Prototype HyspIRI Thermal Infrared Radiometer (PHyTIR) for Earth Science

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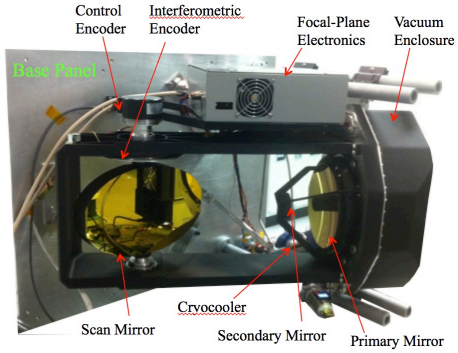
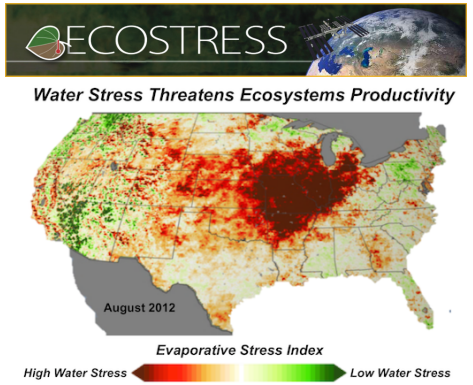
Objective

- To improve maturity of key components of the Thermal Infrared Radiometer for the Decadal Survey's HyspIRI mission concept (HyspIRI-TIR), and reduce risk and cost for the satellite implementation by developing an instrument prototype.
  - The key components are a high sensitivity and high throughput Focal Plane Array (FPA) and a scanning mechanism that requires stringent pointing knowledge.
  - Performance goals include: noise-equivalent temperature sensitivity (NEΔT) better than 0.2K, saturation temperatures above 480K and pointing knowledge on the order of 10 mrad.



As-built PHyTIR instrument



PHyTIR is the instrument for the NASA Earth Venture ECOSTRESS experiment on ISS to study water stresses in plants and climate-sensitive biomes

Accomplishments

- Designed, built, and demonstrated a state-of-the art, multi-band thermal imager that meets the form, fit, and function requirements for the Thermal Infrared Radiometer - a candidate instrument for the HyspIRI measurement concept
- Designed and fabricated the Thermal IR focal plane detector with quantum efficiency (> 99%) and dark current (~183 e-) performance that exceeded the requirements set for this task
- Successfully completed an end-to-end test and demonstrated the following system performance:
  - Fully synchronized instrument data recording at the required speed of 31.25 KHz
  - Noise-equivalent delta temperature sensitivity exceeded HyspIRI-TIR requirement (0.18K measured vs. 0.2K required)
  - The scan mirror, together with the instrument structure, exhibited excellent stability, and the resulting pointing knowledge exceeded the requirement (0.1 instantaneous field-of-view (IFOV) measured result vs. 0.5 IFOV requirement)
- Selected by NASA Earth Venture Program as the instrument for the ECOSTRESS experiment on International Space Station to study water stresses in plants and climate-sensitive biomes and for measuring agricultural water consumption

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TRL_{in} = 4 **TRL_{out} = 5**