NASA SBIR 2011 Phase I Solicitation

X4.02 Space Suit Life Support Systems

Lead Center: JSC

Participating Center(s): GRC

Advanced space suit life support systems 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. Exploration missions will require a robust, lightweight, and maintainable Primary Life Support System (PLSS). The PLSS attaches to the space suit pressure garment and provides approximately an 8 hour supply of oxygen for breathing, suit pressurization, ventilation and CO_2 removal, and a thermal control system for crew member metabolic heat rejection. Innovative technologies are needed for high-pressure O_2 delivery, crewmember cooling, heat rejection, and removal of expired CO_2 and water vapor.

Focused research is needed in the following space suit life support system areas:

Feedwater Supply Bladder for PLSS - Focused research is needed to develop a shallow, translucent water bladder that will serve to pressurize the water loop for the new PLSS by using the suit pressure to compress the flexible bladder material. The unique aspect of this bladder includes a detection system to indicate via a signal that the remaining usable feed water is approximately .5 kg. Some additional requirements are: Usable capacity => 4.5 kg, Chemically inert to avoid chemical reactions with the feed water which may be DI water to potable standards, Approximate shape is a semi-circle with a diameter of 16 in (40.6 cm), Configuration is similar to an accumulator with a single inlet, 1/8in hose barb, and the Maximum Allowable Working Pressure => 20 psid (138 kPa differential).

$PPCO_2$-H_2O-O_2 Sensor for PLSS - Focused research is needed for a PLSS sensor that is able to measure critical life support constituents in a single combined flow-through sensor configuration. Free water tolerance is an important feature. Test and Shuttle/ISS space suit experience has shown this to be a real possibility that the sensor should tolerate.