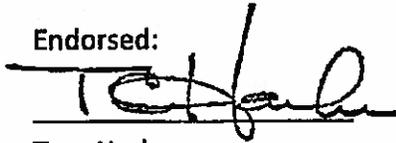


2015 Unmanned Aircraft Technology Demonstration Overview

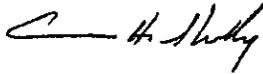
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Endorsed:



Tom Harbour

Director, Fire and Aviation Management
U.S. Forest Service, USDA



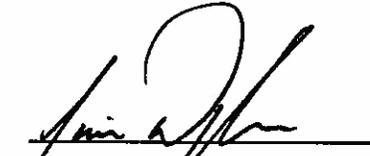
Cam Sholly

Associate Director, Visitor and Resource Protection
National Park Service, DOI



Aaron Baldwin

Acting Chief, Forestry & Wildland Fire Management
Bureau of Indian Affairs, DOI



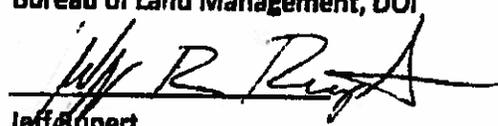
Jim Douglas

Director, Office of Wildland Fire
Policy, Management & Budget, DOI



Ron Dunton

Acting Director, Fire and Aviation
Bureau of Land Management, DOI



Jeff Rupert

Chief of the Division of Natural
Resources and Conservation
Planning,

U.S. Fish and Wildlife Service, DOI



Kim Thorsen, Assistant Secretary, Public Safety, Resource Protection,
and Emergency Services, DOI

Approved:



Mark L. Bathrick, Director, Office of Aviation Services,
Office of the Secretary, DOI

FY 2015 Unmanned Aircraft Technology Demonstration Strategy

Background

The DOI Office of Aviation Services (OAS) is charged by Departmental Manual (350 DM 1) with responsibility for ***“conducting DOI aircraft and equipment research and development efforts.”*** Since 2006, OAS has executed these responsibilities in the area of Unmanned Aircraft Systems (UAS) by establishing and managing an Operational Test and Evaluation (OT&E) program to assess UAS technologies across the full range of DOI and related interagency missions. This UAS OT&E program has been briefed to and received support from the Office of Management and Budget (OMB), Congressional Appropriation Staffers, the Federal Aviation Administration (FAA) and others. To reduce test program costs, OAS has leveraged excess small UAS (sUAS) from the Department of Defense (DOD). Since its inception, DOI has successfully flown hundreds of UAS flight hours across dozens of diverse mission types. This success has garnered DOI significant recognition from the FAA, which has approved the OAS training program for sUAS as equivalent to the FAA Pilot Written Exam and has also granted DOI UAS operations flexibility previously only authorized for DOD and NASA. The 2015 Unmanned Aircraft Technology Demonstration continues to build on the previous successes of the current UAS OT&E initiative by examining vehicles and capabilities that have been developed and successfully proven and fielded by DOD. Additionally, in the 2015 initiative OAS continues to reduce cost by leveraging industry’s willingness to initially demonstrate potential new UAS technologies at reduced cost.

UAS technology has advanced dramatically over the past 10 years. These systems include aircraft as small as a few ounces to full-scale aircraft weighing several tons. The rapid expansion of this technology provides the opportunity to evaluate if the diverse capabilities they possess can be used to improve the efficiency, effectiveness, and safety of current operations. As part of this evaluation, UAS technology advancements created through DOD funded Research and Development (R&D) can be leveraged to hasten the safe, efficient, and effective integration of UAS for Fire and other interagency missions. These capabilities can range from small UAS providing reconnaissance and intelligence for firefighters, to full-size UAS with the ability to operate either as fully piloted or remotely operated aircraft or optionally piloted aircraft (OPA). At least one such OPA (K-max helicopter) has successfully flown thousands of hours resupplying forward deployed ground troops in its unmanned configuration. This technology holds similar potential for resupplying crews and potentially dropping water or retardant during times that manned aircraft typically do not operate, such as night and periods of reduced visibility (inversions), without risk to air crews or ground personnel. Today, aerial firefighting aircraft are usually limited to operations during periods of good visibility and daytime. This typically limits operations to about 1/3 of the available 24-hour operating period. Utilizing optionally piloted rotary wing aircraft could dramatically increase the time that aircraft would be available for water/retardant and cargo delivery on fire and other natural resource missions requiring resupply. Unlike typical intelligence, surveillance, and reconnaissance (ISR) missions associated with traditional UAS use, the operation of OPA in their unmanned configuration with the ability to deliver fire

suppressant/retardant during the 2/3 of the day we typically do not fly manned aircraft, has the ability to directly reduce the size of the fire and the time/cost to contain it.

Purpose

The purpose of this document is to provide a high-level overview of the ongoing aircraft and equipment research and development effort in UAS as it transitions to a risk managed, phased approach to inflight technology demonstrations. The purpose of this technology demonstration is to allow the Interagency fire community to conduct a **limited test and evaluation** of proven UAS technologies in increasingly representative mission scenarios. The lessons learned from the technology demonstration will serve help to inform DOI and USFS decisions regarding integration of UAS for fire applications over the next 2-5 years and beyond. Utilizing short-term call-when-needed contracts, the DOI and USFS will be able to evaluate a variety of different sensors/platforms/workflows to determine which systems are most capable of producing the desired products or performing the desired missions. In addition, vendors would gain from receiving valuable feedback from the DOI/USFS subject matter experts allowing them to focus R&D efforts to create better products and services for the emerging UAS market for first responders.

Scope

The scope of the 2015 technology demonstration will be **very limited and is not intended to fully operationalize UAS in the fire environment**. The following assumptions and conditions will be met during each phase of the demonstration.

- Manned aircraft and UAS **will not** operate in the same airspace. **UAS will be segregated from manned aircraft temporally or spatially at all times.**
- The wildfire demonstration will be **limited to a small subset of fires with a high level of management** (National Incident Management Organization (NIMO) or type 1 Incident Management Team) and **only with the agreement of specified team(s).**
- Requests for UAS support will be approved by the DOI National UAS specialist or the FS UAS lead as appropriate for the jurisdiction of the fire.
- The **demonstration will be limited** to a small number (<5) vendors who have current approved operations by either the FAA, DOD or both.
- **Coordination with FAA will be accomplished at every phase through OAS National UAS specialist.**
- Any beyond visual line-of-sight operations will occur **entirely within an active temporary flight restriction (TFR), including takeoff and landing in accordance with FAA approvals obtained for such test operations.**
- Test aircraft will be programmed to **avoid overflying known populated or congested areas.**
- Test aircraft employed outside the auspices of an approved FAA UAS Test Site (Phases 2 and beyond) **will fall under the normal ICS organization** for the incident.
- Additional aviation overhead (AOBD, ASGS) will be ordered to oversee the UAS operation on wildfires.

- The **decision to proceed** to the each subsequent phase of testing **will require the successful completion of exit criteria established for the preceding phase as determined by the designated decision authority.**

Plan

Conduct a **limited and phased** series of **technology demonstrations** for the purpose of assessing **aircraft/system/sensor suitability and compatibility** in wildland fire and related natural resource mission areas. Two types of UAS will be evaluated. An optionally piloted K-Max helicopter (OPA) will be evaluated for suitability to deliver cargo and/or drop water. Reconnaissance UAS will be evaluated to determine effectiveness of data acquisition and delivery. These aircraft will be small scale UAS <300 LBS and be capable of being launched and recovered from within a TFR.

Phase 1 Initial Demonstration

Phase 1 involves the initial demonstration of OPA technology in the highly controlled environment of an FAA designated UAS Test Site. Lockheed Martin will be providing a demonstration of their optionally piloted K-Max helicopter in November 2014 at the New York State UAS Test Site in Rome, NY. Attending DOI/USFS representatives will evaluate whether or not the aircraft is capable of fulfilling firefighting missions. Existing Pilot Testing Standards (PTS) will be utilized to evaluate the effectiveness of the aircraft. Depending on the outcome, further exploration of these aircraft may or may not take place. Lockheed will employ a safety pilot on board during these tests as a risk mitigation measure. The prospective test scenarios for Phase 1 Testing are included as Appendix A.

Primary Exit Criteria for Phase 1 Success includes:

1. The OPA successfully locates the dip site.
2. The OPA successfully executes a water dip with a standard bucket configuration.
3. The OPA successfully flies to the designated fire coordinates with a loaded bucket.
4. The OPA successfully releases the water from the bucket.
5. The water hits the fire target.
6. The bucket and OPA do not impact the ground or any obstructions.
7. Intervention by the Safety Pilot is not required during any of the above maneuvers.

Secondary exit criteria for Phase 1 (desired, but not required to take the basic water dip/drop capability proven through successful completion of the primary exit criteria outlined above to the next Phase):

1. The OPA sensors provide an immediate initial post-drop outcome effectiveness assessment of the drop on the fire.
2. In a subsequent test run, the OPA successfully receives and responds to new drop coordinates relayed from the ground.
3. In a subsequent test run, the OPA successfully receives and responds to new drop coordinates relayed from an airborne reconnaissance sUAS. In this scenario, the OPA and the sUAS

successfully maintain safe separation from each other without intervention by the OPA safety pilot.

4. In the cargo delivery test run, the OPA successfully lifts, transports, and deposits the designated external load to the desired coordinates.

Outcome / Decision to Proceed: Based on the completion of the established exit criteria noted above, the OAS Director will Approve/Disapprove the aircraft for continued testing.

Estimated Completion Date: **November 2014**

Phase 2 Planning/Contracting/Approvals

Phase 2 is intended to establish and exercise the contract mechanisms necessary to acquire and test additional proven UAS assets in controlled mission scenarios. OAS/AQD will develop a "call-when-needed" solicitation/contract that will allow DOI/USFS to access a small number of vendors with proven aircraft that can meet FAA airworthiness requirements. These contracts will be for the deployment and operation of the small reconnaissance UAS that have a proven operational track record with DOD or have received positive airworthiness recommendations from OAS's NASA partners. If the OPA in Phase 1 is successful then a similar contract will be established to continue the testing of this aircraft in phase 3. These contracts will allow for maximum flexibility while keeping costs minimized. Vendors are likely to provide services at a low cost due to their desire to be first to market for contracted UAS services in tested mission areas. OAS/USFS will develop a memorandum of agreement (MOA) with the FAA that will contain the parameters under which UAS may be operated. Parameters will be developed as to when/where utilizing UAS would be acceptable, including spatial and temporal separation for safety, conditions that would permit beyond line-of-sight operations, and specific oversight measures.

Outcome / Criteria to Proceed: OAS National UAS Specialist will work with AQD and the Bureaus to develop solicitations and award contracts. OAS director will sign airworthiness statements for contracted aircraft. OAS Director will execute MOA with FAA authorizing fire UAS operations in the national airspace system. If suitable offerors do not materialize, the project will not proceed to Phase 3.

Estimated Completion: **February 2015**

Phase 3 Prescribed Fire

Building on the successful demonstration of UAS technology in Phase 1 and utilizing the contract vehicles and FAA agreement developed in Phase 2, UAS will be deployed to specially selected prescribed fires during spring 2015, based on collaboration between the OAS National UAS Specialist and the cognizant Federal land agency on whose land the prescribed will occur. Employing reconnaissance UAS over the selected prescribed fire will provide the opportunity to evaluate the value of the UAS in providing actionable intelligence to incident leadership, while also providing a chance to examine possible workflows and data management plans necessary to effectively utilize UAS in on a wildfire. Depending on the outcome of the demonstration in Phase 1 the continued testing of the

tested OPA may take place during this phase, with a safety pilot on board. Other than this, there will be no manned aircraft allowed over the designated prescribed fire while the UAS are in the air. This would allow testing in more representative field conditions, building on the experience and lessons learned from the tests at the FAA UAS Test Site.

Outcome / Decision to Proceed: DOI bureaus/USFS will identify suitable locations based on risk and mission alignment. The decision to proceed to the next phase will be made collaboratively by the OAS National UAS Specialist and the Fire Management Board (FMB). Exit criteria for successful transition from this phase include:

1. If used, the OPA is able to meet the same criteria outlined in Phase 1 over this prescribed fire.
2. UAS used for reconnaissance are operated safely and in accordance with the FAA MOA.
3. Reconnaissance UAS provide actionable data that would benefit the accuracy and placement of ground and air resources in combatting the fire.
4. Workflows, airspace deconfliction scheduling and communications, and data management processes are developed that would enable UAS to be safely employed (with spatial or temporal segregation from manned aircraft) in carefully selected and managed wildfire scenarios for further testing.
5. No aircraft accidents.

Estimated Completion: March-June 2015

Phase 4 Limited of UAS on a Selected Wildfire

Phase 4 builds on Phase 3. In this phase, reconnaissance UAS will be deployed on a limited basis as-needed during a wildfire. If successful in phase 3, the optionally piloted helicopter will be tested on a wildfire in the unmanned configuration and completely segregated from manned aircraft. The initial deployment will be restricted to a pre-defined geographic area and only with pre-identified organizations (i.e. NIMO, Type 1 team, etc....). When an incident is identified that may be a good candidate for UAS utilization the pre-identified teams request UAS support through the DOI National UAS Specialist or USFS UAS Lead.

Outcome: Limited deployment of UAS on a wildfire DOI/USFS leads to work with Area Command/Incident Command group to determine the location/organizations that will employ UAS and for what purpose (IR mapping, Briefing tool, Real-time imagery, communications, weather sensing, etc...).

Success criteria for this phase include:

1. If used, the OPA is able to meet the same criteria outlined in Phase 1 over selected wildfires it is employed on.
2. UAS used for reconnaissance are operated safely and in accordance with the FAA MOA.
3. Reconnaissance UAS provide actionable data that would benefit the accuracy and placement of ground and air resources in combatting the fire.

4. Workflows, airspace deconfliction scheduling and communications, and data management processes are successfully employed and refined to enable UAS to be safely employed (with spatial or temporal segregation from manned aircraft) in future wildfire scenarios with other teams.
5. No aircraft accidents.

Estimated Completion: June-Sept 2015

Phase 5 Lessons Learned and Recommendations

DOI/USFS will develop summary of the activities during the 2015 field season along with lessons learned and recommendations on further integration of UAS on a national level.

Outcome: Teams who employed UAS will contribute the needed information for this document. Estimate the direct and indirect impact of UAS on the future of wildland firefighting. Use accumulated data, resultant analysis, and conclusions to inform future wildland fire acquisition, planning, and operations strategies.

Responsible Parties: DOI (OWF, OAS, BLM, BIA, NPS, FWS), USFS

Estimated Completion: November 2015

Examples of the types of aircraft to be evaluated during this demonstration:



Contacts:

DOI

Brad Koeckeritz

National Unmanned Aircraft Specialist

Bradley_Koeckeritz@ios.doi.gov

208-433-5091

USFS

Bob Roth

Aviation Management Specialist

Rroth@fs.fed.us

406-829-6712

2015 Unmanned Aircraft Technology Demonstration Overview Amendment #1

As stated in the original overview document the initial strategy for the demonstration was to obtain approvals for demonstrating both the optionally piloted helicopter as well as fixed wing reconnaissance platforms on a series of prescribed fires during the spring of 2015. In working with the vendor providing the demonstration of the OPA it became apparent that moving to a fall demonstration would be best based on scheduling as well as configuration changes being made to the aircraft. The new date for that demonstration will be 14 October 2015 in Boise. The second phase of the demonstration involved setting up contracts for the use of reconnaissance aircraft. Due to the timing of the contract cycle and the limited scope of the 2015 demonstration it was decided that issuing a Request for Information (RFI) for vendors wanting to demonstrate their capabilities would be preferred to a full Request for Proposals (RFP). As a result, DOI issued the RFI and received 13 responses from interested companies. After reviewing the offers there were only 3 aircraft that met the criteria listed in the RFI. Those aircraft included the [Lockheed Martin Stalker XE](#), the [Insitu ScanEagle](#) and the [Textron Aerosonde Mark 4 Z](#). Originally the intent was to use the aircraft in a prescribed fire scenario first and then move to a wildfire when/if the opportunity arose. However due to the time involved in conducting the RFI as well as coordinating with all the interagency stakeholders it is likely that the window of opportunity has passed for the spring burning season in the areas being targeted for the demonstration (Great Basin, Northwest and Northern Rockies). This leaves two alternatives for conducting the demonstration. First, the option exists to push the demonstrations until the fall. Second, plan for the demonstrations to occur on a specially selected wildfires without requiring the prescribed fire as a prerequisite. Although using a prescribed fire as a first event would be desirable it is recommended that it not be a requirement. A demonstration on a wildfire can be conducted safely provided the proper controls are in place and will allow this initiative to continue to move forward without delaying arbitrarily. Employing UAS on any given incident would be required to meet the following criteria.

- **All UAS activity will be completely segregated from the manned aircraft working on the event. This will be accomplished through spatial separation or temporal separation.** We plan to use night operation initially when there are no tactical aircraft flying.
- Agency Line Officer and Incident Commander approve the use of UAS with the concurrence of the DOI and/or USFS national UAS managers.
- **All operations will initiate, operate and terminate within the confines of a TFR for a wildfire.**
- All UAS operations will remain greater than 5NM from any airport.
- Coordination will be done with local law enforcement to ensure that no law enforcement aircraft will be operating within the TFR.
- NOTAM will be issued emphasizing the fact that there will be BVLOS operations ongoing.
- All conditions of the COA or ECOA will be met prior to operations.
- DOI/USFS will report all requested data pertaining to the flights to the FAA.

- A site specific risk assessment will be completed prior to the initiation of operations and operational plan will be approved by the incident commander.
- Selected incidents will be under the supervision of an incident management team.
- This demonstration is not meant to conduct large scale operations. These events will be conducted on a small number of specially selected incidents. Estimate approximately 5-6 wildfires over the course of the season.
- This is a free demonstration provided by the vendors. Vendors will cover all of their costs and the government is under no obligation beyond this demonstration.

Recommendation

Conduct limited demonstrations on selected wildfires during the 2015 season in the targeted geographic areas IF the appropriate situation arises and IF there is a legitimate mission requirement. This planning and implementation will be conducted in coordination with the National Interagency Aviation Council and managed by the Interagency Fire Unmanned Aircraft Subcommittee. Continue planning for additional demonstration during the fall prescribed fire season.

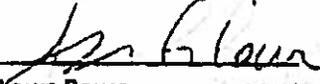
Concur:



Tom Harbour
 Director, Fire and Aviation Management
 U.S. Forest Service, USDA



Jim Douglas
 Director, Office of Wildland Fire
 Office of the Secretary, DOI



Louis Rowe
 Associate Director, Visitor and Resource Protection
 National Park Service, DOI



Ron Dunton
 Assistant Director, Fire and Aviation
 Bureau of Land Management, DOI



Aaron Baldwin
 Chief, Wildland Fire Management
 Bureau of Indian Affairs, DOI



Jeff Rupert
 Chief of the Division of Natural
 Resources and Conservation
 Planning,
 U.S. Fish and Wildlife Service, DOI

KIMBERLEY THORSEN
Digitally signed by KIMBERLEY THORSEN
 DN: cn=KIMBERLEY THORSEN, o=Department of the Interior, ou=KIMBERLEY THORSEN, email=kimberley.thorsten@io.doe.gov, c=US

**Kim Thorsen, Assistant Secretary, Public Safety, Resource Protection,
 and Emergency Services, DOI**

Approved:



**Mark L. Bathrick, Director, Office of Aviation Services,
 Office of the Secretary, DOI**