NASA SBIR 2010 Phase I Solicitation

X14  Space Human Factors and Food Systems

The emphasis on developing new, innovative technologies to enable future Space Exploration encompasses a need for new approaches in the areas of Space Human Factors and Food Systems. Operations in confined, isolated, and foreign environments can lead to impairments of human performance. Research and development activities in this topic address challenges that are fundamental to design, development, and operation of the next generation crewed space vehicles. These challenges include: (1) technologies to unobtrusively and non-invasively measure crew task performance in real time, and (2) a need to develop, evaluate, and deliver food technologies for human spacecraft that allow for food processing or preparation in a reduced gravity and reduced pressure environment to support crews on missions beyond low earth orbit, and efficiently balance vehicle resources such as mass, volume, water, air, waste, power, and crew time.


Subtopics

X14.01 Technologies for Non-Invasive Measurement and Analysis of Human Task Performance

Lead Center: ARC
Participating Center(s): JSC

X14.02 Advanced Food Technologies

Lead Center: JSC
The purpose of the Advanced Food Technology Project is to develop, evaluate and deliver food technologies for human centered spacecraft that will support crews on missions beyond low earth orbit. A safe, nutritious, acceptable, and varied food system will be required to support the crew during future exploration missions.
Concurrently, the food system must efficiently balance appropriate vehicle resources such as mass, volume, water, air, waste, power, and crew time. For example, it would require approximately 10,000 kg of packaged food with a 5-year shelf life for a 6-crew, 1000 day mission to Mars.

It has been proposed to use a food system which incorporates processing of raw ingredients into edible ingredients and uses these edible ingredients in recipes in the galley to produce meals. This type of food system will require technologies that will allow these raw ingredients to maintain their functionality and nutrition for 5-years. This food system would also require food processing and food preparation equipment. The equipment should be miniaturized, multipurpose and efficiently use vehicle resources such as mass, volume, water, and power.

There are some unique parameters that need to be considered when developing the technologies. The Moon's gravity is 1/6 of Earth's gravity, and that of Mars is 3/8 of Earth's. In addition, it is proposed that the habitat will have an atmospheric pressure of 8 psia, equivalent to being on a 16,000 foot mountain top. These two factors will affect heat and mass transfer during food processing and food preparation.

The response to this subtopic should include a plan to develop a technology that will enable safe and timely food processing and food preparation in reduced pressure and reduced gravity. Phase I should concentrate on the scientific, technical, and commercial merit and feasibility of the proposed innovation resulting in a feasibility report and concept, complete with analyses and top-level drawings.

Deliverables: Conceptual designs for food preparation or food processing equipment that can be used in partial gravity while efficiently balancing appropriate vehicle resources such as mass, volume, waste, and crew time.