NASA SBIR 2011 Phase I Solicitation

X12 Exploration Crew Health Capabilities

Human space flight is associated with losses in muscle strength, bone mineral density and aerobic capacity. Crewmembers returning from the International Space Station (ISS) can lose as much as 10-20% of their strength in weight bearing and postural muscles. Likewise, bone mineral density is decreased at a rate of ~1% per month. During future exploration missions such physiologic decrements represent the potential for a significant loss of human performance which could lead to mission failure and/or a threat to crewmember health and safety. NASA is conducting research to enhance and optimize exercise countermeasure hardware and protocols for these missions. In this solicitation, we are seeking portable technologies to collect foot ground reaction force data from current exercise hardware deployed on the International Space Station to be analyzed by research teams on the ground, as well as compact, low mass, low power, high life-cycle, force-generating components for application to future crew exercise concepts.

Subtopics

X12.01 Crew Exercise Systems

Lead Center: GRC

Participating Center(s): JSC

NASA seeks compact, low mass, low power, hi life-cycle, force-generating components for application to future crew exercise equipment - capable of providing aerobic and resistive (>700 lbs) loads over a range of load increments of 5 lbs. for each load setting 100 lbs., and with adjustable stroke range up to 70 inches, while providing return: pull stroke load ratios of 0.9:1.0 or greater (e.g., 1.0:1.0 better, or 1.1:1.0 best) over the entire range of motion.

Phase I Deliverable: Fully developed concept complete with feasibility and top-level drawings/computational methodology as applicable. A breadboard or prototype system is highly desired.

X12.02 Portable Load Sensing Systems

Lead Center: GRC

Participating Center(s): JSC

NASA seeks a portable, force/load measurement system capable of being integrated into existing International Space Station (ISS) exercise systems. During long duration spaceflight, exercise countermeasures are prescribed to mitigate bone and muscle loss. However, advancement of these exercise prescriptions may require biomechanical analysis of exercise on orbit. Output parameters from the proposed device must operate in the bandwidth from 0-100Hz and be able to be synchronized with existing analog data systems. Vertical and shear forces are required and the portable system should be low-maintenance, durable, easy to set-up and calibrate, non-disruptive to exercise form (e.g., running, squat, dead lift, and calf raises), reliable, accurate (

Phase I Deliverable: Fully developed concept complete with feasibility and top-level drawings/computational methodology as applicable. A breadboard or prototype system is highly desired.