Advanced space suit pressure garment and airlock technologies are necessary for the successful support of the International space Station (ISS) and future human space exploration missions for in-space microgravity EVA and planetary surface operations. The space suit pressure garment requires innovative technologies focused on performance, environmental protection, and mass reduction. Two of the critical performance characteristics of a suit are mobility and durability. Improved mobility typically competes against durability and suit component life. Materials that enable both highly mobile and durable designs would negate the need for compromise in one of these areas. Other key suit performance enhancements include materials that enable improved fit and sizing, such as shape change materials that increase the ease of suit don/doff or facilitate adaptable fit for specific functional tasks. Space suit environmental protection includes protection from thermal extremes, vacuum, cuts, abrasion and micrometeoroid and orbital debris (MMOD). Additional environmental protection is desired for plasma, radiation, electrical shock, antimicrobials and dust. It is desirable to provide protection in as few material layers as possible; therefore, multi-functional materials are desired. Self-healing materials and materials that alert the inspector to wear/maintenance needs are also of interest. Mass reduction of the space suit system is highly desirable for many reasons, with arguably the biggest drivers being launch mass and on-back mass during EVA. New materials that can lead to reductions in suit component mass, for example, lightweight materials for bearings and hard structures, are therefore desirable.

Due to the expected large number of space walks that will be performed on the ISS beyond 2020 and during future human space exploration missions, innovative technologies and designs for both microgravity and surface airlocks will be needed. Technology development is needed to decrease the time associated with egressing and ingressing the vehicle or habitat, reducing the gas loss during depressurization, and decreasing the potential of contaminating the cabin due to bringing in dust or CO₂. These enhancements could be achieved with a suitport, suitlock or some type of advanced airlock.

Technology Readiness Levels (TRL) of 4 to 6 or higher are sought.

Potential NASA Customers include:

- EVA Project Office.
• International Space Station.
• Human Exploration Operations Mission Directorate.
• Office of Chief Technologist.