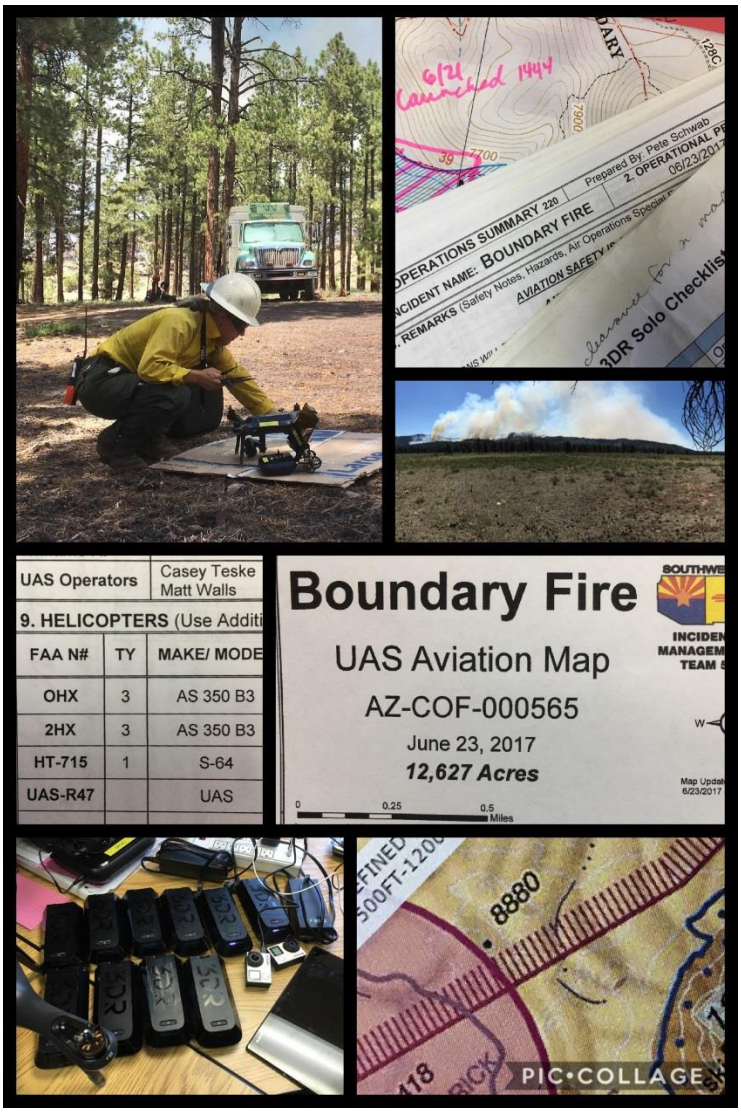
Boundary Fire
Unmanned Aircraft System Operations
After Action Review (AAR) and Lessons Learned



June 2017
Coconino and Kaibab National Forests

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Executive Summary

Southwest Team 5 under Jeff Andrews took control of the Boundary Fire in June 2017. The Incident Commander and the local Interagency Aviation Officer discussed the feasibility of utilizing Grand Canyon National Park's (GRCA) UAS on the Boundary Fire to document pre-fire and post-fire effects in key biological areas of the fire. The Region-3 Regional Aviation Officer for the Forest Service was included in discussions and the request to obtain approvals for the UAS flights.

Approval to proceed from the US Forest Service (USFS) National Office were obtained through email and a project aviation safety plan (PASP) for the Boundary Fire UAS Operations was completed within 24 hours. The GRCA UAS program provided three UAS pilots over five days with two fleet aircraft flying a total of 11 missions. The aircraft flown were 3DR Solo quadcopters, with GoPro camera payloads.

Planning

What went well:

- USFS National office verbal approval was obtained immediately through a conversation between the R-3 Regional Aviation Officer and the USFS National Office.
- The PASP was written and approved within 24 hours.
- The incident commander of the fire understood the possible limitations of the UAS, the intent for testing and evaluation, and was willing to be exploratory in what the UAS flights could provide.
- The draft Interagency UAS Fire Operations Guide was utilized by the UAS pilots and answered many of the unknown questions for flying on a fire for the first time. Albeit in a draft form, it worked very well.

Issues:

- Building a PASP for use on a wildfire is inefficient. There is a draft *Interagency Fire UAS Operations Guide* (IFUASOG) that, once approved, should be used in place of a PASP. This will need to be changed in the *Interagency Standards for Fire and Fire Aviation Operations Guide* (Redbook).

Follow up needed:

- Once the IFUASOG guide has been approved as the appropriate document for UAS operations on fires, remove the need for a PASP. Work with the Redbook committee to change the Redbook to reflect this.
- Work with the interagency community to establish procedures for Incident Management Teams (IMT) on Forest Service fires to order UAS without USFS National Office approval.

Ordering and Dispatching

What went well:

- There was no delay in ordering the UAS pilots, even in the absence of UAS-specific designations in the resource ordering system (ROSS).
- The UAS pilots were local to the area which expedited the process.
- The local Interagency Aviation Officer had extensive knowledge of UAS operations and was available to assist the fire with issues/concerns as they arose.

Issues:

- The ROSS ordering system is currently not set up for UAS resources and there is no way to account for the aircraft itself. The UAS were noted in the Resource Order as 'Authorized' special needs/equipment.
- The UAS pilots were ordered up as Helicopter Manager (HMGB)- UAS Pilot and Field Observer (FOBS)-UAS Pilot, not Technical Specialist (THSP), with notes that UAS were authorized. There was no clean way to do this initially.

Follow up needed:

- Ensure "THSP" is on all UAS pilots' redcards until such time as UAS positions are developed in ROSS.
- Determine minimum qualifications for UAS operators on fire incidents. Firefighter 2 (FFT2) would not have worked in this case due to the single resource aspects of the UAS pilots on the fire determining their own safety zones, communications, etc. If imbedded with a crew and with proper oversight, the FFT2 qualification would be possible.
- Work with the interagency community to develop IQCS qualifications for UAS pilots and account for the aircraft in ROSS. The DOI already has UAS designations in the DOI Interagency Qualification Position Guide (IQPG) however some of these are outdated and will need to be updated as well.

In-Briefing

What went well:

- The AAR notes from BLM's use of UAS the North Fire along with the draft IFUASOG guide greatly helped in the initial coordination with the team.

- The IMT provided a good briefing of fire area specifics. The UAS pilots felt they received the information they needed to proceed with operations safely. UAS pilots' attendance and discussion at the morning/evening briefing was also identified by the incident as positive. The UAS pilots attended an IMT planning meeting early on which was valuable from their perspective.

- Briefing Air Tactical Group Supervisors (ATGS) by the UAS pilots a critical step; one of the team's ATGS was also a BLM UAS pilot, which helped facilitate communication and knowledge of UAS missions.

Issues:

- Ensure who the UAS pilots work for is clear to all involved. On this fire, the UAS pilots were working for Plans Section as the missions were geared towards information gathering. It was noted that the UAS operators were basically fulfilling a FOBS role with a UAS.

- More extensive in-briefing to teams, field personnel (e.g., division supervisors), and aircraft personnel (e.g., helibase), and wider opportunity for awareness should be provided since UAS are just now beginning to integrate into active wildfires and air operations.

Follow up needed:

- Develop a UAS fact sheet that can easily be digested by IMTs and firefighters on an incident.

Flight Operations

What went well:

- NOTAMS were filed for every flight per the FAA Certificate of Authorization (COA) requirements. Because two of the UAS pilots were not yet FAA Part 107-certified, all flights were flown under the authority in the DOI-FAA COA.

- Two helicopters were also assigned to the fire and active each day, however, no concurrent flights occurred with both manned and unmanned aircraft. This was a deliberate decision made by the team given the pace of the fire.

- Initially, there was some confusion on the ground about the UAS missions and the appropriate communication flow. This was alleviated by more thorough briefings in the evening and morning briefings with air ops, field ops, and ground personnel. It's important for UAS pilots to understand both the ground and air communications that need to occur prior to operations. On this fire, the UAS pilots notified DIVS when they entered the fire area. Then, the UAS pilots followed the draft Interagency UAS Fire Operations Guide protocols and called the ATGS to request airspace for the mission. If the ATGS was not up, a call was made to the Helibase to confirm no aircraft were up and that a UAS mission would be occurring. Once authorized (but prior to launch), the UAS pilots notified DIVS that they had been approved to fly and that a UAS would be in the air on the division. This allowed DIVS to notify all of their resources a UAS would be active over the fire. Immediately prior to launch ATGS was notified that the UAS would be launching (or a call in the blind on A/G and A/A about the UAS mission if no ATGS was present). Upon completion of flight mission(s), the UAS pilot notified ATGS (or helibase) that the UAS was on the ground and the status of further missions. Additionally, the DIV was notified that the UAS was on the ground, and was able to relay that information through to the ground resources.

- The communication flow worked great and was critical on the last day of operations; once the last UAS mission occurred, communications were made that no further UAS missions were planned. Shortly after that, an unauthorized UAS was seen flying on the division. Fire resources knew this was not the agency UAS and appropriate safety maneuvers needed to occur. Without the communication between the UAS pilots, division supervisor (DIVS), and aircraft resources, the unauthorized UAS could have been mistaken for the agency UAS and no notifications would have happened/precautions taken.

- The UAS pilots integrated well into the traditional Incident Command System (ICS) structure via the Planning and Operations Section Chiefs.

- Multiple observers were used for flights in timber with tight launch sites.

- Because the UAS pilots were local and GIS/data savvy, data management was easily provided by GRCA. If this had not been the case, there would have been a need for a UAS Data Manager to process data.

Issues:

- A Public Information Officer's message needs to be available and ready for dissemination. With "if you fly, we can't" campaign, it can be confusing to public on why we are flying.

- The limitations of the 3DR solo were not known to most of the team. Time was spent educating the IMT – what UAS is/isn't, can/can't do, etc. UAS pilots/data managers need to be clear on what they can provide for the fire and be able to relay this information to the team. In addition, the incident needs to be specific in what they need/want from UAS operations.

- The ground control station monitors were extremely difficult to see in direct sunlight, and in bright light.

- Finding safe launch and recovery areas was a challenge.

- Vehicle traffic in the launch/recovery area at times was problematic, signs and road guards were needed to block road during takeoff and landings.

- Our ground-based location aspect led to some issues in communications; in several instances, it was too far over the hill to clearly reach the helibase by radio. This could be a larger issue in the future if helibase operations are much more remote than they were for this fire.

- Three props were broken and there was no way to replace through the fire. Landing pad purchase to protect the UAS were also denied by the team.

- Data management protocol needs to be developed.

- 3DR solo limitations make 'large overview' products unfeasible as opposed to local situational awareness, such as embedding a UAS pilot with a crew.

<u>Follow up needed:</u>

- Ensure all UAS pilots obtain FAA Part 107 certification prior to future flights to enable multiple authorities of flight (Part 107, DOI-FAA-COA, etc).

- In the future there will most likely be a need for concurrent manned and unmanned flights. Air branch personnel, UAS pilots and fire personnel need to understand how to integrate UAS and manned aircraft in the same airspace; this will be critical for safe operations.

- Provide information for PIOs to have ready to disseminate at incidents for the public to explain why the IMT is using a UAS when the public cannot. Tackle this at a National level as we move forward to provide guidance to forests/teams.

- It may be necessary to utilize a UTV to reach appropriate launch/recovery sites. The IMT may need to procure landing pads, UTVs and canned air (for use after missions to help keep aircraft in good working order-- e.g., dust, etc).

- Develop checklists for fire vs SAR vs training, Also checklists for specific procedures (with ATGS vs without ATGS, etc.), for briefing other personnel in area (e.g, helibase, line personnel, etc). Most of these are in the IFUAS guide, but specific field checklists would be beneficial.

- Courses in mission planning software would have helped in the missions. A course is planned for the GRCA UAS pilots in Sep of 2017.

- Develop key points on UAS protocols to be inserted into Incident Action Plans and possibly the Incident Response Pocket Guide.

- Provide education and training during the off-season for fire personnel, possibly utilize WFSTAR for an educational piece on agency UAS use on fires. Take UAS and the UAS presentation to IMT meetings, aviation meetings and other appropriate venues. Talk about standard operating procedures, limitations, etc.

- Determine how the flight hours or daily rates will be billed to the incident.

- Establish guidelines on how to replace damaged equipment or components. Identifying the appropriate system in the event of such damage or operational need should be an emphasis as UAS become more prevalent in the fire mission.

- Though not an issue on this fire, do UAS flight crews/data managers/etc. have same limitations as a pilot in terms of a duty day, etc…? This is/will be a challenge to address in future, especially if UAS becomes embedded in crews for Situational Awareness uses (considering that a typical fireline shift is 14-16 hrs).