

# Low-energy Planetary Excavator (LPE)

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## Identification and Significance of Innovation

ORBITEC proposes to develop an innovative Low-energy Planetary Excavator (LPE) to excavate *in situ* regolith, ice-regolith mixtures, and a variety of other geologic materials to support future activities on the Moon and Mars. The LPE utilizes an innovative cutterhead to efficiently excavate a wide range of different planetary surface materials. Current mechanical excavators operate efficiently only in a narrow range of material conditions. The LPE will sense geologic changes and respond with changes in the cutterhead to achieve the lowest cutting energy possible. The result is a flexible machine with reduced power and mass requirements.



## Technical Objectives

- Define the LPE systems requirements
- Define the range of physical properties of the ice-regolith mixtures that would likely be encountered on the Moon or Mars
- Design, assemble, and use a device to measure the force-indentation behavior of the ice-regolith samples
- Generate a complete performance prediction matrix for the LPE
- Create a preliminary design for the Phase II sampler LPE

## Work Plan

- Task 1. Define LPE System Requirements
- Task 2. Create Design Input Matrix of Ice-Regolith Properties
- Task 3. Fabricate Ice-Regolith Samples
- Task 4. Measure Physical Properties of Ice-Regolith Samples
- Task 5. Predict Cutter Forces and Production Rate
- Task 6. Preliminary Phase II LPE Design
- Task 7. Reporting

## NASA Applications

The LPE would be a general-purpose machine with the ability to mine ice, regolith, and rock; it would also excavate. It is applicable to future manned/unmanned exploration missions to the Moon, Mars, and beyond. Efficient and reliable excavation of a wide variety of planetary surface materials will greatly enhance/enable exploration, start-up outposts, and eventually advanced self-sustaining bases.

## Non-NASA Applications

Development of the LPE will improve terrestrial mechanical excavators. The terrestrial market is expanding rapidly as demand for urban infrastructure skyrockets. Urban construction settings restrict the use of explosives, to minimize damaging vibrations, making mechanical methods attractive.

## Firm Contacts

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