# NASA SBIR 2014 Phase I Solicitation

## H4 Extra-Vehicular Activity Technology

Extra-Vehicular Activity (EVA) system technology advancements are required to enable forecasted microgravity and planetary human exploration mission scenarios and to support potential extension of the International Space Station (ISS) mission beyond 2020. Advanced EVA systems include the space suit pressure garment systems; the portable life support system (PLSS); the power, avionics and software systems including communications, controls, and informative displays; the common suit system interfaces; and airlock alternatives in varying host vehicles. More durable, longer-life and higher-reliability technologies for Lunar and Martian environment service as well as those suitable for working on and around near earth asteroids (NEAs) are needed, as are technologies that enable the range and difficulty of tasks beyond those experienced to date to encompass those anticipated for exploration, with improved comfort and productivity, less fatigue and lower injury risk. Reductions in commodity and life-limited part consumption rates and the size/weight/power of worn systems are needed. All proposed Phase I research must lead to specific Phase II experimental development that could be integrated into a functional EVA system.

# Subtopics

### H4.01 Space Suit Pressure Garment and Airlock Technologies

**Lead Center: JSC**

Space suit pressure garment and airlock technology advancements are needed to accomplish future human space exploration missions and support ISS operations. EVA and crew survival pressure garments are addressed in this subtopic. Exploration destinations include deep-space microgravity objectives such as near-earth asteroids and Mars moons as well as lunar and Martian surface objectives involving gravitational forces and local environments. Innovative space suit technologies that improve performance and prevent injuries, extend service life and eliminate or reduce overhead, provide better environmental protection, and reduce suit system mass are required to enable a robust and flexible exploration capability. Innovative airlock technologies that protect habitable environments and reduce operational and logistical overhead are required to integrate with deep space and surface EVA-hosting systems to enable and operationally optimize achievement of exploration objectives. Key innovations sought include, in priority order:

- Reduction of suit mass, emphasizing light-weight structural components and bearings and the use of multi-function materials to reduce environmental protection layers.
- Improved mobility for enhanced task performance that also reduces injury risk.
- Improved material durability and extended service life (time and cycles).
- Improved accommodation of crew size variations for a suit system and an individual crew member.
- Reduction of crew time for maintenance and logistical support.
- Improved protection from natural and induced environments including vacuum/atmosphere, thermal, loads

and dynamics, radiation, plasma and conventional shock hazards.
- Includes thin atmosphere thermal protection.
- Elimination/reduction of dust-caused failure or degradation and intrusion/contamination of habitable volumes.
- Innovative data collection techniques to define and improve methods for the human-to-suit interface.
- Improved occupant thermal comfort management.
- Improved ability to don and doff pressurized rear-entry suits.
- Self-diagnosing and repair technologies for suit wear and damage.
- Long-duration (week or longer) suited survival concepts, including nutrition delivery and hygiene maintenance.
- Low power, consumable, overhead and light-weight airlocks.
- Suitport designs reduce the impact to the pressure garment and crewmember (on-back mass during EVA).