

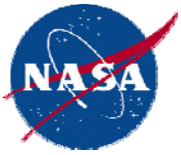


IKHANA

2007 Western States Fire Mission



**Kathleen Howell, Ikhana Flight Operations Engineer
NASA Dryden Flight Research Center**



Introduction



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The NASA Dryden Flight Research Center Ikhana Project Team and Ikhana



Ikhana UAS



IKHANA



Ikhana Aircraft

Ground Control Station (GCS)



OTH KU Antenna



Ikhana UAS / Ground Control Station (GCS)



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The Ikhana "Cockpit"

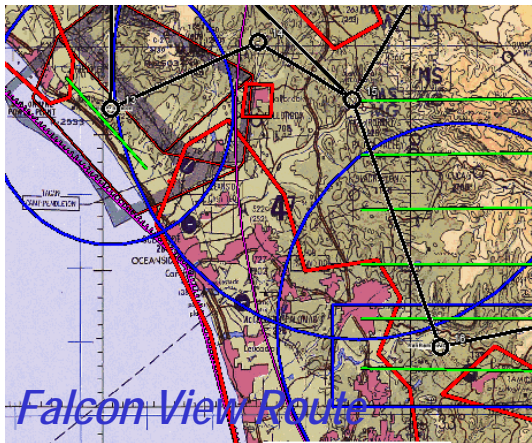


Ikhana UAS / Ground Control Station (GCS)



IKHANA

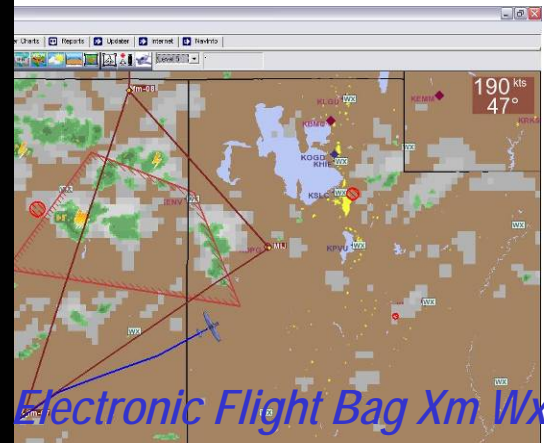
Pilot Displays for Situational Awareness



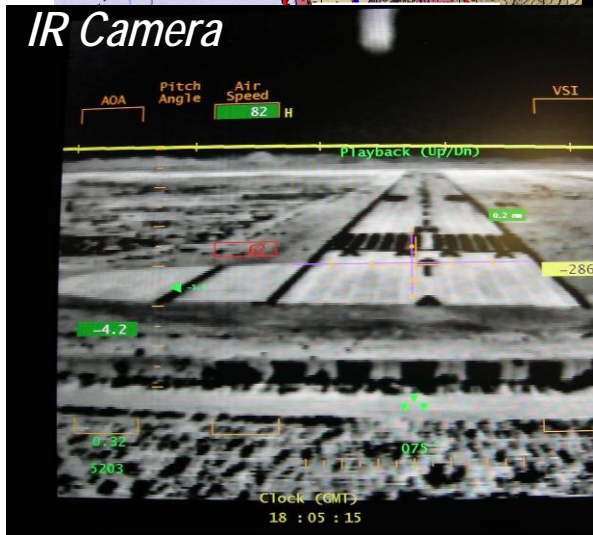
Falcon View Route



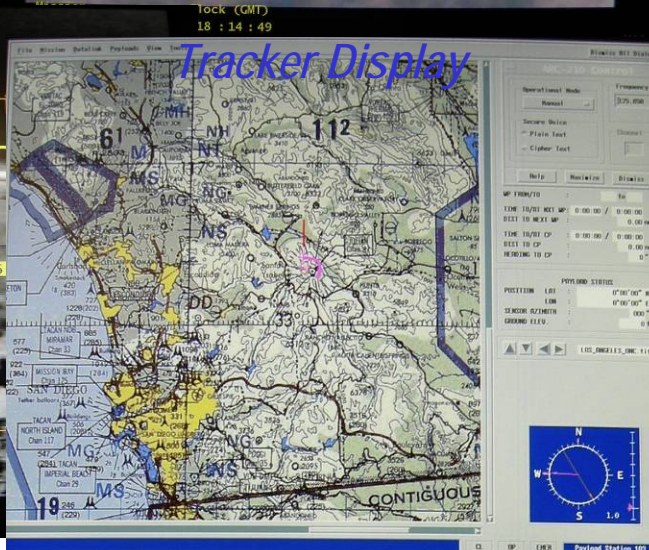
45 Degree Camera



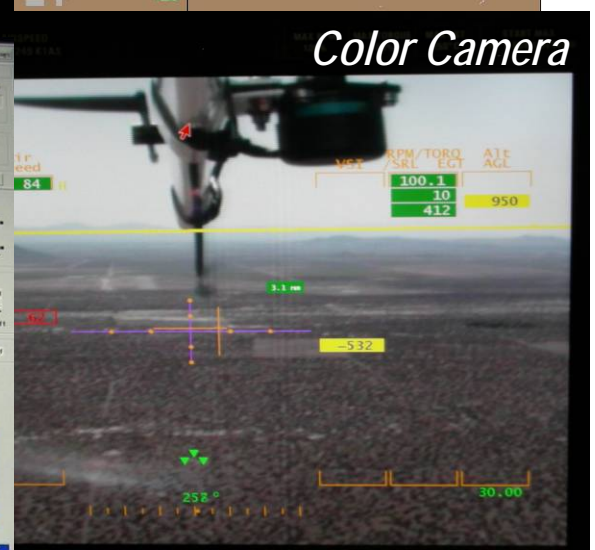
Electronic Flight Bag Xm Wx



IR Camera



Tracker Display



Color Camera



Ikhana UAS / Ground Control Station (GCS)



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Mission Control and Research Workstations



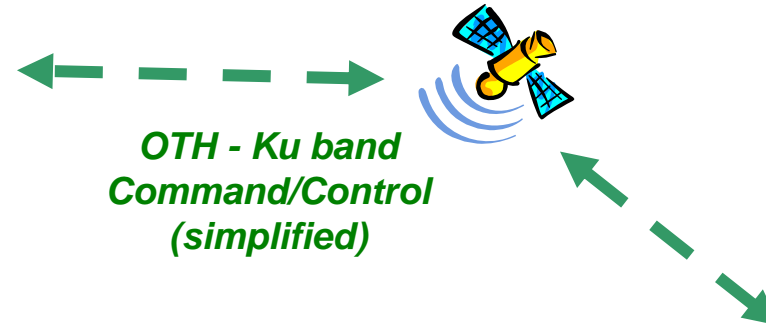


Ikhana UAS / Antennas



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Communications with Ikhana and ATC



LOS - C-band
Command/Control
(simplified)

ATC

Phone





Western States Fire Mission 2007 Partners



IKHANA

Science Partners



Operational Partners





Ikhana UAS / Aircraft



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**Ikhana with the
Fire Sensor
Pod**

**NASA Ames
Fire Sensor**



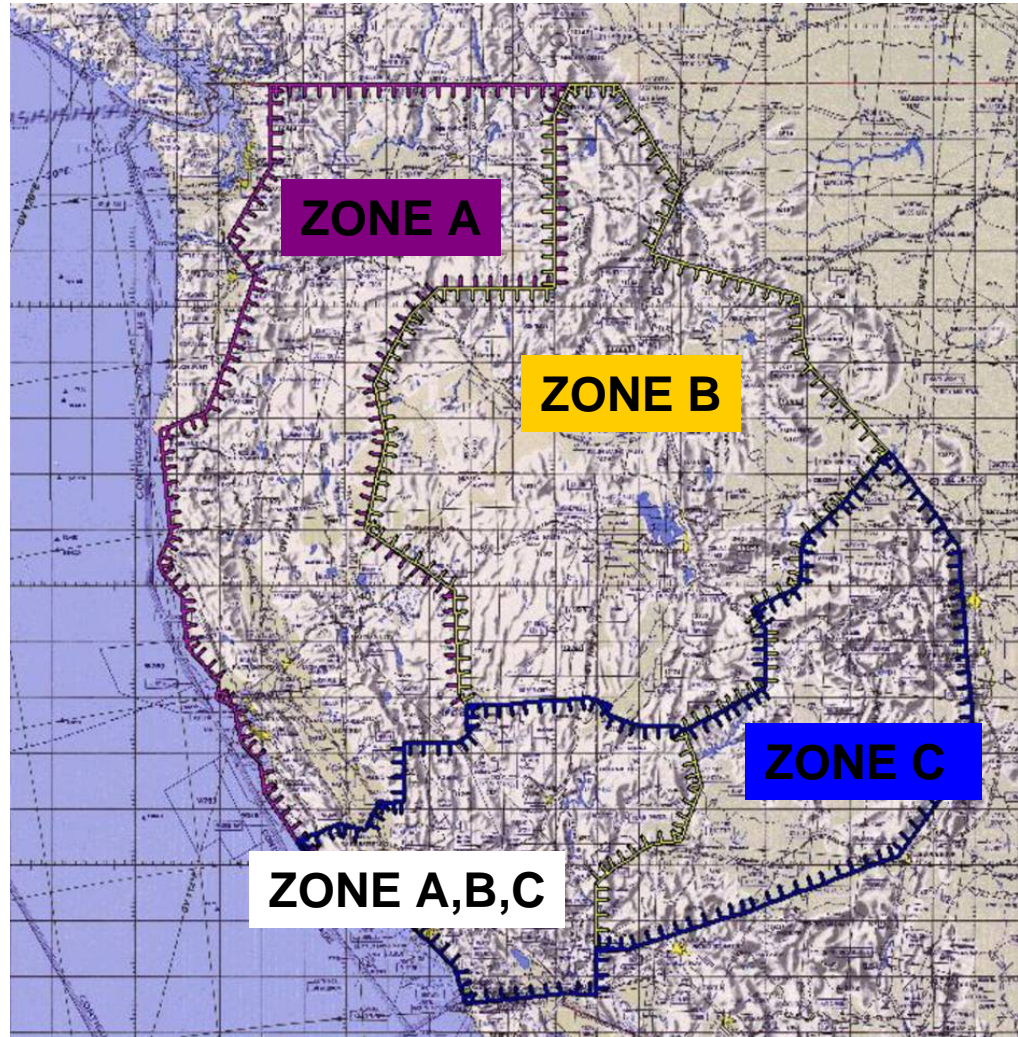


FAA Certificate of Authorization (COA)



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COA Application Boundary



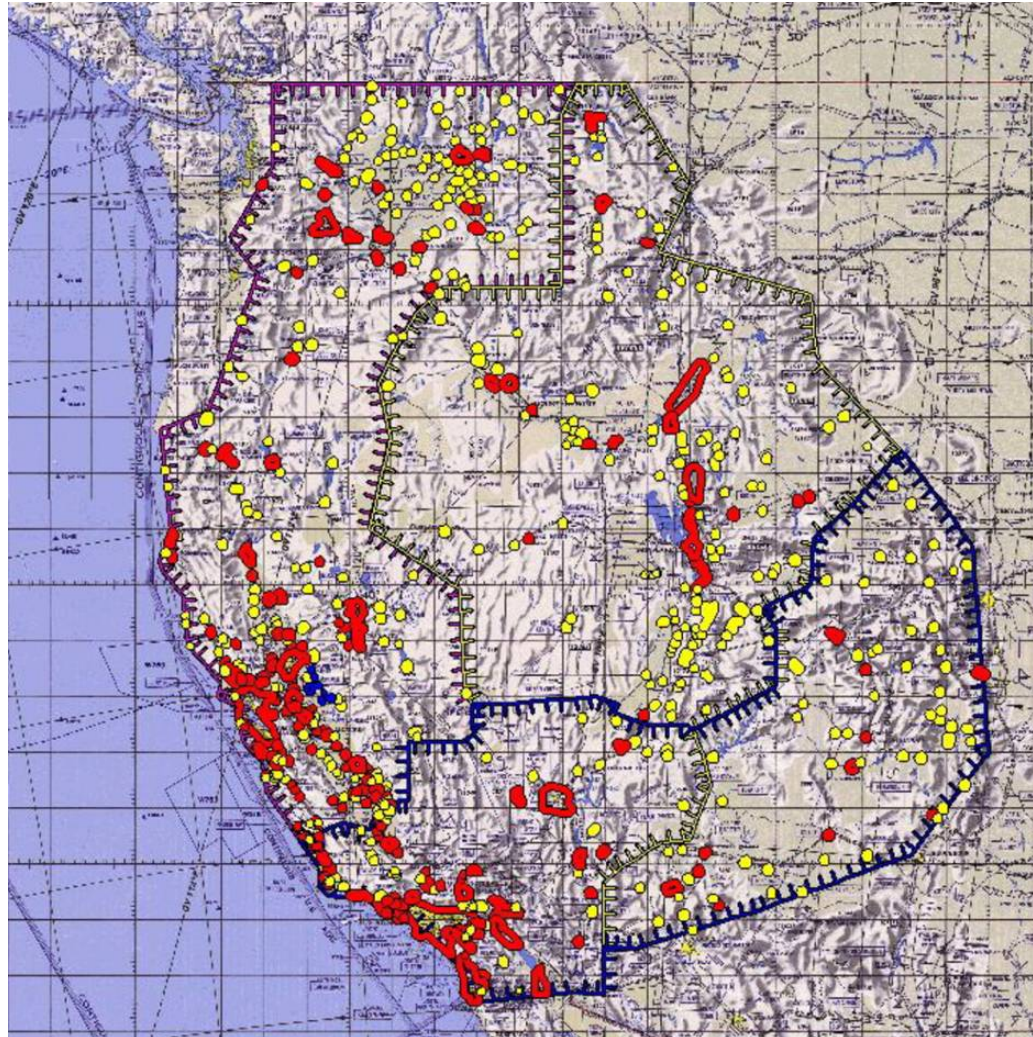


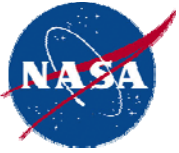
FAA Certificate of Authorization (COA)



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Population Keep-Out Zones (Pop KOZ)



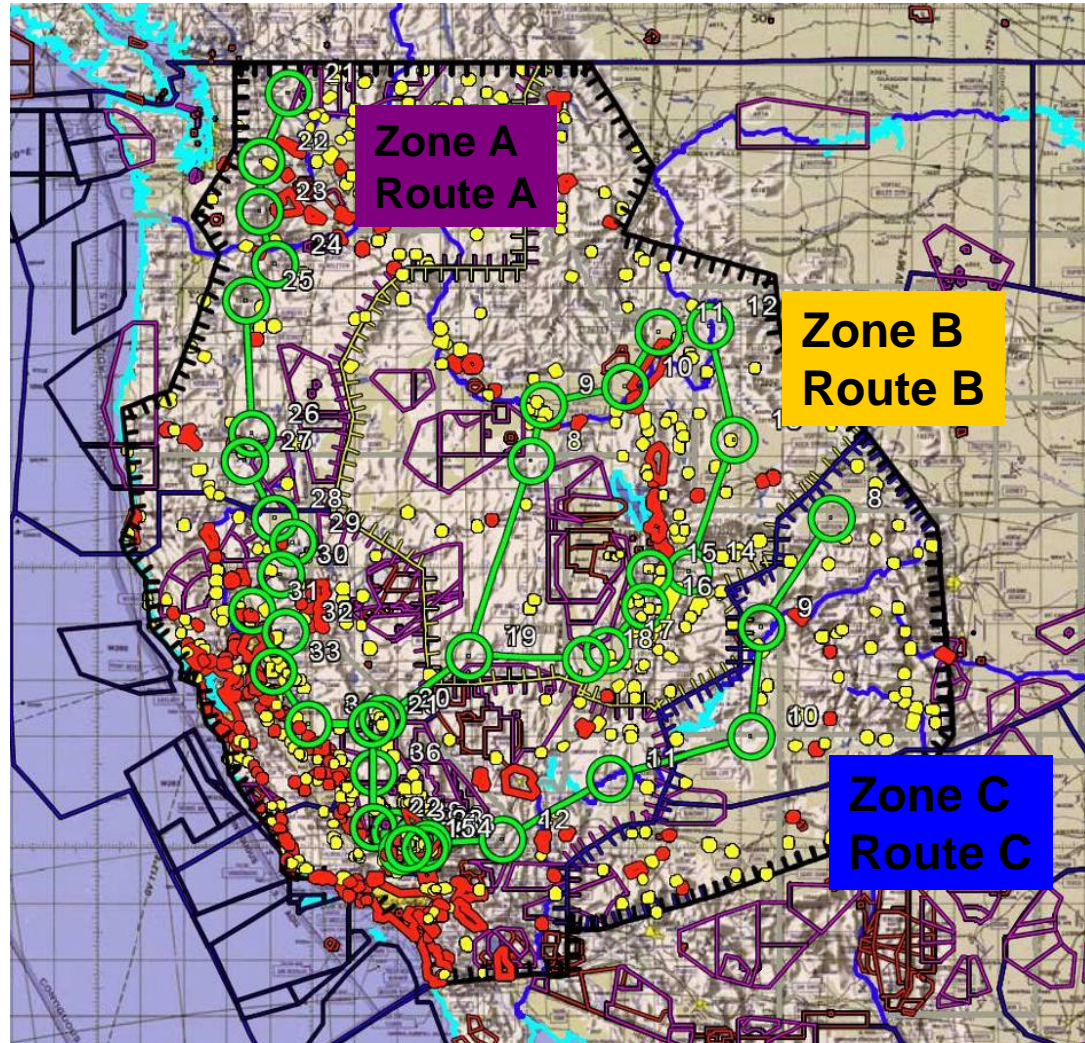


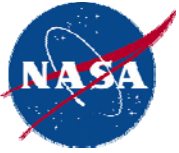
FAA Certificate of Authorization (COA)



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“Backbone” Routes



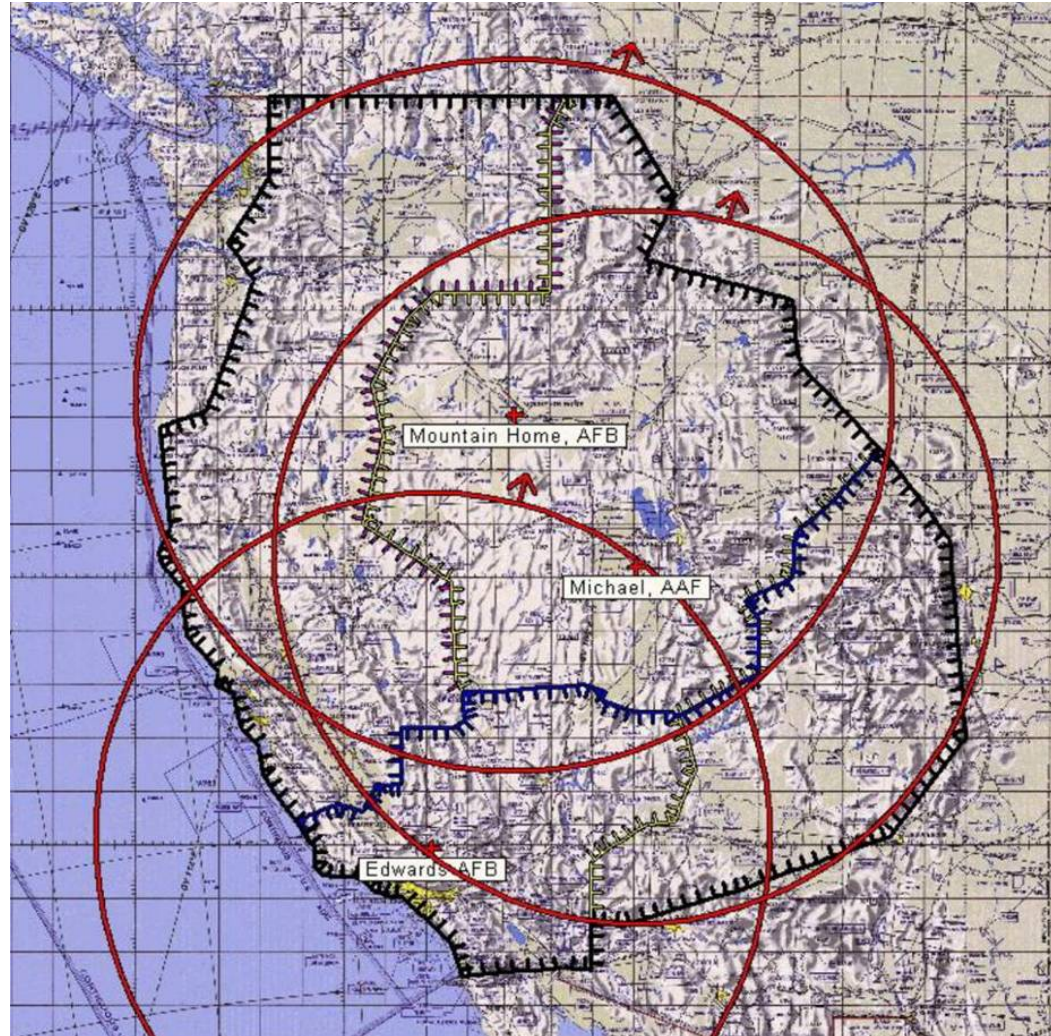


FAA Certificate of Authorization (COA)



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Contingency Planning – Primary ELSs



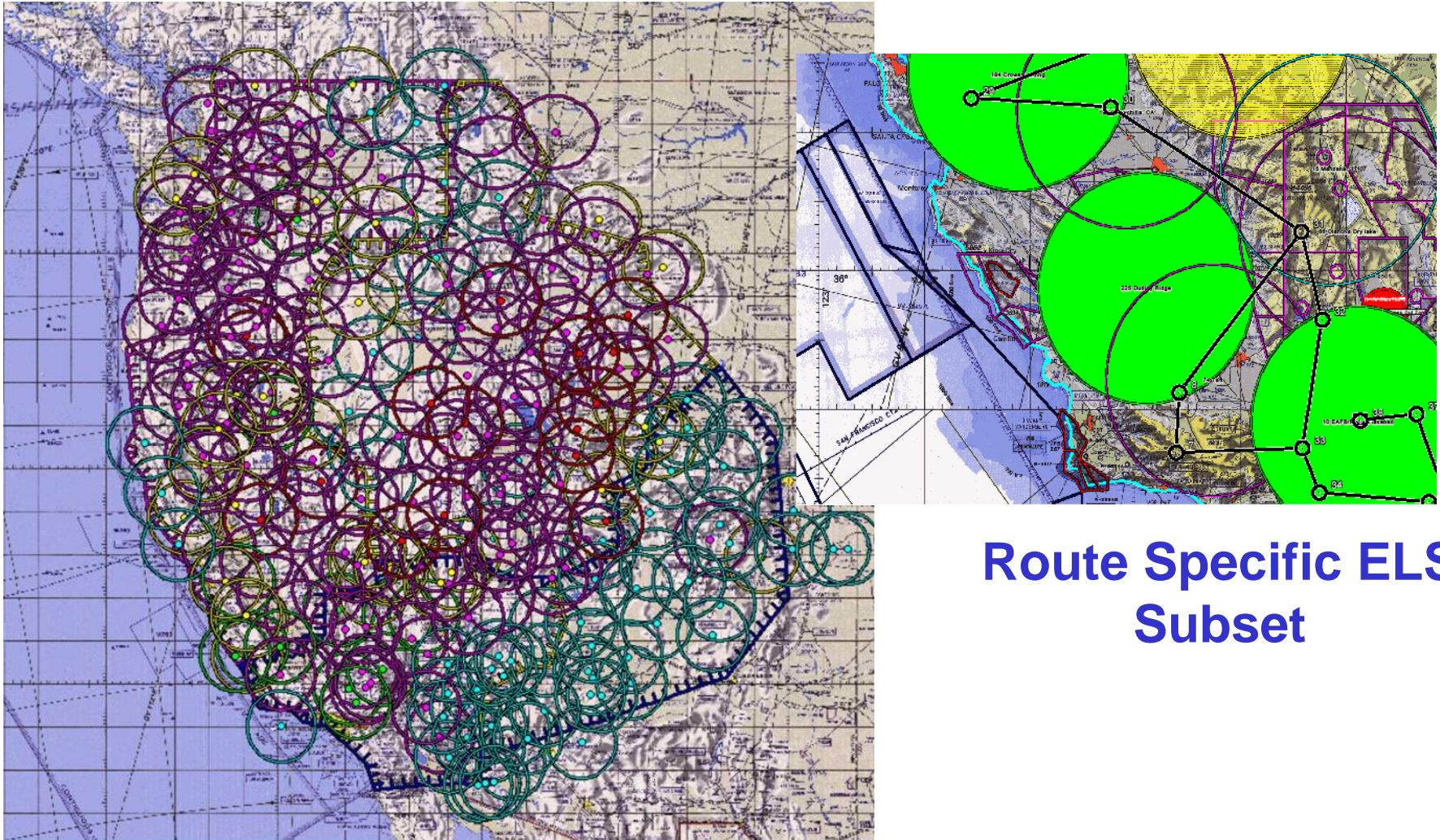


FAA Certificate of Authorization (COA)



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Contingency Planning – Secondary ELSs



**Route Specific ELS
Subset**



FAA Certificate of Authorization (COA)



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Pilot ELS Information

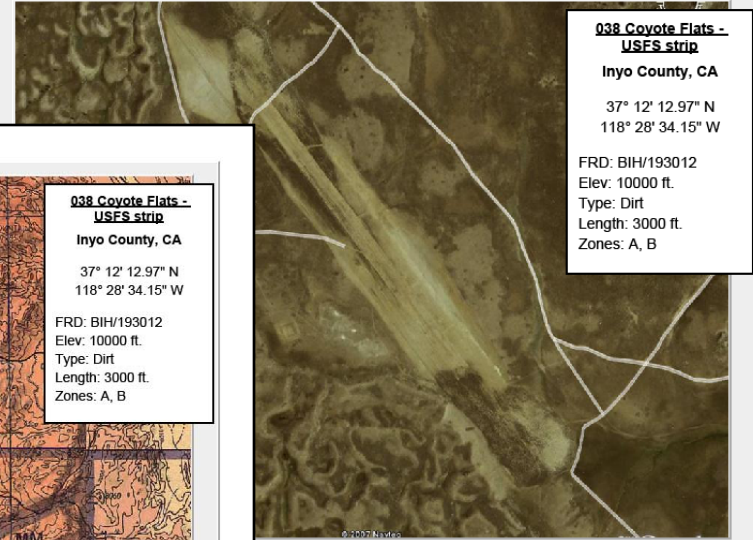
038 Coyote Flats - USFS strip

Inyo County, CA

- 37° 12' 12.97" N
- 118° 28' 34.15" W
- FRD: BIH/193012
- Zones: A, B
- Length: 3000 ft.
- Type: Dirt
- Elev: 10000 ft.
- Sectional: None
- Contact Info:
 - None
- Sheriff Info:
 - Inyo County Sheriff, Bishop
 - 12 Miles
 - Phone 760-873-7887
- WX:
 - BIH ASOS 125.25 13mi NE

Pilot Ranking: 3

Looks OK.

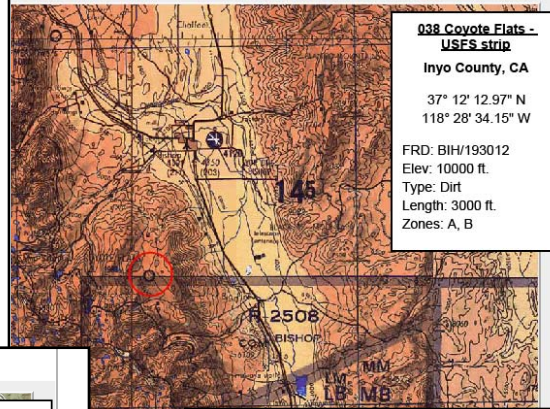


038 Coyote Flats - USFS strip

Inyo County, CA

37° 12' 12.97" N
118° 28' 34.15" W

FRD: BIH/193012
Elev: 10000 ft.
Type: Dirt
Length: 3000 ft.
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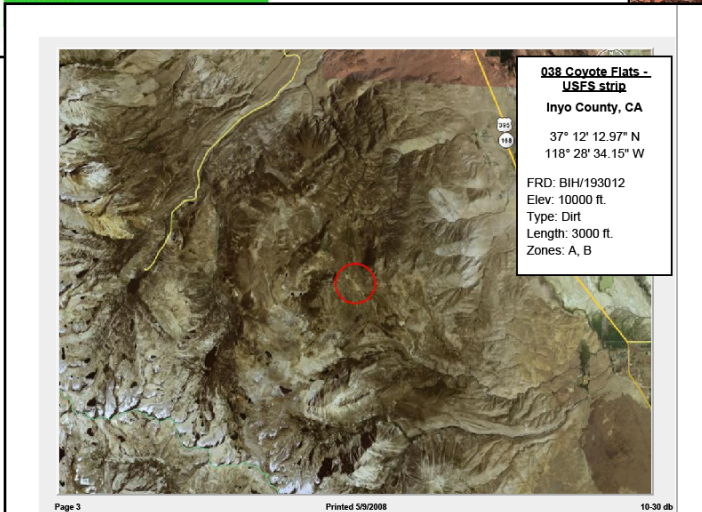


038 Coyote Flats - USFS strip

Inyo County, CA

37° 12' 12.97" N
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Elev: 10000 ft.
Type: Dirt
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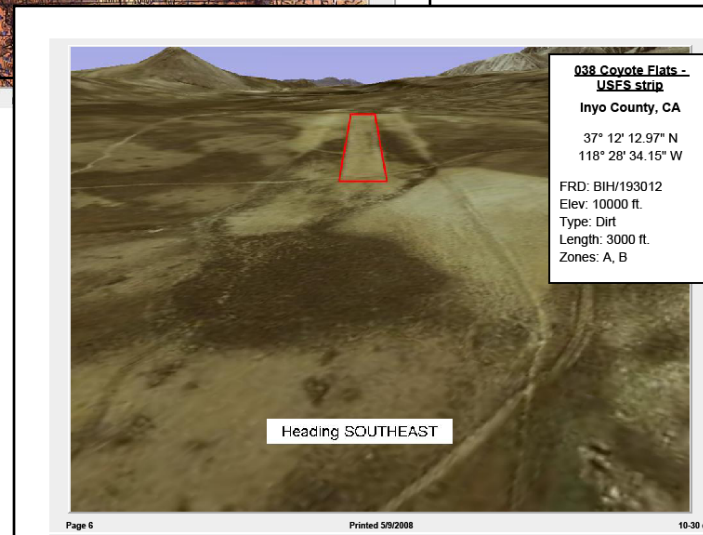


038 Coyote Flats - USFS strip

Inyo County, CA

37° 12' 12.97" N
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Type: Dirt
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038 Coyote Flats - USFS strip

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37° 12' 12.97" N
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FRD: BIH/193012
Elev: 10000 ft.
Type: Dirt
Length: 3000 ft.
Zones: A, B

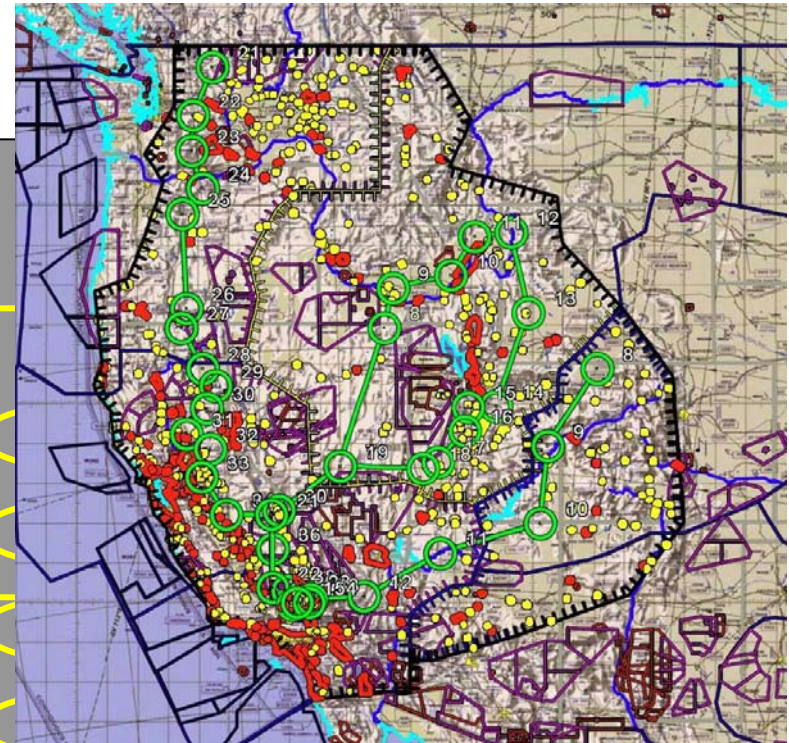
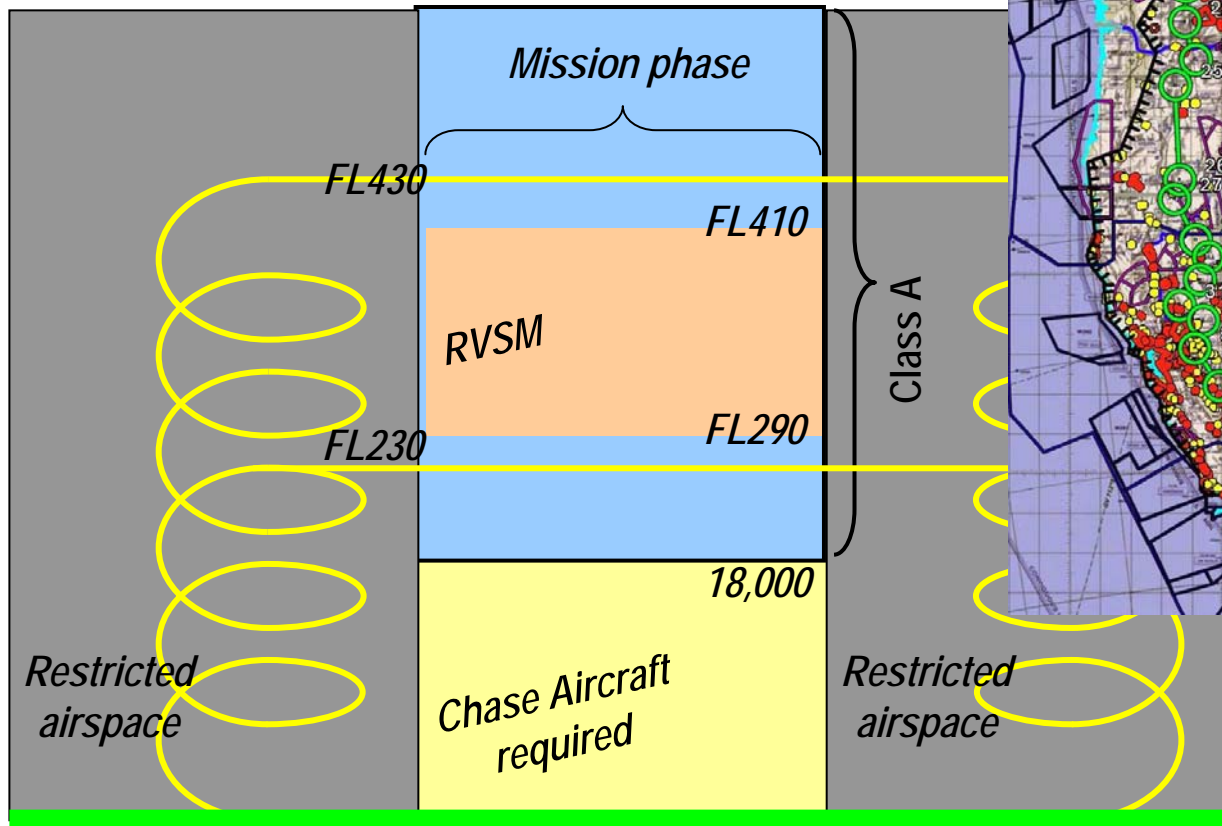


FAA Certificate of Authorization (COA)



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Mission Information



Flight Planning

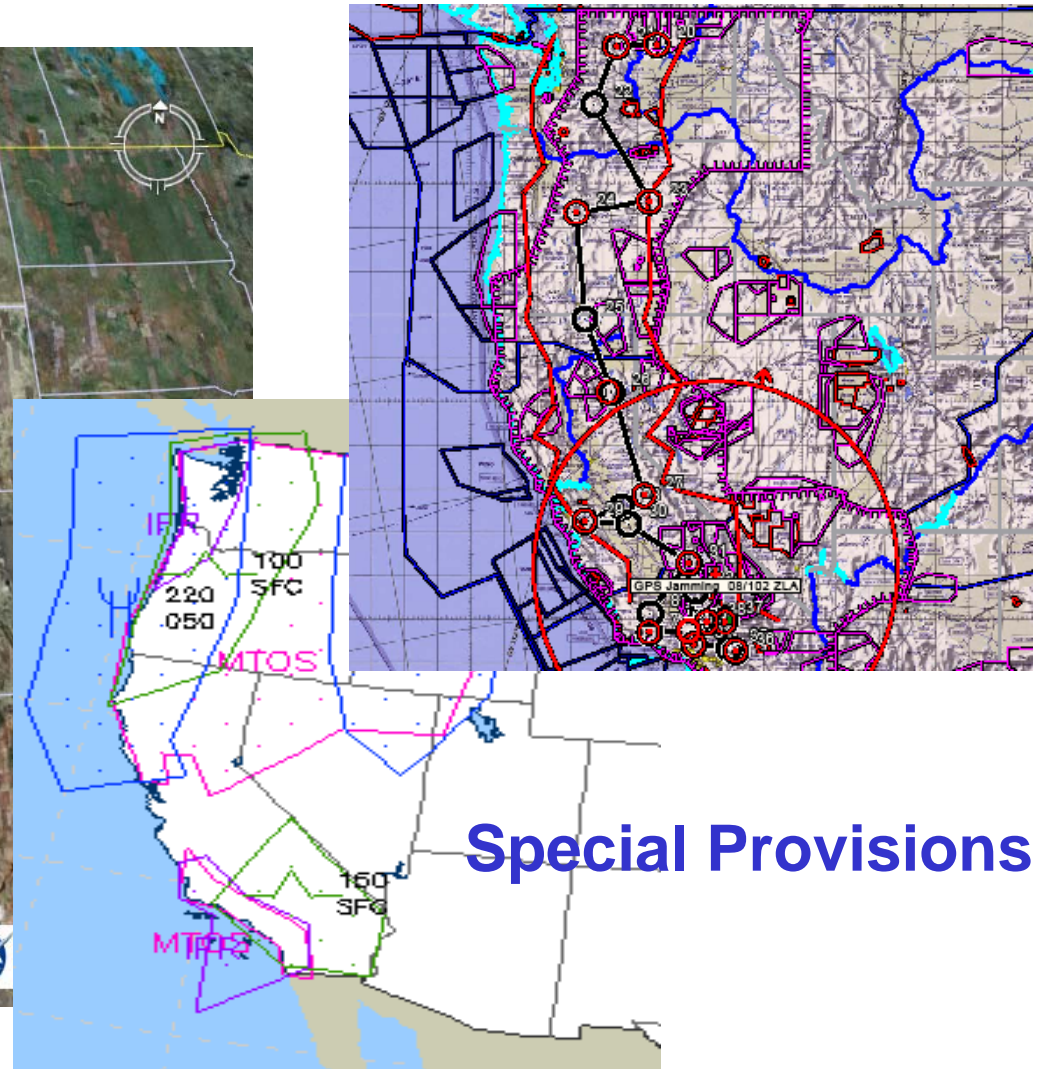
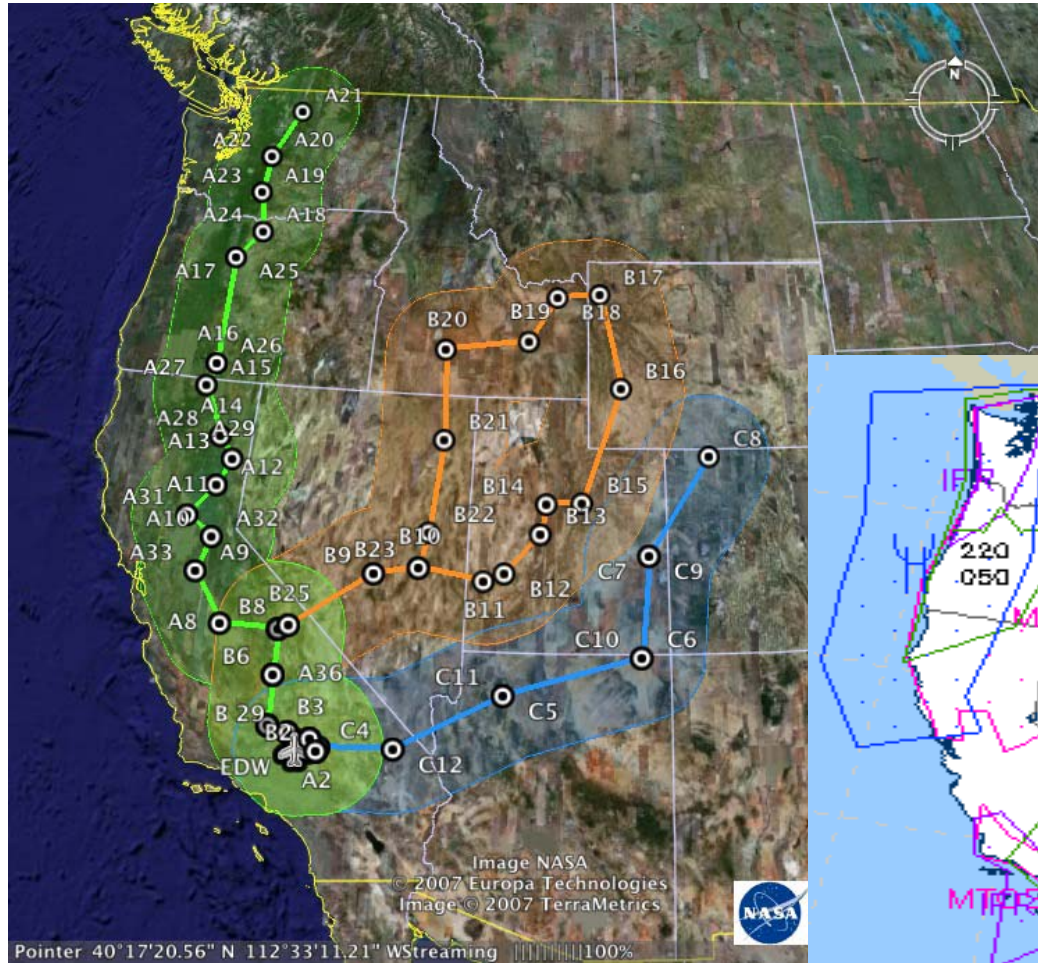


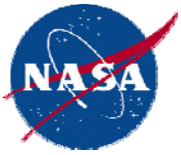
FAA Certificate of Authorization (COA)



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Approved COA Area





Western States Fire Missions 2007



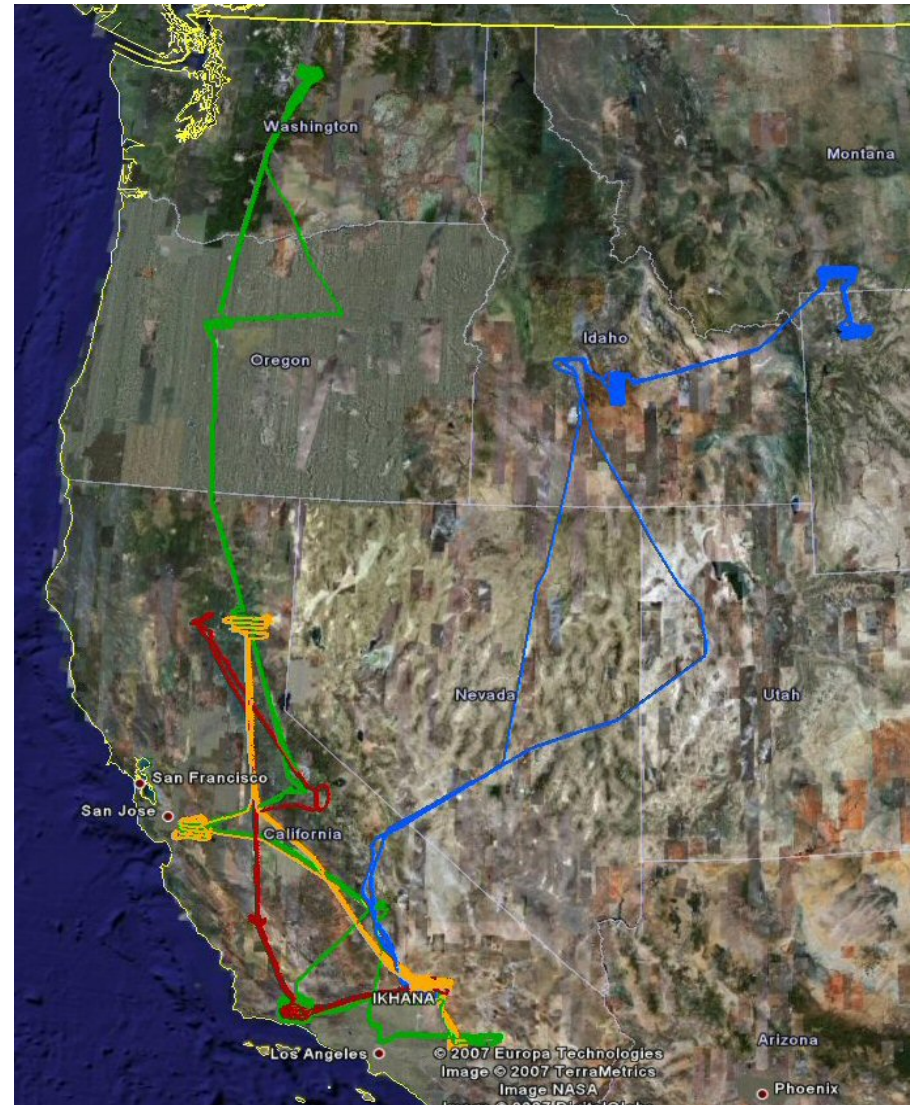
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WSFM 1 Aug. 16
4 Fires, 1400 nm, 9.5 hrs

WSFM 2 Aug. 29 – 30
7 Fires, 2500 nm, 16.1 hrs

WSFM 3 Sept. 7 – 8
12 Fires, 3200 nm, 20.0 hrs

WSFM 4 Sept. 27
BAER, 3 Fires, 1800 nm,
9.9 hrs



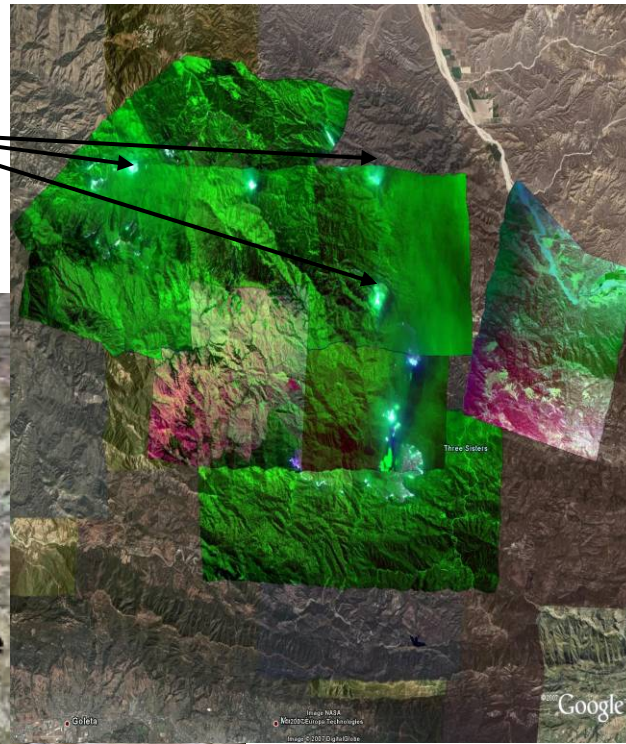


WSFM #1 2007



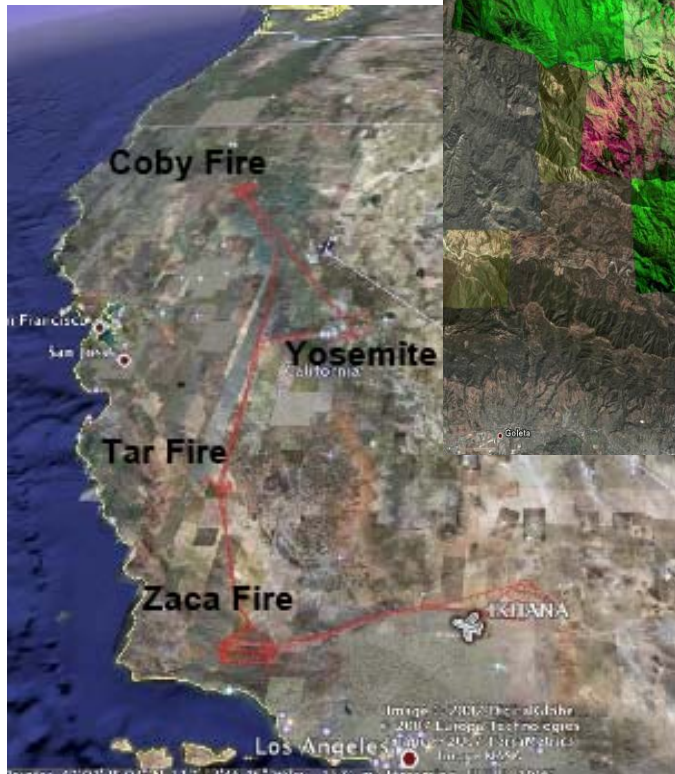
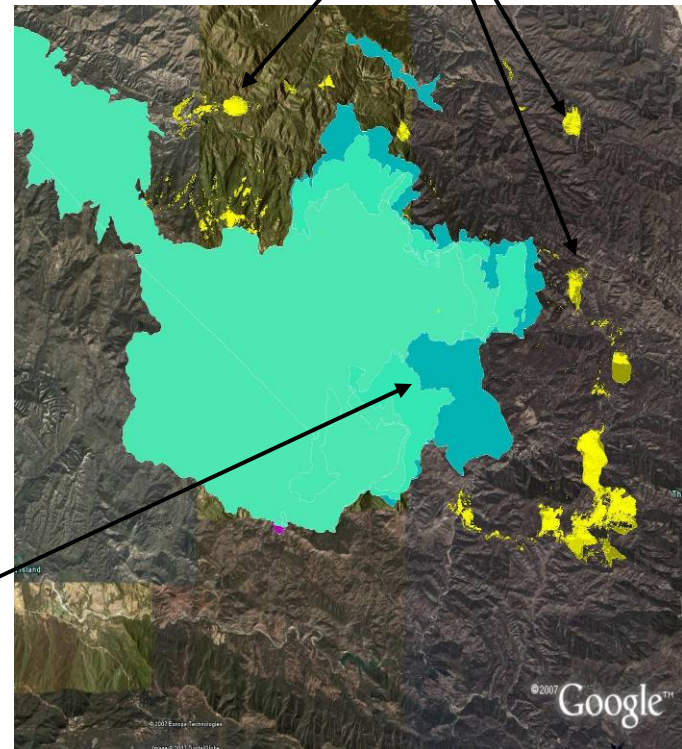
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Active Fire



Zaca Fire Images

Unknown Fire



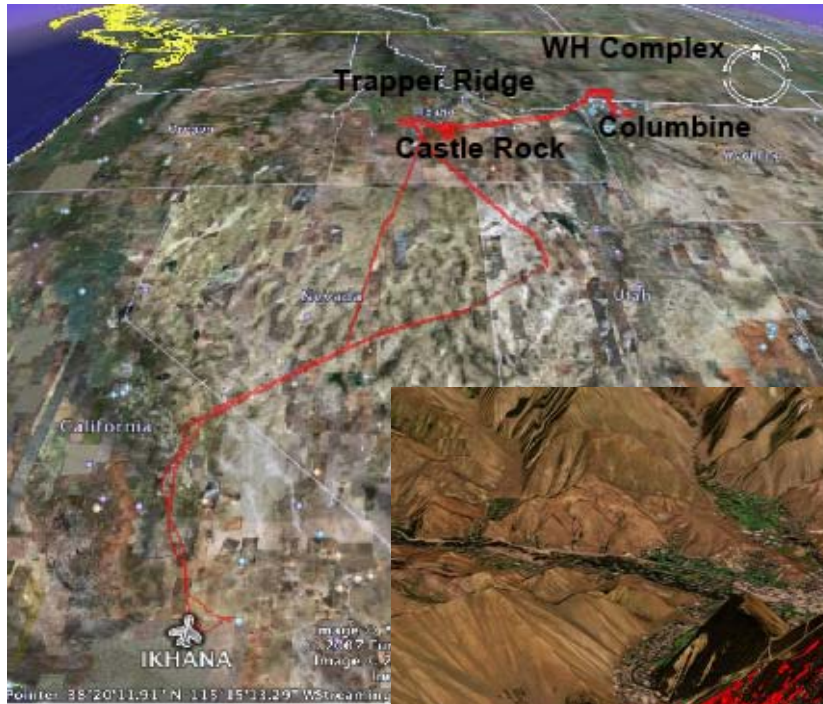
Changing Fire Perimeter



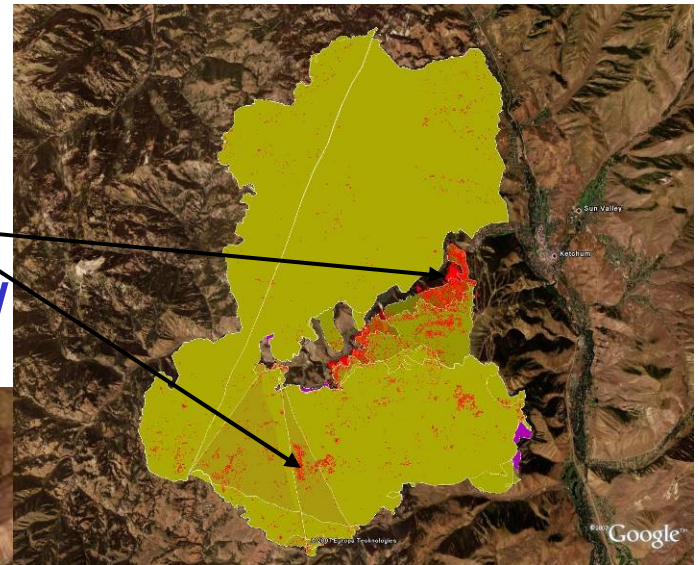
WSFM #2 2007



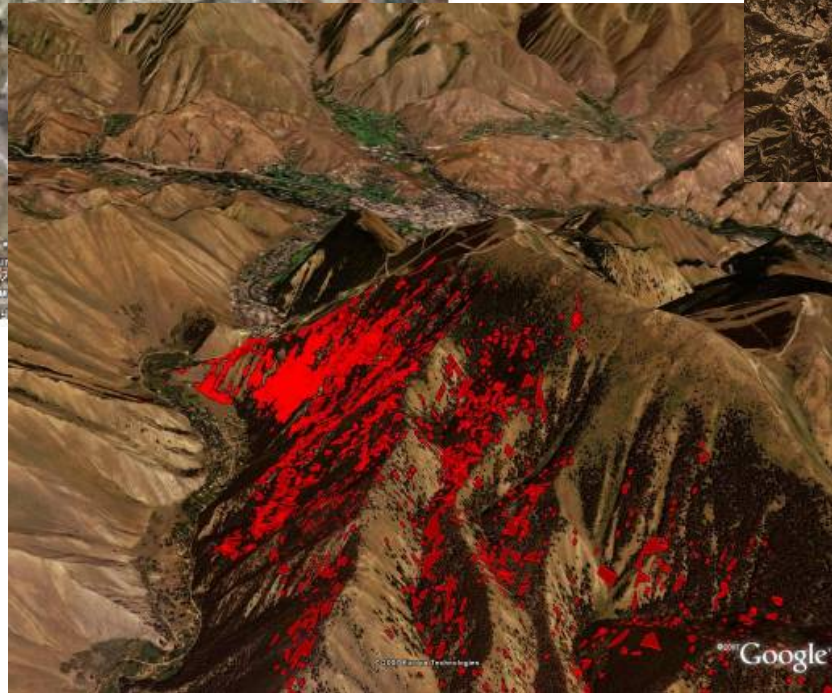
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New Detects from Overhead



3-D View



Castle Rock Fire Imagery

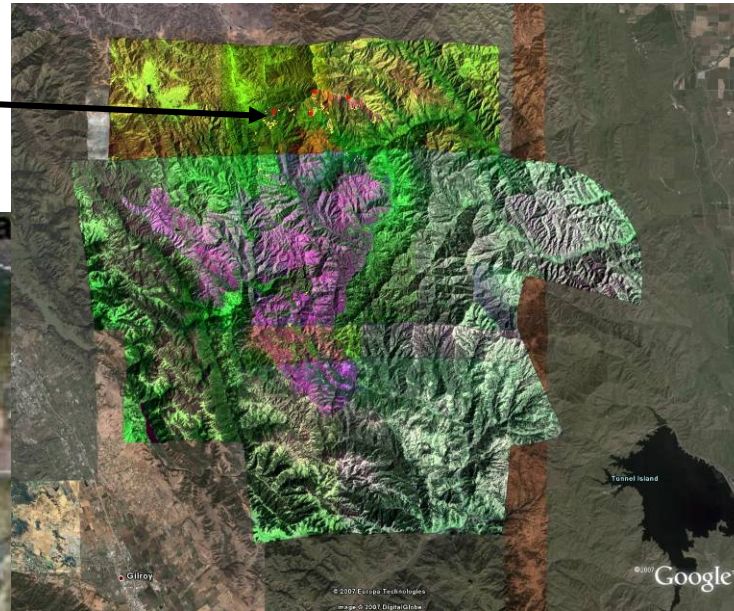


WSFM #3 2007



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*Infrared Imagery
(hot spot)*



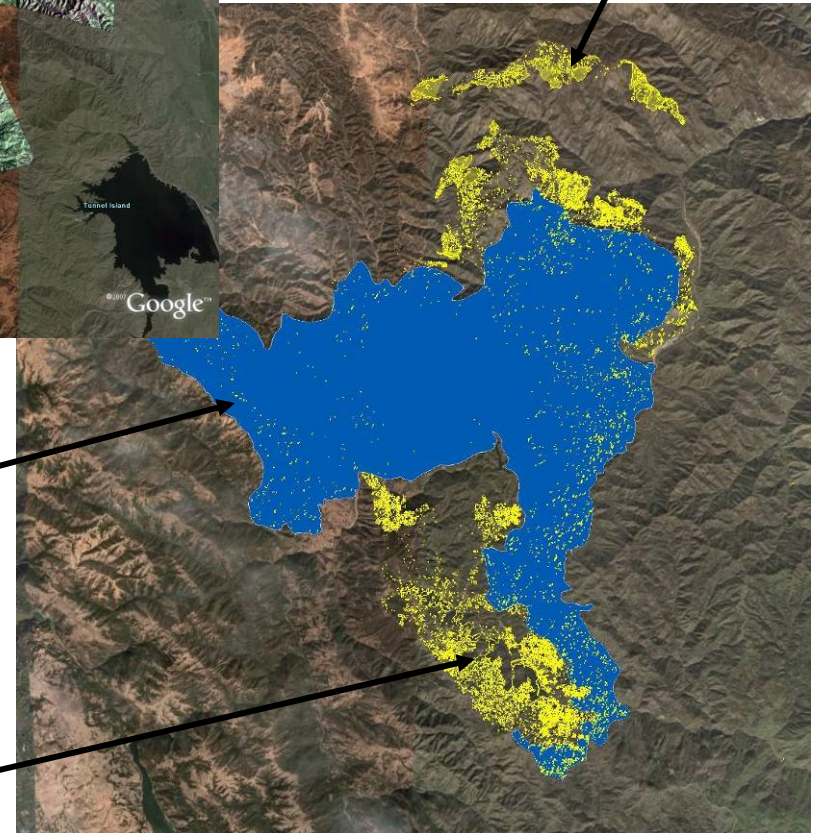
Lick Fire Imagery

Back-Fire



*Previously
known fire
perimeter*

Active fire

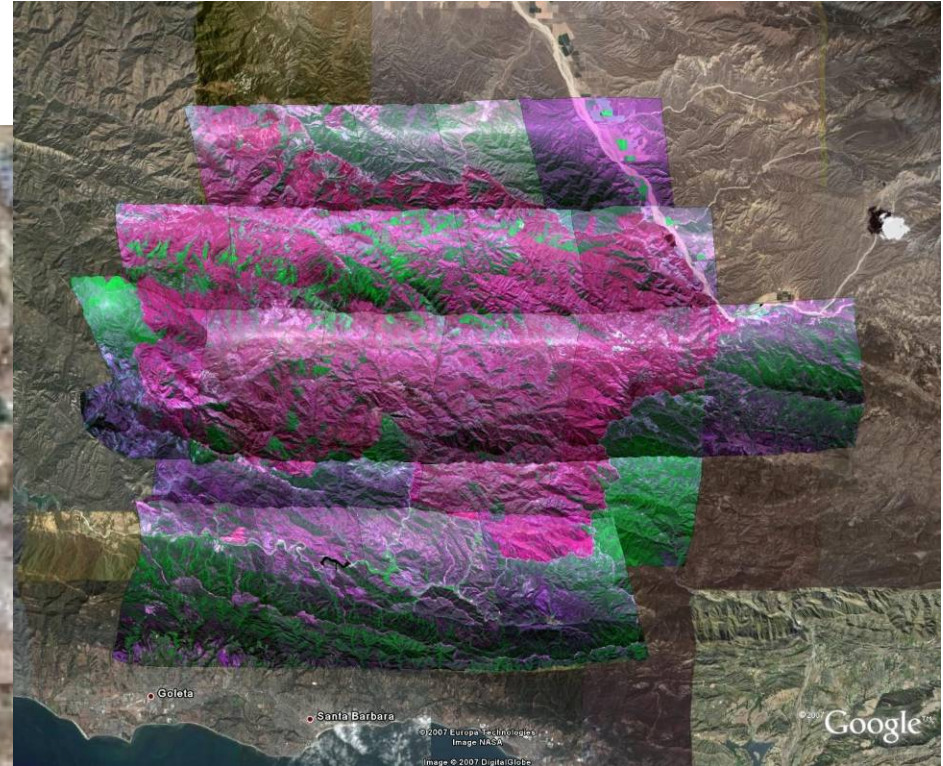
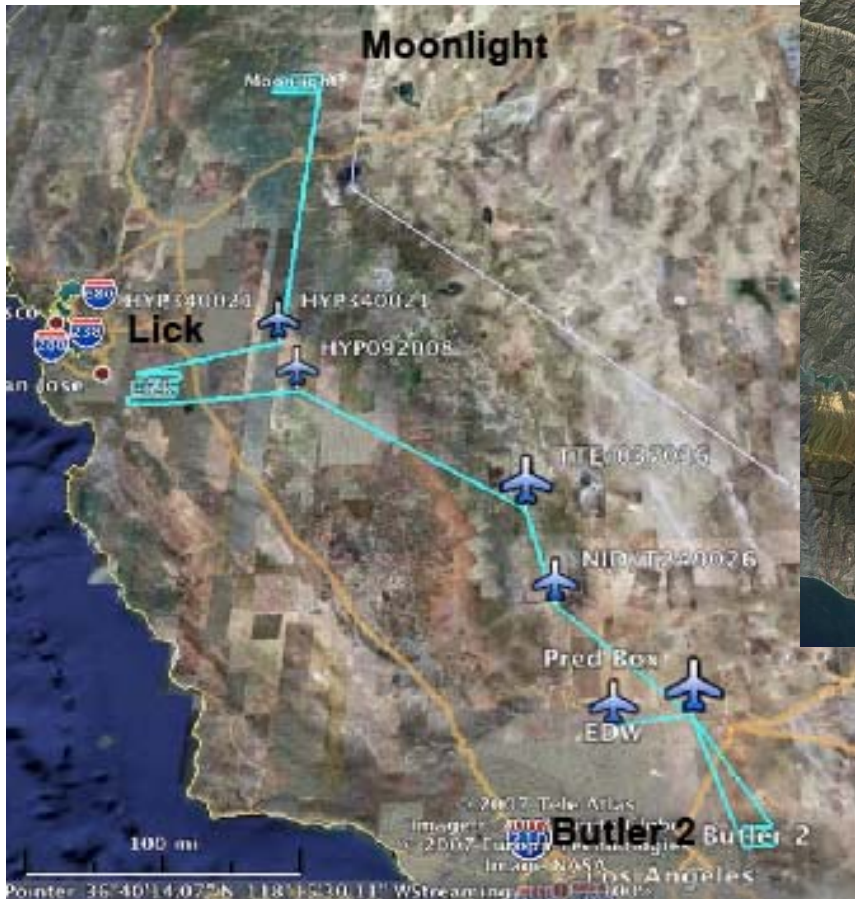




WSFM #4 2007



IKHANA



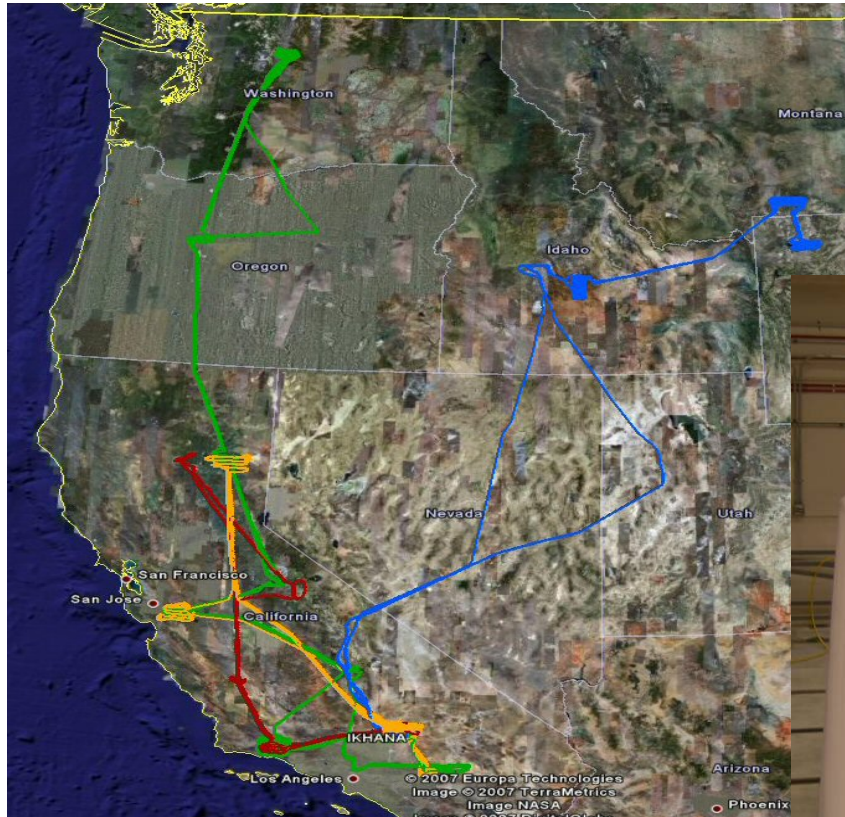
Burn Area Emergency Rehabilitation and Stabilization (BAER) Assessment Imagery



California Wildfire Emergency Response 2007

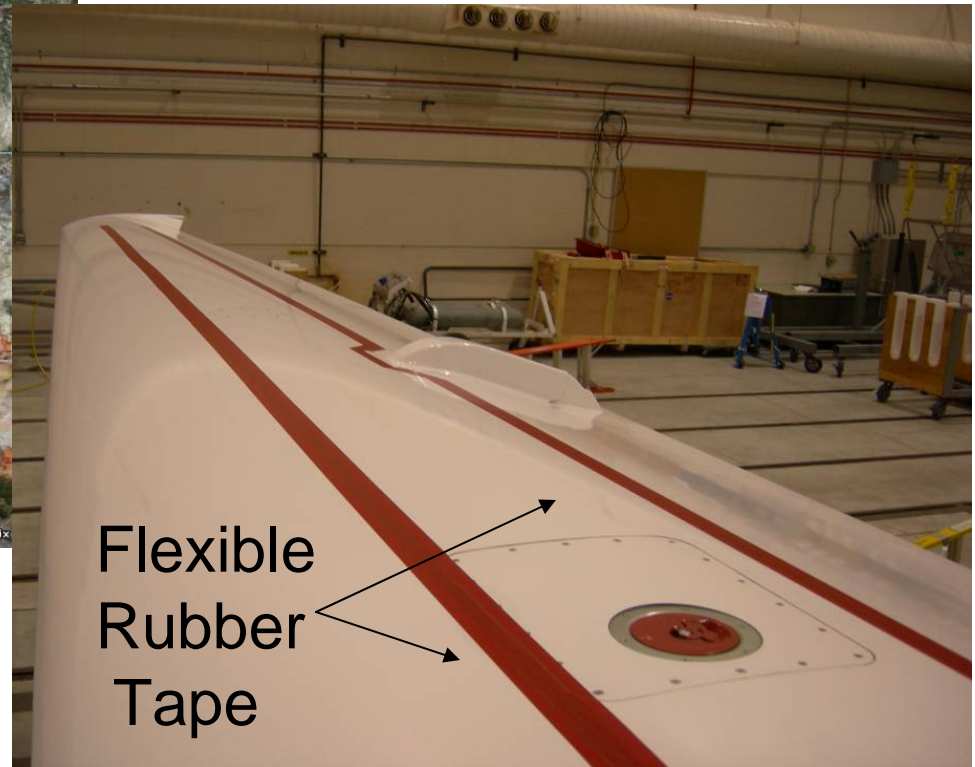


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**WSFM 2007
Objectives
Accomplished**

**New Research
Configuration**





California Wildfire Emergency Response 2007



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WSFM 5

Oct. 24, 11 Fires,
~1350 nm, 9.0 hrs

WSFM 6

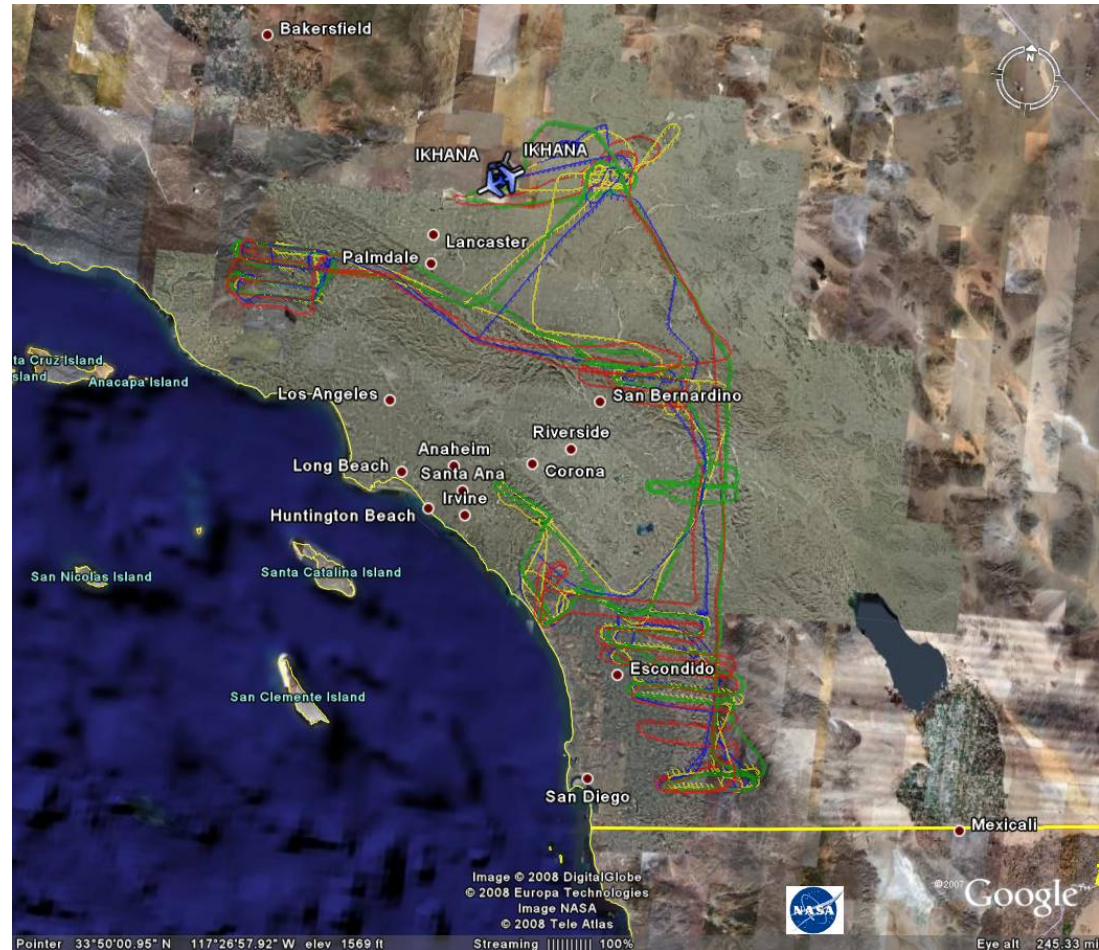
Oct. 25, 8 Fires,
~1350 nm, 7.8 hrs

WSFM 7

Oct. 26, 8 Fires,
~1350 nm, 7.8 hrs

WSFM 8

Oct. 28, 8 Fires,
~1350 nm, 7.1 hrs

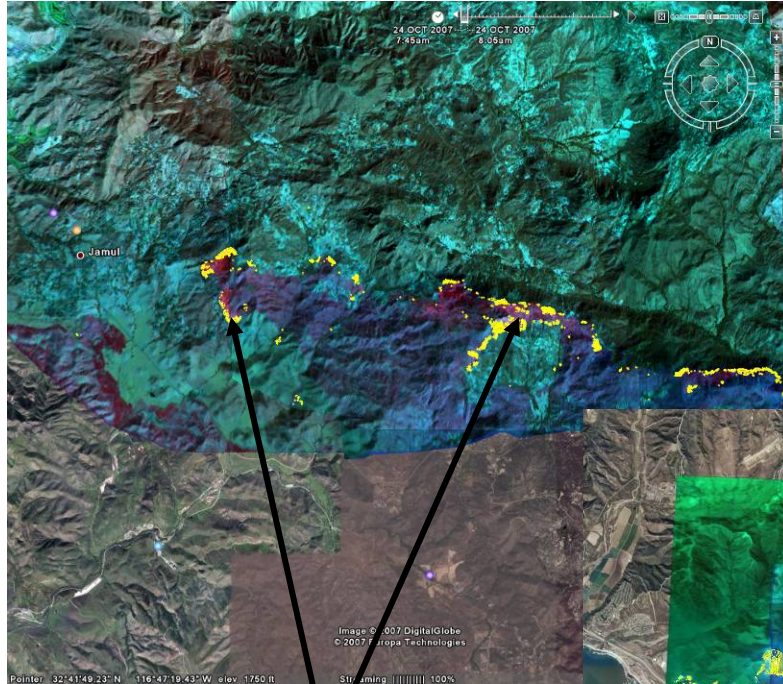




WSFM #5 Emergency Response 2007



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*Harris Fire
Hot Detects*



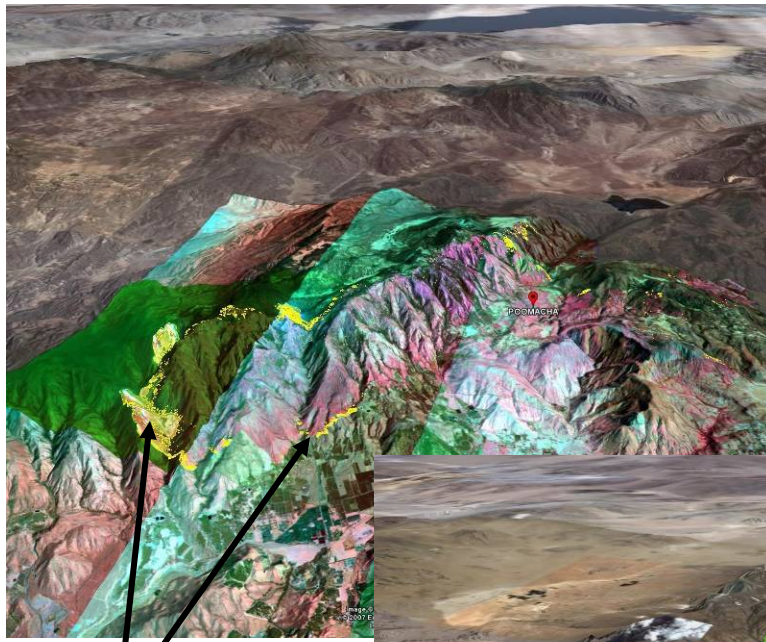
*Ammo Fire
Hot Detects*



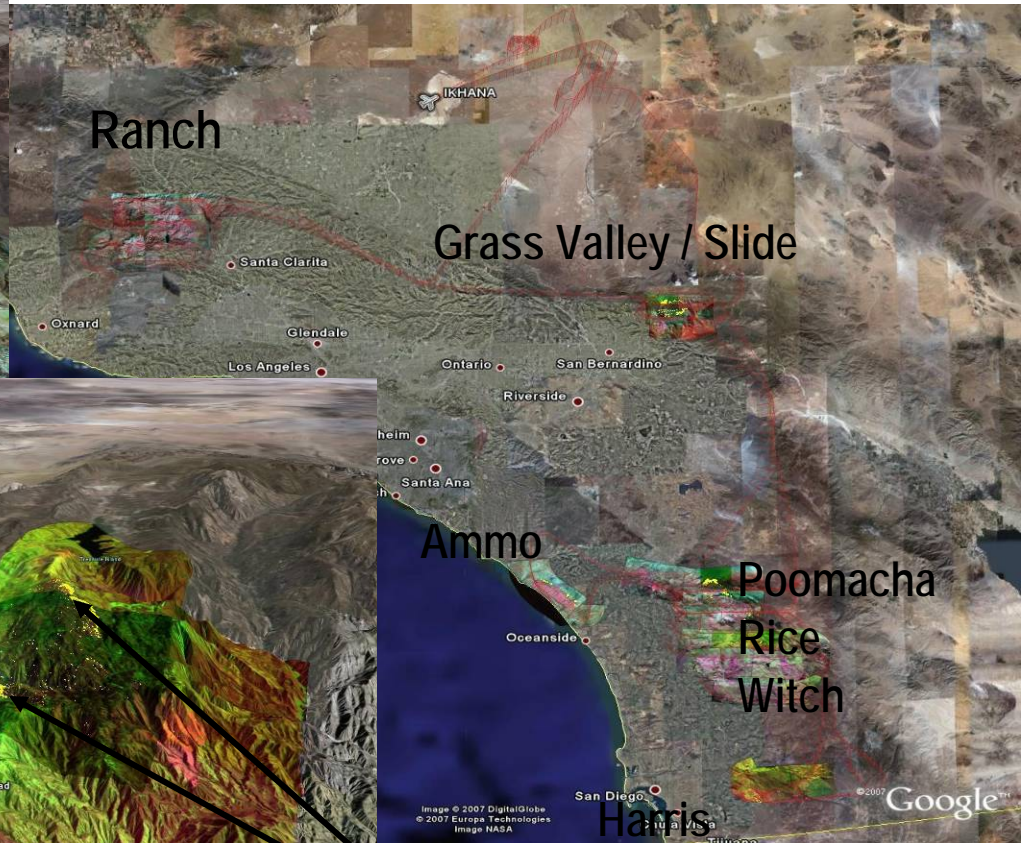
WSFM #6 Emergency Response 2007



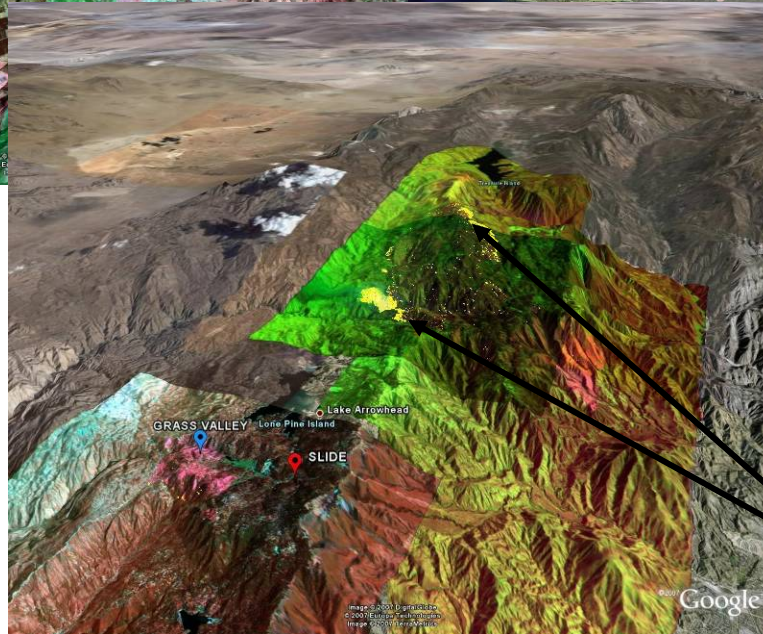
IKHANA



Poomacha /
Rice Fires –
3D with Hot
Detects



Grass Valley / Slide Fires –
3D with Hot Detects



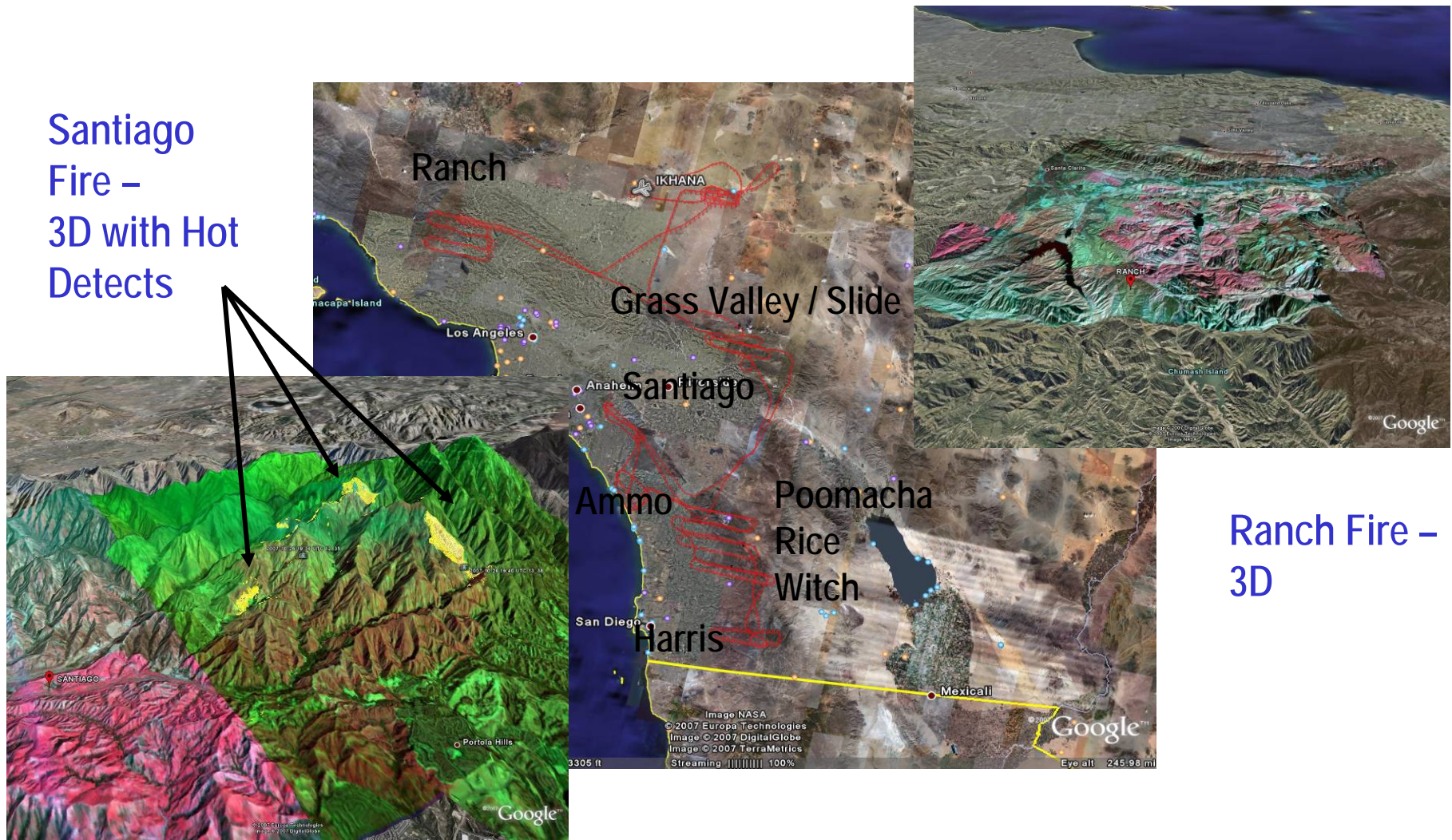


WSFM #7 Emergency Response 2007



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Santiago Fire – 3D with Hot Detects



Ranch Fire – 3D



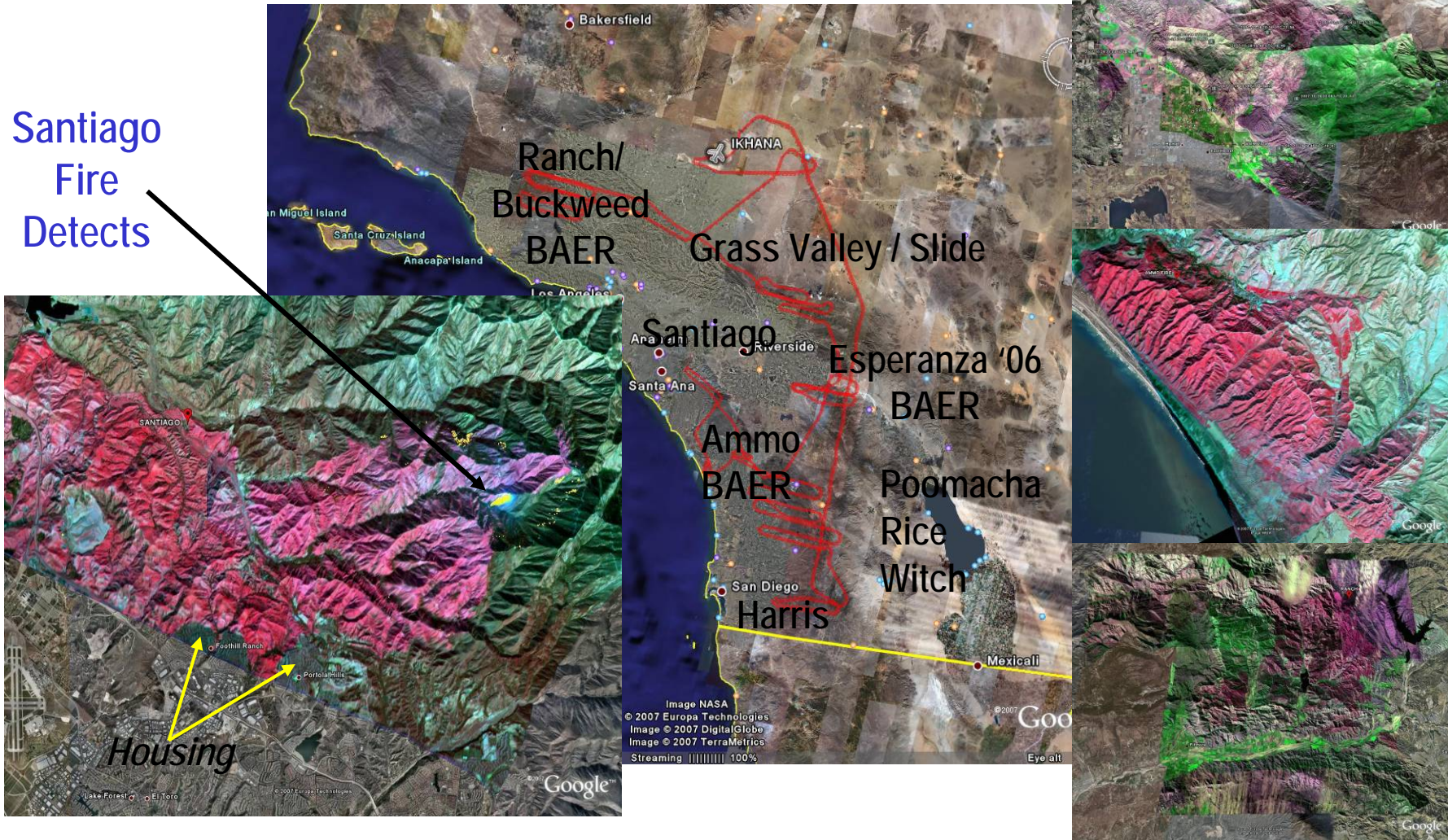
WSFM #8 Emergency Response 2007



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Ranch, Ammo and Esperanza BAER

Santiago
Fire
Detects

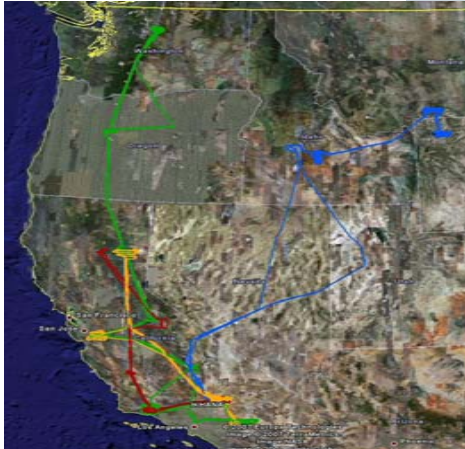




WSFM Achievements



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	Flight Date	Flight Duration	Fires Flown	Mileage NM
WSFM 1	16 Aug	9.5 hrs	4	1400
WSFM 2	29 Aug	16.1	5	2500
WSFM 3	7 Sept	20	11	3200
WSFM 4	27 Sept	9.9	4	1800
WSFM 5	24 Oct	9	9	~1350
WSFM 6	25 Oct	8.7	8	~1350
WSFM 7	26 Oct	7.8	8	~1350
WSFM 8	28 Oct	7.1	11	~1350

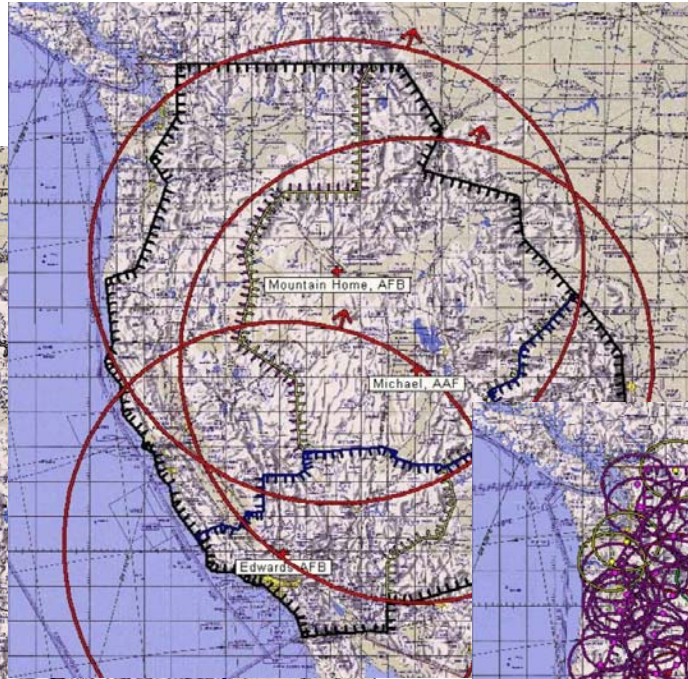
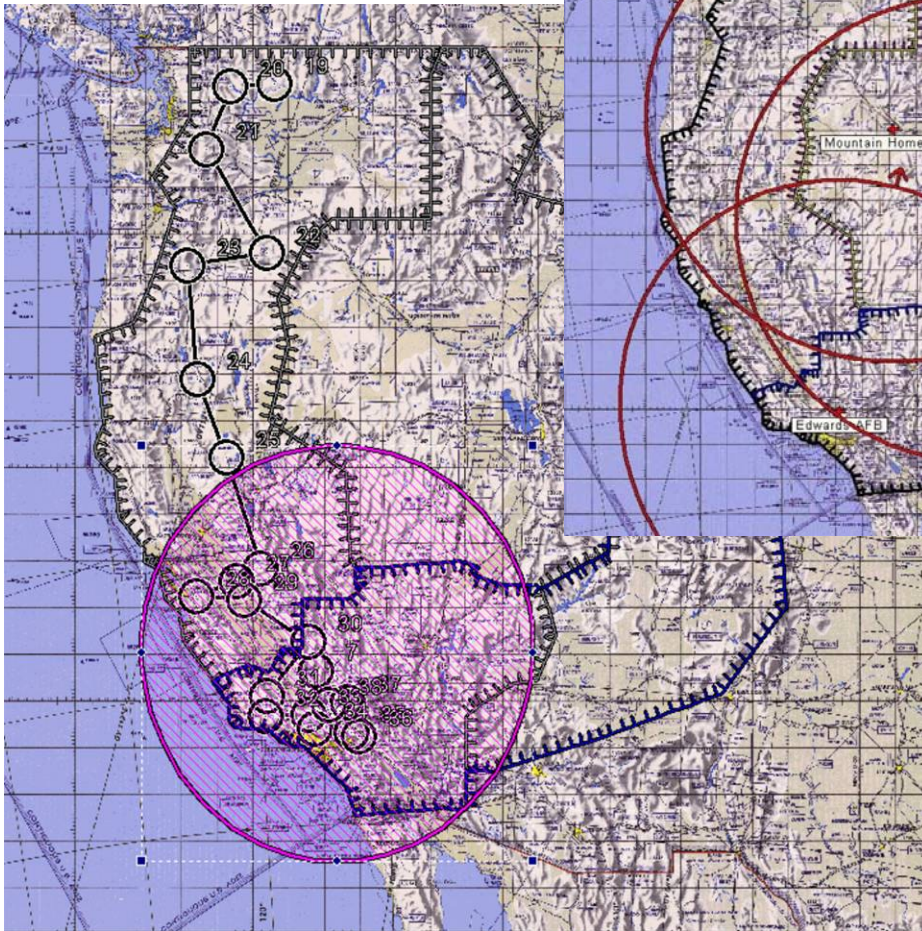


WSFM Challenges

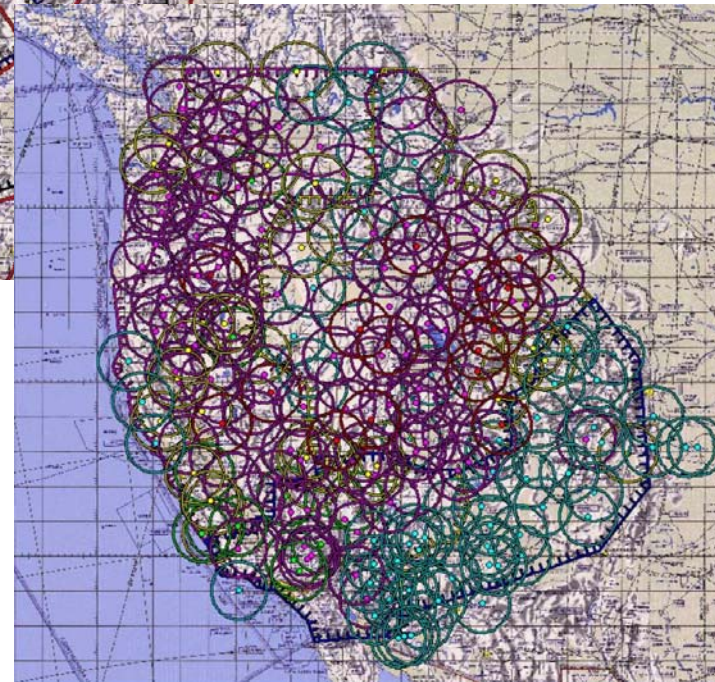


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Operational



Planning





WSFM Conclusions and Kudos



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