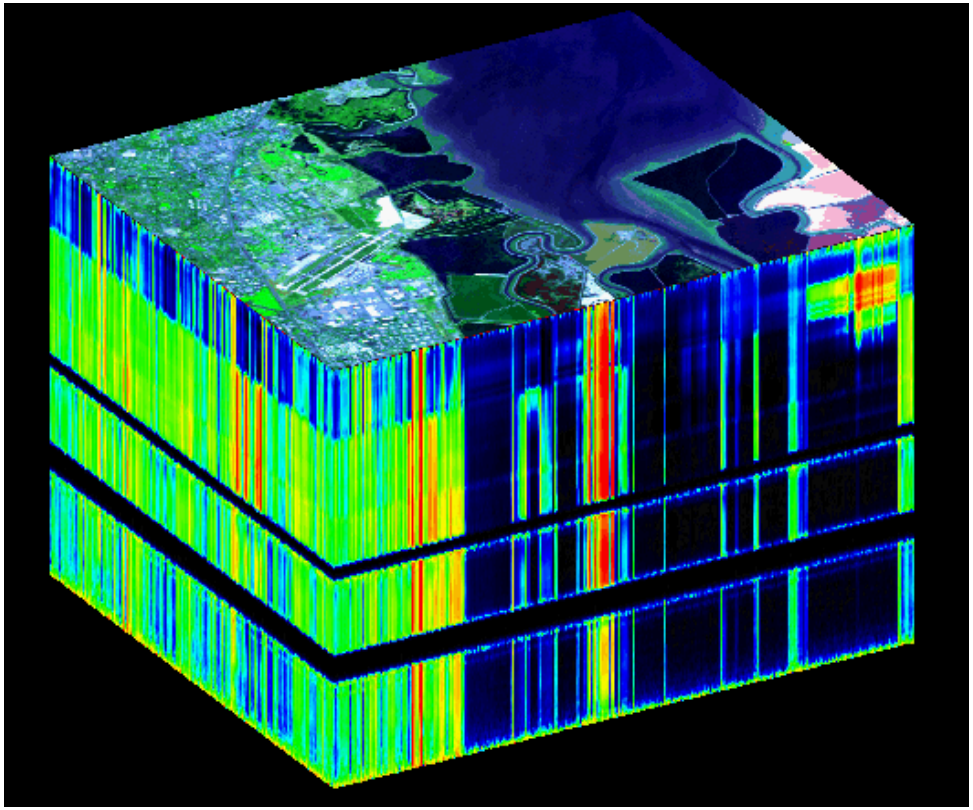
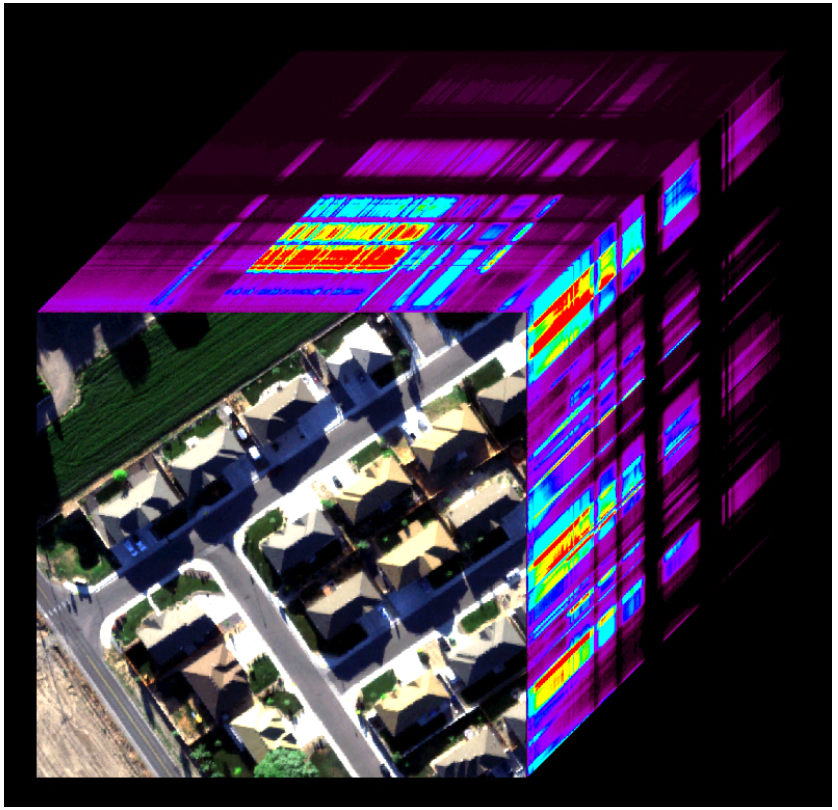
AVIRIS-C and AVIRIS-NG VSWIR Status

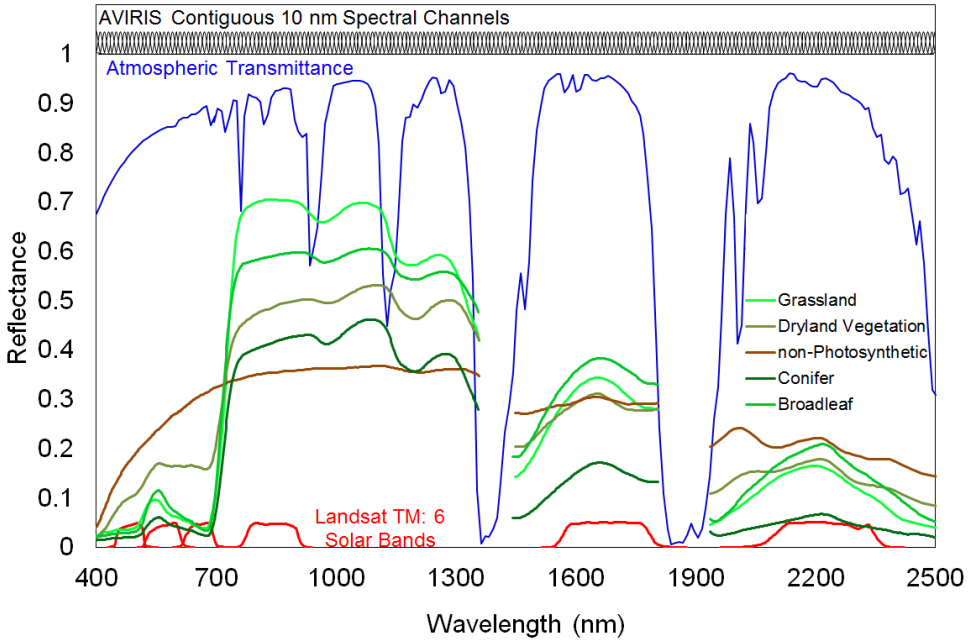




Robert O. Green and the Team

AVIRIS-Classic

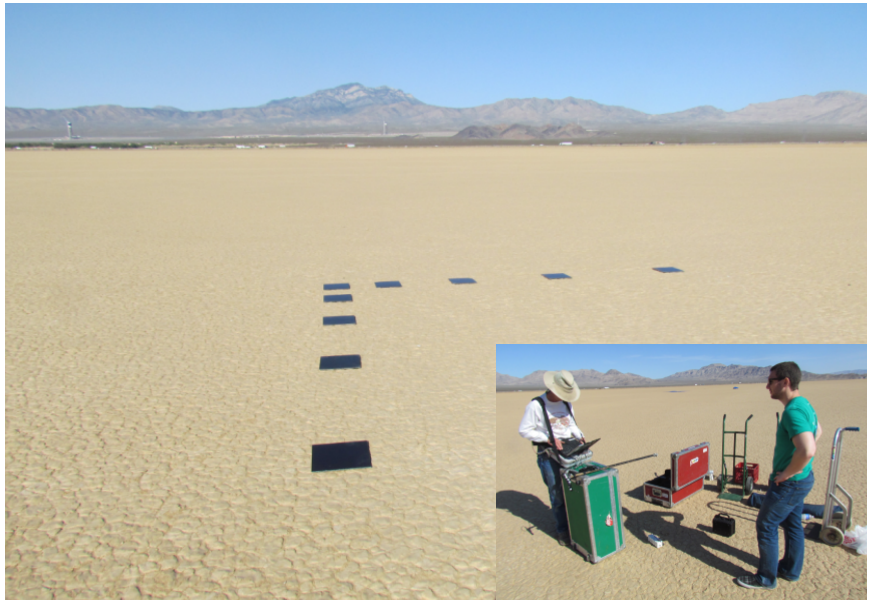
The Airborne Visible-Infrared Imaging Spectrometer (AVIRIS)



- Proposed 1983 and first flew in late1986
- F/1 optics; Si, InGaAs, InSb detectors; 200 µm class detectors
- 87 µs integration time; ≥1 M electrons in 10 nm channels for bright targets
- 8700 spectra per second; > 100 Terabytes of data and products
- AVIRIS is mentioned in more the 850 refereed journal articles
- Flew the RIM Fire, CA on the 13th of September 2013 (28 consecutive years)

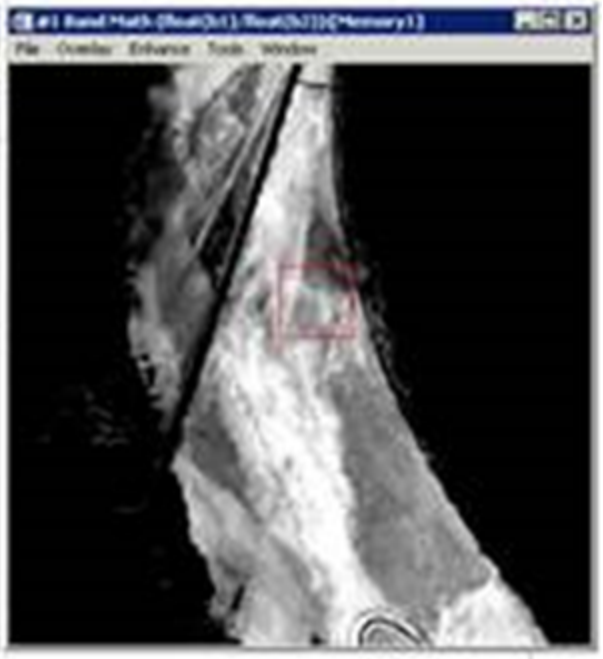
AVIRIS on the ER-2

Example AVIRIS Calibration Validation Experiment
Ivanpah Playa Calibration Site

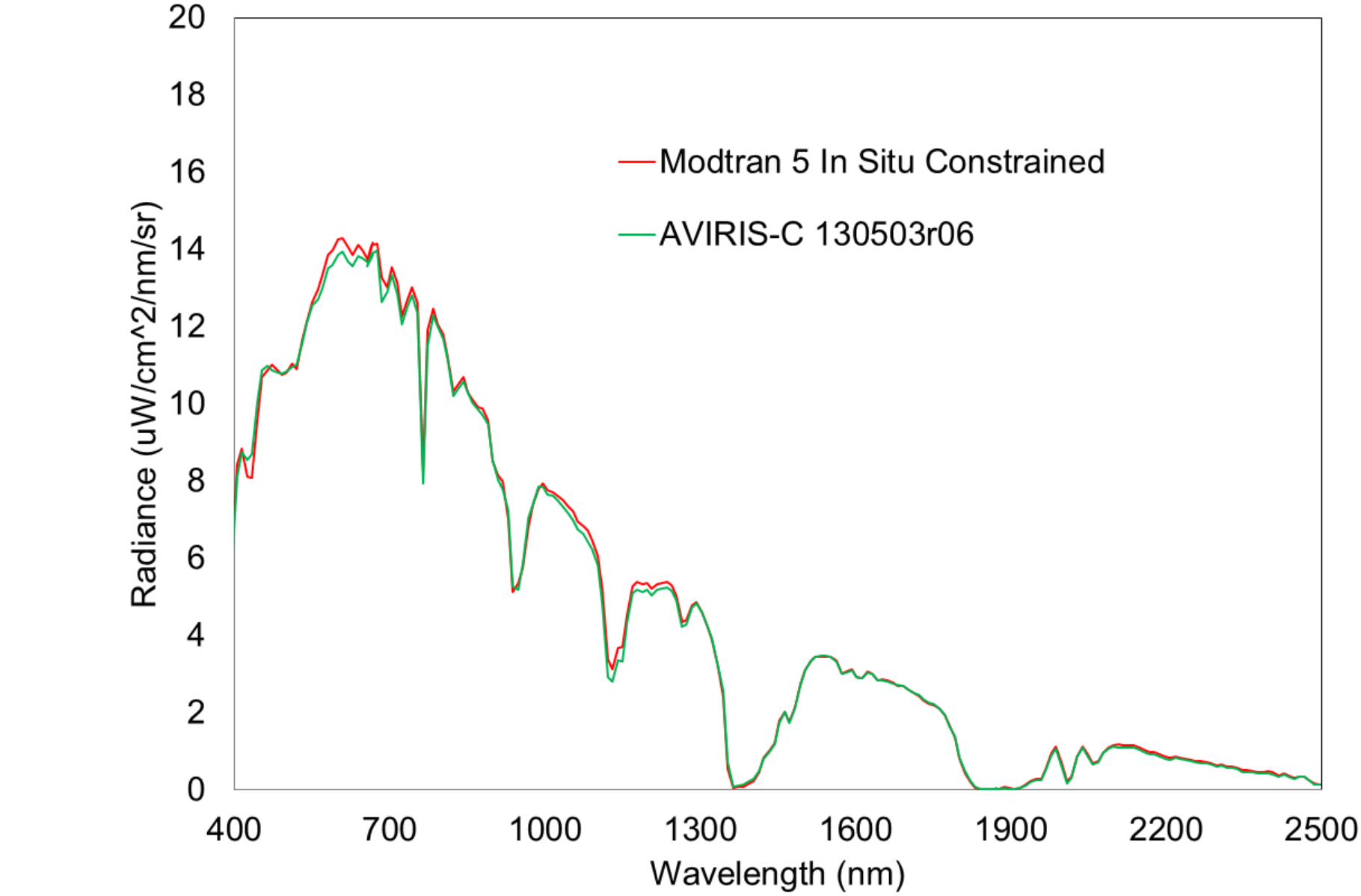


AVIRIS-C Calibration Experiment 3 May 2013

Ivanpah Tarp Location 130503

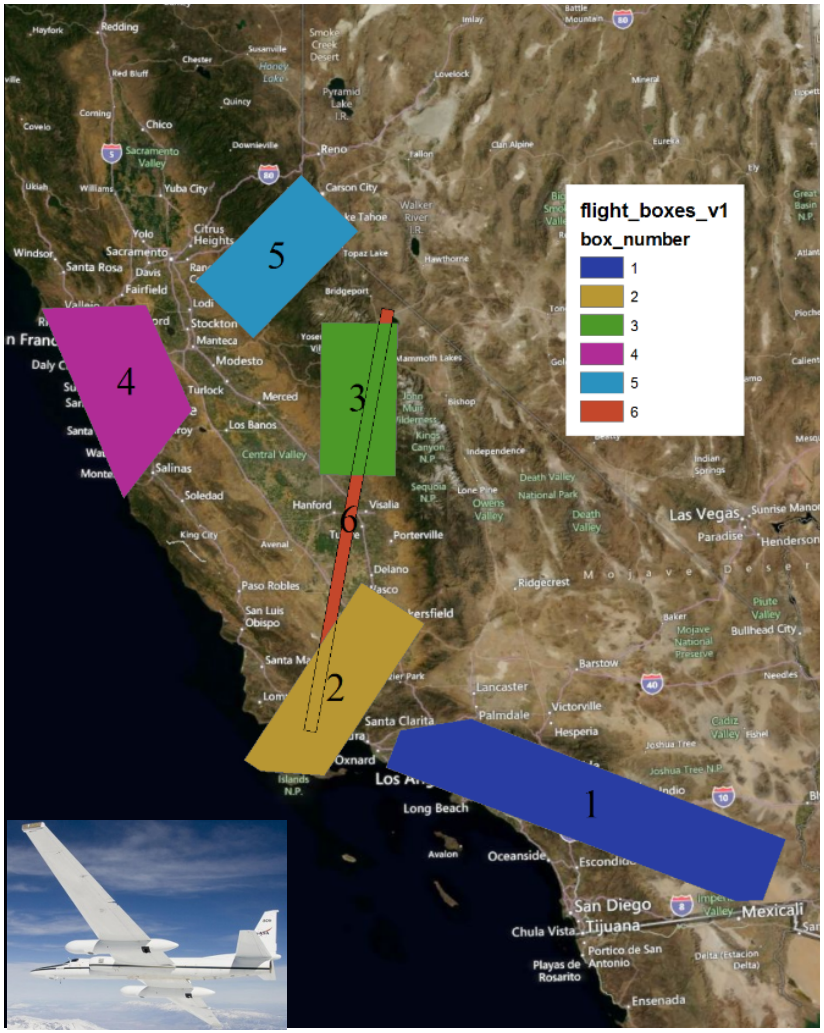


Preliminary Results 3 May 2013 HyspIRI Preparatory Campaign



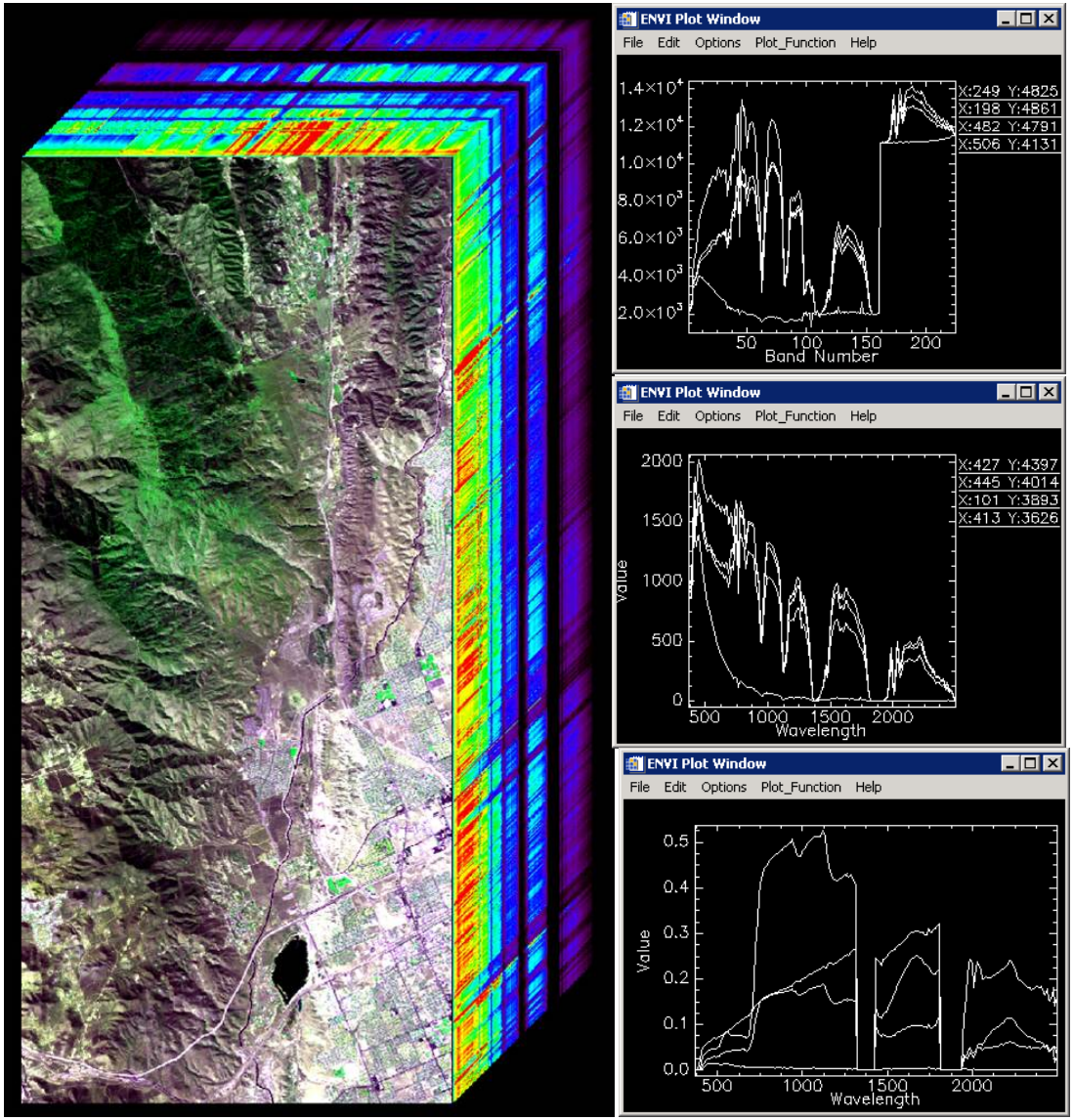
HyspIRI Preparatory Airborne Science

(Ecosystems, Seasonal, Climate, Coastal, Urban, Resources)



- 6 zones, 3 seasons, 2 years
- Objective: Advance HyspIRI Mission Science Readiness
  - Ecosystem composition, function, biochemistry, seasonality, structure, and modeling
  - Coastal ocean phytoplankton functional types, habitat
  - Urban land cover, temperature, transpiration
  - Surface energy balance
  - Atmospheric characterization and local methane sources
  - Surface geology, resources, soils, hazards

HyspIRI Airborne Campaign – First Flights March 29, 2013, Palmdale CA



AVIRIS image cube and Level 1a, 1b and 2 spectra. The reflectance spectra (L2) will be used to address the full range of science objectives including ecosystems and climate.

AVIRIS Files

The following types of files should be found:

PER FLIGHT LINE (i.e., occurs once per tar file/directory):

*info	general information about the flight line,
*gain	multiplication factors, radiance to 16-bit integer,
*nav	navigation data,
*rcc	radiometric calibration coefficients,
*readme	this file,
*txt	description of AVIRIS orthocorrection processing,
*spc	spectral calibration file.
*rcc	radiometric calibration coefficients,
*glt	geometric look up table file
*glt.hdr	geometric look up table file header
*igm	input geometry file
*igm.hdr	input geometry file header
*eph	the position data in a WGS-84/NAD83 UTM x,y,z coordinate system
*lonlat_eph	the position in WGS-84 longitude, latitude and elevation
*obs	raw spatial format of the observation and illumination conditions of the uncorrected AVIRIS data,
*obs.hdr	associated header
*obs_ort	rendered image using the *_ort_glt lookup table and matches the orthocorrected imagery,
*obs_ort.hdr	associated header
*img	orthocorrected, scaled radiance image
*img.hdr	orthocorrected, scaled radiance image file header

To list files (table-of-contents):

```
tar tvf "tar file name,"
```

To extract files:

```
tar xvf "tar file name" "extract file name,"
```

To get information about tar:

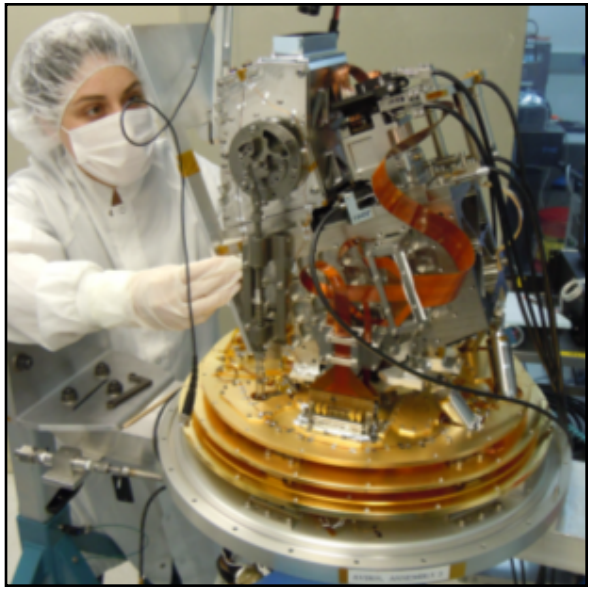
```
man tar
```

AVIRIS-Next Generation

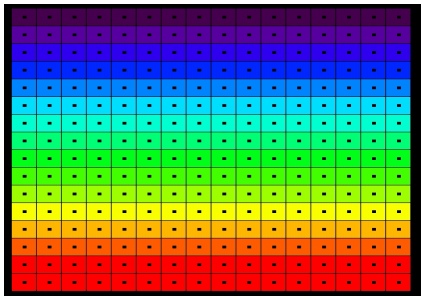
AVIRIS-C Compared to AVIRIS-NG

	AVIRIS-Next Generation	AVIRIS-Classic
SPECTRAL		
Range	380 to 2510 nm	380 to 2500 nm
Position	5 nm	10 nm
Response	1 to 1.5 X sampling	1 to 1.5 X sampling
Calibration	+-0.1 nm	+-0.1 nm
RADIOMETRIC		
Range	0 to max Lambertian	0 to max Lambertian
Precision (SNR)	>2000 @ 600 nm	>1000 @ 600 nm
	>1000 @ 2200 nm	>400 @ 2200 nm
Accuracy	95% (<5% uncertainty)	90% (<10% uncertainty)
Linearity	>=99% characterization	>=99% characterization
SPATIAL		
Range	34° field-of-view	34° field-of-view
Sampling	1 milliradian	1 milliradian
Response	1 to 1.5 X sampling	1 to 1.5 X sampling
Sample Distance	0.3 m to 20 m	4 m to 20 m
Geom Model	Full 3 Axes cosines	Full 3 Axes cosines
UNIFORMITY		
Spectral Cross-Track	>95% across FOV	>98% across FOV
Spectral-IFOV-Variation	>95% Spectral Direction	>98% Spectral Direction

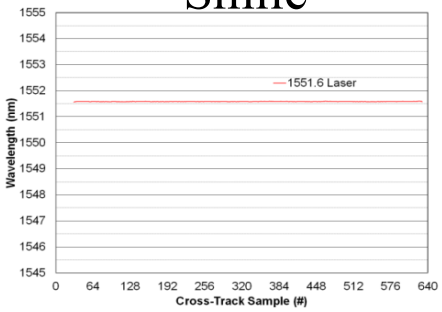
2012 AVIRIS-Next Generation
Substrate removed MCT 380 to 2510 nm



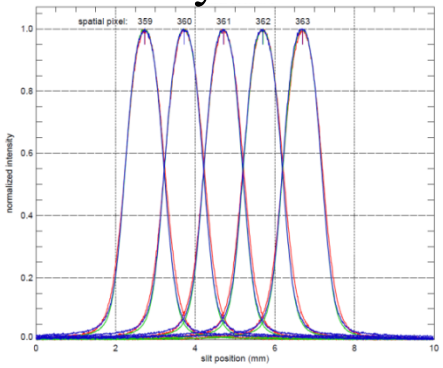
>95% cross-track and IFOV uniformity

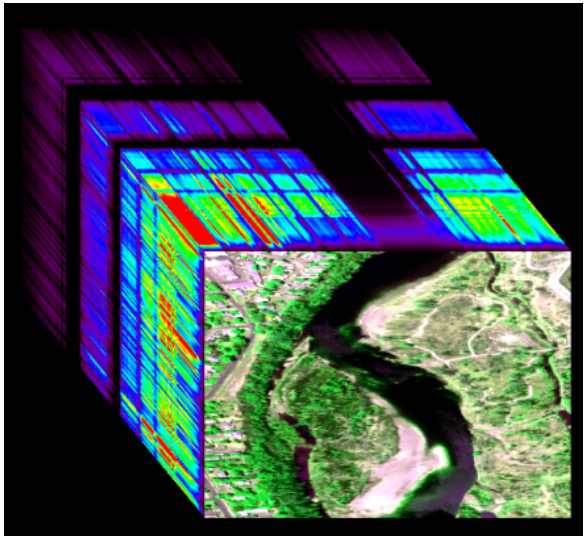


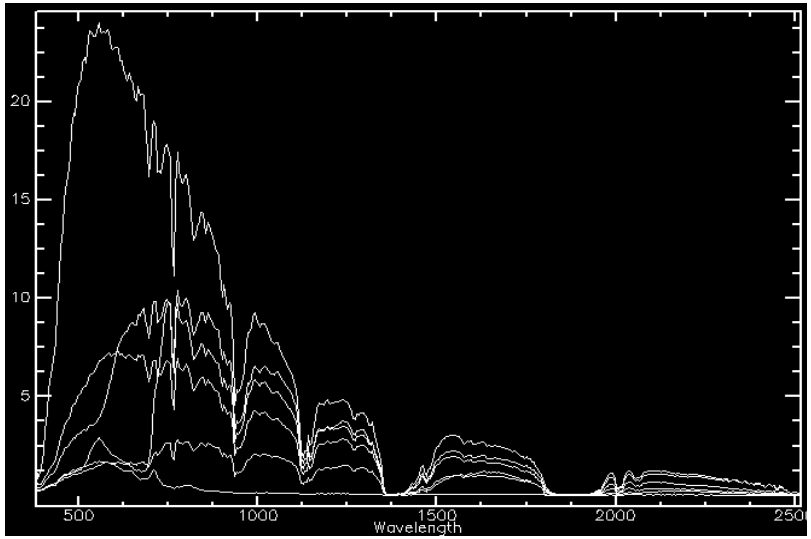
"Smile"



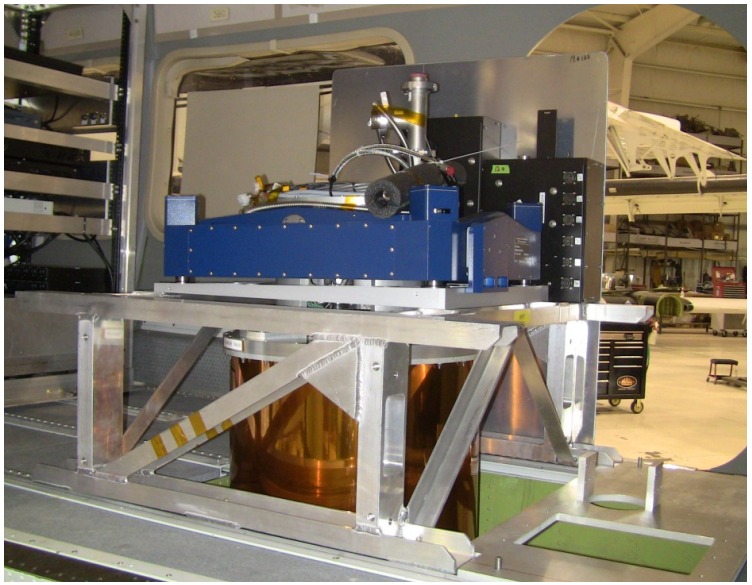
"Keystone"



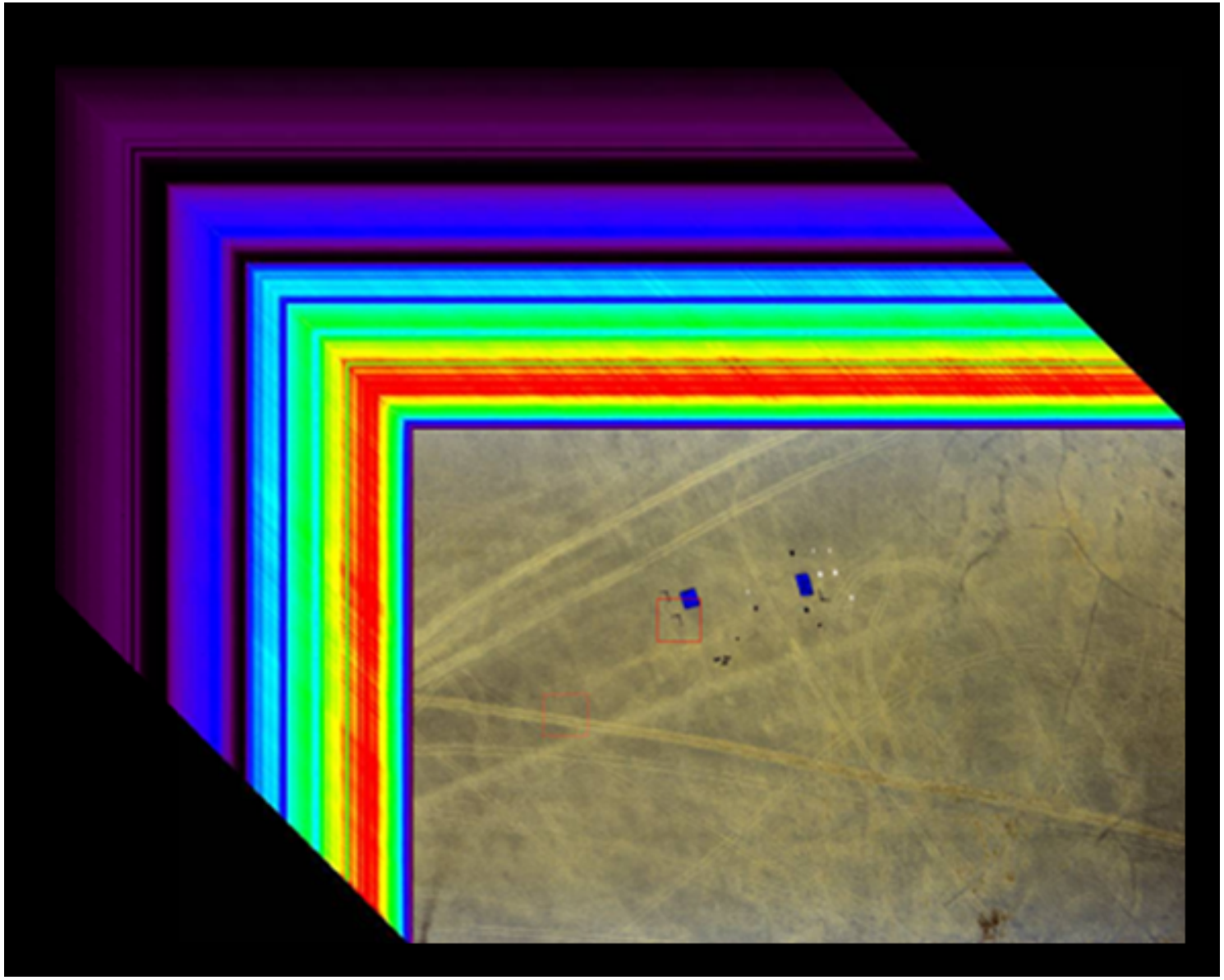




AVIRIS-Next Generation Installation
17 April 2012

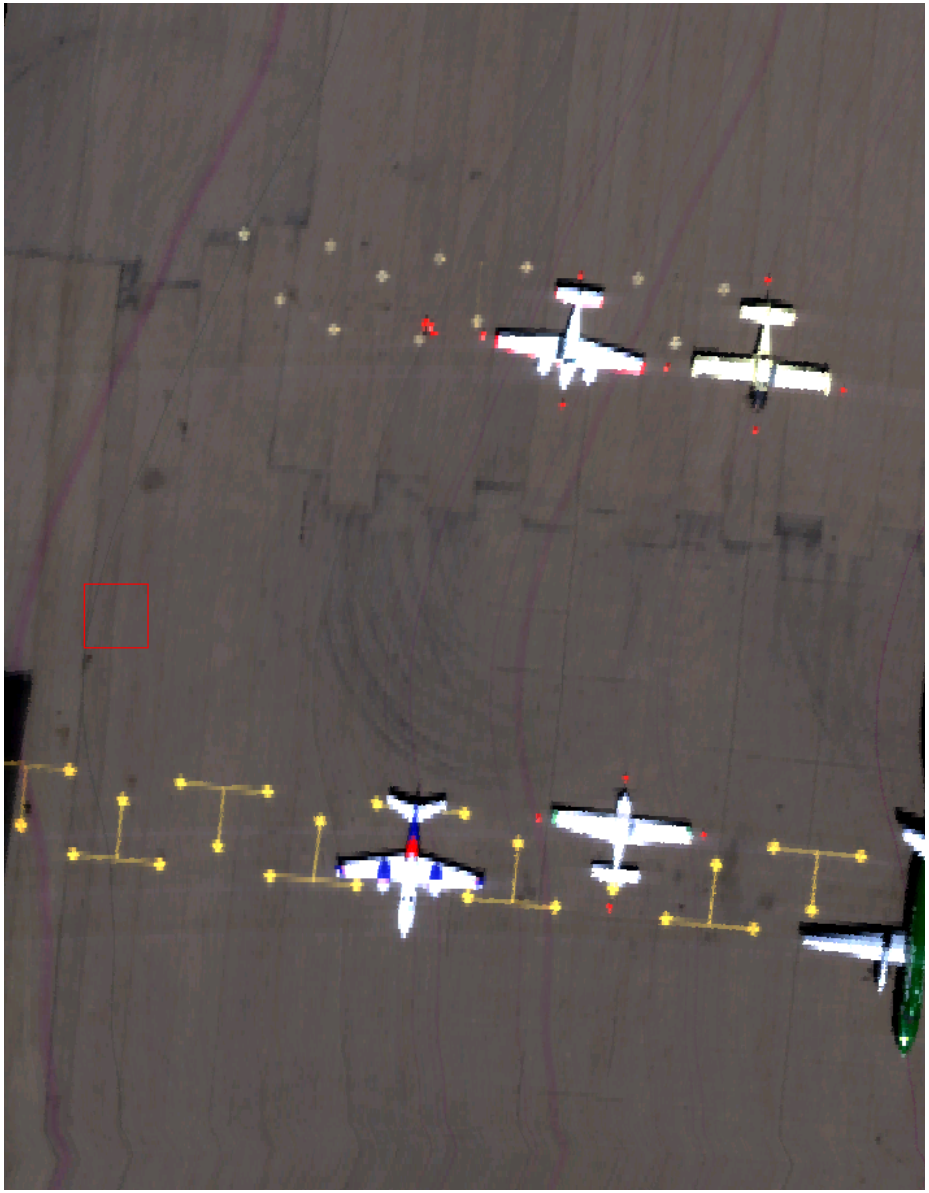


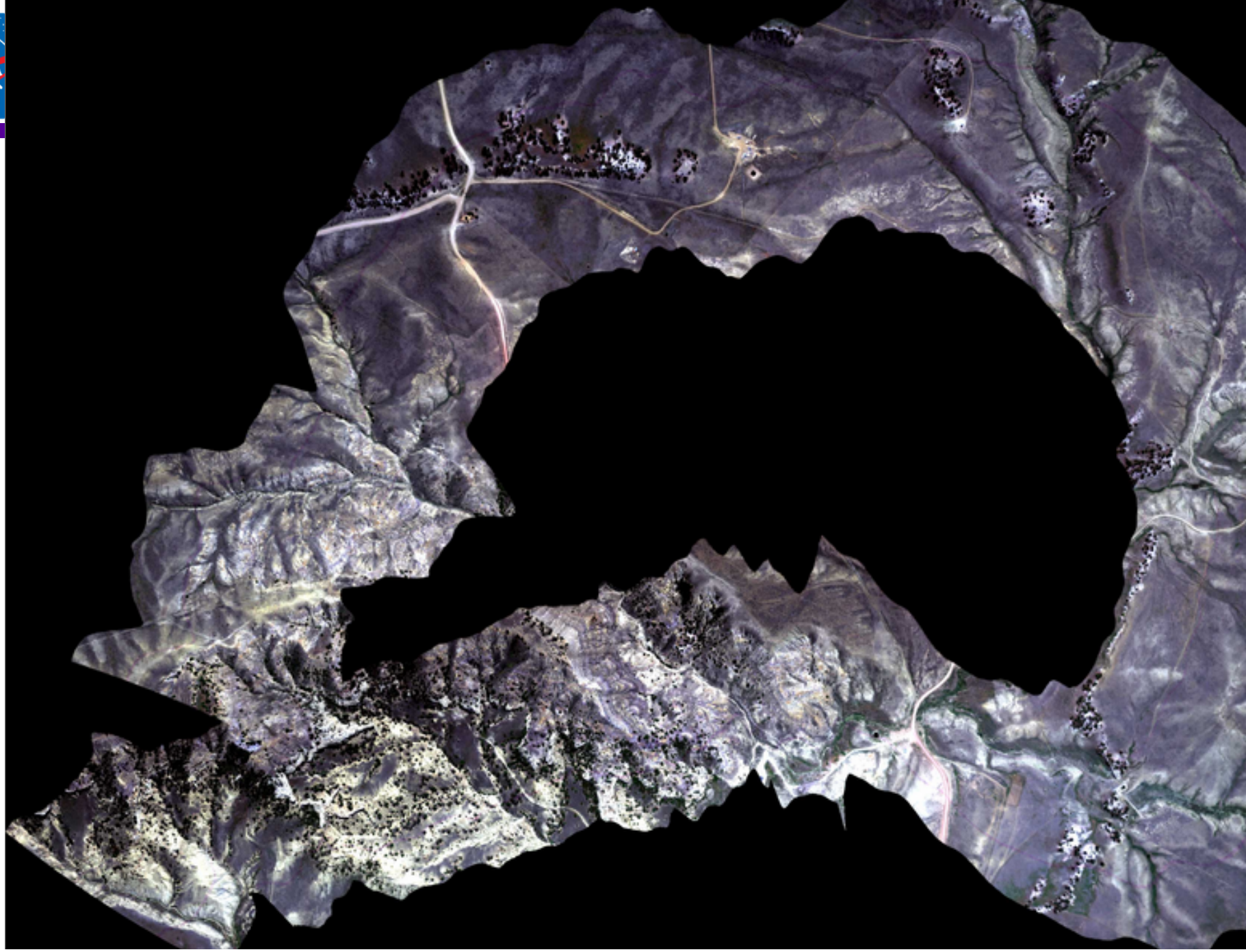
AVIRIS-NG Cube 427 Spectral Channels



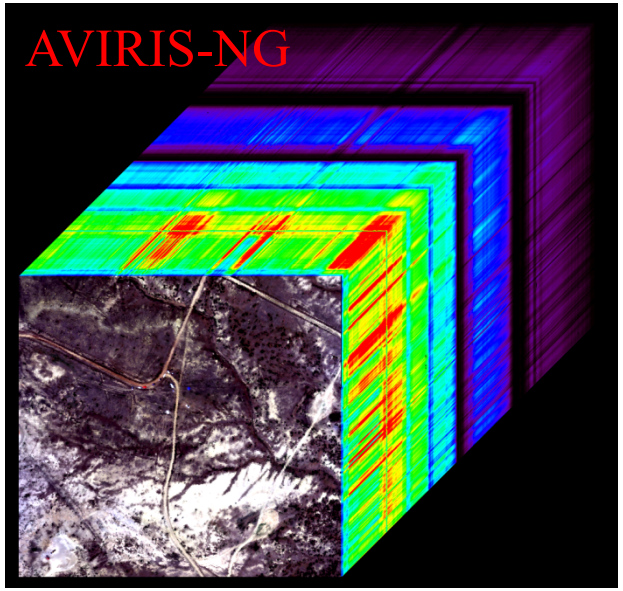
Casper, Wy 2013

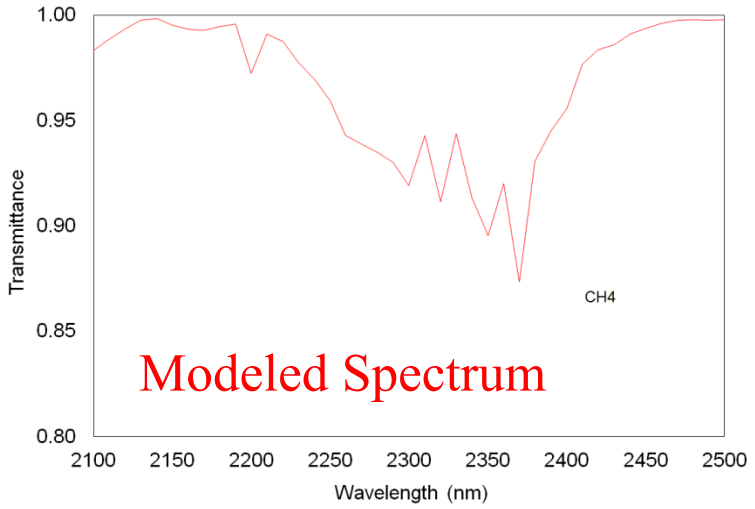
High Spatial Resolution

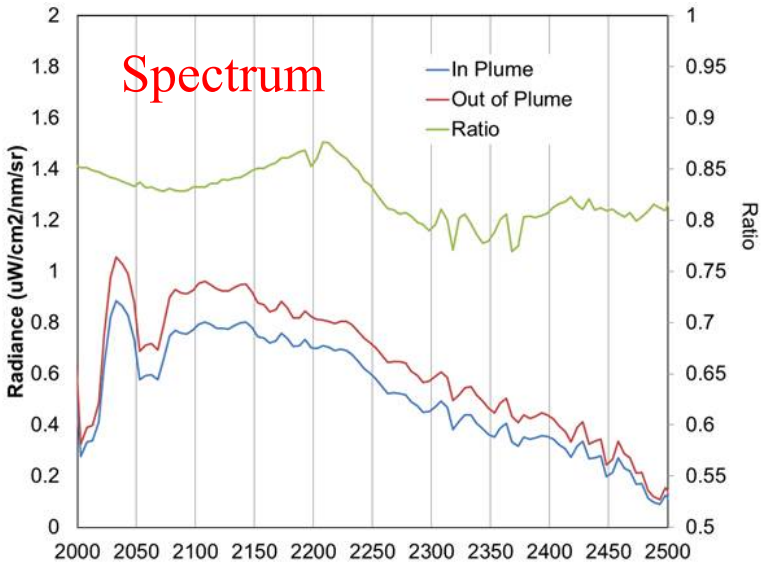


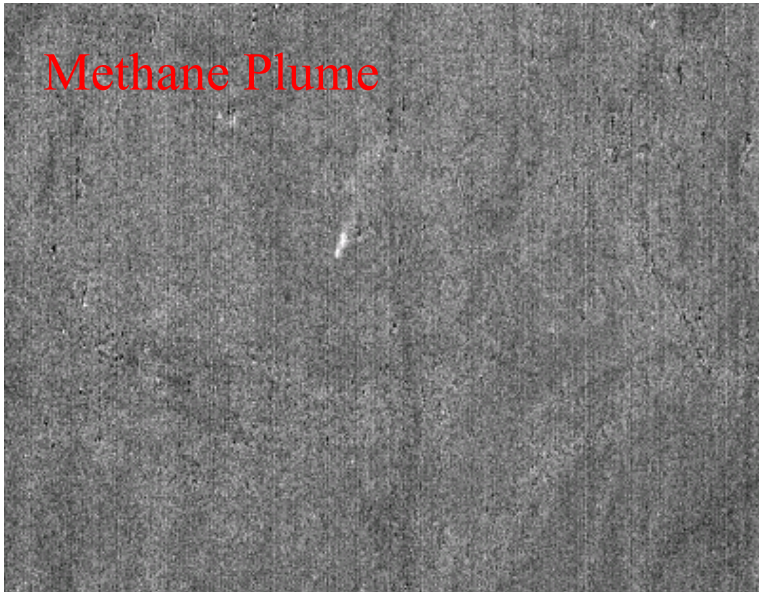


Methane Plume Detection

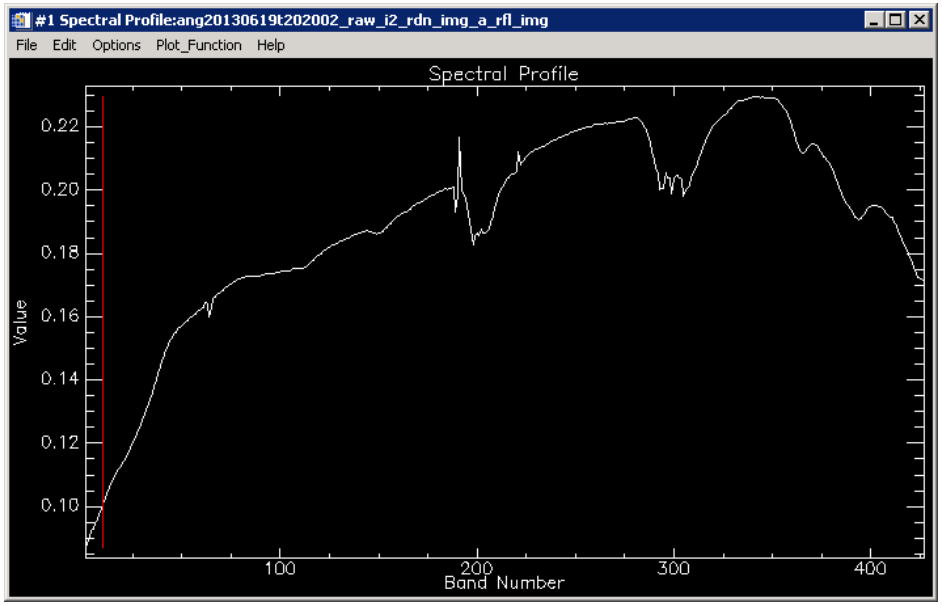


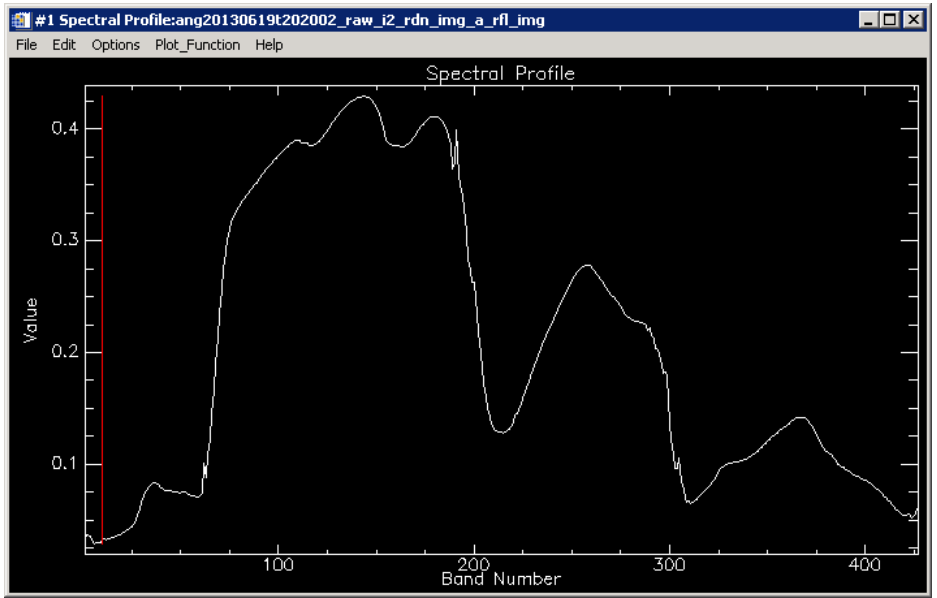




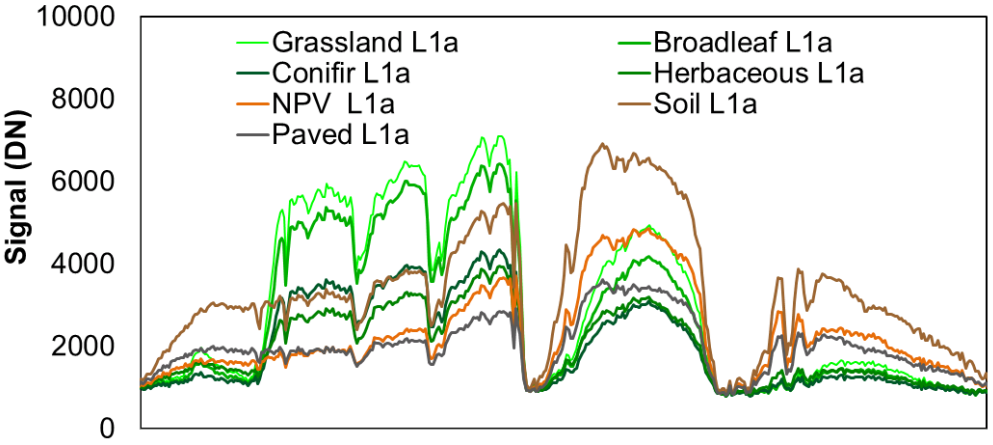


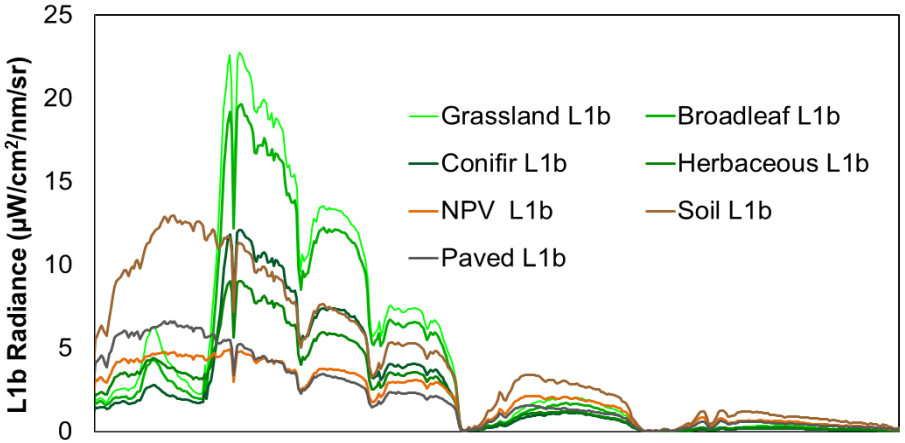
Level 2 Data Product Dry Atmosphere

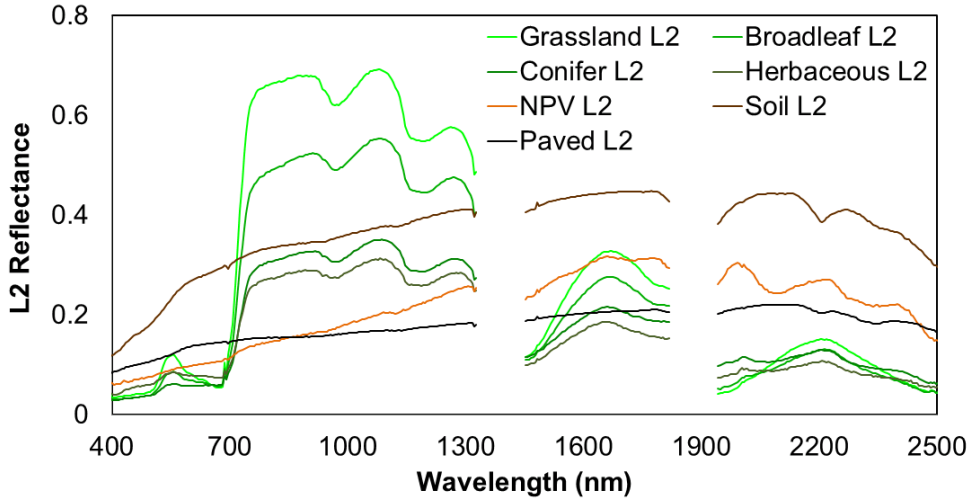




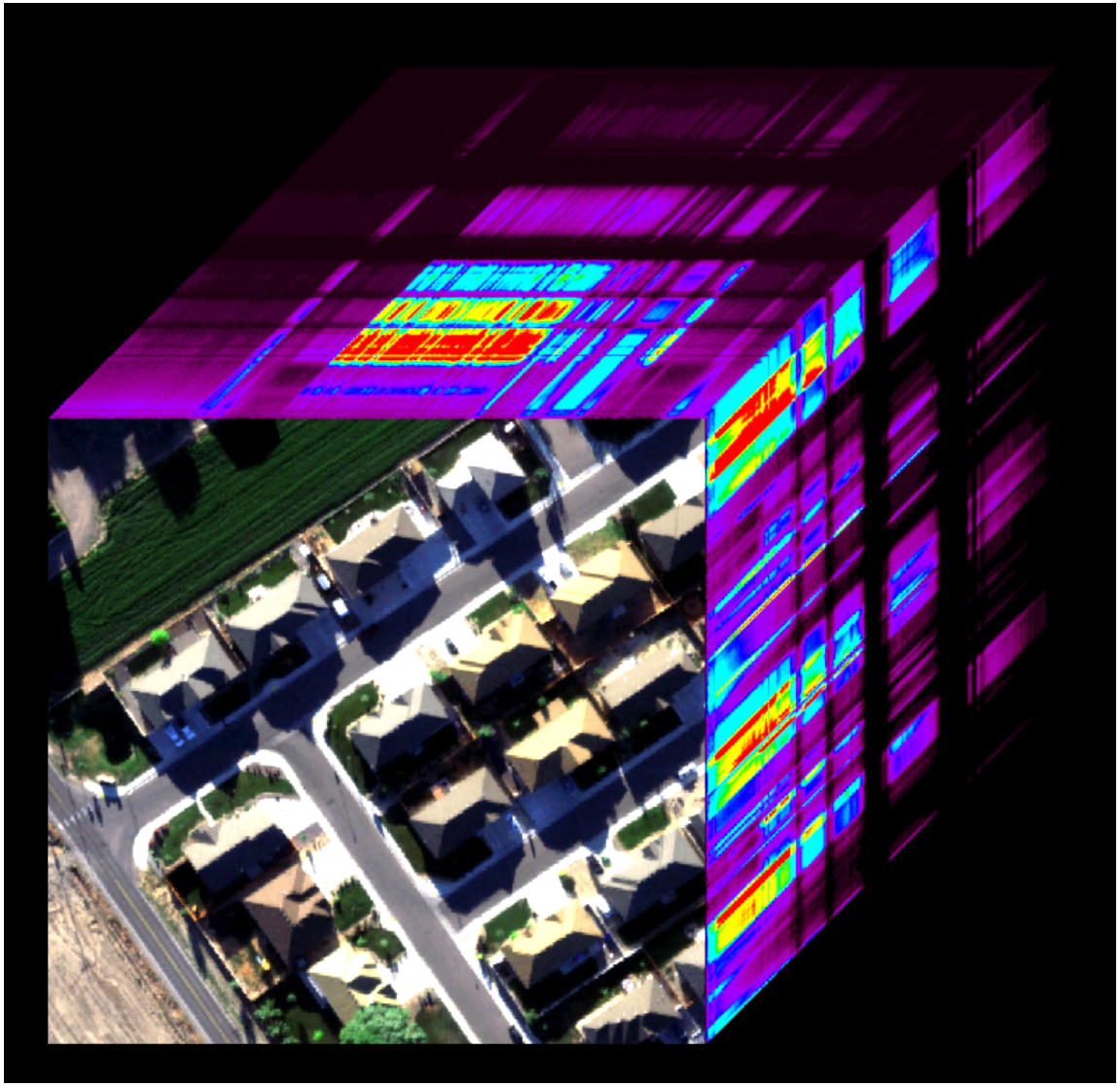
AVIRIS-NG


Signal (DN)
10000
8000
6000
4000
2000
0
Grassland L1a
Broadleaf L1a
Conifir L1a
Herbaceous L1a
NPV L1a
Soil L1a
Paved L1a

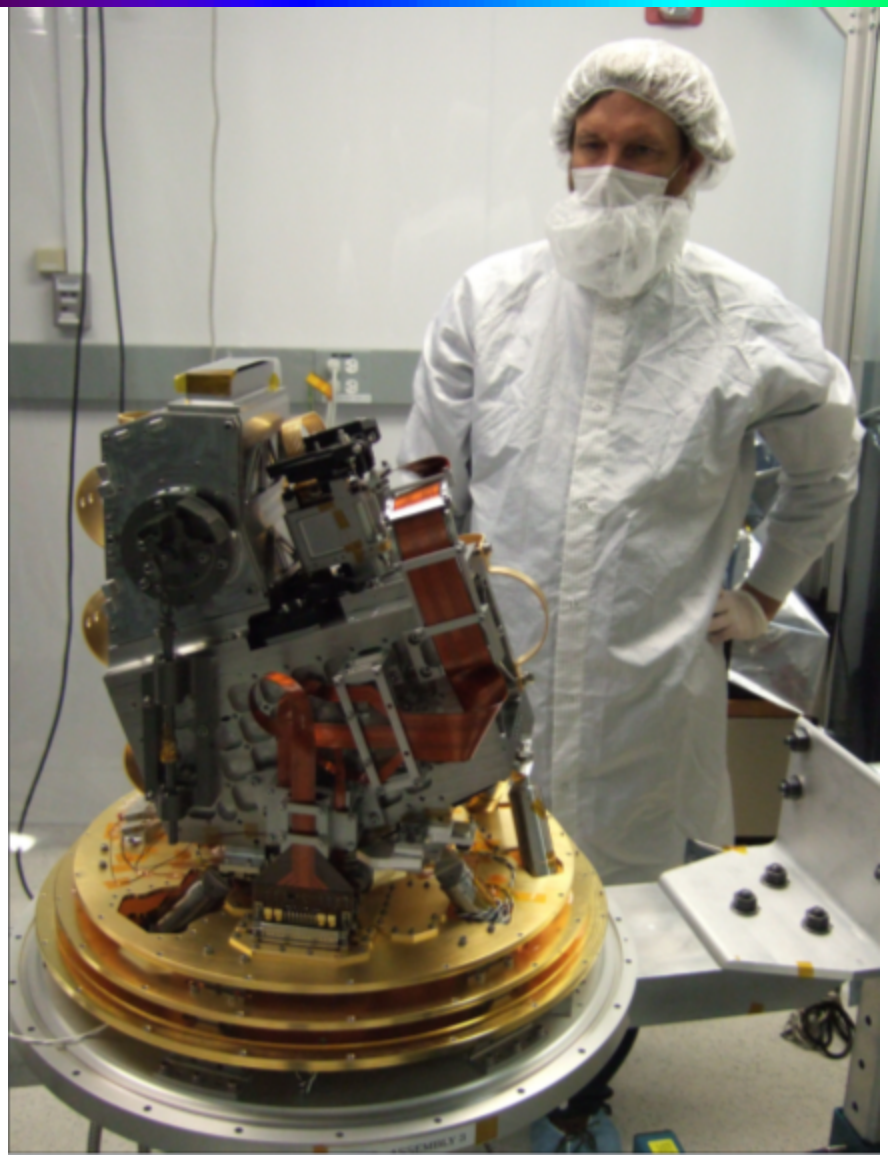

L1b Radiance (μW/cm²/nm/sr)
25
20
15
10
5
0
Grassland L1b
Broadleaf L1b
Conifir L1b
Herbaceous L1b
NPV L1b
Soil L1b
Paved L1b


L2 Reflectance
0.8
0.6
0.4
0.2
0
400
700
1000
1300
1600
1900
2200
2500
Wavelength (nm)
Grassland L2
Broadleaf L2
Conifer L2
Herbaceous L2
NPV L2
Soil L2
Paved L2

AVIRIS-NG



AVIRIS-NG and HyspIRI VSWIR Concept



- Two mirror telescope
- Offner spectrometer
- Uniform SiN slit (eBL)
- Convex grating (eBL)
- Alignment mounts
- Alignment process
- All aluminum telescope
- Full range detector
- Order sorting filter
- Uniformity requirements
- Vacuum operation
- 140 K operation

Summary

- Successful collection the first season of the HyspIRI preparatory airborne campaign
- A calibration/validation experiment was held on the 3rd of May
- Level 1a, 1b and L2 data are being loaded into the AVIRIS locator/download tool
- AVIRIS-NG has flown in 2013 for a methane experiment at testing of the new data capture system including cloud and compression testing
- The AVIRIS_NG detector is being upgraded now.
- AVIRIS-C and AVIRIS-NG are expected to be available in 2014 and beyond
- AVIRIS-NG paves the way for a HyspIRI-type VSWIR imaging spectrometer