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UAVs for Fire Fighting

- Overview
- UAVs Fighting Wildfires
- Benefits
- Requirements
- Challenges
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## **FACTOR LEADING TO USE OF UAV**

- National Park under significant threat
- San Francisco's main water source threatened by falling ash (Hetch Hetchy Reservoir)
- Magnitude of the fire
- Inaccessibility of ground vehicles to assess state of fire

## **UAV Contributions**

- Real time video feed for the first time (previous NASA support was not real time)
- Real time video made a difference
  - Allowed for vectoring of crews to hotspot beyond the fire line
  - Allowed for mapping large areas in hours vs days
- Manned spotter aircraft do not fly at night
  - The UAV continued to gather images and video at night
  - Real-time, wide area monitoring provided fire analysts data that was 1-2 hours old vs a 1-2 days old
  - Fire suppression aircraft were able to vector aircraft and drop their loads more accurately



Traditional Methods



Use of UAVs for mapping and monitoring

- Fire analysis evolving – from human gathered data and mapping to technology based gathering and mapping.
- Driven by need – RIM fire tripled in size on day 3 – then doubled in size on day 4...then doubled in size on day 5

## **CALFIRE FEEDBACK**

“The IR flight through NIROPS showed a spot fire across the line by almost a mile during the night. The fire adviser was notified by the Infrared Interpreter of the spot and directed the UAV over the spot fire to confirm its presence. The UAV confirmed that a small spot fire was burning across the fire lines and the fire adviser notified the Branch Director of the spot...it proved the value in getting a head start on potential problems where other technologies might not have such flexibility.”

**Todd Tuggle, Captain/ GIS Analyst, CALFIRE (Fresno)**

“This is a very remote fire, a very large fire, so the ability to see all sides is virtually impossible, and using this platform we have been able to get eyes on the perimeter and keep eyes on the perimeter...I saw more here in 30 minutes than I did in 3-4 days of hiking the fire line...”

**Jeremy Salizzoni, Captain, CALFIRE (San Diego)**

- Commercial use of Group 1 & 2 UAVs
  - Capabilities:
    - Lower cost than MQ class UAVs
    - Capable of gathering the data needed by fire analysts
    - Can fly above smoky places too dangerous for manned flights
    - EO/IR payload resolutions in Groups 1 & 2 can be better than better than MQ class UAVs due to proximity to the ground
    - Capable of supporting basic assessment for wind and fire direction
    - Capable of live video feed – real time monitoring for fire and wind direction changes and identification of hot spots
  - Advantages over manned aircraft
    - Able to fly at night (helos limited to daytime spotting missions)
    - 2-12 hour endurance
    - 24 hour intelligence cycle
    - Wide area and narrow surveillance
  - Sensors vs Eyeballs
    - More accurate information for the fire intelligence cycle
    - Geo-referenced data
    - High resolution FMV and digital stills
    - Multispectral data: dryness factors, water sources, forest health

## Suggested / Recommended Capability Requirements

- Video Requirements
  - Ability to record video
  - Ability to play back video
  - Ability to burn video to a disc, thumb drive, common drive or drop box
  - Push near real time video to a remote location
  - Mark Points of Interest (POI)
  - Rapid retrieval of POI data and video
  - Meta data such as point and line data
- Change Detection:
  - Details on size, area and elapsed time of burn over and area to help calculate speed and direction of fire
  - Software that supports reports developed from point and line data

- Point Data
    - Water sources
    - Hot spots
    - Spot fires
    - Safety zones
    - Damaged structures
  - Line Data
    - Fire edge
    - Road
    - River
    - Flood line
    - Vegetation type
  - Real time video playback
    - Accessible for the FBAN (Fire Behavior Analyst) to review
- The fire analyst should be able to mark, label, retrieve and share points of and lines of interest.
- Ideally data would be extracted from FMV or stills, and compatible with other mapping products (ex Google Earth).



- Regulatory Challenges
  - RIM Fire
    - Required FAA Approval: Specific altitude and orbit restrictions 30 nm orbit and 18-20K feet
    - Required approval from the office of Secretary of Defense – strict sensor use guidelines
  - Group 1 & 2 UAS
    - Temporary Flight Restriction (TFR) set up for fighting fires are not permission for flying UAVs
    - Certificate of Authority (COA) is required for UAV flights
    - The COA must be issued to the public entity – federal state or local fire fighting agency
    - May be assigned to a specific area, such as a city, or county
    - COA depends on UAS use (training, operations), and who will use the UAV (contractors, firefighters)
  - Navigating the COA process is complex and would require a close relationship with the supported fire agency
  - Some aircraft have recently gained limited type cert (ScanEagle, Puma)

- Challenges
  - Small UAV engines
    - Reliability of small engines has been an issue in recent years
    - Industry continues to address reliability
  - COA approval
    - Engine reliability and historical data is a consideration for the FAA
  - Drone Hysteria
    - General lack of understanding of unmanned systems and privacy concerns add to barriers
  - Availability Requirements
    - Fire agencies need services, not hardware
    - Exclusive use (90-120 day), or Call When Needed
    - Availability within 24 hours of call to respond
    - May deploy but not fly (limiting revenue)
    - Maintain current operations support personnel in off season
  - Costs
    - Even Group 1 & 2 UAVs hardware costs are a challenge: \$0.5 - \$5M
    - MQ-1 (Predator) = \$25K per flight hour
    - Manned flights are in the hundreds of dollars an hour

Contact Information  
Philip Mahill  
Phone # 252-258-5075  
Email: pmahill@academi.com



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## Overview

- HQ in Northern, VA
- Training Facilities CONUS & OCONUS
- Moyock, NC - Largest private tactical training facility in the United States
  - 25 miles south of Norfolk, VA
  - 300 miles from Ft Bragg
  - 220 miles from Washington DC
- Training 35,000+ persons per year
- Currently 1,500+ personnel deployed to multiple locations worldwide



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