Geophysical Research Abstracts
Vol. 21, EGU2019-8200, 2019
EGU General Assembly 2019

Toward UAV based Compact Thermal Infrared Hyperspectral Imaging Solution for Mineralogy Mapping of Mine Faces.

Stephane Boubanga Tombet, Frederick Marcotte, Eric Guyot, and Martin Chamberland
Telops, Research, France (stephane.boubanga@telops.com)

The integration of thermal infrared (TIR) hyperspectral systems into Unmanned Aerial Vehicles (UAVs) platforms is expected to open doors toward a wide variety of demanding thermal imaging applications ranging from academics and research to industry. Currently, the UAV remote sensing technology in TIR region is still in its infancy and the main expectations are the reduction of both, sensor sizes and cost while maintaining their performances at a high level.
In this communication, we report on Telops newly designed compact, light and robust TIR hyperspectral module of less than 10 kg with about 50W of power consumption. The new module can be integrated into a complete stand-alone imager with applications such as 360° Hyperspectral Surveillance. Integration in complete, highly flexible UAV based, infrared hyperspectral imaging solutions, such as airborne regional mapping of mineralogy and lithology in an open mine face is also possible. The UAVs based TIR remote sensing technologies may offers many benefits as it allows exploring large areas with relatively high spatial resolution.
While hyperspectral imaging from airborne/spaceborne platforms is now a well-established method applied to many geological problems, it has mostly been developed only in the Visible-Near Infrared (VNIR, 0.4–1.4 [U+F06D]m) and Shortwave Infrared (SWIR, 1.4–3.0 [U+F06D]m) regions of the electromagnetic spectrum. However, the reflectance spectral features measured in the VNIR and SWIR spectral ranges are generally overtones and combination bands from fundamental absorption bands at longer wavelengths, such as in the Longwave Infrared (LWIR, 8–12 mm). The single absorption bands in the VNIR and SWIR spectral ranges are often very closely spaced so that the reflectance features measured by common spectrometers in this spectral region are typically broad and/or suffer from strong overlapping, which raises selectivity issues for mineral identification in some cases. Remote sensing solutions that uses LWIR may improve selectivity in certain situations since the spectral features associated with fundamental vibrations are generally stronger and sharper than their overtones. Else more, the inherent self-emission associated with TIR would allow geological surveys in various weather (cloudy, partly cloudy or clear sky) and illumination (day or night) conditions.
Beside the newly designed compact and light TIR hyperspectral module, Telops have also developed in-scene atmospheric correction solutions based on MODTRAN to conduct Temperature-Emissivity Separation and unveil from TIR measurements the spectral features associated with each mineral in the targeted scene.
We will discuss two applications: i) to a carbonate open mine predominantly composed of dolomite and calcite carbonate minerals and ii) a chrysotile open mine composed of serpentine minerals (lizardite, serpentinite) and silicates (quartz). Our results open new doors toward highly flexible TIR hyperspectral airborne geological surveys at a low cost of operation, thus meeting the recurrent wish of many actors in the natural resources exploration and mining industry.