NASA SBIR 2008 Phase I Solicitation

X5.01 Lunar Surface Systems

Lead Center: JSC

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

The objective of this subtopic is to address projected technology needs for surface system elements supporting lunar operations. Communication integrity between lunar assets is essential during crewed translation across the lunar surface as well as during uncrewed autonomous translation of mobile assets. Navigation is essential to performing many lunar surface tasks, including exploration traverses, site surveys, material/payload transport, etc. The current lunar architecture plan for lunar surface navigation focuses on a deployed infrastructure-based solution (fixed radiometric towers, comm/nav orbiters, etc.) Although this approach is appropriate for outpost-centric operations, it is insufficient for operations in rough and steep terrain (e.g., inside deep craters) or when activity is temporarily required in regions without coverage. Commodities distribution systems (including umbilicals/connectors) will be employed to route communication and power lines to remote equipment and surface assets. These new capabilities are required to make planetary surface missions more reliable, safer, and affordable.

Maximizing the useful life of surface assets is essential to a successful lunar program. Material components must be robust and tolerate extreme temperature fluctuations and endure harsh environmental effects due to solar events, micrometeorite bombardment, and abrasive lunar dust.

Proposals are sought which address the following technology needs:

- Electrical connectors that can be repeatedly mated and de-mated (5000+ cycles) without failure in a contaminating environment consisting of regolith grain size ranging from 100um down to 10um. Capable of carrying 10kw of power transmission. Automated mating and de-mating is required.
- Lunar wireless network. Must support 15 simultaneous users with aggregate bandwidth of 80mbs at extended ranges to at least 5.6km. Must support minimum data rates of 16kbs and maximum data rates of 20mbs. Must be able to convert conventional IP stacks to SN stacks.
- 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.

Communication infrastructure not limited to surface-based assets but could include orbiting communication assets as well. Line of site communication must be maintained at all times. Redundant communication paths assure constant communication link and reduce the possibility of loss of communication. Data rates in excess of 200 Mbps for comm network. Less than 100W system power. Coverage area on the order of 100 km radius from a central point.

- Passive navigation sensors to improve surface vehicle operation: collision avoidance, hazard detection, relative positioning (to artificial and natural objects). Emphasis is placed on sensors that can function in a wide range of lunar conditions (illumination, temperature, etc.)

- Flight vehicle sensors repurposed for surface use. Numerous flight sensors (low light imager, star tracker, 3D flash & scanned lidar) may be suitable for lunar surface operations if modified appropriately.