

Cislune–UCF - Lunar Mobility, Excavation & Site Prep.

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Introduction

The collaboration between Cislune Inc. and UCF represents a dynamic partnership bridging academic research and commercial innovation in lunar surface systems, robotic mobility, and regolith interaction modeling. The partnership connects students, faculty, and industry engineers to accelerate technologies and research and development that enable sustainable lunar operations.

RIDER: Testbed Collaboration

The RIDER (Regolith Interaction Design and Evaluation Rig) facilities at UCF Exolith are central to validating Cislune's and UCF's lunar mobility designs.

RIDER enables:

- Controlled, repeatable wheel–soil interaction experiments
- Measurement of traction forces, sinkage depth, and slip ratios under lunar gravity analogs
- Benchmarking Cislune's DEM-based simulation models with physical data

RIDER used on Cislune/UCF NASA contracts:

T7.04 **Refuse to Get Stuck Rovers** (80NSSC23PB393)

T7.04 **GRASP** (80NSSC25CA024)

H15.02 **TREAD** (80NSSC25C0166)

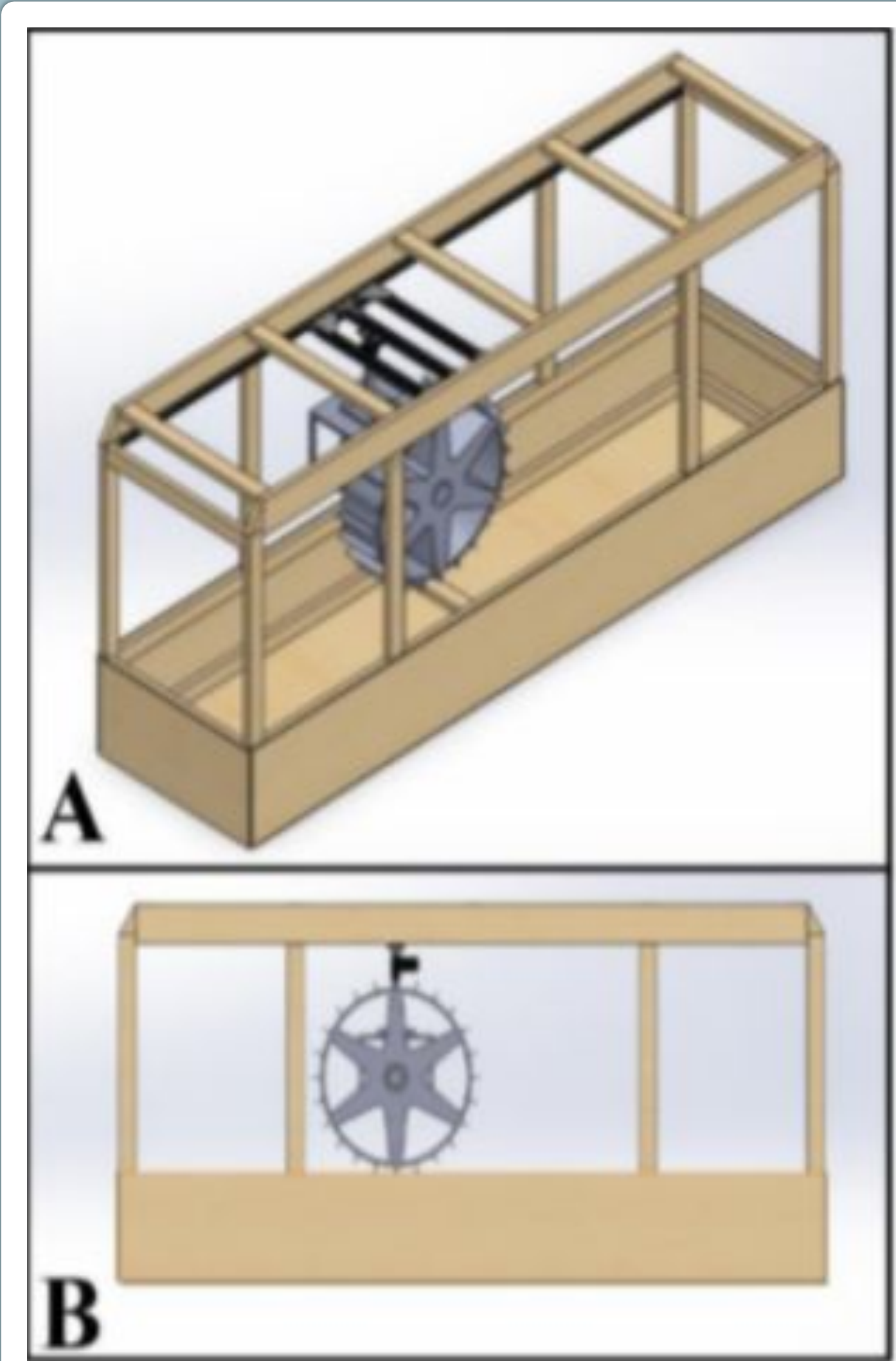


Figure 1.
The RIDER bin testing setup used for evaluating rover wheel regolith interaction under controlled conditions. This system is a core component of the Cislune–UCF collaboration, supporting various research initiatives experiments.

Geotechnical Regolith Acquisition and Sensing Platform

GRASP focuses on developing sensor-integrated regolith compaction and excavation systems for lunar surface site preparation.

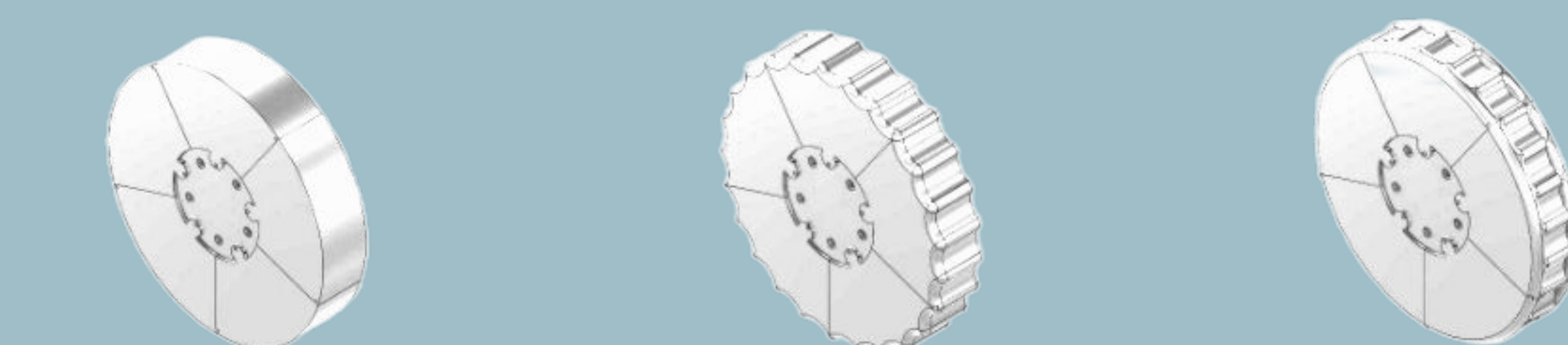
Key collaboration areas include:

- Modeling regolith behavior using Discrete Element Method (DEM) simulations
- Designing and testing wheel systems for measuring shear, sinkage, and compaction
- Investigating graded surface formation for landing pad construction

Together, Cislune and UCF advance regolith mechanics research essential for in-situ resource utilization (ISRU) and infrastructure deployment.



Figure 2.
GRASP wheel prototypes evaluated using the RIDER testing system. The upper image shows the fourth wheel undergoing active testing, while the lower image presents three previously tested designs used to collect data on traction, sinkage, slip, and other performance metrics for comparative analysis.



TREAD: Terrain Regolith Excavation and Assessment Device

The TREAD initiative develops advanced mobility platforms for traversing and manipulating lunar terrain.

Joint UCF–Cislune work includes:

- Creating novel tread geometries and lightweight wheel structures through generative design
- Integrating additive manufacturing and structural optimization
- Conducting RIDER testbed trials to assess traction, slip, and power efficiency on lunar simulant terrain

This project bridges simulation-to-reality testing, improving confidence in off-Earth rover performance.

RE-RASSOR: Regolith Advanced Surface Systems Operations Robot

The RE-RASSOR project developed at UCF aims to create an open-source, affordable, and accessible lunar excavation robot. Its purpose is to make advanced regolith handling technology available to universities, startups, and research groups without the barriers of cost or proprietary systems. Cislune's collaboration focuses on turning that vision into reality by documenting, organizing, and refining the build process to ensure RR can be replicated and improved by others.

Current efforts include:

- Documentation of the assembly process, subsystem integration, and wiring architecture
- Hardware modifications such as DC brushless motor implementation, a larger, more stable chassis, and improved housing for electronic systems
- Circuitry design and configuration for power, control, and signal management, with organized and accessible enclosures

By standardizing documentation and hardware configurations, Cislune is helping transform RE-RASSOR from a prototype into a reproducible open-source platform empowering students, researchers, and industry partners to advance lunar regolith excavation and mobility research collaboratively.

Figure 3.
Cislune-built RE-RASSOR prototype advancing open-source, low-cost lunar excavation technology. A new unit is being rebuilt to document the full assembly supporting reproducibility and future design improvements.



Conclusion

From GRASP and TREAD to RASSOR and RIDER, the collaboration between Cislune Inc. and UCF showcases how industry and academia unite to develop next-generation lunar mobility, excavation, and surface infrastructure technologies. Together, they are paving the way for sustainable human and robotic presence on the Moon.

Acknowledgements

Notable contributors: Erik Franks (Cislune), Angelina Vazquez (FIU; Cislune intern, Fall 2025), Angelina Torres (Cislune), Lilly Coffin (Cislune), Mila Arasu (Caltech), Ethan Uphoff (University of Nebraska–Lincoln). NASA: Rob Mueller, Nathan Gelino. UCF: Dr. Philip T. Metzger, Dr. Daniel T. Britt. Supported in part by NASA Florida Space Grant Consortium.