North Fire UAS Assignment

Overview and Lessons Learned – June 15, 2016

Overview – USFS and BLM collaborated to mobilize a four-person UAS crew to the North Fire on the Cibola National Forest on June 1, 2016.

The objective of the assignment was to test UAS and UAS sensors in the incident (wildfire) environment and develop operational procedures for future missions based on lessons learned and practical applications of the aircraft/sensors based on feedback provided by operations/planning personnel.

The lessons learned from this assignment will be shared with the interagency community and the Interagency Fire UAS Subcommittee (IFUAS) as an initial step in developing a strategy to safely and effectively integrate UAS into incident operations.

Crew Composition
Gil Dustin, UAS Crew Leader, UAS Operator (BLM)
Steve Stroud, UAS Operator (BLM)
Steve Ramaekers, UAS Operator (DOI/OAS)
Jeff Safran, Data Specialist (BLM)

UAS Aircraft
Falcon (fixed wing)
3DR Solo (quadcopter)

Sensors
Falcon - 2 axis stabilized gimbal video payload (Sony Block and Tau 2 640 IR)
Falcon - Sony A-5100 with Voigtlander lens (mapping/photogrammetry)
Solo - Gimbaled GoPro Hero4 (mapping/video)

Flight Times
Falcon – 2 missions for 56 minutes
Solo – 23 missions for 5.73 hours

Operations Summary
UAS were flown in two Divisions on the incident and provided live infrared video, performed mapping missions, and provided real-time intelligence and situational awareness to firefighters. Data (still and video imagery) was collected and sent to a processing specialist every evening over a Wi-Fi network.

Data Processing Summary
Each evening the flight crew uploaded that day's imagery, video and telemetry logs to a shared drive that the UAS Data specialist could download the data from. Any data in the form of video files was multiplexed using the ArcGIS Full Motion Video AddIn for ArcGIS 10.4. The flight path and video framed could then be placed on a map for spatial awareness.

Any aerial photography datasets were processed using Agisoft Photoscan, and resulting Orthomosaics and Digital Elevation Models (DEMs) were delivered back to the shared drive, along with a map of the products. The maps were generated as GeoPDF for use on tablets and phones.

Assignment Chronology

6/5	Crew mobilizes from Boise, ID with Govt. vehicle.
6/7	Crew receives briefing from USFS UAS Program Manager, Jamie Anzalone and the local dispatch/aviation staff and provides demonstration of aircraft at Cibola Forest Headquarters. Crew meets with SWICC staff to discuss operations. Crew checks in at the incident and develops an operational plan with the Operations Chief.
6/8	Crew provides and aircraft demonstration to fireline personnel in Division B.
6/9	Crew performs Infrared mission to support burnout operation in Division B Crew attempts to provide an aircraft demonstration in Division A, but scrubs the mission due to thunderstorm activity.
6/10	Crew flies a mapping mission in Division B (Cooney Gap)
6/11	Crew works in Division A and demonstrates the capability of the micro system to provide real-time situational awareness and intelligence gathering.
6/12	Crew flies mapping mission in Division A (Big Rosa canyon area).
6/13	Crew attempted flights to support a burnout in Division A. The burnout and flights were postponed due to high winds.
6/14	Crew works on the fireline with Division A and King's Peak Fire Wildfire Module and provides real-time intelligence to ignition/holding crews. Crew demobilized from the incident.

What Worked Well

- Resource orders were processed efficiently once the crew was statused in ROSS as THSP.
- The PASP was written and approved within 24 hours.
- Coordination between agency Public Information Officers.
- Treating the UAS/Crew as a normal aviation asset and including them in operational briefings.
- Working with helicopter pilots and OSC3 to establish aircraft separation procedures and mission priorities.

- Direct communication with the helicopter to coordinate missions in the same geographic area (Fire Traffic Area protocol).
- Integrating into the traditional ICS structure via the Planning and Operations Section Chiefs.
- **Working directly with crews to demonstrate and provide situational awareness. Firefighters would watch live video on a tablet (IOS device) as the aircraft flew over points of interest as directed.**
- Developing high resolution mapping products for pre and post burn analysis.
- Having a Data Specialist work a night shift to develop planning products (maps).
- Using established technologies to view map products. Most of the firefighters carried IOS devices to view geo-referenced maps with the Avenza app.
- Flight crew coordination with the Data Specialist, primarily by texting and evening phone conversation.
- Aerial photography flights with Geotagged photos were easy to process.
- The ESRI Full Motion Video (FMV) extension worked as designed, and allowed the video to be displayed spatially.
- The shift offset between the Data Specialist and flight crew was good. The UAS Data Specialist is a cross between a GISS and an IRIN, working afternoons into the night.

Challenges

- Incidents don't typically require a PASP. Building a PASP for fire use is inefficient. An operating plan, similar to the Aerial Supervision Guide, would be useful.
- Familiarizing IMT personnel with the capabilities and limitations of the aircraft.
- Familiarizing IMT personnel with final data product types.
- Uploading data over a WiFi network.
- Finding safe launch and recovery areas for the fixed wing system.
- Lack of aerial supervision caused delays for some UAS flights. Our protocol for this assignment was to obtain flight clearance from the OSC who was extremely busy coordinating incident operations.
- The ground control station monitors were extremely difficult to see in direct sunlight.
- Hand flying the micro UAS for situational awareness. A high degree of skill is required.
- DOD GPS testing caused two flight delays.
- FAA Emergency Certificate of Authorization (ECOA) process was not implemented as advertised. There was confusion between Albuquerque ARTCC and the ECOA office, which created a substantial workload for the DOI staff. FAA 107 regulations have made this easier.

- Current work/rest policy for UAS flight crews was difficult to manage and may not be appropriate since most of the crew's time was spent performing normal and expected incident duties (driving, briefings, hiking, etc.).
- Data Management was the single biggest time hit for the Data Specialist. It was very time consuming to match up the logs with videos, especially having not been on site.
- Data transfer rates between the BLM NOC EGIS servers over VPN was very slow.

Items to Work on

- Design a standard UAS ordering process.
- Mobilization times. Consider shipping equipment to the incident and flying the crew to it.
- Establishing a high trust climate between UAS and assigned flight crews through face-to-face communication prior to mission implementation.
- Developing UAS briefing products for end users.
- Establishing NWCG training and positions for incident UAS personnel.
- Increasing the efficiency of data sharing processes.
- Developing terrain following features for UAS flight planning.
- Developing altitude limit fail-safe's future micro UAS flights.
- Shared folder location on the NIFC FTP server, similar to GIS and IR would be very helpful for data transfers.
- We need to define what the final geospatial products are so that the data specialist knows exactly what to put together. Even having some MXD templates would be very helpful.
- The ESRI FMV software needs to be on the BLM Software baseline for ArcGIS 10.4 so other people can view the videos with their spatial components. Alternatively we could put this software on Fire laptops
- UAS Data Specialist should have a Fire Laptop for data processing.
- DOI and FAA must be lockstep in the ECOA process.

Applying Lessons Learned – Action Items

- Develop an *Interagency UAS Operations Guide*, which captures all the requirements of a PASP. This will mitigate the need to write a PASP for every incident response.
- Build a UAS briefing packet for incident use.
- Research SATCOM for data upload, download, and live video feeds to incident decision makers.
- Conduct debriefs focusing on data and products, particularly on the final deliverables.
- Training for the GISS personnel on what data we can provide.
- Work with UAS vendors and ESRI on simplifying the data processing workflows.

Kudos

- Thanks to Jami Anzelone for her work coordinating this assignment with the Forest, IMT, and Public Information Officers.
- The Command and General Staff were accommodating and receptive to testing this technology.
- The Division Supervisors (Chris Brashears and Ben Sanders) were easy to work with and excited to develop uses for UAS on the fireline.
- The King's Peak Wildfire Module was receptive to testing this technology to provide situational awareness, scout line, and monitor fire activity.
- The Albuquerque Dispatch staff was easy to work with for flight planning and resource tracking.
- Brad Koeckeritz and Colin Milone at DOI/OAS did a great job coordinating with the COA Office.
- FAA did a great job efficiently managing the confusion regarding the ECOA process and authorizing flight on this incident.
- The Forest Supervisor and management staff did a great job authorizing this assignment and approving mission-planning documents.

Conclusions

- Micro UAS are a powerful tool on the fireline. The crew we worked with (Kings Peak) found immediate utility. UAS program strategies must be developed to safely integrate this technology into established fire/aviation incident management/operations procedures.
- UAS capable of 16-24 hr. flights, loitering above all incident aircraft, and delivering high resolution images/video in multiple spectrums will be more effective than flying smaller systems to gather imagery to develop planning products.
- Micro UAS used for crew level situational awareness and large UAS used for strategic planning may be a consideration for UAS program development within incident management.
- It's critical to maintain an interagency approach regarding UAS operational procedures, qualifications, and data support/management.
- National UAS procedures and guidelines will ensure a safe approach to incident UAS operations.

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