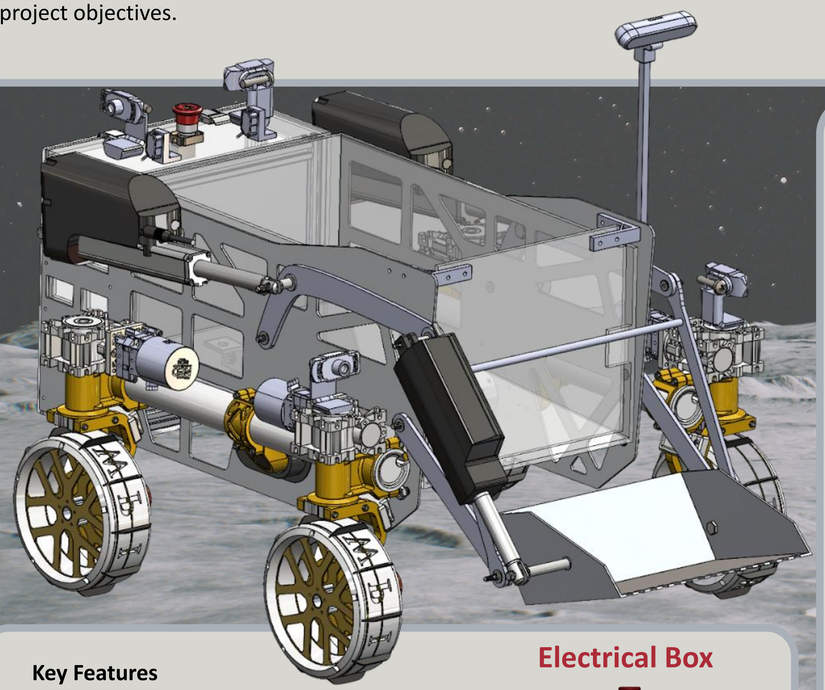
# NASA Lunabotics 2025-2026


Students: Christopher Adzima (RBE/ME), Luis Alzamora (RBE), Jesse Dawson (ME), Jeremy De La Cruz (ECE), Abraham Dionne (RBE/ECE), John Larochelle (RBE), Alana Moretti (ME), Michael Napoleone (RBE), Piotr Skoczylas (CS)

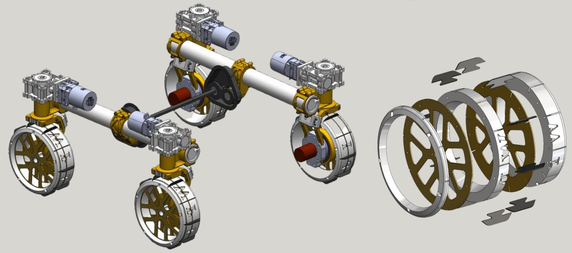
Advisors: Professor Kenneth Stafford (RBE/ME), Professor Suat Ay (ECE), Professor Loris Fichera (RBE/CS)


## Project Overview

The NASA Lunabotics Challenge was created to help identify innovative robotic designs for the Artemis program. This two-semester competition invites higher education students to design and prototype a lunar robot by applying NASA's systems engineering process. In previous years, teams were tasked with designing a robot capable of excavating in-situ resources below surface-level regolith simulant. Recently, NASA presented teams with a challenge that involves excavation, navigation, and berm construction. Therefore, the goal of this project was to design, manufacture, and test a semi-autonomous lunar excavation vehicle that meets these functional requirements. The 2025-2026 WPI Lunabotics Team developed the WPI Moon Tracks Rover to fulfill these project objectives.



## Locomotion Subsystem



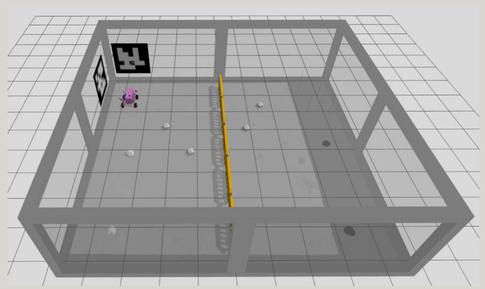
**Key Features**

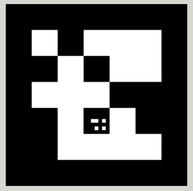
- Rocker suspension traverses uneven terrain
- Quadruplex swerve steering pivots each wheel independently
- Non-backdriveable swivel motors prevent unintentional wheel movement
- Cycloidal gearboxes drive wheels with a 10:1 gear reduction ratio
- Wheel treads imprint 'WPI' on ground during terrain traversal

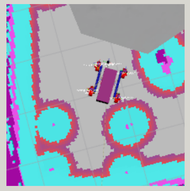
## Navigation Subsystem

**Key Features**

- ArUco fiducials detected by four wheel-mounted USB cams for robust, multi-view pose in the arena
- Fiducial tags feature an embedded fiducial for accurate localization throughout the arena
- RealSense depth camera records depth images for obstacle detection and mapping
- Depth data informs a static costmap layer for collision awareness and path planning
- Robot Operating Software 2 (ROS2) coordinates internal processes and peripheral communication







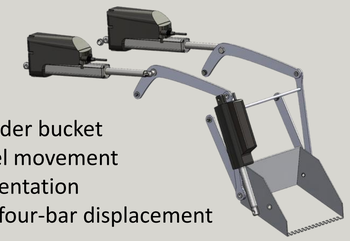
## Excavation Subsystem

Excavation Rate: 0.0252m3/min

- 9 full buckets fill regolith storage

**Key Features**

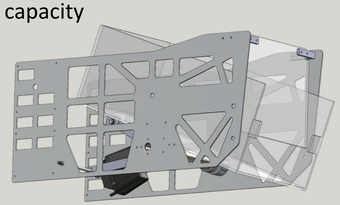
- Four-bar mechanisms guide front loader bucket
- Arm linear actuators maintain parallel movement
- Wrist linear actuator varies scoop orientation
- Crossbar support reduces horizontal four-bar displacement

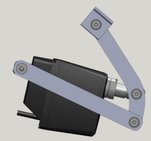


## Berm Construction Subsystem

**Key Features**

- Clear polycarbonate bucket and mounted deposit door hold regolith
- Rocker shaft supports container weight and pivot movement
- Photoelectric sensors monitor payload capacity
- Scissor lift orients the container
- Brushes reduce dust intrusion along the deposit door
- Wall frame interfaces excavation, berm construction, and electrical box subsystems

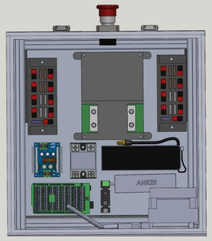




## Electrical Box

**Key Features**

- NVIDIA Jetson AGX Xavier and Arduino Mega handle computation and communication
- LiPo battery power distributed by 24V and 12V power distribution units
- Gaskets and chassis mounts mitigate dust intrusion
- Component configuration redistributes heat
- E-STOP button is accessible during operation




**Acknowledgements**

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