

2012 NASA Lunabotics Mining Competition: Taxonomy and Results

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NASA's Lunabotics Mining Competition is designed to promote the development of interest in space activities and STEM (Science, Technology, Engineering, and Mathematics) fields. The competition uses excavation, a necessary first step towards extracting resources from the regolith and building bases on the moon. The unique physical properties of lunar regolith and the reduced 1/6th gravity, vacuum environment make excavation a difficult technical challenge. Advances in lunar regolith mining have the potential to significantly contribute to our nation's space vision and NASA space exploration operations.

The competition is conducted annually by NASA at the Kennedy Space Center Visitor Complex. The teams that can use telerobotic or autonomous operation to excavate a lunar regolith geotechnical simulant, herein after referred to as Black Point-1 (or BP-1) and score the most points (calculated as an average of two separate 10-minute timed competition attempts) will win the on-site mining category of the competition and earn points towards the *Joe Kosmo Award for Excellence* and the scores will reflect ranking in. The minimum excavation requirement is 10.0 kg during each competition attempt and the robotic excavator, referred to as the "*Lunabot*", must meet all specifications.

We will review each Lunabot design fielded in the 2012 NASA Lunabotics Mining and classify them in a taxonomy. By providing a framework for robotic design and fabrication, which culminates in a live competition event, university students have been able to produce sophisticated lunabots which are tele-operated or autonomous. Multi-disciplinary teams are encouraged and the extreme sense of accomplishment provides a unique source of inspiration to the participating

students, which has been shown to translate into increased interest in STEM careers.

Our industrial sponsors and partner organizations (Caterpillar, Newmont Mining, Harris, Honeybee Robotics, USA, AIAA, ASCE) have all stated that there is a strong need for skills in the workforce related to robotics and automated machines. In 2012, over 59 university teams from 8 countries participated. More students and the public were engaged via internet broadcasting and social networking media. This is expected to be of value for actual future space missions, as knowledge is gained from testing many innovative prototypes in simulated lunar regolith.

More information is available at
www.nasa.gov/lunabotics/.

