NASA SBIR 2007 Phase I Solicitation

X7.03 Surface Mobility and Transportation

Lead Center: JSC

Participating Center(s): ARC, GRC, GSFC, JPL, KSC, LaRC, MSFC

The objective of this subtopic is to provide new capabilities for delivery, handling, transfer, construction and repackaging of Extra Vehicular Activity (EVA) equipment and preparation of site infrastructure for lunar operations. This includes access/handling and transportation equipment/carriers for delivery and deployment of materials, components, and infrastructure; surface mobility systems to provide the power train for site clearing, pad construction, and regolith manipulation (note that the power train attachments for this activity will be provided by the in situ resource utilization (ISRU) area); and commodities distribution systems (including umbilicals) for routing to equipment and infrastructure. These new capabilities are required to make planetary surface missions more reliable, safer, and affordable.

Several vehicle features will be critical to surface operations: expanded mobility, range and duration, life support recharge, crew following, automated path planning, automated driving, and obstacle avoidance. Vehicles with life support recharge capabilities will extend useful EVA time. The ability of a vehicle to follow a crewmember will enable science and exploration support equipment to be carried for the astronaut as well as extend the traverse distances. While the utility of autonomy is easily recognized when the crew is not on the surface, these functions could also be advantageous to long traverses and rescue or emergency operations when crewmembers are present.

Proposals are sought which address the following technology needs:

- Lightweight, power-efficient manipulation devices (dexterous and non-dexterous) that can be deployed on small rovers and that are appropriate for multiple tasks. Much of this activity can be performed with teleoperated and semi-autonomous robots controlled from ground. Some of this activity, however, will also require human presence at the site. In both cases, the effectiveness of Human-Robot interaction (HRI) will have a major impact on the efficiency and productivity of mission operations.

- Low-mass, high-strength, long-life wheels capable of spreading supported load over an extended contact patch area and moving over surface terrain similar to loose beach sand. Range, Life, Mass, Mean-time-to-repair, and Mean-time-between-failure are key performance parameters being sought.
Reliable navigation sensors to support surface mobility by a range of vehicles (ranging from MER-class to LRV-class). For example, a range finder with dynamically-operated foveal aperture could support wide field-of-view scanning and three-dimensional object tracking.

Navigation and communication infrastructure technologies for use on the Lunar surface to support surface mobility and communication between lunar base, EVA astronaut and mobile rover/robotic assistant.