A.R.E.S.

Aztec Regolith Environment Sculptor

Lunabotics 2024 and Beyond Competition

SDSU San Diego State University

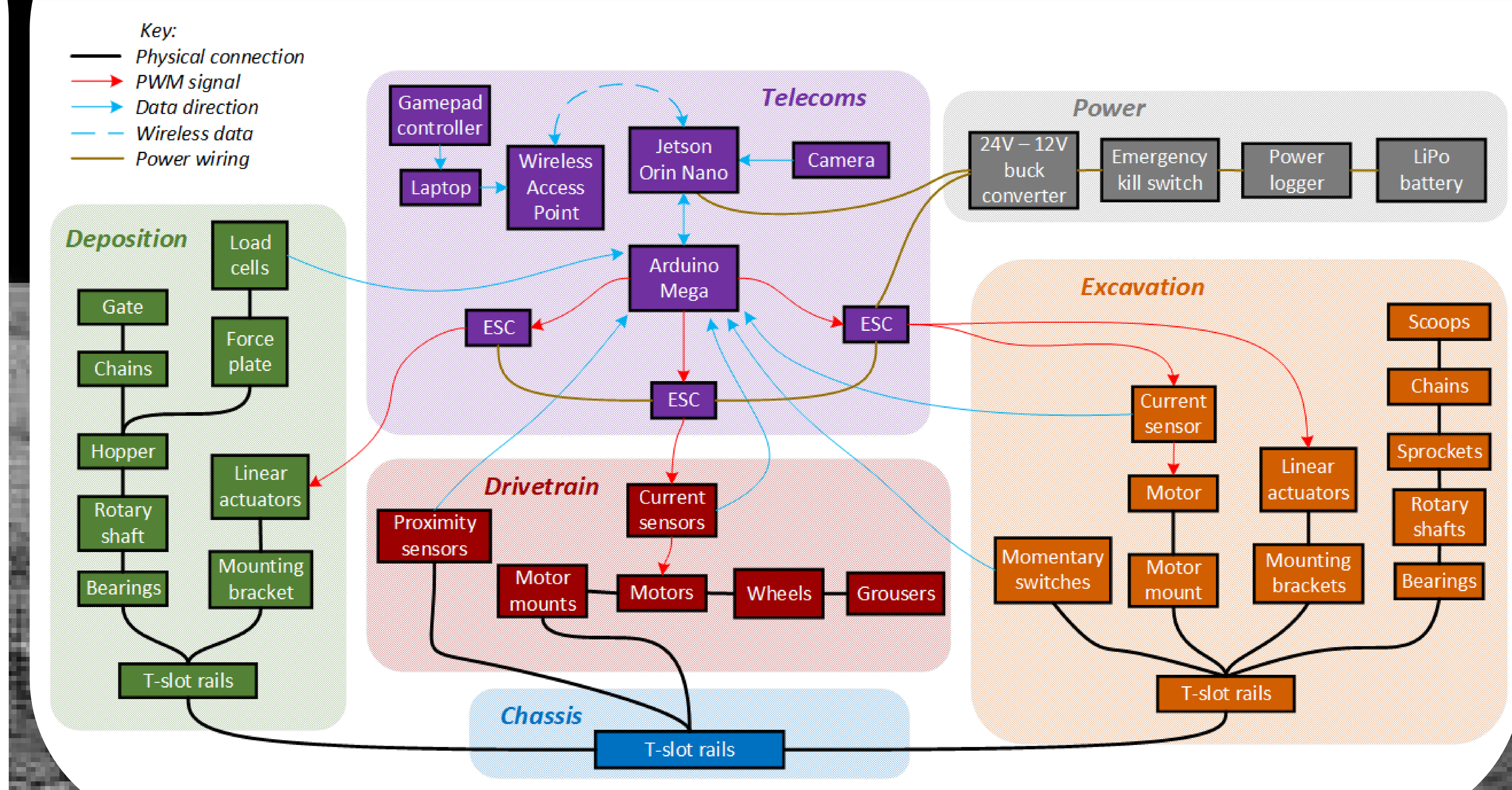
Project Overview

Problem:
To support the establishment of a permanent presence on the moon, berms will be needed to protect sensitive items from solar heat, radiation, and lunar launch and landing ejecta.

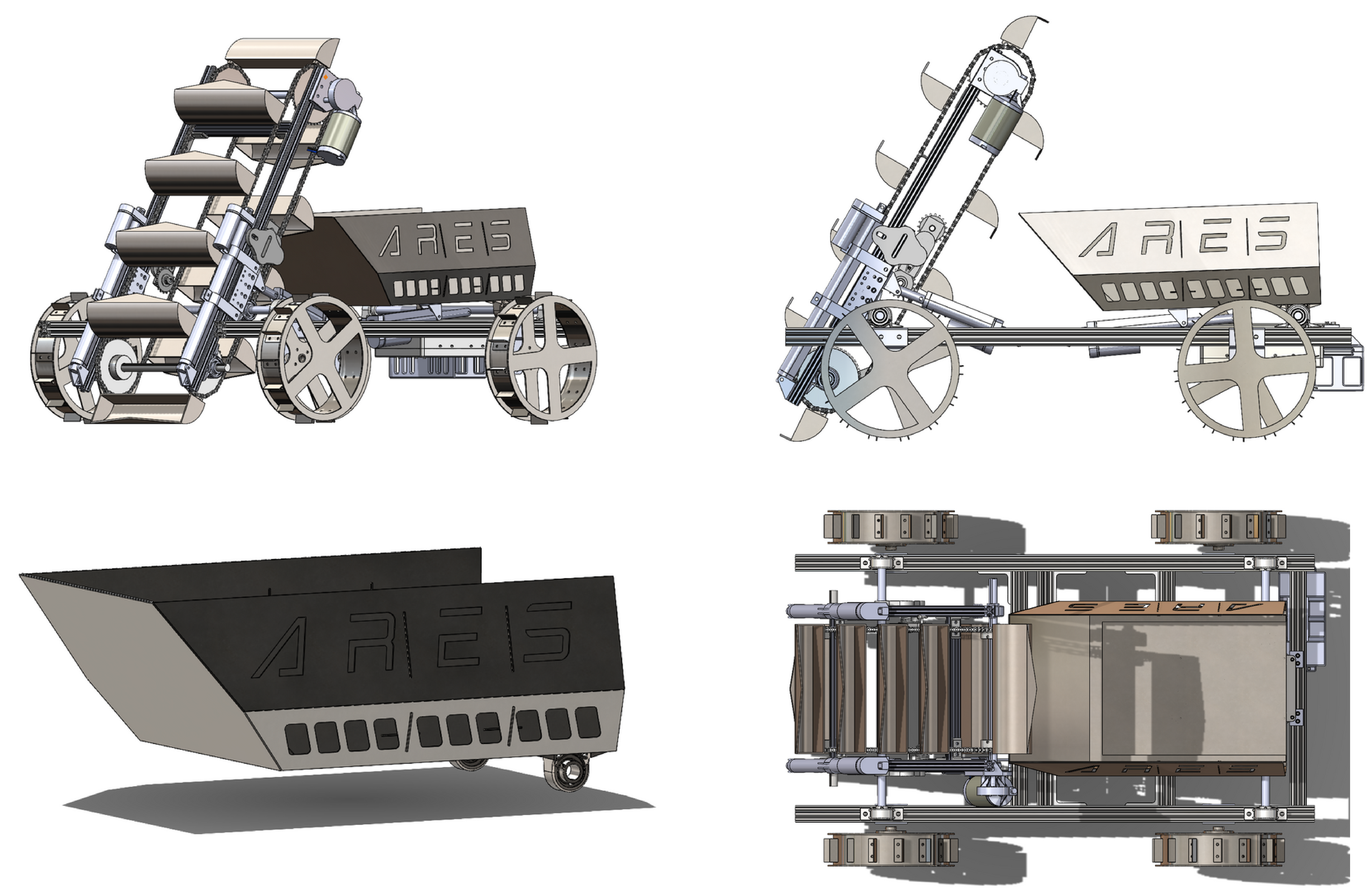
Goal:
Create a telerobotic rover that is able to extract lunar regolith, traverse to a construction zone, and deposit the regolith into a berm.

Requirements:
The rover must minimize dust production, power consumption, bandwidth usage, camera usage, dimensions, and weight. The rover must maximize traction on the shifty regolith, autonomous features, and berm volume deposited within the competition time frame.

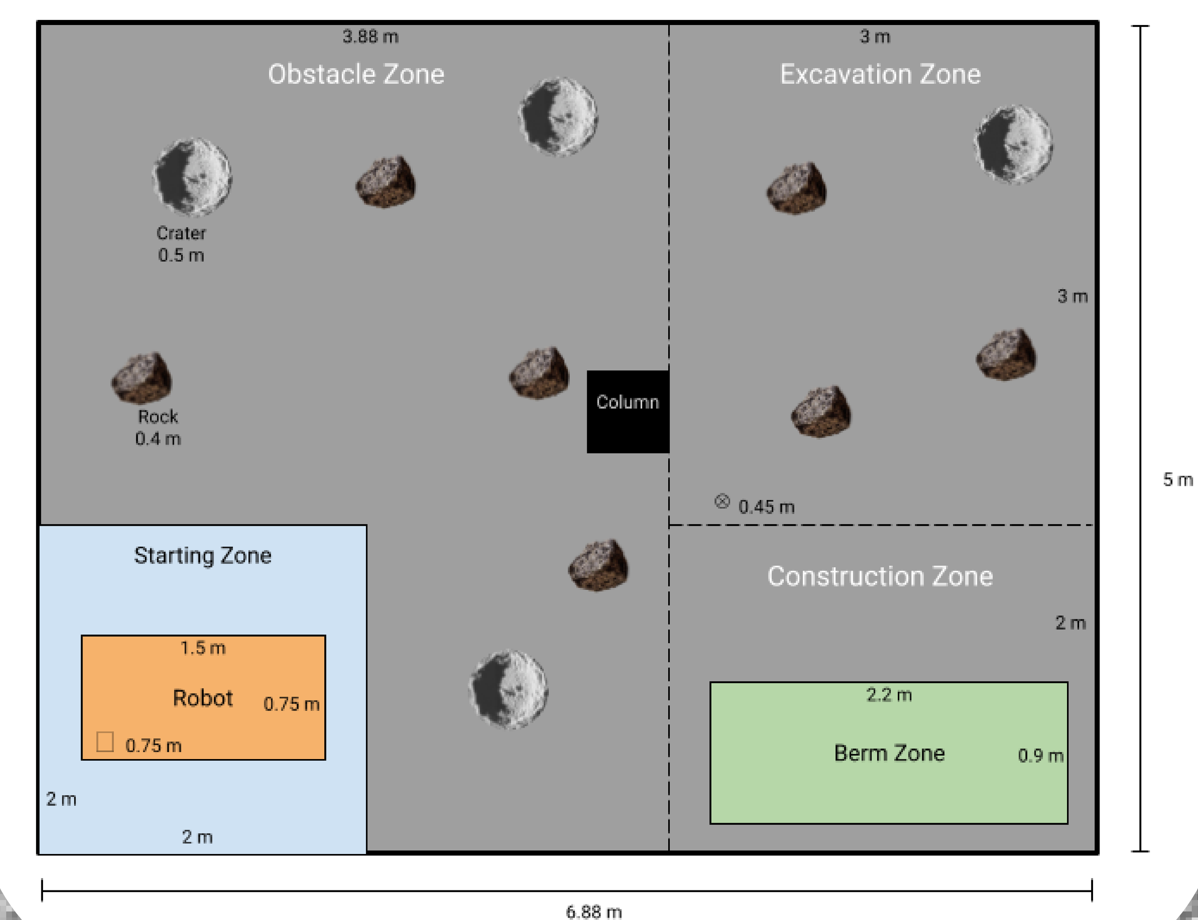
System Level Diagram



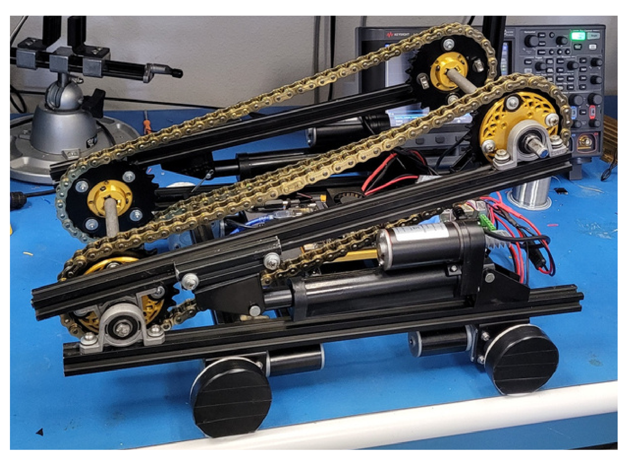
CAD



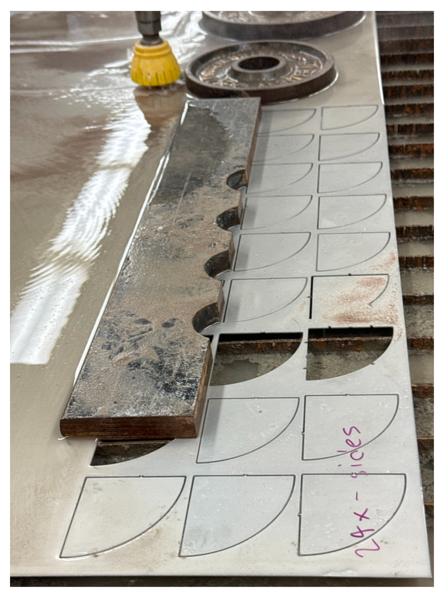
Competition Arena



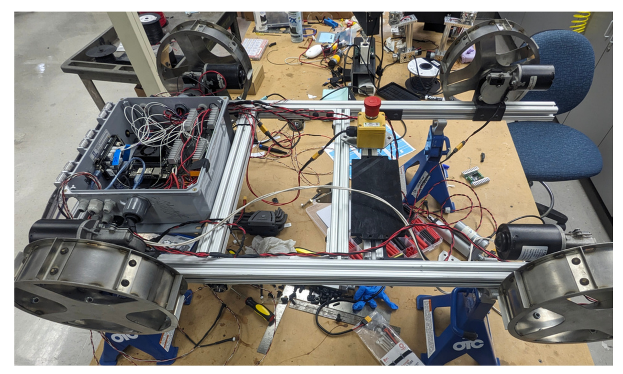
Prototyping and Integration



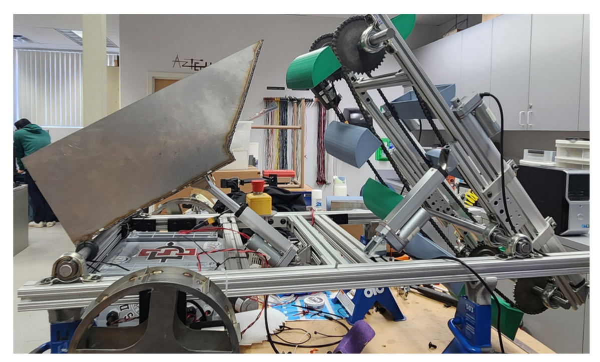
Small-scale prototype:
Used for early development and testing of electronics and controls code.



Manufacturing:
Water jetting, bending, and welding steel and aluminum parts.



Electronics Integration:
Mounting all electrical components and ensuring that procured items, custom PCBs, and code all work together reliably and with the desired behaviors.



System Integration:
Integrating all subsystems, certifying that each works independently & collaboratively. Optimizing the system as a whole.

Team Members

Mechanical Engineering:


Montserrat Castel


Hannah Hong


Jack Riffle


Scott Shoupe


Jack Volponi

Electrical & Computer Engineering:


Patricia Munn


Christian Monroy

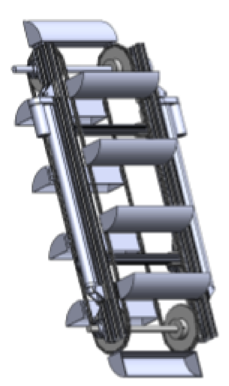

Sara Pirasteh


Stuart Pollman

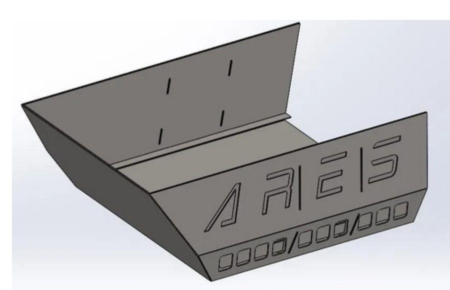

Andrew Vu

Key Components

Bucket ladder excavator:
Consists of scoops suspended on a chain, driven by sprockets and a motor. Linear actuators lower the ladder to regolith.



Tilting deposition bin with a tensioned gate:
In-house welded aluminum bin that tilts to deposit regolith. A tensioned gate automatically opens when tilted & closes when leveled.

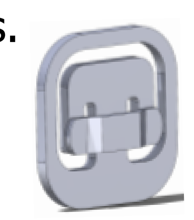


Chassis & drivetrain wheels:
Chassis is made of 80/20 T-slot rails due to ease of adjustment and reassembly.

FEA analysis conducted on wheel design led to choosing 306 stainless steel given the structural rigidity.

Wheel grousers allow the rover to maintain traction on regolith.

Load cell sensors:
Placed under the deposition bin to measure the weight of regolith collected. Load cells are enclosed in a 3D printed case, oriented in a Wheatstone bridge, and placed so the deflection of a force plate contacts all sensors.



Current sensors & proximity sensors:
Current sensors monitor each motor, alerting the user of changes that indicate a loss of drivetrain traction or an excavation motor stall condition.

Proximity sensors at chassis corners aid in navigation, supplementing the camera's limited field of view.

Acknowledgements

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