

# Rover Payloads

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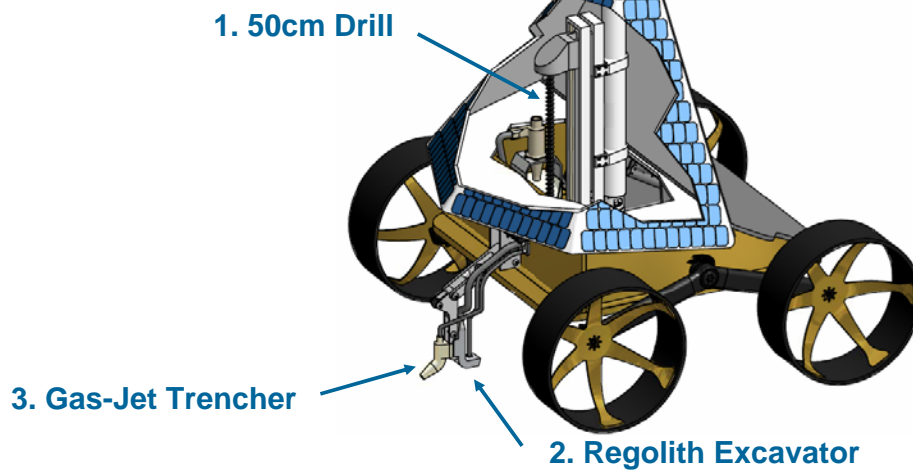
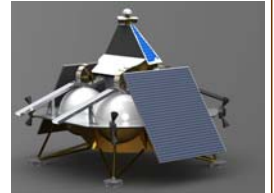
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HONEYBEE ROBOTICS

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1. Moon Breaker Drill Testing



The MoonBreaker drill was tested in the Antarctic lunar analog and vacuum chamber in ice-cemented JSC-1a lunar soil simulant. In both environments, the drill penetrated to 1 meter in 1 hour with 100 Watts and 100 Newton Weight on Bit and acquired samples into a cup.



2. Regolith Excavator



K10mini rover based Regolith Pneumatic Excavator undergoing testing in a 11ft long vacuum chamber.

Payload	Details
<b>1. Drill</b>	Drill acquires samples from up to 50cm depth and deposits them in a sampling bin or an instrument inlet cup for analysis. The drill requires ~100 Watt power and <100 Newton preload to penetrate ice cemented ground to 50cm depth in approximately 30 minutes. <u>References:</u> Paulsen G. Zacny K. McKay C. Glass B. Szczesiak M. Craft J. Santoro C. Shasho J. Davila A. Marinova M. Pollard W. Jackson A. Field Testing of the IceBreaker Mars Drill in the Antarctic, LPSC 2011, Abstract #190]
<b>2. Regolith Excavator</b>	Top layer of regolith is pneumatically acquired and transferred into a sample cup or an instrument inlet cup. One gram of gas at 6 psia is sufficient to excavate ~3000-6000 grams of soil. <u>References:</u> K. Zacny, G. Mungas, C. Mungas, D. Fisher, and M. Hedlund, Pneumatic Excavator and Regolith Transport System for Lunar ISRU and Construction, Paper No: AIAA-2008-7824 and Presentation, AIAA SPACE 2008, 9 - 11 Sep 2008, San Diego, CA
<b>3. Gas-Jet Trencher</b>	Compressed gas is jettisoned towards the surface, removing the loose top soil until ice-cemented ground is reached. Rover can drive back and forth to make the trench longer/wider. Pressure can be increased to make the trench deeper. Gas jet trencher can blast away a wide enough area, with a few passes, so that the rover as a whole could stand on the ice cemented ground, and thus the drill is guaranteed to get ice despite its short 50 cm length. Mast mounted optical camera or spectrometer can also be used to analyze the walls and the bottom of the trench. <u>References:</u> K. Zacny; J. Craft; M. Hedlund; P. Chu; G. Galloway; R. Mueller, Investigating the Efficiency of Pneumatic Transfer of JSC-1a Lunar Regolith Simulant in Vacuum and Lunar Gravity During Parabolic Flights. AIAA Space 2010, Aug 31-Sep 2, 2010, Anaheim, CA