



Application of Real-time Tactical Intelligence on Wild Land Fire

Hart Drobish, Pat Basch & Pete Koerber

May 30, 2019
TFRSAC Conference



OBJECTIVES

- Display Product, Process, Utility and Customer variables.
- Provide audio/ visual validation of past events
- Define the Culture and Acceptance Issues facing implementation and use in technology products.

Agenda

1. Overview – Products
 - Live streaming thermal infrared (IR) FMV
 - Mapping: 5 minute fire polygons, whole maps, ortho-mosaics
2. Use Case
 - IA
 - Large Fires
3. Technology



Wildfires Contained While Small

What is a small fire ?

A Commonly Stated Goal:

Increase Success Containing Fires at “Small” from 98% to 99%



S-T-O-M-P

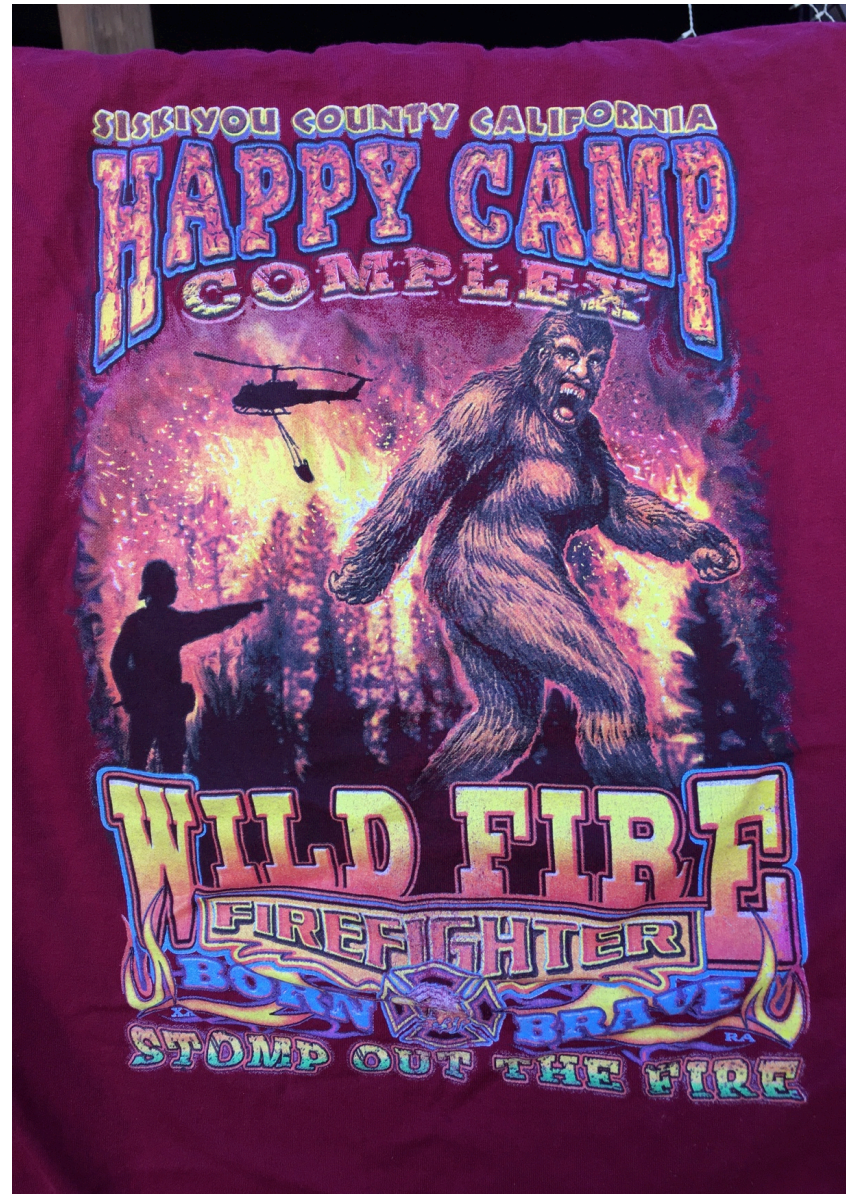
F-I-R-E

STRONG TACTICS OVERWHELM MOST PROBLEMS

FAST INITIAL RESPONSE EXTINGUISHERS

(Only if you know where the fire is to apply tactics)

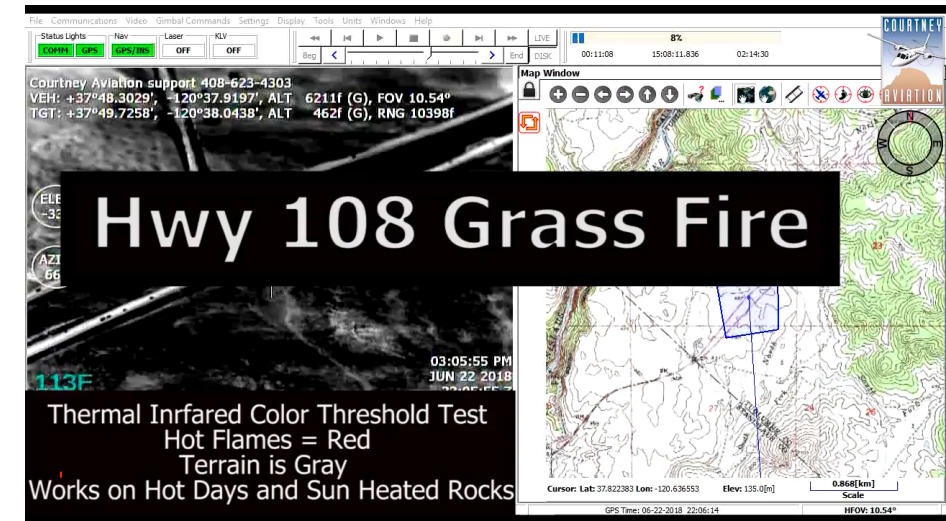
STOMP THE FIRE





Easy Shared Operating Picture (SOP) Fire Mapping

- Live Streamed Aerial FMV (Full Motion Video)
 - Thermal Infrared with colored thresholds
 - Visible color superzoom
 - Cellular FirstNet and Verizon failover
 - Microwave Adhoc Network (MANET)
- Fire Perimeter mapping Artificial Intelligence (AI)



May 30, 2019

Hart Drobish Air Attack Operator hartd@CourtneyAviation.com

Pat Basch ATGS

Pete Koerber ATGS/IR Systems Specialist





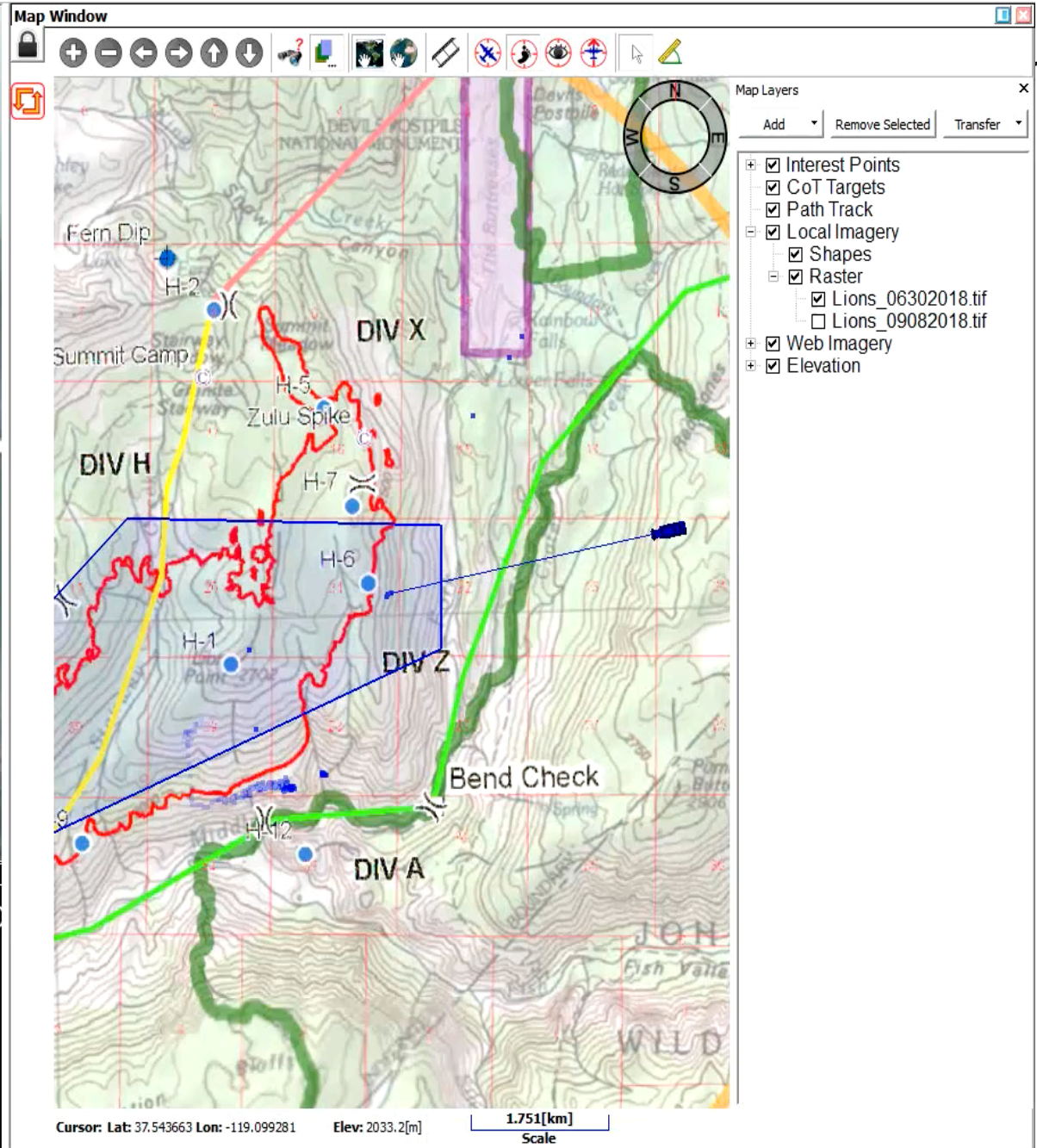
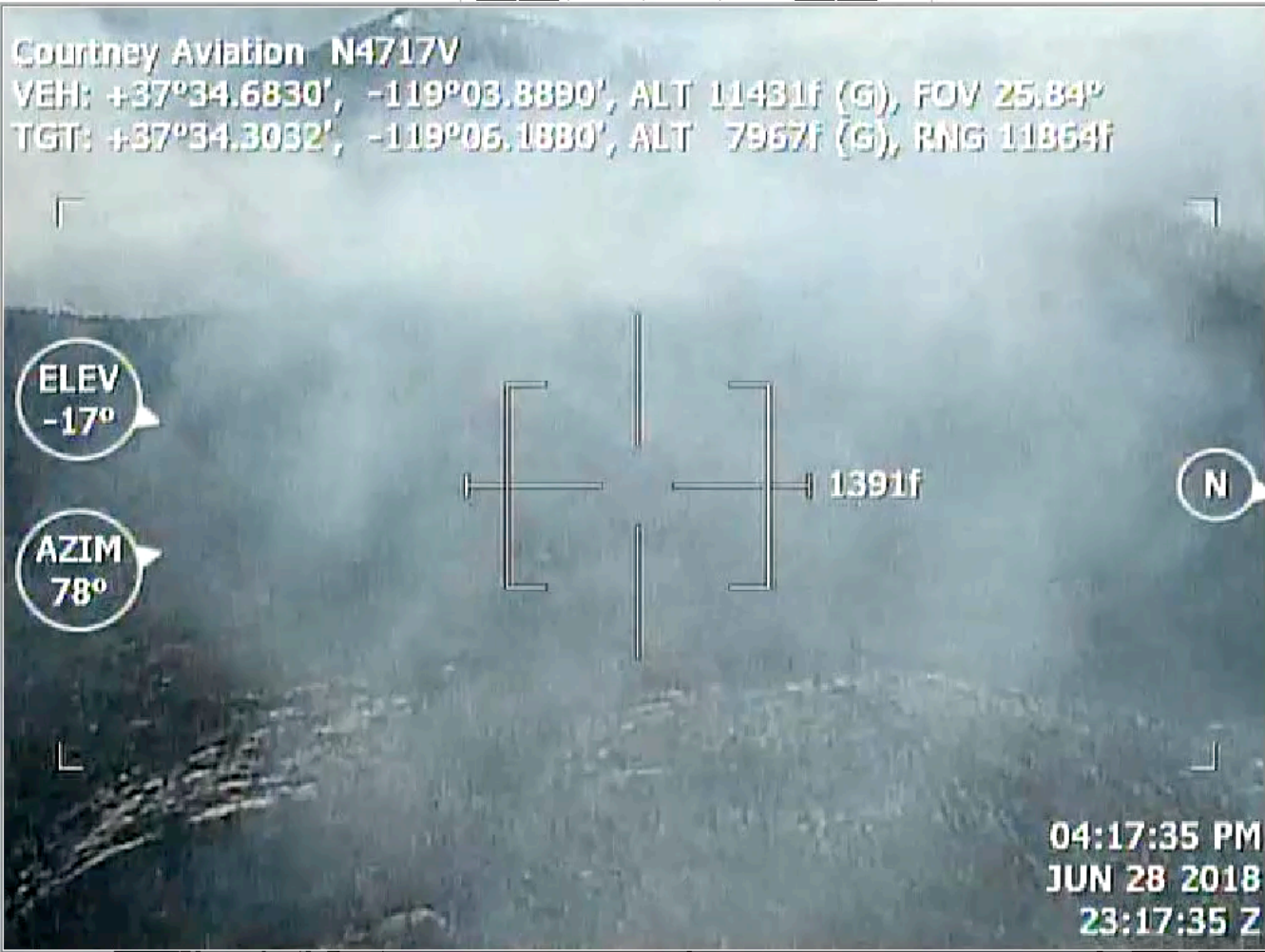
Live Aerial FMV (Full Motion Video)

Product: Live IR video to unlimited personnel

- Shared Situation Awareness through smoke/dark: Shared Operating Picture organically
- iOS & Android phones & pads, Windows & MacOS
 - No user limit: Firefighters, Dispatch, IMT, HQ, Governor's Office, etc.
 - Easy for untrained: Thermal thresholds, Fire=Red on black & white terrain image
 - At limits of cellular Operation Control stops and streaming continues. **Operators are not required**
 - New in 2019: Moving map of Aircraft Position: ~3 second delay
- Operate onboard or from ground over the internet
 - Fire Camp, Dispatch, HQ, Sacramento, Courtney, other Aircraft
- Take Requests: Radio to Air Attack
 - or Telephone to ground operator (Phone# on video)

FireAirAttack.com





Lions Fire - June 28, 2019

Air Attack

Sierra & Inyo Nat'l Forest

Status Lights
Nav Laser KLV
COMM GPS GPS/INS OFF OFF

BEG < > END LIVE DISK
00:11:08 15:08:11.836 02:14:30



Courtney Aviation support 408-623-4303
VEH: +37°48.3029', -120°37.9197', ALT 6211f (G), FOV 10.54°
TGT: +37°49.7258', -120°38.0438', ALT 462f (G), RNG 10398f

Map Window

Map window showing a topographic map with a compass rose and navigation controls.

Hwy 108 Grass Fire

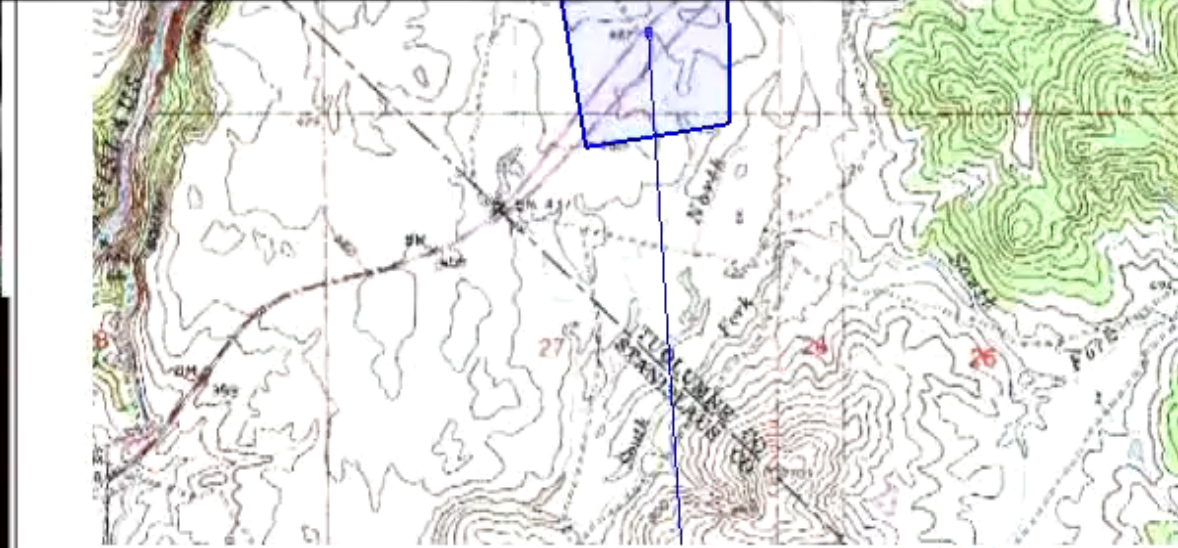
ELE -33
AZI 66



03:05:55 PM
JUN 22 2018

113F

Thermal Infrared Color Threshold Test
Hot Flames = Red
Terrain is Gray
Works on Hot Days and Sun Heated Rocks

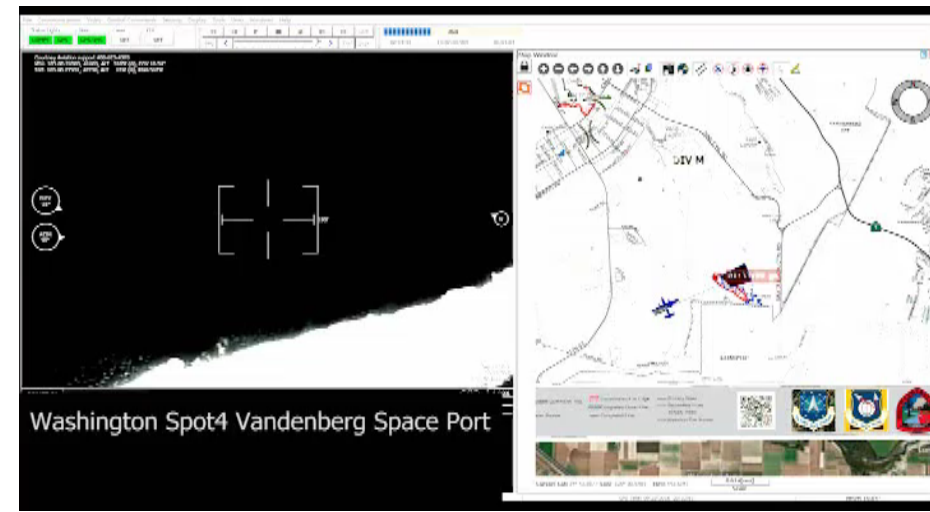
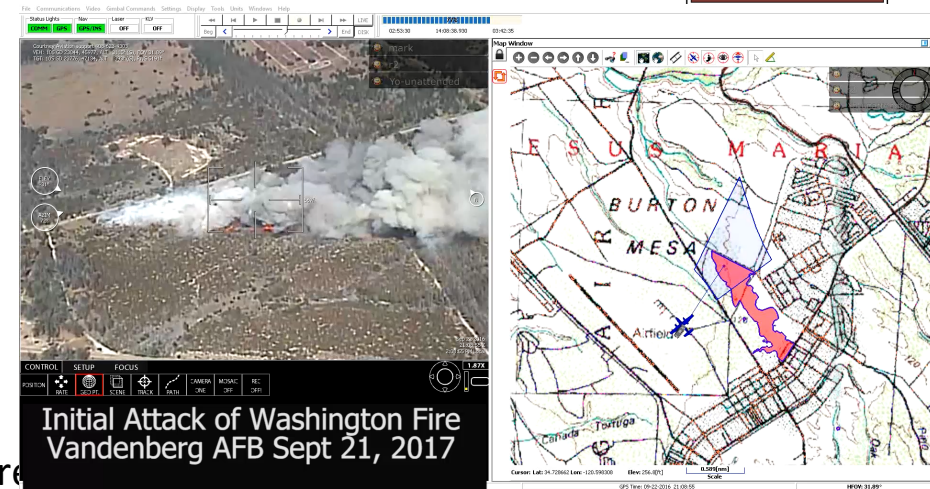


Cursor: Lat: 37.822383 Lon: -120.636553 Elev: 135.0[m]
0.868[km] Scale

IA Use cases



- Air Attack often first to fire and auto streams to responding engines and Dispatch
- Live IR FMV auto-streamed: 60-95% coverage over FirstNet
 - Camera operated from Columbia Airport flying
 - or, camera is locked wide angle on fire center
- Unknown features become known: New roads, vehicles, scars, structures, natural fire
- Assessing, Pre-planning, Decisions occur sooner and faster
- Dispatch saw fast moving fire and structures threatened
- Forest HQ & PIO control released images instead of news stations
- Air Attack sees through smoke, and can watch two places at once
- Recordings contributed to catching an arson (Vandenberg AFB)
- IMT - Vandenberg EOC synchronized by live view of fire
 - Planned evacuations
- Created the only map for many fires



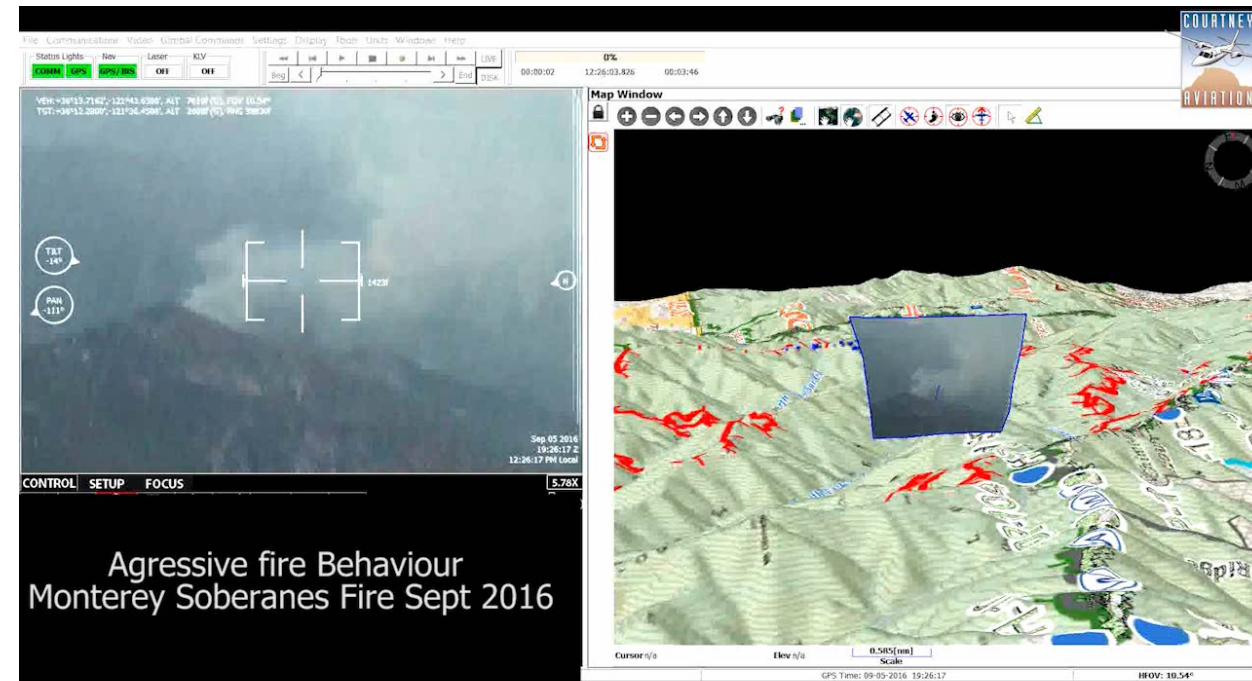
2016-15 Large Fires use case

Blue Cut, Soberanes, Vandenberg/Canyon, River, Rough

- MANET 90%. Extensive 2-3 million acre mesh
- Air Attack scanned for spots and slops, assets at risk, walked in fire crews, coordinates
- Situations/GIS mapping received regular polygon updates
- Ops had live in trailers. Planned evacs
- Fire Behavior Analyst studied video
- SOPL Strategic Operations Planning Liason
- Meteorology watched winds
- PIO used movies for community
- Governor's Office movie
- Burnout: scan for spots, Ops watched
- Fire tornado recorded over 1 mile long
- Linked 3 camps: Torro, Molera & Spike
- Ops Operated (ground team released)



Soberanes Fire



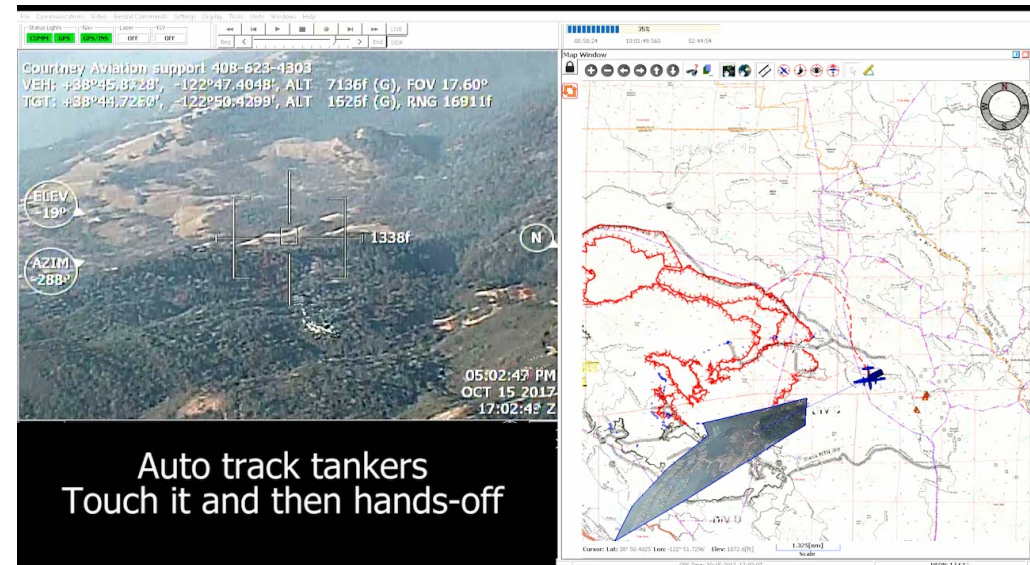
Aggressive fire Behaviour
Monterey Soberanes Fire Sept 2016



2017 Large Fires

Thomas, Central LNU Complex, Klamath, Happy Camp, Orleans

- Air Attack sees through smoke
- Inspected tanker drops
- Discover and caught slops and spot fires
- FMV in Ops tent
- Fire polygons to Situations prior to briefings
- Klamath fire line operated by Division Sup
- Mesh reached ocean to Interstate 5



Central LNU Complex, Santa Rosa



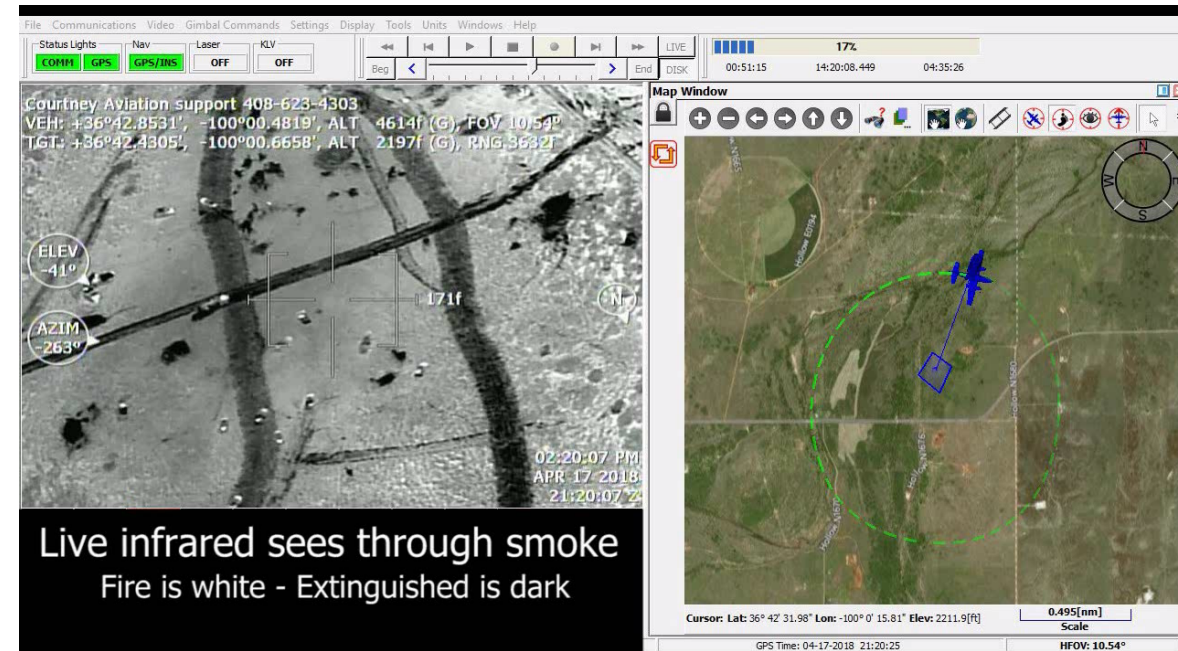
2018 Large Fire use cases

California: Camp, Lions, Holy, Carr, Milton, Mendocino Complex, Parrotts, Trinity Lightning Complex, Ranch, Klamathon, Ferguson

As many fires: New Mexico, Arizona, Utah, Nevada, Oregon, Washington, Idaho, Oklahoma

- 50-70 % coverage over FirstNet, 90% FirstNet combined with MANET
- Track progress and change of fire and activities more easily
- Divisions regularly requested line scans, especially hard to get or risky places
- First and Last lap around provided intel for crews
- South Ops and Forest HQ watched
- Medical Evac transmitted live
- PIO controlled released images instead of news stations
- Ops chief didn't require helicopter. Helicopter kept dropping water that saved houses
- Common Operating Picture sync'd groups fire wide

Laverne Fire, Oklahoma





File Communications Video Gimbal Commands Settings Display Tools Units Windows Help

Status Lights: **COMM** **GPS** **GPS/BRS** **OFF** **OFF** Nav Laser KLV

00:00:02 12:26:03.826 00:03:46

VER: +36°13.7162', -121°43.6388', ALT 7619' (0.1 FOV 10.54°)
TGT: +36°12.2800', -121°36.4588', ALT 3688' (0), RWG 3883'

TILT -14°
PAN -111°

1423'

Sep 05 2016
19:26:17 Z
12:26:17 PM Local

CONTROL SETUP FOCUS 5.78X

Map Window

Cursor n/a Elev n/a 0.585[nm] Scale

GPS Time: 09-05-2016 19:26:17 HFOV: 10.54°

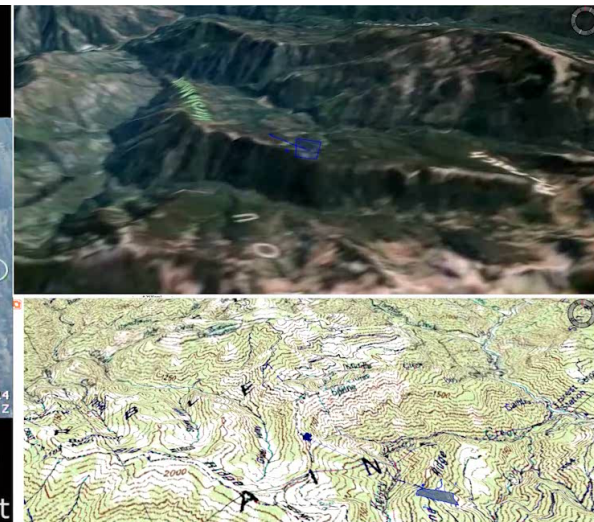
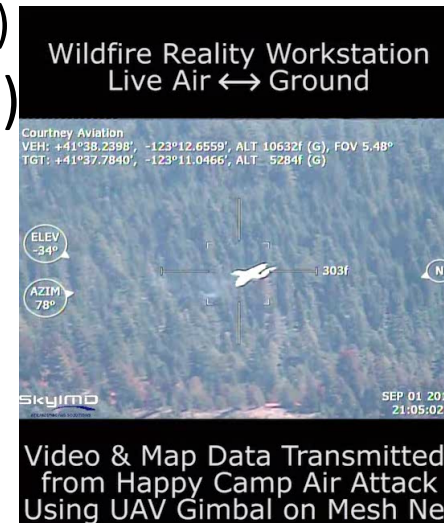
Agressive fire Behaviour
Monterey Soberanes Fire Sept 2016



Technology: Drone Gimbal on Manned

- Drone gimbal (used in Afghanistan & Iraq) on Manned-aircraft
- Easy interface: Mouse, Keyboard, Joystick, Touch video screen or map
- Auto Tracking: touch once (Hands off)
 - Moving objects: Tankers and helicopters. Vehicles much less so
 - Fire, dozer, hand Lines. Powerline, pipeline, roads, river/creeks from GIS
 - Coordinates, stationary objects, any symbol on a map
- Real Time Geo-referencing
 - Coordinates and measuring scales on display
 - Recorded locally and transmitted by STANAG (military spec)
- Perimeter mapping of small fires (under 10,000 acres)
- Live FMV Streaming
- Instant Replay

Happy Camp Complex 2014



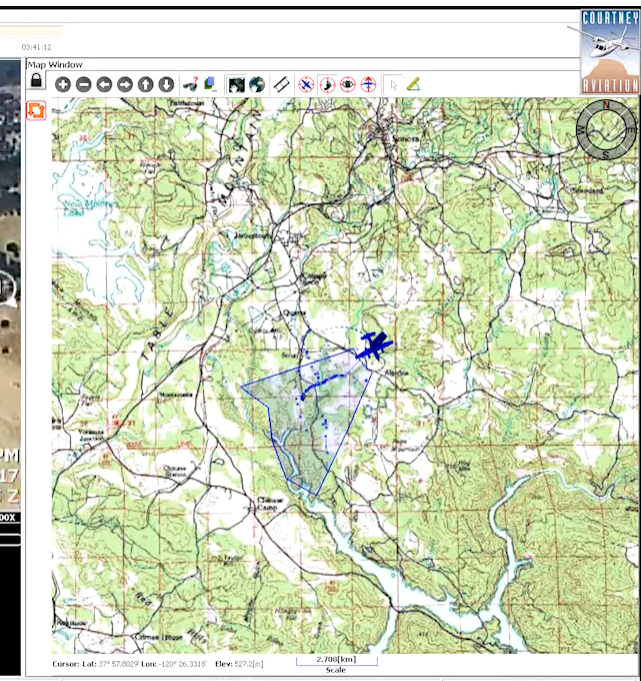


Technology: DataLink

- End user's own personal cell phone: Web browser
- Very low bandwidth. 300Kb, but will use 2 Mb if available
- FirstNet (AT&T) and Verizon failover in the planes and in Vans
 - Works for any ground cellular carrier
 - Stronger in air than on ground
- MANET
- Iridium Satellite
- WIFI
- Radio – Mapping Vans
- Solar Power Mountain Top Repeaters
- *AirCell*



Cal Fire IA - 2017

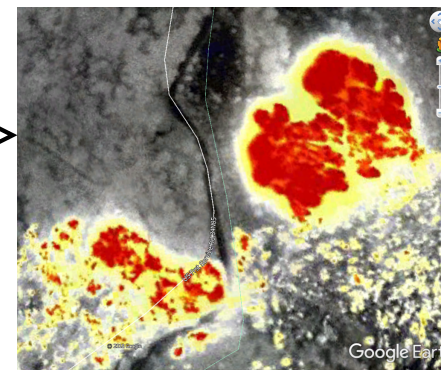
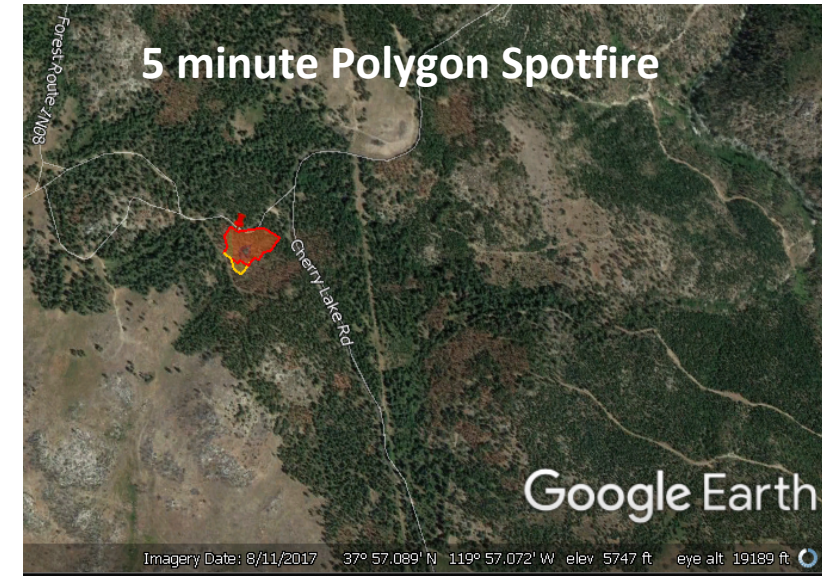


Perimeter Mapping

- Products:
- Fire Polygons every 5 minutes
 - Whole Fire perimeter when done gathering
 - Mosaics and Imagery post fight



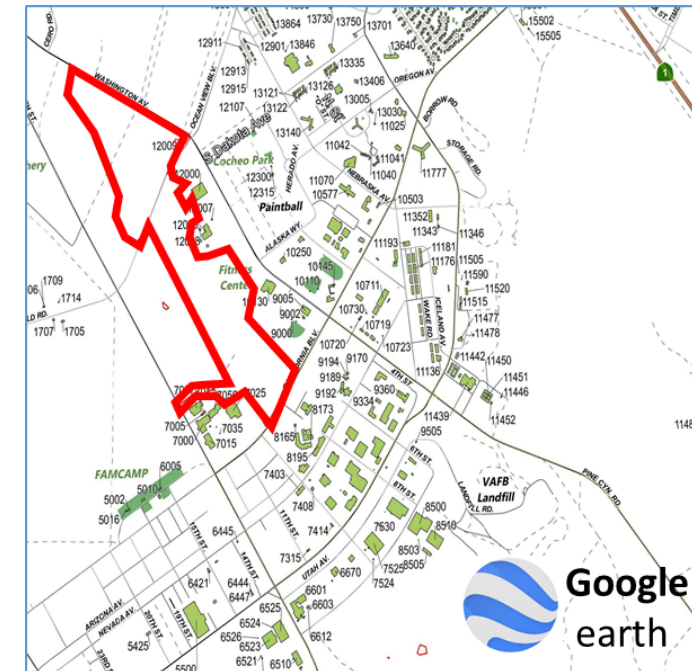
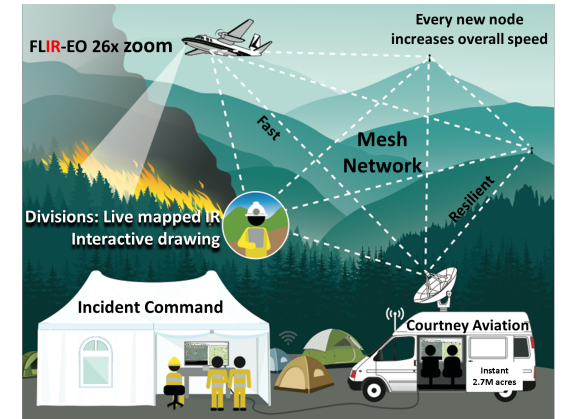
- Type 1 Air Attack FMV Gimbal day or night. Maps small fires 1000-50000 acres
 - Mapping: ~1000 acres per hour. 1,000-30,000 feet. Limited polygons in flight, maps post flight
 - FMV. Two thermal infrared (LWIR), one Color-superzoom. Gimbal controlled from ground
 - Downlink: FirstNet-ATT & Verizon from plane can be received on any carrier. Also MANET
- NADIR FLIR TAU day or night. Maps 50-100,000 acres/hour (wide area manned-drone)
 - Step Stare or fixed
 - Flies 40-200 knots, 8 hour duration
 - Thermal infrared (LWIR), Near Infrared (NIR), Color visible. Overwatch TK-5. No FMV
 - Downlink: FirstNet-ATT, Verizon, Iridium Satellite, *AirCell*
 - Mapping: Up to 100,000 acres per hour. Automatic polygons transmitted every 5 minutes





Technology: Mapping large Fires

- OverWatch TK-5
 - One FLIR Tau 2 Step-Stair 7 wide
 - Up to 100,000 acres per hour
- Aero Scientific FireFlight
 - Two FLIR Tau2, Wide and Narrow
 - Up to 50,000 acres per hour
- Fire Polygons every 5 minutes
 - AI thermal thresholds auto extracted
 - Transmitted near-real-time
 - Whole map immediately after gathering data
 - Manually verify
 - Mosaics: Thermal or Visible-Color





Why? Barriers to FMV Use

- **What have been the “Barriers to Acceptance and Use”?**
 - Generalization of what the IR product is. Who wants it and why.
 - Change and comfort level in something new, or new to the user.
- **What has been in “Acceptance and in Long Standing Use”**
 - NIROPS
 - Firewatch Program / Cobra
- **What has recently been in use?**
 - Military Predator
 - Military Beach 1900
 - Small Drones by Fire Agencies
 - Call When Needed Contractors
- **What has been the “Culture” in Development, Application and Acceptance of technology products.**
 - Added complexity to aircrews
 - Contractual acceptance
 - Competition
 - Single mission platform vs. multi tasked platform

