

Collaborative Efforts in R&D and Applications of Imaging Wildfires

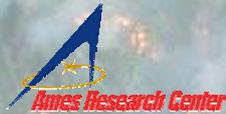
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P. Greenfield, and S. Wegener**

**NASA-Ames Research Center
And
US Forest Service**



Wildfire Research and Applications Partnership (WRAP)

“Enabling Technologies for Real-Time Disaster Management Decision Support Systems”



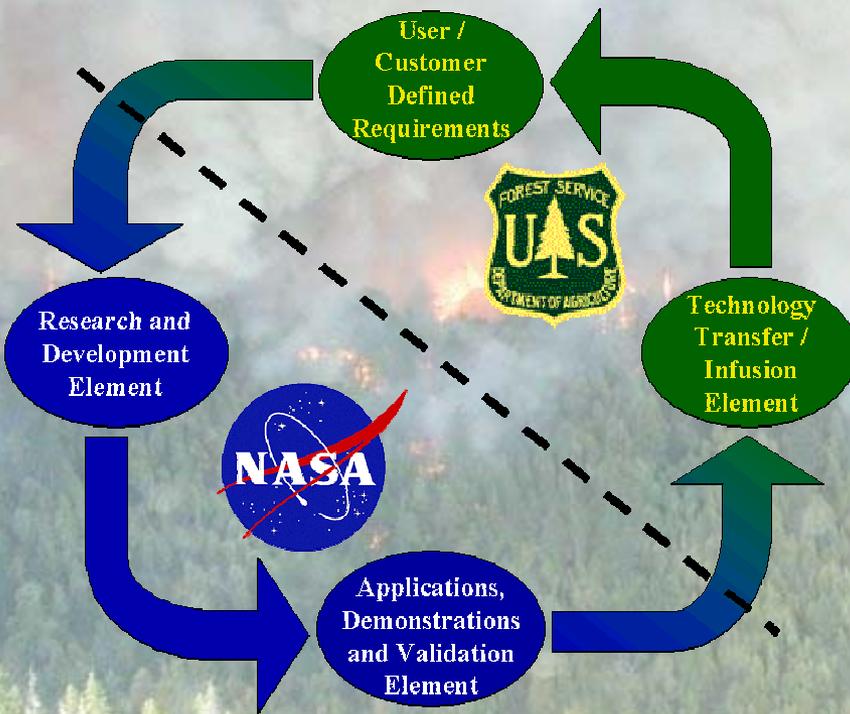
2003 – 2007 (5 Year Effort)

NASA Office of Earth Science, Earth Science Enterprise, Applications Division

NASA CAN-02-OES-01, Earth Science REASoN (Research, Education and Applications Solutions Network)



Partnering to Enhance Technologies



Objective:

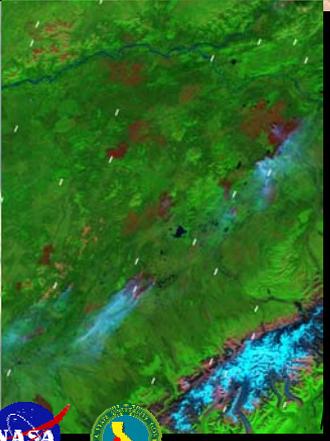
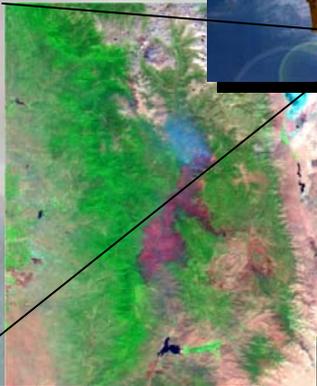
- Provide mechanism for defining requirements for improving wildfire imaging;
- R & D of those required technologies;
- Demonstration and validation of those technologies;
- Technology transfer and training.

To:

- Increase information content;
- Reduce information delivery time;
- Simplify data integration processes.

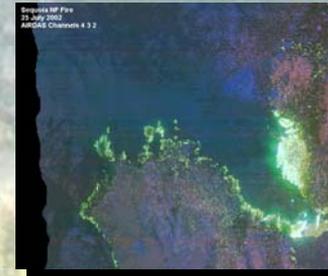
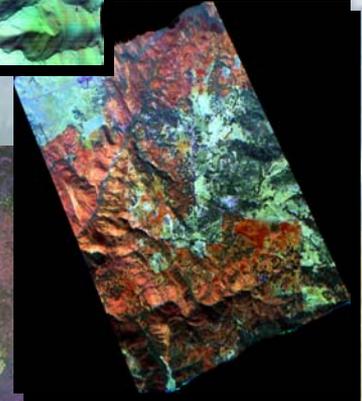
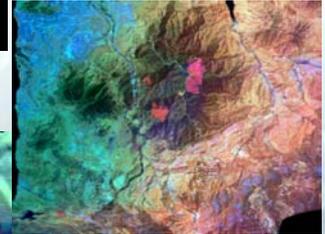
Validation of Strategic Fire Products

Strategic Assets

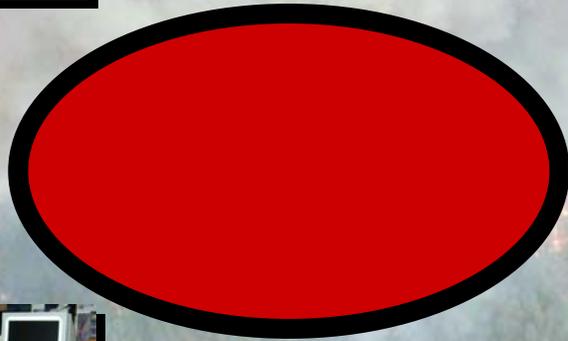
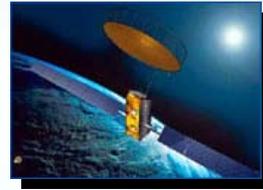


Under-flight
of MODIS-
acquired
fire data with
tactical airborne
assets
to validate fire
location and
algorithm.

Tactical Assets



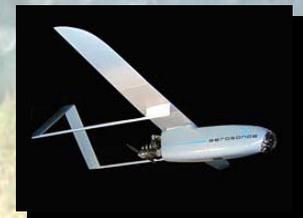
Exploring Three Technology Elements to Improve Fire DSS



Telemetry



Unique UAV Platforms

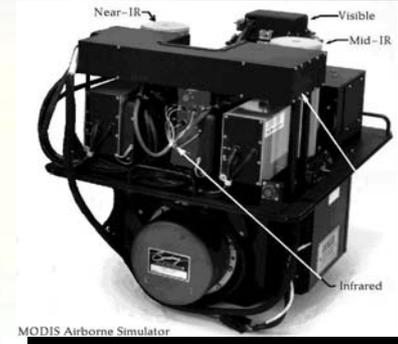




NASA-Ames 12-channel scanner



NASA-Ames AIRDAS



MAS

Sensing Systems – Explore, test, and evaluate improved sensor designs by academia, industry and within-NASA.

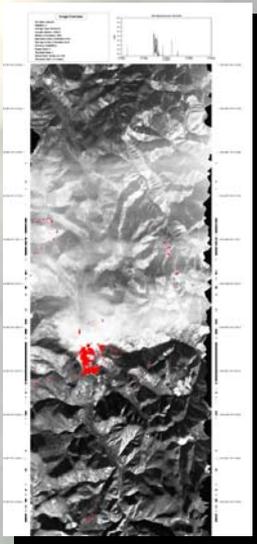
RIT
WASP



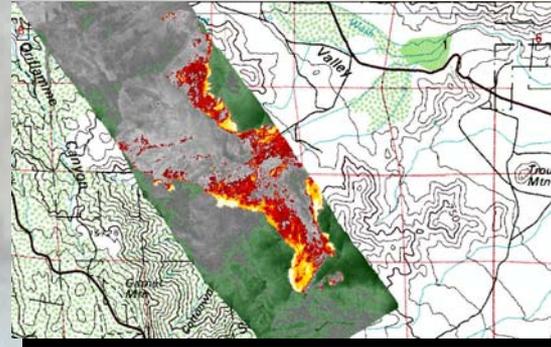
- SenSyTech Sensor
- Airborne BIRD
- Langley Fire Sensor
- Other niche Instruments



FireMapper

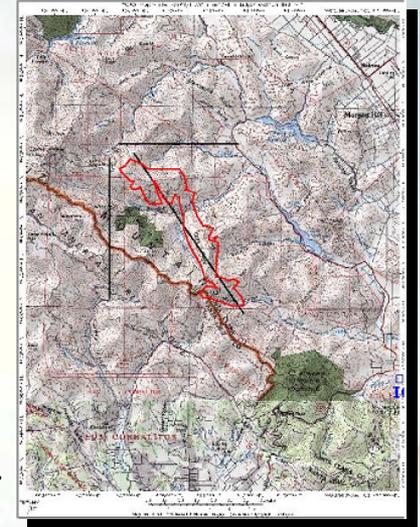


AIRDAS Fire data

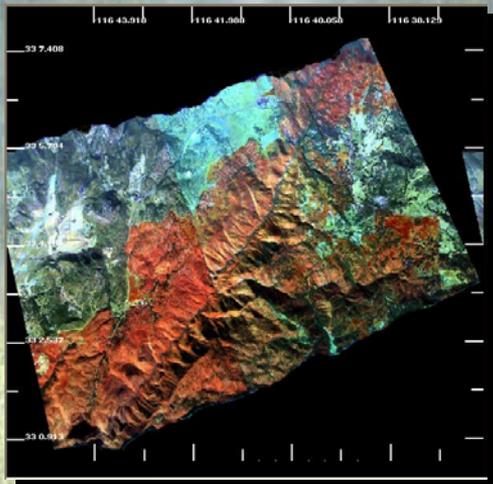


FireMapper – Pine Fire

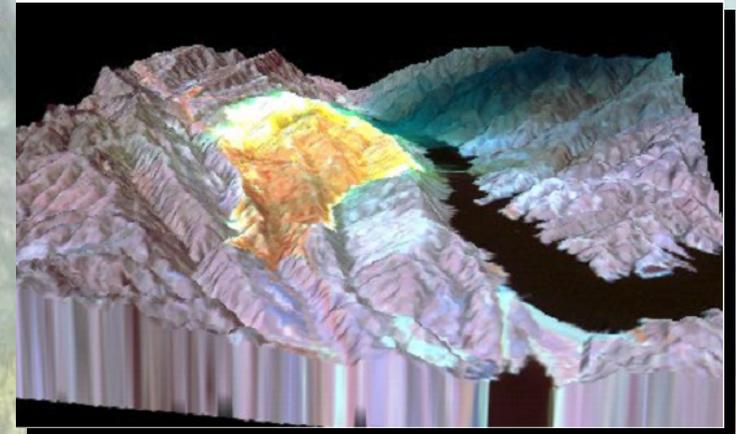
AIRDAS
Croy Fire
Perimeter



Sensing Systems - Improve On-Board Data / Information Processing.



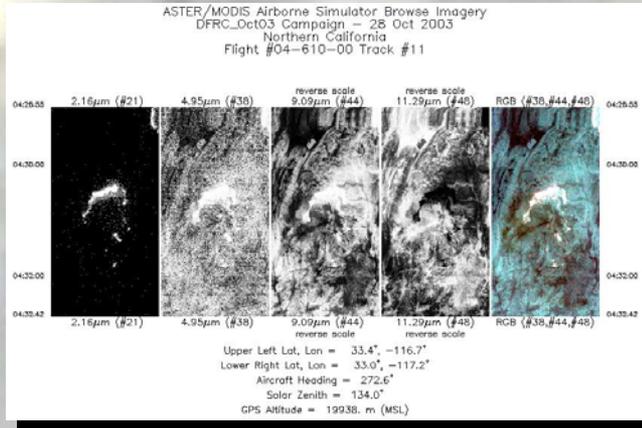
AIRDAS Old
Fire, CA, geo-
rectified



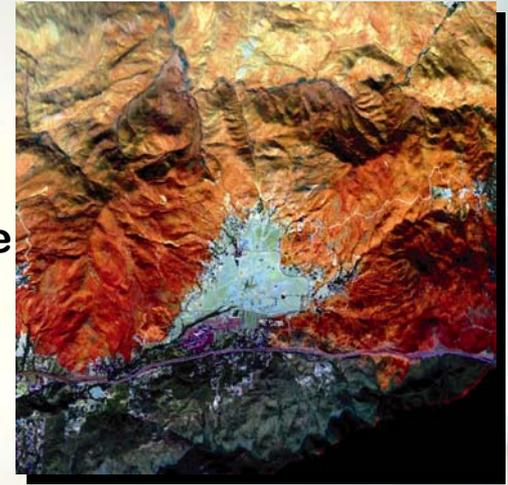
TMS Data Draped on Terrain



MAS Spectral Data - Fires



AIRDAS
Cedar Fire



Sensing Systems – Explore Improved Radiometric & Spectral Capabilities

Band	Wavelength μm
1	0.42-0.45
2 (TM1)	0.45-0.52
3 (TM2)	0.52-0.60
4	0.60-0.62
5 (TM3)	0.63-0.69
6	0.69-0.75
7 (TM4)	0.76-0.90
8	0.91-1.05
9 (TM5)	1.55-1.75
10 (TM7)	2.08-2.35
11 (TM6) High Gain	8.5-14.0
12 (TM6) Low Gain	8.5-14.0

NASA-Ames
12-channel scanner
Spectral capabilities

MAS – Aspen Fire





Sterling & TE- cooled Detectors



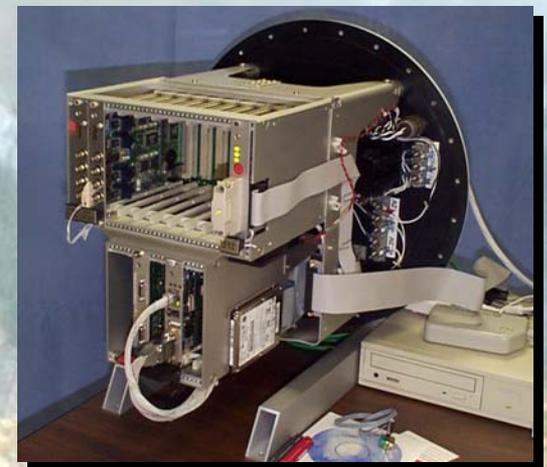
Digitizer Module With Pressure Housings and Motor Controller

Sensing Systems - Improve Instrument Capabilities



Autonomous operation

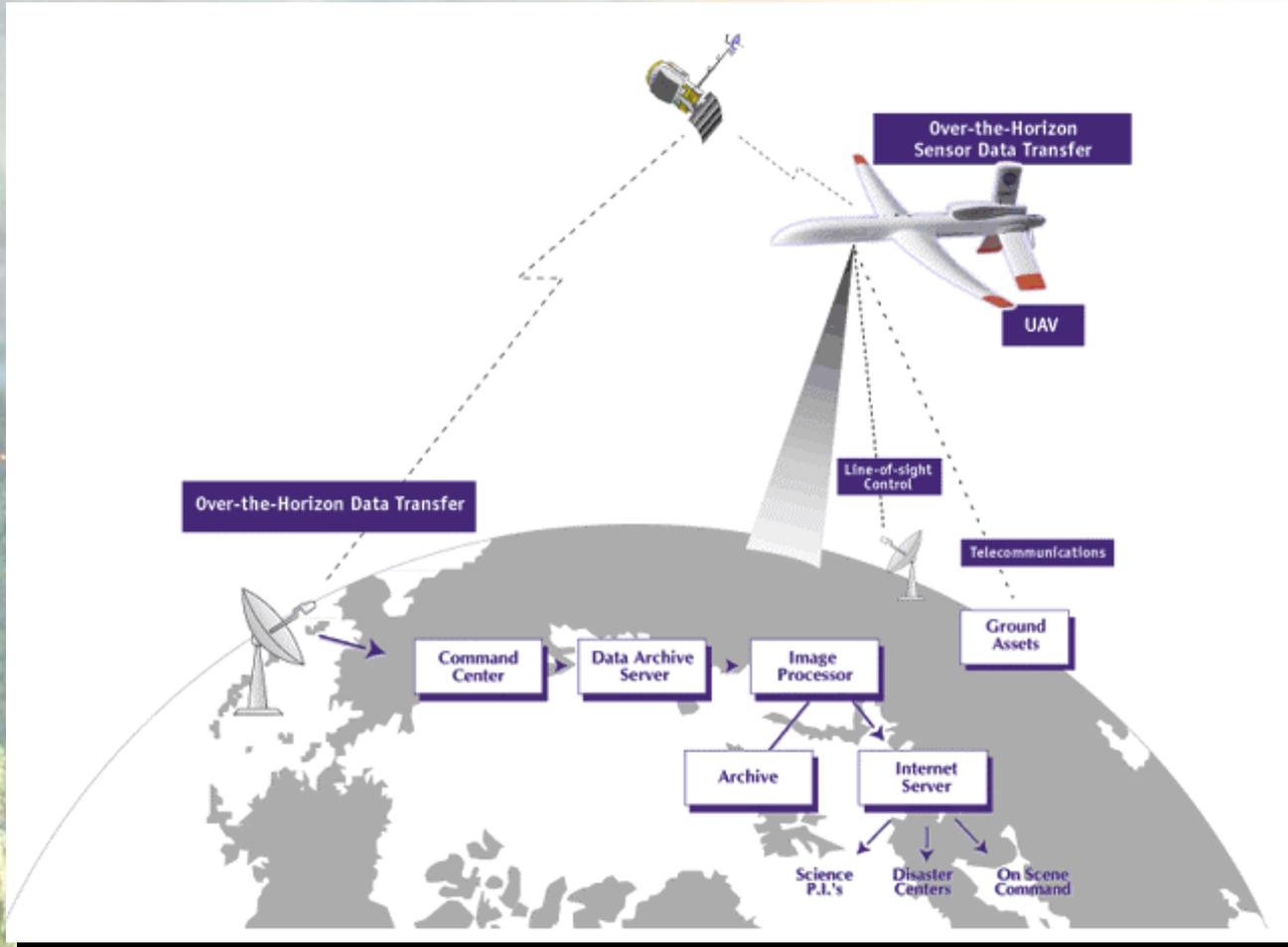
- Fully network & web-enabled
- Improved blackbody calibrators
- Cross-platform portability

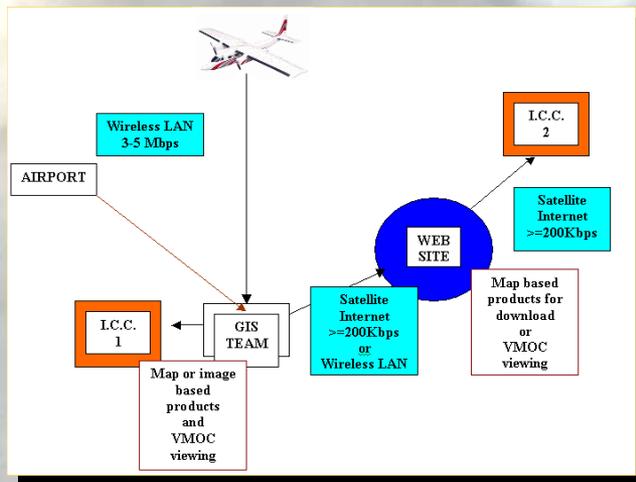


New 16-bit multi-use digitizer



Telemetry – Explore, test, and evaluate Line of Sight and Over The Horizon capabilities.





Ground-based Ethernet Bridge
LOS telemetry antenna

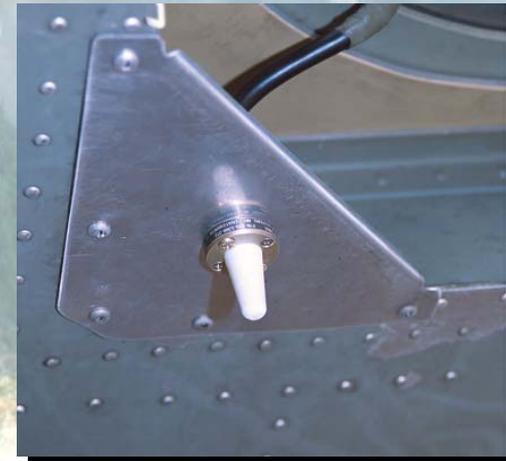


Telemetry - Line of Sight (LOS)

High data rates (1-5 Mbs) w/in 30 mi. of aircraft / ground station. Wireless communications devices.

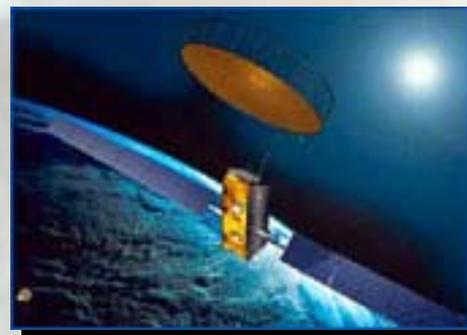
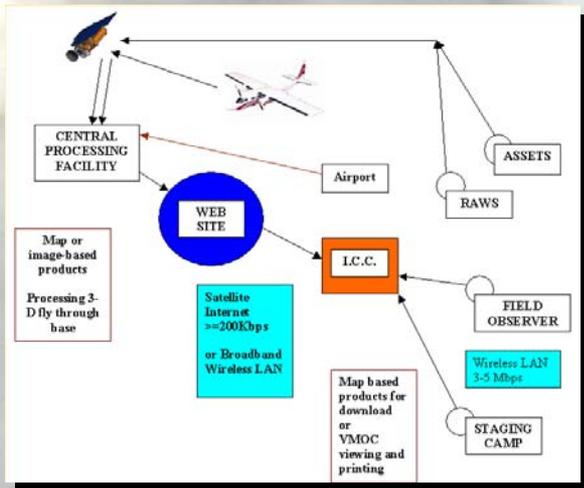


2.4 GHz Antenna fitted on Caravan platform



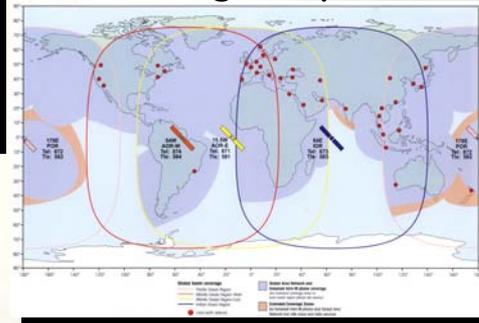
FreeWave FGR-115 Wireless network





INMARSAT Platform

INMARSAT Coverage Map



Telemetry – Over The Horizon (OTH)

Moderate data rates anywhere on globe. On-board satcom antenna required.

- Currently 64 Kbs w/ upgrades to 384 Kbs in 2005
- Over next five years possible data rates of 5 Mbs



NERA M4 WC

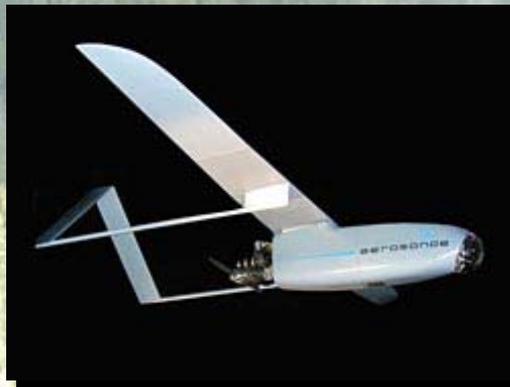


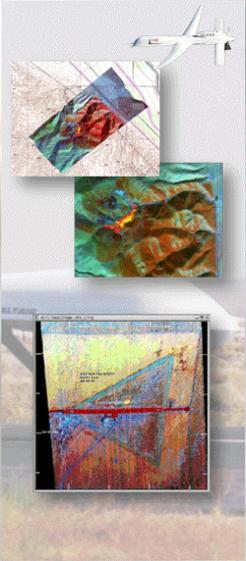
Thrane & Thrane CAPSAT Tracking Antenna





Unique UAV Platforms - Explore, test, and evaluate UAV utility as fire imaging platform.





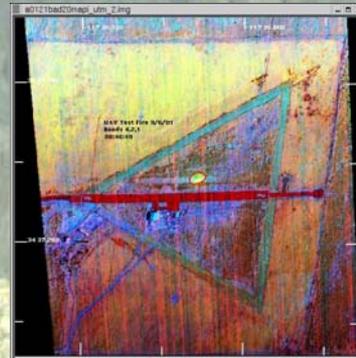
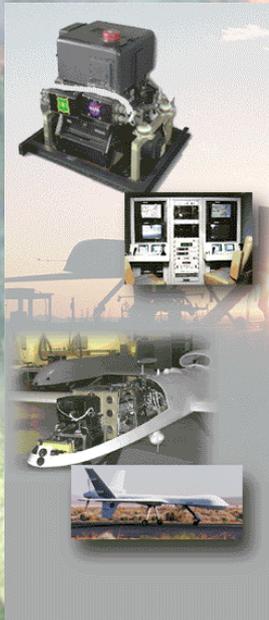
Altus II, Sept 2001
FiRE Mission



Pathfinder Plus
Imaging 2002
Coffee harvest
optimization



Unique UAV Platforms Missions to Date



APV-3 UAV
Imaging 2003
Plant vigor





ALTUS Specifications:

Wing Span: 55.3 ft.; Length: 23.6 ft.; Height: 9.8 ft.

Payload: 330 lb

Max Altitude: 65,000 Feet

Endurance: 8 Hours @ 60K ft.

18 Hours @ 30K ft.

24 Hours @ 25K ft.

Cruise / Loiter Speed: 65 KIAS

Range: ~1500 Mi. at 25K ft.

Unique UAV Platforms - Capabilities

ALTAIR Specifications:

Wing Span: 84 ft.; Length: 36.2 ft.; Height: 11.8 ft.

Payload: 750 lbs.

Max Altitude: 55K feet

Endurance: 32 hrs w/ 700 lb payload

Cruise / Loiter Speed: 144 KIAS

Range: 4500 nm



APV-3 UAV Specifications:

Wing Span: 12 ft.; Length: 6.5 ft.; Height: 2.5 ft.

Payload: 20 lbs.

Ceiling Altitude: 2000 ft (manual radio control);
9000 feet (auto-pilot)

Endurance: 8 hours

Cruise / Loiter Speed: 45 - 90 KIAS

Range: 160 miles



Unique UAV Platforms - Capabilities



Helios Specifications:

Wing Span: 84 ft.; Length: 36.2 ft.; Height:
11.8 ft.

Payload: 220 lbs.

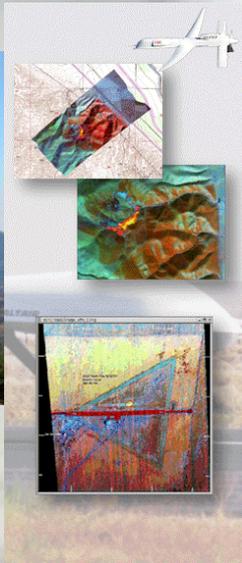
Planned Operating Altitude: 50 – 100K feet

Endurance: 14 days to 6 months

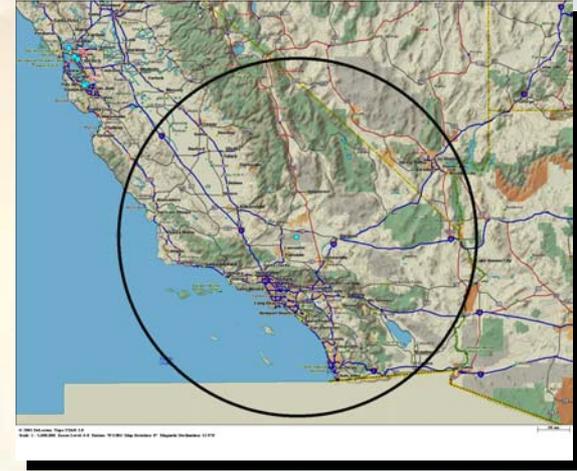
Cruise / Loiter Speed: 30 KIAS

Range: unlimited

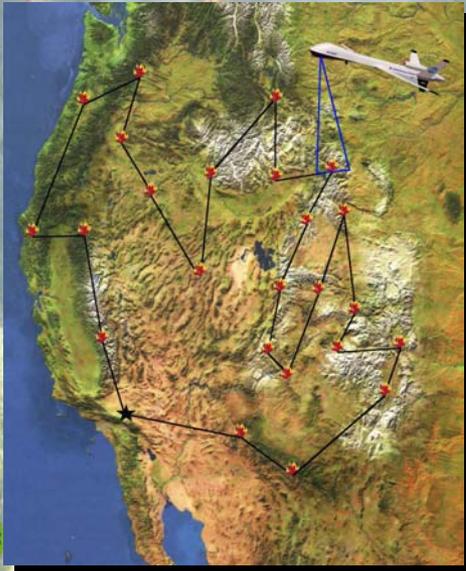




**Fall 2004
Wildfire Event
High Altitude / Extended
Duration
NAS
12-Channel
Real-time Telemetry**



Upcoming Demonstration Mission Plans



**2005
Multiple Wildfires
High Altitude / 24-hour
mission (~4500 mi range)
Real-Time Flight Profiling
NAS
Real-time telemetry**



Concluding Remarks

NASA and the USFS will explore innovative solutions to improving the timeliness, content, and methods of gathering tactical information on fire activity.

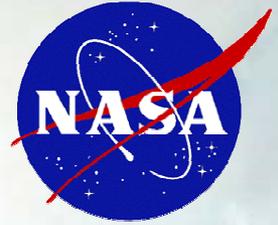
The partners are poised to ensure the delivery of:

“ The Right Information to the Right People, at the Right Time ”



WRAP

Wildfire Research and Applications Partnership



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



Enabling Technologies For Real-Time Disaster
Management Decision Support Systems

