

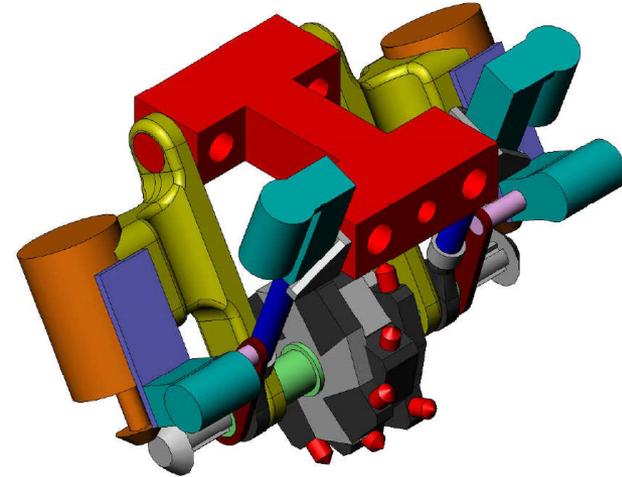
Low-energy Planetary Excavator (LPE)

PI: Robert Gustafson/Orbital Technologies Corporation-Madison, WI
Proposal No: 04-II X1.02-8480



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.



Phase II LPE Prototype Cutterhead

Technical Objectives

- Refine the LPE system requirements
- Determine the range of potential ice-regolith properties and develop a simulant for testing
- Design and analyze a LPE prototype unit
- Construct a computerized performance prediction model
- Build, test and deliver the LPE prototype unit
- Develop conceptual designs for a Phase III LPE applications

Work Plan

1) Refine the LPE System Requirements, 2) Determine the Potential Ice-Regolith Properties, 3) Develop an Ice-Regolith Simulant for LPE Prototype Testing, 4) LPE Design and Analysis, 5) LPE Prototype Development and Fabrication, 6) . LPE Prototype Testing and Data Analysis, 7) LPE Prototype Delivery to NASA, 8) LPE Technology Demonstration Unit, 9) LPE Production Unit, and 10) Project Management & Reporting

NASA Applications

The LPE would be a general-purpose machine with the ability to mine ice, regolith, and excavate. It is applicable to future manned/unmanned exploration missions to the Moon, Mars, and beyond. Efficient and reliable excavation 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

Mr. Robert Gustafson, Proposed Principal Investigator
608-827-5000, 608-827-5050 FAX, gustafsonr@orbitec.com