NASA SBIR 2017 Phase I Solicitation

Z1.02 Surface Energy Storage

Lead Center: GRC

Participating Center(s): JPL, JSC

Technology Area: TA3 Space Power and Energy Storage

NASA is seeking innovative energy storage solutions for surface missions on the moon and Mars. The objective is to develop energy storage systems for landers, construction equipment, crew rovers, and science platforms. Energy requirements for mobile assets are expected to range up to 120 kW-hr with potential for clustering of smaller building blocks to meet the total need. Requirements for energy storage systems used in combination with surface solar arrays range from 500 kW-hr (Mars) to over 14 MW-hr (moon). Applicable technologies such as batteries and regenerative fuel cells should be lightweight, long-lived, and low cost. Of particular interest are technologies that are multi-use (e.g., moon and Mars) or cross-platform (e.g., lander use and rover use). Strong consideration should be given to environmental robustness for surface environments that include day/night thermal cycling, natural radiation, partial gravity, vacuum or very low ambient pressure, reduced solar insolation, dust, and wind. Creative ideas that utilize local materials to store energy would also be considered under this subtopic.

Advanced secondary batteries that go beyond lithium-ion, can safely provide >300-400 watt-hours per kilogram, and have long calendar and shelf lives are highly desired for cross-cutting applications. Secondary batteries that can operate at -60°C with excellent capacity retention as compared to room temperature operation are also highly desired. Additionally, for the Mars Ascent vehicle, secondary batteries that can operate reliably after a 15 year shelf life are highly desired.

Of interest for fuel cells and regenerative fuel cells are technologies that can mature hydrogen-oxygen fuel cells and electrolyzers and can address challenges common to both fuel cells fed by oxygen and methane and electrolyzers fed by carbon dioxide and/or water. Hydrocarbon fuels of interest include, but are not limited to, methane, residual fuel scavenged from lander propulsion tanks, and fuels generated by processing lunar and Mars soils. Components and systems of interest include fuel cells, stack, materials, and system development. For space and Lunar applications, gravity-independent operation should be considered in the design. For Mars applications, cell and stacks capable of Mars atmosphere electrolysis should be considered in the design. High power density for fuel cells, high efficiency for regenerative fuel cells, and designs that are scalable to 1 to 3kW sizes are highly desirable.