NASA SBIR 2008 Phase I Solicitation

X4.01 Low Temperature Mechanisms

Lead Center: GSFC

Participating Center(s): GRC, JPL, JSC, LaRC

This subtopic focuses on the development of selected hardware and lubricants to support technologies for motors and drive systems (e.g., gear boxes) that will operate in cryogenic temperature environments such as permanently shaded craters on the Moon, and/or on the lunar surface exposed to the day/night cycle. In the former situation such mechanisms may be exposed to, and will need to operate in, sink temperatures as low as approximately 25K. In the latter situation they will need to operate over a temperature sink range of approximately 83K to 403K (-190Â°C to +130Â°C). A five year lifetime is desired. The component technologies developed in this effort will be utilized for rovers, cranes, instruments, drills, crushers, and other such facilities. The nearer term focus for this effort is for lunar missions, but these technologies should ideally be translatable to applications on Mars. These components must operate in a hard vacuum and/or planetary environment, with partial gravity, abrasive dust, and full solar and cosmic radiation exposure. Additional requirements include high reliability, ease of maintenance, low-system volume, low mass, and minimal power requirements. Low out-gassing is desirable, as are modular design characteristics, fail-safe operation, and reliability for handling fluids, slurries, biomass, particulates, and solids. While dust mitigation is not specifically included in this subtopic, proposed concepts should be cognizant of the need for such technologies. Specific areas of interest include innovative long life, light weight wide low temperature motors (in the range of 100W to 5 kWatts), gear boxes, lubricants, and closely related components that are suitable for the environments discussed above. One lubrication technology of specific interest is ionic fluids. Proposals for ionic fluid lubricant improvement should identify and/or formulate low volatility, non-corrosive extreme pressure (EP) and anti-wear additives for ionic fluid space lubricant candidate materials. Lubricant proposals should also include a sufficient quantity of the formulated end product so as to allow standard STLE 4-ball evaluation testing, comparing neat (unformulated) base ionic fluid performance to formulated ionic fluid performance.

Research should be conducted to demonstrate technical feasibility during Phase 1 and show a path toward a Phase 2 hardware demonstration, and when possible, deliver a demonstration unit for functional and environmental testing at the completion of the Phase 2 contract.