Tactical Fire Remote Sensing Advisory Committee

20 March 2012
Sacramento Convention Center; Room 315
Sacramento, CA

TFRSAC Agenda; 20 March 2012

8:30 AM **Meeting Start**

- **Morning Presentations (Government Only)**
  - Welcome and introductions (30 min) — Quayle / Ambrosia
  - WRAP 2011 & ROSES Update — Ambrosia
  - AMS Sensor Transfer — Ambrosia / Quayle
  - USFS Aircraft Modification Process — Zajkowski / Quayle
  - NIROPS Update — Zajkowski / Quayle

10:00 AM **Break** (20 min)

  - USFS UAS Committee — Roth / Quayle
  - AFFEUE Project / New Run Road Demonstration — Roth / Tom Z / Quayle
  - RxCadre JFSP UAS Support — Zajkowski
  - USGS Update — Hutt / Sloan
  - CalFire Update — Strazzo / Rosenberg

- **12:00 pm** **Lunch** (1 hour)

TFRSAC Agenda; 20 March 2012

1:00 PM (ASPRS Attendees Invited)

– Welcome and Introductions	Ambrosia / Quayle
– Agency Overviews	Agency Reps
– DHS	Bruce Davis
– GOES Early Fire Detection System: Overview)	Alex Koltunov

2:30 PM Break (20 min)

– Jornada Expewrimental Range / Earthmetrics	Andrea Laliberte
– NASA Type Certification Study for UAS	Francis Enomoto
– VIIRS Update	Evan Ellicott
– Open Discussion	Moderated
– Closing Remarks	Quayle / Ambrosia

5: 00 PM Dinner plans and adjourn for day

6:30 PM Meet for dinner @ nearby restaurant (TBD)

WRAP 2011 Review

WRAP 2011 Review

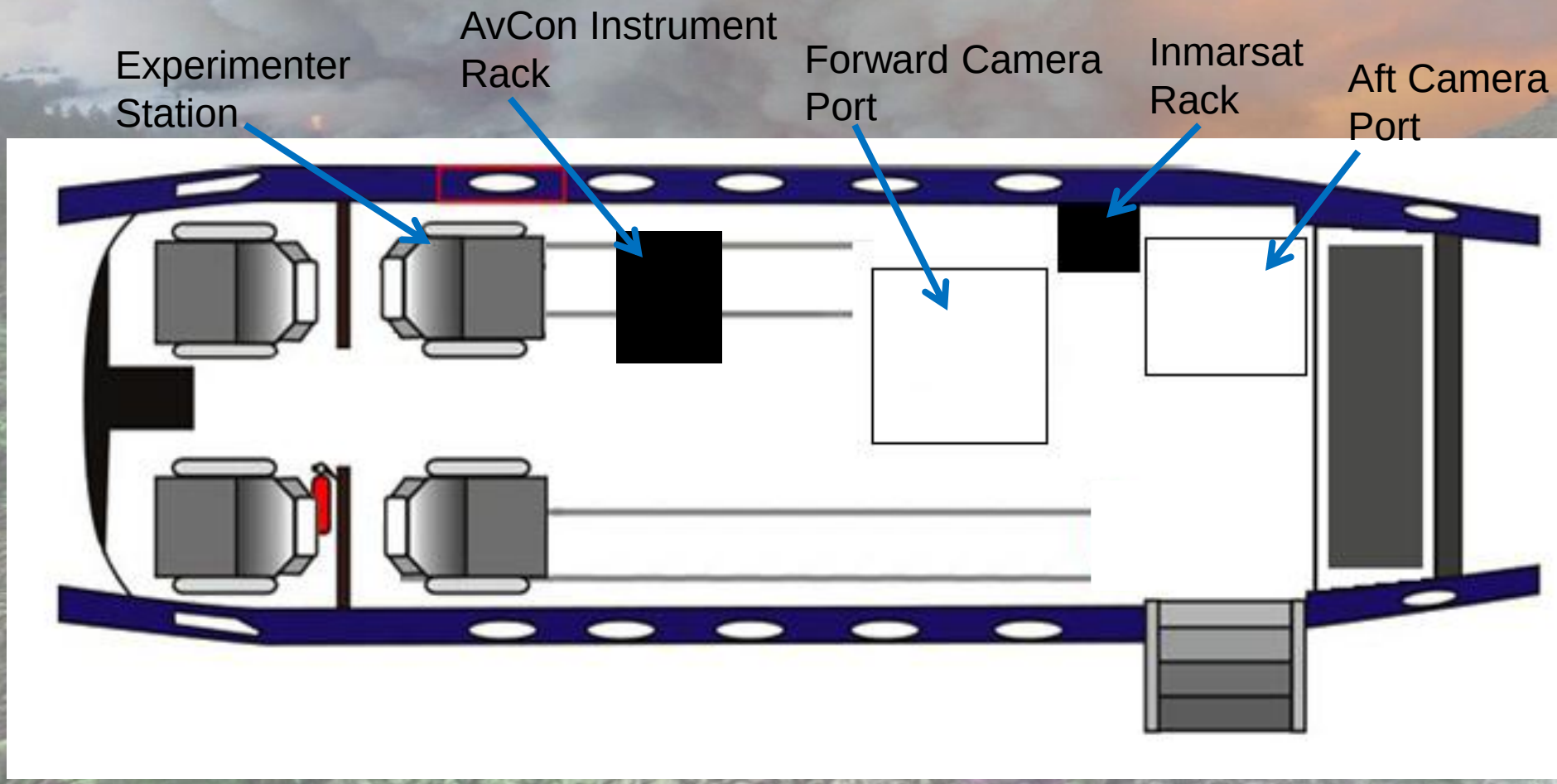
- **ARRA Funded effort to sustain and mature data collection over fires and partnership arrangements (2009-2011).**
  - NASA-Airborne Science Program provided 10-16 hours of flight / sensor check flight time.
  - NASA-HQ funds 30-hours of DFRC B200 fire mission support (none used in 2010; carry-over to 2011).
  - USFS funds additional hours for support of NASA to Las Conchas Fire, NM.
  - NOAA funds additional hours of support for wildfire science imaging
- **New AMS algorithm development and enhancements (including FRP)**
- **AMS / B200 Support wildfires in western US (primarily CA)**
- **AMS / B200 supports prescribed fire measurement campaign in CA.**
- **Xiomas WAI Instrument tested and modified with Fireball assistance.**
- **Examine AMS on USFS A/C option**

2011 B200 Developments

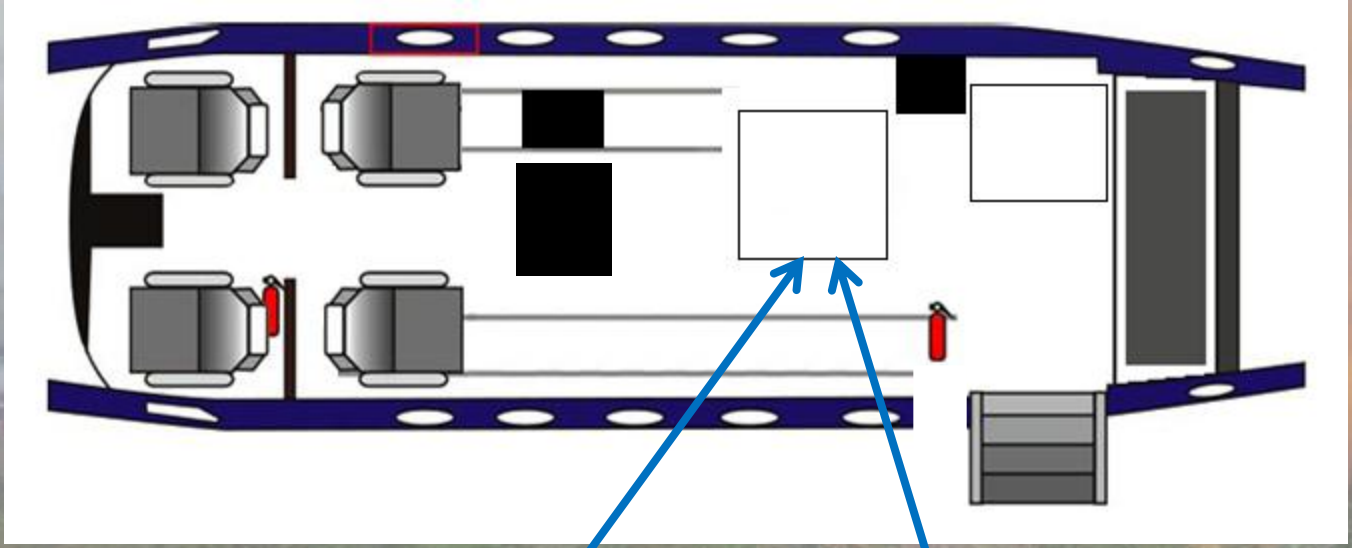
King Air B-200

Operations: ~32K ft; 1883 nm
Endurance: ~4.0 hours
Speed: 250 kts..
Onboard Operators: 4 (inc. flight team)
Payload: 2000 lbs. of instruments
Sensor telemetry: Inmarsat

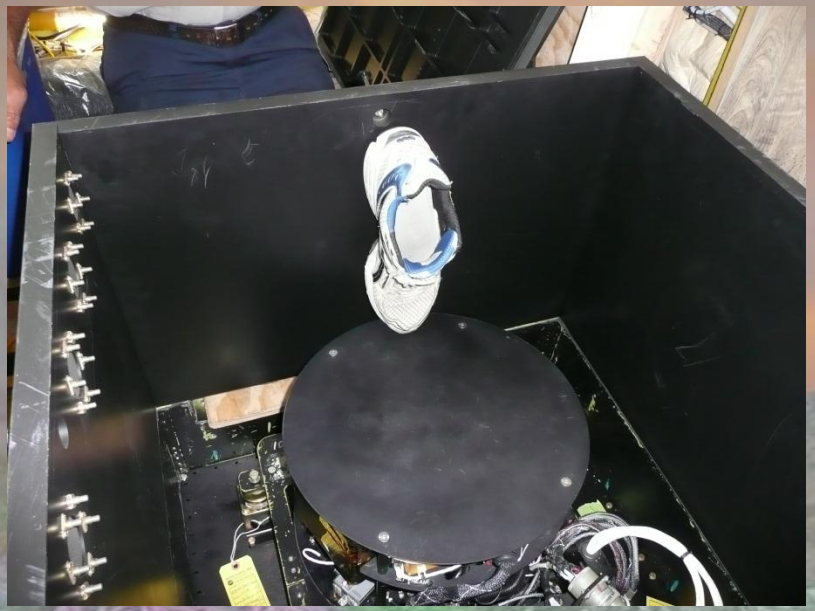
2010 DFRC B200 Developments



2010 DFRC B200 Developments

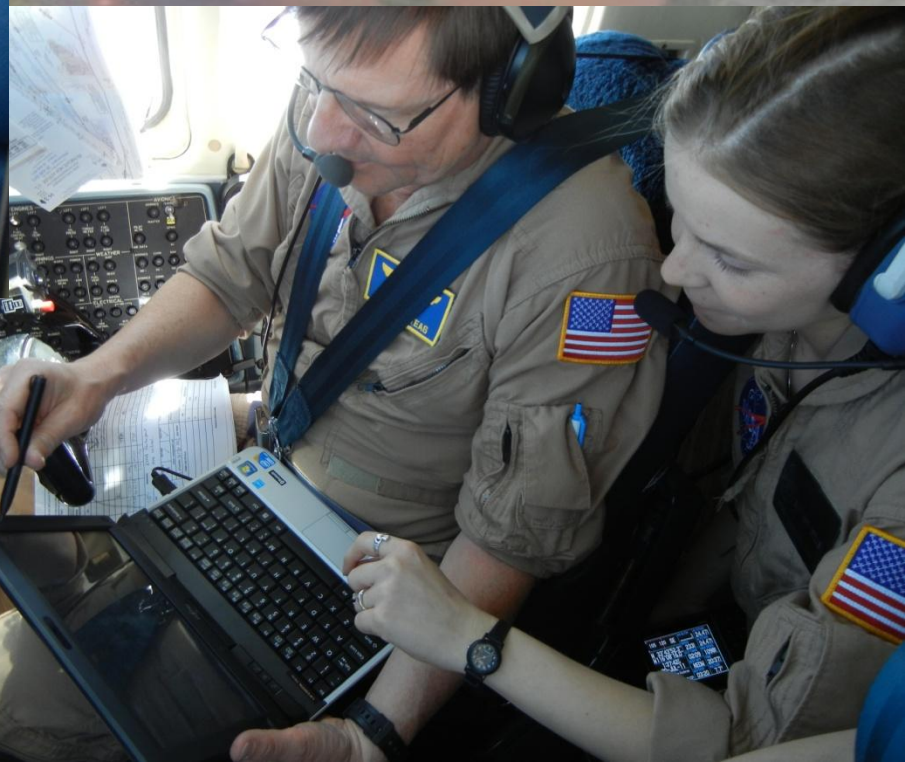


2011 DFRC B200 Developments



2011 DFRC B200 AMS OPS.

AMS “Manned” Sensor Operations



AMS Flight Line Updating

2011 AMS / B200 Missions

There have been nine (9) AMS fire imaging missions aboard the NASA DFRC B200 through 25 October 2011:

2011 AMS Missions on NASA B200 A/C

Flight Number	Date	Location / Target Fire	Mission Hours
11-AMS-01	20-Jul-11	Lancaster, Palmdale, Salton Sea	3.5
11-AMS-02	22-Jul-11	LION FIRE & EAGLE FIRE	2.9
11-AMS-03	26-Jul-11	LAS CONCHAS & EAGLE FIRES	8.05
11-AMS-04	19-Sep-11	Shakedown and MINT FIRE	1.7
11-AMS-05	3-Oct-11	GREAT FIRE	2.0
11-AMS-06	11-Oct-11	Shakedown	1.6
11-AMS-07	13-Oct-11	COE FIRE: Pre-Burn	3.2
11-AMS-08	18-Oct-11	COE PRESRIBED FIRE	5.3
11-AMS-09	19-Oct-11	COE FIRE Post-Burn	3.3
TOTALS:			31.55

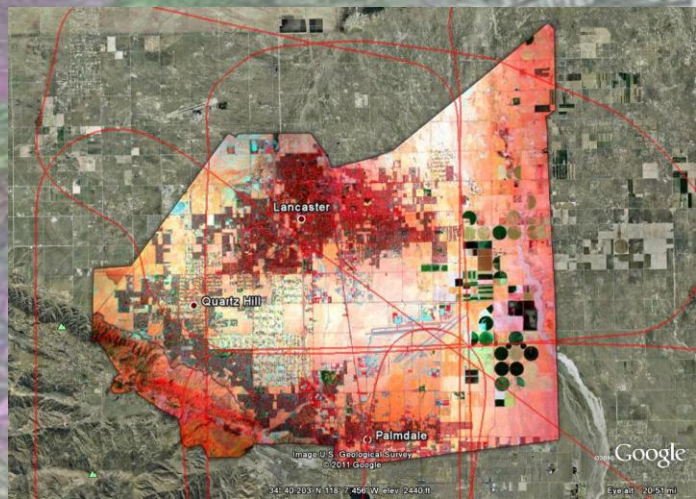
System Shakedown Missions: 11-AMS-01, 11-AMS-04, 11-AMS-06

- **Collect data for calibration over known field location sites near EAFB / NASA-DFRC**
  - Palmdale Airport GPS Sites (geo-calibration)
  - Lancaster crossing intersections (geo-locations)
  - Old burn scars near EAFB (Piute Fire)
  - Salton Sea: flat field TIR spectral noise calculation
  - Castaic Lake (see Salton Sea, above)

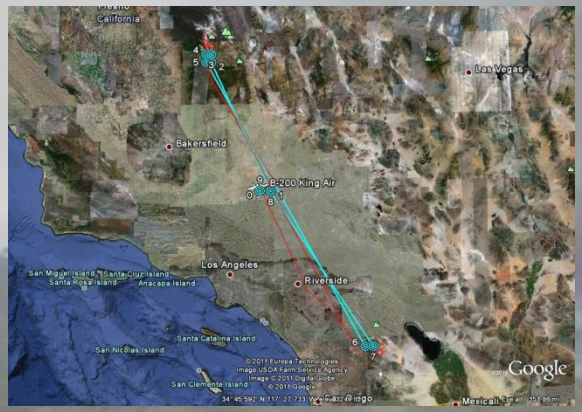
- **Procedure development for flight and mission communications between ground crew and A/C crew (Chat room processes).**

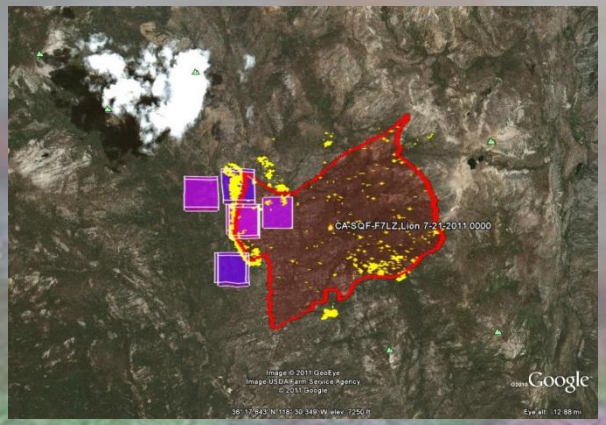
- **Test Inmarsat data telemetry links and communication procedures.**

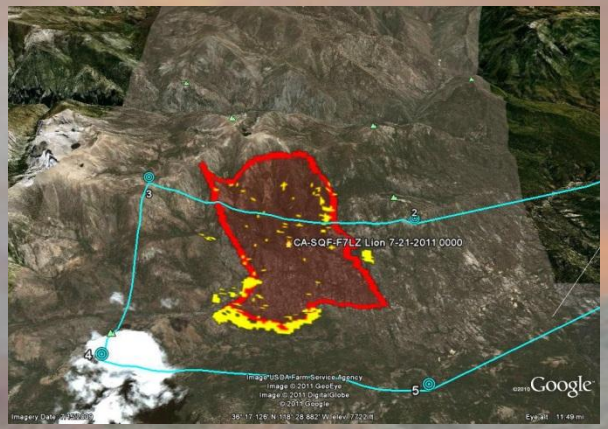
- **Test end-to-end sensor-to-CDE process**

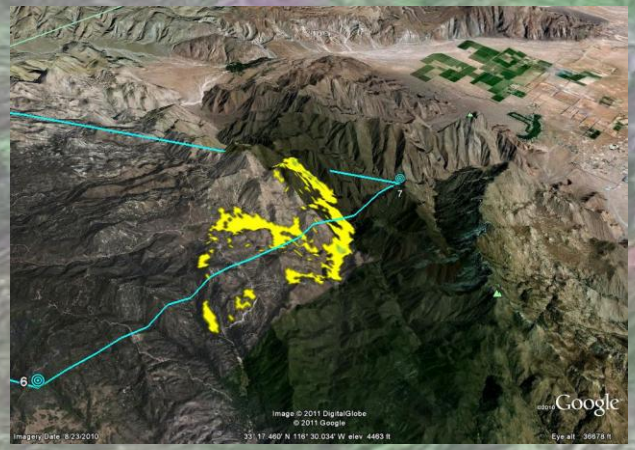


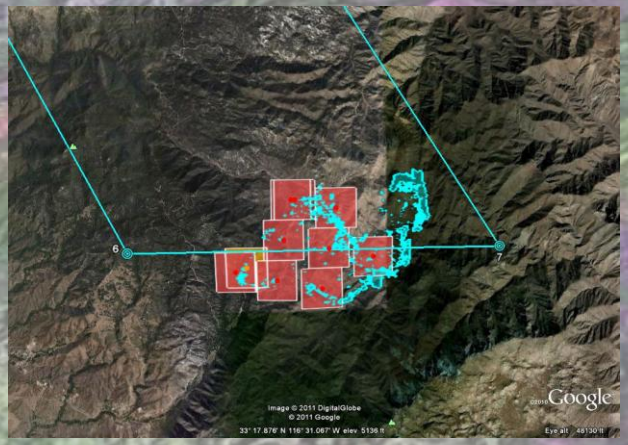
11-801-02; 22 July 2011
Lion and Eagle Fire



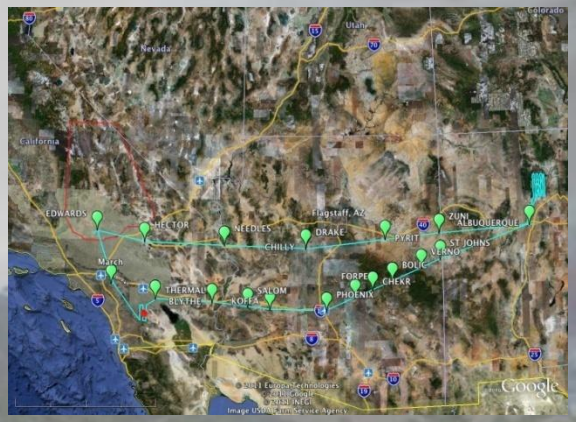


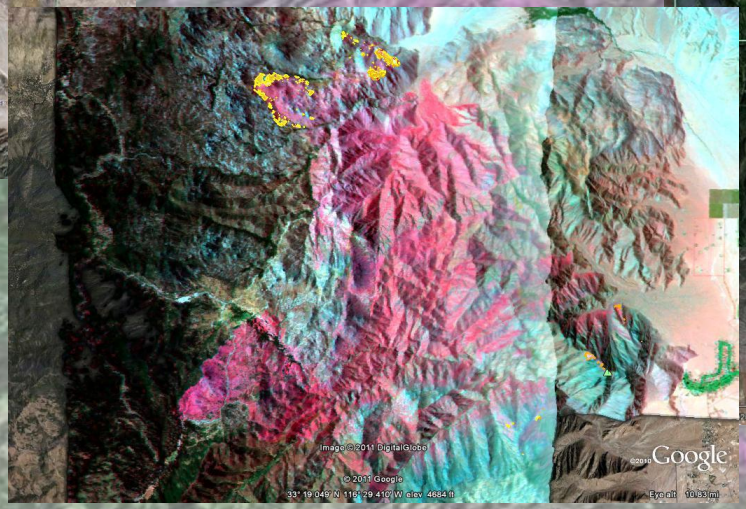




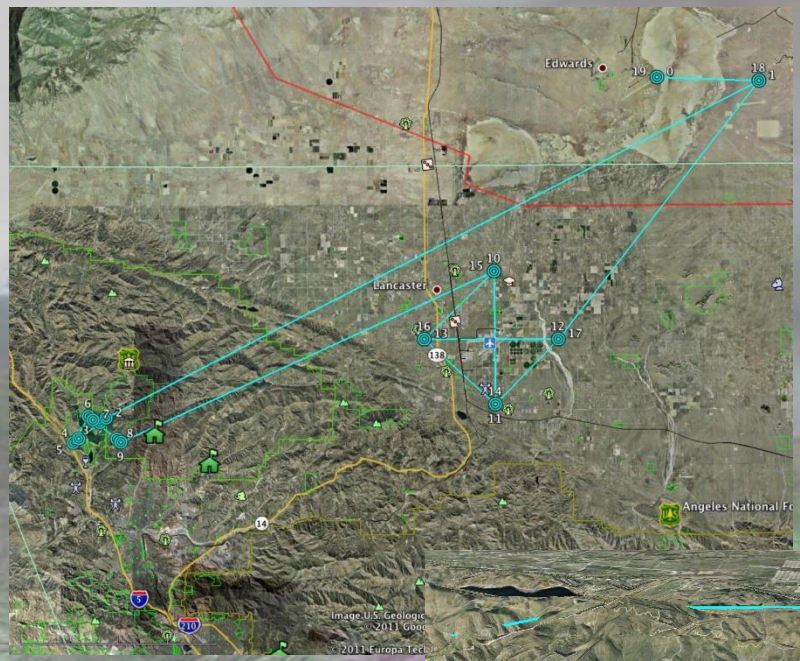


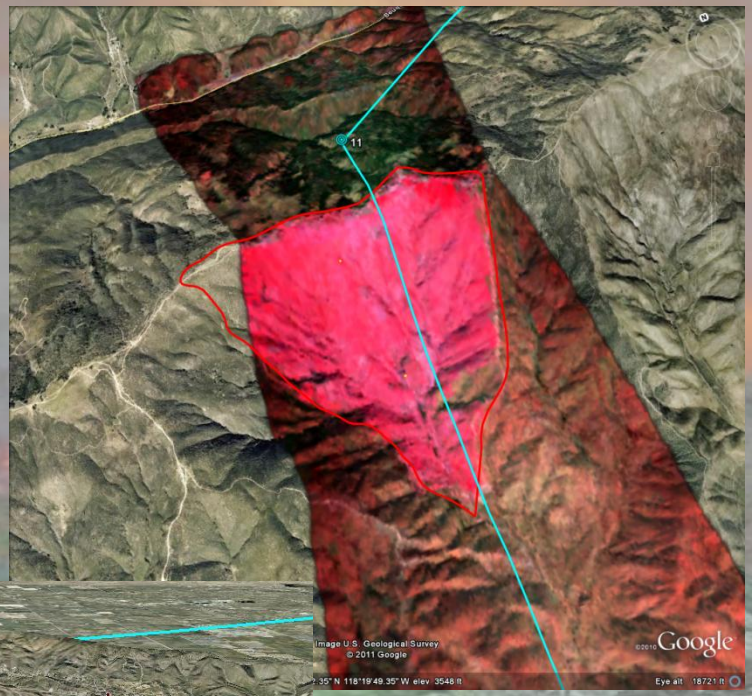
11-801-03; 26 July 2011
Las Conchas & Eagle Fires

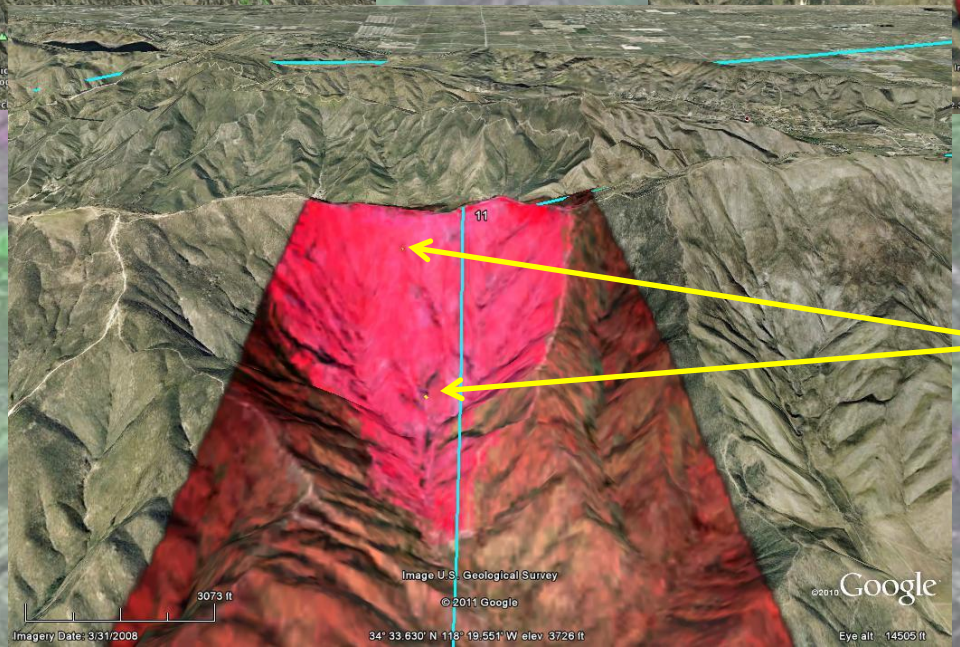




11-801-04; 19 Sept 2011
Shakedown and Mint Fire

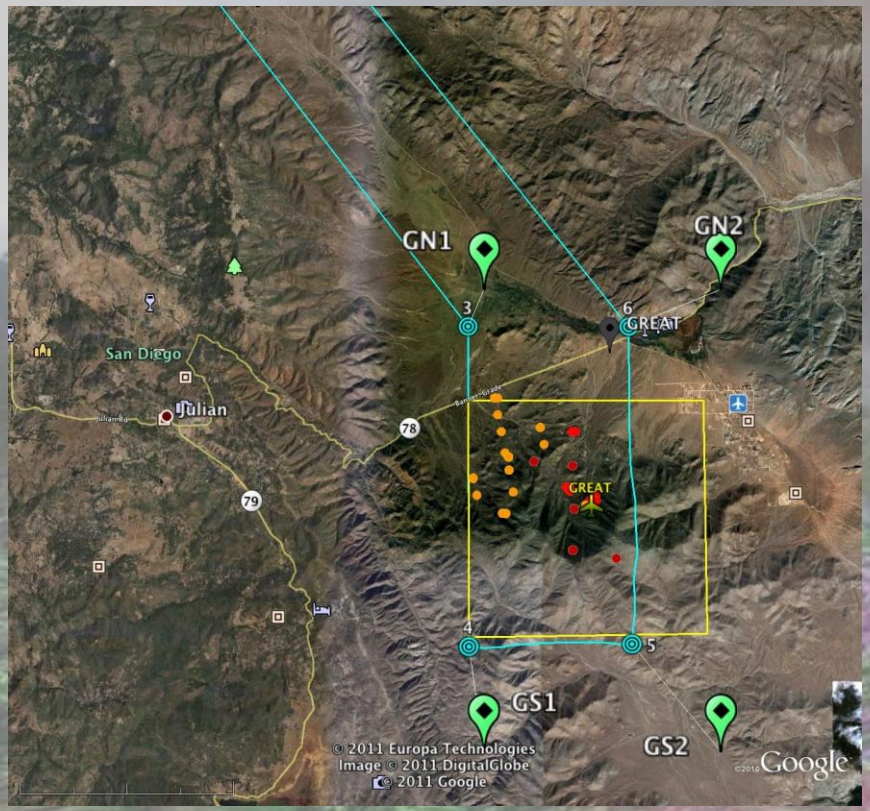


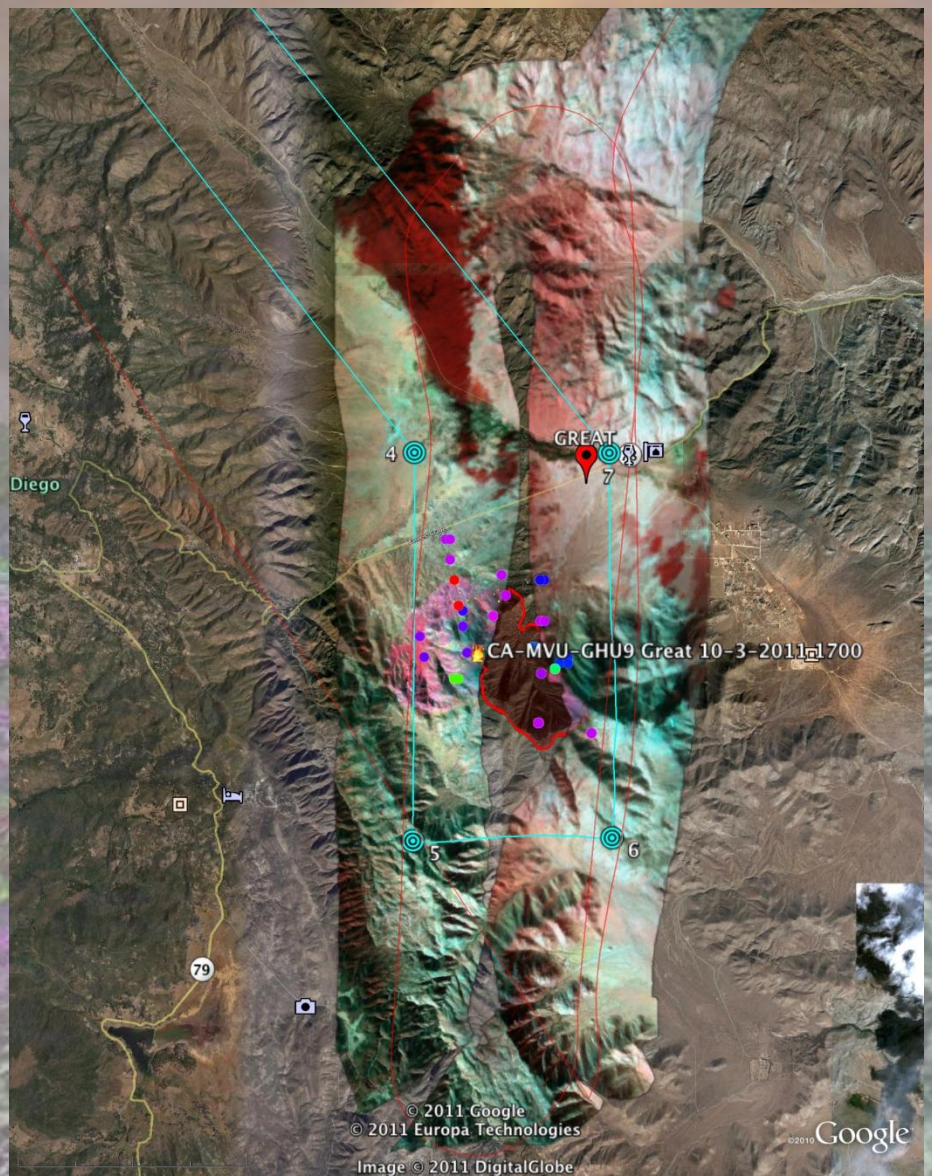




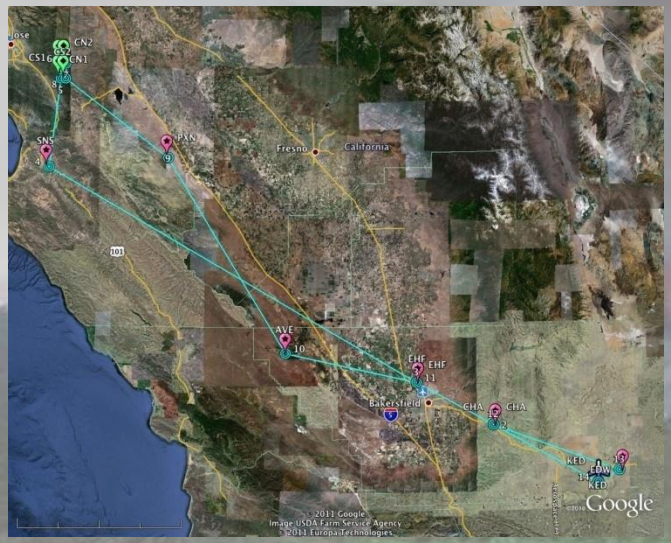
Two small hot-spot detects

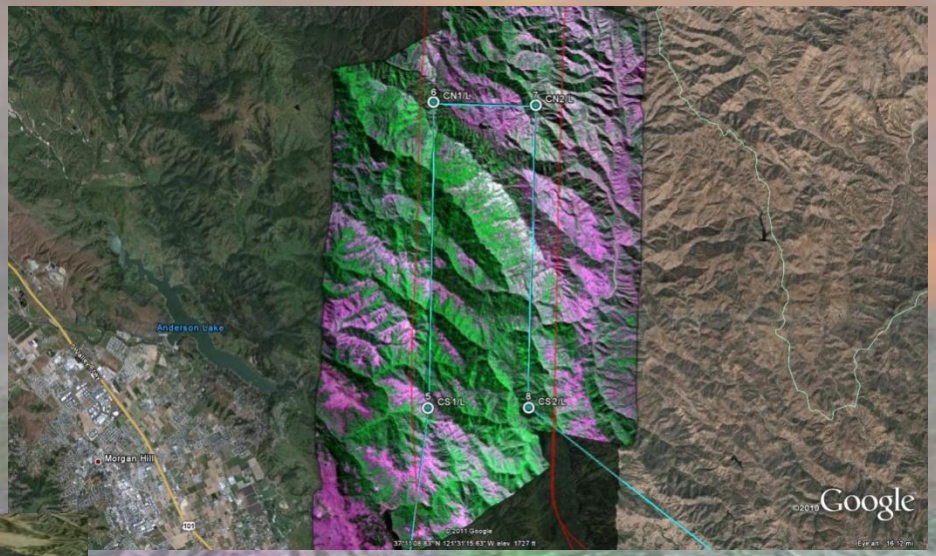
11-801-05; 3 October 2011
Great Fire

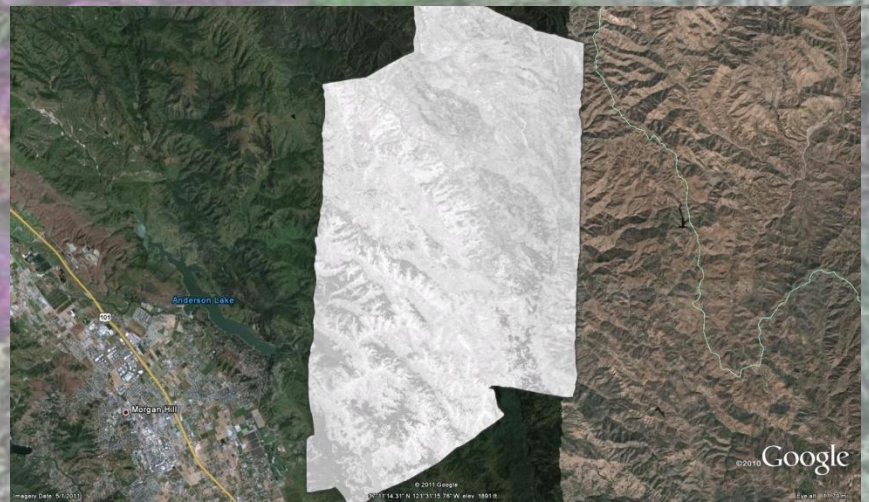




11-801-07; 13 October 2011
Coe Fire, Pre-Burn

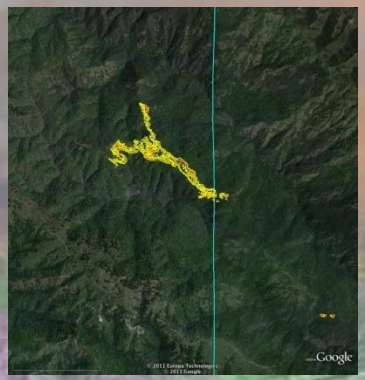


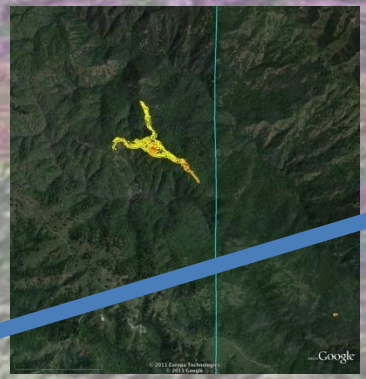




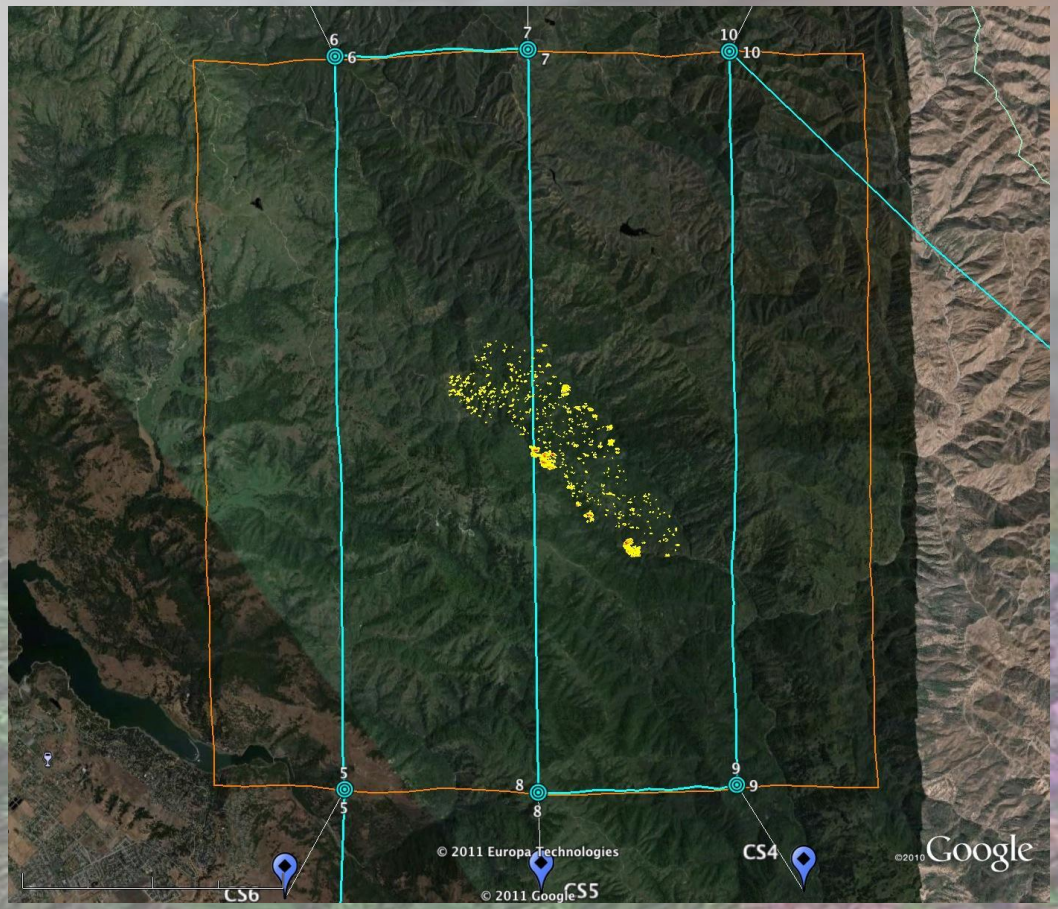
11-801-07; 13 October 2011
Coe Prescribed Fire



11-801-02; 22 July 2011
Coe Fire; Post-Burn



Post-Fire Hot Spot Detects

dNBR with pre- and post-fire

On-Board Algorithm Development

Develop Fire Radiative Power (FRP) algorithm:

FRP is a measure of the radiant energy liberated per-unit-time from burning vegetation. The MODIS FRP is estimated as:

$$R_{fre} = a\,(T_4^8 - T_{4b}^8)$$

Where:

a is a constant used for MODIS (4.34×10^{-19});

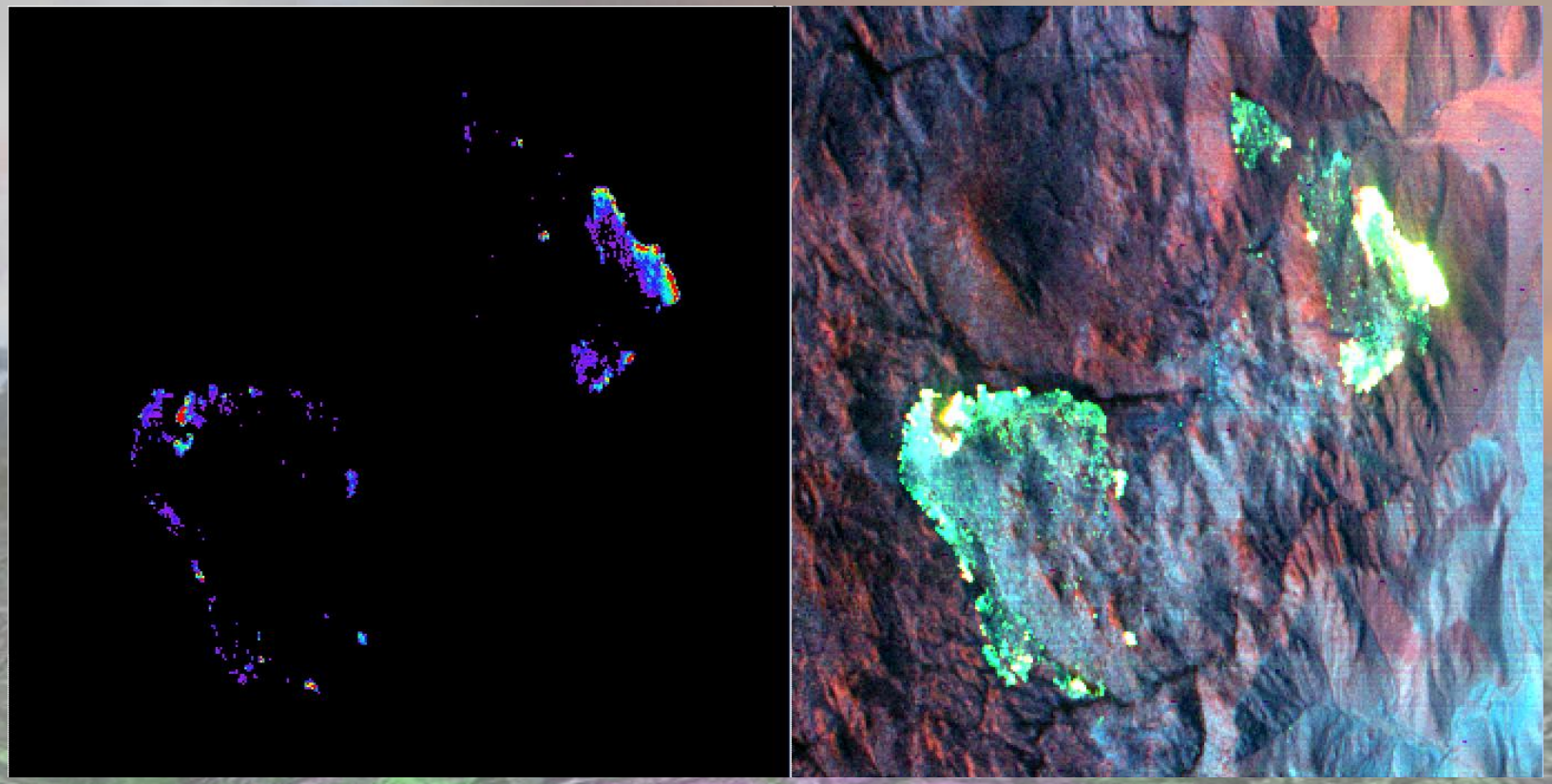
R_{fre} (in MW or MJ/s for MODIS) is the pixel fire radiative power;

T_4 (in K) is the fire pixel brightness temperature at the 4-μm channel;

T_{4b} is the 4-μm brightness temperature of the background surrounding the fire pixel [*Kaufman, et al., 1998*].

The MODIS FRP algorithm is being adapted with AMS data by using the radiance to temperature calibration for the MIR region covered by the AMS channel 11 (3.60- 3.79 μm). The AMS FRP equation is then the same as the MODIS FRP equation above, but with units of W/m^2/pixel.

On-Board FRP Development



AMS FRP measurement for the Eagle Fire, California, 26 July 2011 (left). The colors range from purple (150W/m^2) to red (3000+W/m^2. Values below 150W.m^2 are non-fire. The three-channel color composite of the Eagle Fire (right) (AMS channels 12, 9, 10) vividly show the hottest regions of the burning.

XIOMAS Instrument Development (SBIRs)

- Covered by John Green later today

NASA ROSES 2011, A35
ES Applications: Wildland Fires

NASA ROSES 2011, A35
ES Applications: Wildland Fires

- Implemented in two stages:
  - Stage 1: Feasibility Study; 12-months
  - Stage 2: Option 3-year Decision Support projects awarded at end of Phase 1.
- Proposals submitted: 16 December 2011; proposed start dates: June 2012
- Expected program budget: ~$6M
- Number of Awards: ~9-12 Stage 1; ~4-6 Stage 2
- Page Limit: 8 pages for central Science / Technical section of proposal
- Web site for proposal: http://nspires.nasaprs.com or https://grants.gov
- Funding opportunity number: NNH11ZDA001N-FIRES
- NASA POC: Woody Turner (woody.turner@nasa.gov; 202-358-1662)

NASA ROSES 2011, A35
ES Applications: Wildland Fires

Priority Topics

- **Address activities from pre-fire to post-fire stages**
- **Must address topics that span two or more of the NASA Application themes.**
- **Framed around practitioner' problems and challenges.**
- **Example topics:**
  - Fire risk assessment, prediction and planning;
  - Fire mitigation activities, including assessment of the potential effectiveness
  - Fuel inventory, characterization, mapping, and treatment planning;
  - Restoration of fire-impacted ecosystems and post-fire management and rehabilitation;
  - Fire emissions and smoke, including direct and indirect impacts;
  - Carbon management; Regulatory compliance; and,
  - Public and environmental health

NASA ROSES 2011, A35
ES Applications: Wildland Fires

End of Stage 1

- Describe comprehensively the fire-related challenges and it's importance;
- Describe the fire-related decision-making activities and actions, including reasons to improve the decision-making (or create new decision support tools;
- Determine and state the feasibility of the proposed application;
- Assess / substantiate the potential impact of applying earth observation products to support the fire-related challenge (assuming the feasibility proves positive);
- Establish a partnership with organizations that are able and willing to commit resources;
- Articulate and quantify the baseline performance of the decision-making activity; and,
- Establish a preliminary plan to make the identified, feasible improvements to the fire-related decision-making activity.

NASA ROSES 2011, A35
ES Applications: Wildland Fires

Partner Organization Involvement

Project	Stage	Activity	NASA Share	Partner Share
Year 1	Feasibility	Prove out application potential	100%	Optional
Year 2	Decision Support	Develop application	~80-85%	~15-20%
Year 3	Decision Support	Continue development	~60-70%	~30-40%
Year 4	Decision Support	Complete application and transition	~30-40%	~60-70%
Subsequent Years	Following the Stage-2 project phase, the partner organization(s) is responsible for the operational costs to run its decision support system using the Earth observations.[6] If additional activities are needed to assist in the sustained use of the Earth observations, NASA will support additional efforts with in-kind support as possible. NASA will continue to provide appropriate Earth observations through the NASA data centers and near real time data distribution systems for use by the partner organization(s).			

NASA ROSES 2011, A35 Proposal: "*Integration of the NASA AMS Into U.S.F.S. Operations*"

- Transition real / time AMS processing and sensor operations to USFS aircraft
- Support engineering efforts to achieve the transition including :
  - Support installation engineering efforts;
  - Lab engineering training in instrument maintenance, support;
  - Operations support during missions;
  - Software maintenance support;
  - Lab Calibration support. At RSAC;
  - Training interpreters in utility of data;
  - Data archiving and maintenance of an archive.

- USFS aircraft (with AMS) to support NASA science missions with AMS and other instruments.

Proposed Schedule

Start Date	Completion Date	Milestones
1 March 2012	1 May 2012	Project Initiation / TFRSAC Review of Plans
1 March 2012	31 August 2012	USFS Aircraft Engineering Modification Studies
1 March 2012	28 February 2013	USFS Aircraft Pod Feasibility and Procurement Evaluation
1 March 2012	1 April 2012	AMS Engineering Ops Manual Development
1 May 2012	1 June 2012	AMS Sys. Electronic Rack Design (for USFS A/C install)
1 May 2012	1 June 2012	AMS Upgrades – Noise Reduction Feasibility Assessment
1 May 2012	1 June 2012	AMS Upgrades – Evaluate Saturation Threshold Expansion
1 May 2012	1 June 2012	AMS Upgrades – Digitizer Evaluation Development Plan
1 May 2012	1 July 2012	Algorithm Tech Transfer / Integration Plan
1 June 2012	1 July 2012	AMS Installation / Operations Training
August 2012	August 2012	Project quarterly report to NASA Applied Science
1 July 2012	28 February 2013	AirCell Feasibility Study and Procurement Evaluation
1 September 2012	30 November 2012	AMS Test Flight Series on USFS Aircraft
November 2012	November 2012	TFRSAC Review / Assessment of Progress
December 2012	January 2012	Complete TFRSAC Evaluation / Plan Phase 2 efforts
November 2012	November 2012	Project quarterly report to NASA Applied Science
1 February 2013	28 February 2013	Phase 1 Final Report; Prep Phase 2 Proposal;

AMS Transitioning to Operations: NASA to USFS

- Transition Agreement signed by NASA and USFS in February 2012
- Plan for transitioning instrument; initially loan AMS “model” for fit check on B100 (127Z) .
- Long-Term objective: Transition to B200 (182Z) following proof of capabilities and operations on B100

AMS on USFS Aircraft for Operations

- Potential to fit AMS on one (or both) of two USFS Beechcraft aircraft: B200 (182Z) and B100 (127Z).
- Aircraft would require a data link for realization of full AMS capabilities
- Data link may be “shared” between platforms, with antennae on both A/C.
- AMS would be provided on long-term loan or possibly handed over to USFS for operations.
- NASA can still support sensor calibration.
- Discussions between parties on enhancement costs, new components, etc.
- AMS sensor operator to assist in transitional development, then hand off operations (or continue role as AMS Ops Engineer.

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- J. Myers (NASA-ARC) will discuss the options / opportunities next

2012 - ? Mission Platforms

USFS King Air B100 (N127Z)

Operation Base: Fox Field, Lancaster, CA
Endurance: ~4.0 hours
Onboard Operators: 3 (inc. flight team)
C&C and sensor telemetry: Planned AirCell integration

USFS King Air B-200 (N182Z)

Operation Base: Currently USFS R8 (Atlanta)
Endurance: ~4.0 hours
Onboard Operators: 3 (inc. flight team)
Sensor telemetry: Planned AirCell Integration

DRI Proposal:

"Feasibility Study of Automated Wildland Fire Visualization and Decision Support Integrating AMS-Wildfire Sensor with Fire Behavior and Growth Prediction"

- D. Coming, T. Brown, F. Harris
- Use R/T AMS coupled with GPU-accellerated fire behavior model to support and develop fire response efforts;
- Use TFRSAC as sounding board for integration and evaluation of capabilities in first (feasibility) stage.

Proposed Schedule

Proposed Schedule