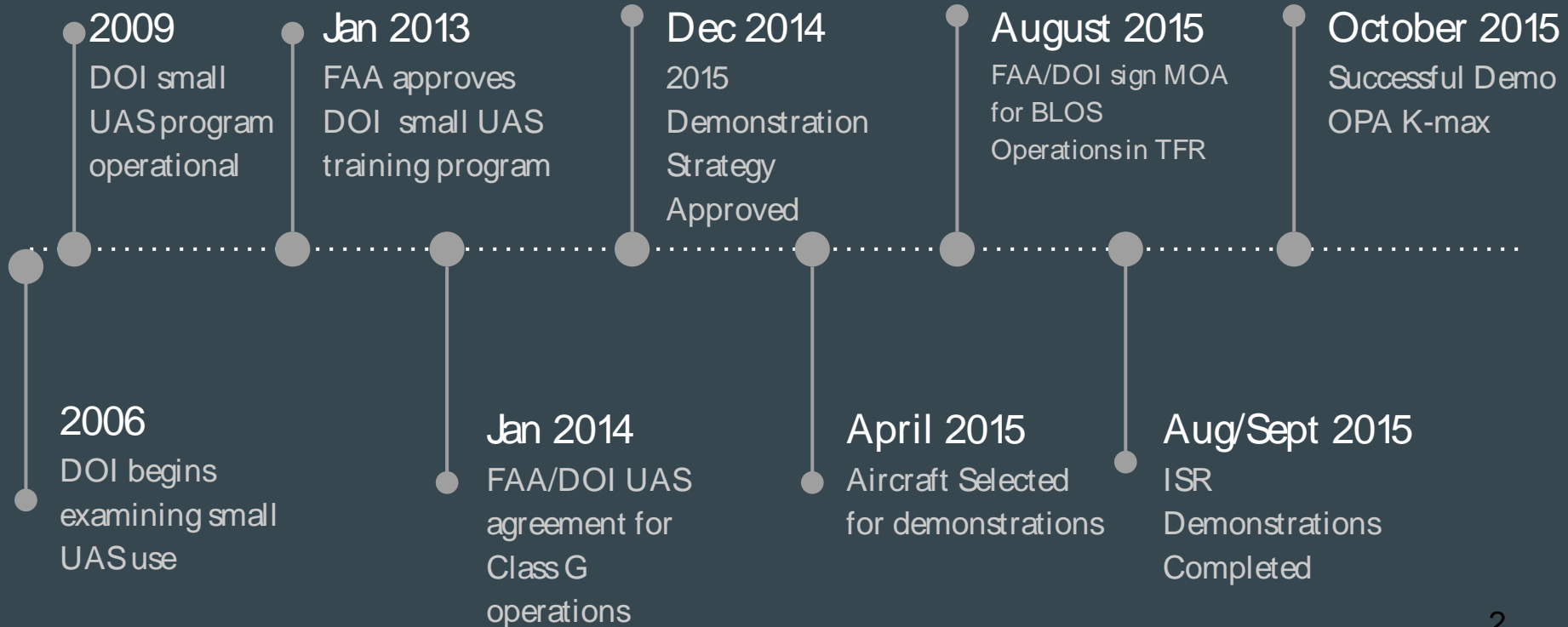




Fire UAS Integration

...

Milestones



Aircraft Selected



Insitu Scan Eagle

Electro-Optic Imager
Up to 170X Zoom
Mid Wave Infrared
12X zoom
24 Hour Endurance
10' Wingspan
50 Lbs MGTOW
19,000' Ceiling

Catapult Launch/Skyhook Recovery



Textron Aerosonde Mark 4.7

Electro-Optic Imager
31X zoom
Mid Wave Infrared
10X zoom
18 Hour Endurance
11.8' Wingspan
55 Lbs MGTOW
15000' Ceiling

Catapult Launch/Net Recovery



Lockheed Martin Stalker XE

Electro-Optic Imager
26x Zoom
Infrared
2X zoom
8 Hour Endurance
10' Wingspan
22.5 Lbs MGTOW
15000' Ceiling

Hand/Bungee Launch/Belly landing



Lockheed/Kaman OPA K-MAX

Optionally Piloted
Electro-Optic Imager
38x Zoom
Infrared
10X zoom
3-Hour Endurance (12-aux)
Up to 6000 lb Payload
15000' Ceiling

Water/Cargo Delivery

Demonstrations Completed

Paradise Fire

Olympic National Park

- Real time ISR
- IR Mapping
- Data direct to web
- IMT Integration
- First Ever DOI BLOS COA
- Airspace Integration
- Personnel/Wildlife Tracking

Teepee Springs Fire

Payette, NF

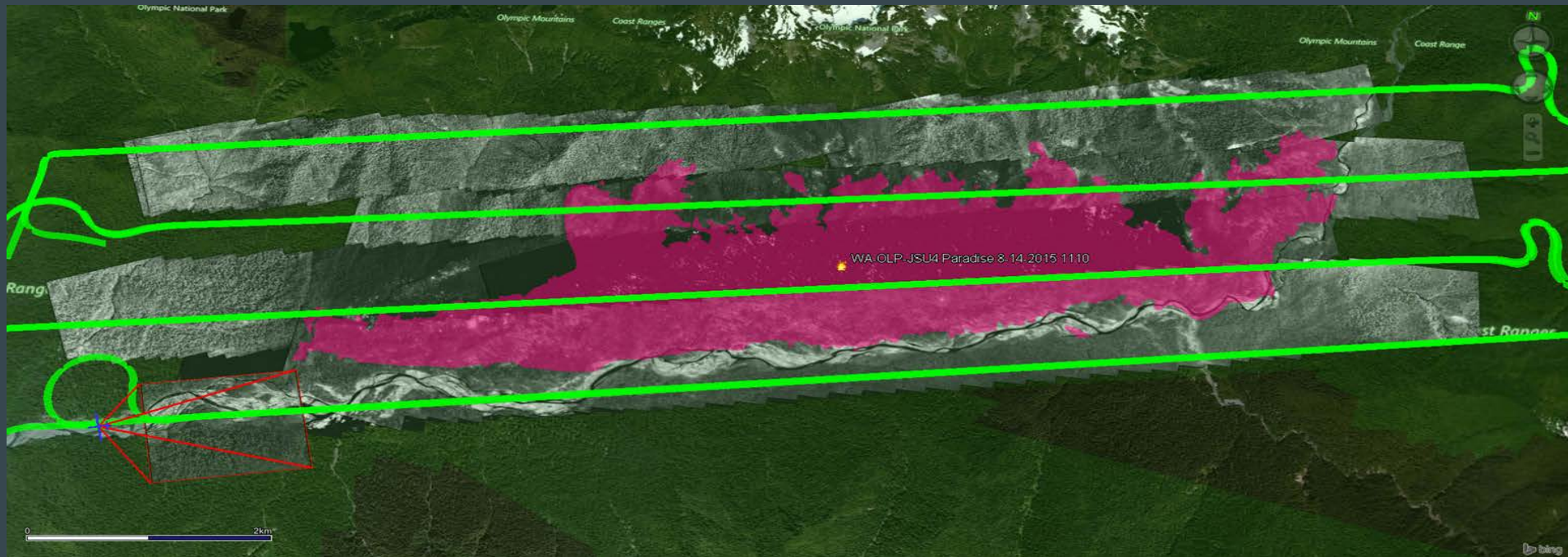
- Real time ISR
- IR/EO Mapping
- Data direct to web
- Integration with IMT
- Multi Agency
- Airspace Integration
- Highly Sensitive Public

K-Max Demonstration

Boise, ID

- Water Dropping
 - Spot
 - Trailing
 - Line Building
- Cargo Delivery
 - Carousel
 - 55-150' Line

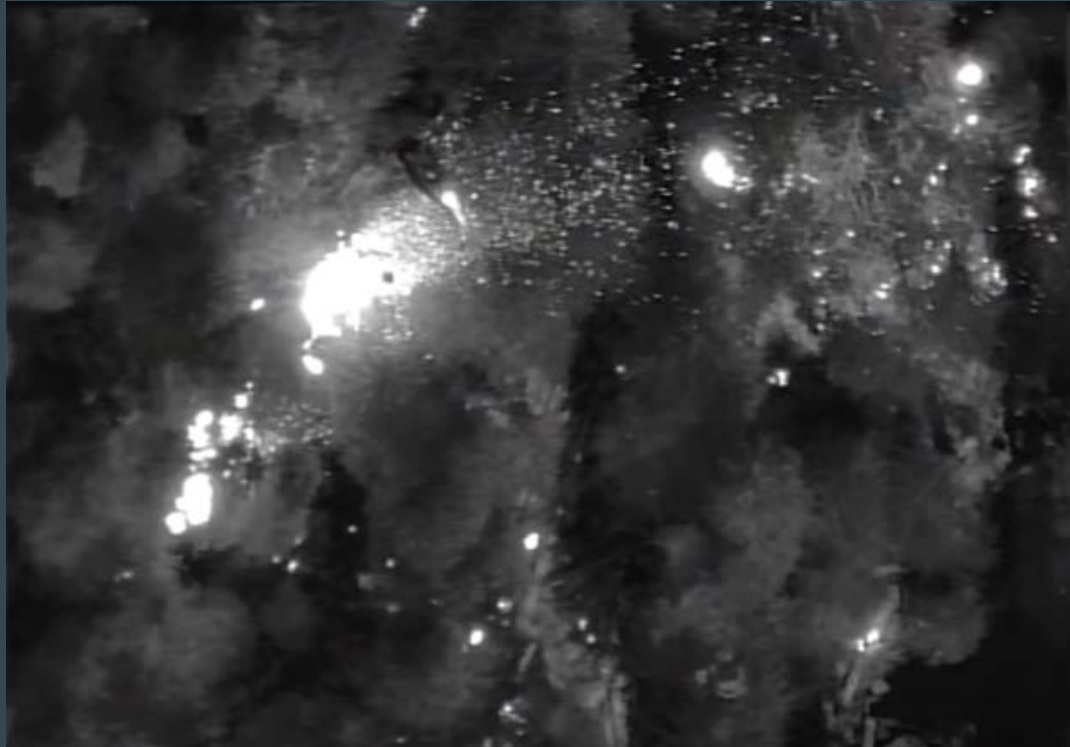
Paradise Imagery



Google Earth Export



Helicopter Drops



[Click image to view video on youtube](#)

Mapping Strip



[Click image to view video on youtube](#)

Scaneagle Recovery



[Click image to view video on youtube](#)

Elk Survey



Teepee Springs Lessons Learned

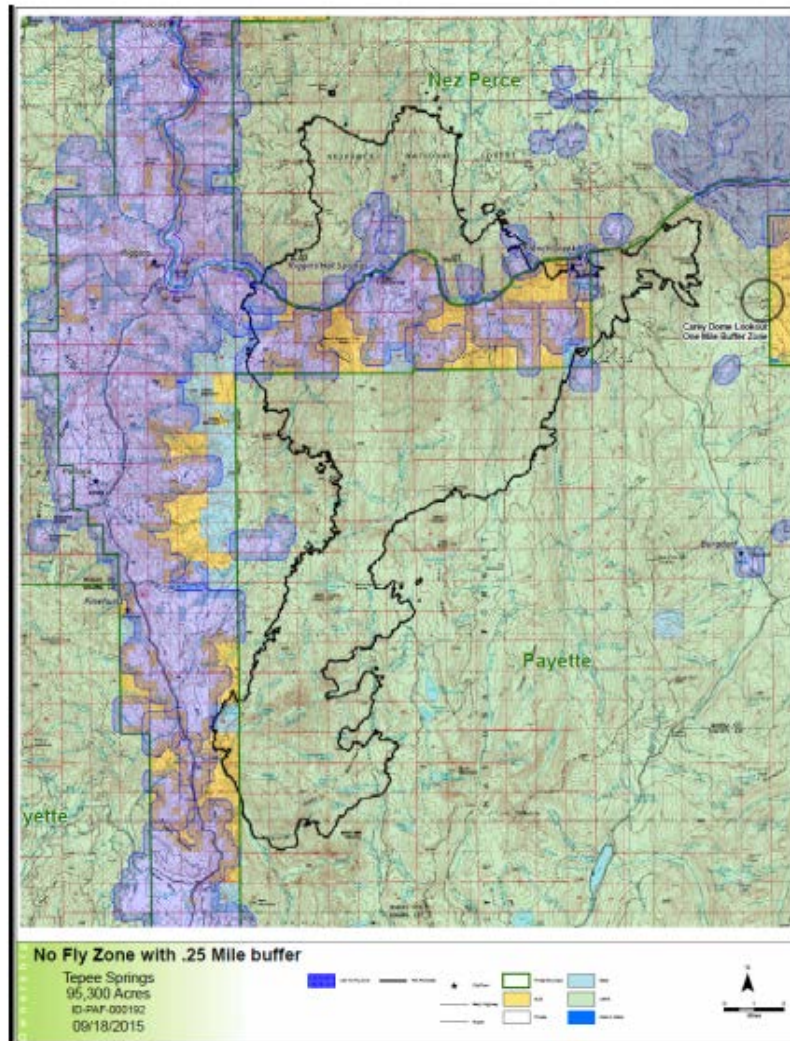
Successes

- Aircraft was excellent for real-time ISR.
- Highly mobile launch recovery system
- Interface with ATGS and Helicopters
- Airspace segregation was simple and effective. ROZ
- Dual Imager was useful
- MWIR sensor is the best choice for wildfire monitoring
- 21 hours of flying over 4 days with no incidents
- No-fly zones built around private land
- Integrated with GISS on incident
- TCAS

Challenges

- Sensor automation proved challenging for mapping.
- Spectrum requirements
- LOS communications vs. Satcom

No Fly Zones



Sample Imagery



Sample Video

[Click image to view video on youtube](#)

Note: watch till the end to see a visual image showing the fire. The smoke is marked by a circle



Aerosonde Launch



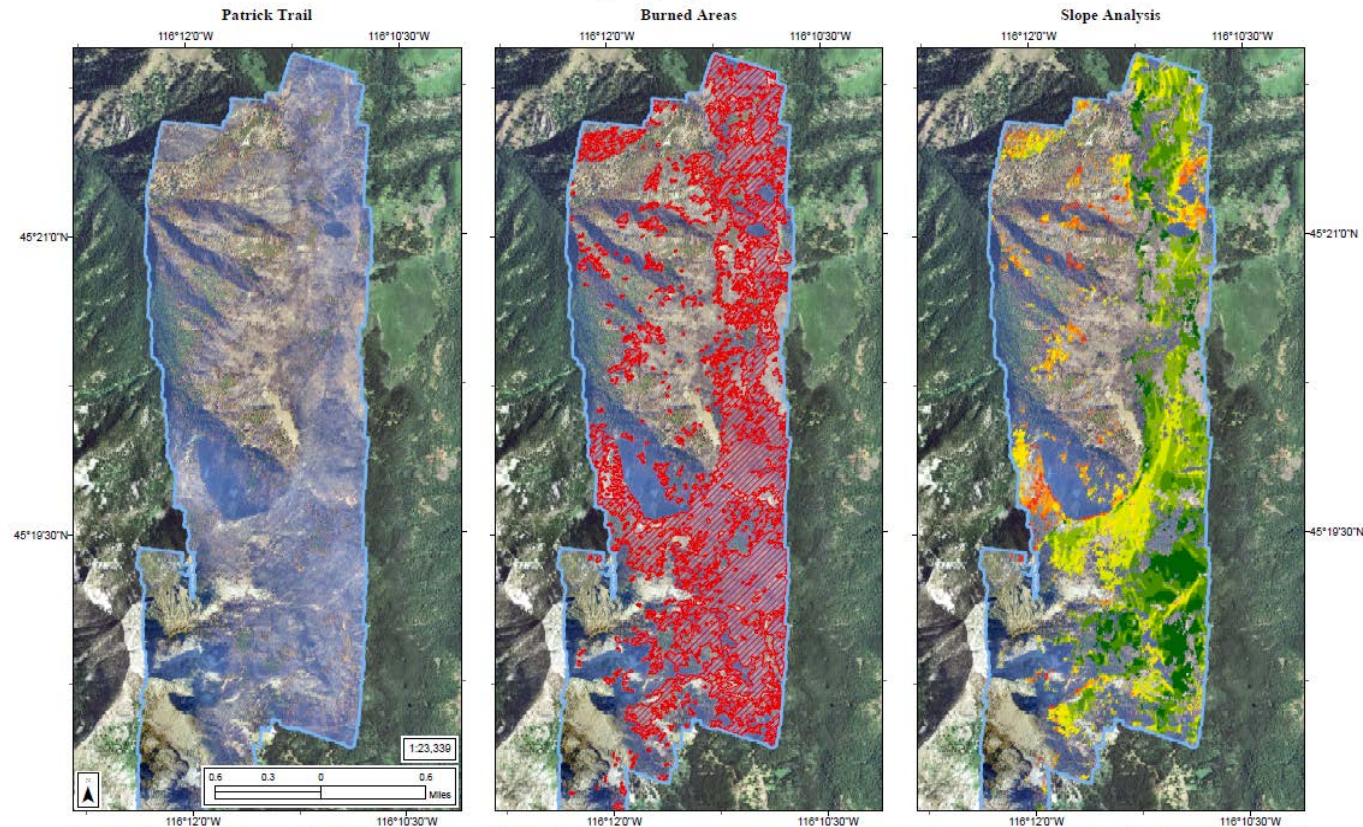
[Click image to view video on youtube](#)

Aerosonde Recovery



[Click image to view video on youtube](#)

Image Analysis



Description: Burn area analysis for Partridge Creek from imagery captured on 20 September 2015. Center image shows burned areas as identified by Feature Analyst. Right image shows slope map, masked by burn areas. This analysis visualizes the areas of steep slope that have incurred burn damage and may indicate potential for dangerous recovery sites.

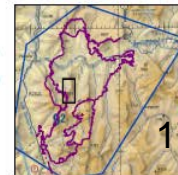


Legend

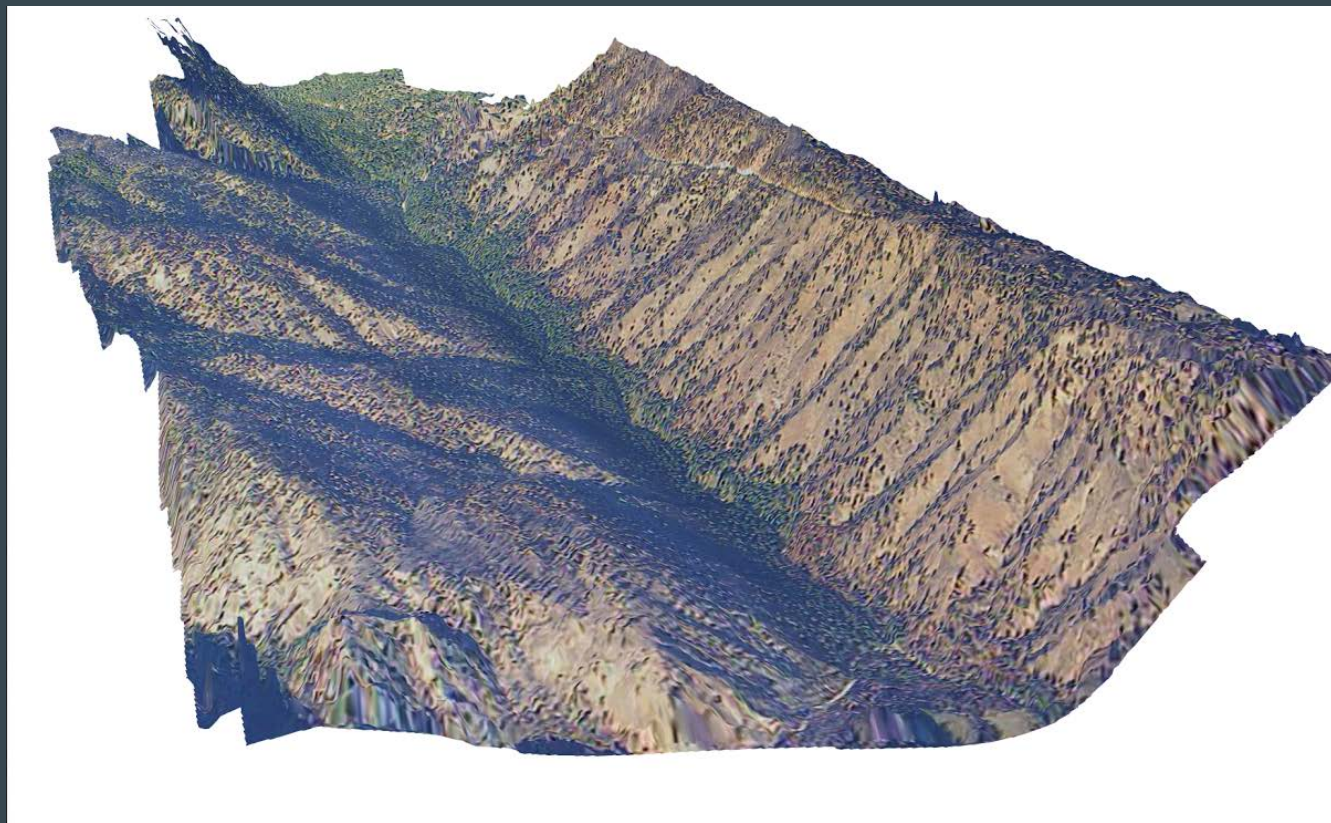
- ▨ Burned Areas
- ▭ Patrick Trail Imagery

Slope in Burned Areas

- ▭ 0 - 7.5
- ▭ 7.5 - 12
- ▭ 12 - 15.5
- ▭ 15.5 - 20
- ▭ 20 - 24.5
- ▭ 24.5 - 30
- ▭ 30 - 37
- ▭ 37 - 58



3D Modeling



Optionally Piloted K-Max Demonstration

Successes

- Consistently and reliably delivered cargo to a variety of locations
- Multiple loads on one flight
- Accurate to within 2-3 feet
- Fit into existing training for firefighters
- Able to build wetline
- IR camera can assess accuracy
- Satcom relay allowed for BLOS operations
- Camera was able to lock on and track targets
- IR capable of “erasing” smoke
- Able to operate in terrain with DTED

Challenges

- Satcom can drop out if helo is on N heading
- 60 Meter DTED was not high enough resolution
- Radar altimeter sometimes senses load vs. ground
- Operators unfamiliar with tactics normally used in fire

Video



[Click image to view video on youtube](#)

Sample EO/IR



[Click image to view video on youtube](#)

Planned Actions for 2016

- Incrementally increase the usage of UAS from what was done during the 2015 fire season.
- Utilize in-house “fleet” aircraft and operators on prescribed fires and low complexity wildfires for the purpose of improving workflows for turning data into actionable intelligence.
- Work with NIMO and T1 and T2 IMTs to plan for additional deployments of UAS for 2016.
- Explore contractor provided services for post-fire imagery collection.
- Develop on-call contract for reconnaissance UAS similar to the aircraft that were flown during the 2016 season.
- Compare data collected via manned aircraft and data collected using UAS.
- Collect lessons learned during the 2016 season to develop interagency UAS operator practical standards and aircraft inspection standards.
- Develop state/federal partnerships for conducting UAS missions.



Discussion



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<https://www.doi.gov/aviation/uas>