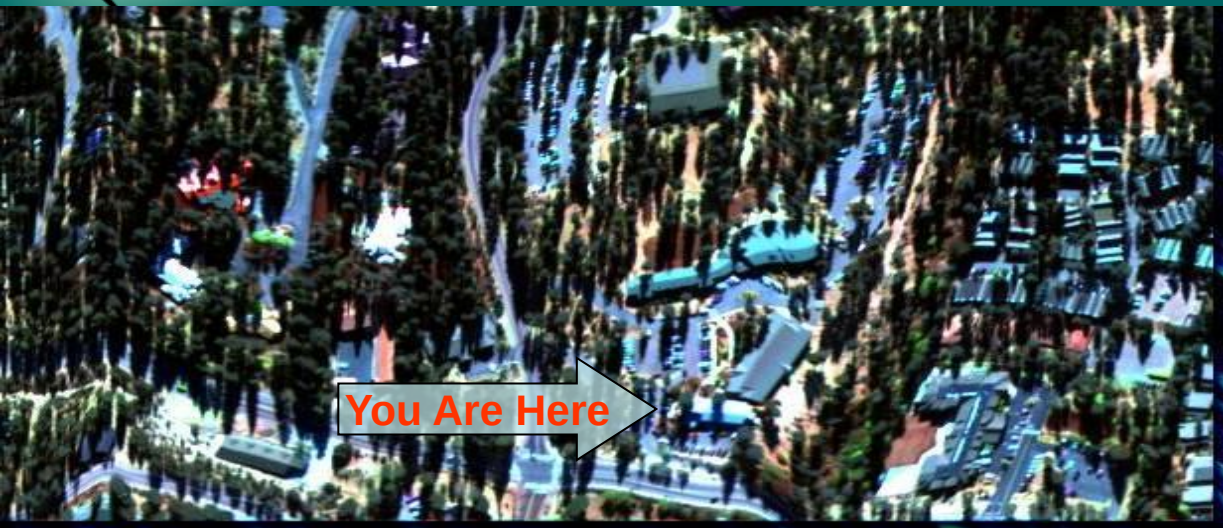
SpecTIR™

Presented by Kevin Rock

May, 23rd 2012



Aerial Hyperspectral Data: 360 Spectral Bands of Visualization

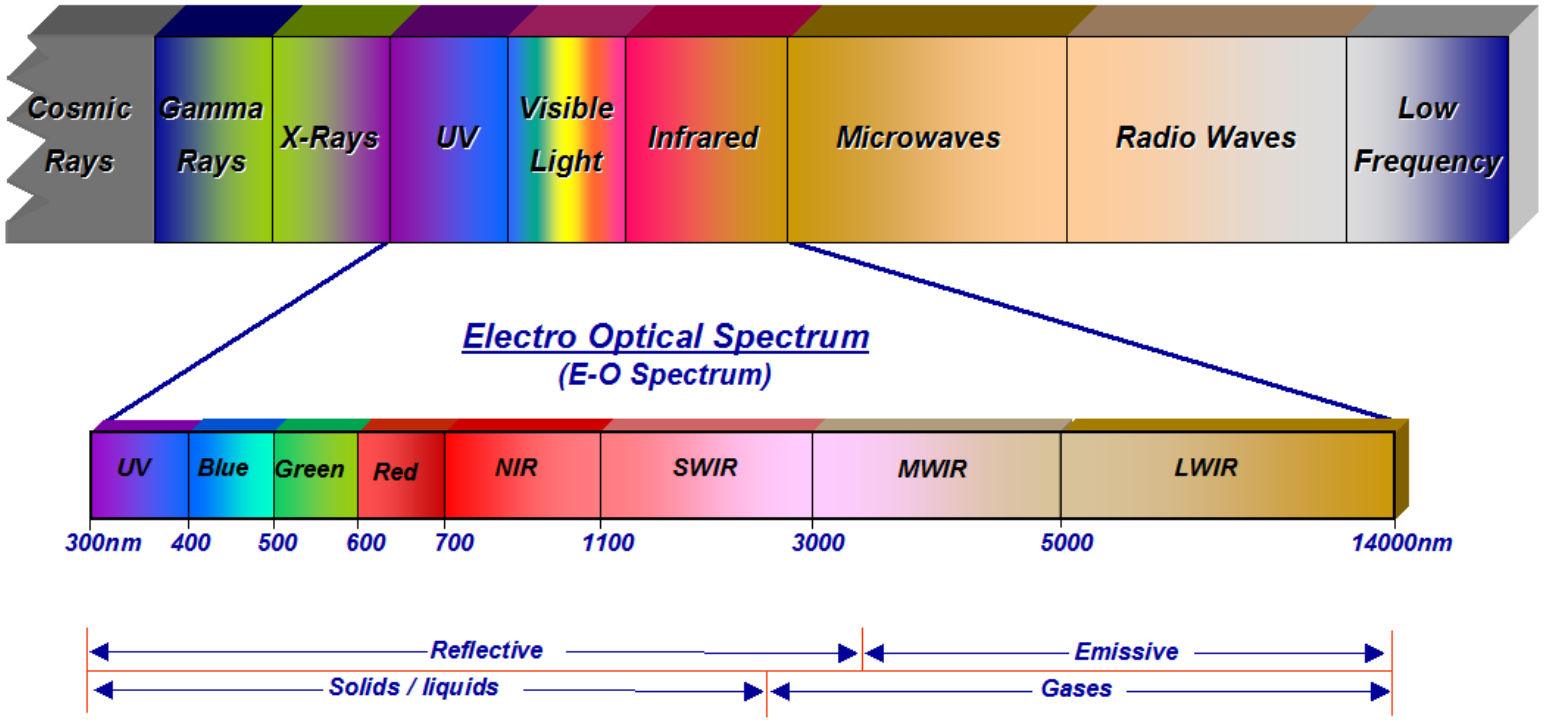
11781 Lee Jackson Memorial Hwy
Suite 210
Fairfax, VA 22033

9390 Gateway
Suite 100
Reno, NV 89521

www.spectir.com

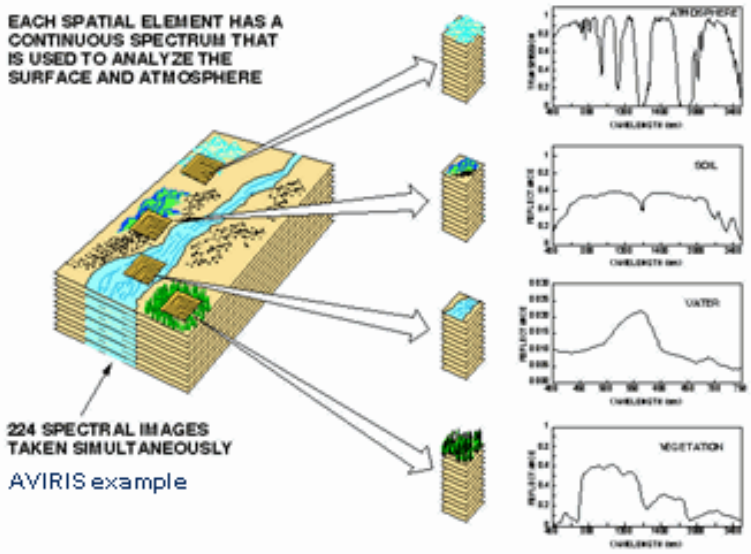
end to end hyperspectral solutions

Electromagnetic Radiation: The Big Picture



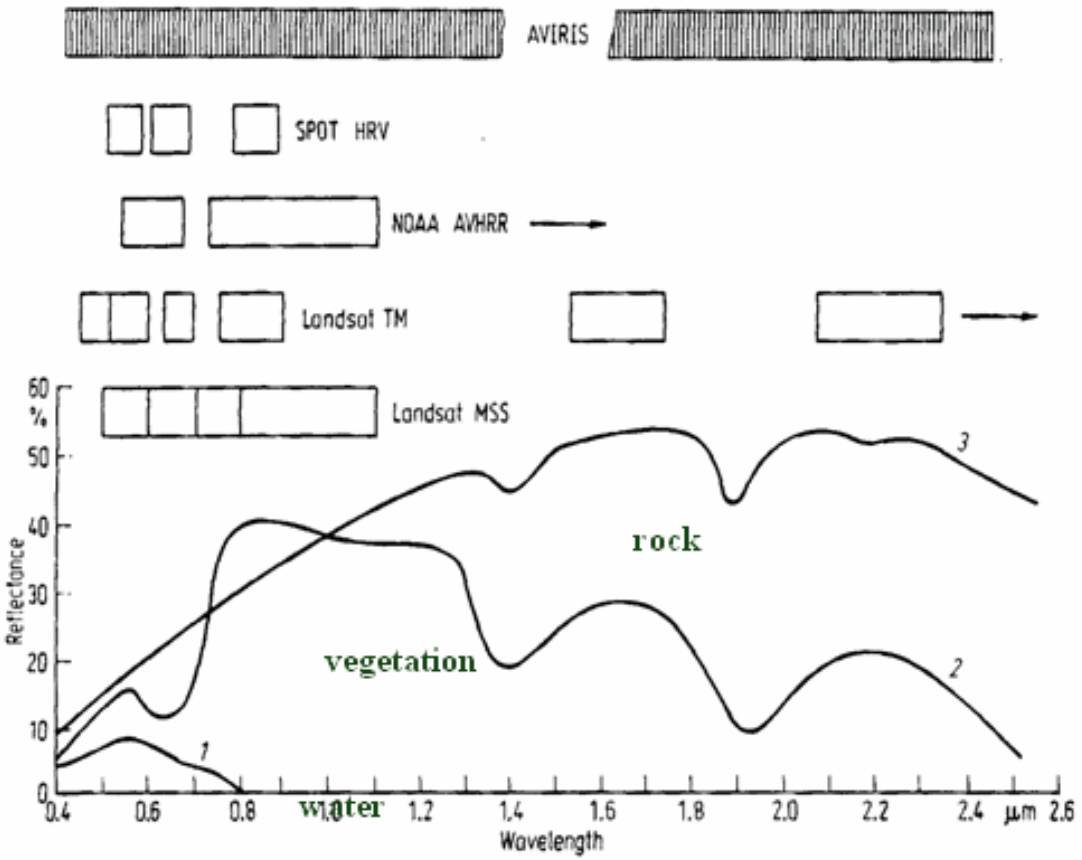
What is Hyperspectral?

- Also known as Imaging Spectrometry.
- The acquisition of images in hundreds of registered, contiguous spectral bands such that for each picture element of an image it is possible to derive a complete reflectance spectrum.



Other Forms of Remote Sensing

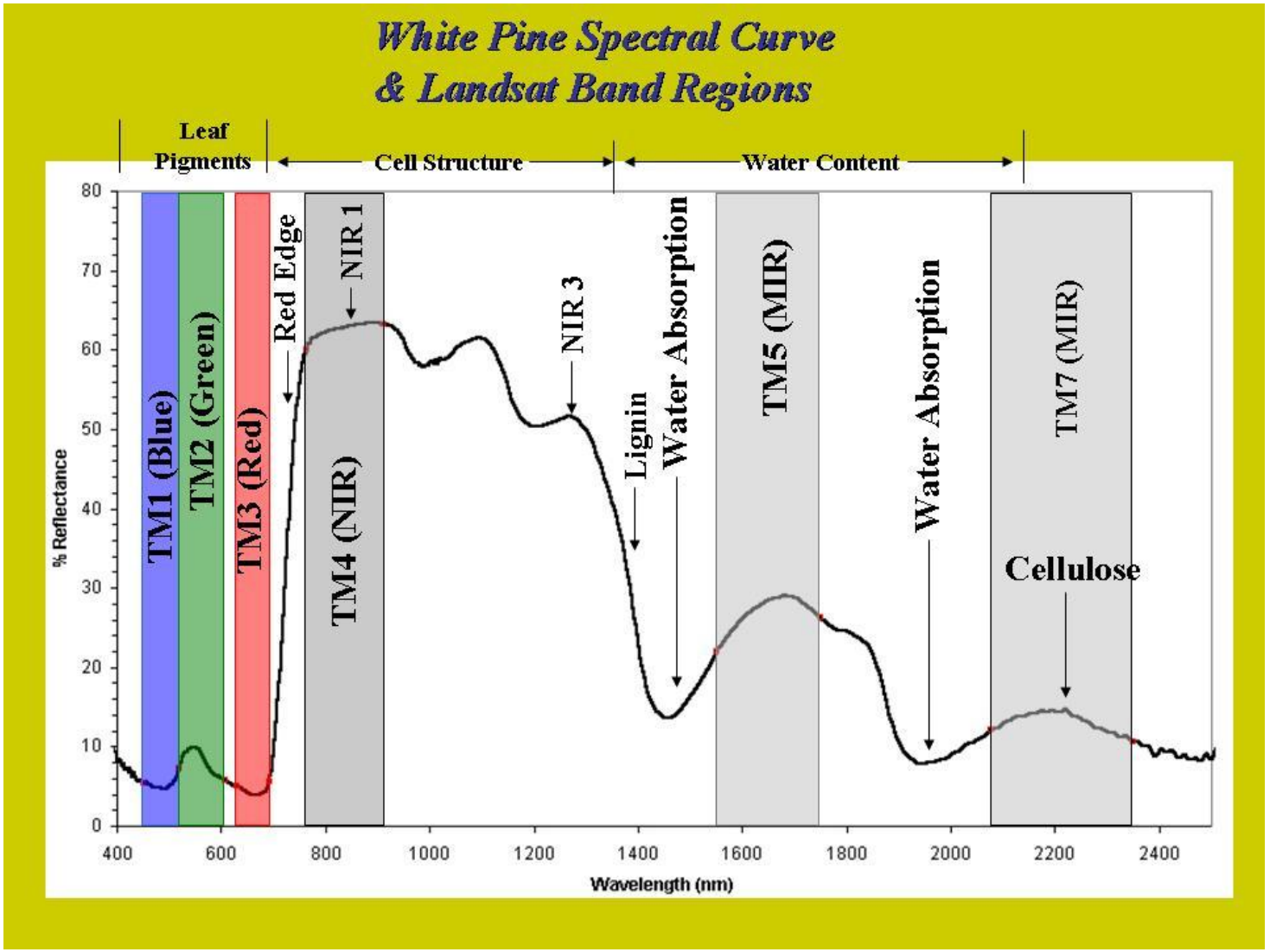
Typical Reflectance Curves



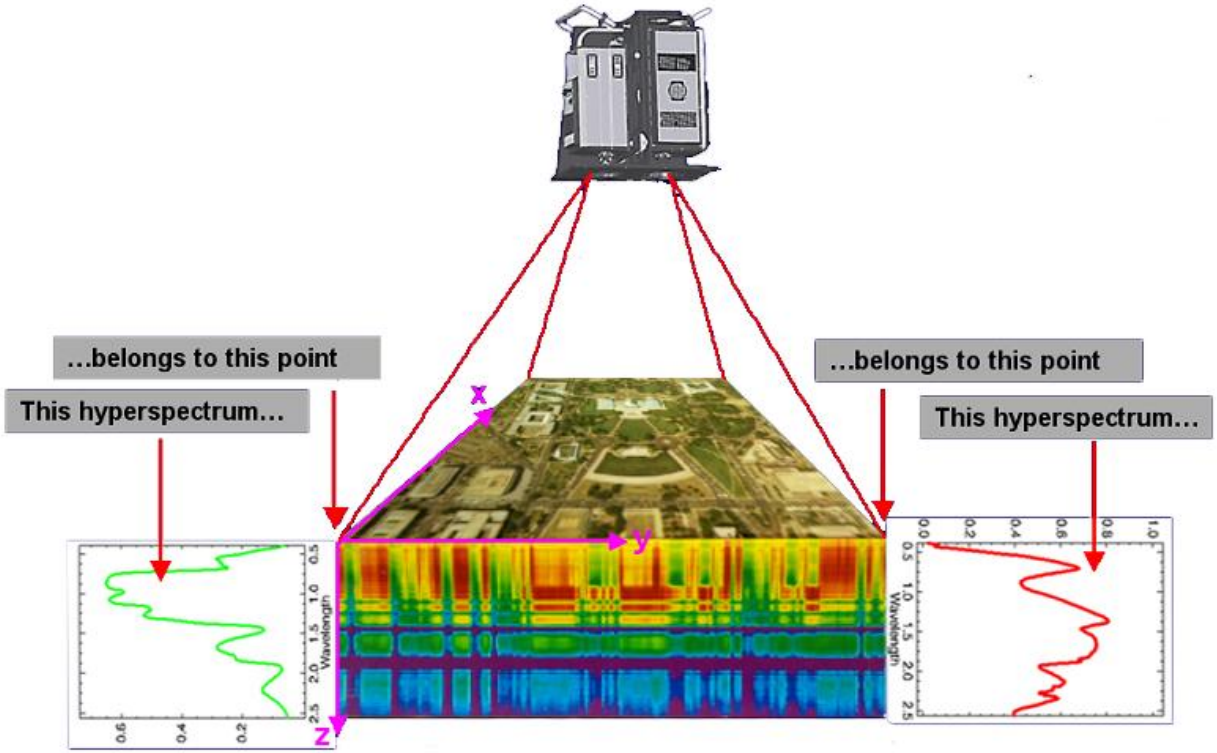
After Richards, 1993

SpecTIR™

It's in the Details!



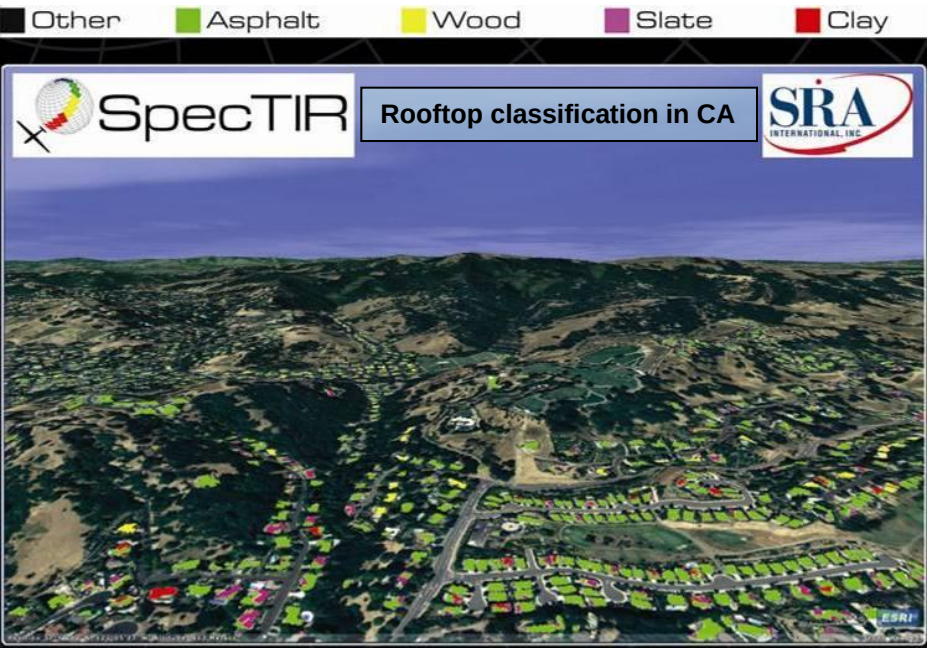
The hyperspectral data cube *has as (x,y) coordinate the longitude and latitude on the ground of an image pixel, and as z coordinate the* hyperspectrum *at that particular (x,y) location.*

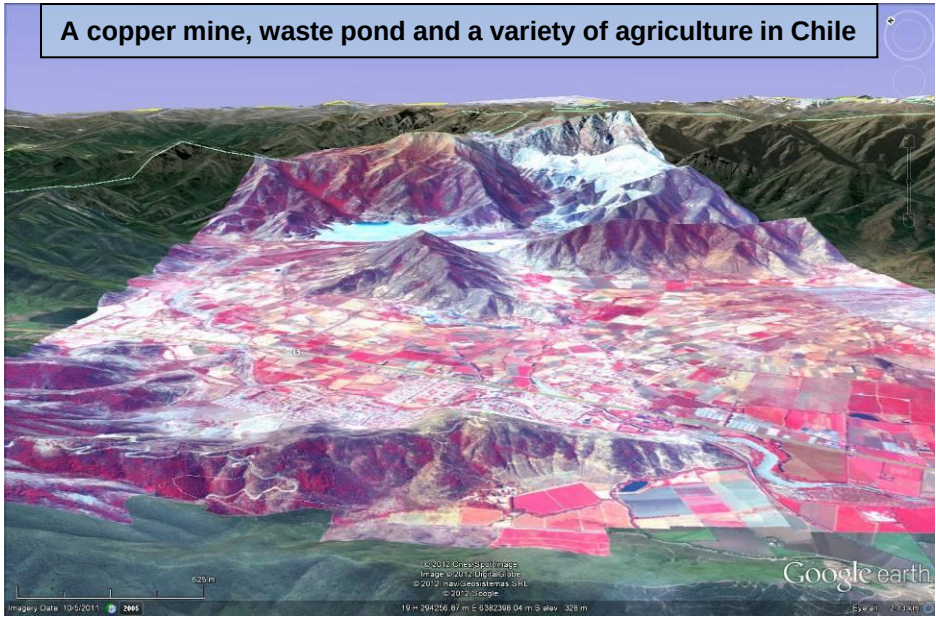


Hyperspectral Applications

Hyperspectral Applications as a Visualization Tool:

- Fire Risk/Fuels Mapping
- Forest Heath
- Invasive Species Mapping
- Water Quality
- Crop Residue
- Geothermal Exploration



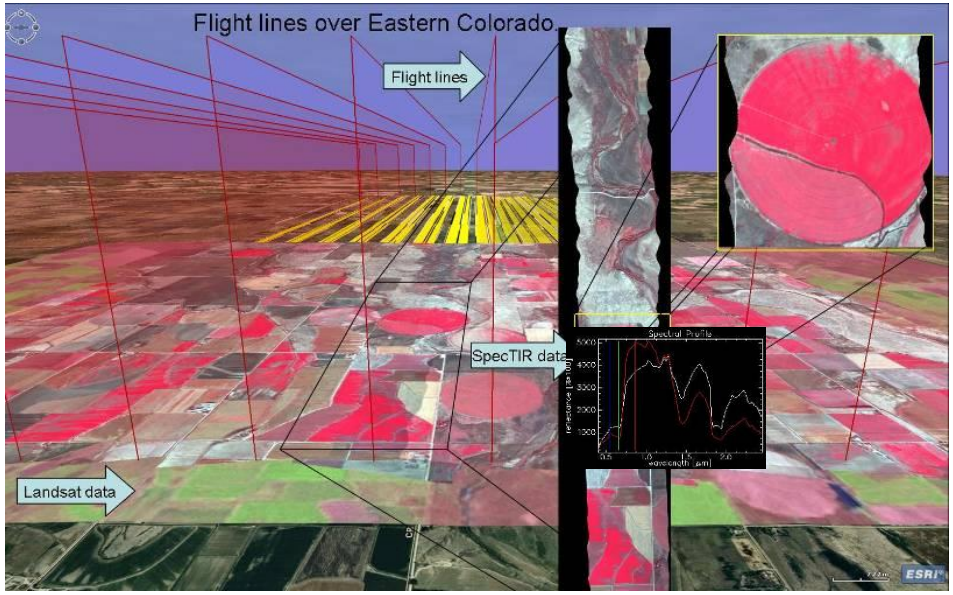


SpecTIR™

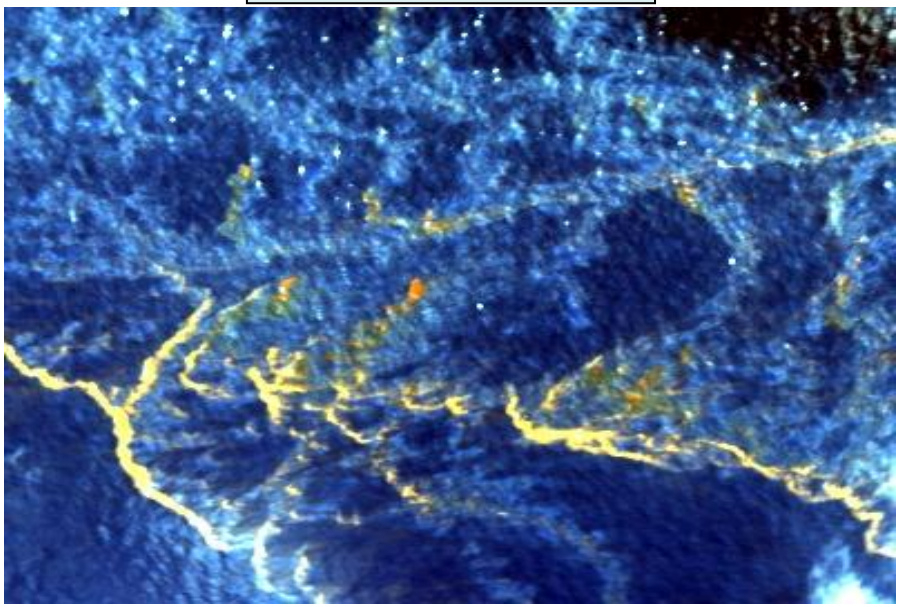
Visualizing the Data

Data Can Be Displayed in a Variety of Ways:

- Google Earth
- GIS Software (ArcGIS, QGIS)
- Image Software (ENVI, ERDAS)
- GPS (Trimble, Garmin)
- Plotted to Hardcopy Maps
- 3D Software

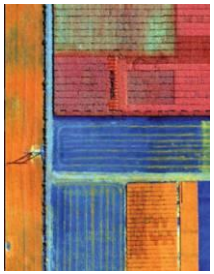


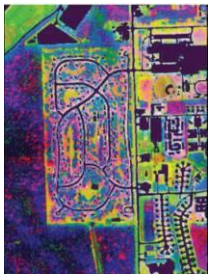
Deepwater Horizon Oil Spill

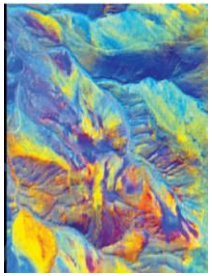


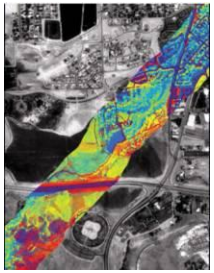
SpecTIR™

ProSpecTIR VS VNIR-SWIR Instrument





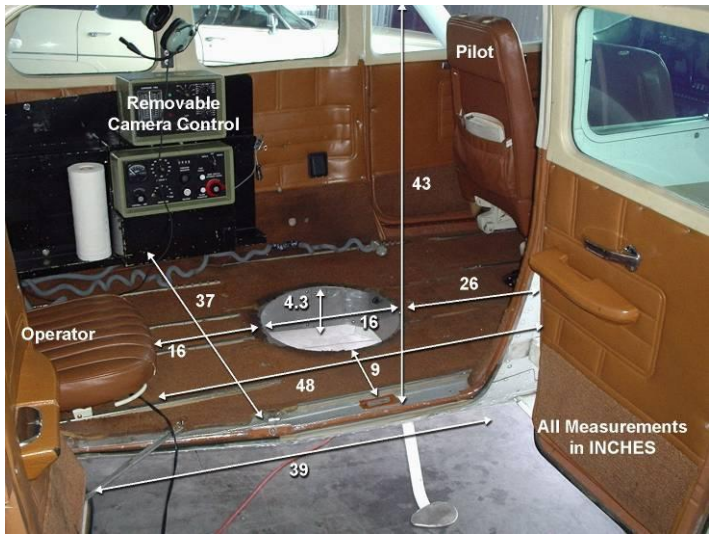




TYPICAL SPECIFICATIONS								
SPECTRAL RANGE	VNIR 400-970 nm				SWIR 970-2500 nm			
	Total 400-2500 nm							
SPECTRAL RESOLUTION (OPTICAL)	VNIR 2.9 nm				SWIR 8.5 nm			
SPECTRAL CHANNELS	376 typical operation, 500 at highest resolution							
SPECTRAL BINNING CONFIGURATION	VNIR	1x	2x	4x	SWIR	1x	2x	4x
SPECTRAL CHANNELS		244	122	60		254	127	63
SPECTRAL SAMPLING (nm)		2.3	4.6	9.2		5.8	11.6	23.2
TERRAIN COVERAGE & FIELDS OF VIEW								
SPATIAL PIXELS	320							
FOV	24 degrees							
IFOV	1m GSD @ 2500' 0.075 degrees (1.3mrad)							
SWATH 0.43 x altitude	1km @ 7600'							
OPERATIONAL CHARACTERISTICS								
CAMERA A/D	VNIR	Si CCD 12 bits			SWIR	MCT 14 bits		
SNR	500:1 typical, 750:1 peak				650:1 typical, 1100:1 peak			
INTEGRATION PERIODS	adjustable at each sensor for optimum exposure levels							
IMAGE RATE	Up to 100 images/s							
MECHANICAL & POWER								
DIMENSIONS	25 x 19 x 16 inches (HWD)							
WEIGHT	40kg sensor 25kg for flight computer, power supplies							
POWER	INSTRUMENT - 200W OPERATIONAL, 500W AT COOLDOWN FLIGHT OPERATIONS COMPUTER - 600W							

SpecTIR™

Installation



• After the mission is planned an aircraft is selected and the sensor is installed. In the US, SpecTIR utilizes a Cessna 206 stationed near headquarters in Reno, NV or a Cessna 207 or 310 located outside Philadelphia, PA for work in the Eastern US. We also work closely with a company in TX, which have several aircraft types.

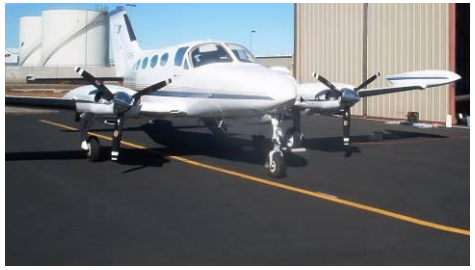
VS2 setup in 206

• Each mission is carefully planned to integrate the ProSpecTIR system as quickly as possible.

Twin Otter

King Air - 90

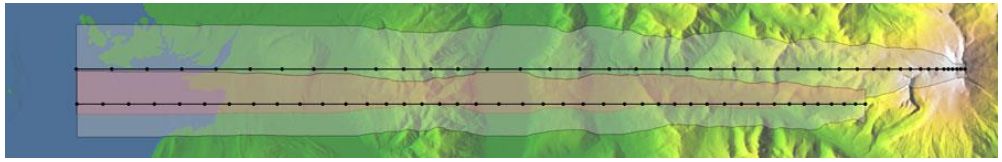
Cessna - 414

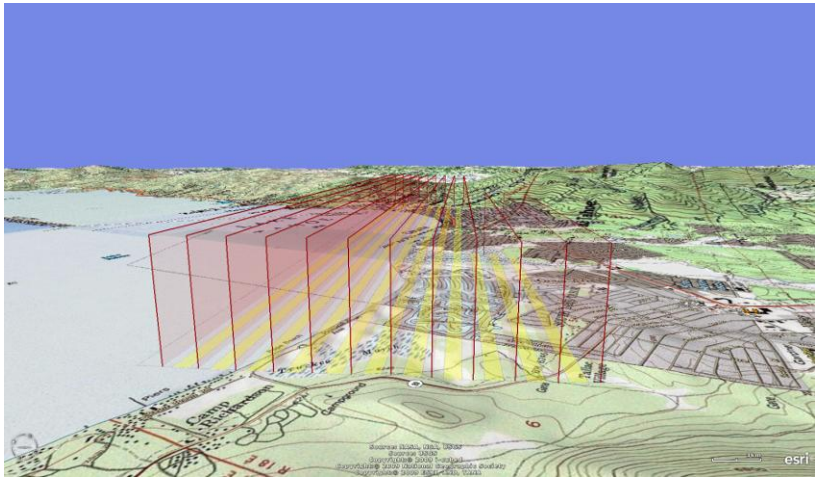


Piper - Navajo

Creating a Flight Plan: A Visualization Tool

TopoFlight
3D FLIGHT PLANNING SOFTWARE



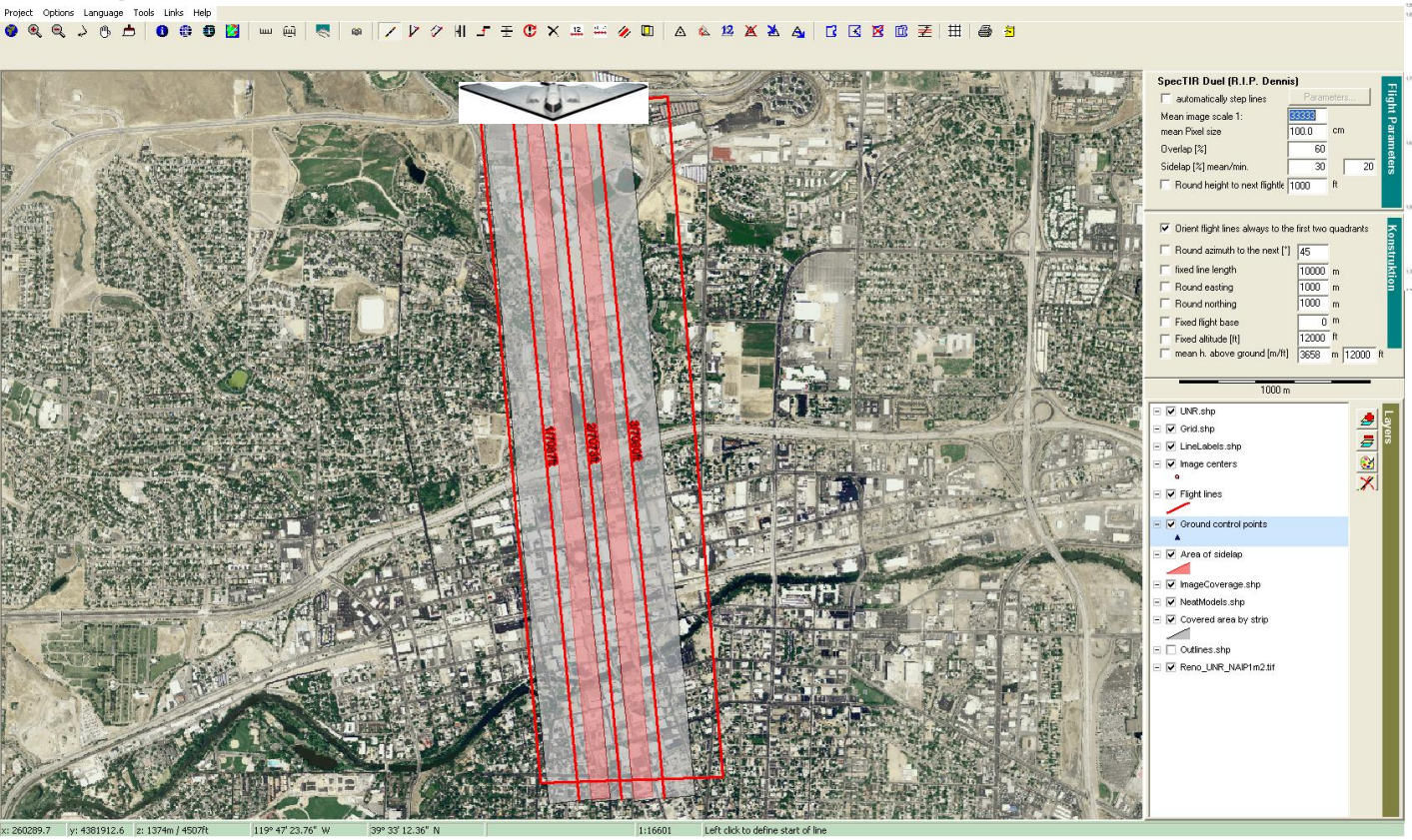


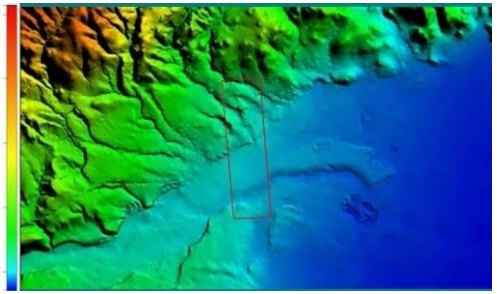
Topoflight is a planning software for:

- DEM integration
- Flightline creation
- Maximizing coverage, while minimizing reflys
- Export to KMZ (Google Earth)
- Export to flight following software (TrackAir)
- Export of Excel to for flight-time management

SpecTIR™

Visualizing Flightlines



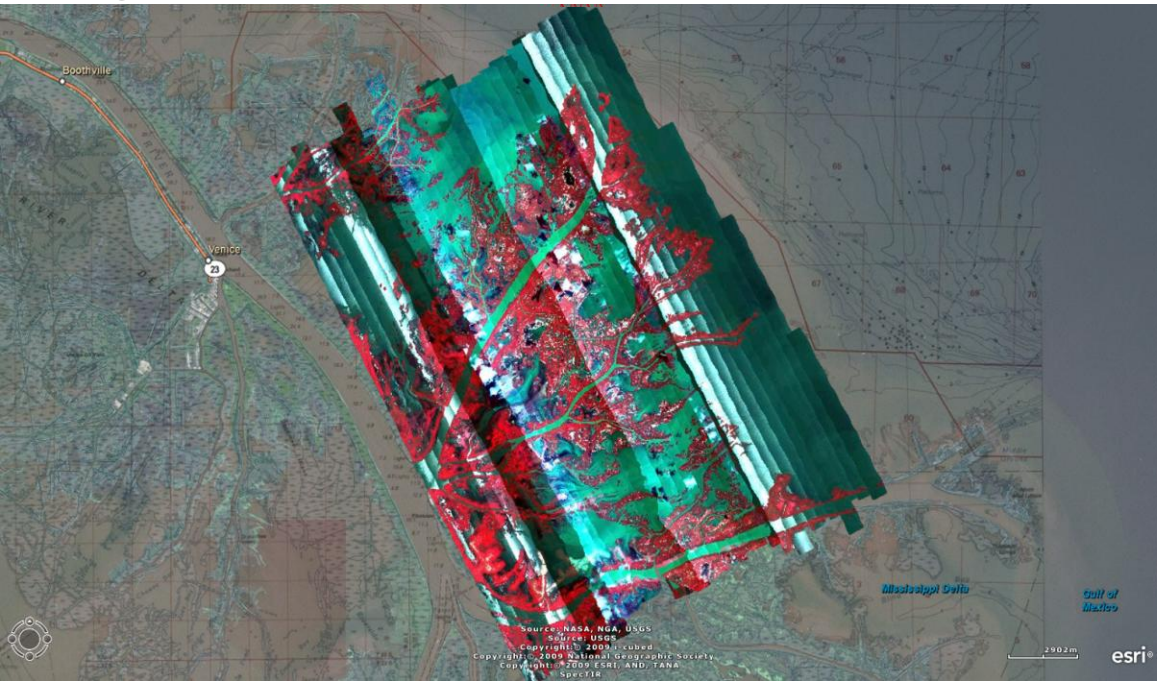


Creating flightlines in Topoflight:

- **Flightline generation incorporates the topography of the region and the parameters set by the planner/sensor.**
- **Attributes such as: swathwidth, line length, flight height and flight azimuth can all be edited to fit your parameters.**
- **Shapefiles, DEMs, GeoTIFFs and other vector and raster data can be added to enhance the flight plan.**

SpecTIR™

Execution of the Collection



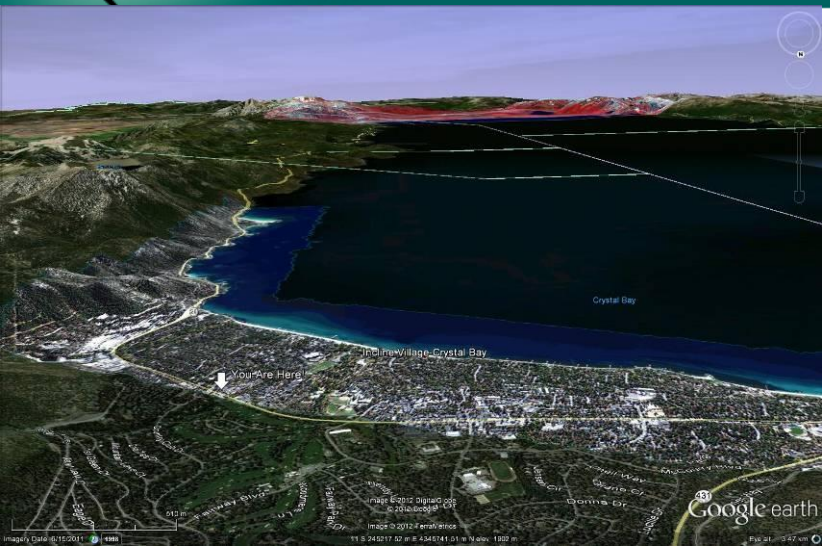
- ***From Shapefile to flight plan***
  -From flight plan to data

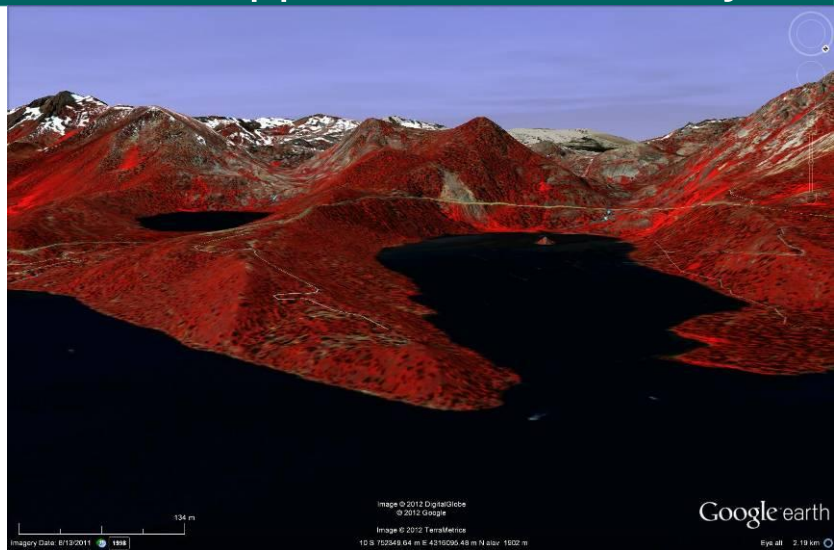
Once your flight plan is created, you have a better idea of the size and scope of the mission:

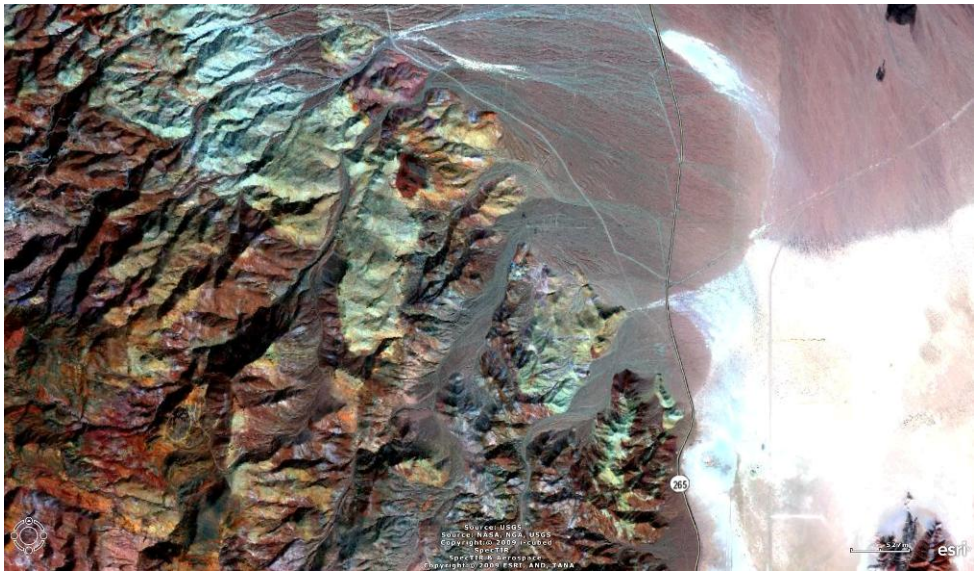
- ***Flight time***
- ***How many lines the acquisition will require***
- ***Transit time (if there is more than one AOI)***
- ***Cost***
- ***Efficiency***
- ***Safety***

SpecTIR™

Applications and Analysis

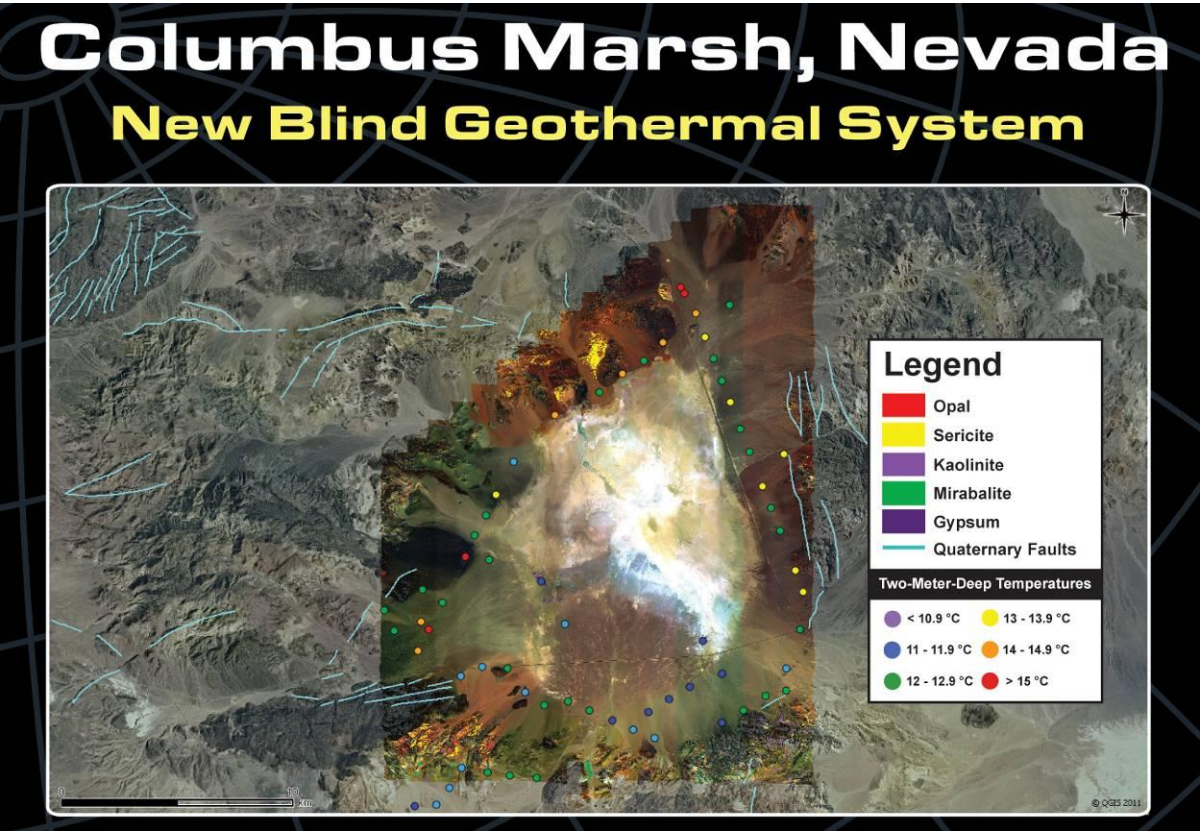






www.spectir.com

end to end hyperspectral solutions

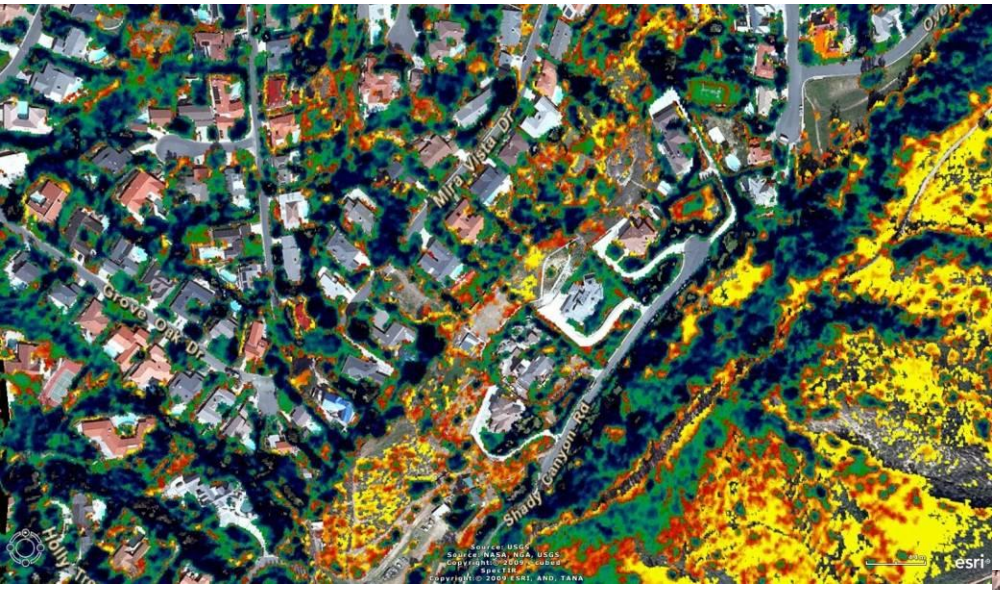


By analyzing the hyperspectral data, we are able to generate mineral maps. In the case of Columbus Marsh, we used the mineral maps to guide a field campaign to conduct shallow temperature surveys for geothermal exploration.

Photo courtesy of Chris Kratt

SpecTIR™

Forestry/Fire Fuels Analysis



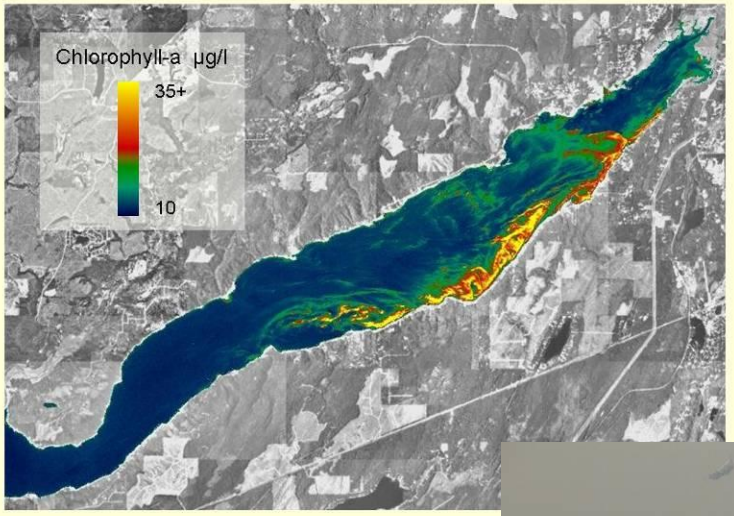
Fire Fuels Mapping

These images represent both a vegetation stress layer and species identification, SpecTIR provided the Orange County Fire Authority of California. The stress layer present is based on the water content of the vegetation, where dark blue signifies higher water content and the yellow color represents the least water content in the canopy. In this instance, the lower the water content of the vegetation, the higher the risk of becoming wildfire fuel.

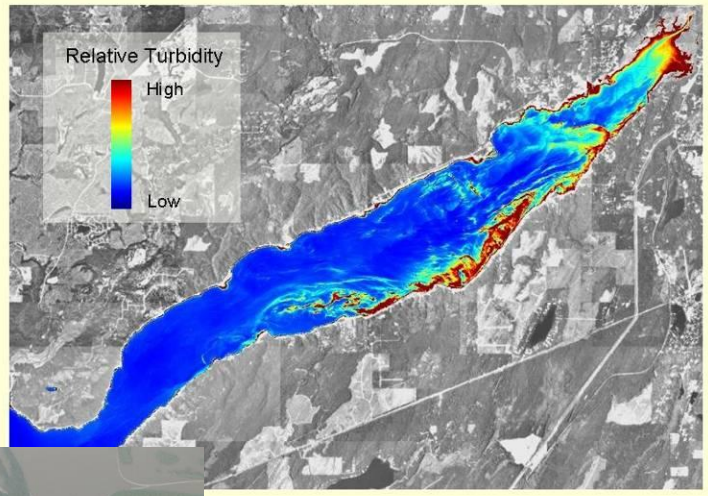
Species Identification

Water Quality Analysis

Chlorophyll Concentration
Hood Canal, Washington



Water Turbidity
Hood Canal, Washington



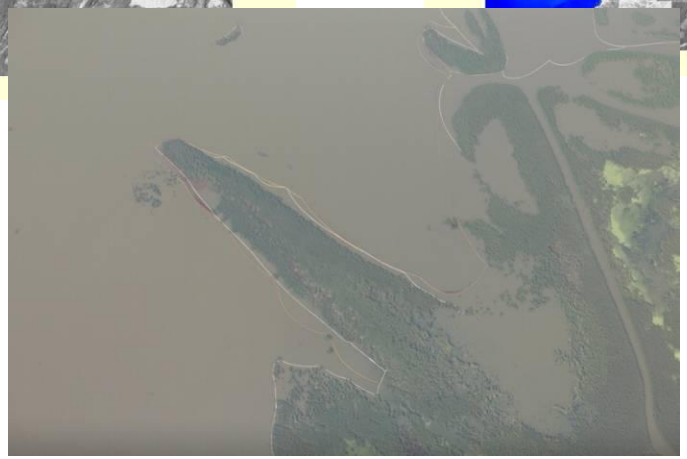
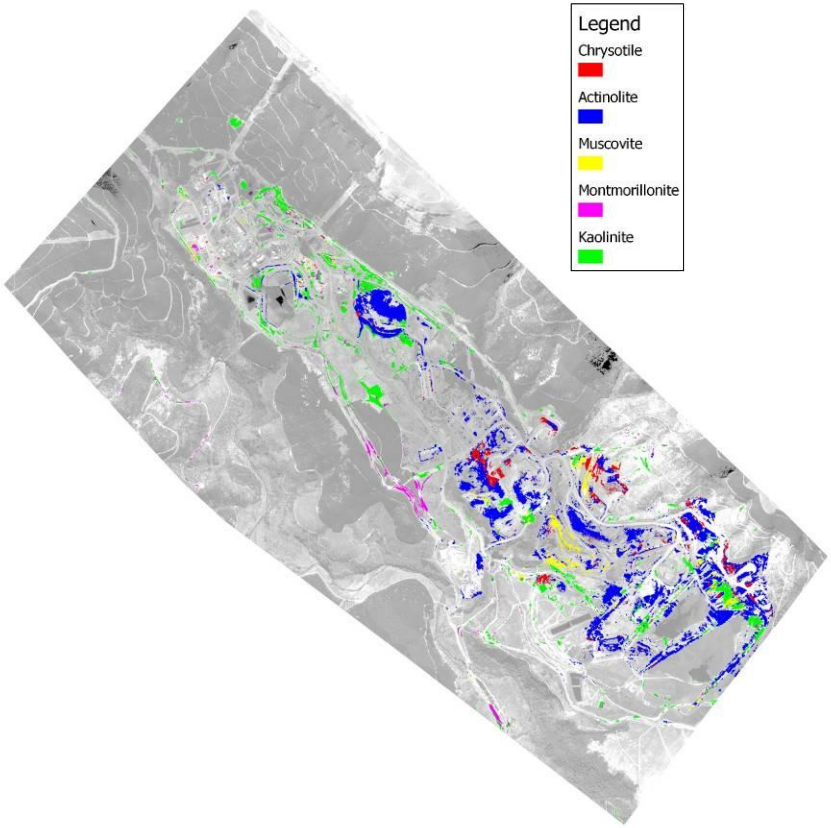
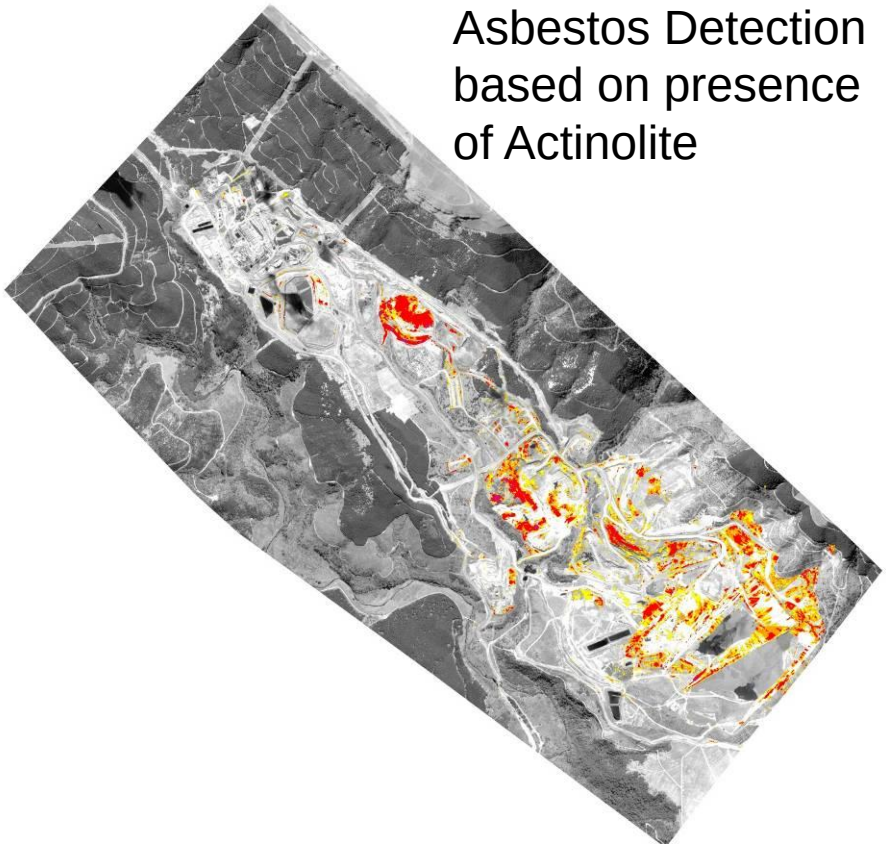


Photo courtesy of Len Subick

SpecTIR™

Mineral Mapping and Asbestos Detection

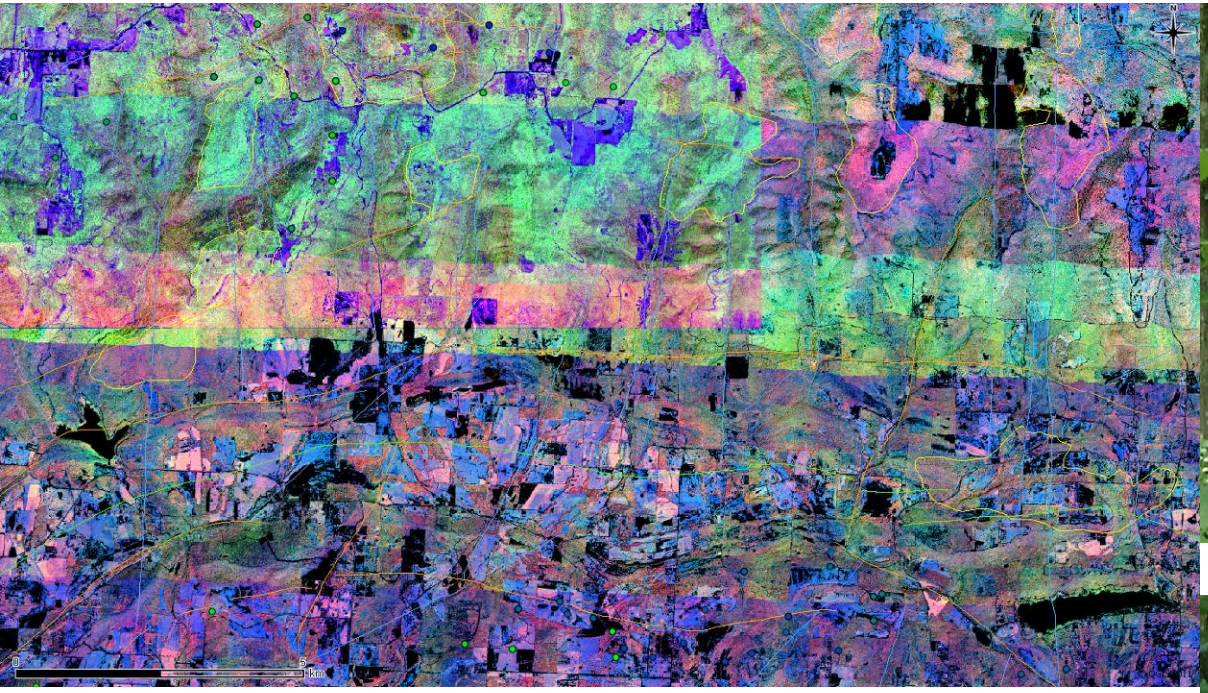




Asbestos Detection based on presence of Actinolite

SpecTIR™

Oil/Gas Analysis



Oil and gas exploration is executed by interpreting bare ground or vegetated areas. By analyzing vegetation stress and/or abrupt changes in vegetation species, analysts can identify anomalous plant communities tolerant to disturbed soils indicative of oil/gas seepage.

Questions?

Thank you for your time and feel free to contact us:

Kevin Rock
krock@spectir.com

Other Points of Contact:

- Conrad Wright,
  Chief Business Development Officer
  - Reno, NV ; conrad@spectir.com

Emerald Ash Borer survey in NV

Mountain Pine Beetle trap in NV

Evidence of Mountain Pine Beetle near Lake Tahoe

Other ground sampling techniques that can be utilized.