What is the HyLab?

- An NSF funded research facility at the Geophysical Institute (GI), University of Alaska Fairbanks (UAF).
- Provides low-cost, in-state field-based and airborne hyperspectral data acquisition capabilities.
- Supports data acquisition, processing, and analysis for resource exploration and ecologic research (see lower box for an overview of our expertise).
- Coordinates education, training and public outreach activities related to techniques and applications of imaging spectroscopy.

What is hyperspectral imaging?

- Also known as Imaging Spectroscopy. It is a remote sensing technique where images are acquired in many contiguous and contiguous spectral regions, so that each pixel contains a reflectance spectrum.

- Reflectance spectra provide the basis for the discrimination and characterization of different target materials.

- Hyperspectral imaging provides a means for detailed analysis of field samples in order to detect pathfinder minerals, and biological variables with unprecedented accuracy.

- Despite huge potential for mineral development, Alaska remains largely under-explored. Hyperspectral imaging has the capability to identify on-deposit related mineral assemblages. However, its application in Alaska has lagged because of the remoteness and the unique challenges posed by Alaska’s high-latitude setting. The Hyperspectral Imaging Laboratory (HyLab) at the University of Alaska Fairbanks (UAF) was established in 2014 to help meet the exploration and mapping needs of the State of Alaska.

The image below was processed at USGS and shows the results of hyperspectral image analysis for carbonate, clays, sulfates and alteration-related minerals, draped over 3-D topography of the Nabesna area.

The hyperspectral imagery spanning the 0.4 to 2.5 micron wavelength region of the electromagnetic spectrum was collected over the Nabesna areas in 2014. The data were collected at a nominal 6-foot ground instantaneous field of view (GIFOV). Simultaneously with the airborne survey, representative samples of geologic units were collected for ground verification of remote sensing data during field-scans additional equipment such as DGPS, laser scanner and robotic total stations were used to gather the exact position of the instruments as well as to produce precise terrain models of the scanned surfaces.

Areas of high interest, such as Orange Hill, were additionally scanned with the Hyperspec in field configuration. This produced full-range hyperspectral images with a GIFOV of approx. 0.8 m. Spectro-radiometer measurements helped to atmospherically correct the image cubes before they could be processed using the Material Identification and Characterization Algorithm (MICA). MICA is a module of the USGS PSRM (Processing Routines in DIL for Spectroscopic Measurements) software.

This image below shows a true-color composite image with false-color composite image of an outcrop scan at Orange Hill, Nabesna area.

Our tools

- The HypSpectro instrument (field-based & airborne)
  - VNIR-1500 and SWIR-2848 cameras (300 - 2,500 nm)
  - Pushbroom HS sensors with low stray light levels, low sensitivity to polarization, in-flight stable and low-voltage effects.
  - Across track FOV of 17° and 16° that can be increased to 34° and 32° respectively (using a FOV expander).

- Field based operation:
  - The PSR + 3500 spectro-radiometer is powered by batteries and connected to a laptop for post processing, GPS, photo logging, and voice logs.
  - Our development software allows in-field mineral identification and measurements.

- Laboratory operation:
  - High spectral resolution for improved reflectance values by using full-range tangent horn.
  - Detailed analysis of field samples in order to detect pathfinder minerals for exploration of gold, silver, iron, nickel, copper, and more.

During field-scans additional equipment such as DGPS, laser scanner and robotic total stations were used to gather the exact position of the instruments as well as to produce precise terrain models of the scanned surfaces.

Field-Based and Airborne Hyperspectral Imaging for Mineral Exploration in Alaska

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Processed imagery helped to map carbonates, clays, sulfates, and alteration-related minerals. In airborne mode the instrument:
- is mounted with a precision elevation damping to a Eurocopter AS-350 or similar airplanes (Bouvet, bushhawk, etc.);
- is connected to an NIKON topographic and airborne systems unit;
- is controlled by a compact, high-performance data acquisition unit (DOM), connected to a laptop solid state drive and a compact, touch screen flat-panel monitor.

In the field configuration:
- the two HS cameras are mounted on an autonomous rotation stage affixed to a survey-grade tripod;
- the horizontal accuracy of HS data is possible for targets at a distance of ~3 meters to hundreds of meters;
- a rugged field portable data acquisition unit is used to control the rotation stage and camera during in-flight imaging.

power supply is provided by a generator.

- high resolution field pPortable spectroradiometer with 512 element array and 256 element extended Littokla airship;
- various optics ranging from 1° to 25° for reflectance, radiance and radiometric measurements.

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