A Flight-like Prototype of the Ocean Radiometer for Carbon Assessment (ORCA)

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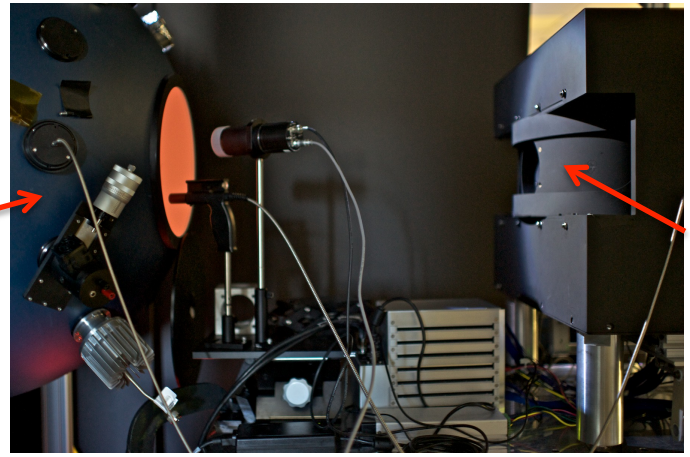
Objective

- Develop a flight-like sensor design concept and functional prototype which is capable of imaging at flight data rates in support of PACE and ACE ocean radiometer measurements (temporal and spatial coverage, radiometric attributes, data rates).
  - Scanning capability over a 120° field-of-view at 6 Hz (nominal rate for a low earth orbit),
  - Spectral data at a spatial resolution of ~1 km
  - Two gratings (blue and red channel) provide 5 nm spectral resolution from UV to NIR
- Retire risk associated with the custom CCD detectors
- Verify mechanical and electronic subsystem (i.e., detector readout and telescope rotation) synchronization



ORCA viewing monochromatic laser light from a sphere during spectral calibration at GSFC

Accomplishments

- Built and tested a functional prototype radiometer (optical, mechanical and flight-like detectors) aligned in flight-like configuration
- Designed, fabricated, and tested UV/VIS/NIR detectors showing that customized CCDs met flight needs with margin
- Demonstrated excellent yield (> 90%) and dark current (100 pA @20°C) for regular InGaAs detectors (SWIR detectors from Discovery Semiconductors, SBIR) and completed fabrication of 16 channel SWIR photoreceiver
- Demonstrated high fidelity imaging at flight data rates (6 Hz telescope rotation, full swath imaging) with jitter less than 1/40th of a pixel, exceeding spatial registration goal on the order of 1/10th of a pixel
- Improved depolarizer (to reduce stray light), improved dichroic (to reduce polarization in transition region), verified spectral performance and polarization sensitivity of ORCA, and spin-balanced the telescope
- Designed and fabricated system electronics and data system software to support evaluation
- Developed radiometric model providing credibility to on-orbit sensor SNR predictions

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$TRL_{in} = 3$ $TRL_{out} = 5$