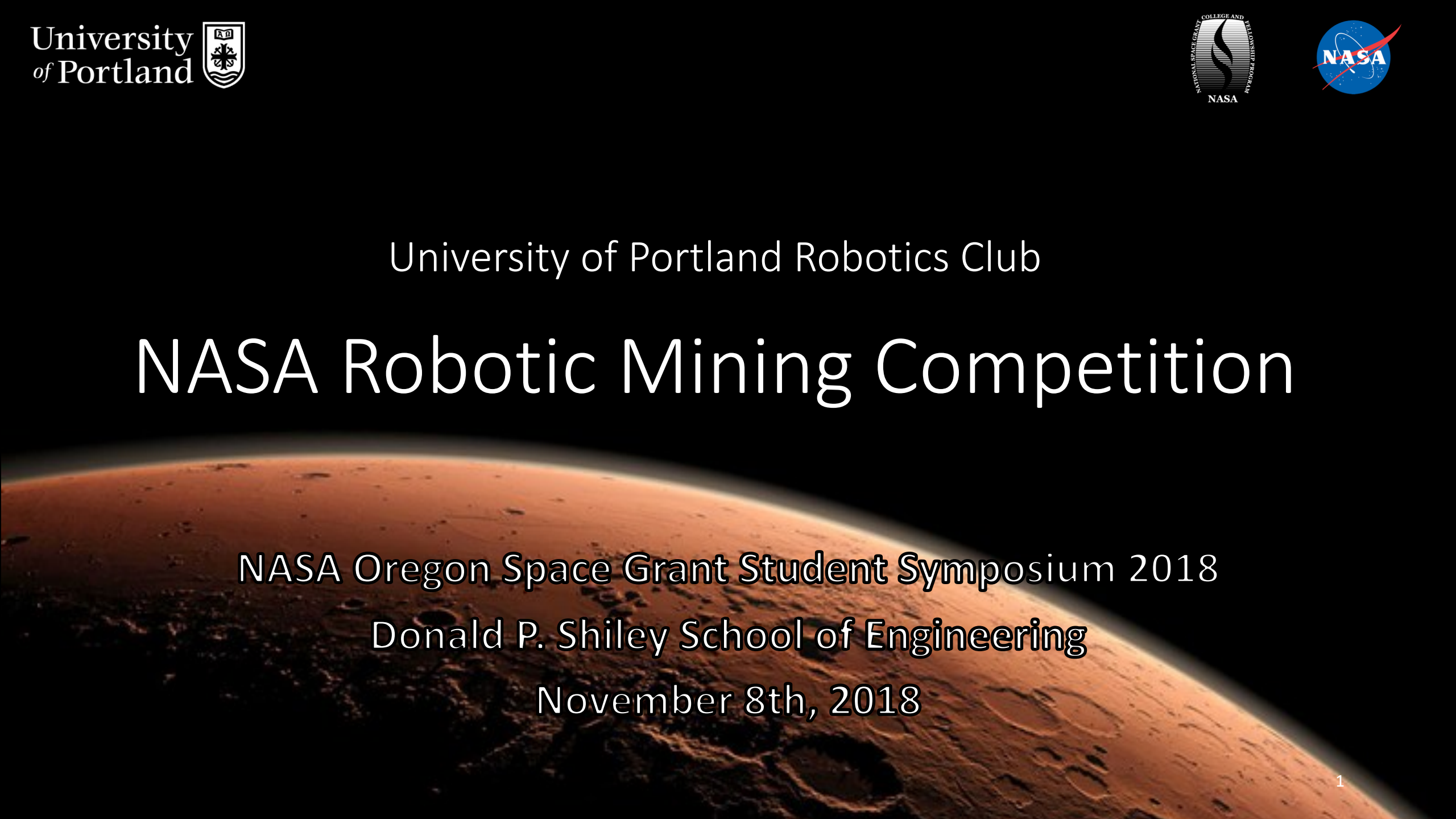
University of Portland

University of Portland Robotics Club

NASA Robotic Mining Competition



NASA Oregon Space Grant Student Symposium 2018

Donald P. Shiley School of Engineering

November 8th, 2018

Outline

RMC History
- Competition
- Team

Mars Rover
- Mechanical Systems
- Electrical Systems
- Computer Science

2018 Competition
- STEM Outreach
- Results

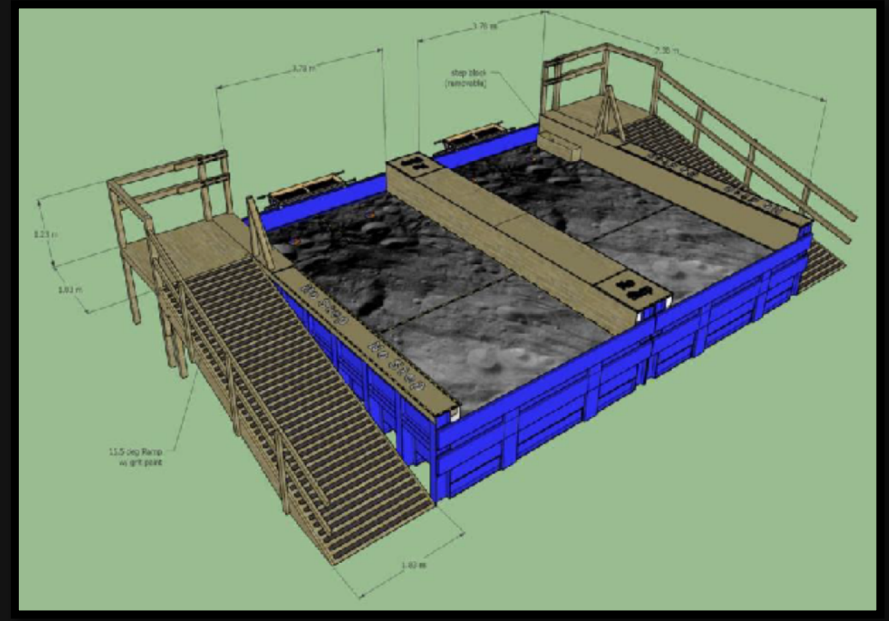
2019 Competition
- Rover Redesign
- Budget Plans

NASA's Robotic Mining Competition

Every May, 50 university/college teams work to “Design it,” “Build it,” and “Dig it”

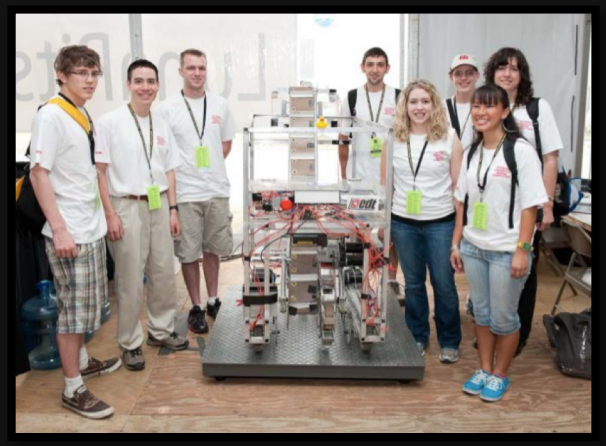
Four ways to earn points:

1. Slide Presentation and Demonstration
2. STEM Outreach Project and Report
3. Systems Engineering Paper
4. Mining Competition



University of Portland's Rover Evolution

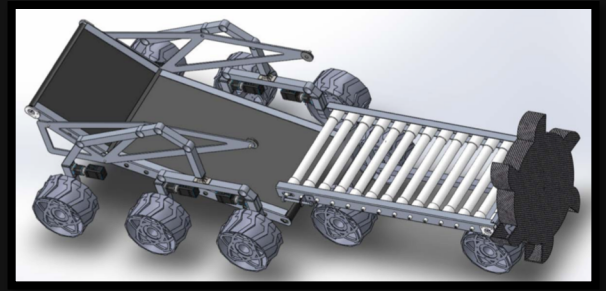
2010 - 2011



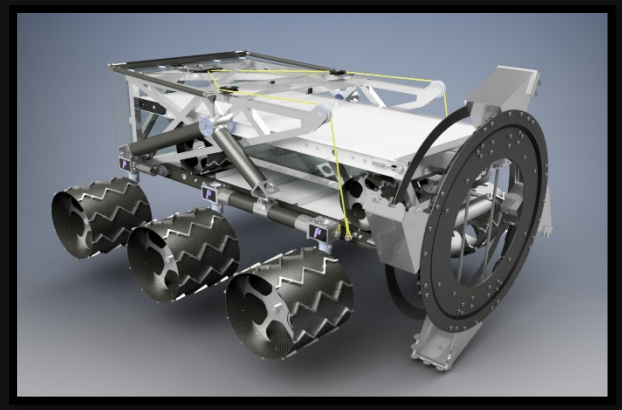
2011 - 2012

2012 - 2013

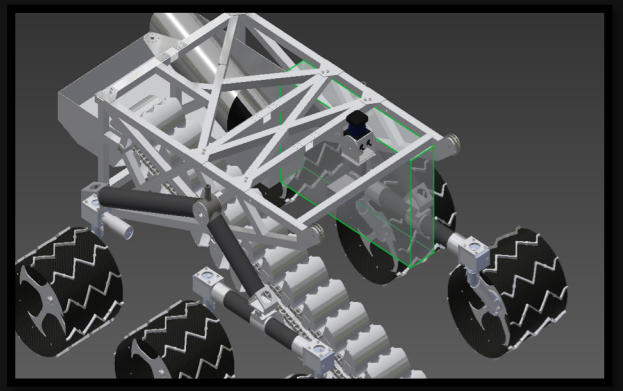
2013 - 2014



2014 - 2015

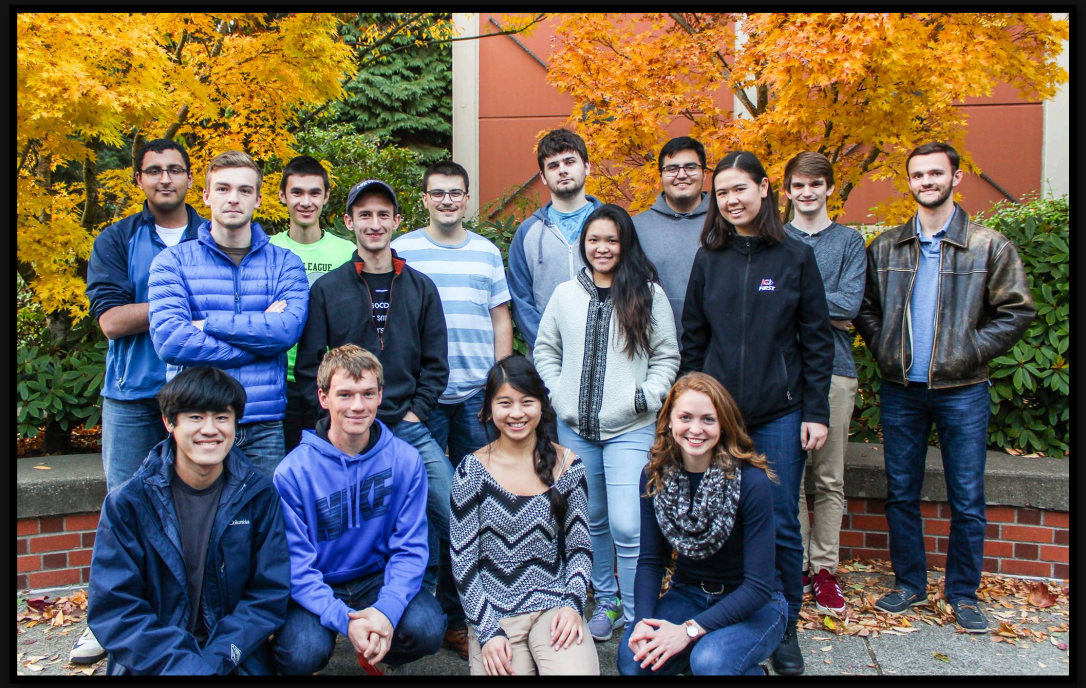


2017 - 2018



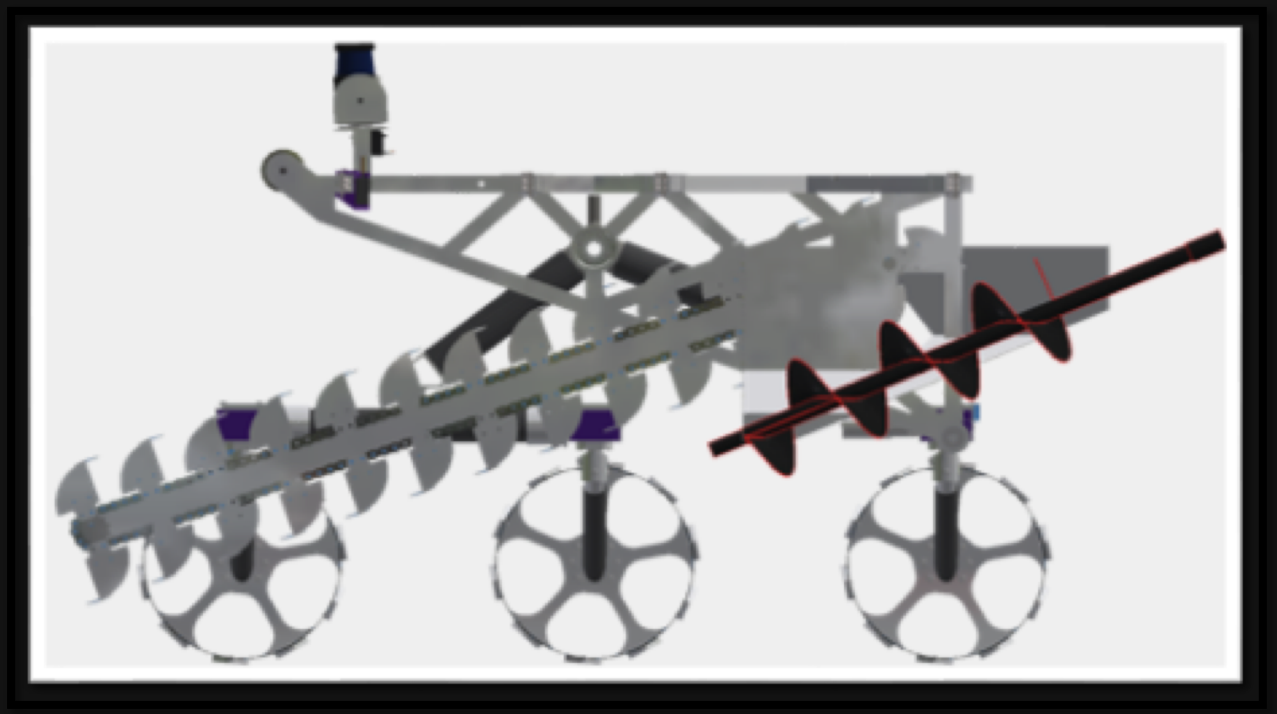
Our Team

Robotics Club + Senior Capstone



Our Robot

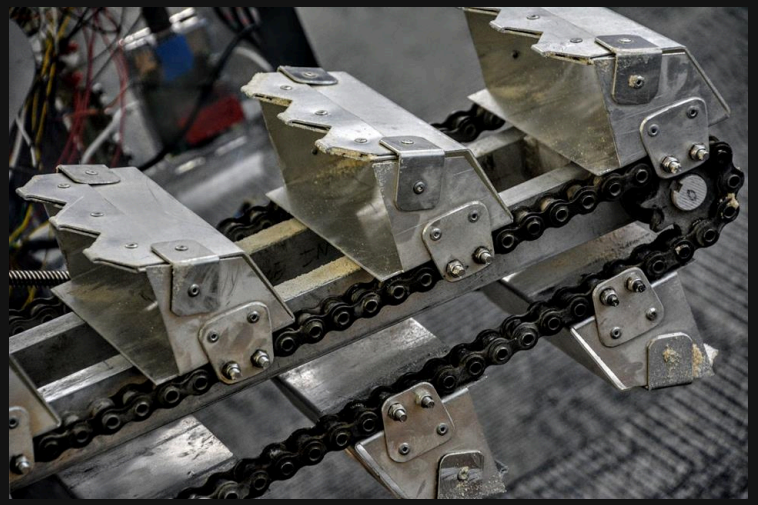
Containment and Deposition System

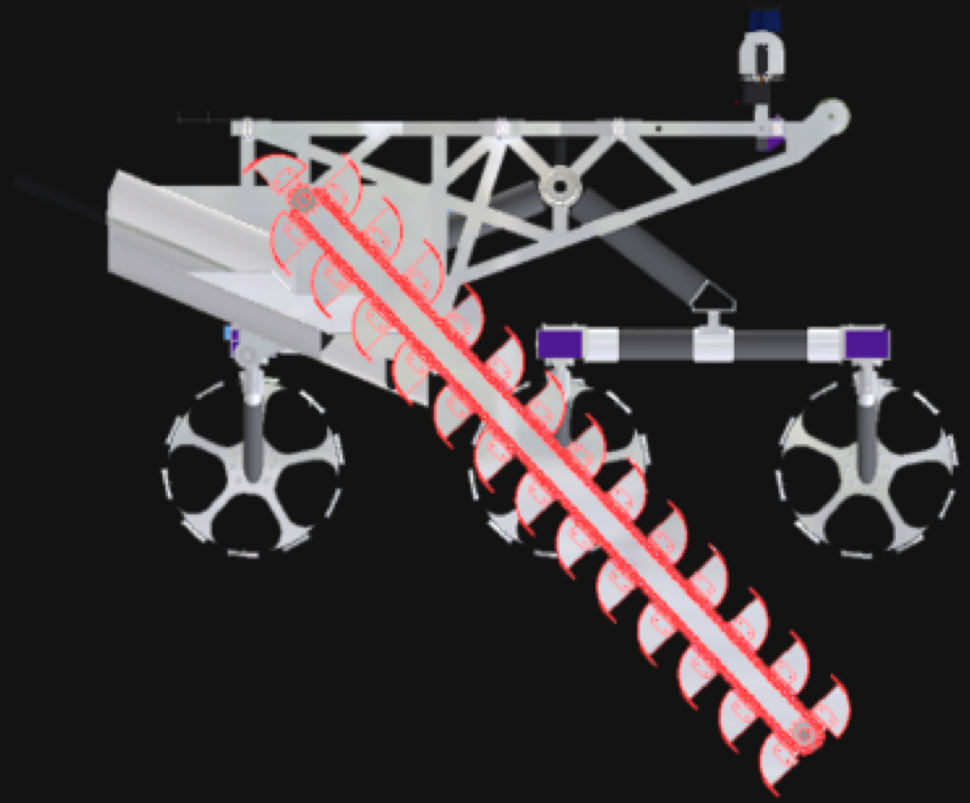


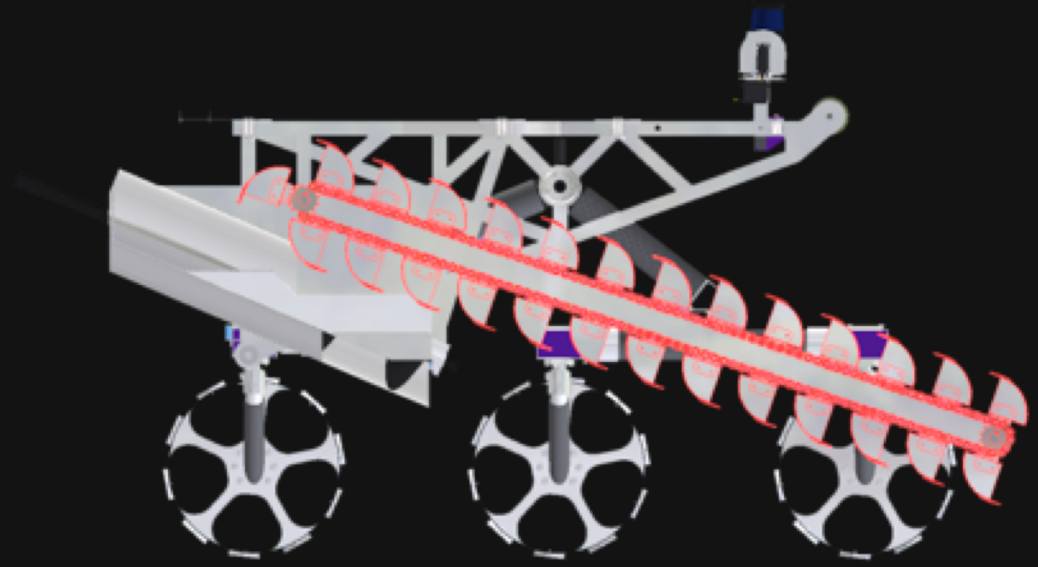
Excavation System

Bucket Chain

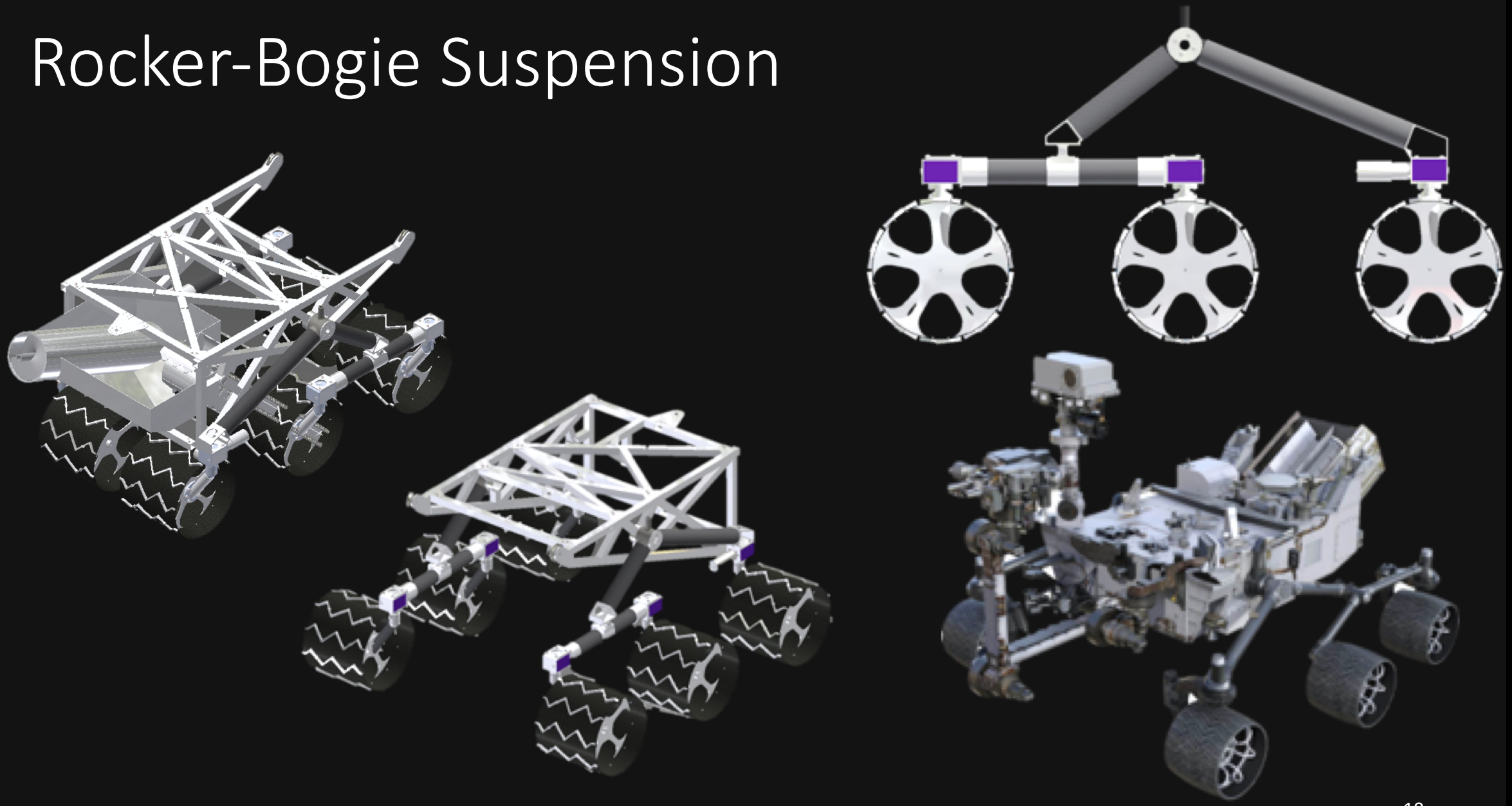
- 20 Buckets
- Z-Axis Stepper Motor to raise and lower
- 280 ft-lb digging torque
- 35 cm maximum depth



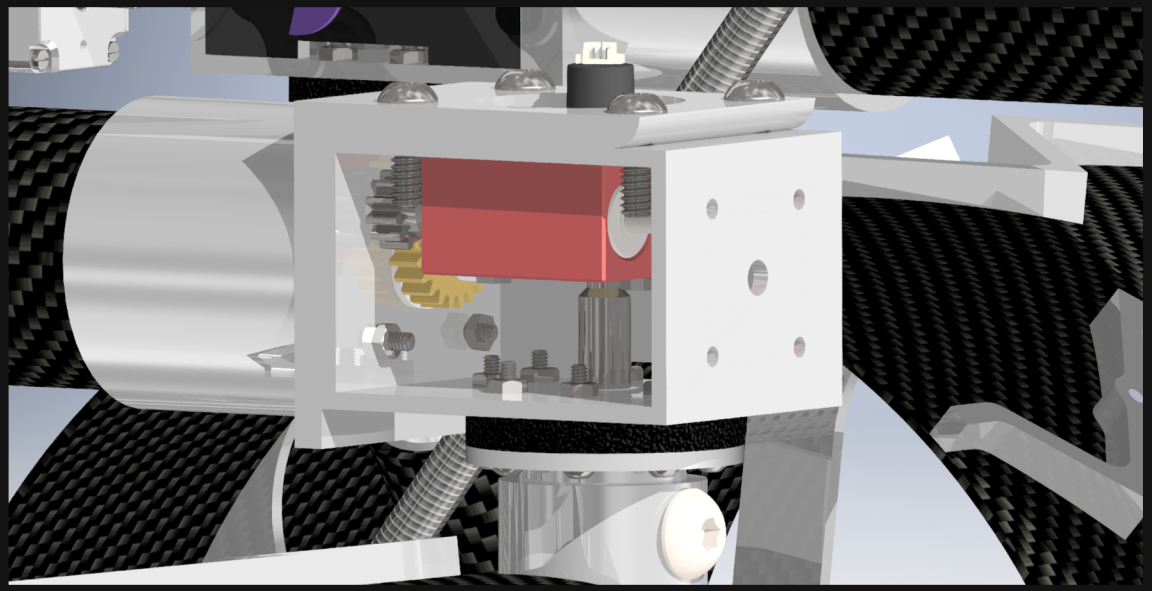




Rocker-Bogie Suspension



Articulation Joints




IBM
LIVE

Power System

- Lithium Polymer batteries
- 1x 14.8V battery
  - Powers drive and articulation motors
  - Powers z-axis stepper motors
  - Powers voltage regulators
- 1x 20V battery
  - Powers Excavation and Deposition motors
- 3x 5V regulators
  - Powering R-Pi and Arduinos

Control & Communication System

Arduino Mega

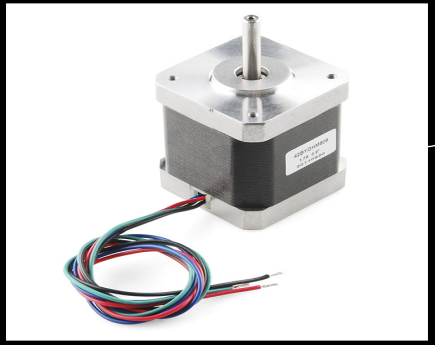
Sabertooth Motor Driver

x 6 wheels

Drive & Articulation Motors

Stepper Motor Driver

Stepper Motors



-Excavation

-Deposition

Control & Communication System

Laptop
(Manual Control)

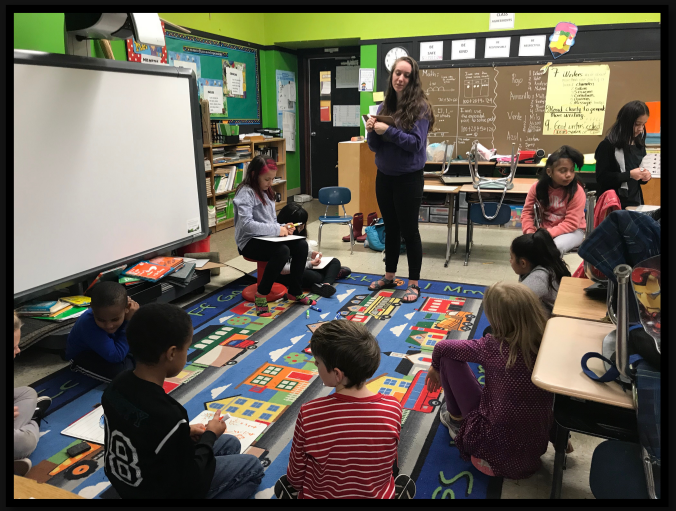
Router

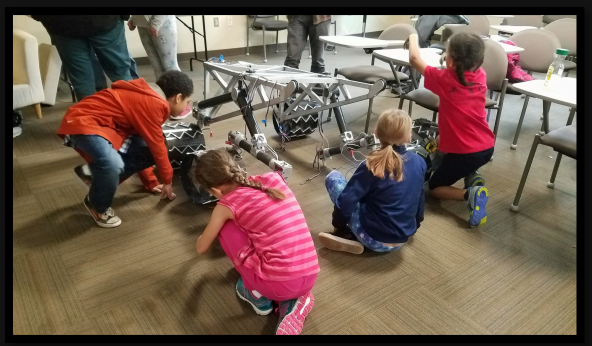
Raspberry PI 3B
(ROS with Python)

Arduino Mega
(C++)

STEM Outreach

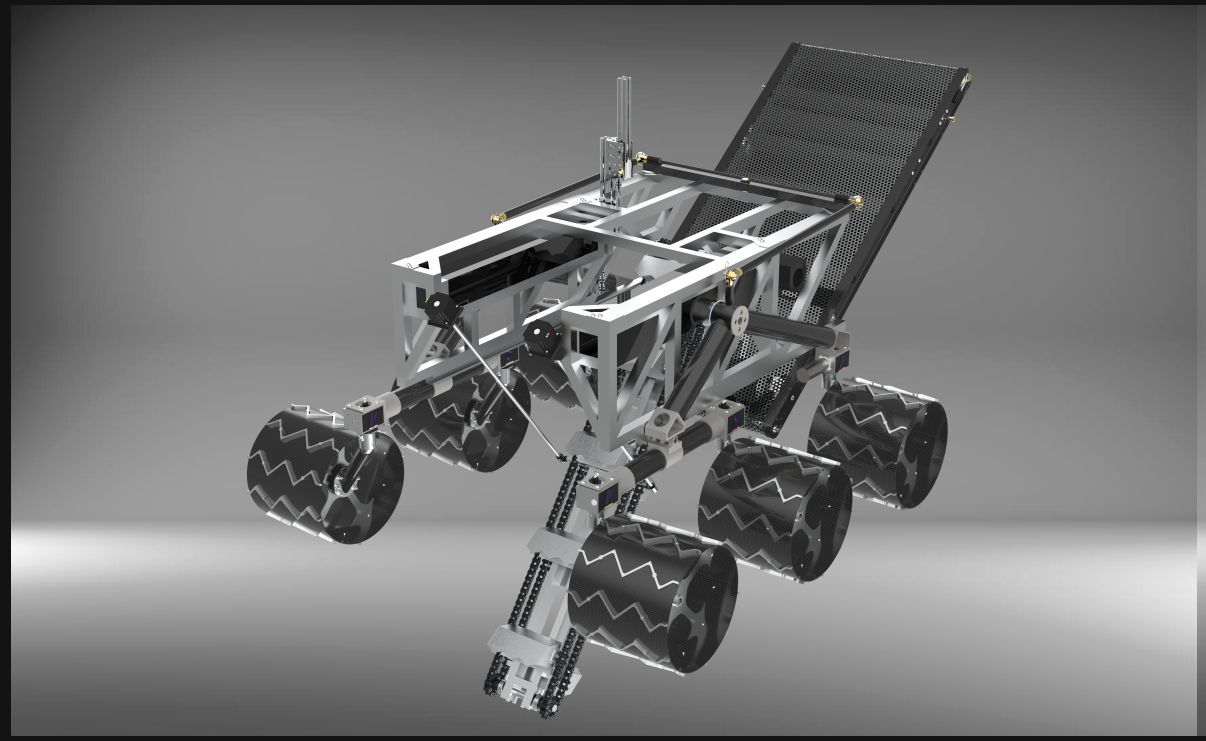
- Dozens of weekly afterschool workshops at local elementary schools
- Seven-hour STEM camp on campus
- Over 200 students reached

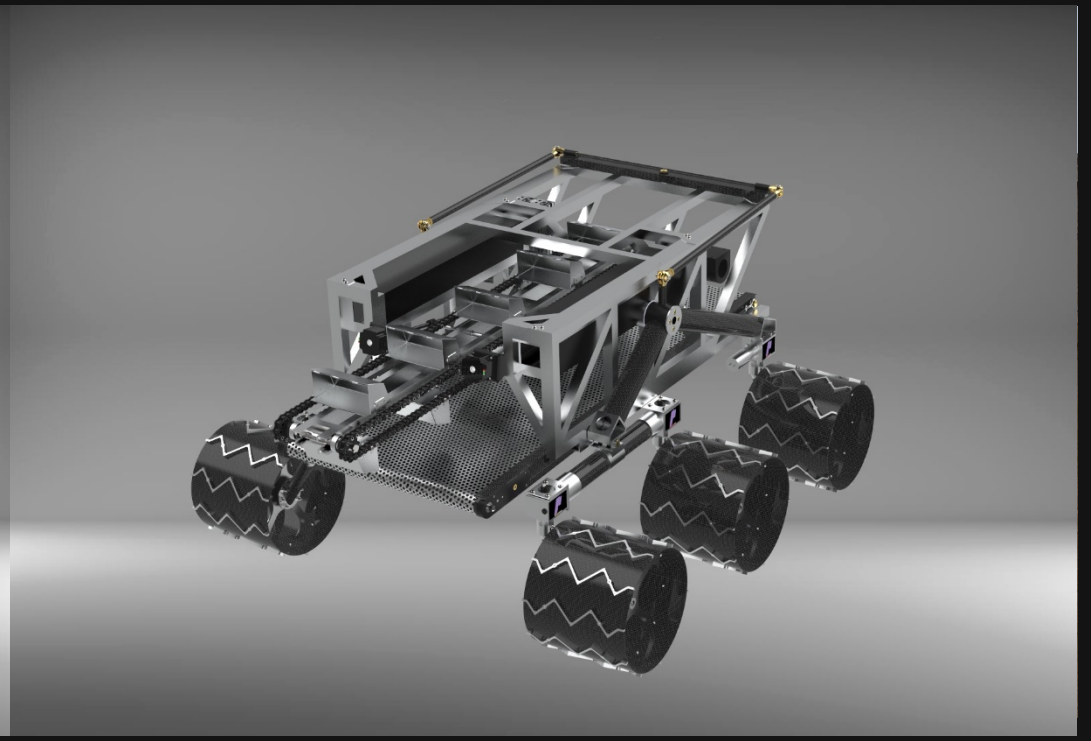




2019 Team

Redesigned robot frame, bucket chain, deposition, electrical box, and navigation systems.





Acknowledgements

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- Dr. Thomas Greene – Provost, University of Portland
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- Dr. Ben Tribelhorn – Professor of Engineering, Faculty Advisor
- Dr. Timothy Doughty – Professor of Engineering, Faculty Advisor
- Jacob Amos and Jared Rees – Shop Technicians
- Lisa Bassett – Budget Coordinator, Shiley School of Engineering

Thank You!