



# Oregon Tech RockSat-C 2020

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**Students:** Carter Knutson, Davia Fleming, Patrick Cornwall, Laura Sanchez, Justin Ringle, Juliana Bateman

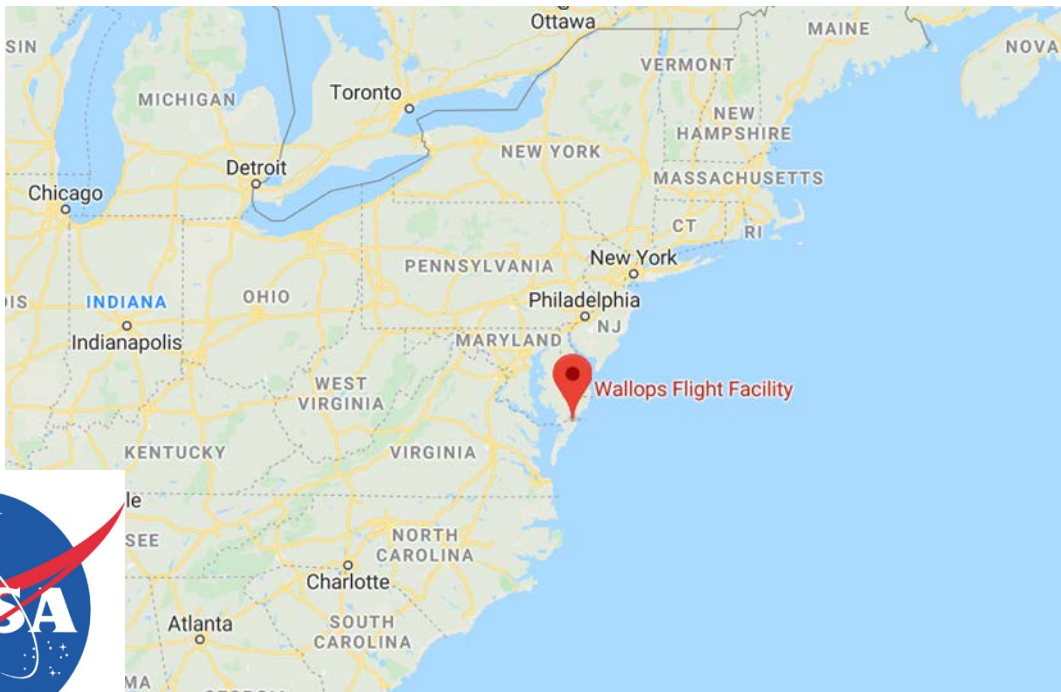
**Advisors:** Dr. Lara Pracht, Dr. Mike Myers

# Content Overview

- History
- Student profiles
- Current experiments
- Financing this incredible group of students on this phenomenal project

# What is RockSat?

- Competitive program run by the Colorado Space Grant Consortium in conjunction with NASA
- Uses the Wallops Flight Facility and sounding rockets to offer students opportunities to experience working on real-to-life engineering projects



*Picture from [spacegrant.colorado.edu](http://spacegrant.colorado.edu)*



# What is RockSat?

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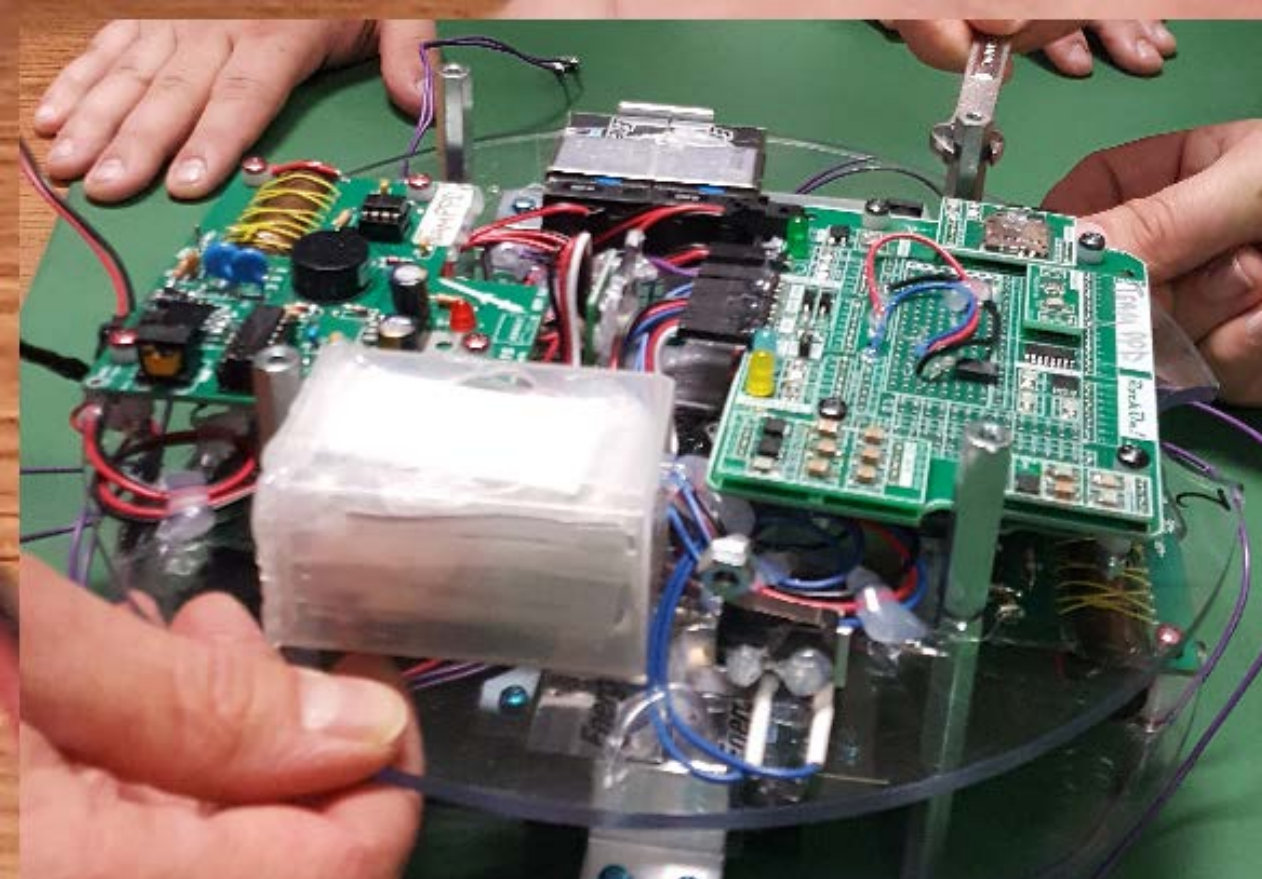
- In addition to solving engineering problems, students also gain experience with writing proposals for research and funding, as well as creating presentations after the completion of data analysis
- Offers three levels of involvement:
  - RockOn: Smallest experimental payload
  - RockSat-C: Full-sized experimental payload
  - RockSat-X: Payloads designed for orbit
- Open to colleges around the country, the program draws applicants from many prestigious engineering programs, including Oregon Tech!
- Launch planned for June 25<sup>th</sup>, 2020



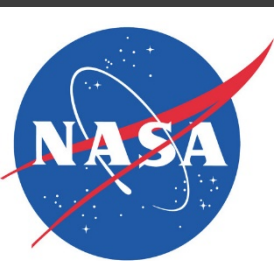
*Pictures from [spacegrant.colorado.edu](http://spacegrant.colorado.edu)*







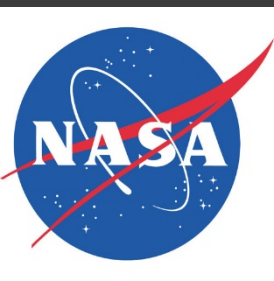
# RockOn 2016-2017



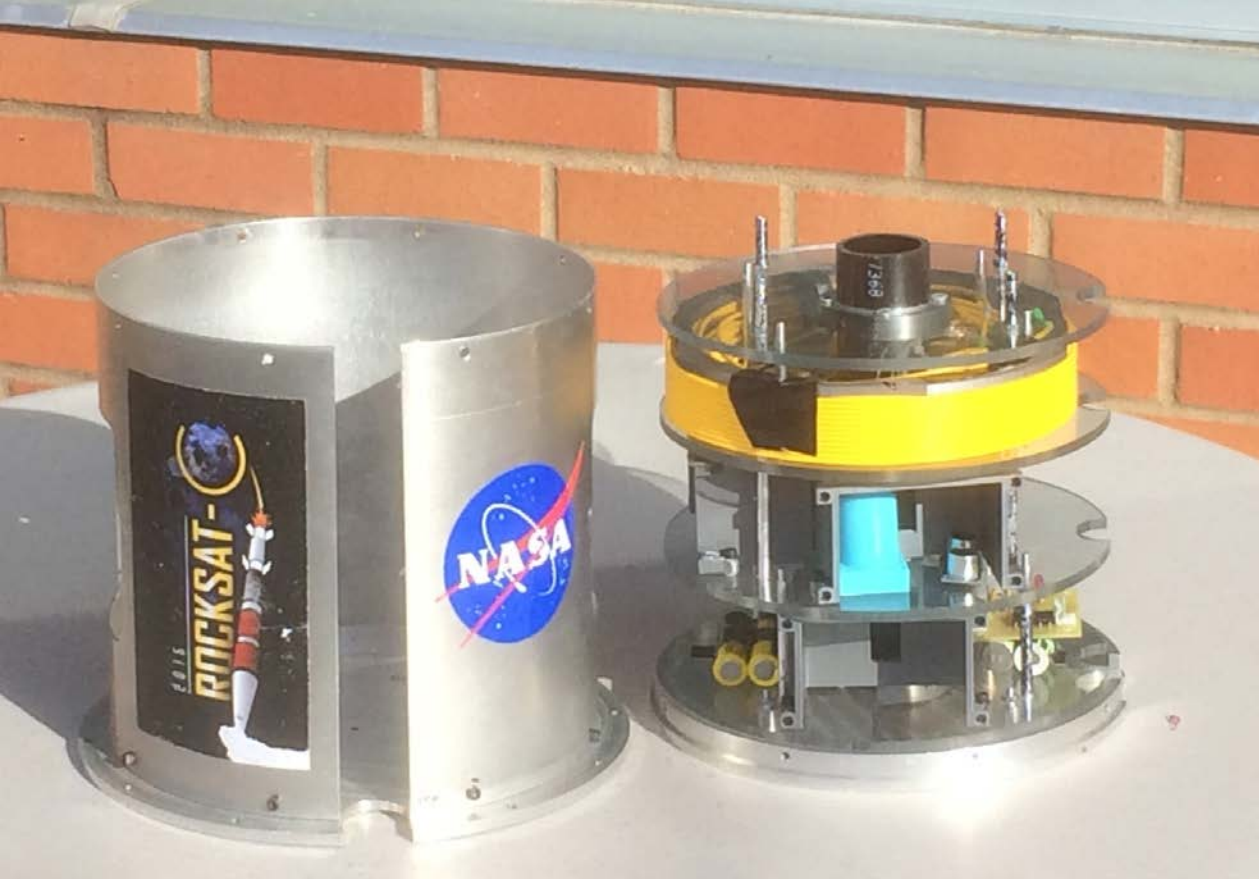




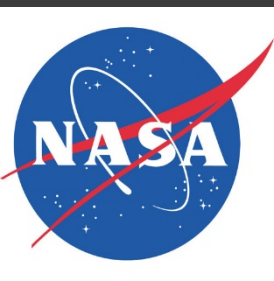
# RockOn 2017-2018







# RockSat—C 2017-2018







# RockOn 2018-2019





# Diego

*BSEE/MSE  
Electrical Engineering,  
Automation, Robotics &  
Control, 2019*



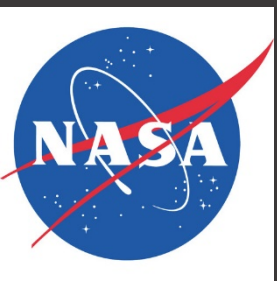
RockSat was able to bridge the disciplinary schools of engineering and I was able to learn applications and techniques I was not going to learn from courses at Oregon Tech.

# Krystal

*BS/MSE  
Electrical Engineering, 2019  
  
Electrical Design and Analysis  
Engineer – Boeing*

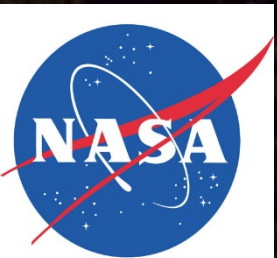


- RockSat had a direct correlation to being hired at Boeing.
- “Higher level of engineering” than courses.
- Difficulties included finding components within budget. Most times paid out-of-pocket.



# RockSat-C 2019-2020

- Team of passionate students with a variety of academic backgrounds
- Each person contributes to the project as a whole
  - Davia Fleming- Mechanical Engineering
  - Carter Knutson - Software Engineering
  - Laura Sanchez - Embedded Systems Engineering
  - Justin Ringle - Renewable Energy Engineering
  - Patrick Cornwall – Electrical Engineering

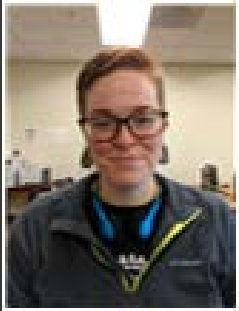




# RockSat-C 2019-2020

Davia Fleming

Mechanical Engineering, Senior  
Project Lead & Mechanical Design



Patrick Cornwall

Electrical Engineering, Senior/Master's  
Piezoelectric Energy Harvester



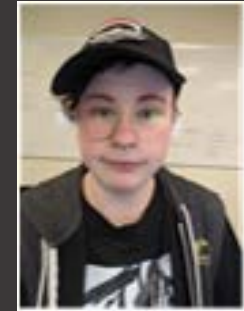
Justin Ringle

Renewable Energy Engineering  
Post-Bac/Masters  
Wireless Power Transfer



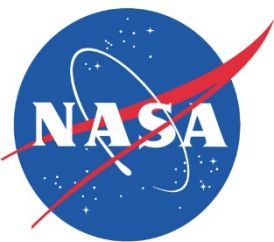
Carter Knutson

Software Engineering, Senior  
STROS



Laura Sanchez

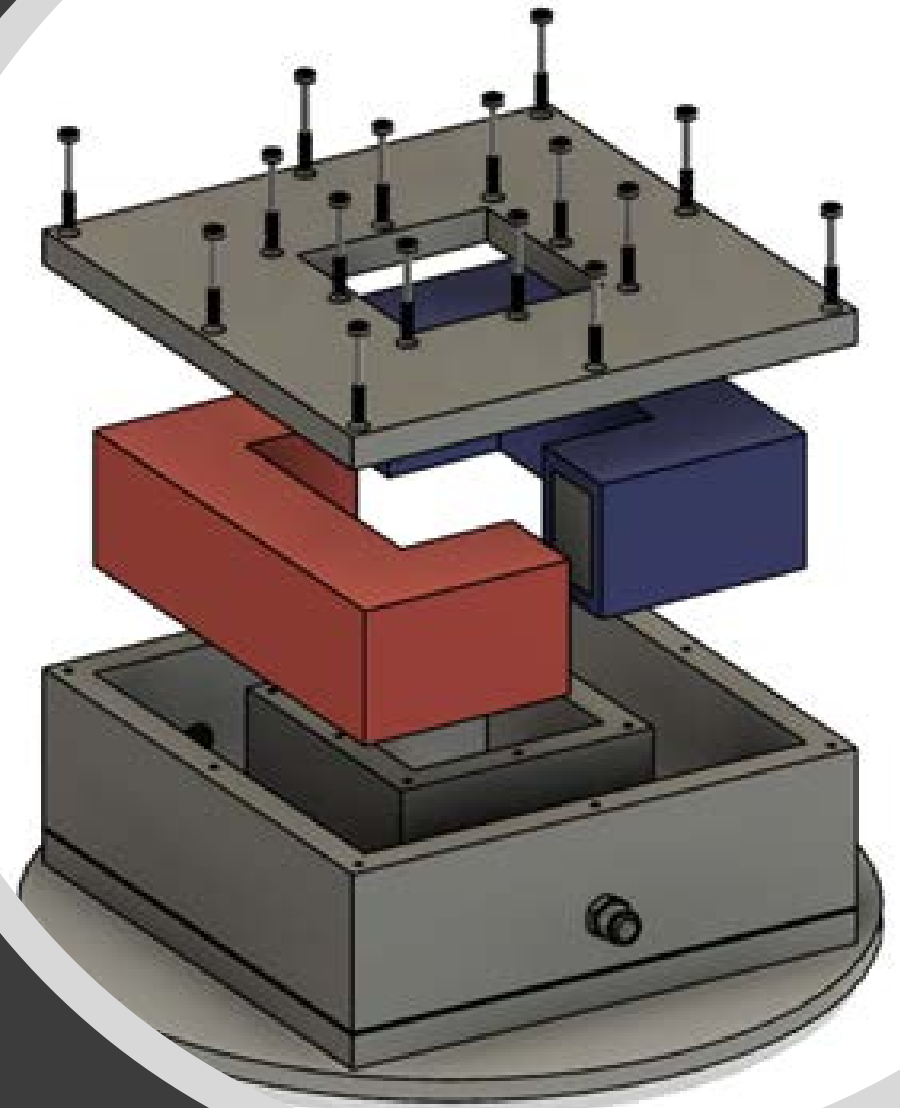
Embedded Systems Engineering, Senior  
Methane Gas Levels Analysis (GLA)



# Justin Ringle: Capacitive Power Transfer (CPT)

- Mission Overview

- To measure the conductivity of the atmosphere, as a function of altitude, and to transmit power wireless through Capacitive Power Transfer (CPT)
- The goals of the mission is to have a better understanding of the application of wireless power transfer in Low Earth Orbit and beyond.

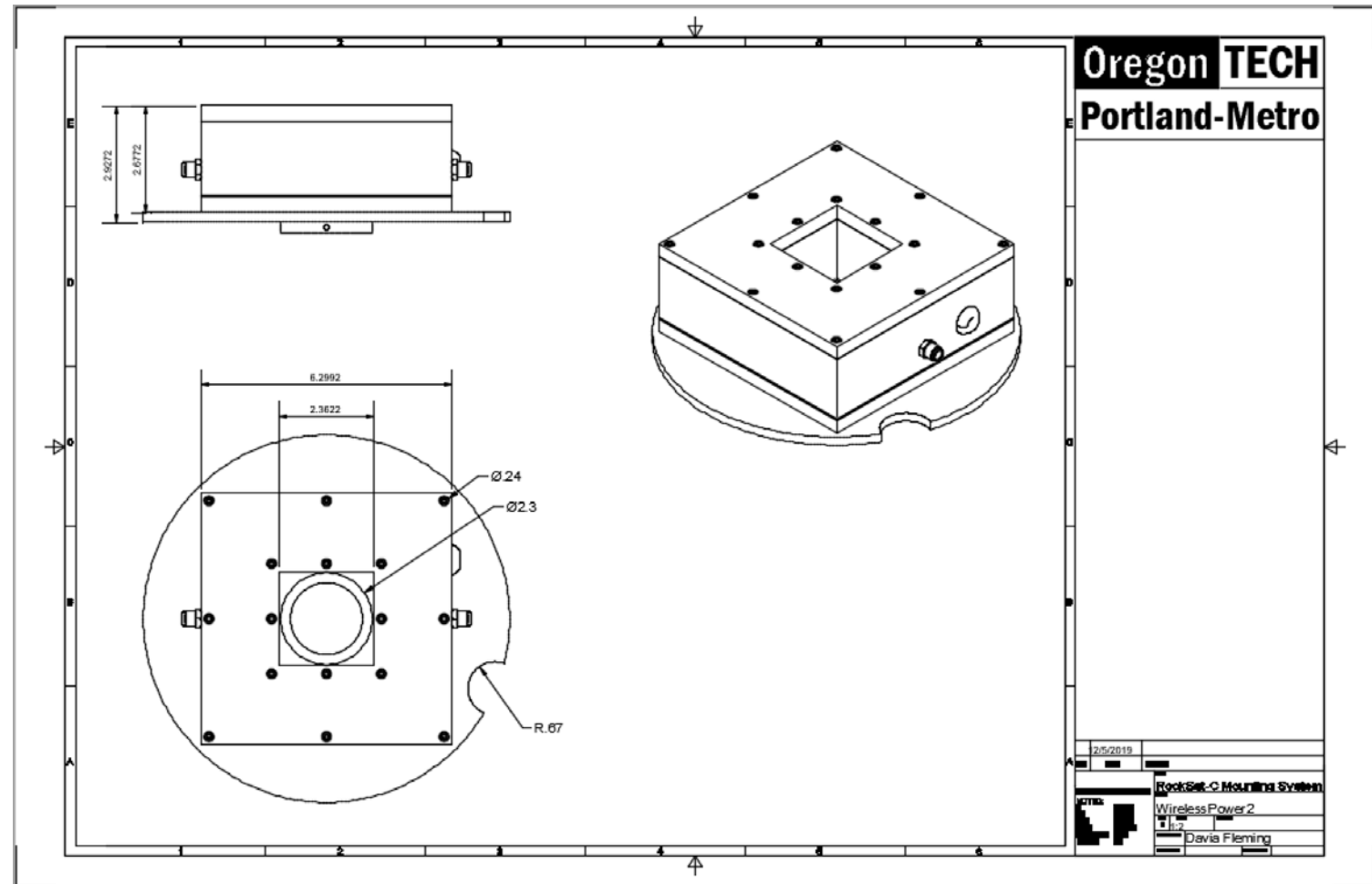
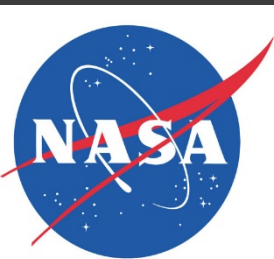




# Justin Ringle: Capacitive Power Transfer (CPT)

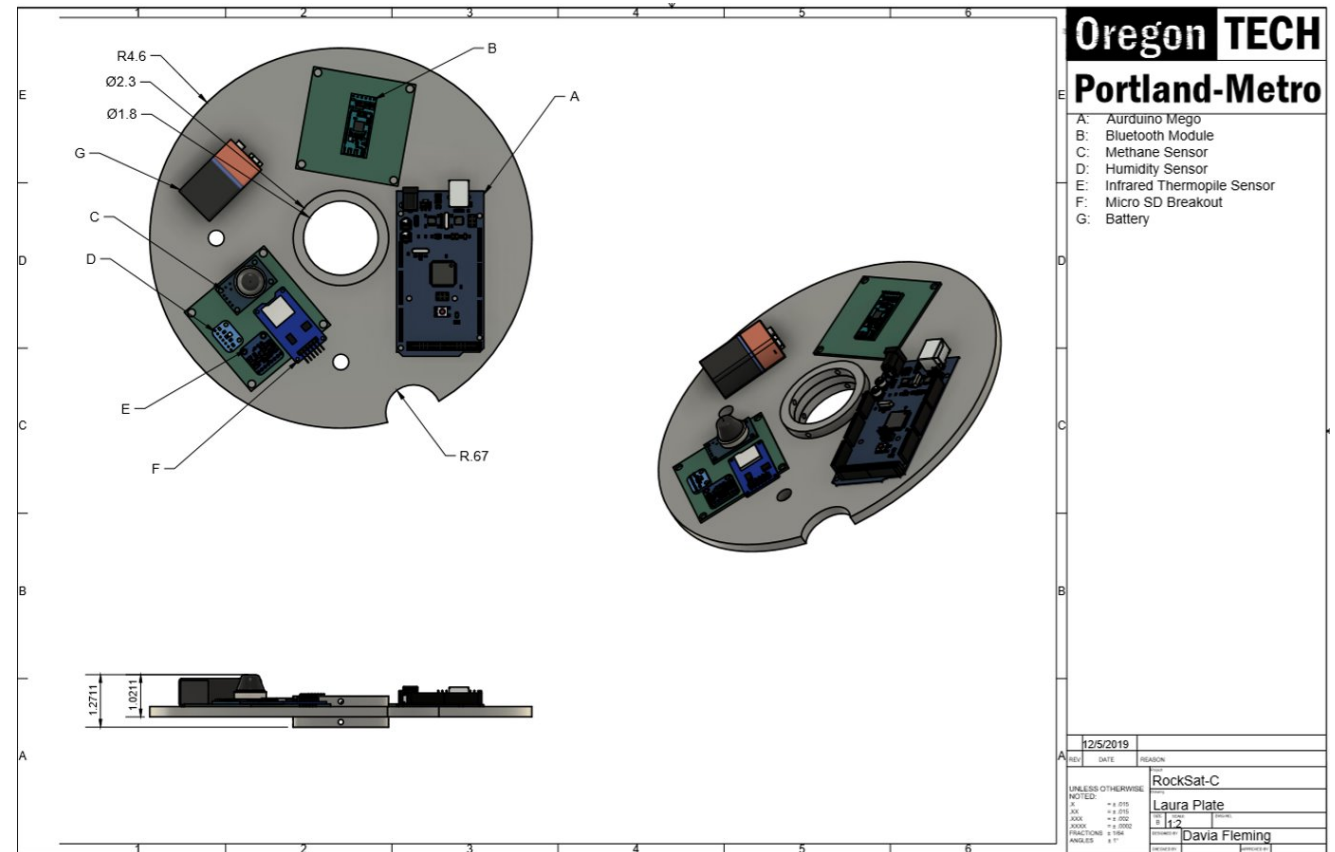
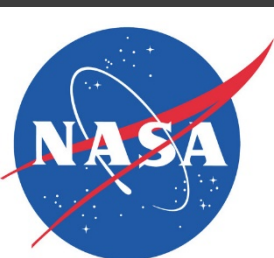
## Theory & Future Work

- Atmospheric conductivity increases as you increase in elevation.
- Using this relationship, wireless power transfer becomes more efficient.
- IEEE Research paper with Professor Scher.
- RockSat-X and future Master's Project.



# Laura Sanchez: Gas Level Analysis (GLA)

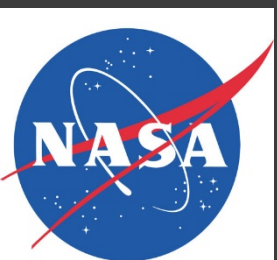
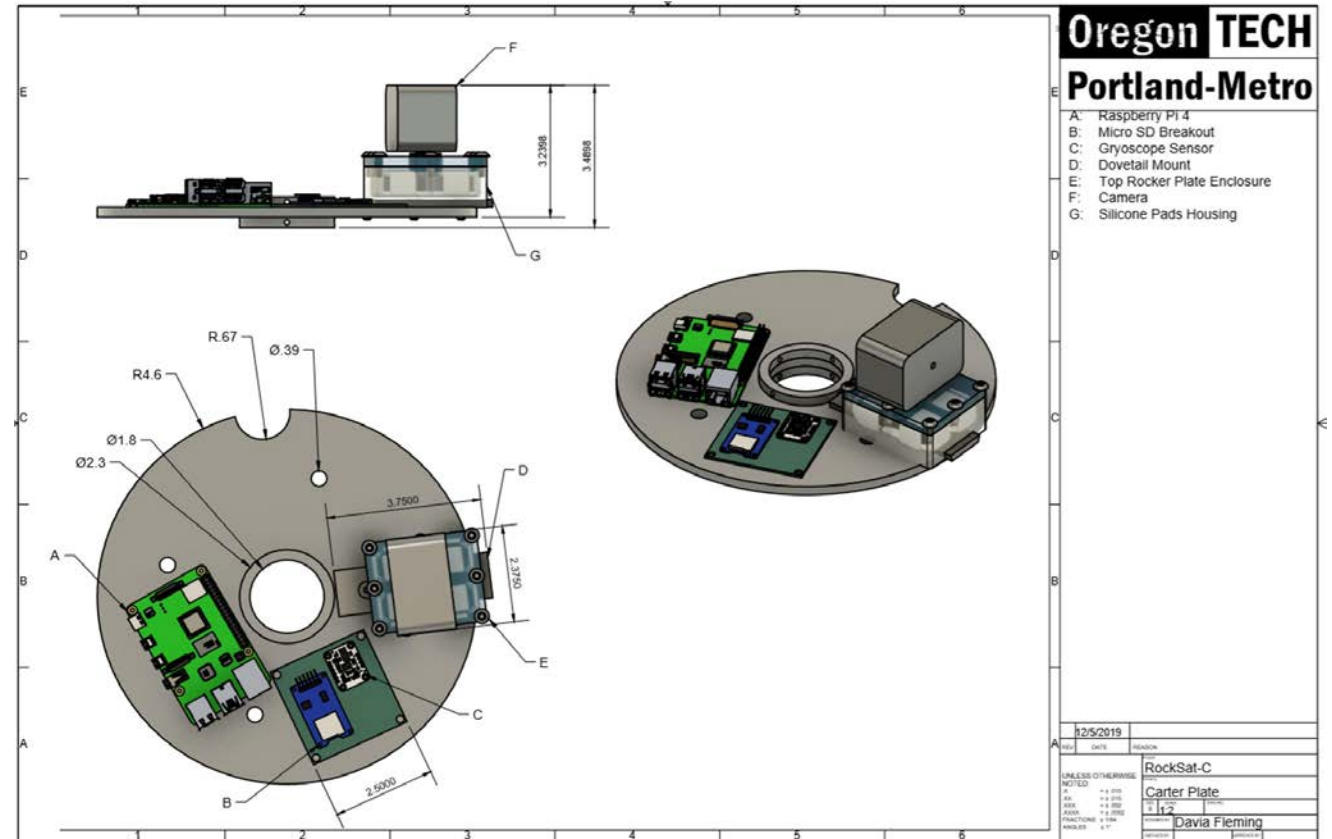
- Mission Overview
  - Measure methane and humidity levels with respect to payload temperature as the payload enters space.
  - The goals of the mission is to compare current methane levels to previous data collected by earth system research laboratory's
  - Compare methane levels with the amount of humidity in the atmosphere with respect to temperature.
  - Examine the effects that humidity and temperature has on the amount of methane within the atmosphere.





# Carter Knutson: Star Targeting and Recognition Optical System (STROS)

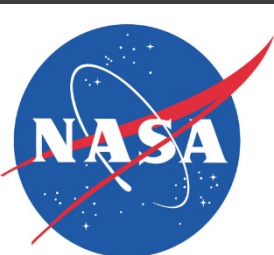
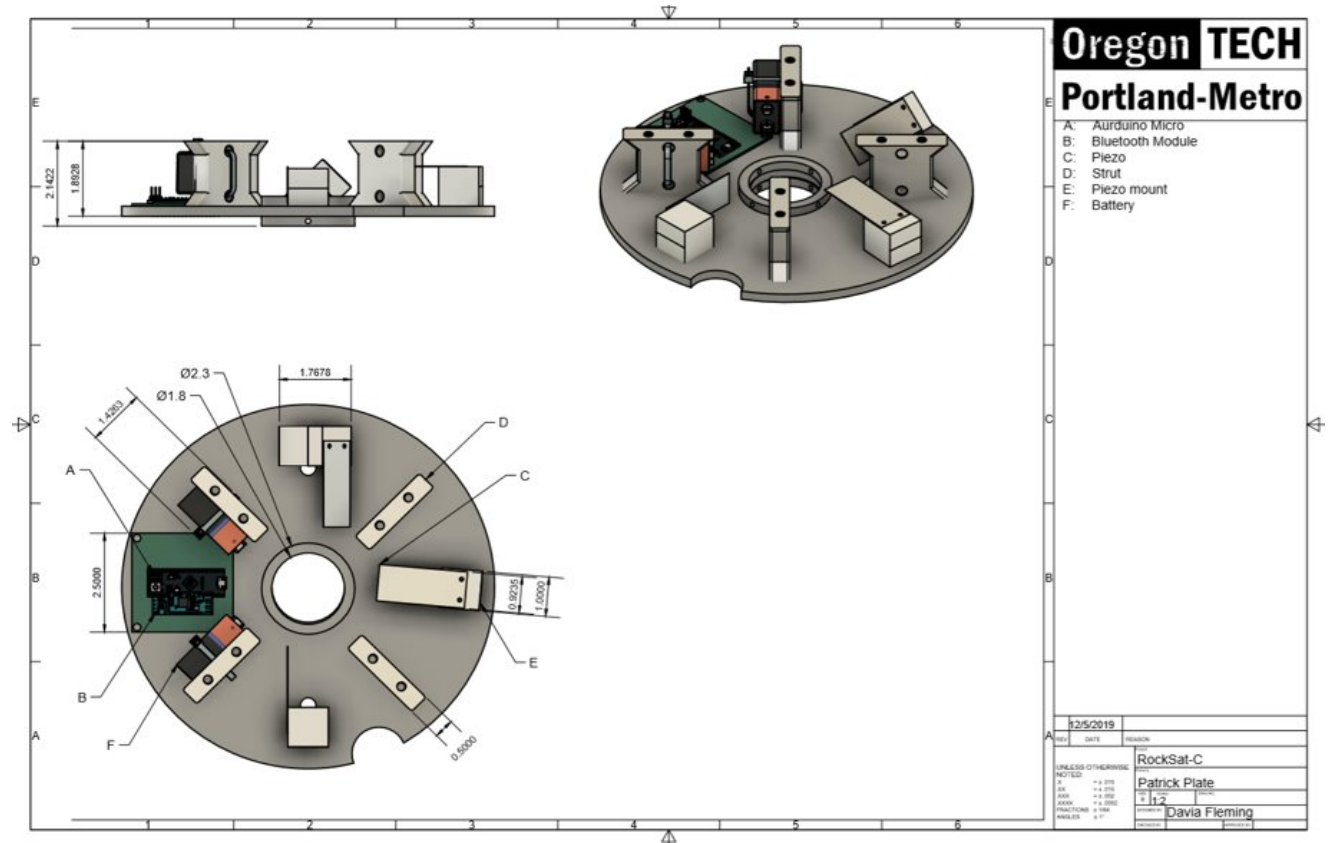
- Overview & Basis
- The primary objective of this subsystem is to implement an optical star recognition and targeting system. This will assist in diversifying the use of photo recognition software with potential to expand the world of astral navigation.
- The key theory behind implementation will be the parallax method. The camera will capture and analyze frames to extract a parallax angle used for distance calculation. This distance will then be used to determine position. Base languages will be python, c++, c#, and bash scripting



# Patrick Cornwall: Piezoelectric Energy Harvester

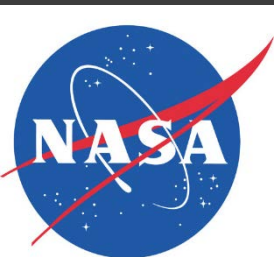
- Mission Overview

- This experiment aims to measure and model the potential to harvest energy through the use of piezoelectric materials in the high-g environment of a rocket launch.
- It follows previous Oregon Tech and MESA experiments on the subject, while applying industry standard materials. These materials are arranged in such a way that the power created will be compared to an onboard accelerometer in order to predict the best positioning for future use.
- Applications include powering remote sensors for monitoring future missions



## Davia Fleming: Integrated Cannister Design

- Cannister which will contain all experiments. This design has been created in order to provide a stable platform that can not only withstand the rigorous demands of launch, with forces in excess of 25g's, but also to provide a stable platform for the unique demands of the experiments involved.
- Prototyping construction of individual components has begun, with further testing planned over the next 6 months

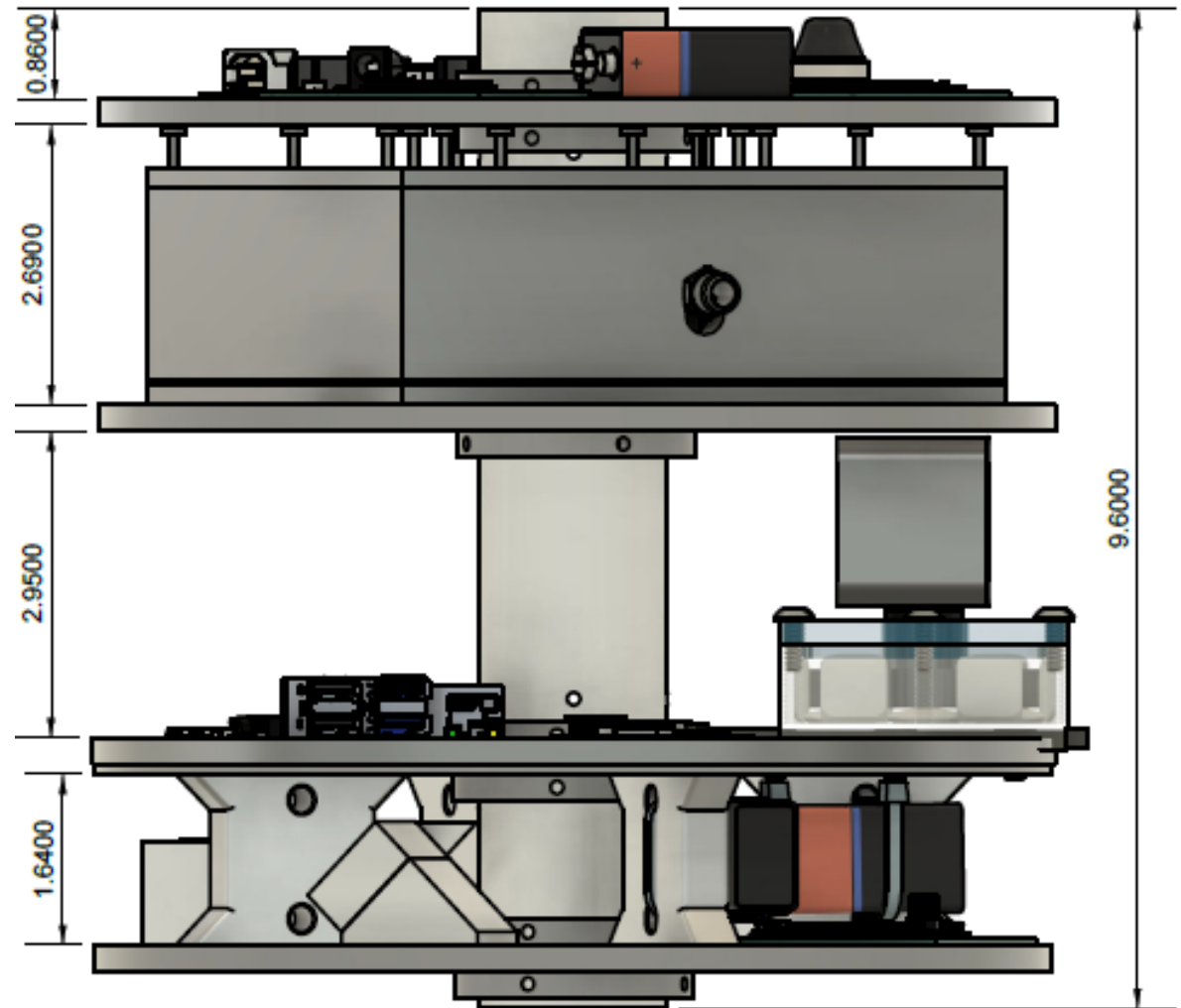




## Balancing Mechanical Aspects

Rigidity is vital to keeping components intact, however, too much rigidity can cause brittleness.

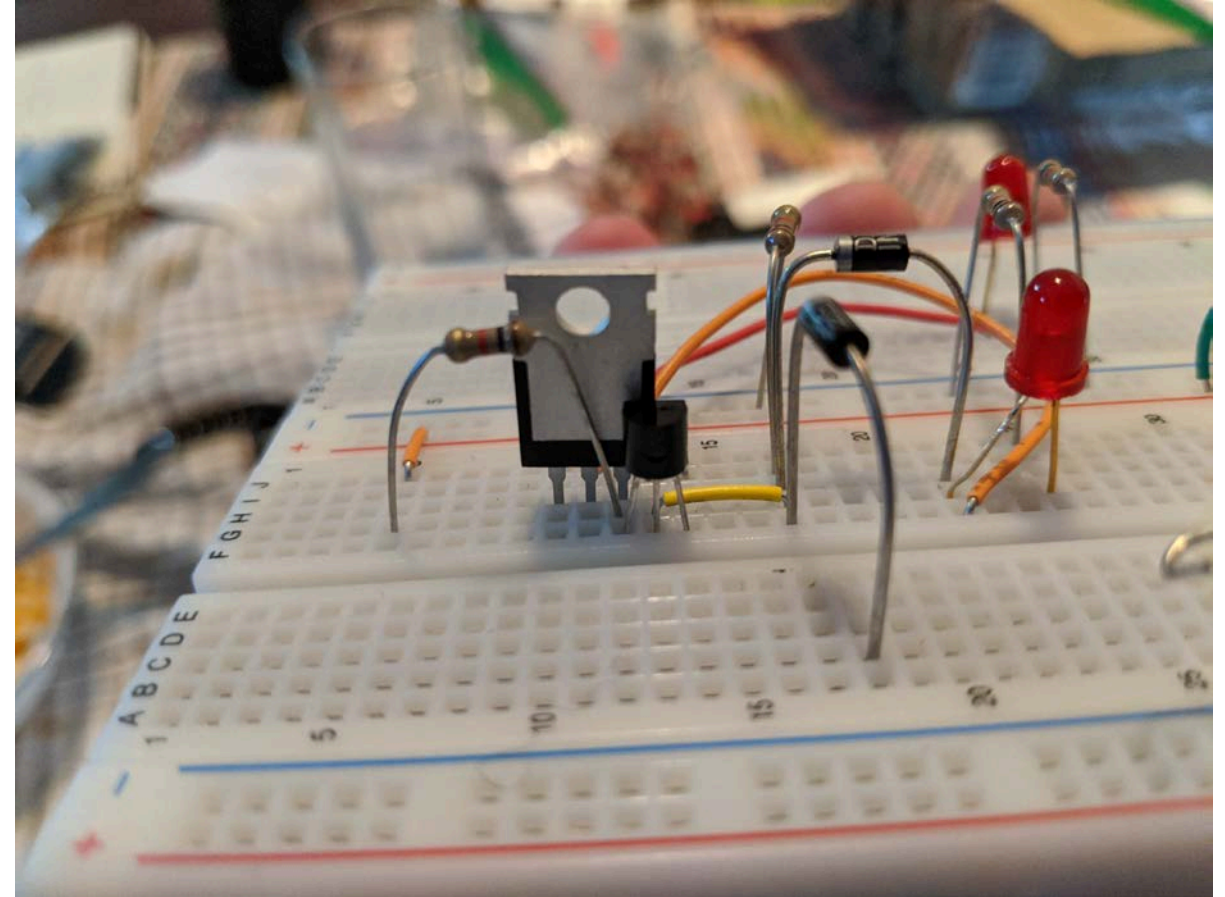
Materials need to be carefully chosen to assist with dampening while resisting heavy vibration and not shear.



# Power Delivery System

Each experiment needs consistent electrical power delivered according to their individual needs. In addition, Wallops flight facility does not allow devices to be powered before flight begins.

A power deliver system, that can meet these requirements with a high level of reliability, (the prototype is pictured at right) is currently being developed.



# Budget

Category	Item	Amount	Total
Project			
	Registration	\$12,000.00	\$12,000.00
	Parts & Supplies	\$ 4,750.00	\$4750.00
		<b>Subtotal</b>	\$16,750.00
Travel & Food			
	Accommodations	\$120.00	\$1,080.00
	Airfare	\$626.00	\$3,130.00
	Food	\$56.00	\$840.00
	Fuel	\$400.00	\$400.00
	Van Rental	\$300.00	\$300.00
		<b>Subtotal</b>	\$5,750.00
		<b>Total</b>	\$22,500.00







# Financial Standing

- RockSat team applied for the Oregon Space Grant Consortium (OSGC) and have been awarded \$9000. Dependent on finding matching funds from other sources.
- Applied to the Oregon Tech RBC first round of funding.
  - Historically the RBC has helped to fund RockSat teams.
  - Currently, we are not sure if we are able to apply for the 2nd round.
- Currently looking for funding from internal sources like academic departments, the Foundation, as well as external corporate sponsors.

