2015 Tepee Springs Fire
Payette National Forest
Beyond Visual Line of Sight (BVLOS) Test and Evaluation
Overview of Preliminary Results

Background: Departmental Manual (350 DM 1) charges The U.S. Department of the Interior (DOI) Office of Aviation Services (OAS) with responsibility for ***"conducting DOI aircraft and equipment research and development efforts."*** Since 2011, OAS has collaborated with DOI Bureaus and Offices to conduct Operational Test and Evaluation (OT&E) of unmanned aircraft systems (UAS) in Departmental science and natural resources missions. The 2015 Unmanned Aircraft Technology Demonstration Overview, Amendment #1, (https://www.doi.gov/sites/doi.opengov.ibmcloud.com/files/uploads/2015%20Unmanned%20Aircraft%20Technology%20Demonstration%20Overview%20%2812-5-2014%29%20and%20Amendment%201%20%288-9-2015%29.pdf) provided a phased, risk-managed approach to safely conducting UAS OT&E in the more complex wildland fire mission area. Following successful completion of Phase 1A and 2, testing of Phase 3A (Amendment #1) was conducted. These OT&E tests were also consistent with the 2015-2020 DOI UAS Integration Strategy (https://www.doi.gov/sites/doi.opengov.ibmcloud.com/files/uploads/DOI_UAS_Integration_Strategy_2015-2020.pdf). These tests were made possible as a result of close collaboration between OAS and the FAA. Together, OAS and the FAA crafted a Memorandum of Agreement (MOA) that authorized DOI to fly beyond visual line of sight within an established and active Temporary Flight Restriction (TFR): (https://www.doi.gov/sites/doi.opengov.ibmcloud.com/files/uploads/FAA_DOI_UAS_TFR_MOA_8-13-15.pdf). Test operations were also governed by the requirements and conditions outlined in an addendum to Certificate of Waiver or Authorization 2015-WSA-63.

Purpose: This series of tests examined the ability of an UAS to be employed from within a TFR in the intelligence, surveillance, and reconnaissance role, while being safely flown BVLOS and segregated from manned aircraft.

Test Objectives:
1. Examine the ability to deploy and operate an UAS completely within an established TFR.
2. Establish procedures for notification and deconfliction procedures for potential non-participating aircraft with access to the TFR (e.g. law enforcement, emergency medical aircraft, etc.).
3. Develop and employ airspace segregation protocols for separating manned and unmanned aircraft operating over the fire during the same time period.
4. Assess the ability of the UAS to be operated BVLOS in the fire environment.
5. Evaluate the ability of UAS hotspot detection during mop-up and patrol.
6. Evaluate the utility of UAS developed precision map products for near-real time incident command and field use.

Test Conditions: The Tepee Springs Fire was an actively suppressed fire on the Payette and Nez Perce-Clearwater National Forests. Due to the active TFR, the threat of non-participating aircraft was low. Because the fire was receiving moisture and downsizing, the number of ground personnel and manned aircraft participating in this fire was minimal, mitigating this risk during testing. The fire activity was minimal, making it ideal for examining the potential of the infrared (IR) sensor on the UAS to detect hotspots and map their location.

Test Aircraft: A Textron Aerosonde Mark 4.7 UAS was employed during these tests. The aircraft was operated and paid for by the company as part of a government-sponsored notice of demonstration for which this aircraft was offered and was selected.

Flight Data: The test aircraft flew on four separate days. Although the test aircraft was capable of much longer flight durations, time to accomplish individual flight test objectives dictated daily flight totals. Daily and total flight times:

9/19/15	5 hrs. 32 min.
9/20/15	6 hrs. 21 min.
9/21/15	6 hrs. 26 min.
9/22/15	2 hrs. 59 min.
TOTAL	**21 hrs. 18 min.**

Results / Lessons Learned: The mobility of the Aeronsonde Mark 4.7 launch and recovery systems enabled the UAS to be deployed in remote terrain within the TFR. Prior planning to locate the launch and recovery equipment on high ground enabled communication requirements for safe operations. Aircraft deconfliction procedures with participating fixed wing and helicopters were easily accomplished through preflight planning and disciplined flight execution. Segregation of manned and unmanned aircraft on the initial flights was achieved through the coordination of the Fire Traffic Area by the Air Tactical Group Supervisor (ATGS). Later, separation was achieved through the use of designated altitude reservations (ALTREV's) set by the ATGS with a minimum 1,000' altitude buffer between manned and unmanned aircraft operating in the same geographic area. This enabled the UAS to conduct intelligence, surveillance, and reconnaissance role.

The UAS was easily integrated into the fire incident communications structure. Consistent communication was established pre and post launch/recovery with the following contacts:

- Incident Commander
- Air Attack
- Helibase
- Incident Communications

- Payette Dispatch
- Back Country AM 122.9

The onboard electro-optical (EO)/IR capability allowed for good views of the fire from a long distance away, enabling real-time course/mission refinements based on actual observations.

While planning launch and recovery operations within the Fire Traffic Area, it was important to define the restricted operating zone ROZ on the incident aviation maps (No Fly Zone attached below).

Cooperation between local Forest Management and the Incident Management Team to create the No Fly Zone with a .25 mile buffer preventing any UAS flights over private land.

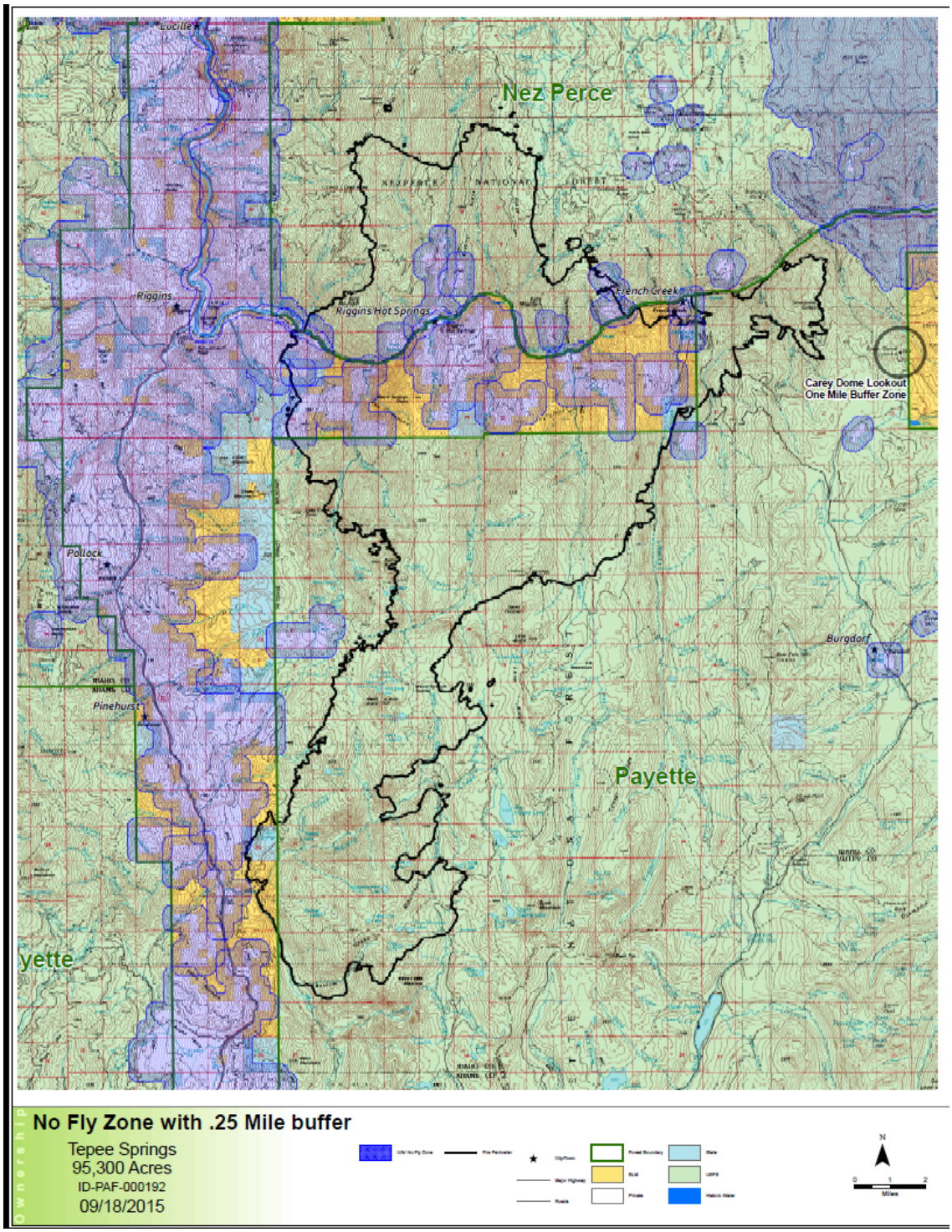
Successful operations within the TFR was a result of clear communications with the ATGS requesting altimeter setting, obtaining clearance for all operations and declare position while entering and exiting the ROZ.

Collaboration between the vendor's GIS specialist and the incident GIS specialist prior to and during the mission is key to successful mapping.

Sensors need to be evaluated to prove declared results. Two of the exact same MWIR cameras produced different results based on date of production.

Conclusions: With proper coordination, briefing, and inflight discipline, UAS and manned aircraft can operate safely together over a managed fire in a BVLOS mode, within a TFR. While raw images provided some useful data, continued development of data post processing needs to be priority to prove a positive niche.

Recommendations for Further Testing: Additional testing in more complex fire and airspace environments should be conducted to continue to refine protocols for safely employing UAS on fires in a BVLOS mode of operation. Continued development and refinement of *data-to-information-to-knowledge-to-action* processes that provide critical UAS outcome products is also recommended. Ongoing improvements in the speed, fidelity, and utility of these critical "back-end" processes are recommended.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French Creek
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One Mile Buffer Zone
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Burgdorf
No Fly Zone with .25 Mile buffer
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