



NASA SBIR 2008 Phase I Solicitation

X10.01 In Flight Diagnosis and Treatment

Lead Center: JSC

Participating Center(s): ARC, GRC

Proposals may respond to one or more of the following areas:

Non-Toxic Sprain/Strain Treatment

With longer missions and more labor intensive tasks expected in the Constellation Program, the likelihood of musculoskeletal injuries such as sprains and strains are expected to increase. Standard terrestrial therapeutic response to treating sprains and strains is to provide cold compress or heat treatment to the affected area. The focus of this subtopic is to develop a reusable cold compress and/or heat treatment that can be stowed in its inactive state in the vehicle's ambient environment, activated to provide the desired therapeutic relief, recharged using available vehicle resources, and restowed in its inactive state for future use. This capability is desired on the International Space Station and all Constellation Program vehicles that support missions involving labor intensive tasks or exercise countermeasures. Efforts should be made to minimize the volume and mass footprint of the deployed system so that when activated and treating the patient, the patient will have mobility and free movement to continue with mission tasks and objectives. The cold compress and heat treatment capability can be provided through separate systems and does not necessarily have to be the same piece of hardware. The materials used shall be non-toxic in the quantities provided. Current terrestrial solutions are undesirable due to the chemicals involved, onetime use designs or requirement for pre-cooling (e.g., freezer) or pre-heating (e.g., microwave) devices.

Phase 1 Requirements: Phase 1 would include trade studies with reports and down select recommendation. A prototype is preferable.

Phase 2 Requirements: Phase 2 would deliver a working prototype and documentation packages for NASA safety and design reviews.

Reusable Diagnostic Lab Technology

On-board clinical diagnostics to monitor crew member physiology must be available for both mid-term lunar and long-term Mars exploration missions. As in terrestrial medicine, devices with which to measure multiple constituents of small volume samples of bodily fluids are crucial components in assessing astronaut health. Nevertheless, mass, space, and power requirements of such devices are an obvious concern in an environment with scarce resources. Miniaturized laboratory analysis sensors represent a potential solution, given that these devices and supporting hardware are designed to be small, lightweight, and require little power. However, current sensor cartridges are typically single-use with limited shelf life. In order to satisfy the needs of longer duration exploration missions, reusable laboratory analysis sensors with increased shelf life must be designed without compromising accuracy or sensitivity. NASA seeks proposals for developing such reusable laboratory analysis sensors for analysis of bodily

fluids, including blood, urine and saliva. The ability to analyze whole blood for a complete blood count with differential and hemoglobin is essential. Priority will be given to designs which also incorporate onboard detection capabilities for other analytes, such as electrolytes, lipids, proteins and hormones. Multiplexed systems providing runtime selection of the assay suite are also desirable. The detection system should minimize the use of electrical power, external optics or other infrastructure, and the use of reagents and additives. The device can rely on a PC or PDA for signal processing and display if desired, but the footprint of all other components should be tightly controlled. The best design will require minimal user interaction for processing or maintenance.

Phase 1 Requirements: During Phase 1, research should be conducted to demonstrate technical feasibility with a draft end item functional requirements document. Phase 1 will also produce documentation showing a viable path to a Phase 2 breadboard demonstration.

Lightweight/Compact Oxygen Concentrator

Concentrated oxygen for medical use is a consumable that when used cannot be replenished. Due to relatively low metabolic consumption, a large percentage of the concentrated oxygen is not consumed but is instead released into the vehicle's cabin where it offers minimal medical use and is essentially wasted. This release of concentrated oxygen leads to increased ambient oxygen levels to the point where the vehicle oxygen fire limit will be exceeded. An effective solution to both these issues involves use of an oxygen concentrator that can take ambient air and re-concentrate the oxygen providing medical grade oxygen and removing excess oxygen from the vehicle cabin. However, oxygen concentrator technology to date is mostly large, massive, and power intensive. The focus of this subtopic is to develop a small, lightweight, portable oxygen concentrator that can produce concentrated medical oxygen using ambient vehicle cabin air. Of particular interest is oxygen concentration technology that can produce at minimum 60% oxygen at 4-6 liters per minute. Efforts should be made to minimize the volume, mass, and power draw of the system. The oxygen concentrator will use vehicle power as its primary source of power; however there is a brief need for battery power for when the patient is transported between vehicles. This technology is desired on ISS and future exploration vehicles supporting long duration missions.

Phase 1 Requirements: Phase 1 deliverables should include trade studies with down select criteria and recommendations for which technology will best meet the O₂ concentrator figures of merit. A requirements document for a Phase 2 prototyping effort should also be included.