



Department of the Interior Unmanned Aircraft Systems (UAS) Integration Strategy (2015-2020)



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DOI Unmanned Aircraft Systems

The U.S. Department of the Interior has the responsibility to manage, protect and sustain America's lands, water, wildlife, and energy resources, honors our nation's responsibilities to tribal nations, and advocates for America's island communities. As part of this mission, DOI utilizes a wide variety of aircraft, including unmanned aircraft systems (UAS). DOI missions can be hazardous to personnel, require persistent presence, and often need to be conducted without disturbing native species or visitors to our lands. Development of the UAS program within DOI will support in the accomplishment of our mission through better **Science**, greater **Safety**, and increased **Savings**.

Goal

DOI has employed aircraft in support of its missions for over 50 years. The goal of the DOI UAS program is to incorporate this new class of aircraft into DOI's government-owned and commercially contracted aircraft fleet to support DOI missions for which UAS may be better suited than manned aircraft, achieving superior science, safety, savings.

Background

DOI's initial investigation of UAS technology dates back to 2004 when a UAS was used to acquire data during a volcanic event on Mount St. Helens. DOI began evaluating the broad use of UAS in DOI in 2006 with operational test and evaluation missions beginning in 2010. The Department has accomplished more than 500 flight hours over 500+ completed mission flights. After carefully monitoring the rapid advancements of UAS technology, the Department determined in 2006 that UAS were ready to be employed for scientific, environmental and land-management applications. OAS, working with USGS, BLM, NPS, and other DOI partners, has established UAS-specific policies and training that will facilitate further development of the program. DOI is not alone in this endeavor. There is an energized, active collaborative team working across the DOI, Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), U.S. Forest Service, academia, and private industry. The Department of the Interior Executive Aviation Committee (EAC) formed a UAS working group to develop this cohesive, long range UAS strategy.

The tangible benefits of the current Office of Management and Budget (OMB)-approved DOI UAS operational test and evaluation program can be summed up in three words: **Science**, **Safety**, and **Savings**. Examples of these benefits include:

1. UAS can be less disruptive to sensitive animal species than manned aircraft. They can carry sophisticated sensors and possess the ability to transmit real-time data that can be recorded for future analysis. Many UAS offer greater airborne persistence and launch responsiveness than manned aircraft. These unique characteristics enable UAS to gather repeatable, scientifically valid observations leading to better **science** and therefore better policy decisions, which benefit all Americans.
2. DOI missions often expose personnel to significant safety hazards. From 1937 to 2000, 66% of all field biologist fatalities in DOI were aviation-related. Additionally, UAS have also been used to replace ground personnel in certain missions, reducing their risk to injury. Use of UAS can increase the level of **safety** for personnel both on the ground and in the air by reducing their exposure to hazardous situations.
3. The cost to operate small UAS (sUAS, under 55 pounds) currently employed by DOI are less expensive than manned aircraft for certain missions. For example, FWS and USGS estimated the cost to survey Sandhill Cranes is about \$2,500 using sUAS. Estimates to fly a similarly equipped manned aircraft for that mission range from \$40,000-\$50,000. DOI has obtained approximately \$22M worth of sUAS assets from DOD and the Department of Commerce at **zero procurement cost** for the Department. Had these aircraft not been transferred to DOI they would have been destroyed by DOD. This *"try before you buy"* strategy mitigated the financial and operational risk the Department would have incurred if these type of assets were acquired outright. The DOI UAS program strategy using excess UAS has resulted in substantial **savings**. Where UAS can adequately replace manned aircraft or significantly reduce other costs (i.e. replacing many man hours on the ground to perform the same mission), the **savings** to the Department and the American taxpayer will be significant. This may be particularly true in the potential application of Optionally Piloted Aircraft (OPA), operated in both the unmanned and manned modes during wildland firefighting. Currently, reduced visibility due to smoke and night time limit aerial support to ground firefighters to an average of eight of the available 24 hours in a day. OPA that could safely and effectively conduct suppression or

ground firefighter cargo delivery missions during these otherwise no fly periods using various sensors, this could significantly reduce the time, cost and landscape loss associated with large wildfires.

Initial Program Strategy

DOI's UAS program strategy has been tailored to the mission, funding, personnel, and infrastructure levels of the Department. The facets of this strategy include:

1. Focus on small UAS. These aircraft are more aligned with DOI's decentralized mission execution strategy, the locations in which we operate, and are more supportable by the Department's funding, personnel, and infrastructure levels.
2. DOI initially obtained available excess sUAS to minimize procurement, training, and support costs.
3. Establish partnerships with Federal departments who possess UAS capabilities beyond DOI's to support DOI missions that require more extensive UAS capabilities.
4. Conduct operational tests and evaluations of various sUAS technologies to support the development of long-range UAS requirements for the DOI UAS program.
5. Based on the requirements and strategy developed in the above step, procure (buy or contract) for UAS capabilities that cannot be met either through excess DOD sUAS or those available through partnerships with other Federal agencies.
6. Develop a scalable program that allows bureaus to develop the size of program that best meets their requirements.

Current Environment

The DOI fleet of sUAS consists of the following: 69 AeroVironment RQ-11B Raven aircraft, 57 AeroVironment RQ-11A Raven aircraft, 44 Honeywell RQ-16C T-Hawk rotorcraft and 5 MLB Super Bat aircraft. The RQ-11 aircraft are battery powered with an endurance of roughly 1 hour. The RQ-16 aircraft are gas powered with an endurance of 40 minutes. Currently the DOI has access to the national airspace system through a Certificate of Authorization (COA) granted by the FAA on a case-by-case basis or by way of a [Memorandum of Agreement \(MOA\)](#) between the FAA and DOI that allows broad access to the national airspace system as long as certain conditions are met. This MOA signed in January of 2014 is a significant milestone in the departmental UAS program and demonstrates its maturity in the eyes of the FAA.

The excess equipment obtained from DOD, while very rugged and capable, has some limitations that make their long term use, in the original configuration, unrealistic. There are two primary challenges that must be addressed with these aircraft. First, the radios they use operate on DOD frequencies that are either prohibited from use within continental United States or require approval from the National Telecommunications and Information Administration (NTIA) prior to use. This approval can take several weeks to several months to obtain and is the single largest barrier to full employment of these aircraft. Second, the stock sensors available on these aircraft are not suitable for most missions that the DOI bureaus would like to accomplish. DOI is working with NASA to determine a path forward for modifying sensors in order to make them more effective for our mission. In addition Bureaus are, investigating cooperative sensor activities with universities and other Federal agencies. FAA requires UAS to meet either a DOD airworthiness standard or "some other standard" prior to use in the national airspace system. DOI has also signed an agreement with NASA to complete airworthiness evaluations for non-DOD aircraft. This partnership will allow DOI to evaluate purpose built, commercially available UAS that are more suitable to the missions of the bureaus. OAS will work with NASA to schedule the evaluations of any new aircraft planned for use by DOI. In addition to the DOI fleet UAS, the Department can access larger UAS (over 55lbs) for a variety of applications through agreements with DOD and DHS.

Missions Performed

As the DOI UAS program has matured, there have been many different types of missions conducted. A subset of these missions can be found below:

1. Population surveys of threatened species:
http://uas.usgs.gov/CO_SandhillCranesMonteVistaNWR.shtml
2. Habitat surveys: http://uas.usgs.gov/ID_PygmyRabbitLandscape.shtml
3. Erosion mapping: http://uas.usgs.gov/SD_MissouriRiverBankErosion.shtml
4. Monitoring breeding:
http://uas.usgs.gov/CO_GrandCountySageGrouseLeks.shtml
5. Boundary assessment and invasive species detection:
http://uas.usgs.gov/HI_HaleakalaNP.shtml

6. Abandoned solid waste assessments:
http://uas.usgs.gov/CA_MojaveP.shtml
7. Run-off and coal seam fire assessment:
http://uas.usgs.gov/WV_OSMSurfaceCoalMineInspections.shtml
8. River impact monitoring during dam removal:
http://uas.usgs.gov/WA_BORRiverSedimentMonitoring.shtml
9. Burned area assessment:
http://www.youtube.com/watch?v=ryqrI6f41Ng&feature=share&list=UUv72CvH6RLIvIv00rMhk96g&index=3gov/UAS/WV_OSMSurfaceCoalMineInspection.shtml

Future Environment

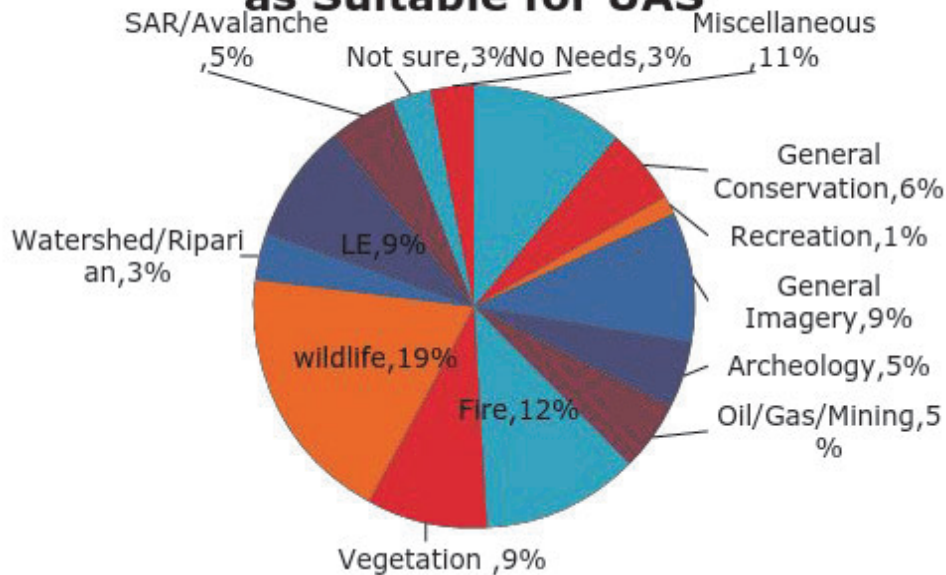
Requirements Development

In the spring of 2014, a Department-wide UAS mission requirements survey was conducted. DOI employees identified hundreds of missions that could be conducted with UAS. The survey focused on three primary questions;

- o Within your bureau, what mission requirements are going UNMET by current aviation methods, and may be serviced by unmanned aircraft systems?
- o Within your bureau, what mission requirements are being MET by current aviation methods but may be better serviced by unmanned aircraft systems?
- o Within your bureau, what mission requirements are being serviced through other means (ground, satellite, etc.) but could benefit from unmanned aircraft systems?

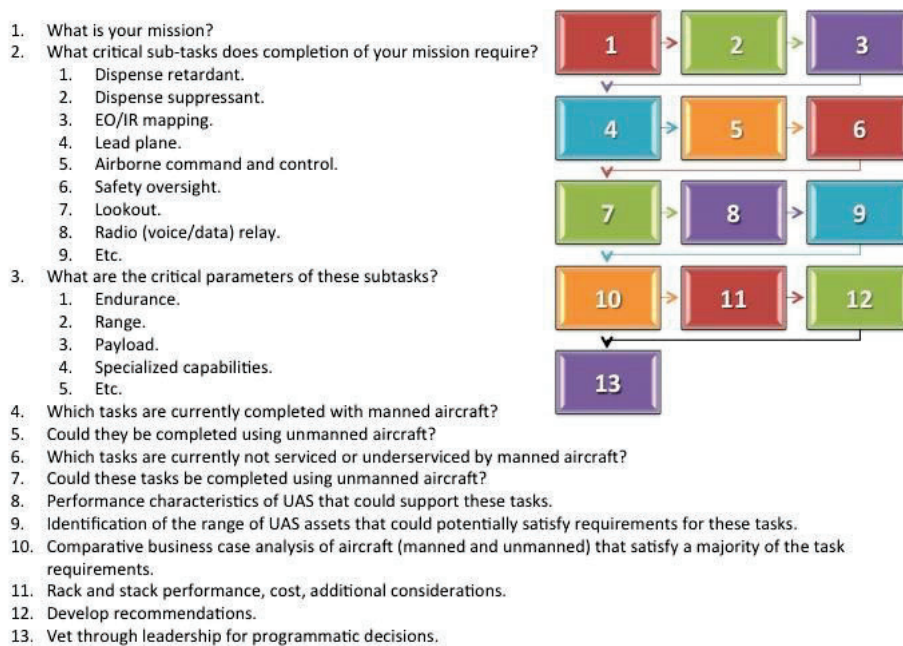
The potential scope and range of missions identified is quite diverse and represents a wide cross section of the Department. A small sampling of the types of missions that were identified include, basic aerial imagery, archeological survey, wildlife survey, vegetation surveys, emergency response, facilities management, multi/hyperspectral imagery, search and rescue, invasive species management, law enforcement and security, geographical measurements, and wildfire reconnaissance and suppression.

Missions Identified by DOI Personnel as Suitable for UAS



Based on the responses to the survey, it is possible to anticipate the future demand of these systems across the Department.

Use of UAS within DOI has been and will continue to be done, based on each bureau's requirements for the data and products provided by UAS. The graphic below provides a notional framework for developing the business case for the use of UAS for any given mission.

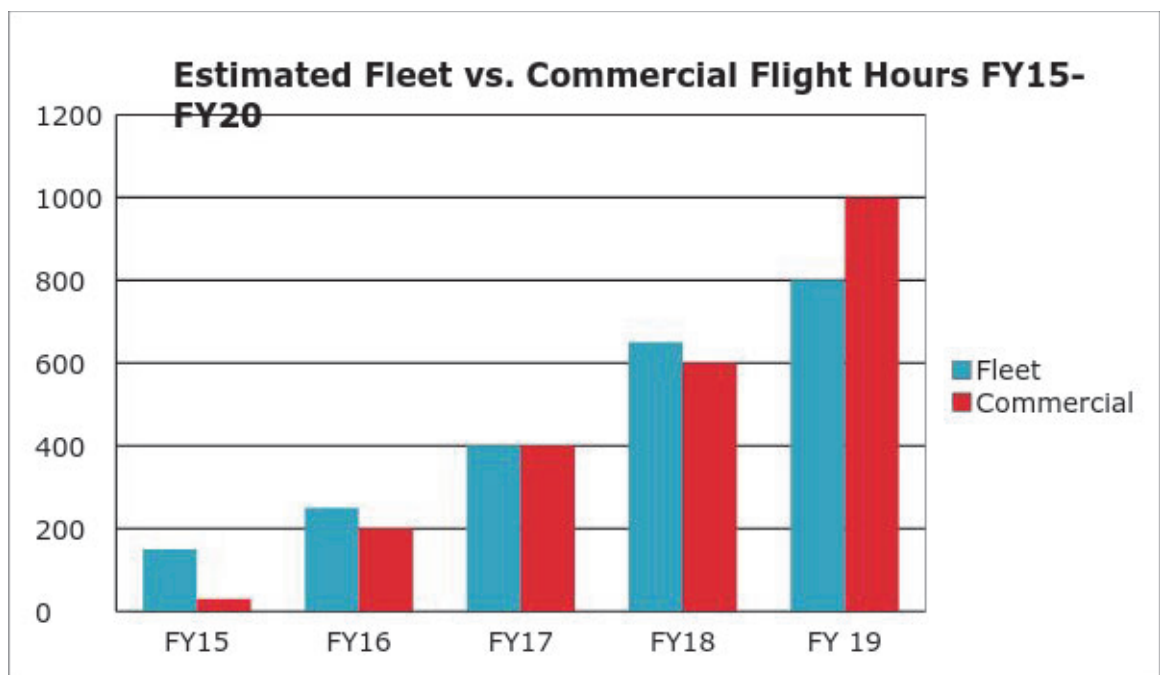


Assets

Unmanned aircraft, especially sUAS, are rapidly evolving and can become obsolete within a few years. As a result, the DOI UAS acquisition strategy is to plan for a limited life span of any given model of aircraft. Purchase of UAS for DOI will be limited to sUAS for the foreseeable future. This strategy will prevent the purchase of large and very expensive UAS that will rapidly lag behind the cutting edge of UAS technology. OAS, in collaboration with the DOI bureaus, has developed a purchase contract solicitation based on the 2014 survey inputs and bureau derived requirements. This solicitation is for three types of rotorcraft and two types of fixed-wing aircraft. It is anticipated that these contracts will be awarded in the Q3 of FY15.

- A. Fleet. Analyzing the results from the survey, it is estimated that over 80% of the missions can be performed by a limited number of makes and models. Specifically, three types of rotorcraft and three types of fixed wing aircraft. All fleet DOI operations will be with aircraft that fall under the 55lb threshold for sUAS. For the majority of these missions, the smallest (least expensive) rotor or airplane will meet the requirements. Vendors who are selected from the responses to the purchase solicitation will be required to complete the NASA airworthiness review process. This process consists of the vendor completing a questionnaire about the UAS along with a one-day site visit to NASA-Ames to conduct a hands-on inspection and evaluation flights. If successful, the vendor will be awarded a contract. These contracts will be for an indefinite quantity of aircraft. This will enable DOI (and other federal partners) to purchase as many or few aircraft as needed to meet mission requirements. The contract duration will be for one year with the option for additional years (up to 4), allowing or maximum flexibility in the length of the contract.
- B. Commercial UAS Services. Increasingly, UAS services will be available from vendors as the FAA finalized its sUAS rule or grants more exemptions for commercial operations. Similar to manned aircraft, many of the UAS missions performed for DOI in the future will be done through service contracts rather than DOI-owned fleet operations. These vendors will be approved and carded in the same fashion as our manned aircraft fleet (i.e. carded aircraft, carded pilot). Over the next five years there will be a rapid increase in the number of FAA approved vendors capable of providing UAS services. There are several different possibilities for contracting for these services. DOI, through OAS, can contract for either

exclusive-use or on-call type UAS services. Development of these types of contracts will require a deliberate requirements development process similar to the business case for purchasing a fleet UAS. All aircraft under the operational control of DOI will need to be approved by OAS through the issuance of an airworthiness statement and OAS-36U Aircraft Data Card. Requests for these types of contract services will follow the same acquisition procedures utilized for manned aircraft including the completion of the AQR-13 Request for Contract Services form. In addition to the use of flight service contracts it is possible for the Department to utilize end product contracts to obtain data from vendors. The FAA is in the early stages of authorizing some limited commercial operations. Procedures and guidelines for obtaining end product services will be issued as a part of the 2015 revision of [OPM-11](#). In the meantime, DOI personnel wanting to utilize this type of service should route their request through their National Aviation Manager to the OAS National UAS Specialist.



C. Cooperator UAS. DOI has partnerships with many local, state, federal and academic entities. These partnerships may offer access to UAS technology. Use of cooperator UAS will be managed through the existing cooperator policy outlined in [351DM4](#). All cooperator UAS will be required to have a Letter of Authorization from OAS prior to any mission in which DOI has operational control.

D. UAS Cost. The purchase of sUAS will represent the single largest “new” cost to the Department. It is estimated that the cost of procuring new UAS will range from \$2-3.5M across DOI over the next five years. Individual UAS cost will likely range from as low as \$3K for a small rotorcraft system to upwards of \$100K for a larger, more capable UAS. Aircraft that cost in excess of \$12K are considered capital assets and will be managed accordingly purchase of aircraft will follow the process outlined OPM-8. This means that there will be costs associated with these aircraft if they will be replaced at the end of their life. Bureau personnel wishing to purchase sUAS will be required to obtain the concurrence of their National Aviation Manager and their Executive Aviation Committee member through the process outlined in OPM-8. Final approval of aircraft purchases resides with OAS.

Examples of available small UAS



People

A. Training. Based on the responses to the scoping survey sent to the bureaus, it is anticipated that DOI could expect to train as many as 235 sUAS operators over the next five years. This is contingent upon the bureaus allocating the funds to train, equip and maintain these operators. The strategy for providing training has been and will remain for the DOI to manage its own UAS operator training through its FAA approved operator course. At current time, outside of DOD, DOI is one of only three federal agencies to have such an approved sUAS training program. Going forward, training for the smallest and easiest to operate aircraft will continue to be conducted in-house. The vendor, as part of the purchase process, will provide training for larger and more complex aircraft. The goal is to reduce the length of the basic operator course from an 8-day course to a one-week course (5 days or less). Training will be developed as new systems are

introduced to the DOI fleet for each specific platform. The amount of training required for any given system will be commensurate with the level of complexity for that aircraft. As the numbers of operators increase, OAS will utilize approved bureau instructors and pilot inspectors to assist with training and certification. Once the FAA has finalized its sUAS rule, DOI operators will be expected to comply with those requirements. In addition to the FAA requirements to become a UAS operator, DOI will have Department specific training requirements prior to certifying a UAS operator. Bureaus may choose to have additional training requirements for their personnel.

- B. Certification. Currently DOI UAS operators are required to perform an annual certification. This requirement will continue as the method for assuring that DOI operators maintain the skill and knowledge to safely and efficiently operate these aircraft in the national airspace system. As simple to operate aircraft are procured, the length of time between checkrides may be increased to up to 24 months. Requirements for pilots/aircraft inspections will be evaluated annually and updated in OPM-11.

- C. Personnel Costs. While the majority of the trained operators within DOI will conduct missions as a collateral duty, there will be costs associated to develop and maintain a UAS operator certification. Initial certification will require the student to travel for 1-2 weeks for training. Once qualified, the minimum time required to maintain currency and proficiency is estimated to be 10-20% of an employee's time. This percentage will rise if an operator is qualified in several different aircraft.

Summary

Use of unmanned aircraft systems is expanding rapidly around the world. DOI can expect to see high demand for their use over the next several years. Use of these aircraft across DOI will greatly increase the ability of our employees to gather the data necessary to accomplish their missions. This increase in use must be managed in order to ensure that Departmental missions adhere to the current regulatory environment and to prevent unintended consequences. The strategy outlined in this document will allow DOI to safely increase the use of UAS across the Department to achieve the goal of providing superior science, safety, and savings.