

NIROPS Closeout: NASA Perspective

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NASA

830

Boise, ID

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2009 WRAP / Western States Missions

- ***Submitted Proposal to Receive Support under NASA Applied Science “Stimulus” Announcement:***
 - ***TITLE: “Sustaining and Transitioning NASA Airborne Wildfire Observation Capabilities: Disaster Monitoring Improvements for California and the Nation”***
 - **MAJOR FOCUS ELEMENTS:**
 - Emergency Fire Mission Continuity Support through FY2011;
 - Mature collaboration with CalFire to foster technology transfer and adaptability.
 - **PROPOSAL DURATION:** July 09-Sept. 2011 (2 years).
 - **BUDGET:** \$1.3M
 - **DISPOSITION:** Funded.
- **Additional “Stimulus” Support to NASA Airborne Sciences:**
 - Develop NASA DFRC B-200 KA as a sensor platform.
 - Integrate Inmarsat Com package on B-200 KA.

2010 Mission Platforms



Ikhana UAS

Operations: ~50K ft; >4000 nm

Endurance: ~24-hours

Speed: 170-200 kts

Payload: 2400 lbs of instruments

C&C and sensor telemetry: C-band (local) & Ku-band (global)

COA Issues

King Air B-200

Operations: ~32K ft; 1883 nm

Endurance: ~4.0 hours

Speed: 250 kts

Onboard Operators: 4 (inc. flt team)

Payload: 2000 lbs of instruments

Sensor telemetry: Inmarsat (planned)



Sensor System: AMS Wildfire Instrument

AMS Wildfire Sensor

<u>Band</u>	<u>Wavelength μm</u>
1	0.42 - 0.45
2	0.45 - 0.52 (TM1)
3	0.52 - 0.60 (TM2)
4	0.60 - 0.62
5	0.63 - 0.69 (TM3)
6	0.69 - 0.75
7	0.76 - 0.90 (TM4)
8	0.91 - 1.05
9	1.55 - 1.75 (TM5) (high gain)
10	2.08 - 2.35 (TM7) (high gain)
11	3.60 - 3.79 (VIIRS M12) (high gain)
12	10.26 - 11.26 (VIIRS M15) (high gain)
13	1.55 - 1.75 (TM5) (low gain)
14	2.08 - 2.35 (TM7) (low gain)
15	3.60 - 3.79 (VIIRS M12) (low gain)
16	10.26 - 11.26 (VIIRS M15) (low gain)

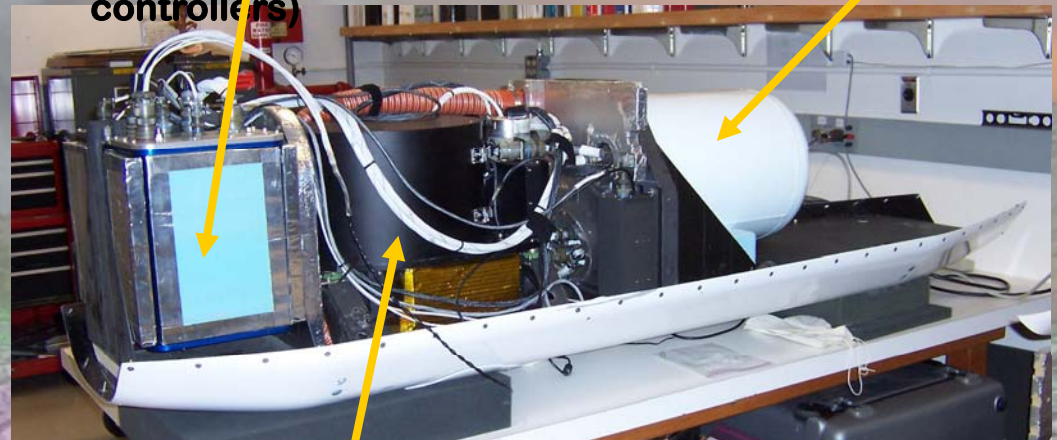
Total Field of View: 42.5 or 85.9 degrees
(selectable)

IFOV: 1.25 mrad or 2.5mrad (“)

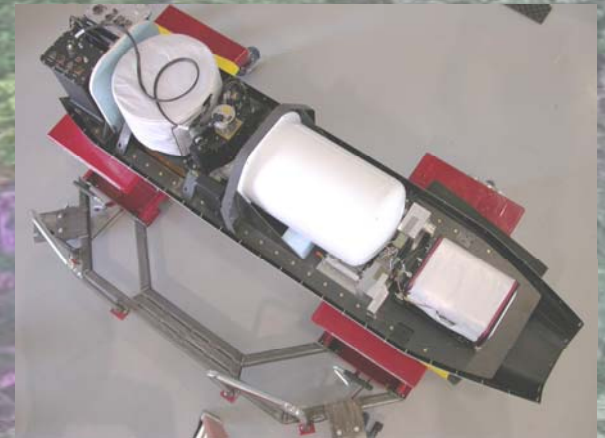
Spatial Resolution: 3 – 50 meters (variable)

Two environmental enclosures (data disks & GPS; and power supplies & controllers)

Data System Enclosure

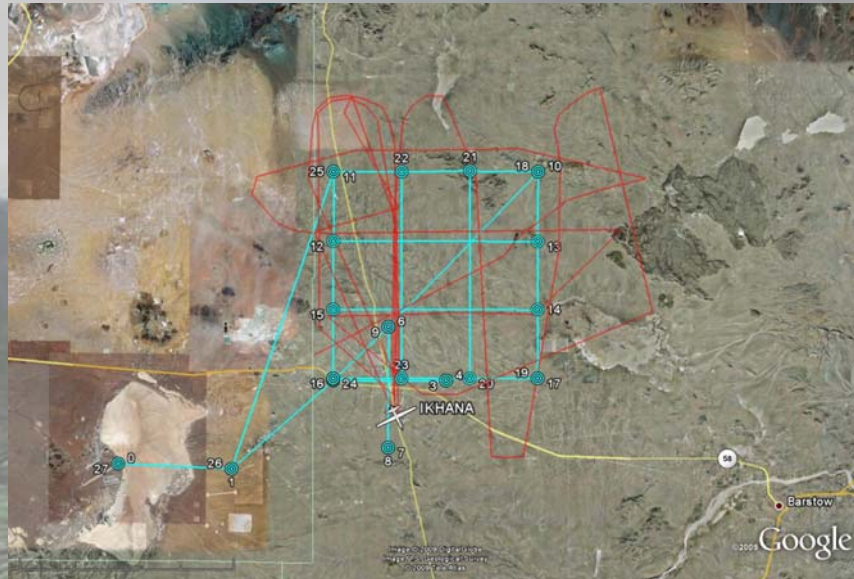


Scan Head



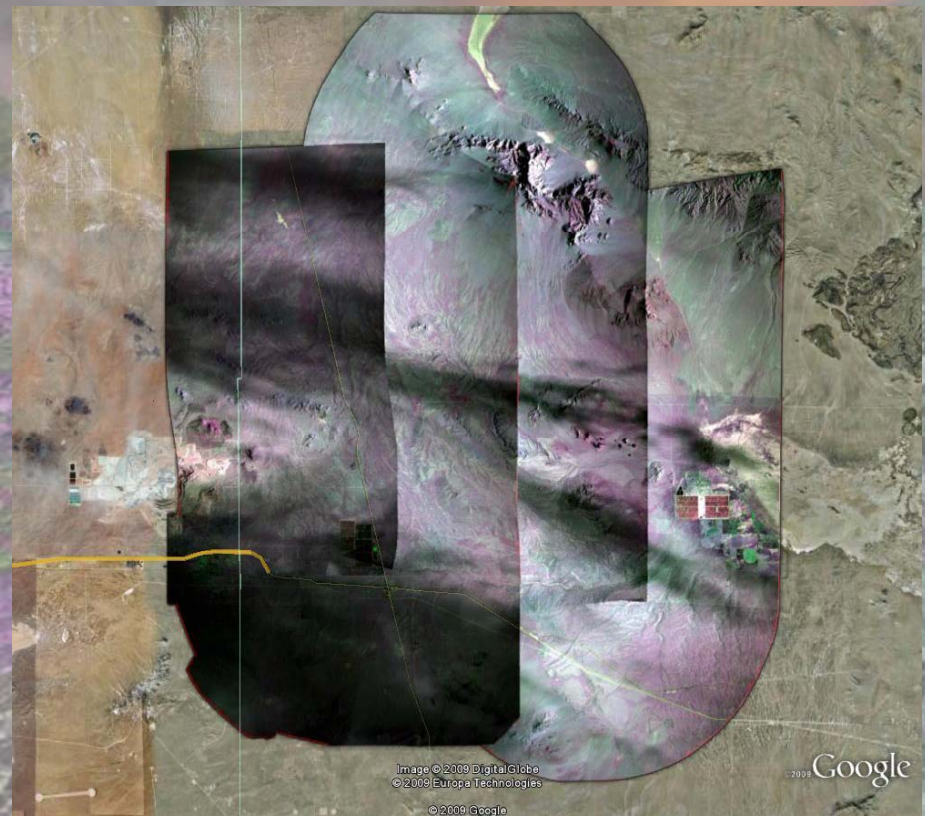
2009 Mission Series: Test Flight

11 September 2009

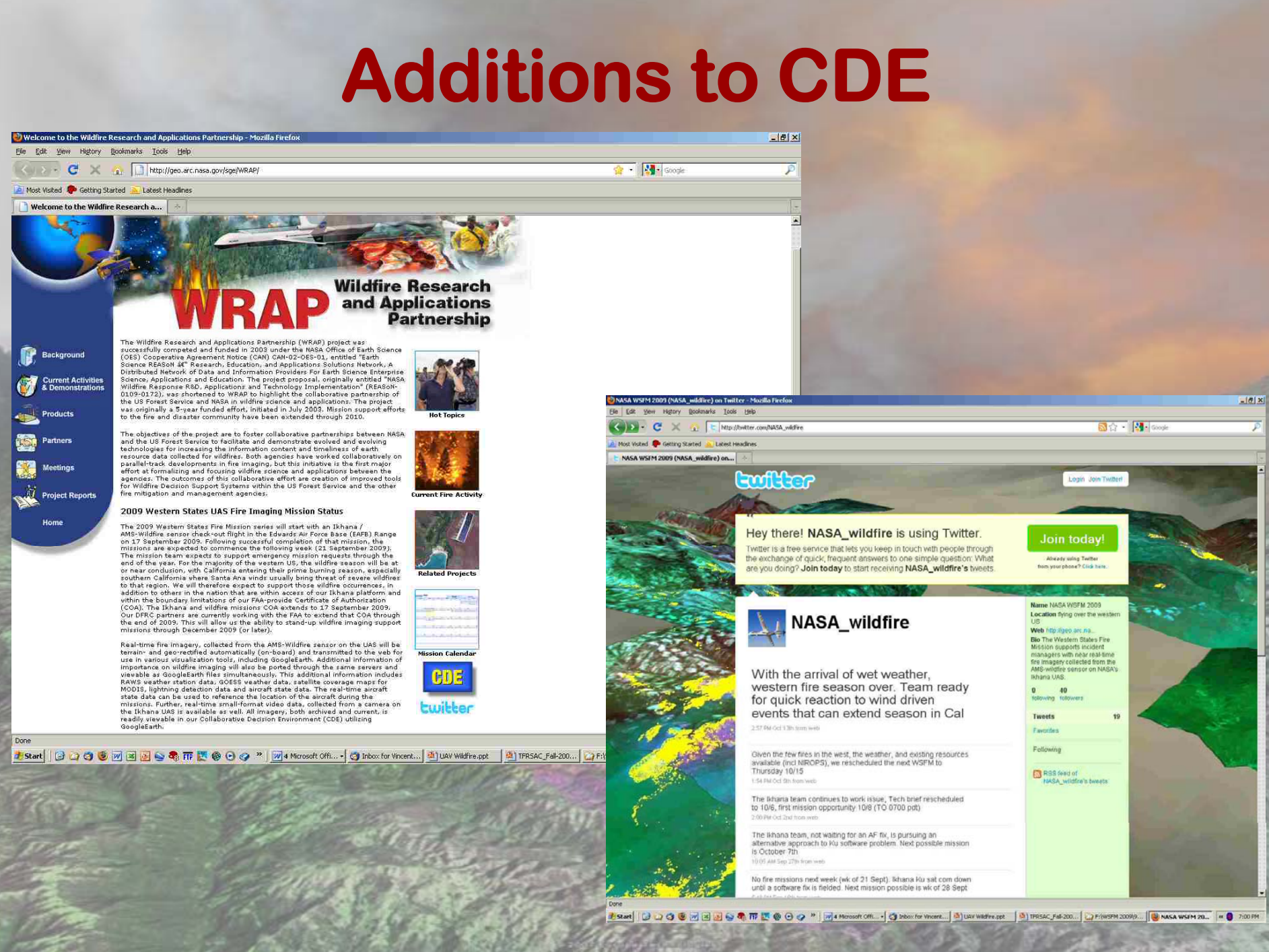


Flight Plan & Ikhana Location

Kramer Junction
Automated Mosaic



Additions to CDE



The image displays two web browser windows. The left window shows the 'Welcome to the Wildfire Research and Applications Partnership' website. The website features a navigation menu on the left with links to Background, Current Activities & Demonstrations, Products, Partners, Meetings, Project Reports, and Home. The main content area includes a large 'WRAP' logo, a description of the partnership, and a section titled '2009 Western States UAS Fire Imaging Mission Status'. The right window shows a Twitter page for 'NASA_wildfire'. The page includes a header with the Twitter logo and a 'Join today!' button. The main content area features a tweet from NASA_wildfire about the arrival of wet weather in the western fire season. The right sidebar shows the user's profile information, including the name 'NASA WFSM 2009', location, and a list of tweets.

Welcome to the Wildfire Research and Applications Partnership - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://geo.arc.nasa.gov/sge/WRAP/

Most Visited Getting Started Latest Headlines

Welcome to the Wildfire Research and Applications Partnership

WRAP Wildfire Research and Applications Partnership

The Wildfire Research and Applications Partnership (WRAP) project was successfully completed and funded in 2003 under the NASA Office of Earth Science (OES) Cooperative Agreement Notice (CAN) CAN-02-OES-01, entitled "Earth Science REASON 4: Research, Education, and Applications Solutions Network, A Distributed Network of Data and Information Providers For Earth Science Enterprise Science, Applications and Education. The project proposal, originally entitled "NASA Wildfire Response R&D, Applications and Technology Implementation" (REASON-0109-0172), was shortened to WRAP to highlight the collaborative partnership of the US Forest Service and NASA in wildfire science and applications. The project was originally a 5-year funded effort, initiated in July 2003. Mission support efforts to the fire and disaster community have been extended through 2010.

The objectives of the project are to foster collaborative partnerships between NASA and the US Forest Service to facilitate and demonstrate evolved and evolving technologies for increasing the information content and timeliness of earth resource data collected for wildfires. Both agencies have worked collaboratively on parallel-track developments in fire imaging, but this initiative is the first major effort at formalizing and focusing wildfire science and applications between the agencies. The outcomes of this collaborative effort are creation of improved tools for Wildfire Decision Support Systems within the US Forest Service and the other fire mitigation and management agencies.

2009 Western States UAS Fire Imaging Mission Status

The 2009 Western States Fire Mission series will start with an Ikhana / AMS-Wildfire sensor check-out flight in the Edwards Air Force Base (EAFB) Range on 17 September 2009. Following successful completion of that mission, the missions are expected to commence the following week (21 September 2009). The mission team expects to support emergency mission requests through the end of the year. For the majority of the western US, the wildfire season will be at or near conclusion, with California entering their prime burning season, especially southern California where Santa Ana winds usually bring threat of severe wildfires to that region. We will therefore expect to support those wildfire occurrences, in addition to others in the nation that are within access of our Ikhana platform and within the boundary limitations of our FAA-provide Certificate of Authorization (COA). The Ikhana and wildfire missions COA extends to 17 September 2009. Our DFRCC partners are currently working with the FAA to extend that COA through the end of 2009. This will allow us the ability to stand-up wildfire imaging support missions through December 2009 (or later).

Real-time fire imagery, collected from the AMS-Wildfire sensor on the UAS will be terrain- and geo-rectified automatically (on-board) and transmitted to the web for use in various visualization tools, including GoogleEarth. Additional information of importance on wildfire imaging will also be ported through the same servers and viewable as GoogleEarth files simultaneously. This additional information includes RAWIS weather station data, GOES weather data, satellite coverage maps for MODIS, lightning detection data and aircraft state data. The real-time aircraft state data can be used to reference the location of the aircraft during the missions. Further, real-time small-format video data, collected from a camera on the Ikhana UAS is available as well. All imagery, both archived and current, is readily viewable in our Collaborative Decision Environment (CDE) utilizing GoogleEarth.

Background

Current Activities & Demonstrations

Products

Partners

Meetings

Project Reports

Home

Hot Topics

Current Fire Activity

Related Projects

Mission Calendar

CDE

twitter

NASA WFSM 2009 (NASA_wildfire) on Twitter - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://twitter.com/NASA_wildfire

Most Visited Getting Started Latest Headlines

NASA WFSM 2009 (NASA_wildfire) on...

Join today!

Hey there! NASA_wildfire is using Twitter.

Twitter is a free service that lets you keep in touch with people through the exchange of quick, frequent answers to one simple question: What are you doing? Join today to start receiving NASA_wildfire's tweets.

Already using Twitter from your phone? Click here.

NASA_wildfire

With the arrival of wet weather, western fire season over. Team ready for quick reaction to wind driven events that can extend season in Cal

2:57 PM Oct 13 from web

Given the few fires in the west, the weather, and existing resources available (incl NROPS), we rescheduled the next WFSM to Thursday 10/15

1:54 PM Oct 5th from web

The Ikhana team continues to work issue, Tech brief rescheduled to 10/6, first mission opportunity 10/8 (TO 0700 PDT)

2:00 PM Oct 2nd from web

The Ikhana team, not waiting for an AF fix, is pursuing an alternative approach to fix software problem. Next possible mission is October 7th

10:05 AM Sep 27th from web

No fire missions next week (wk of 21 Sept). Ikhana Iku sat com down until a software fix is fielded. Next mission possible is wk of 28 Sept

4:48 PM Oct 1st from web

Name NASA WFSM 2009

Location flying over the western US

Web http://geo.arc.nasa.gov/sge/WRAP/

Bio The Western States Fire Mission supports incident managers with near real-time fire imagery collected from the AMS-Wildfire sensor on NASA's Ikhana UAS.

0 following 40 followers

Tweets 19

Favorites

Following

RSS feed of NASA_wildfire's tweets

Done

Start | Microsoft Office... | Inbox for Vincent... | UAV Wildfire.ppt | TFRSAC_Fall-200... | F:\WSFM 2009\... | NASA WFSM 20...

7:00 PM

The screenshot shows a Twitter profile for 'NASA_wildfire'. The background image is a satellite view of a wildfire. The profile information includes the name 'NASA WSPM 2009', location 'Flying over the western US', and a website link 'http://geo.arc.nasa.gov'. The bio describes the mission as supporting incident managers with real-time fire imagery from the AMS-wildfire sensor. The tweet history shows several tweets, including one about the 10th mission opportunity on October 10th.

Name: NASA WSPM 2009
Location: Flying over the western US
Web: <http://geo.arc.nasa.gov>
Bio: The Western States Fire Mission supports incident managers with real-time fire imagery collected from the AMS-wildfire sensor on NASA's Ikhana IWS.

0 following **40** followers

Tweets **19**

Favorites

Following

RSS feed of NASA_wildfire's tweets

With the arrival of wet weather, western fire season over. Team ready for quick reaction to wind driven events that can extend season in Cal

2:57 PM Oct 13th from web

Given the few fires in the west, the weather, and existing resources available (incl NROPS), we rescheduled the next WSPM to Thursday 10/15

1:54 PM Oct 9th from web

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2:50 PM Oct 2nd from web

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10:01 AM Sep 27th from web

No fire missions next week (wk of 21 Sept), Ikhana Ku sat com down until a software fix is fielded. Next mission possible is wk of 28 Sept

8:48 PM Sep 24th from web

On-Board Algorithm Development

- **Develop useful fire spectral band combinations for different collection scenarios (day / night):**
 - **DAY:** b12 (10.26 -11.26 um), b9 (1.55- 1.75 um), b11 (3.60- 3.79 um) as R-G-B;
 - **NIGHT:** b12 (10.26 -11.26 um) for night ops
- **Develop R/T “hot-spot detect algorithm”:**
 - **Modified CCRS algorithm:**

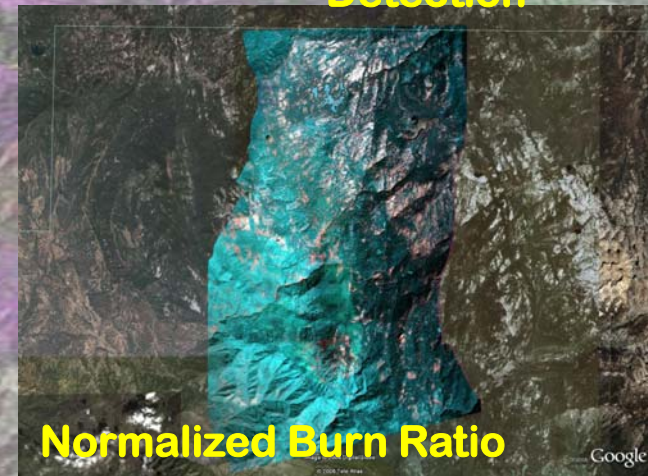
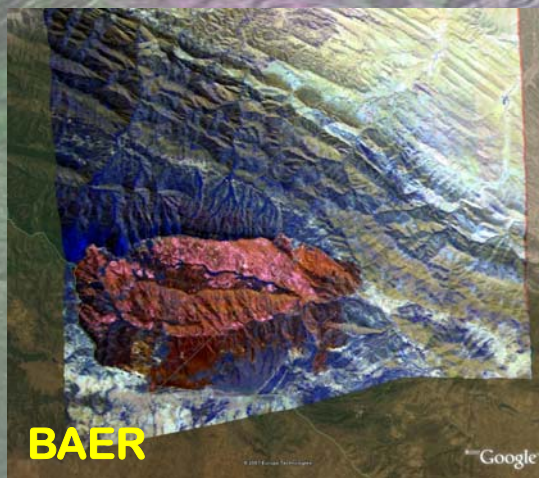
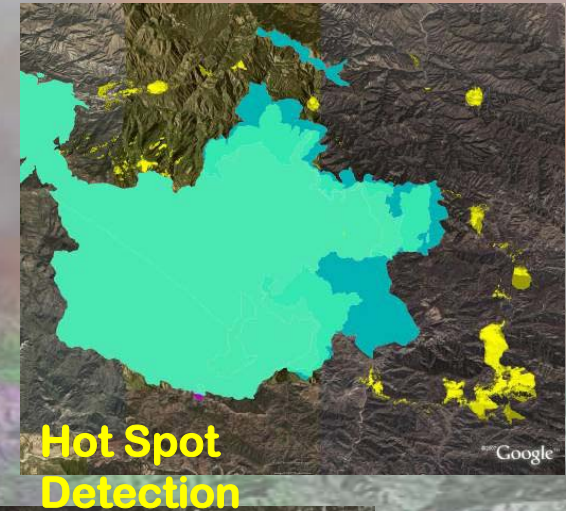
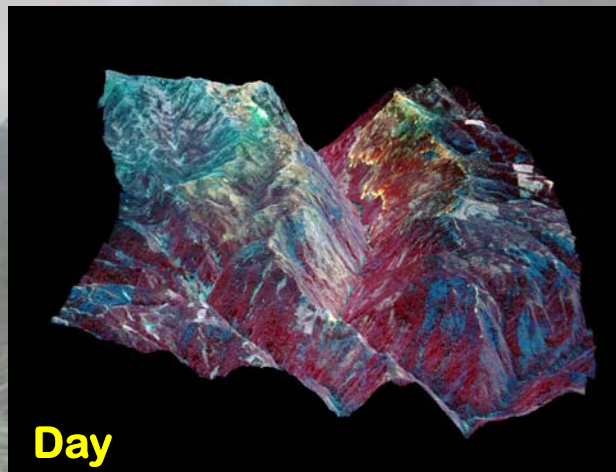
Fire = If b11 (3.60- 3.79 um) brightness temp > 380⁰ K; and b12 (10.26 -11.26 um) brightness temp > 240⁰ K; and b11 - b12⁰ > 12K; and Band 7 (0.76 – 0.9um) < .22 (screen high reflectance commission errors).
- **Develop R/T BAER visualization spectral band combinations:**
 - b10 (2.08 – 2.35 um), b9 (1.55- 1.75 um), b7 (0.76 – 0.90 um) as RGB
- **Develop R/T post-fire, calibrated NBR algorithm data:**

$$\frac{b7 - b10}{b7 + b10}$$

where, (b10 (2.08- 2.35 um); b7 (0.76 – 0.90 um))

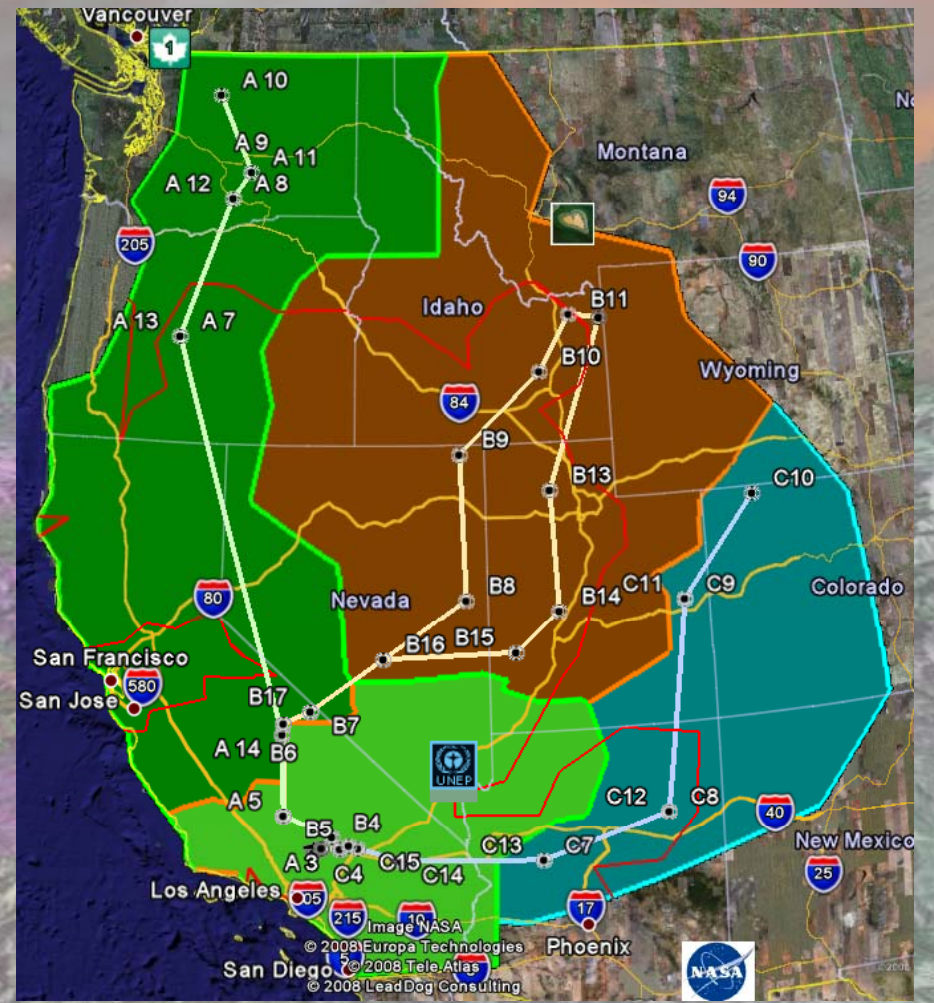
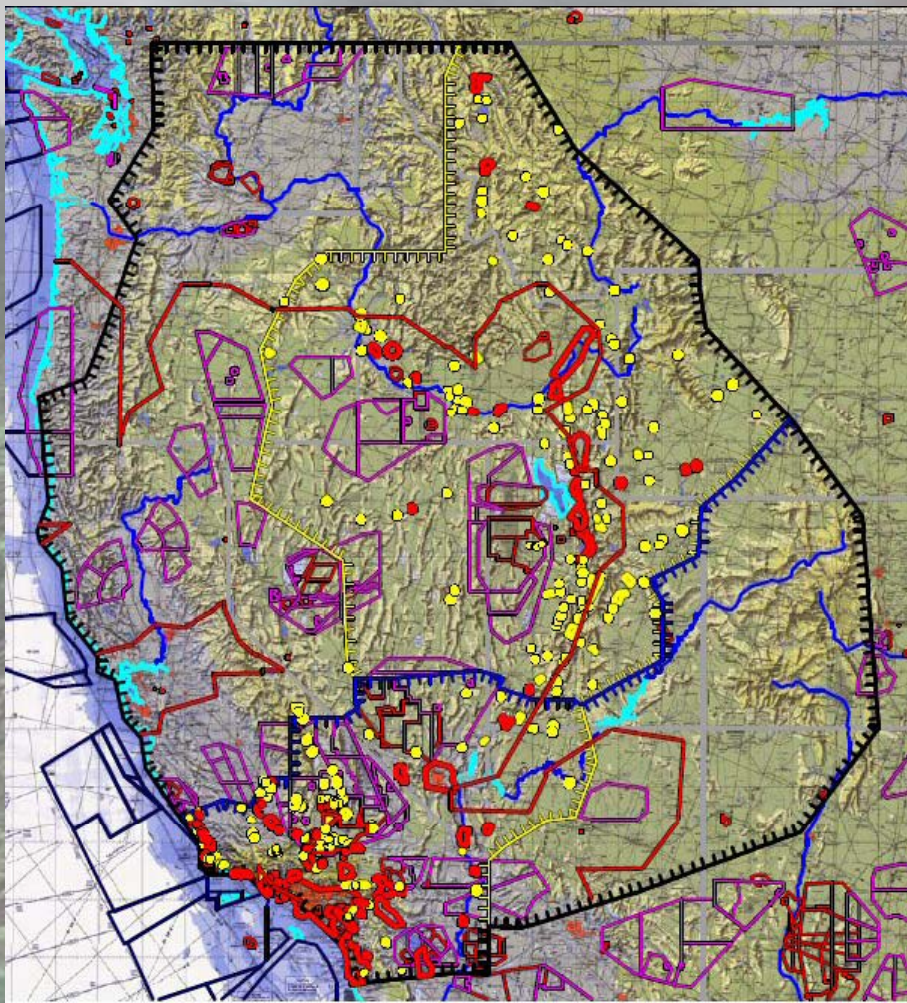
On-Board Algorithm Development

Develop automated on-board product-generation processes for different collection scenarios: Day / Night; R/T Hot Spot Detection Algorithm; R/T BAER visualization; Post-Fire NBR Algorithm



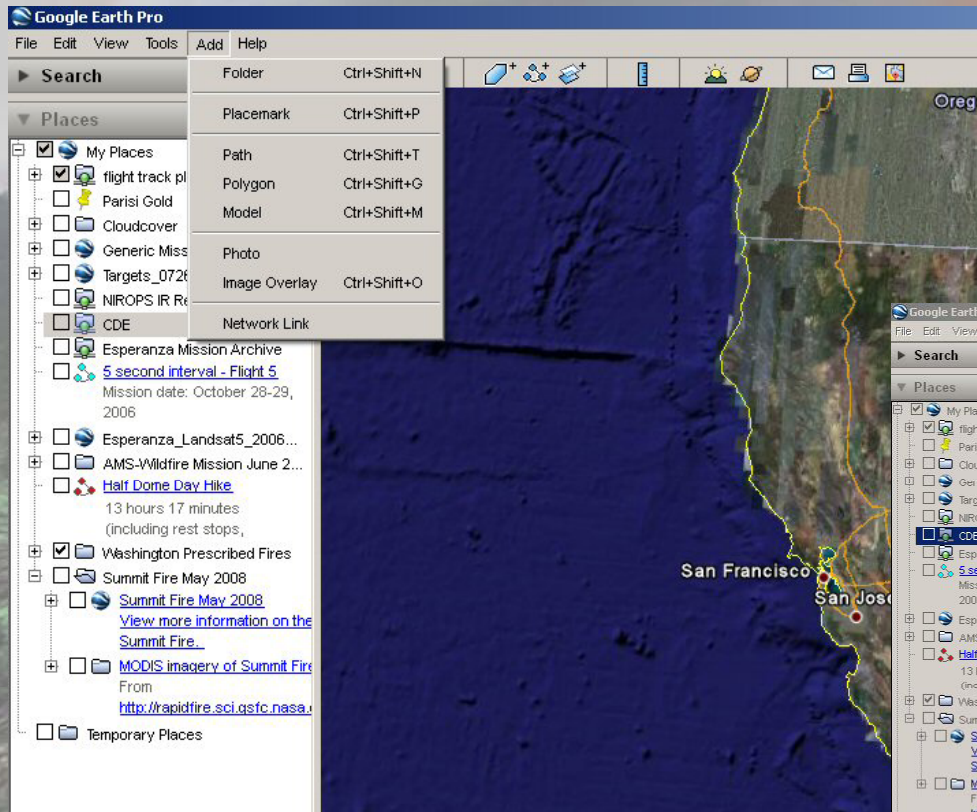
Ikhana UAS: 2009 COA Changes

Maintain operations within 50 nm of either a Restricted Area (R) or Military Operations Area (MOA).



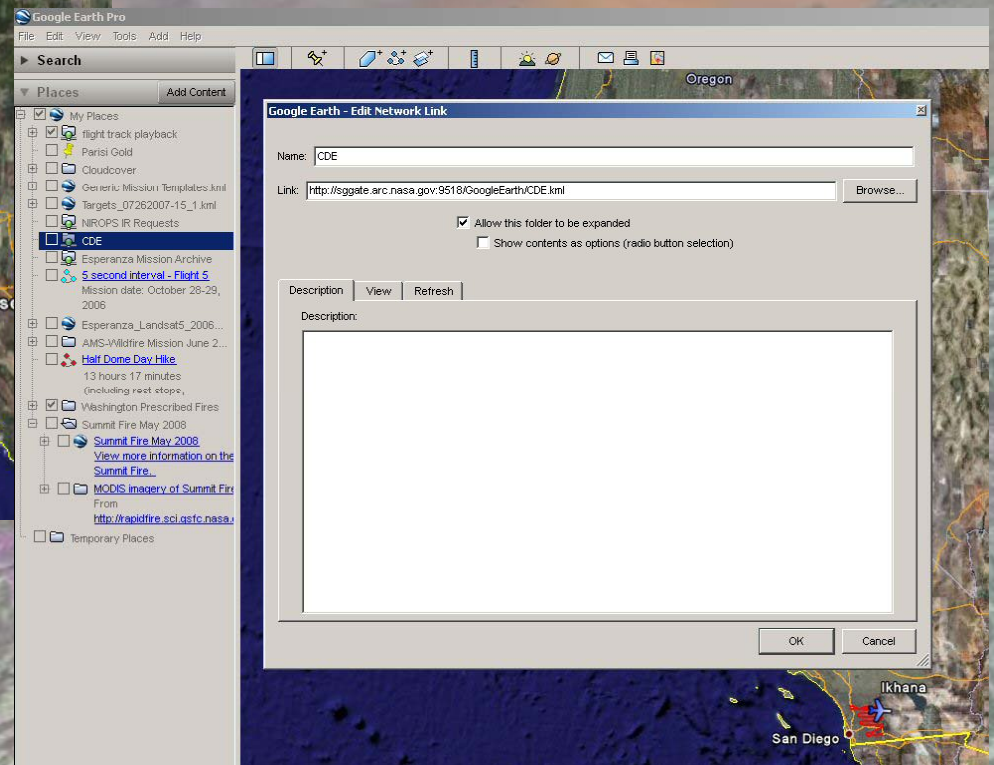
Accessing the Wildfire CDE

Step 1: Add Network Link



Step 2: Enter URL:

<http://sggate.arc.nasa.gov:9518/GoogleEarth/CDE.kml>



Additional Information

Vince Ambrosia
vincent.g.ambrosia@nasa.gov

Wildfire Research and Applications Partnership (WRAP)
Web Site:

<http://geo.arc.nasa.gov/sge/WRAP>