Small Satellite Research Laboratory

Franklin College of Arts and Sciences

UNIVERSITY OF GEORGIA

Mechano-Optical Design of a CubeSat Ready Hyperspectral Camera System

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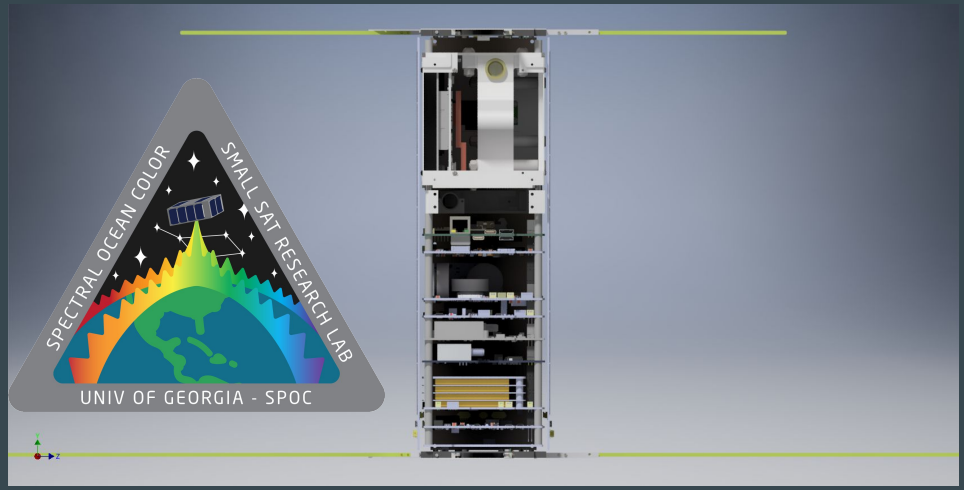
2017 Space Science and Innovation Symposium

SPectral Ocean Color imager Overview:

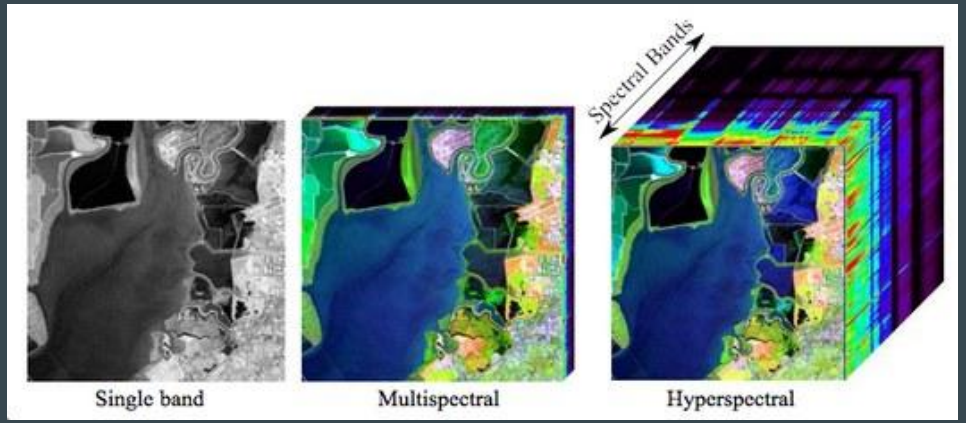
- Partnered with the University of Georgia's Center for Geospatial Research
- Cloudland Instruments provided guidance in the optical setup and camera electronics
- Clyde Space Frame and Electronics Stack
- SPOC Subsystems
  - SpocEye Camera
  - Finderscope
  - Electronics Stack
  - Frame



SPOC - Mission Objectives:

Objectives:

1) SPOC shall acquire moderate resolution imagery of coastal ecosystems and ocean color
2) SPOC shall acquire image data between 400 and 850 nm
3) SPOC shall use multispectral imaging products to monitor coastal wetlands status, estuarine water quality, and near-coastal ocean productivity
4) SPOC shall be entirely built by undergraduates in STEM fields



Mission Success:

Minimum Mission Success:

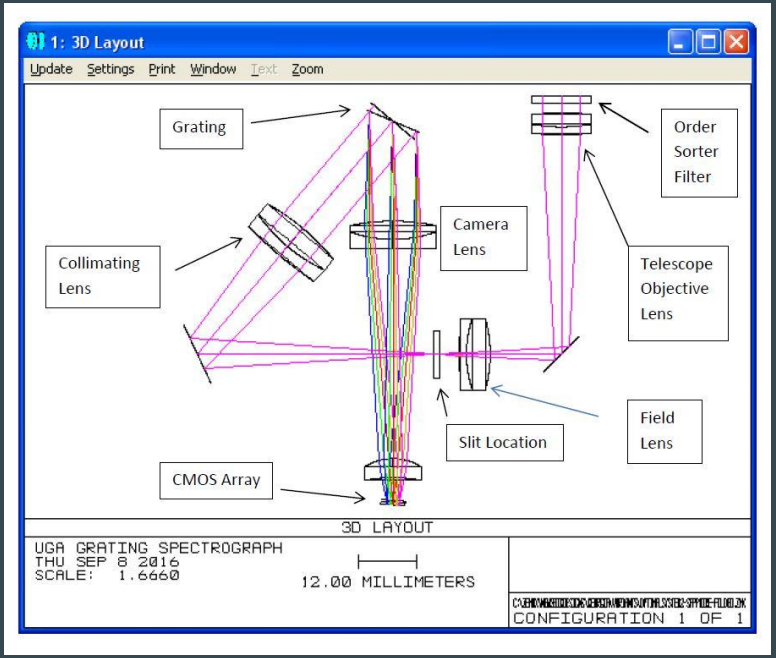
1) Image coastal target once in a month. Images shall be a minimum of 250 m spatial resolution
2) Acquire images between 400 and 850 nm with spectral resolution of 50 nm
3) Acquire analyzable hyperspectral images
4) 30 students involved for at least 2 semesters over the lifetime of the project
5) Minimum community outreach requirements

Full Mission Success:

1) Image the same coastal target 5 times in a month. Images shall be a minimum of 150 m spatial resolution
2) Acquire images between 400 and 850 nm with spectral resolution of 10 nm
3) Acquire analyzable hyperspectral images
4) 75 students involved for at least 2 semesters over the lifetime of the project
5) Satisfy community outreach goals

Optical Design:

- Partnered with Cloudland Instruments
- Camera lens system contains:
  - Six lenses
  - Two mirrors
  - One diffraction grating
  - One slit plane lens
- Two section system
  - Telescope
  - Camera
- Push Broom style camera



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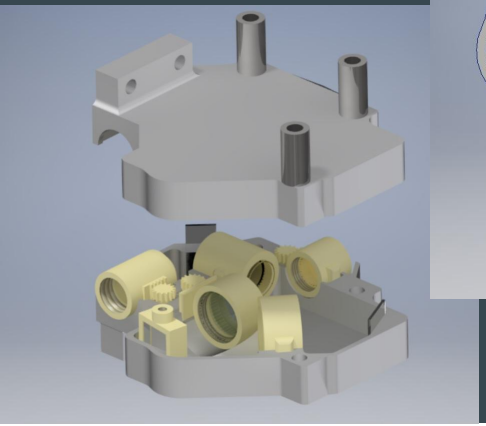
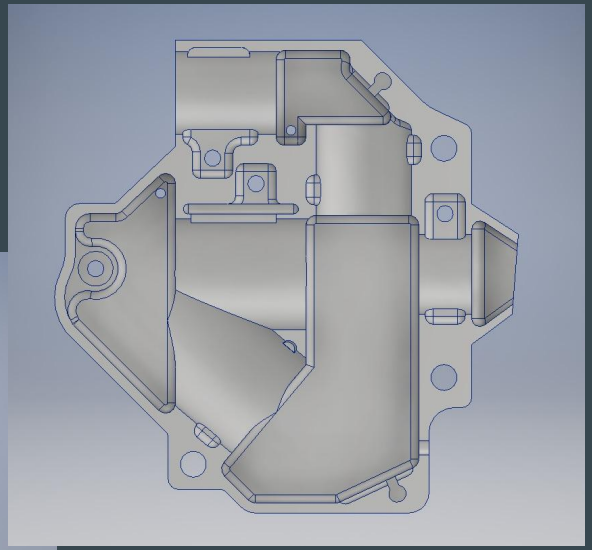
Mechanical Design:

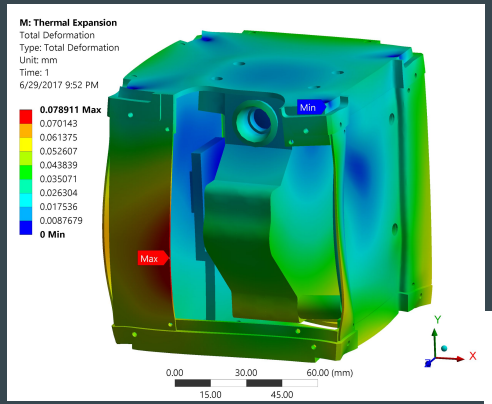


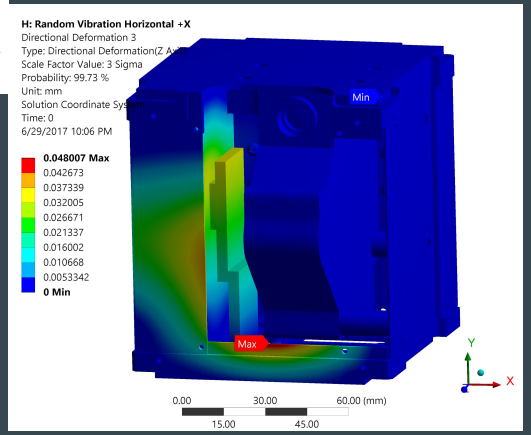


- Design requirements:
  - Fit within 1U platform
  - Meet mission goals
  - Mass < 1 kg
  - Must survive launch and vacuum environment
  - Self cooling
- Material Selection:
  - Aluminium 6061-T6
  - Ultem 8095
- Needed to incorporate ground calibration for three lenses and the diffraction grating

Simulation Results:

- Thermal:
  - Thermal expansion model
- Structural:
  - Inertial
  - Modal
  - Response Spectrum
  - Random Vibration





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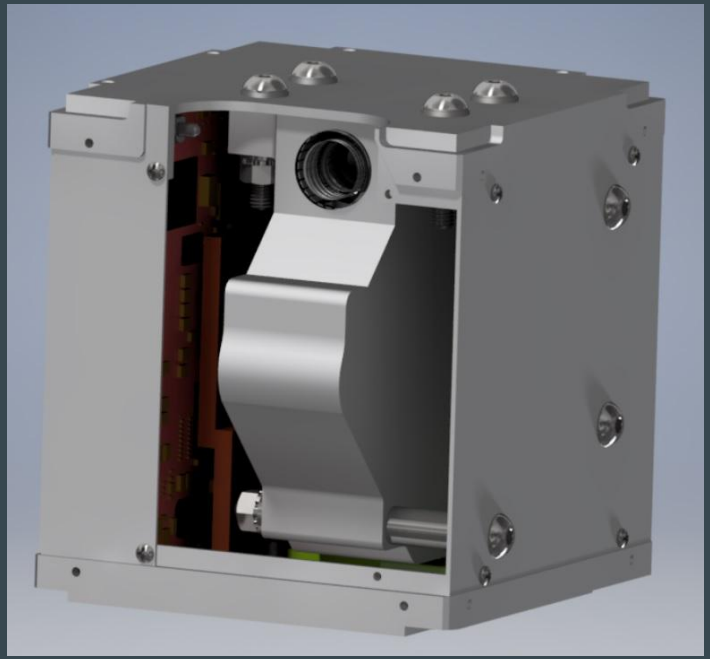
Satisfaction of Mission Requirements

Still in the building and testing phases but have thus far been successful in:

- Optics Design
  - 131 meter ground resolution
  - Images acquired will be between 400 and 850nm
- Mechanical Design
  - Approx. mass (+10% contingency): 0.713 kg
  - 105mm x 96 mm x 97 mm
  - Three adjustable lenses and diffraction grating for ground calibration



Questions?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