

# Team 517

# Sample On-Boarding and Orientation

December 3, 2019

Justin Bomwell  
Victor Prado  
Kalin Burnside

Ryan Dingman  
Joshua Jones  
Matthew Schrold

# Senior Design Team 517



**Justin Bomwell**  
Software Engineer



**Victor Prado**  
Design Engineer



**Kalin Burnside**  
Power Systems Engineer



**Ryan Dingman**  
Controls Engineer



**Joshua Jones**  
Robotics Engineer



**Matthew Schrold**  
Test Engineer

# Mechanical Systems



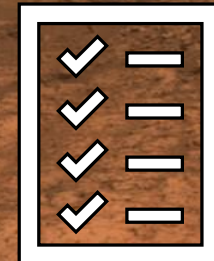
Victor Prado  
Design Engineer

Generating concrete designs  
based off the existing vague  
concepts



Matthew Schrold  
Test Engineer

Determine methods, based on  
our goals, to validate our design

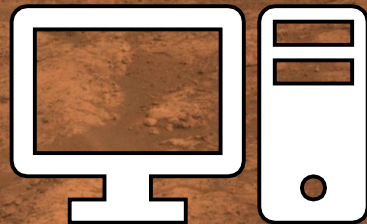


# Electrical Systems



Microcontroller  
selection, programming and  
low-level motor control

Justin Bomwell  
Software Engineer



Responsible for the design,  
simulation, and building of  
the power system

Kalin Burnside  
Power Systems Engineer



# Robotic Systems



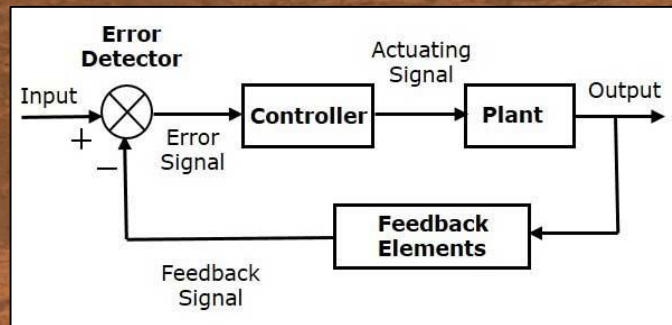
Ryan Dingman  
Controls Engineer

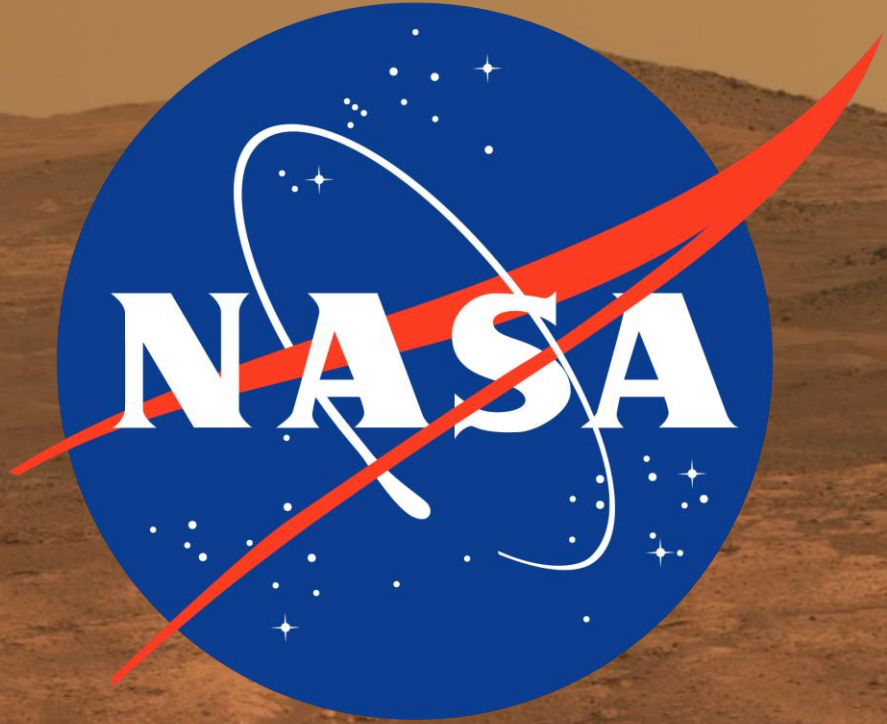
Designing and simulating the controllers for the project



Joshua Jones  
Robotics Engineer

Design and simulation of low and high-level robotic systems





Angela Jackman  
Sponsor

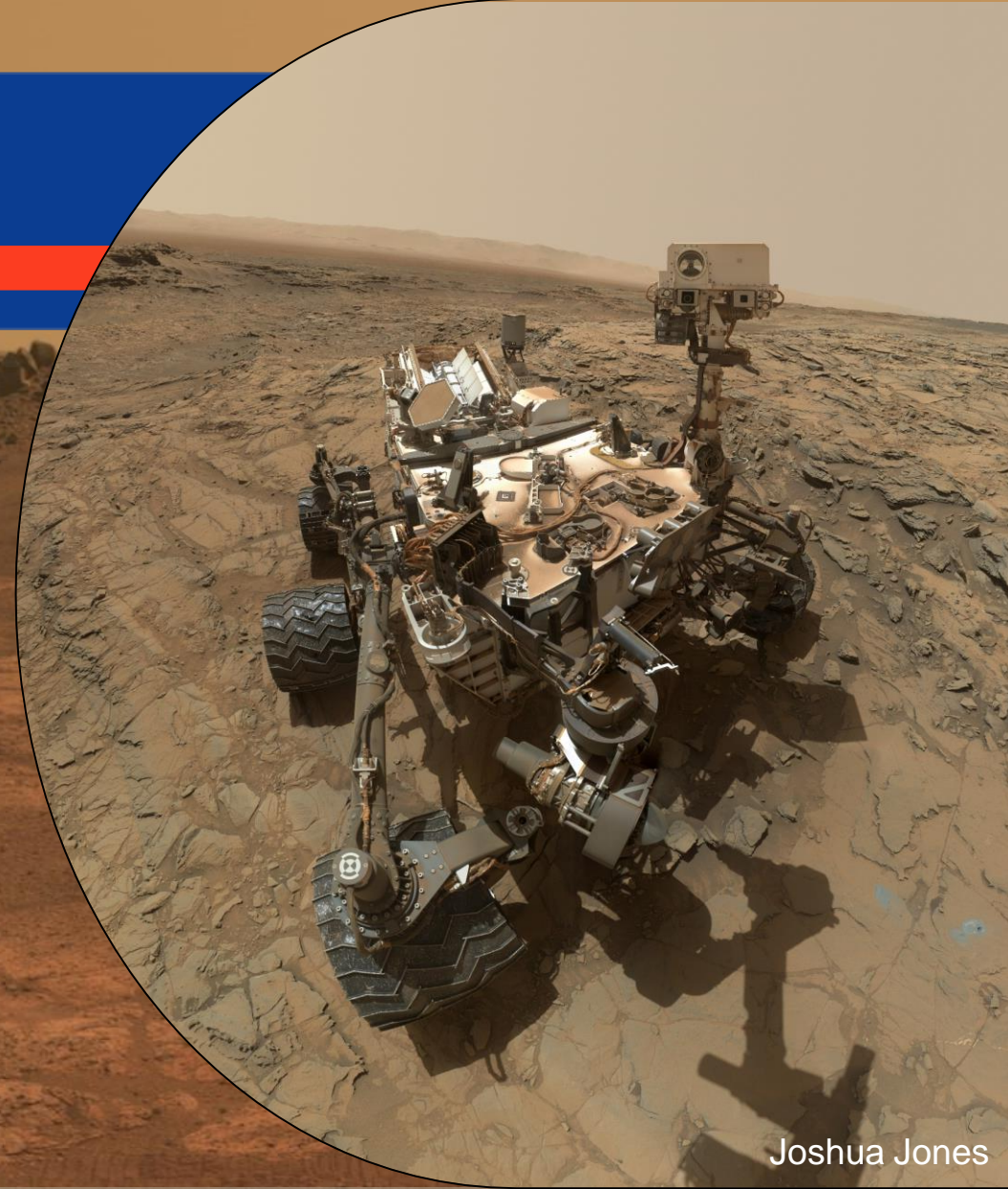


Dr. Camilo Ordóñez  
Advisor

Joshua Jones

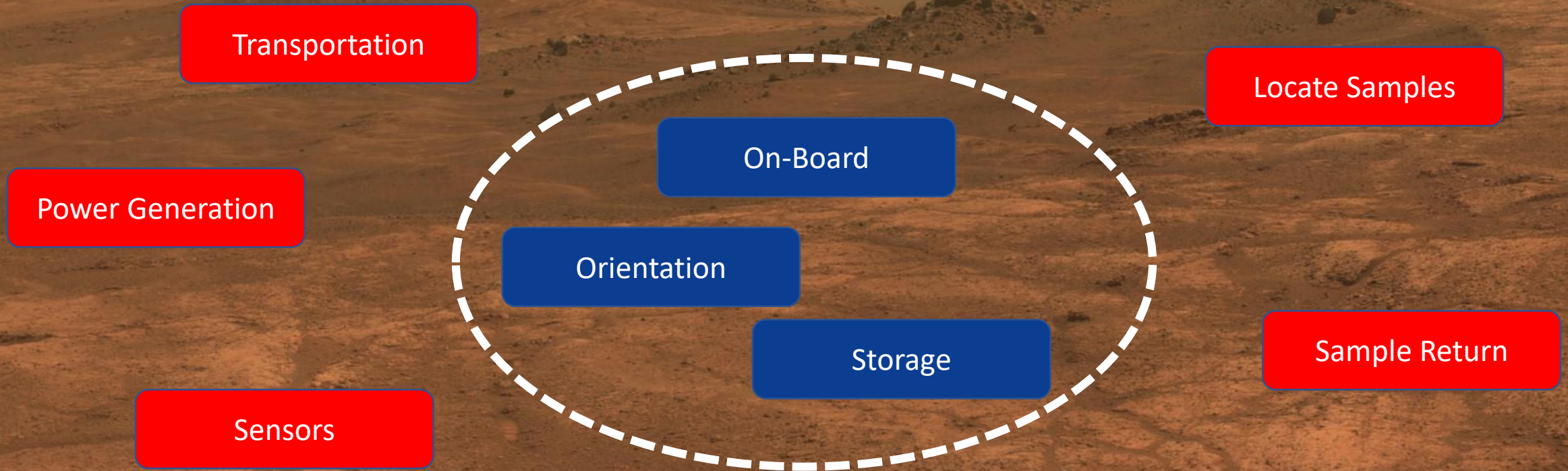
# Objective

The objective of this project is to onboard a sample from the environment, then manipulate it within the rover so that testing instruments can perform all necessary tests on the sample.



Joshua Jones

# Scope



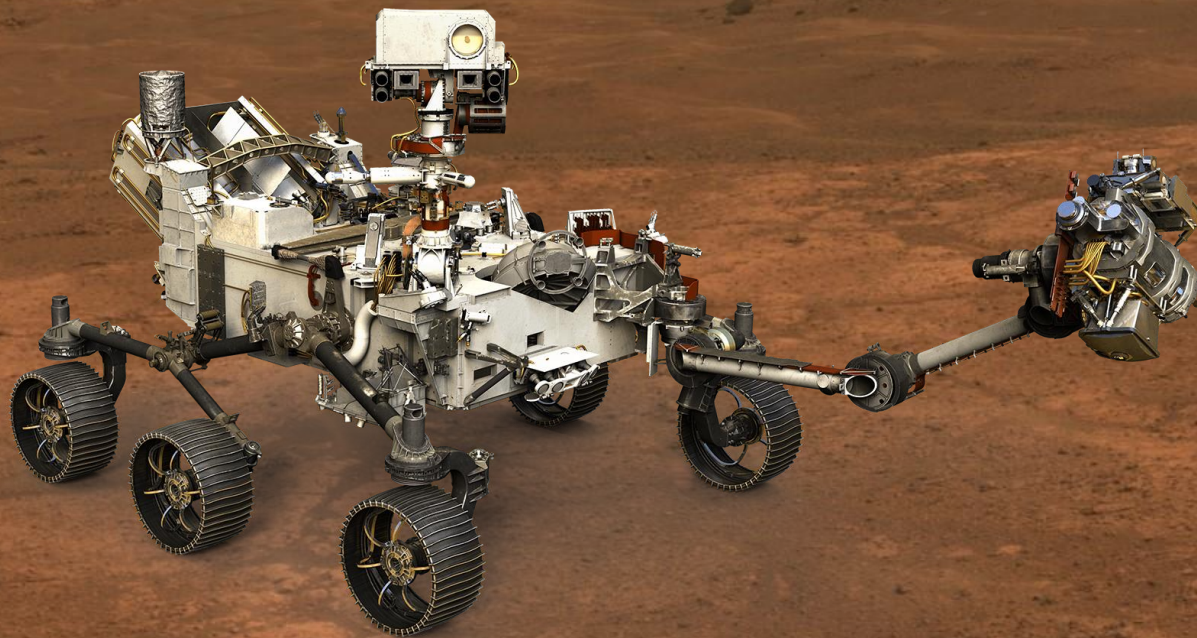
Joshua Jones



# Research

Mars 2020 Rover

Puma 560



Ryan Dingman

# Research

Prevention of sample contamination

Designing to withstand the Martian environment

Exploring programs to simulate the design

NASA's Office of Planetary Protection

Sand on Mars is much finer than that present on Earth

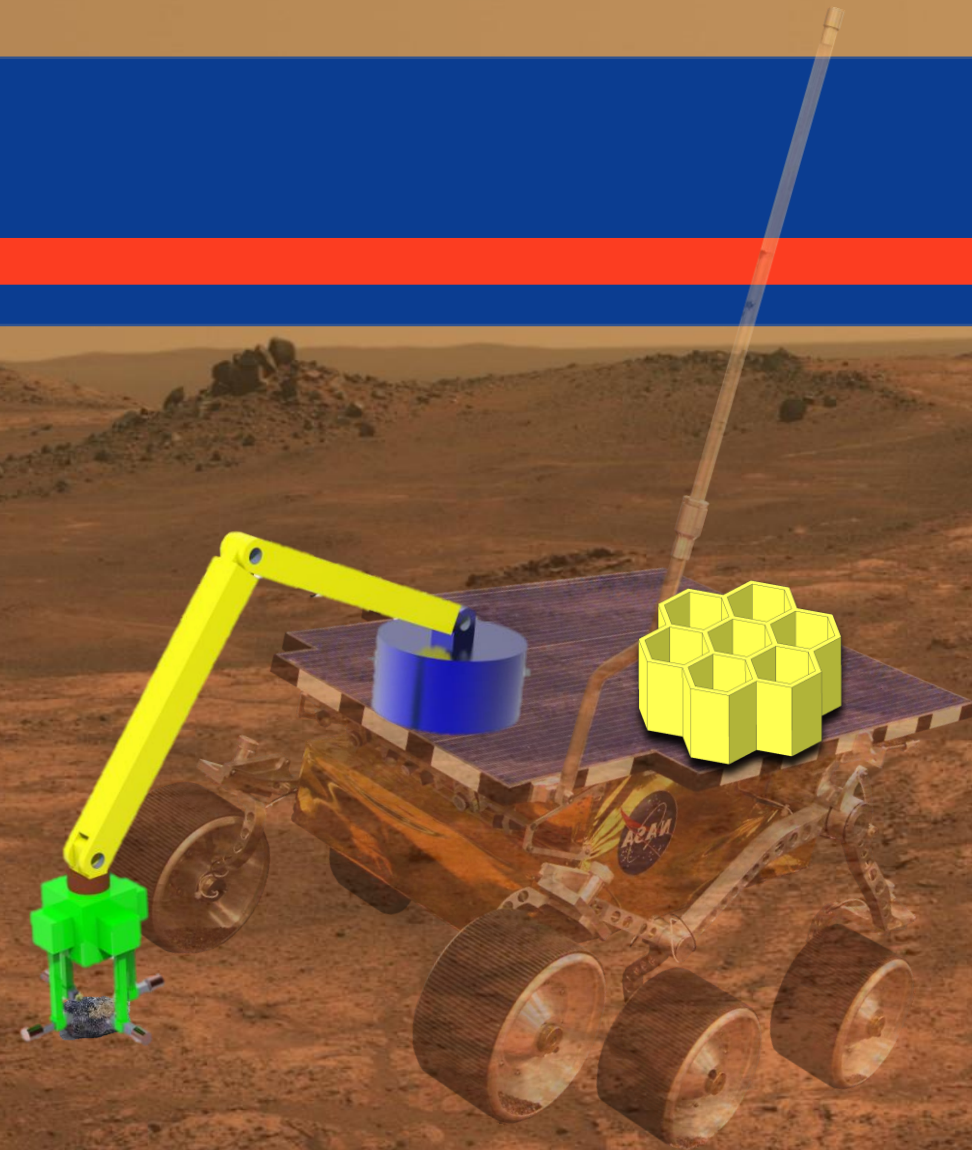


Ryan Dingman

# Current Design

Robotic arm brings the end effector/manipulator towards the sample, instrumentation, and storage

Our design is expected to undergo multiple revisions throughout the duration of this project



Victor Prado

# End Effector

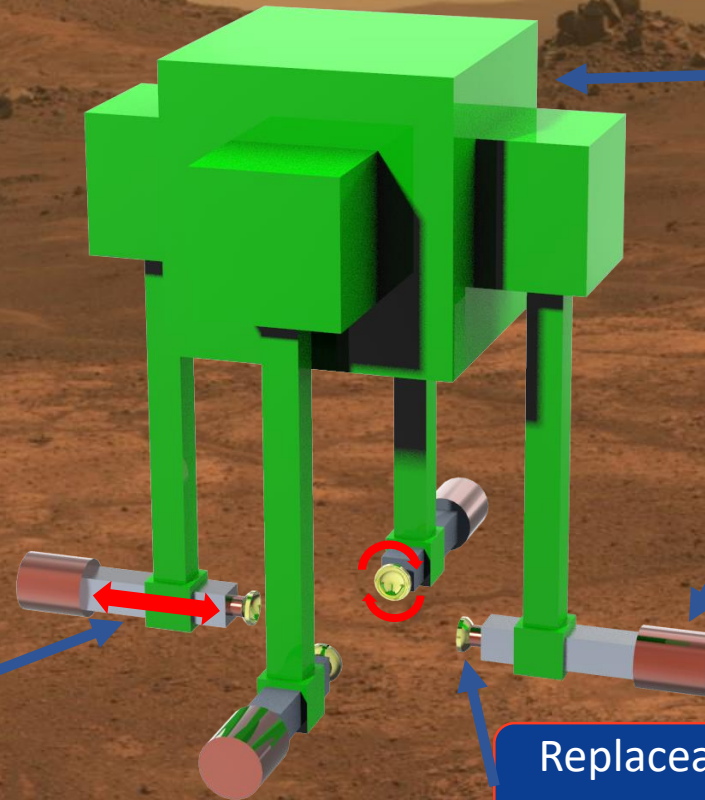
Designed to securely hold sample and rotate it in order to expose its surface to sensors

Attached to end of robotic arm

Only one pair of "fingers" will activate at once, switching to the other pair if a needed part of the surface of the sample is obscured

"Fingers" translate to grip sample then rotate to display surface to instrumentation for analysis

Replaceable rotation tips to prevent contamination of samples



Victor Prado

# Robotic Arm

Revolute joints

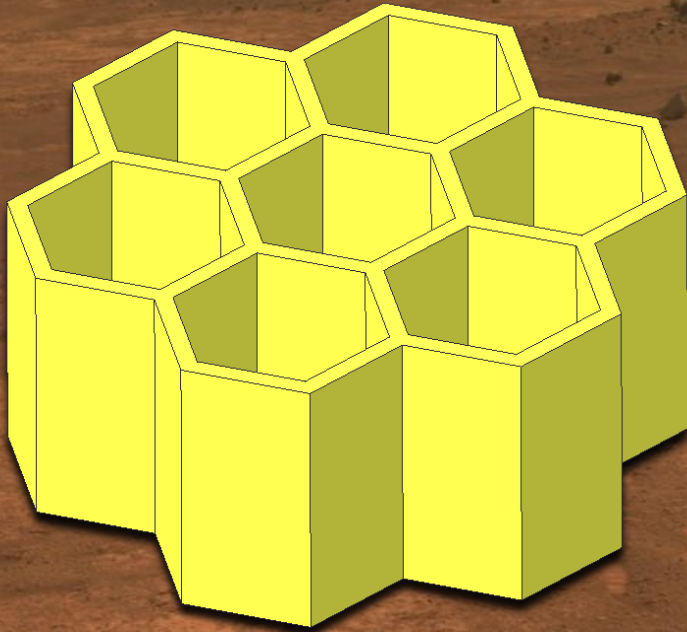
Attached to the rover

Mounted on rover

Allows access to all samples within a 50 cm radius

Matthew Schrold

# Storage

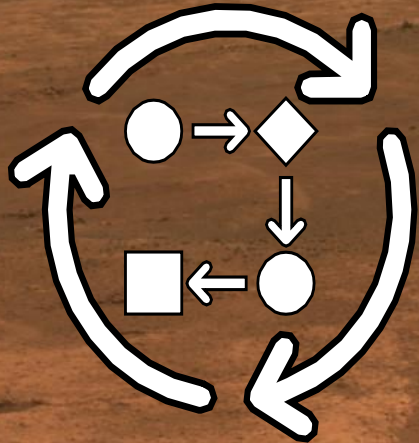


Accepts samples up to 7 cm in diameter

Moveable cover (not shown) prevents contamination of samples

Matthew Schrold

# Future Work



Simulations



Finalize Design



Assembly



Testing

Justin Bomwell

# Spring Timeline

Team Number: 517		Project: Sample Manipulator																	
		Spring Project Plan																	
Tasks / Milestones		January				February				March				April					
Week Start Date		6th	13th	20th	27th	3rd	10th	17th	24th	2nd	9th	16th	23rd	30th	6th	13th	20th	27th	
Motor Spec'ing		█																	
Final Purchasing			█																
Simulation			█																
Assembly				█															
Programming			█																
Testing							█												
Debugging										█									
Final Testing												█							
Engineering Design Day														█					
Finals																	█		
Graduation																		█	

Justin Bomwell



# Challenges

Prevention of sample contamination



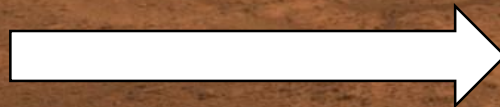
System to change out rotation tips between samples

How to best interact with the sensors



Designing end effector to allow the sensors suitable access to samples

Designing to withstand the harsh Martian environment



Conduct further research on the topic and consult with NASA mentors

Justin Bomwell

# References

<https://mars.nasa.gov/mars2020/>

<https://sma.nasa.gov/sma-disciplines/planetary-protection/>

<https://mars.nasa.gov/mer/mission/technology/severe-environments/>

<https://www.nasa.gov/feature/new-report-addresses-limiting-interplanetary-contamination-during-human-missions>

<https://www.britannica.com/science/robotic-surgery>

Justin Bomwell

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Background

Research

Current Design

Future Work