The Exolith Lab

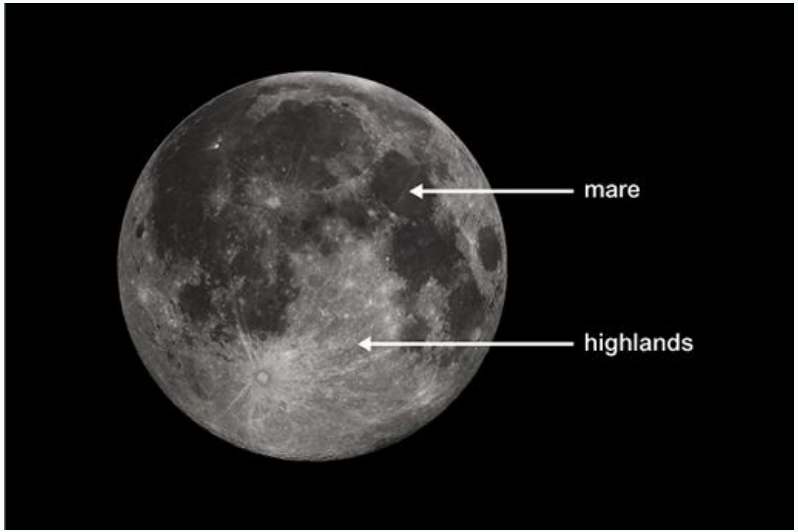
Developing a Large-Scale Lunar Regolith Test Bin with Gravity Offload Capabilities

What is Exolith Lab?

- Exolith provides the space industry with Lunar, Martian, and Asteroid surface analogs
  - Also called “regolith simulants”
  - Working with companies like SpaceX, Blue Origin, NASA, ESA, and JAXA
- Part of the Florida Space Institute and CLASS
  - Under the University of Central Florida

Lunar Regolith

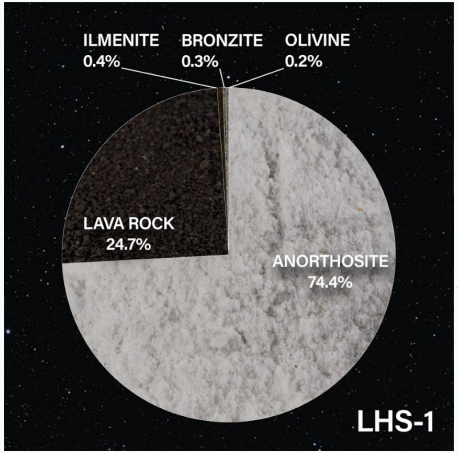
- Two regions of regolith on the Moon
  - Lunar Highlands make up 85% of the lunar surface
  - Lunar Mare makes up only 15% of the surface
- Highlands is primarily Feldspar
  - Most abundant mineral on Earth
- Mare is primarily Basalt
  - Igneous rock formed by volcanic processes

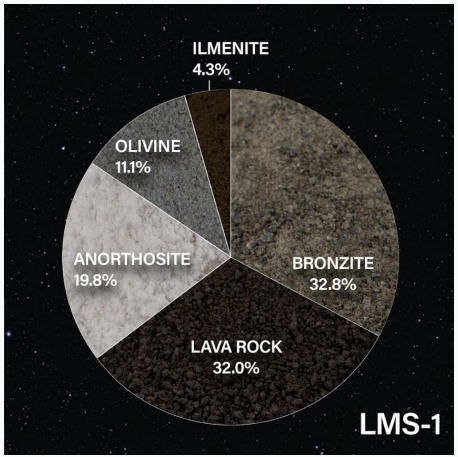


Geological Regions of Moon

Standard Lunar Simulants

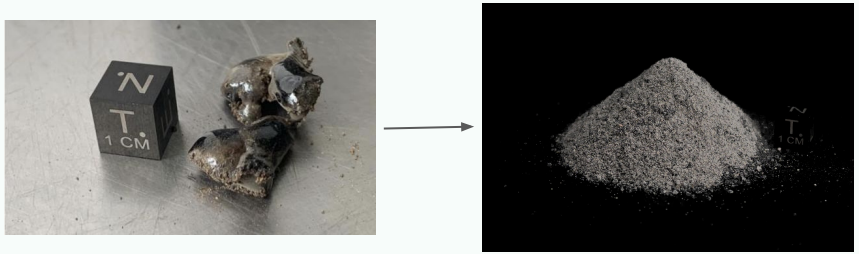
- Lunar Highlands Simulant (LHS-1)
  - Based on Apollo 16 data
  - Mean particle size of 80 microns
  - Used for many of the upcoming lunar missions
- Lunar Mare Simulant (LMS-1)
  - Based on the other Apollo data
  - Mean particle size of 91 microns
  - Useful due to higher Iron content





Specialized Lunar Simulants

- Lunar Dust Simulants (LHS-1D and LMS-1D)
  - Maximum particle size of 35 microns
  - Used to test dust sensitive systems
- Simulated Agglutinates (LHS-1-25A)
  - Agglutinates are glassy aggregates created by micrometeorite impacts
  - The Lunar surface contains between 15-60% agglutinates



LHS-1D (top) and LHS-1-25A (bottom)

Current Regolith Bin Examples

- NASA Kennedy Space Center Swamp Works
  - 8x8m size
  - BP-1 Simulant (Lunar Mare)

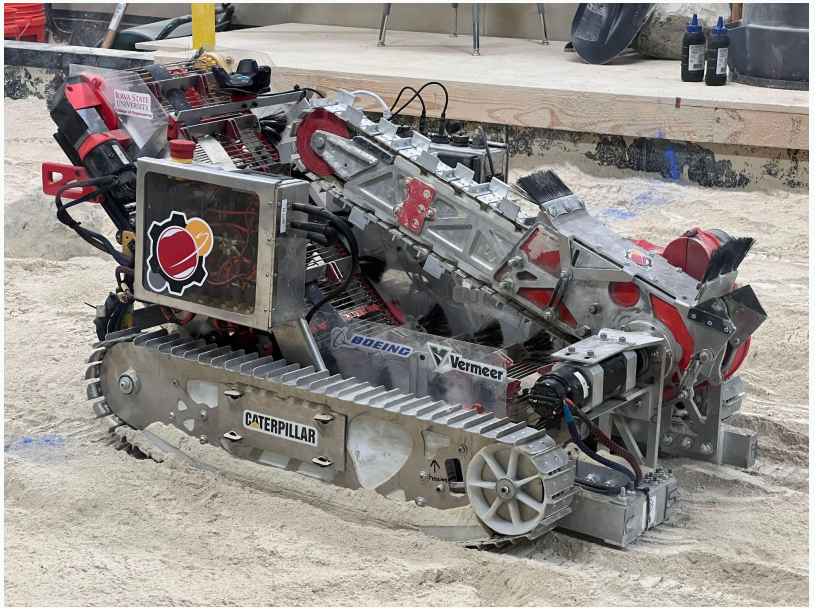
- University of Alabama Astrobotics
  - Crushed Limestone
  - Hosts University of Alabama's Astrobotics team

NASA Swamp Works

UA Astrobotics

Robotics Mining Competition

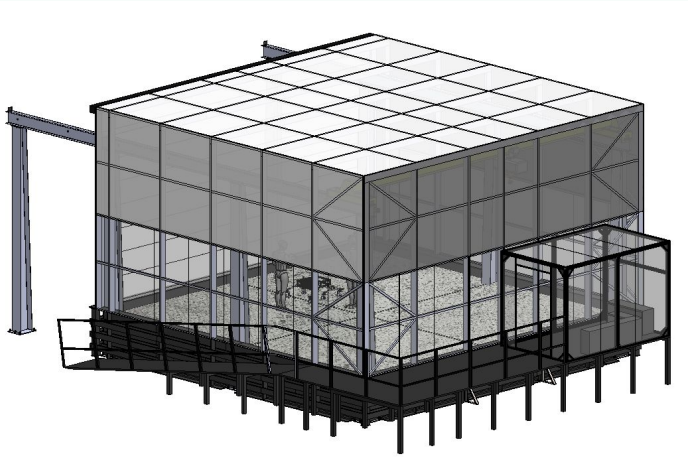
- Many different Universities competing to create a Lunar excavator
  - Designed to mine for ice in the Lunar Highlands



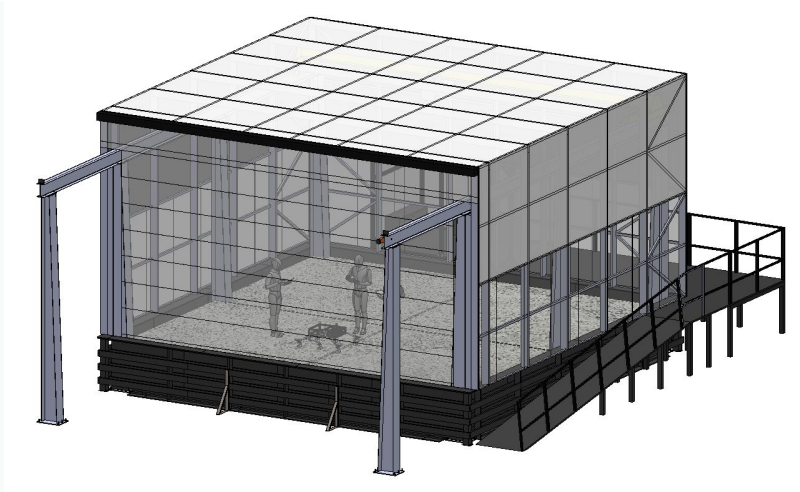
University of Iowa
Lunabotics Rover

Exolith Lab Regolith Bin Design

- Creating a high fidelity Lunar Highlands test bed
  - 10x10m and 1m deep
  - 130 tons of Lunar Highlands Simulant (LHS-2E)
  - Enclosure, two way airlock, and negative pressure mitigate dust
  - Roll up door in front of regolith bin provides access for large equipment testing

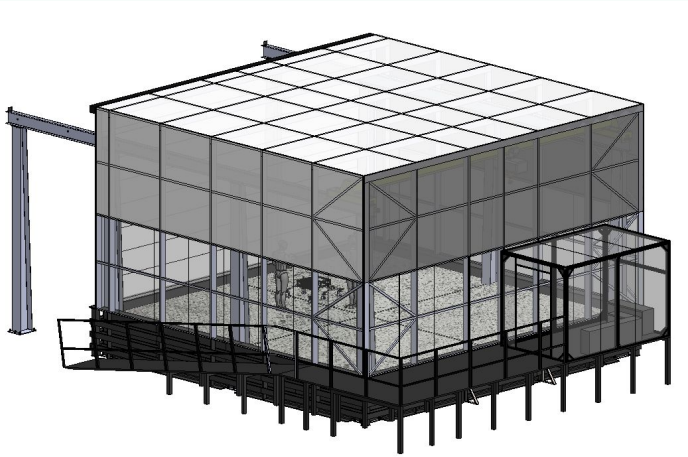


Exolith Lab's $100m^3$ Regolith Bin

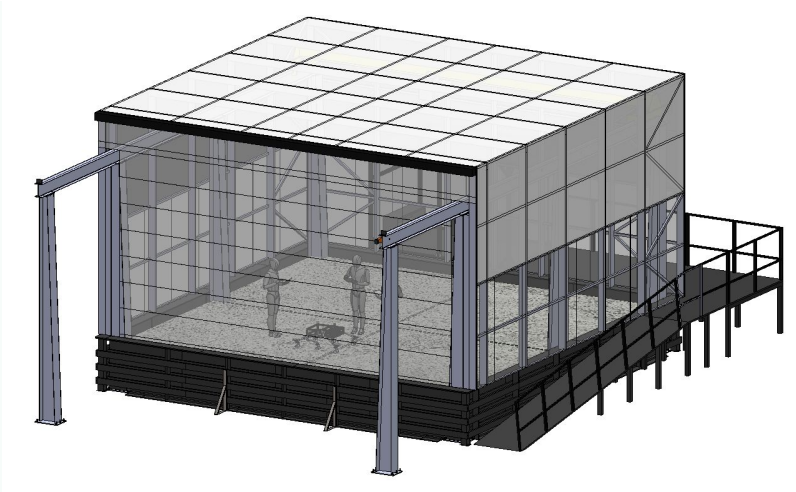


Exolith Lab Regolith Bin Testing Features

- Multiple forms of ISRU data collection are available
  - Terraforming options
    - Hills, Craters, Boulders, etc.
  - ISRU mining available
  - Gravity offloading
    - Uses overhead gantry crane



Exolith Lab's 100m^3 Regolith Bin



Regolith Bin as a Service

- Available to researchers starting in 2024
- Available to governmental, commercial, and educational users
- More information available at exolithlab@ucf.edu

Exolith Lab Engineering Team

Any Questions?