels treatment effectiveness monitoring.

### **Region 3:**

- Hosted both a UAS Flight for School for Incident Operations and UAS Flight School for Resource Management.
- Hired the first Regional UAS Data Specialist in the agency.
- Hired the first Regional UAS Program Manager in the agency.
- Assisted the national effort to develop fulltime UAS Modules and their position descriptions.
- Supported wildfire and prescribed fire UAS operations throughout the region and nation.
- Completed multiple natural resource management UAS missions for recreation, wildlife, range, forest health and archeology/heritage applications.

### **Region 5:**

- Filled one 120-day UAS detail to support the two Regional UAS Specialists.
- Completed two week intensive mapping/modelling/training assignment in the Central Sierra, including support of multiple projects on the Eldorado, Sequoia and Sierra NFs, and Sequoia Kings National Park.
- Opened duty location and aircraft storage location in Redding, CA.
- Hosted UAS Flight School for Incident Operations course in Ventura, CA.
- Hosted and assisted with UAS Hybrid Aerial Ignition Academy course in Ventura, CA.

### **Region 6:**

- Supported multiple UAS modules assigned to incidents from June-October. Significantly reduced the number of UTF's by using GACC preposition of modules.
- Hosted UAS Flight School for Incident Operations course in Redmond, OR.
- Hosted UAS Flight School for Natural Resource Management in Wenatchee, WA.
- Significantly increased our capability to support prescribed fire activities with UAS, including use of a TFR for a prescribed fire for the first time in Region 6.
- Utilized detailers to assist with the increased UAS workload, including both wildland fire and natural resource projects.
- Offered and supported multiple A-454 Small UAS Add-on Course sessions for Anafi and Alta X platforms.

- Facilitated Crew Resource Management course for prospective students/pilots and to maintain currency.
- Added three additional Assistant Unit Aviation Officer UAS positions increasing the number of total permanent positions to four in the region . We now have a total of four permanent UAS positions throughout Region 6 located at Fremont-Winema, Rogue-Siskiyou, Wallowa-Whitman and Okanogan-Wenatchee NFs.
- Invested in additional UAS fleet and support equipment to further enable natural resource and wildland fire UAS operations.
- Acquired first support vehicle outfitted to support UAS operations (Ford F550).
- Supported multiple UAS aerial surveys and monitoring assessments for Forest Health Protection and other resource management programs.
- Developed inspector/evaluator and instructor qualifications with support from several Region 6 pilots as cadre and evaluators for multiple training sessions and workshops.
- Conducted several testing and evaluation with the Teal and Astro UAS platforms.

### **Region 8:**

- Completed 147,465 prescribed fire acres in Region 8 using UAS aerial ignition capabilities. 118 burns were conducted with UAS replacing the use of a helicopter.
- Conducted 66 hours of UAS surveillance of wildland fire activity within the region and 81 hours in of support for wildland fires in other regions.
- Mobilized Region 8 staff in response to UAS support requests for western US wildland fire incidents, including 24 UASP assignments as well as one UASD assignment.
- Conducted UAS aerial survey activities in support of disaster event response and recovery efforts affecting NFS lands in the region, including multiple tornados, Tropical Storm Ernesto, Hurricane Beryl and Hurricane Helene.
- Conducted UAS resource management missions throughout the region, including Southern pine beetle infestation assessments, recreation area imagery collection for construction planning, and collection of forest conditions for measuring fire effects over time.
- Delivered onsite UAS aerial survey support to provide actionable post-event intelligence to IMTs in response to Tropical Storm Ernesto impacts on El Yunque NF in Puerto Rico and multiple NFS units throughout Region 8 affected by Hurricane Helene.
- Hired Regional UAS Program Manager (GS-13).
- Hired two Zone UAS Specialist for Fire (GS-09 and GS-11).
- Supported a detail for a Regional UAS NRM Specialist (GS-12).
- Hosted UAS Flight School for Incident Operations in Tallahassee, Florida.
- Gained one qualified A-450 lead instructor.
- Gained two final evaluators and 4 pilot evaluators.

### **Region 9:**

- Hosted A-450 Basic Remote Pilot for Eastern Region States hosted in Whitewater, WI.
- Qualified three staff as new UASPs (carded for ELOS/BVLOS operations) to increase the number of UASPs in Region 9 to six
- Qualified four new staff as aerial ignition pilot trainees.
- Doubled the numberof UAS aerial ignition pilots in Region 9 to two.

- Performed seven weeks of UAS training support to other Forest Service regions.
- Trained and recommended carding for 51 pilots.
- Assisted in the first Hybrid Aerial Ignition Academy (wildfire instead of prescribed fire focused) in California.
- Maintained a pilot currency level of 91% in the region (as of September 20, 2024).
- Supported inspections of The Conservation Fund (TCF) – Potlach Realty lands (high priority 17,000 acre land purchase on the Superior National Forest).

### **Region 10:**

- Developed and released the R10 UAS Resources SharePoint site.
- Developed an R10 Aviation Hazard Web Map to support UAS and crewed aircraft mission planning and execution.
- Facilitated multiple standard acquisition missions through general operations UAS Mission Aviation Safety Plans on Tongass and Chugach NFs.
- Added four new Parrot Anafi aircraft to the R10 aircraft inventory.
- Completed multiple resource management UAS aerial survey missions to collect imagery and process data to generate 2D and 3D geospatial products, including ortho imagery, digital surface models, videos and 360 degree panoramic images, for projects throughout the region. Documented projects include:
  - Development and improvement of planned/existing recreation sites.
  - Assessment and documentation of mine closure sites.
  - Mapping support for landslide events and glacial lake outburst flood monitoring.
  - Assessments of roads, bridges, parking lots, cabin sites, buildings and recreation sites.
  - Volumetric assessments to estimate rock/gravel removal from pit sites.

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### **NTDP, Enterprise, and GTAC Support Highlights**

The National Technology and Development Program (NTDP) played a pivotal role in supporting the UAS program across a range of vital areas. Notable accomplishments from FY24 included continuing to develop the Unmanned Aircraft Screening and Evaluation Committee (UASEC) and using the UASEC to complete the first of its kind aircraft carding and approval of the Alta X and Astro for agency fleet. NTDP also set up an UASEC Project Proposal Intake Process to gather innovative ideas from field and UAS users. In addition, NTPD worked on the integration of approved payloads and sensors. Their contributions also extended to use case evaluations and providing field support. For example, NTDP evaluated UAS for conducting reforestation tasks, inventorying USFS nursery seedlings, estimating volume of fire salvage log decks, and conducting bridge inspections. And for field support, they used UAS lidar to assist in the planning and monitoring of severely disturbed (high burn intensity and overland debris flow) high priority landscapes. They also provided prescribed burn and wildland fire support after one of the NTDP pilots became qualified near the end of the 2024 wildfire season.

The Enterprise Team was able to conduct UAS flights to support the collection of data to better inform Rapid Assessment of Vegetation Condition after Wildfire (RAVG) models. RAVG produces data estimating post-fire vegetation conditions on National Forest System. Flights were

conducted in areas recently burned by wildfires and identified by the RAVG team as suitable for training the models. That data has been processed, and data products were created and posted on the Image Data Manager (IDM). Lessons learned have been documented and will be shared for those conducting future similar projects. Enterprise has also added 2 pilot staff to support the Enterprise team's project goals.

The Geospatial Office - Geospatial Technology and Applications Center (GTAC) brings their expertise in remote sensing, geospatial analysis, as well as geospatial training development and delivery to support the UAS program. Their contributions include delivering three offerings of the following trainings in FY24: week-long Resource Management for UAS workshop, virtual UAS thermal workshop, and virtual UAS multispectral workshop. They also developed and provided two offerings of the IDM training to teach UAS pilots and analysts how to upload and process UAS imagery in IDM. GTAC staff are also continuing to develop other courses and webinars, including UAS lidar, Spatial Accuracy Methods (SAM), and Case Study webinars. GTAC was also able to utilize contract resources to conduct eight end-product missions to estimate post-fire erosion in meadows and on steep mountainsides, map the results of a stream restoration effort, estimate compaction of soil due to tethered logging activities, provide data for post-windthrow timber salvage, model tree-stand attributes for timber sale activities, and map heritage sites under dense vegetation using lidar.

GTAC federal staff also contributed to the resource management by conducting data collections to support the improvement of USFS roads following seasonal damage and collaborated with NTDP in conducting stocking survey of seedlings planted after wildland fires. GTAC staff also provided support to regional pilots in the mapping of endangered plants and in collecting imagery to provide post-storm damage estimates. GTAC also continued work in the sensor evaluation program to test and develop workflows and best practices for the variety of sensors in use and did extensive evaluations with the Astro.

GTAC provided technical support to the agency for geospatial and other related aspects of UAS, including assistance with UAS data collection and image processing questions. In January 2024, the UAS Help Desk was integrated with Remedy, which is the system used for other Help Desk tickets within the agency. From January through the end of September, 80 UAS Help Desk tickets were completed. The majority (71%) of those tickets were IDM related, and involved creating accounts for new users, helping with processing issues, and adding equipment to the interface. The other 29% of the tickets included questions about flight planning and the use of other photogrammetry software.

### 3. FLIGHT AND PROGRAM PERFORMANCE METRICS

The Forest Service pilot training program provides fundamental pilot training as well as tools and mission-scenario experience to prepare staff to effectively support both incident and resource management objectives. The USFS UAS Program continues its competitive selection process to identify new pilots for training. In FY24, 96 USFS and 29 DOI pilots attended one of eight offerings of the A-450 Basic Remote Pilot course, approximately 21% fewer USFS pilots

compared to FY23. This course provides fundamental classroom and flight training for prospective pilots to conduct UAS missions for the Forest Service in accordance with agency and FAA policies. Successfully carded pilots may continue with S-373 UAS Incident Operations and/or Aerial Ignition Academy training to be qualified to support wildland fire incidents. Pilots may also complete the Resource Management Workshop training to increase their capacity to support resource management projects.

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### **S-373 UAS Incident Operations Course**

A total of 59 USFS and 36 DOI pilots attended one of six offerings of the S-373 Interagency UAS Incident Operations courses in FY24. The number of USFS pilots trained in FY24 is 5% less than the 62 USFS pilots that attended in FY23. This course instructs students how to plan and execute UAS operations on incidents; capture imagery with agency approved UAS; generate and deliver requisite geospatial products; communicate, deconflict, and integrate into fire-traffic-area airspace; and engage in beyond-visual-line-of-sight mission profiles. Graduates receive an agency UAS Remote Pilot Certificate (card) and become a National Wildfire Coordinating Group (NWCG) UAS Remote Pilot (UASP) trainee.

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### **Aerial Ignition Academy**

A total of 39 USFS and 10 DOI pilots were trained at one of three Aerial Ignition Academies in FY24. These numbers were down from the FY23 trainings, which included 66 USFS pilots. The Aerial Ignition Academy is designed to meet the training needs of the Unmanned Aircraft System Aerial Ignition System Operator. The course combines lectures, facilitated discussions, individual/group exercises, and simulations. The UAS Aerial Ignition System Operator flies a UAS equipped with an aerial ignition system and conducts aerial ignition operations under the supervision of the Firing Boss (or designee).

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### **Resource Management Workshop**

A total of 45 USFS pilots attended one of the three Resource Management (RM) workshops, 30% fewer than the 64 pilots that attended in FY23. This course provides instruction to effectively plan and execute UAS missions for resource management (non-fire) applications. The course also provides additional instruction focused on processing the collected data and imagery to create various geospatial derivative and analytical products. Course components include current aviation policy, sensors and product awareness, camera settings, photogrammetry overview, project setup, flight planning, safety considerations, mission implementation and conducting flights, post-flight data review and assessment, image processing, and production of basic image-derived products.

At the end of the fiscal year, 73% of trained UAS pilots were compliant with their training and proficiency flights, which involves performing three takeoffs and landings every three months.

## 4. PILOT METRICS

The Forest Service affords a significant amount of autonomy to its regions and field units. This approach is also being followed in the implementation of the UAS Program. Regions are developing and customizing regional UAS programs to address their unique priorities and needs. The development and availability of pilots is instrumental to a viable program.

### Pilot Locations

Pilot distribution continues to improve as more pilots are onboarded in each region. The UAS Pilots by Region map (figure 3) shows the distribution of pilots by region clustered into five distinct groupings. Region 10 currently has the fewest UAS pilots with a total of 11, and Region 6 has the most with 65. Figure 4 shows the total number of pilots for each region and includes a count of pilots that are current vs those that have not recently flown. Pilots stay current on their training by taking off and landing a total of three times every 90 days. As of the end of FY24, Region 9 had the highest percentage with 100% of pilots current on training. Regions 4 and 2, as well as the Washington Office, were all above 90% of pilots being current on training.

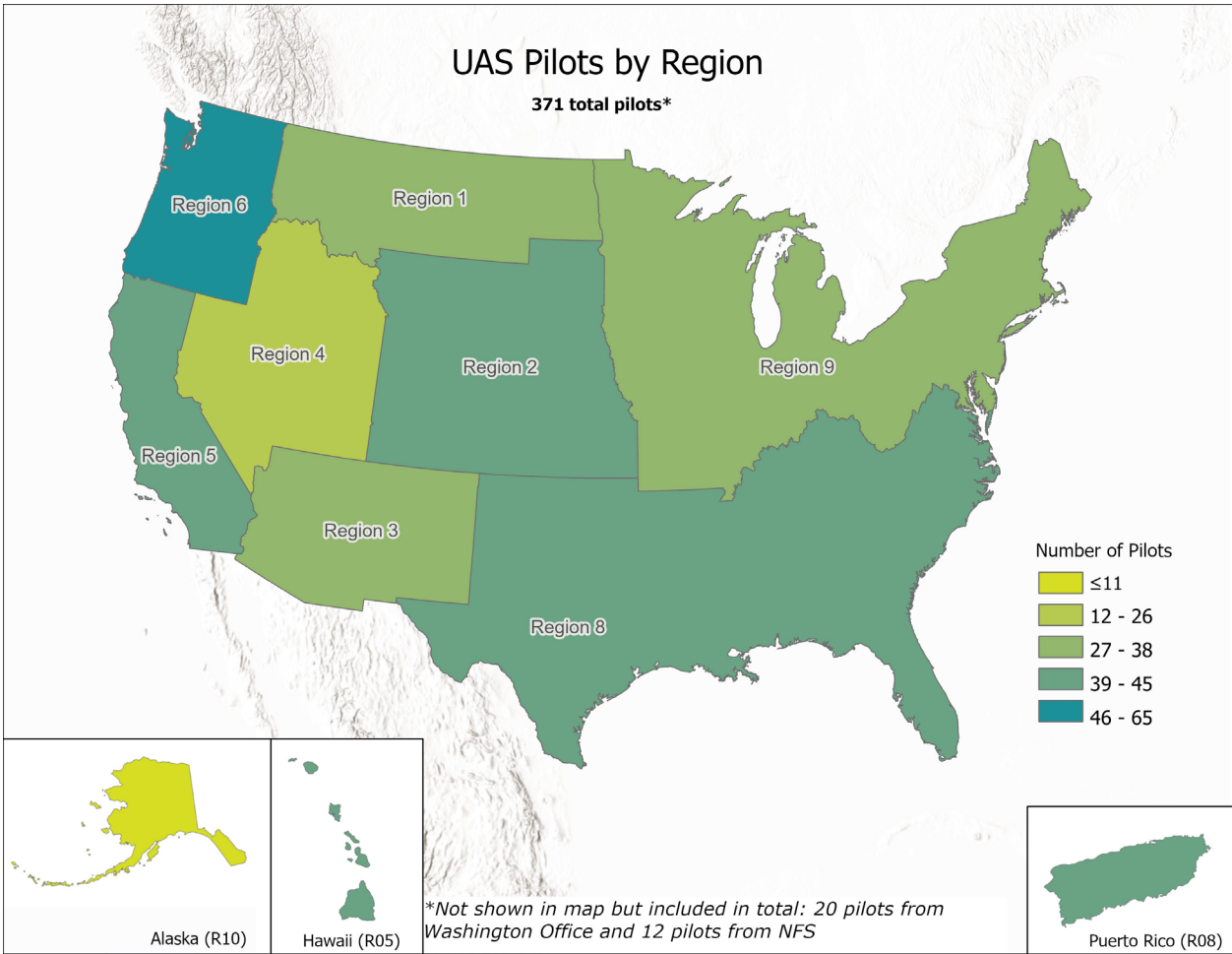


Figure 3. Map of the United States and Puerto Rico (U.S. territory) depicting the number of UAS Pilots per region.

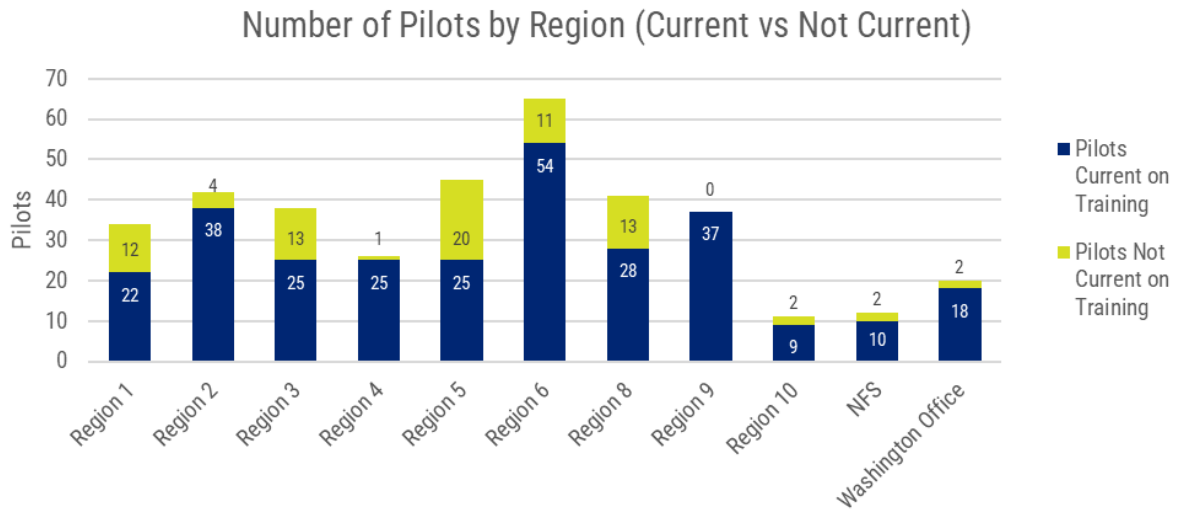


Figure 4. Graph showing the number of pilots who are current on training compared to the total number of pilots.

## Training

Regions 2, 3, 4, 5, 6, and 8 facilitated and hosted Forest Service-sponsored A-450 trainings and follow-on S-373 and Resource Management trainings during FY24. A total of 125 new UAS pilots were trained in the A-450 trainings, with 96 of those pilots being from the USFS and the remaining 29 pilots being from DOI agencies (FWS, BIA, NPS, and BLM). The UAS USFS program continued to expand and grow with the addition of these 96 new USFS pilots, which brings the total to 371.

### Number of Pilots from USFS and DOI for A-450 Training

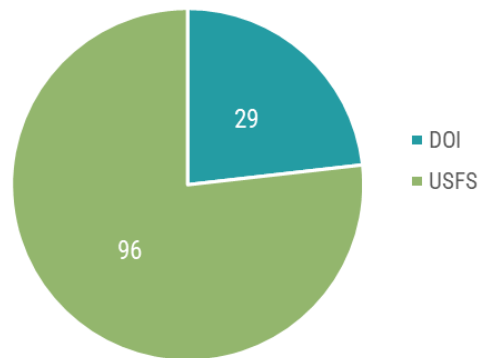


Figure 5. Chart showing number and percentage of USFS and DOI pilots that completed the A-450 training in FY24.

Regions 3 and 6 added the most UAS pilots to their regions by each adding 14. Region 4 was close behind by adding 13 UAS pilots. Of the 96 A-450 USFS graduates in FY24, plus a few others from previous years, 60% went on to complete the S-373 training and the other 40% completed the UAS RM training. Region 9 added the most S-373 graduates with 10 pilots, and Regions 3 and 6 were close behind with 9 pilots. Region 4 and the Washington Office led the way by each

having 6 pilots complete the UAS RM training. Regions 3, 6, and 8 were close behind with 5 pilots.

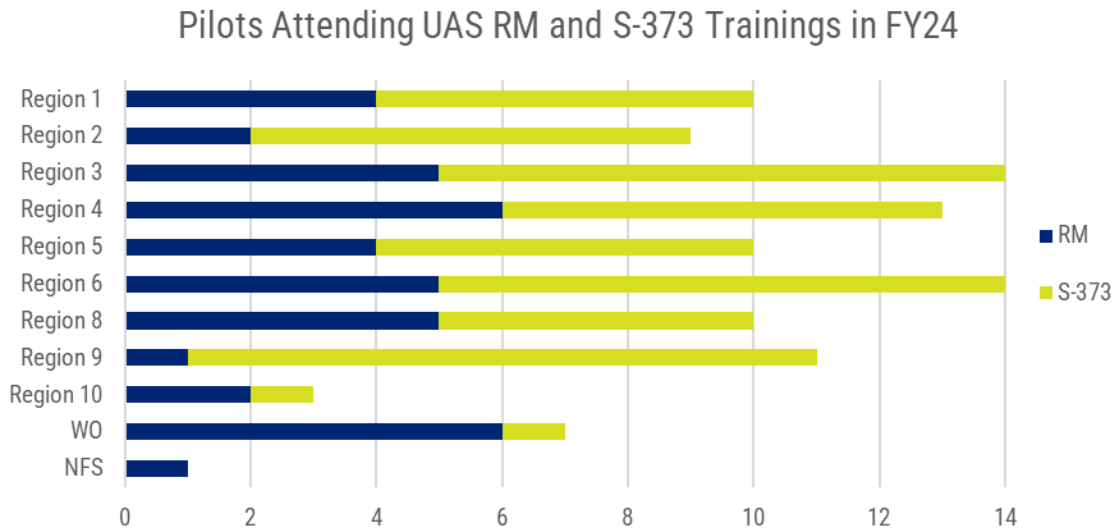


Figure 6. Graph showing the number of pilots by region that have completed the RM and S-373 UAS training in FY23. All these pilots also completed A-450 in FY23.

In FY24, 87% of the newly trained pilots continued to expand on their UAS expertise by completing flights directly after their trainings. This is a major improvement over flights logged by newly trained pilots in FY23, which was only 39%. This is likely due to improved support by regional leadership and better access to UAS equipment.

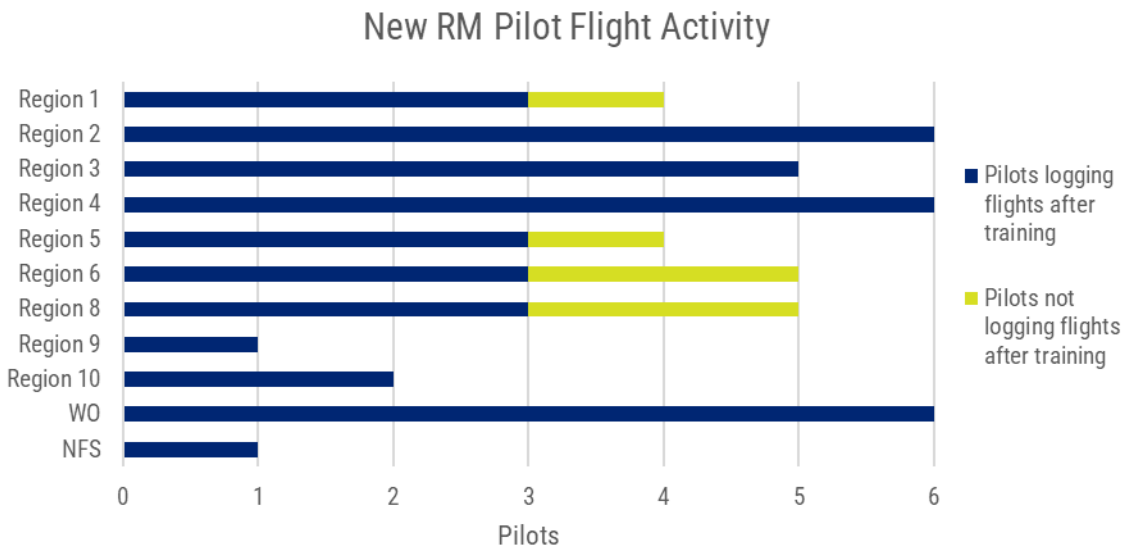


Figure 7. Graph showing the number of pilots who logged flights after completing RM training.

## Pilot Qualifications

In FY24, 60 USFS and 35 DOI pilots attended six S-373 courses to become qualified UASPs. After completing the course pilots must spend time on an incident to compete their training and become a qualified UASP. Of those 60 USFS pilots, at the end of FY24, 17 are qualified UASPs, 35 are designated at trainees, 3 have an undetermined status, and 5 have an incomplete status. There are currently 410 Forest Service UASPs listed in the Incident Qualifications and Certification System (IQCS), with 172 as "Qualified", 160 as "Trainee", and 77 as "Undetermined" or "Incomplete."

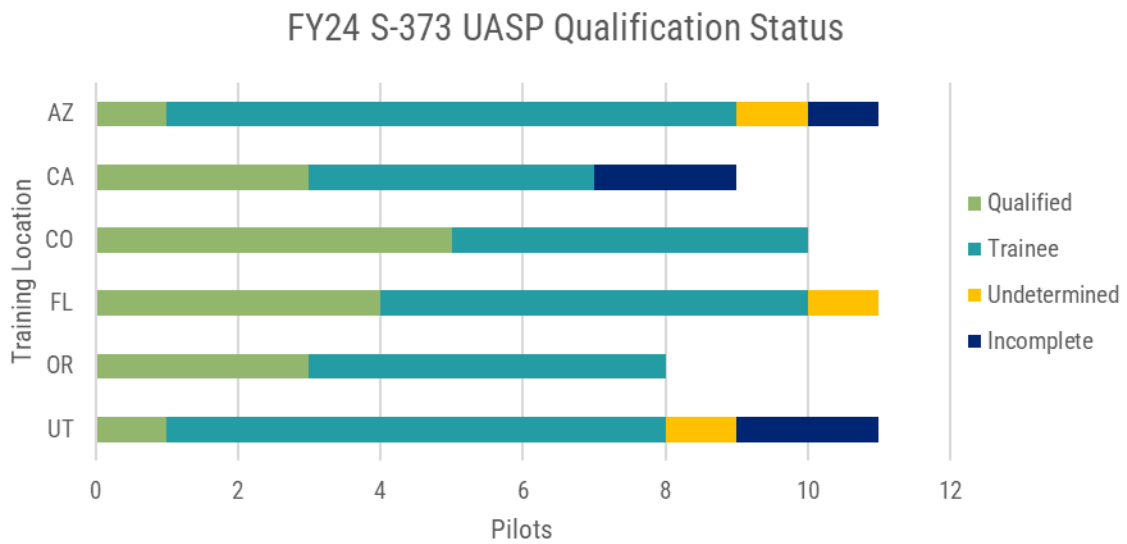


Figure 8. Graph showing the S-373 qualification status of pilots per training location.

## 5. FLIGHT METRICS

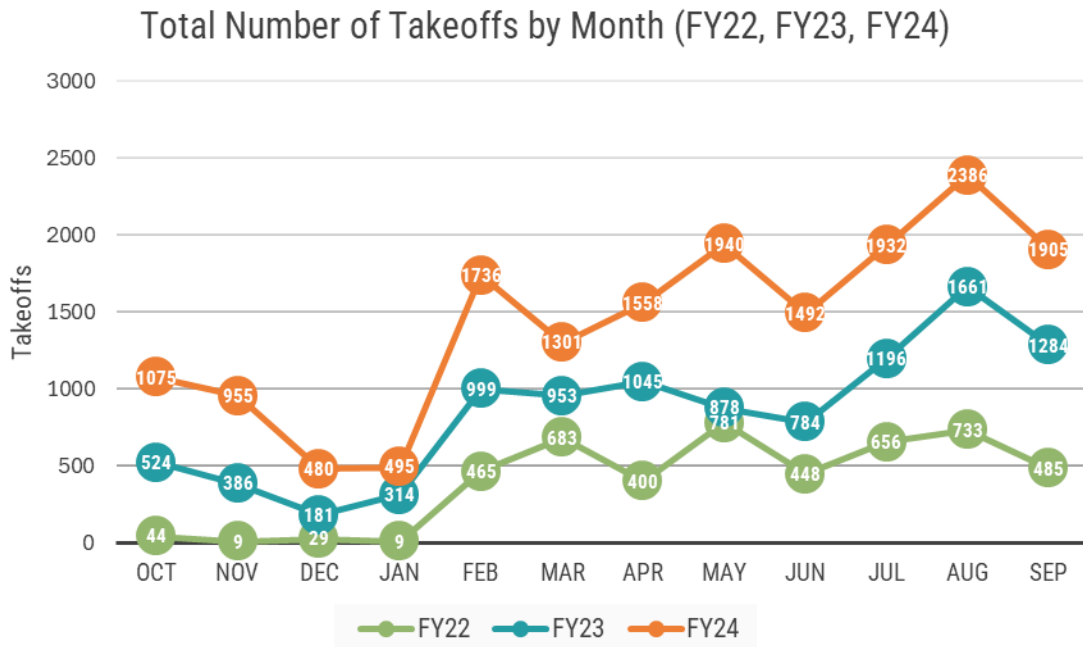


Figure 9. Graph shows the number of takeoffs by month in fiscal year 2022, 2023, and 2024.

A total of 4,525 hours of flights were conducted by Forest Service pilots in FY24, up by about 78% from the 2,553 hours flown in FY23 and up by about 250% from the 1,300 hours flown in FY22. A large proportion of these flights were conducted for training purposes (23%). Seven Forest Service-sponsored two-week flight school sessions consisting of A-450 training followed by S-373 and Resource Management trainings were conducted in FY24. The rapid increase and sustainment in number of take offs by month correspond to the occurrence of these trainings between February and June 2024 and flights conducted afterwards by trainees and qualified pilots conducting flights for incident support and resource management projects. In addition to flights conducted during formal training courses, operational training flights also provided opportunities for new pilots to learn the basics of flying, conducting situational awareness or observation flights, accomplishing prescribed burns, and conducting automated mapping missions.

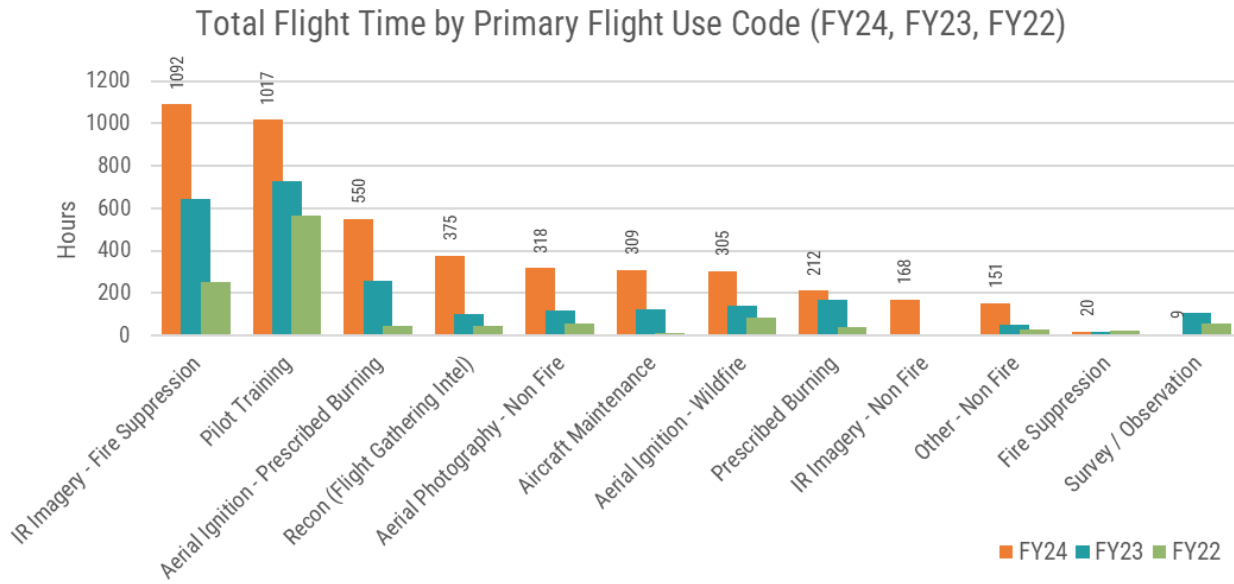


Figure 10. Graph showing the number of hours flown by primary flight use code for FY22, FY23, and FY24.

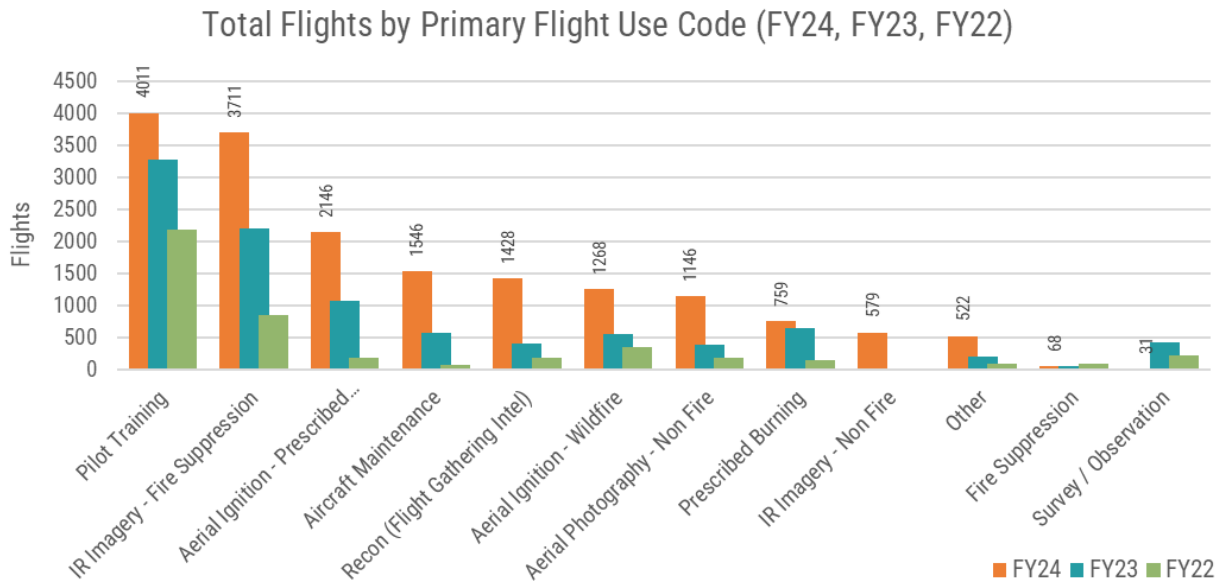


Figure 11. Graph showing the number of flights by primary flight use code.

Flights having use categories associated with wildland fire support were the largest in number in the agency in FY24. Operational flights for collecting thermal infrared data on wildfires and conducting aerial ignitions (prescribed burning) were the first and third most common type of flight conducted by USFS remote pilots. These flight-use categories represented 24% and 12%, respectively, of the 4,525 hours of UAS flights conducted by the agency. An additional 6% of the total flight hours supported aerial ignition for wildfires while other fire-related activities comprise 5% of the total flight hours.

Of the remaining flight use categories, nearly all are associated with resource management applications of UAS technology and represent 29% of the flight hours conducted during FY24, which is up from 22% in FY23. Recon (flight gathering intel) activities were the fourth most common type of flight conducted by USFS remote pilots with 8% of the FY24 flight hours supported. These flight-use categories are expected to grow dramatically soon within the Forest Service and eventually eclipse the number of UAS flight hours conducted for wildfire management.

### Aerial Ignition Operations and Pilot Training Flight Locations

The needs and goals for utilizing UAS are varied throughout the agency. The following chart and maps illustrate how each region has used UAS for the purpose of training UAS pilots as well as operational flights in utilizing UAS for infrared imagery and aerial ignition both for active wildfires and prescribed burns. Regions 4, 5, and 6 have a high use of UAS to collect infrared imagery and conduct aerial ignitions on wildfires, while Region 8 has utilized UAS for prescribed burns the most. Regions 3 and 8 have the highest use for pilot trainings.

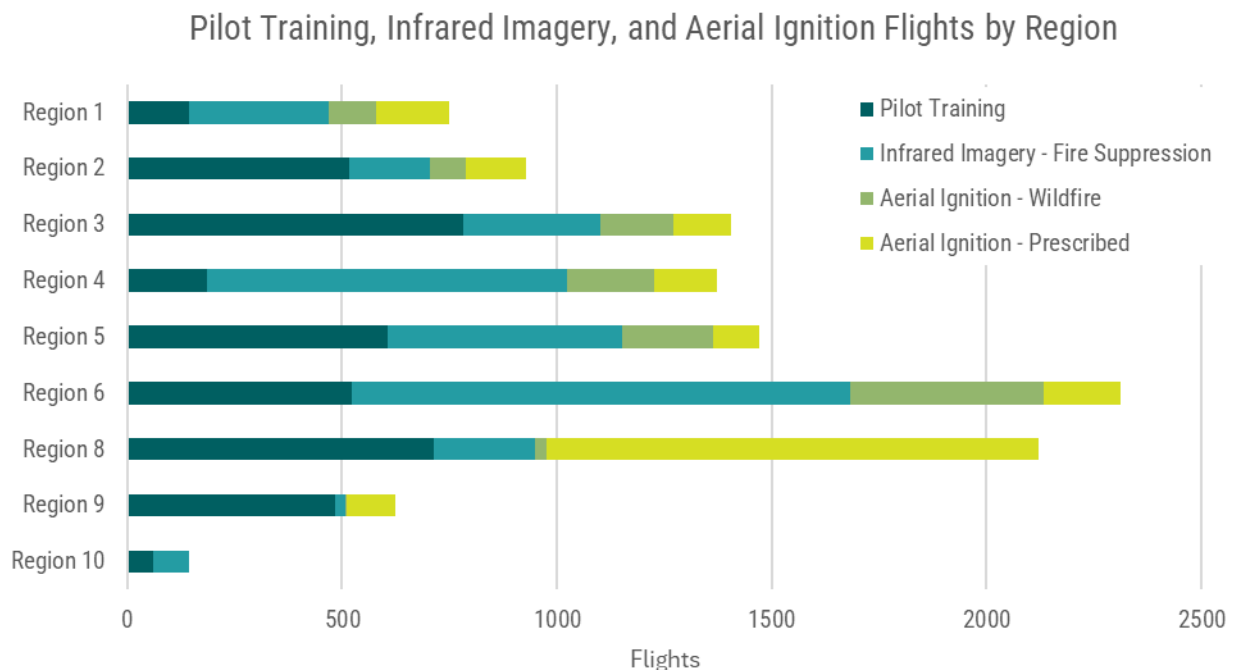


Figure 12. Graph showing the number of Pilot Training, Infrared Imagery and Aerial Ignition flights by region.

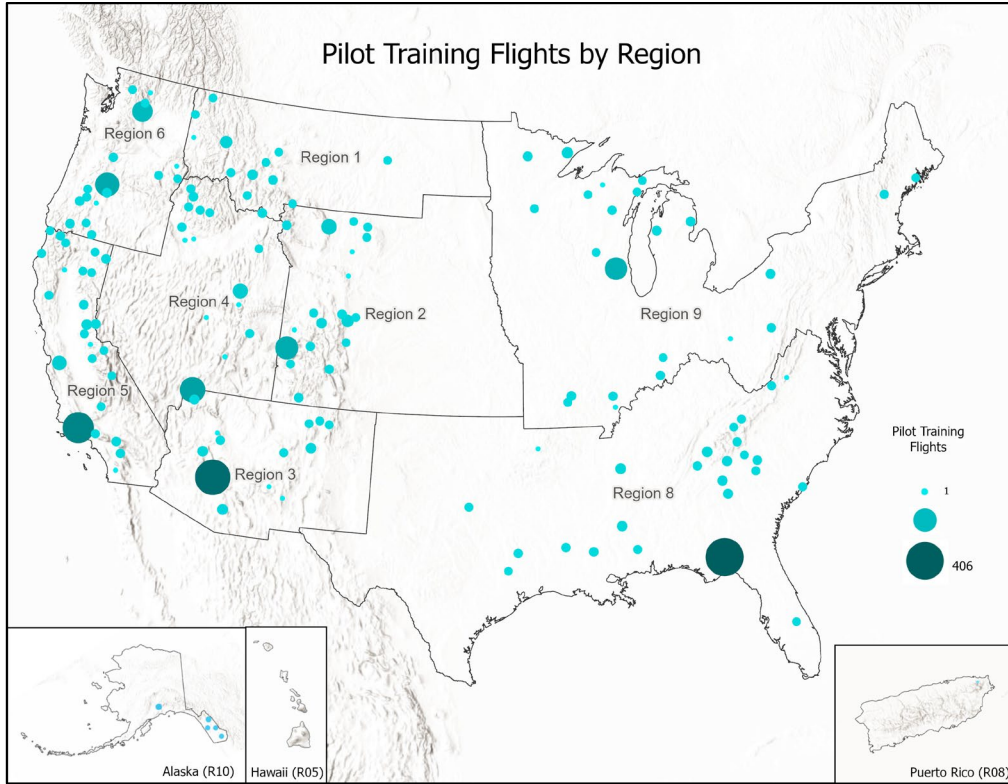


Figure 13. Map showing pilot training flight locations by region.

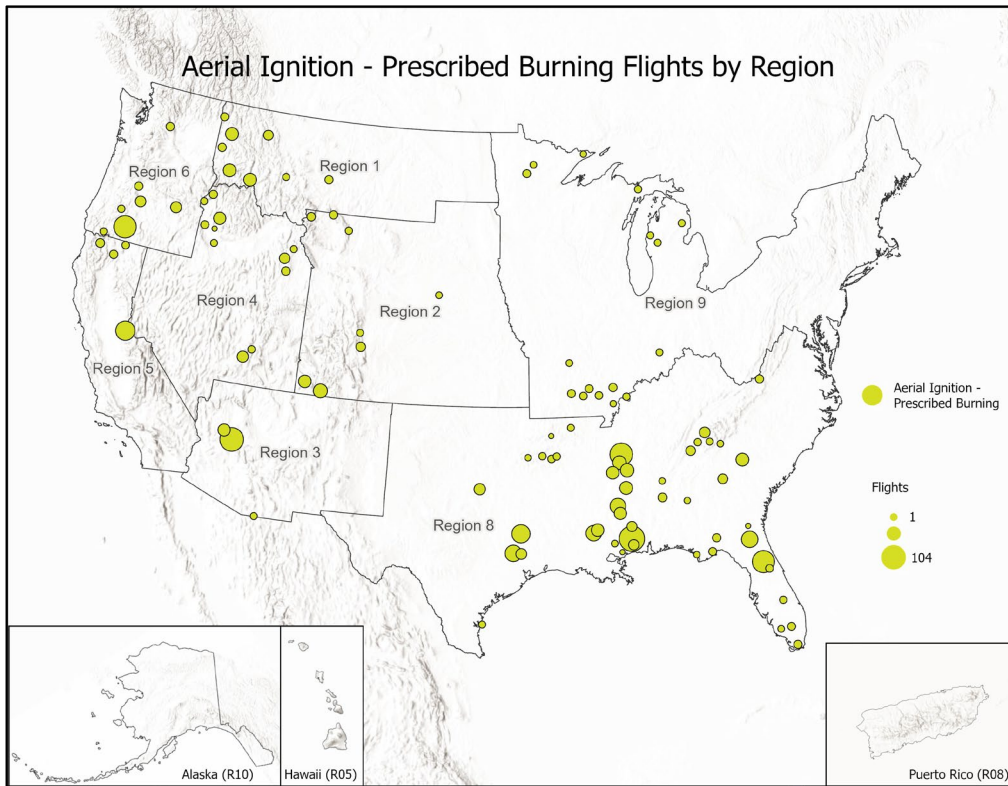


Figure 14. Map showing aerial ignition (prescribed burning) flight locations by region.

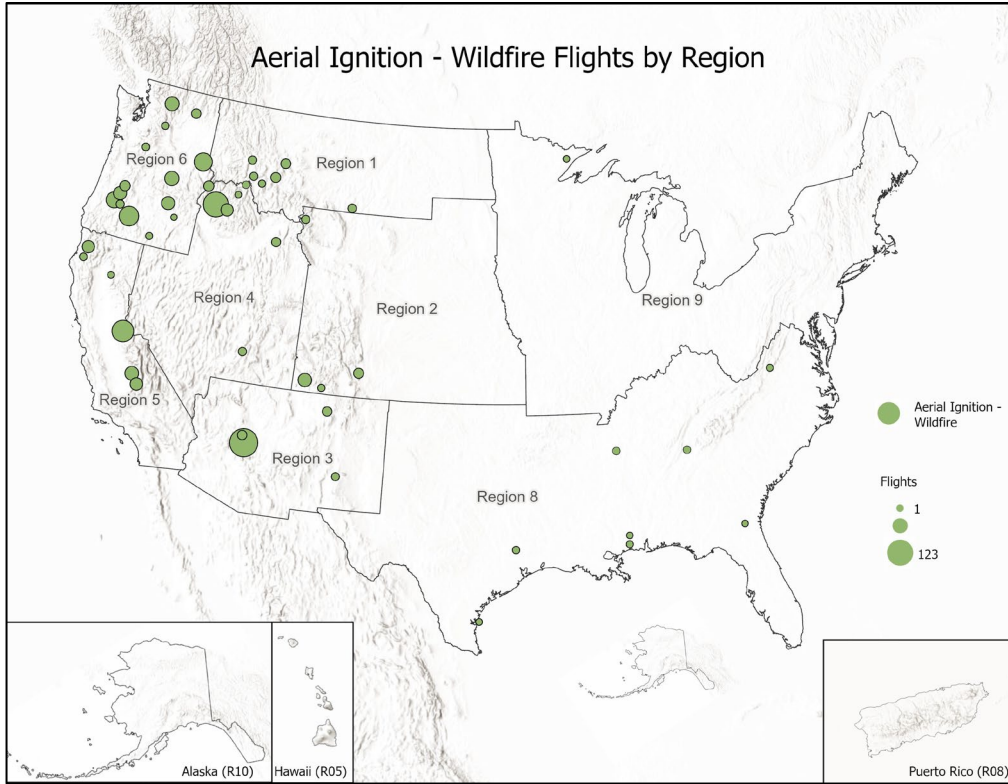


Figure 15. Map showing aerial ignition (wildfire) flight locations by region.

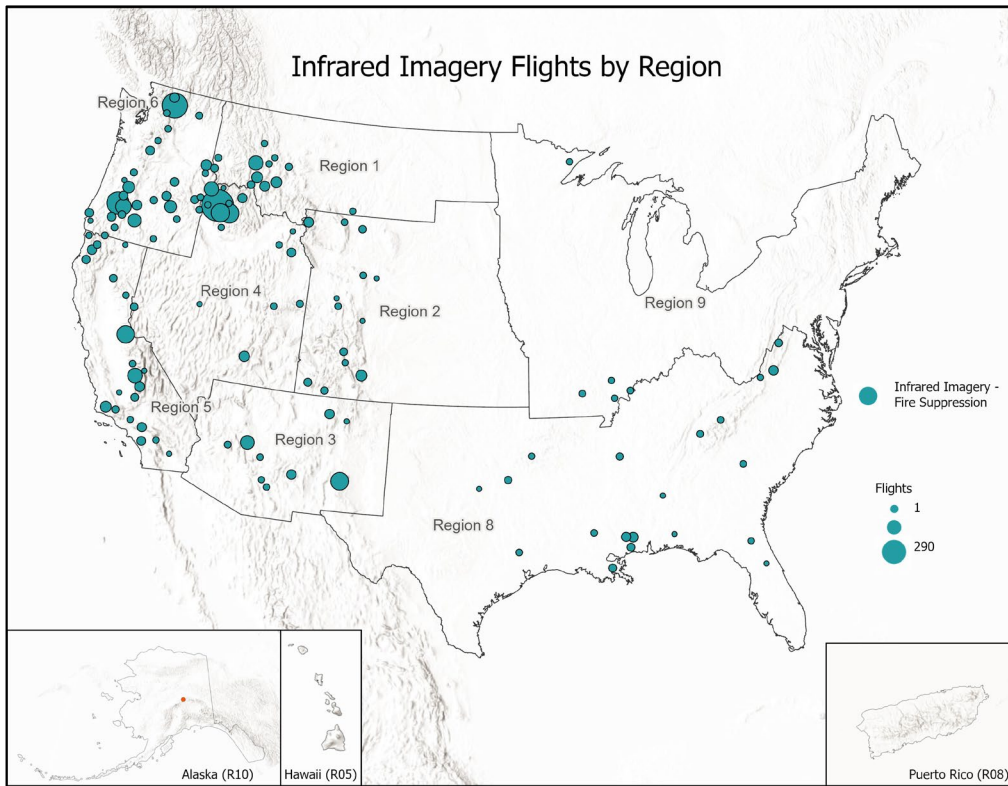


Figure 16. Map showing infrared imagery (fire suppression) flight locations by region.

## 6. AIRCRAFT METRICS

The Forest Service UAS program continued efforts in FY24 to build a fleet to meet the training and operational demands of the agency. Currently, the Forest Service sUAS fleet consists of 342 platforms, with 85 added during FY24. The fleet comprises six main models of aircraft flown by the USFS, each with its own strengths and weaknesses and a purpose to serve the needs of the agency. As new models are introduced into the fleet, much time is invested into training remote pilots on these new aircraft. Charts provided later in this section identify the types and numbers of current fleet aircraft, provide a brief description of their capabilities, and illustrate the flight use metrics for each model in FY24.

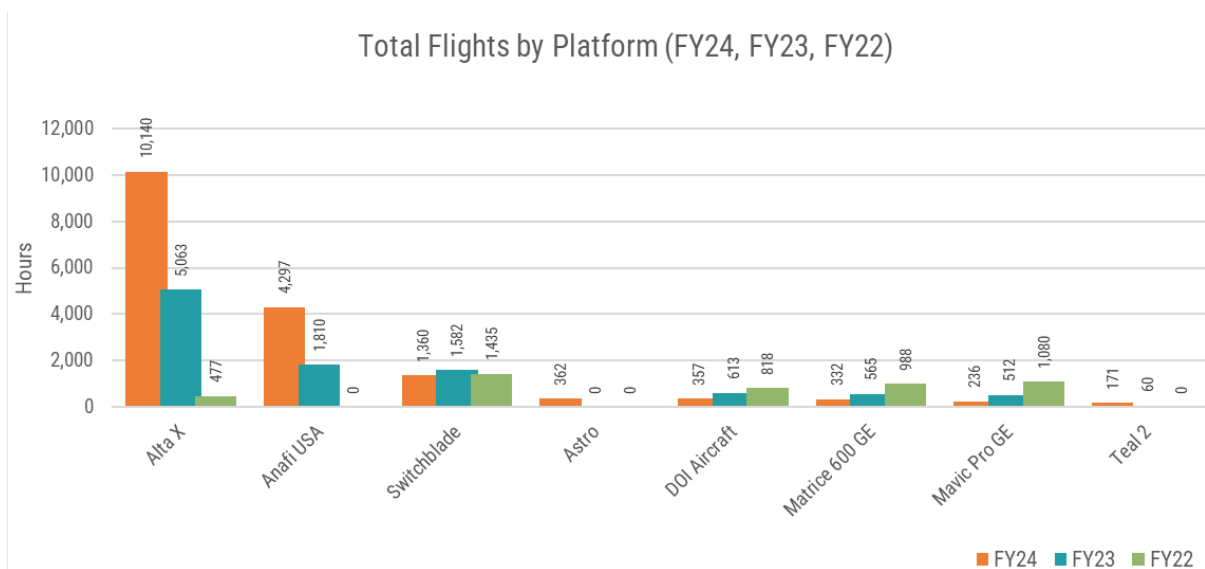


Figure 17. Graph showing the number of flights by UAS model.

A total of 16,898 Forest Service sUAS flights (up from 10,200 in FY23) were conducted during FY24 using seven models of aircraft. Issues encountered by pilots during these flights were documented in the flight logs for 365 (2%) of these flights. An issue can be described as anything that is not performing as expected, from major issues like the crash of a platform, to relatively minor issues such as cameras not working properly or issues with video feeds. Most of these documented issues in FY24 involved equipment (e.g., platforms, sensors, gimbals, and controllers) not working properly. A few entries also mentioned safety concerns with weather and site conditions.

### Flights Logged With and Without Issues

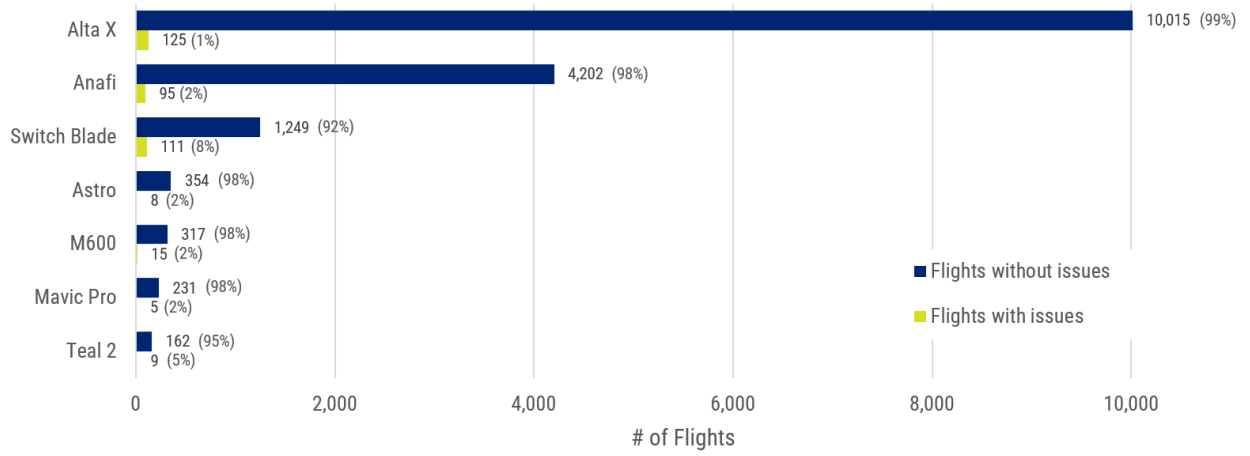

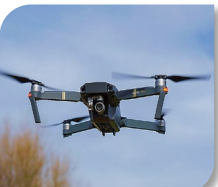


Figure 18. Graph showing the number of FY24 flights where issues were and were not encountered by UAS model.

<b>UAS Platform</b>	<b>Platform Summary</b>	<b>Number in USFS fleet</b>	<b>Flights this year</b>	<b>Average flight time</b>	<b>Top 3 Flight use codes (# of flights)</b>
<p><b>Alta X</b></p> 	<p>The Alta X is a heavy lift quadcopter with the ability to swap payloads weighing up to 35 lbs. The Alta X can fly with RGB, thermal, multispectral, lidar, and aerial ignition payloads.</p>	<p>In FY24, the USFS added 27 new Alta X platforms for a total of <b>83</b>.</p>	<p>In FY24 USFS pilots have flown <b>10,140</b> Alta X flights, up from 5,063 in FY23.</p>	<p><b>16</b> minutes</p>	<p>IR Imagery – Fire Suppression (<b>3,235</b>), Aerial Ignition – RX (<b>2,075</b>), Aerial Ignition - Wildfire (<b>1,184</b>)</p>
<p><b>Anafi USA</b></p> 	<p>The ANAFI USA is a lightweight and compact quadcopter with two natural-color 20MP cameras and a thermal camera.</p>	<p>In FY24, the USFS added 45 Anafis to the fleet for a total of <b>128</b>.</p>	<p>In FY24 USFS pilots have flown <b>4,297</b> Anafi flights, up from 1,810 in FY23.</p>	<p><b>15.4</b> minutes</p>	<p>Pilot Training (<b>2,598</b>), Aircraft Maintenance (<b>509</b>), Aerial Photography – Non-Fire (<b>426</b>)</p>
<p><b>Switchblade</b></p> 	<p>The SwitchBlade-Elite is a medium lift tricopter with the ability to swap payloads weighing up to 5 lbs. The Switchblade can fly with RGB, thermal, and multispectral payloads.</p>	<p>In FY24, the USFS added 7 Switchblades to the fleet for a total of <b>100</b>.</p>	<p>In FY24 USFS pilots have flown <b>1,360</b> SwitchBlade flights, down from 1,582 in FY23.</p>	<p><b>15.6</b> minutes</p>	<p>Pilot Training (<b>446</b>), Aerial Photography – Non-Fire (<b>394</b>), Aircraft Maintenance (<b>317</b>)</p>
<p><b>Astro</b></p> 	<p>The Astro is a newly approved platform this year that is able to carry payloads up to 3.3 lbs. Payloads currently available for the Astro are capable of capturing RGB, thermal, and multispectral imagery.</p>	<p>In FY24, the USFS added 6 Astros to the fleet for a total of <b>12</b>.</p>	<p>In FY24, USFS pilots have flown <b>362</b> Astro flights.</p>	<p><b>18.1</b> minutes</p>	<p>Other – Non-Fire (<b>184</b>), Aircraft Maintenance (<b>86</b>), Aerial Photography – Non-Fire (<b>58</b>)</p>
<p><b>Mavic Pro GE</b></p> 	<p>The Mavic Pro Government Edition (GE) is a lightweight and compact quadcopter with a 12MP camera. These platforms are being removed from service as domestically manufactured systems are onboarded.</p>	<p>No new Mavic Pro GEs were added to the fleet in FY24. There are currently <b>9</b> in the fleet.</p>	<p>In FY24 USFS pilots have flown <b>236</b> Mavic Pro GE flights, down from 512 in FY23.</p>	<p><b>12.4</b> minutes</p>	<p>Aerial Photography – Non-Fire (<b>116</b>), Pilot Training (<b>35</b>), Aircraft Maintenance (<b>30</b>)</p>
<p><b>M600 GE</b></p> 	<p>The Matrice 600 Government Edition (M600 GE) is a heavy lift hexacopter with the ability to swap payloads weighing up to 13 lbs. These platforms are being removed from service as domestically manufactured systems are onboarded.</p>	<p>No new M600s were added to the fleet in FY24. There are currently <b>10</b> in the fleet.</p>	<p>In FY24 USFS pilots have flown <b>332</b> M600 GE flights, down from 565 in FY23.</p>	<p><b>13.1</b> minutes</p>	<p>IR Imagery – Fire Suppression (<b>129</b>), Pilot Training (<b>45</b>), Aerial Photography – Non-Fire (<b>38</b>)</p>

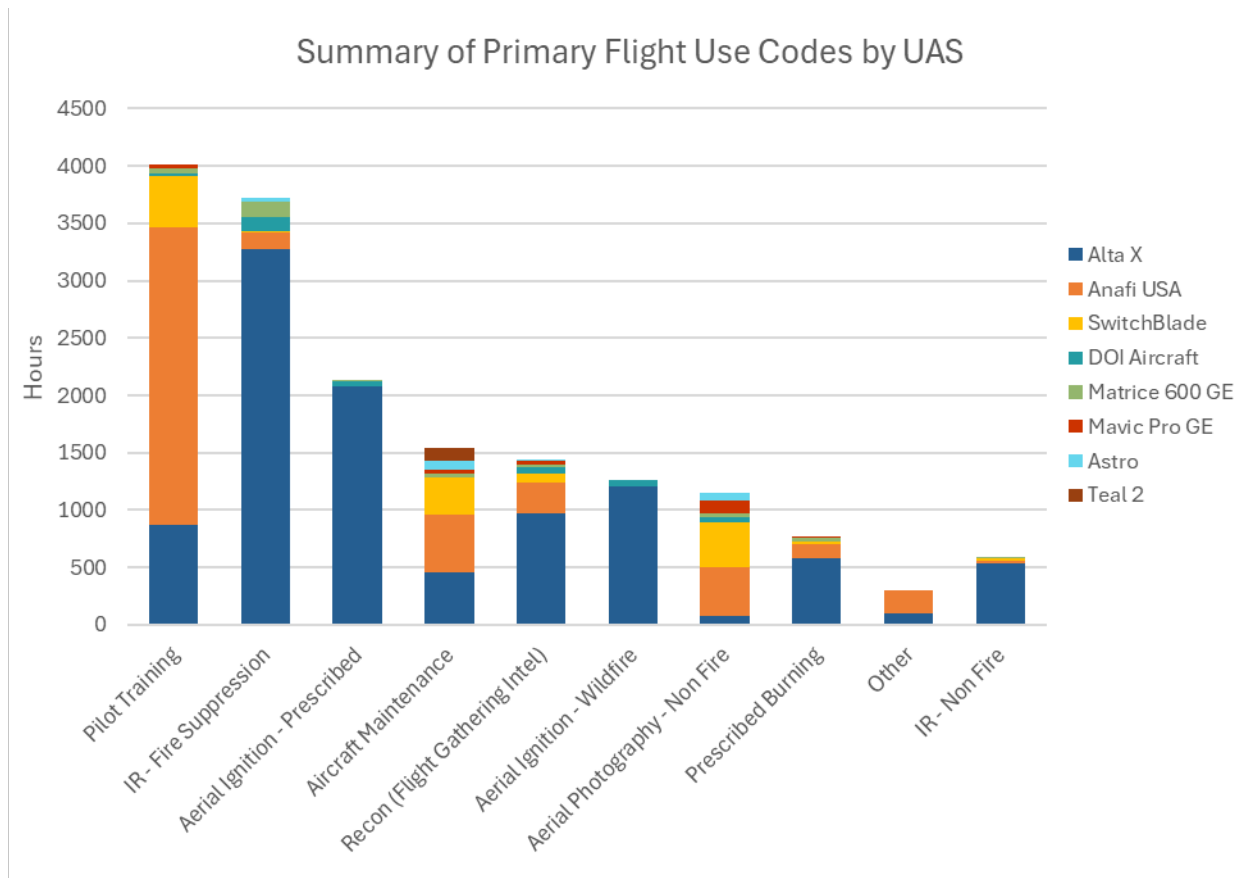


Figure 19. Chart showing the summary of flight use codes by UAS platform in FY24. The lesser-used codes were grouped into the 'Other' column, which includes Other - Non-Fire, Aircraft Pilot Unit Inspection, Other - Fire Suppression, Detection (for Detecting Wildfires), Fire Management, Research, Wildlife / Animal Count, IR Imagery - Non-Fire, Training Other Than Pilot, LE&I, and Seed and Fertilization.

## 7. FY25 OUTLOOK

In FY25, the Forest Service UAS Program will continue to build its foundational support of a comprehensive, state of program. These planned activities include the following:

- Conduct five additional S-373 UAS for Incident Operations courses for trained Basic Remote Pilots. These courses will be conducted the week following each of the planned five A-450 Basic Remote Pilot courses. It is anticipated that 60 USFS and 36 DOI Basic Remote pilots will be prepared to become trainees to support IMTs and incident operations through these efforts.
- Conduct three additional Resource Management workshops for trained Basic Remote Pilots. These courses will be conducted the week following four of the scheduled A-450 courses (concurrently with scheduled S-373 courses). It is anticipated that 48 new USFS resource management pilots will be trained through these efforts.
- Conduct two additional interagency aerial ignition academy training sessions. It is anticipated that 32 new USFS pilots will be trained through these efforts.

- Deliver new trainings focused on developing expertise in collecting multispectral, thermal, and lidar data, and understanding spatial accuracy methods.
- Continue efforts to expand the current Forest Service UAS fleet through acquisitions on current contracts and partner with the vendor community to conduct market research and demonstration/evaluation projects to evaluate new platforms and capabilities to support new and evolving use cases in the agency.
- Build agency capacity and expand the use of IDM for processing, cataloging, storing, and disseminating UAS imagery, video and derived data products throughout the agency.

## 8. APPENDIX A. CALENDAR YEAR REPORT

The following section is a re-creation of the latter part of Section 5 of this report (Flight Metrics) using Calendar Year 2022, 2023, and 2024 numbers.

### Calendar Year 2024 Flight Metrics

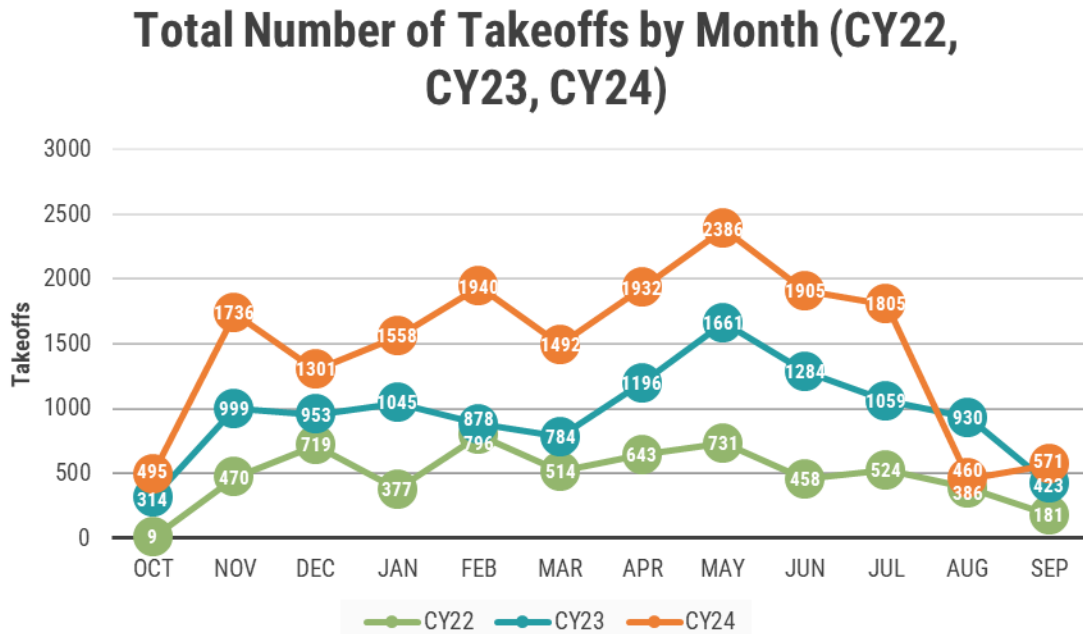


Figure 20. Graph showing the number of takeoffs by month for CY22, CY23, and CY24.

A total of 4,670 hours of flights were conducted by Forest Service pilots in CY24, this is up by about 160% from the nearly 2,902 hours flown in CY23 and up by about 320% from the nearly 1,412 hours flown in CY22. The largest portion of these flights were for IR Imagery – fire suppression (25%) with 1,169 hours. The second largest proportion of these flights were conducted for training purposes (23%) with 1,086 hours. The rapid increase and sustainment in number of take offs by month correspond to the occurrence of Forest Service-sponsored two-week flight school trainings between February and June 2024 and flights conducted afterwards by trainees and qualified pilots conducting flights for incident support and resource management projects. In addition to flights conducted during formal training courses, operational training flights also provided opportunities for new pilots to learn the basics of flying, conducting situational awareness or observation flights, accomplishing prescribed burns, and conducting automated mapping missions.

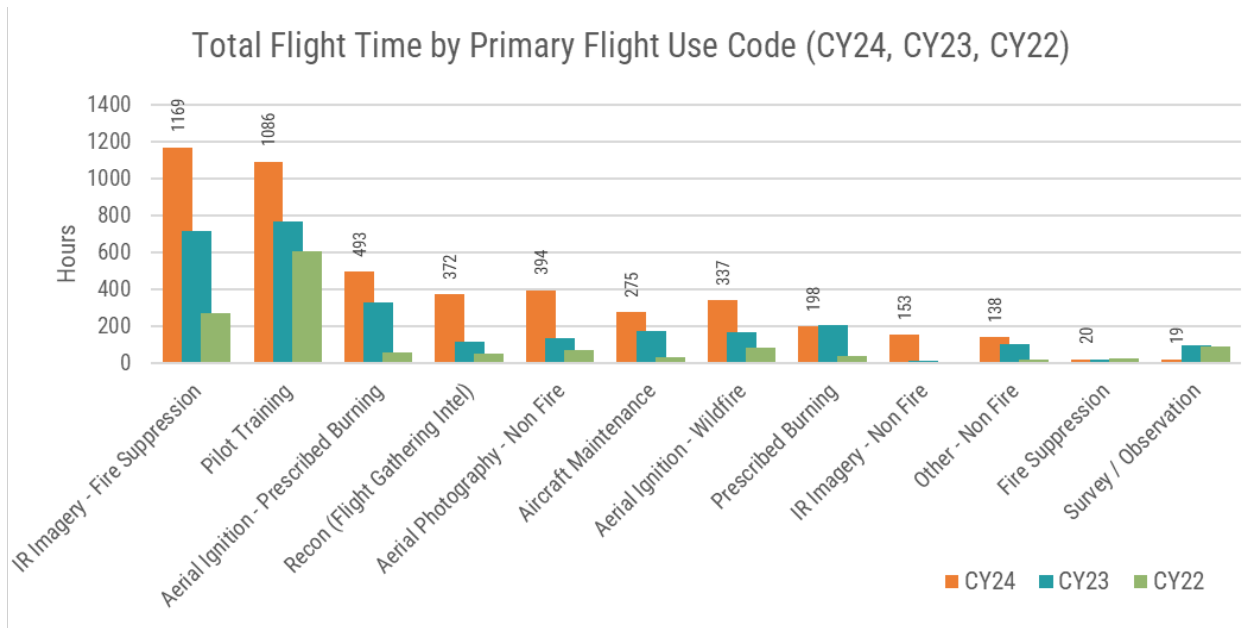


Figure 21. Graph showing the number of hours flown by primary flight use code for CY22 and CY23.

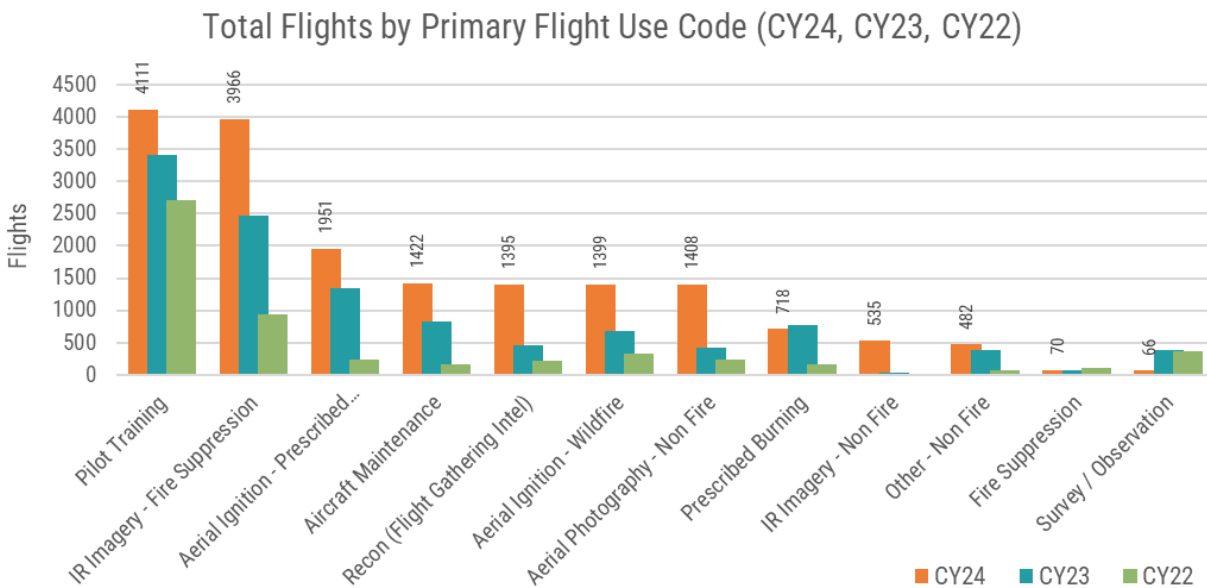


Figure 22. Graph showing the number of flights by primary flight use code.

Following IR imagery for fire suppression and pilot training, flight use categories associated with prescribed burning were the third largest in number in the agency in CY24 (10%) with 493 hours. Aerial photography (non-fire), recon, and aerial ignition (wildfire) are the next most common type of flight conducted by USFS remote pilots. These flight-use categories represented 8%, 7%, and 7% respectively, of the 4,654 hours of UAS flights conducted by the agency. An additional 5% of the CY24 flight hours supported aircraft maintenance while 4% of the total flight hours supported prescribed burning. Of the remaining flight use categories, IR imagery – non fire comprises of 3% of the total flight hours in CY24 while other non-fire flights comprise of 2%. Fire suppression and survey/observation both comprise 0.4% of the 4654 hours.

Nearly 47% of the CY24 flight hours were fire-related with 2,217 hours. Nearly 1,351 hours are associated with resource management application of UAS technology and represent 29% of the flight hours conducted in CY24, which is up from 23% in CY23 and 22% in CY22. These flight-use categories are expected to grow dramatically soon within the Forest Service and eventually eclipse the number of UAS flight hours conducted for wildfire management.

### Personnel and Equipment Requests for Fire and Disasters

Requests for UAS personnel and equipment to support wildland fires, prescribed burns, and disaster response have continued to increase as a whole in CY24. Total requests in CY24 have increased 68% from the previous year. And since CY20, requests have increased 313%. The majority of these requests were for personnel and equipment to support Wildland Fire, which made up 75% of all requests in CY24 (figure 23).

Wildland Fire vs Prescribed Burn Requests (CY24)

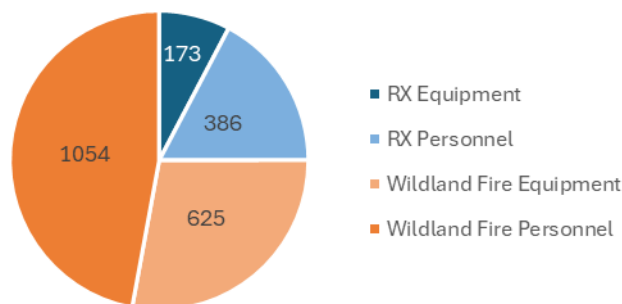


Figure 23. Proportion and count of 2024 requests (equipment and personnel) for wildland fires and prescribed burns.

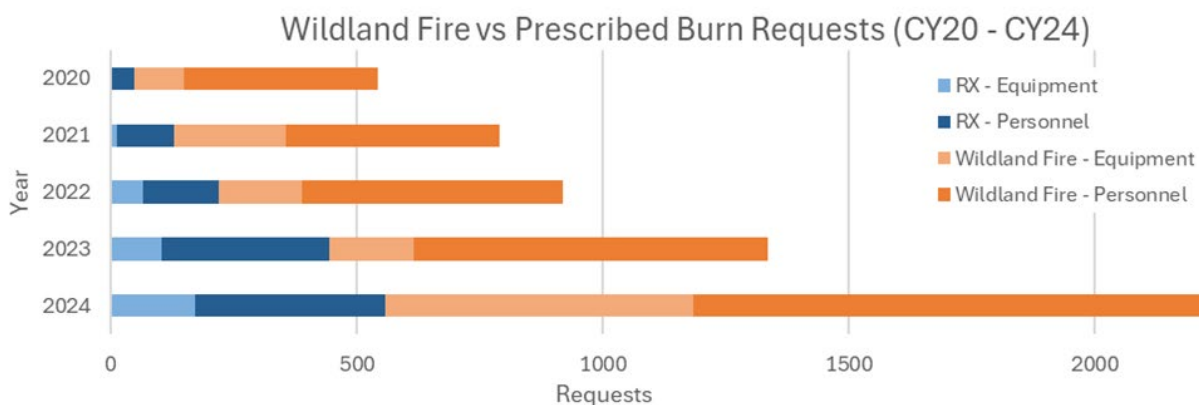


Figure 24. Number of requests (equipment and personnel) in CY20 to CY24 for wildland fires and prescribed burns.

As demand for Type 1 aircraft has steadily decreased, mainly due to limited availability of equipment, overall Type 3 Rotor UAS demand has increased every year since 2020. Type 4 rotor aircraft requests increased dramatically in CY24 when compared to CY23, with 17x more Wildland Fire requests and 5.5x more Prescribed burn requests. This was likely due to the availability of more Type 4 aircraft, such as the Anafi, and more refined uses of such aircraft.

### Aircraft Requests for Wildland Fire (2020 to 2024)

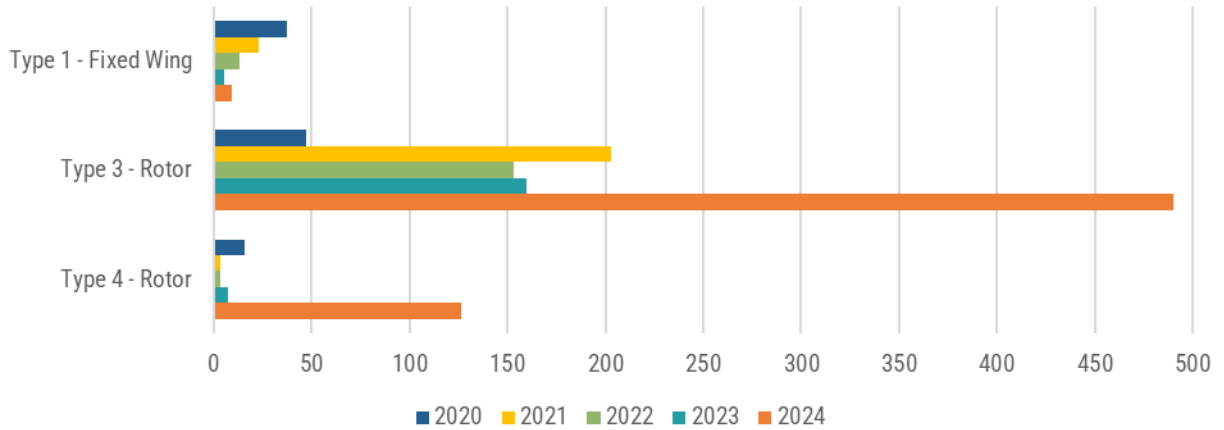


Figure 25. Aircraft requests for Wildland Fire Response by UAS type from 2020 to 2024.

### Aircraft Requests for Prescribed Burns (2020 to 2024)

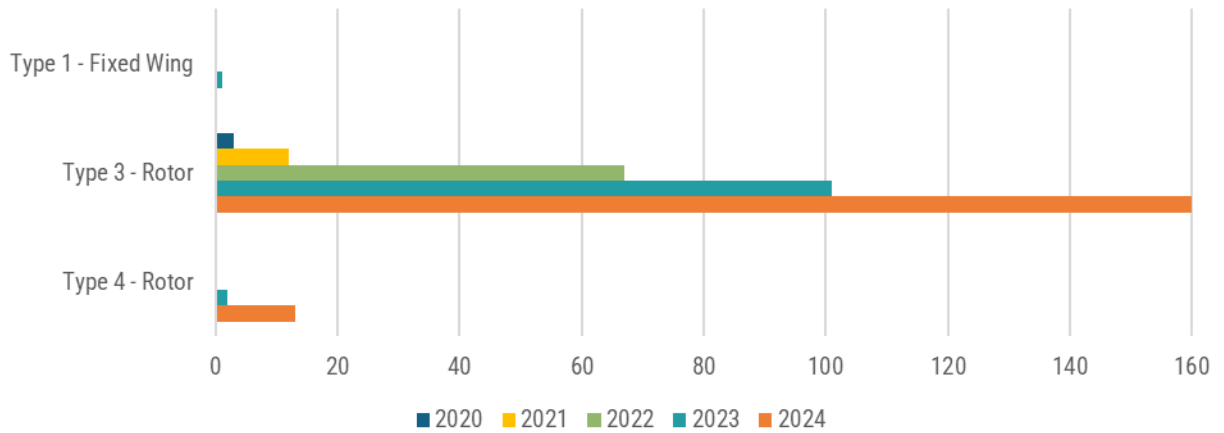


Figure 26. Aircraft requests for Prescribed Burns by UAS type from 2020 to 2024.

Requests for UAS personnel positions on wildland fire and prescribed burns have continued to increase as a whole in CY2024 with demand for pilots taking up a majority of those requests. This is mainly due to the increased capacity of trained pilots, as well as availability of UAS equipment. Descriptions and details for these personnel roles can be found on the <https://www.nwccg.gov/> website.

### Personnel Requests for Wildland Fire (2020 to 2024)

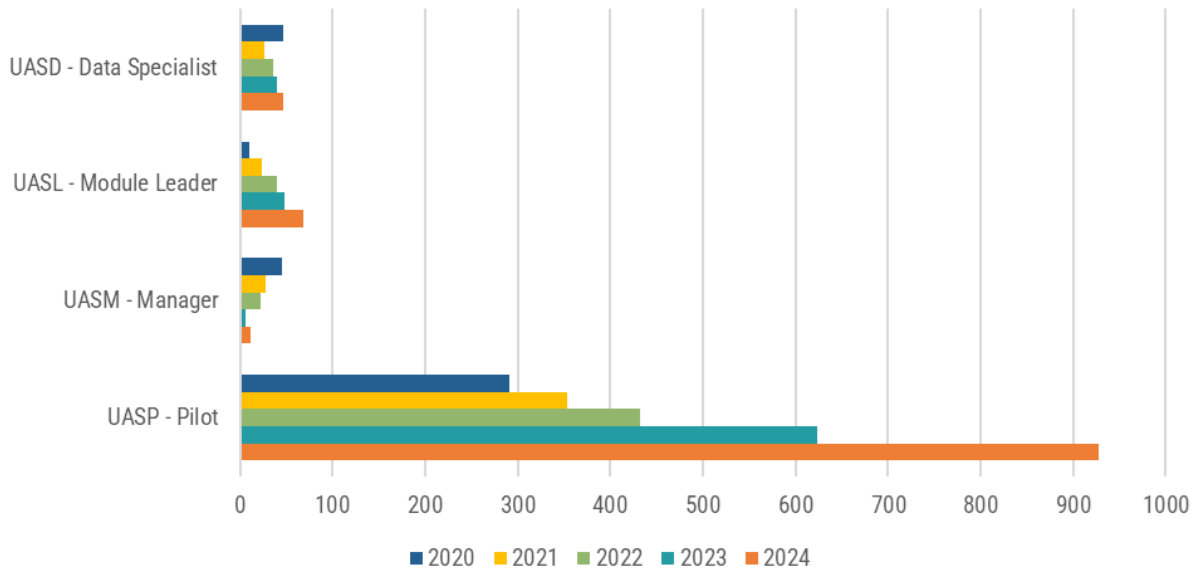


Figure 27. Personnel requests, by position, for Wildland Fire Response from 2020 to 2024.

### Personnel Requests for Prescribed Burns (2020 to 2024)

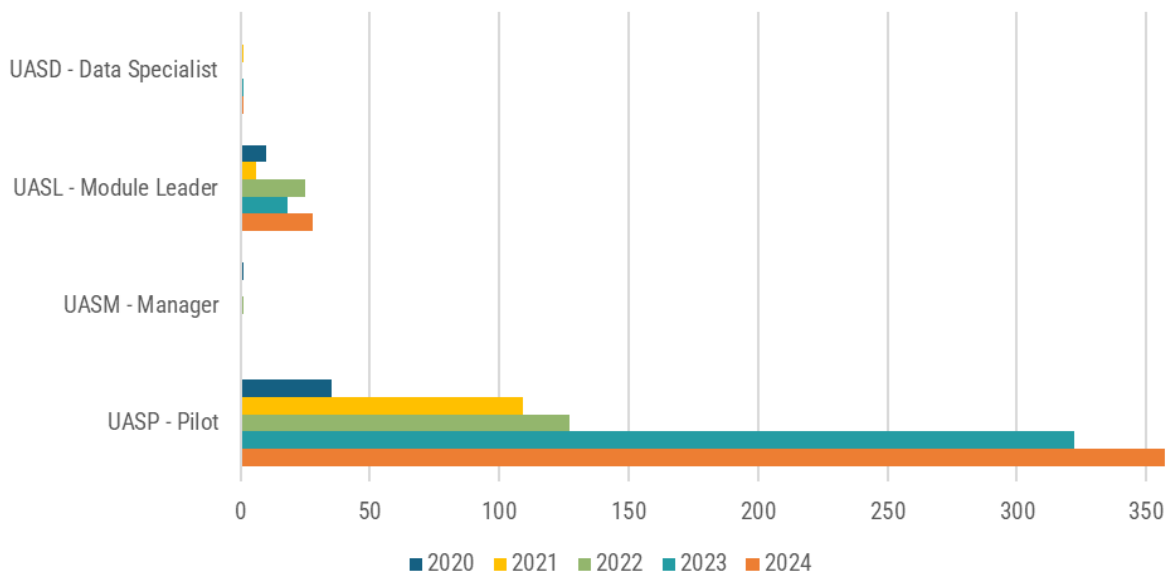


Figure 28. Personnel requests, by position, for Prescribed Burns from 2020 to 2024.

Requests for UAS equipment and personnel on wildland fire response were filled a majority of the time, with requests either being cancelled or unable to fill occurring less than 20% of the type for all categories except Type 3 rotors, which were closer to 30%. Requests for prescribed burns were also filled the majority of times but were noticeably lower for Type 4 – Rotor (about 50%) requests.

### Aircraft and Personnel Request % for Wildland Fire (CY2024)

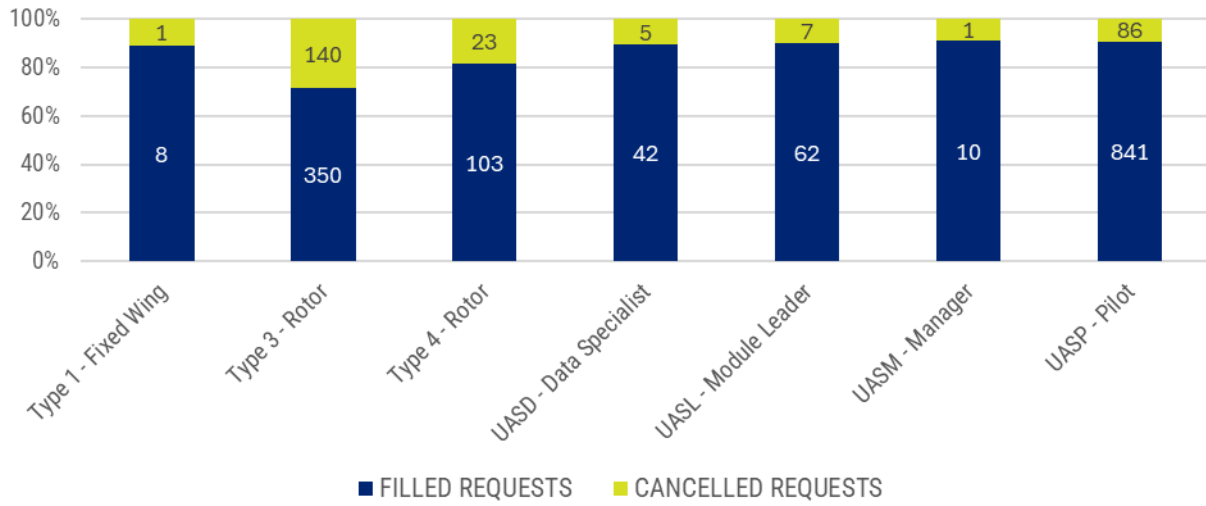


Figure 29. Aircraft and personnel requests for Wildland Fire Response by UAS type and personnel position with percent unable to fill 2020 to 2024.

### Aircraft and Personnel Request % for Prescribed Burns (CY2024)

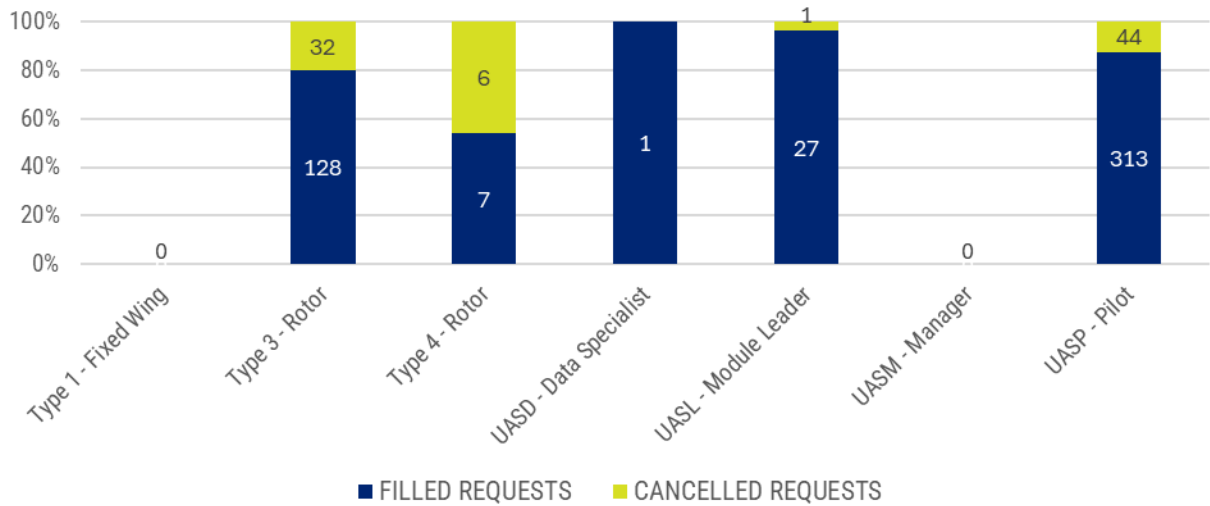


Figure 30. Aircraft and personnel requests for Prescribed Burns by UAS type and personnel position with percent unable to fill 2020 to 2024.