NASA SBIR 2010 Phase I Solicitation

X1.01 Regolith/Soil Transfer, Handling, & Processing of Extraterrestrial Material

Lead Center: JSC

Participating Center(s): GRC, KSC, MSFC

Regolith/Soil Transfer and Handling

- Long-life, light-weight, and minimum consumable technologies to move feedstock material from the surface or a collection hopper to processing reactors (at least 3m); High separation efficiency gas/solid particle separation techniques and regenerable particle filters
- Granular materials mixing and size separation for reactor feedstock conditioning: remove material > 0.5 cm diameter before dumping into storage bin during excavation operation for oxygen extraction from regolith
- Granular flow computer models, devices, and instruments to evaluate material flow and manipulation under low and micro-gravity flight and ground vacuum experimental conditions
- Mineral beneficiation concepts to separate iron oxide-bearing material from bulk regolith; up to 20 kg/hr based on hydrogen reduction

Regolith/Soil Processing To Extract Resources and Products of Interest

- Regolith/soil valve/seal concepts for processing systems with no gas leakage after 1000’s of operating cycles with material. For processes that require elevated temperatures, thermal isolation or minimum heat loss is required
- Regolith/soil processing reactor concepts for extracting volatiles and water/ice
- Regolith/soil processing reactor concepts for extracting metals through electrolysis and/or metal/waste/salt removal and separation techniques.
- High temperature (=1000 C), high efficiency insulation for regolith/soil processing reactors
- High temperature (=1000 C) pressure sensors and instruments for process control and performance assessment
• Alternative thermal, chemical, and/or biological processing concepts for oxygen (and potentially metal) extraction from regolith/soil besides

**Hydrogen Reduction and Carbothermal Reduction Processes**

• Light-weight, deployable solar concentrator concepts and solar energy transfer methods into regolith/soil processing reactors

• Low energy loss methods for redirecting solar energy from concentrators and fiber optic cables to allow multiple users in series

**Regolith/Soil Processing for Protection, Construction, and Energy**

• Thermal energy storage and utilization using bulk or processed regolith

• Techniques for hardening or modifying in-situ materials so that landing pads and roads can be constructed to prevent landing plume debris damage and wear on surface mobility platforms