



NASA SBIR 2011 Phase I Solicitation

X13 Exploration Medical Capability

Further human exploration of the solar system will present significant new challenges to crew health including hazards created by traversing the terrain of asteroids or planetary surfaces and the effects of variable gravity environments. The limited communications with ground-based personnel for diagnosis and consultation of medical events creates additional challenges. Providing health care capabilities for exploration missions will require the definition of new medical requirements and development of technologies to ensure the safety and success of Exploration missions, pre-, in-, and post-flight. This SBIR Topic addresses some key medical technology and gaps that NASA will need to solve in order to proceed with exploration missions.

Subtopics

X13.01 Smart Phone Driven Blood-Based Diagnostics

Lead Center: JSC

Participating Center(s): ARC

As user applications pervade the field of telemedicine, smart phones provide a robust, reconfigurable platform capable of communications, computations and various functions (i.e., imaging, video, power source, signal processing) that will continue to expand at an accelerated pace. By leveraging this technology, NASA seeks to exploit the smart phone for blood-based diagnostics to develop an analytical device that can determine basic metabolic (Chem8), blood gas (PaO_2 , PaCO_2 , SaO_2 , HCO_3 , pH), cardiac (troponin I, CK-MB, total cholesterol, HDL, LDL, VDL, triglycerides and lipoproteins) and liver/renal (total bilirubin, direct bilirubin, ALP, ALT, AST) panels. These panels are representative of the operational and research requirements for space exploration related point of care diagnostics.

The diagnostic device must interface to a smart phone that will drive the device's electronics and/or optics; or use the built-in features of the phone to interrogate the diagnostic device. The described diagnostic component is to be no larger than the phone itself. The microfluidic device must also be reusable or extremely compact if disposable, and minimize reagent consumption. Other requirements to consider are analytical times in two minutes or less, strategies for operational capability up to 144 hours on battery power and a long shelf-life (> 36 months).

The Phase I effort will seek to demonstrate the feasibility of one diagnostic panel in the smart phone format. The

Phase II effort will demonstrate at least two of the above stated panels in an analytical component that interfaces to a cell phone, and provides a path towards FDA approval or similar.

NASA Deliverable: Functional Diagnostic System

X13.02 Non-Wet Prep Electrodes

Lead Center: JSC

Participating Center(s): ARC

Although physiological monitoring has been conducted since the earliest human flights, there has not been substantial improvement in the technology of the sensors used in space since those early years. The current systems on the International Space Station (ISS) are still using wet-prep electrodes - which are time consuming and inconvenient, requiring shaving, application of electrodes, signal checks, and management of lead wires. Skin irritation sometimes develops from the electrode's interactions with roughened skin. And the signals are still subject to noise, corruption, and loss.

NASA desires a non-wet prep sensor system that:

- Is easy to don/doff (requires no shaving or skin prep), has no disposables, and can be worn comfortably for 48 hours.
- Maintains signal integrity at clinical quality (meets or exceeds ANSI/AAMI EC11 Standard for Diagnostic Electrocardiographic Devices) during rigorous exercise.
- Solutions that partially involve software (as opposed to strictly hardware) are acceptable, but any developed software code must be easily integrated into the ECG software system(s) used by NASA and not just into the given company's proprietary and/or standalone product.

NASA Deliverable: Functioning sensor system

