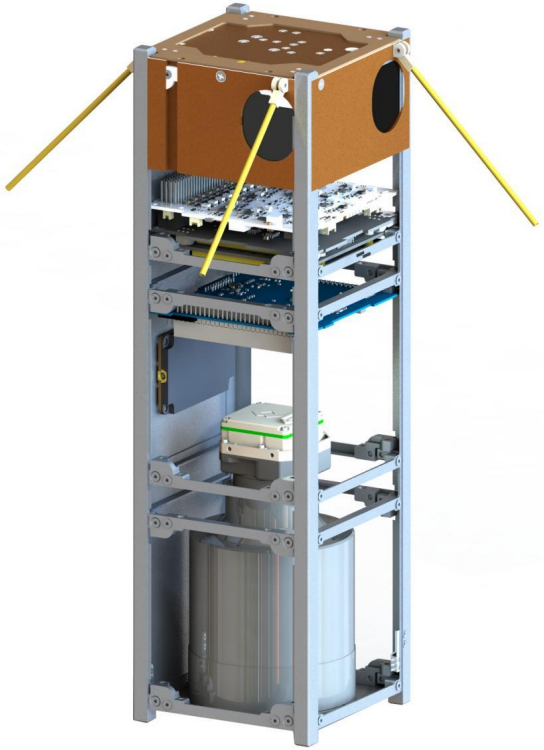
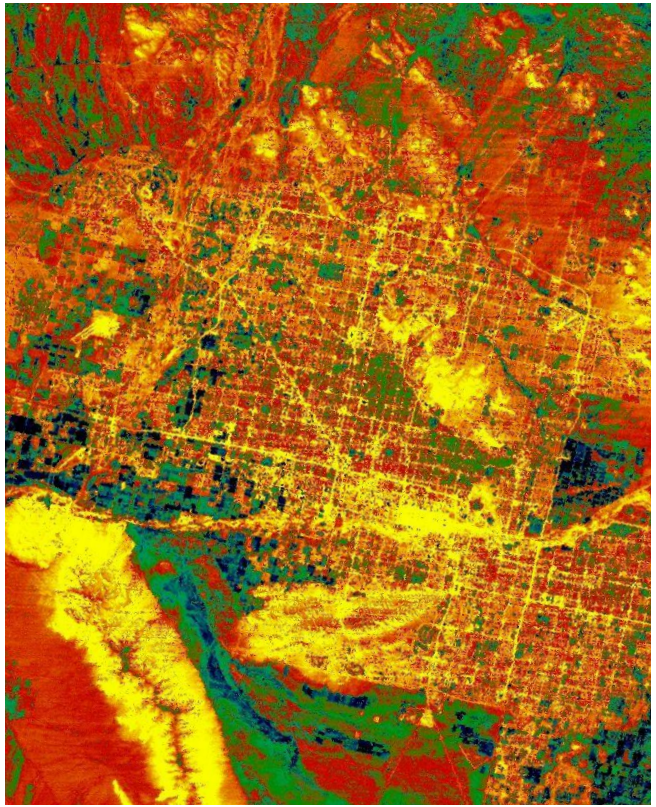
Phoenix CubeSat: Radiometric Work on the Payload Camera

Presented by Andre De Simone and Daniel La Rosa

Overview

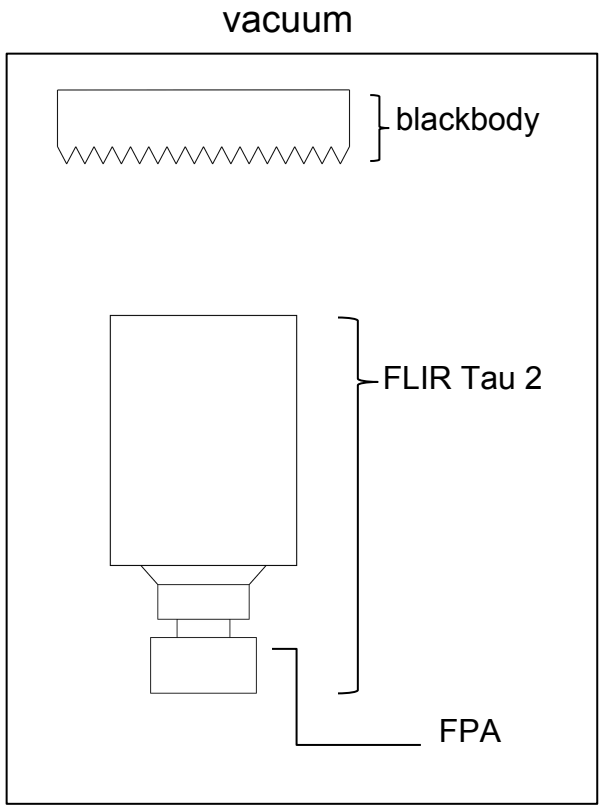




Thermal Vacuum Test

Thermal Vacuum Test - Overview

- A focal-plane array (FPA) is a sensor that detects infrared wavelengths and converts them into images.
- Differences in FPA temperature may affect image value accuracy.
- It is crucial to find the camera's optimal operating temperature so that it with produce meaningful data.
- Optimal FPA temperature can be found by pointing the camera at a blackbody and varying temperature while inside a vacuum chamber.



Thermal Vacuum Test - Setup

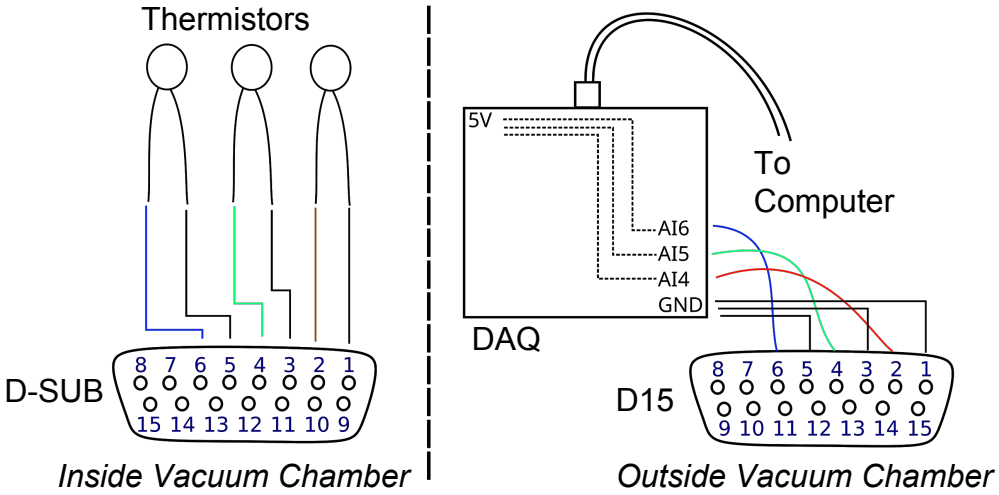


Figure 1. Diagram of the thermistor setup.

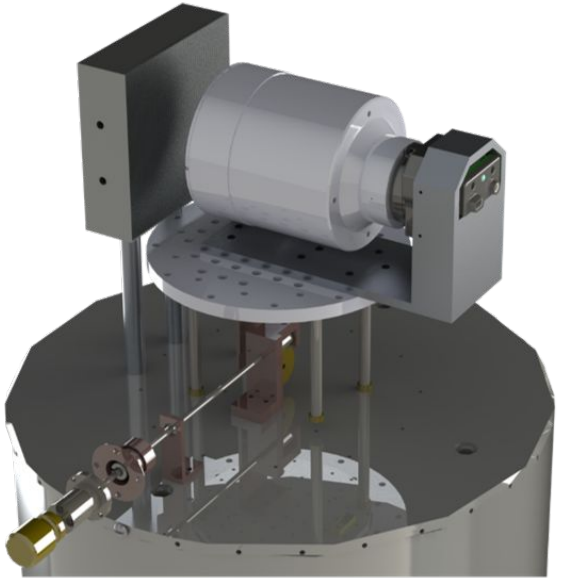
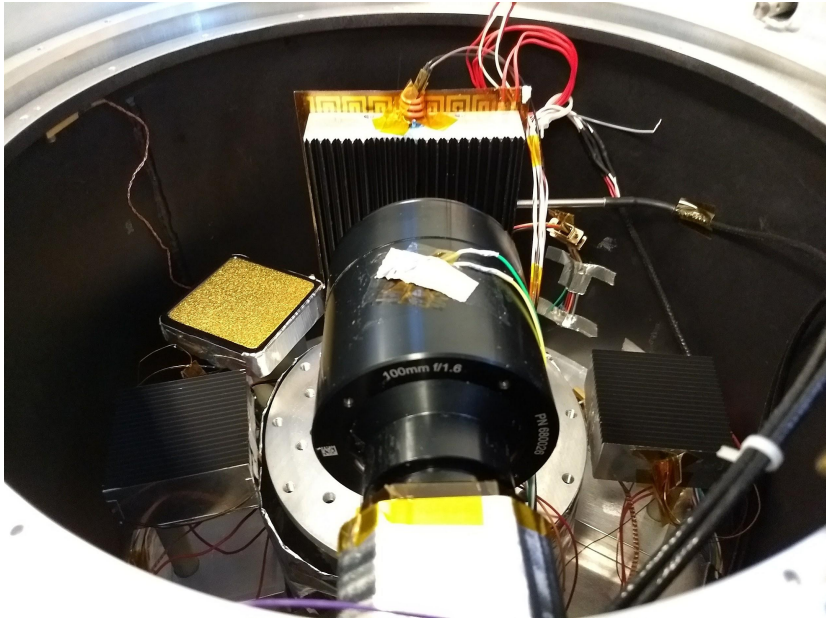
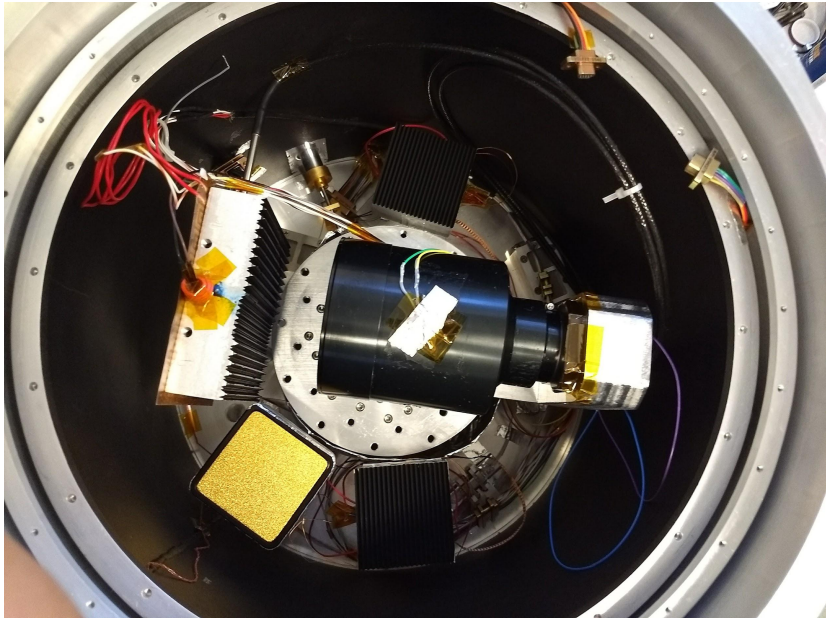


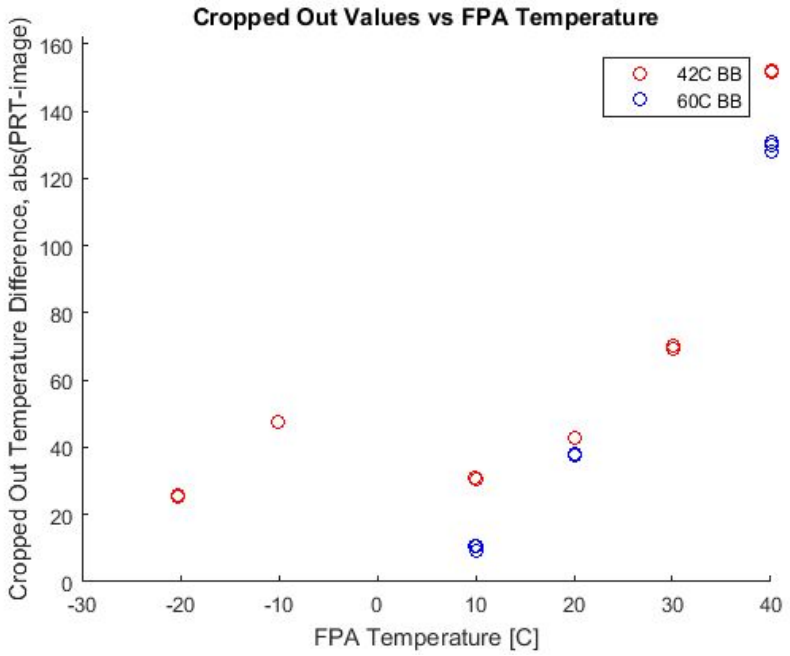
Figure 2. T-VAC test setup CAD model.

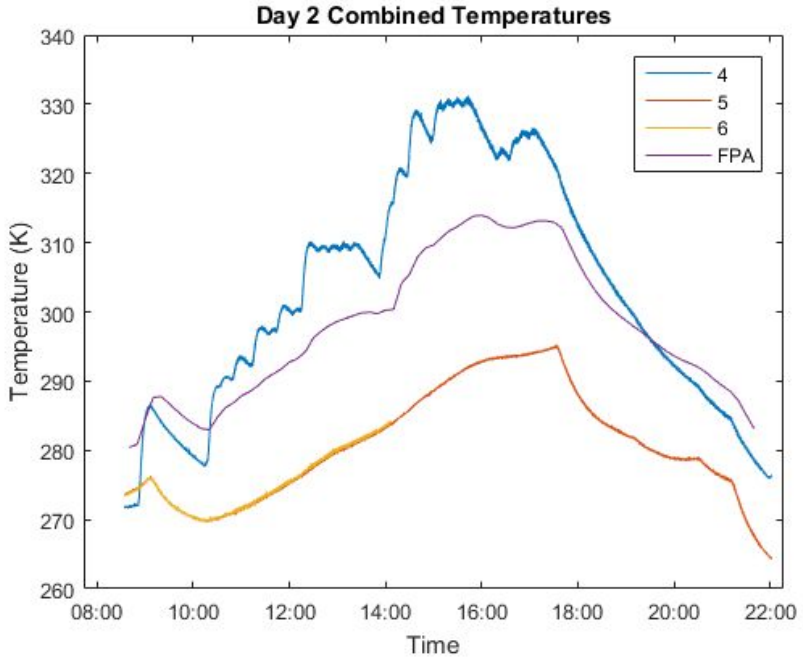
Thermal Vacuum Test - Setup (cont.)





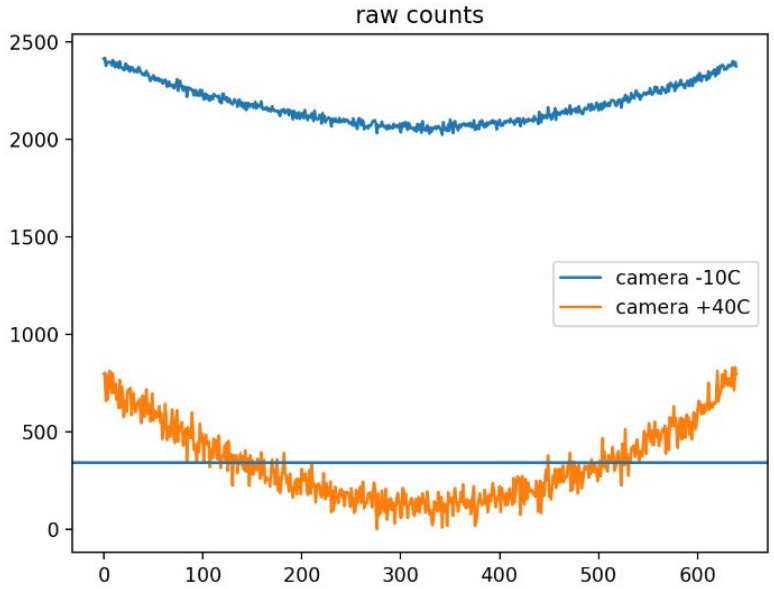
Thermal Vacuum Test - Results

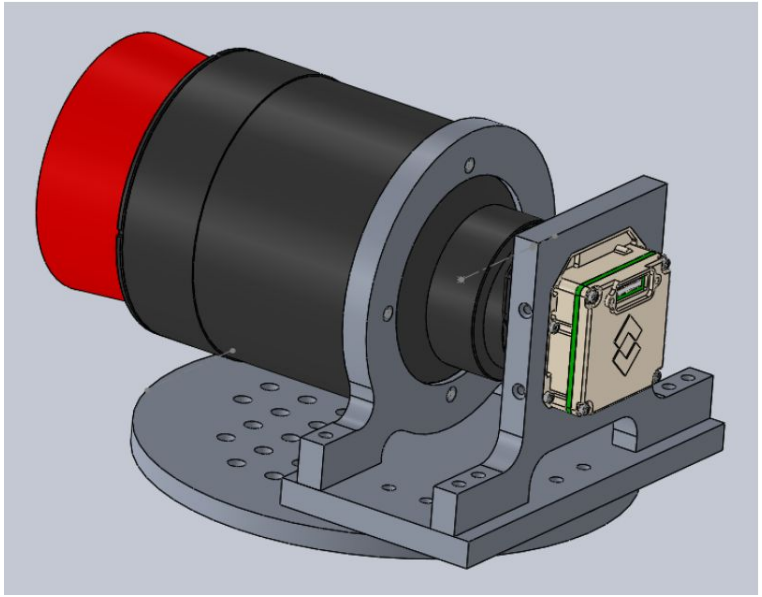




Future Work

Thermal Vacuum Test - Possible Avenues of Error





Lunar Imaging

Lunar Imaging Test - Overview

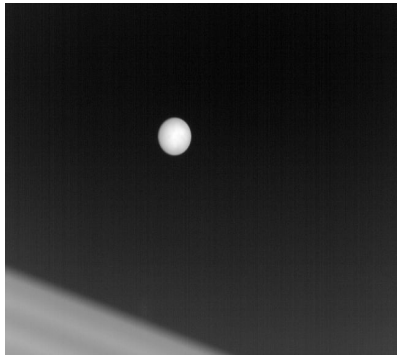
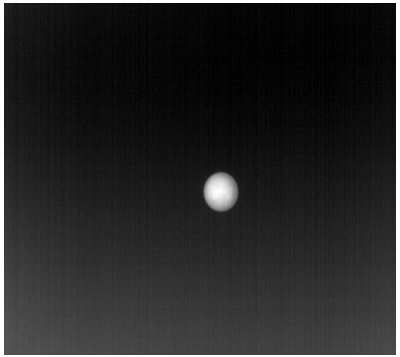
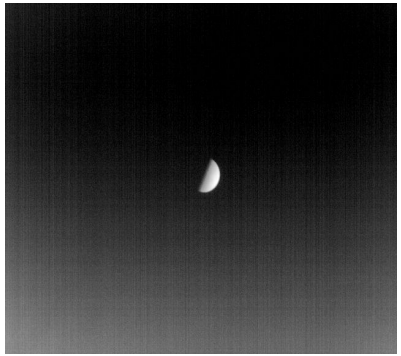
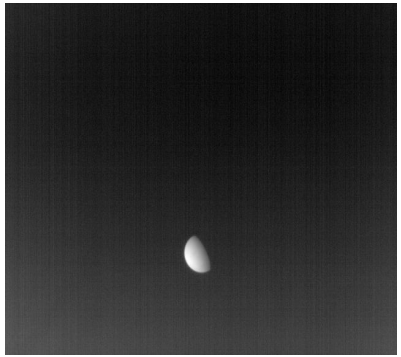
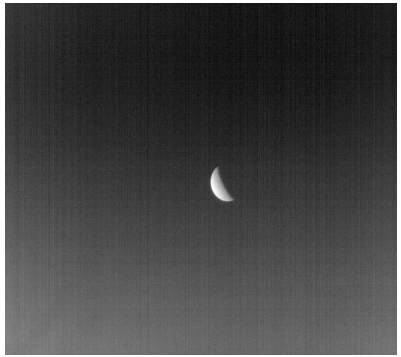
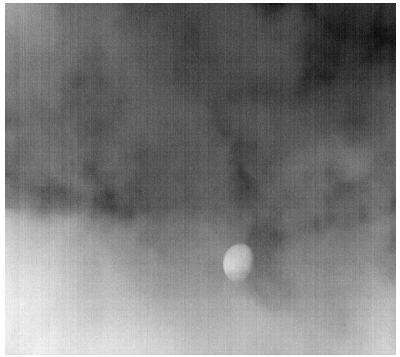
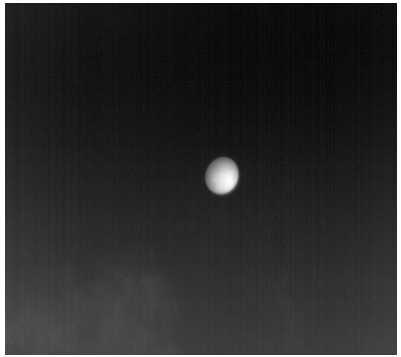
- Goal: To image the moon and come up with an atmospheric model to accurately measure surface temperature.
- Reasoning: To try to recreate the conditions the camera will experience during flight.
    - Image the moon at its zenith over Tempe, AZ

Lunar Imaging Test - Setup

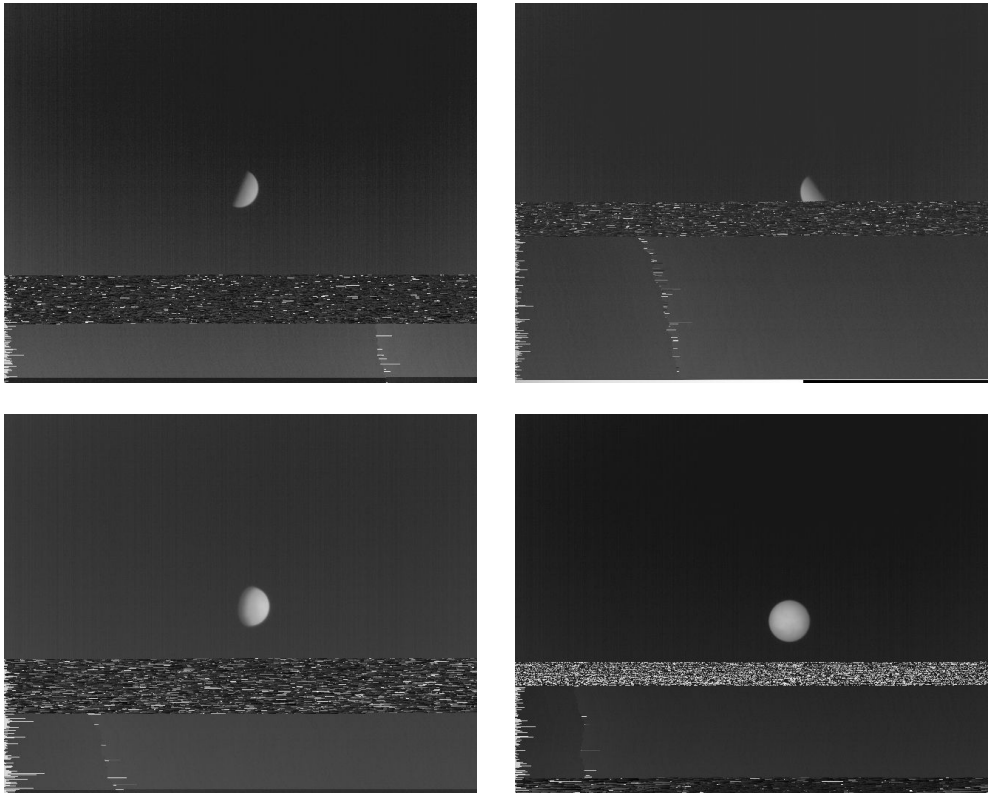
- Tripod mount with 3 axis alligator clamp

Lunar Imaging Test - Setup

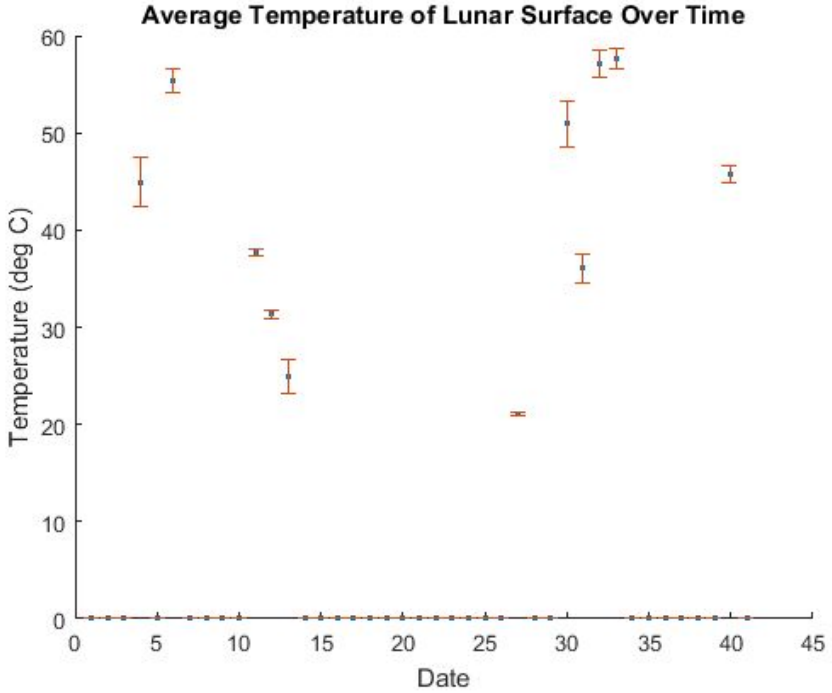
Lunar Imaging Test - Results

Lunar Imaging Test - Results



Lunar Imaging Test - Results



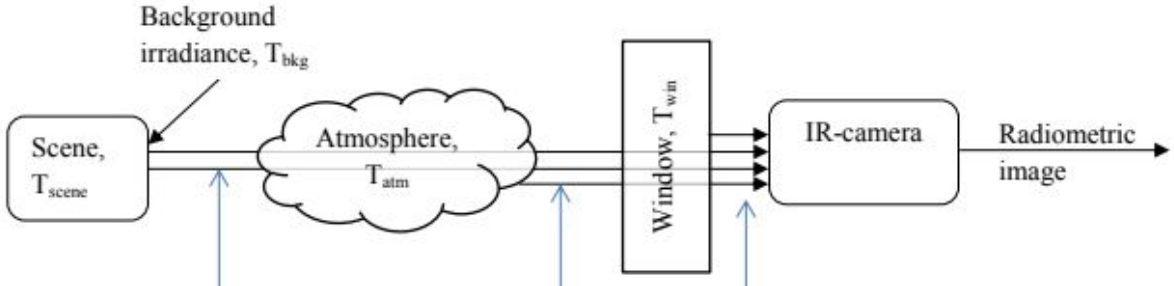
Start date corresponds Oct 1st, end day corresponds to Nov 10th

Future Work

Lunar Imaging/Atmospheric Modeling

- After addressing issues with thermal chamber testing, lunar imaging will be revisited for accurate modeling of atmosphere
- More data will be taken
- Will be tested with filter during cloudy day
    - 10.5-12.5µm

Manipulating the Raw Data from the Camera



The incident radiation onto the camera is given by

$$S = \tau_{win} \cdot \left(\tau_{atm} \cdot \left[\varepsilon W(T_{scene}) + (1-\varepsilon) W(T_{Bkg})\right] + (1-\tau_{atm}) W(T_{atm})\right)$$
$$+ r_{win} W(T_{refl}) + (1-\tau_{win} - r_{win}) W(T_{win})$$

Acknowledgements

- **Judd Bowman**
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- *Mentor*
- *School of Earth and Space Exploration*

ARIZONA SPACE GRANT

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Questions?