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Unmanned Aerial Vehicles and the Rim Fire: Lessons Learned from the IMT

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Firefighters on the 2013 Rim Fire were aided by a new tool in the firefighting toolkit, MQ-1 Unmanned Aerial Vehicles (UAVs) – commonly known as Predator drones. On the Rim Fire, the UAVs proved particularly effective for perimeter and spot fire detection. Fire managers on the Rim Fire say that the UAVs also have potential application in a wide range of missions related to communications, crew safety, and night ops.

According to Mike Wilkins, Incident Commander (IC) for the Southern Area Blue Team, the Predator quickly demonstrated its value on one of its first flights, picking up a critical

Mike Wilkins, IC for the Southern Area Blue Team, at morning briefing on the Rim Fire. Credit: Mike McMillan

spot fire that had developed between a handline and a drainage that could have quickly resulted in fire spread into a populated area.

“The biggest benefit of the UAV is that it gives you another set of eyes,” says Wilkins. “You can look at different parts of the fire real-time, instead of having to rely on IR [infrared] data that may be eight hours old.”

There have been some small experiments with UAVs in the past; however, the Rim Fire was the first and most significant deployment of these types of aircraft on a major U.S. fire. Lessons learned on the Rim Fire could point the way to how these assets are used on future fires.

Logistics and Mission on the Rim Fire

On the Rim Fire, the UAV was supported by the California Army National Guard J-6 Emergency Communications and Air National Guard 163^{d} Reconnaissance Wing. Only the military crewmembers operated the aircraft, and they provided the IMT with imagery to support operations and planning. Marc Hafner, Situation Unit Leader with CALFIRE, served as the primary liaison between the UAV crew and the IMT. He says that the military personnel were not experienced at assessing fire behavior and were not familiar with identifying significant events on the fire, however, working closely with a FBAN (Fire Behavior Analyst), they were able to provide valuable streams of information, especially in perimeter detection. “With just a couple of keystrokes they could look real time at anything we wanted to look at,” says Hafner.

MQ-1 Predator drone.

On the Rim Fire, the UAV flew the following types of missions:

- Reconnaissance and monitoring during burnouts
- Reconnaissance following IR (fixed-wing line scanner flights) to verify hotspots outside the fire perimeter
- Reconnaissance of known spot fires (verification of both location and size)
- Fire perimeter mapping during daytime hours
- Real-time observation of structures immediately after crews had backfired and pulled out of the area
- Ad hoc tasking to verify fire had not overrun structures reported as threatened
- Completed a VHF communication check on Air-to-Ground Tac between the UAV and Incident Communications
- Enabled digital information exchange with reduced time for information flow from sensor to action

According to Hafner, the UAV could stay in the air for about 20 hours before it had to return to base for refueling. On the Rim Fire, the UAVs operated at altitudes above 18,000 feet (due to Temporary Flight Restrictions – TFRs), which allowed cameras to generate imagery from all sides of the fire almost simultaneously. Even though the fire was large (about 200,000 acres), the UAV could fly from one side of the fire to another in about 15 minutes. Hafner says that this was a real advantage over traditional manned aircraft. “At one point, we had a helo with an IR camera on one side of the fire monitoring a firing operation and we had another helo with an IR camera on the other side of the fire,” says Hafner. “With the UAV camera, we could look at both sides of the fire at the same time.”

“The cameras on the UAV allow very good depth of field and allows you to switch real-time between infrared and visible light,” says Hafner. “You could identify a heat source and then watch it and see if it is starting to spread. If so, you can use a precise lat/long to make sure that you get some water on any spots of concern.”

Mike Wilkins was also impressed with the quality of the imagery provided by the cameras, and noted that the cameras could easily see through light, dry smoke. However, he says that there are limitations. For one, the Rim Fire experienced inversions on several days and the UAV was not able to fly or capture effective imagery. According to Wilkins, “it probably wouldn’t work as well on an Okefenokee Swamp fire.”

In terms of cost effectiveness the UAVs also have advantages. The UAV costs approximately $770/hour to operate as opposed to a Type 3 helicopter, which costs $3,500/hour.

The UAVs also present enormous potential to increase situational awareness and protect firefighter safety on big, fast-moving fires. “This gives crews some backup,” says Roger Fryar, the Situation Unit Leader for the Southern Blue Team. The UAV can be used to keep eyes on crews that have lost communications or become disoriented. If a crew got into trouble, it could also help identify escape routes. “It’s another tool for our arsenal,” says Fryar.

Lessons Learned

The IMT provided a number of recommendations for future potential uses of UAVs on wildfires. These include:

- Fire perimeter mapping in the absence of other IR (line scanner) information
- Reconnaissance following lightning storms (new starts)
- Reconnaissance to determine location of dozer lines
- Reconnaissance of lines in patrol status to detect hotspots near containment lines
- Opportunities to conduct reconnaissance at night (when other suppression aircraft are not operating)
- Use of the platform for communications
- Verification of the location of crews and equipment (Safety)

The IMT also identified a number of challenges. First and foremost, the UAVs are military assets and there are no existing mechanisms to request a UAV through NIFC. On the Rim Fire, the UAV was ordered by CALFIRE in unified command. However, approval had to go through the Secretary of Defense. At present, the process of obtaining a UAV is difficult; however, Wilkins suggests that the deployment process could be shortened, possibly with pre-approval through an interagency process, or through requests from state agencies, such as CALFIRE.

In addition, consideration should be given to responsibilities for mission planning and tasking within the IMT. Wilkins, Hafner, and Fryar recommend that using the UAVs as an asset in Planning with strong coordination with Operations may make the most sense since the UAV imagery can be used to compliment existing Planning responsibilities for IR acquisition.

In addition, Wilkins, Hafner and Fryar, suggest that TFR requests submitted to FAA through Air Operations need to reflect the need for sufficient air space (horizontally and vertically) to accommodate RPA operations. Operating altitudes between 12,500 to 18,000 feet would allow RPAs to get above or below clouds to get imagery. On several occasions on the Rim Fire inversions created dense cloud and smoke cover that prevented the UAVs from obtaining imagery.

Conclusion

The UAV experience on the Rim Fire gives us a glimpse into the future of firefighting. While at present, there are considerable challenges to deploying these aircraft on fires, the barriers will inevitably come down over the next decade and fire managers will have a new cost-effective means of collecting data and increasing situational awareness.

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