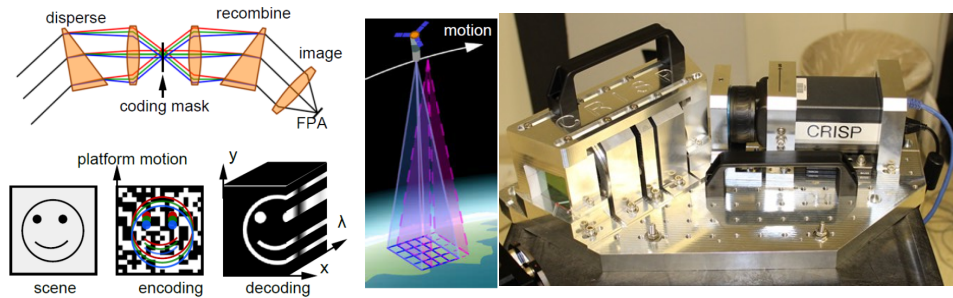


Computational Reconfigurable Imaging Spectrometer (CRISP)

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Objective

- Develop a LWIR computational imaging spectrometer that exploits platform motion, dispersive elements, and coded sensing techniques to make a time series of encoded measurements of the optical spectrum at each pixel
 - The design of this system will enable high performance from smaller and less-expensive components such as uncooled microbolometers, and thus be more suitable for small satellites that can be deployed in constellations.
- Demonstrate significant sensitivity and other advantages over existing imaging spectrometer designs, enabling miniaturization and improved area coverage.
- Demonstrate unique capabilities of a reconfigurable system



- Uses static mask and scan/platform motion to encode spectral data cube
- Sensitivity advantages over traditional designs, enabling smaller instruments with significantly reduced cooling requirements
- Resulting system is inherently reconfigurable, .i.e., can be adjusted on orbit to support multiple mission profiles

Accomplishments

- Developed low-cost CRISP breadboard to validate operating principles, at LWIR wavelengths (7-13 mm, 77 bands)
- Validated performance, SNR scaling, spectral recovery, and key limits versus theoretical predictions
 - SNR advantage over equivalent pushbroom system limited only by dark noise: 13x advantage with 2000 frames (frames correspond to number of imager rows)
- Demonstrated reconfigurable scan modes (long vs. short dwell) in field and laboratory testing
- Demonstrated CRISP operation on an aircraft using laboratory configuration with limited ruggedization
- Performed flight campaign over Lake Tahoe to assess CRISP performance as it relates to Sustainable Land Imaging requirements
 - The CRISP team partnered with the Rochester Institute of Technology (RIT) to provide ground truth data and analyze flight data.
- Identified low-risk "CRISP 2.0" upgrades that would exceed SLI mission requirements
 - Projected 0.08K NETD well below the 0.4K NETD requirement for TIR bands
- US Patent 10,909,670 awarded in 2021

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TRL_{in} = 3 TRL_{out} = 4