NASA SBIR 2006 Phase I Solicitation

**X4.02 Oxygen Production from Lunar Regolith**

**Lead Center:** JSC

**Participating Center(s):** GRC, KSC, MSFC

Oxygen production from lunar regolith processing consists of receiving regolith from excavation and material transportation and chemically, electrically, and/or thermally extracting oxygen from the metal and non-metal compounds in lunar regolith. Other resources of interest, such as silicon, iron, titanium, aluminum, etc. may also be processed in the future based on technologies developed for oxygen production.

To maximize the benefits of incorporating ISRU capabilities into missions, oxygen production from regolith systems must require the minimum amount of mass and power to meet production rates 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 abrasive environments and partial-gravity, and may need to be shut down for extended periods of time during lunar night if power is not available. In addition, the maintenance, human supervision, crew operation, and crew training required for these systems must be minimal and affordable. Process evaluation metrics of interest include: oxygen production rate (kg/hr), oxygen production efficiency (Watts per mass of product produced per hour), percentage oxygen extracted from regolith, closed loop operations (minimal if any feedstocks from Earth), and mass of Earth consumables used per mass of oxygen produced. Specific areas of interest include:

- Solar thermal concentrators and furnaces (> 1000°C and > 2000°C);
- Processes to extract oxygen from lunar regolith, excluding production techniques that utilize hydrogen, carbon monoxide, and/or methane reduction of regolith. Consideration needs to be given to examining the impact of shutting down to a minimal level during lunar night if processing power is not available;
- Processes to extract silicon from lunar regolith;
- Regolith feed inlet designs and sealing mechanisms that allow continuous feed or large number of cycles for batch processing that are tolerant to dust/abrasion and high temperatures (> 1000°C), and allow minimal loss of processing reagent and product gases;
- Spent regolith outlet inlet designs and sealing mechanisms that maximize thermal management and minimize processing reagent and product losses; and
- Long-life electrodes/electrolytes for electrolysis-based regolith processing concepts.