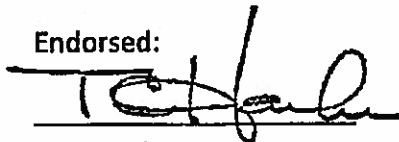


2015 Unmanned Aircraft Technology Demonstration Overview

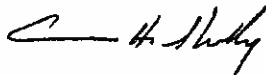
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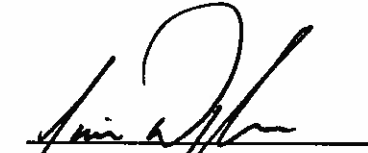
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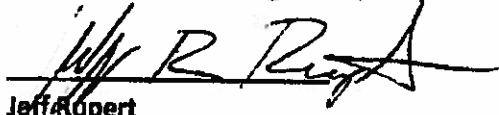
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FY 2015 Unmanned Aircraft Technology Demonstration Strategy

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:



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