NASA SBIR 2006 Phase I Solicitation

X4.01 Lunar Regolith Excavation and Material Handling

Lead Center: JSC

Participating Center(s): GRC, KSC, MSFC

Lunar regolith excavation, handling, and material transportation deal with all aspects of lunar regolith handling for site preparation, resource collection, and construction activities. Excavation and transport technologies and systems are required to support regolith excavation and transport to support oxygen production from regolith (notionally down to 0.5 m), and regolith excavation and transport to support site construction and reactor placement (notional depth down to 3 meters and berms up to 3 meters). To maximize the benefits of incorporating in situ resource utilization (ISRU) capabilities into missions, ISRU excavation and material handling systems must require the minimum amount of mass and power to accomplish the tasks and need to process 100's of times their own mass of extracted resource in their useful lifetimes. Hardware must also be able to operate in wide temperature ranges (-160Å°C to 123Å°C), abrasive environments, and partial-gravity. In addition, the maintenance, human supervision, crew operation, and crew training required for these systems must be minimal and affordable. Excavation metrics of interest include: excavation rate (kg/hr), excavation efficiency (power required/excavation rate), and excavation depth and berm height. Specific areas of interest include:

- Evaluation of granular physics in low gravity and development of models and its effect on material excavation and handling;
- Dust-insensitive and/or abrasion-resistant excavation hardware, actuators, seals and bearings; and
- Dust mitigation and construction techniques to minimize dust generation around landing pads, habitats, dust-sensitive instruments, and airlocks.
- Low energy excavation techniques for excavating compacted lunar regolith down to 50 cm.