NASA SBIR 2014 Phase I Solicitation

H10.02 International Space Station (ISS) Utilization

Lead Center: JSC

Participating Center(s): ARC, GRC, JPL, KSC, MSFC

NASA continues to invest in the near- and mid-term development of highly-desirable systems and technologies that provide innovative ways to leverage existing ISS facilities for new scientific payloads and to provide on orbit analysis to enhance capabilities. Utilization of the ISS is limited by available up-mass, down-mass, and crew time as well as by the capabilities of the interfaces and hardware already developed and in use. Innovative interfaces between existing hardware and systems, which are common to ground research, could facilitate both increased and faster payload development and subsequent utilization. Technologies that are portable and that can be matured rapidly for flight demonstration on the International Space Station are of particular interest.

Desired capabilities that will continue to enhance improvements to existing ISS research hardware include, but are not limited to, the below examples:

- Providing additional on-orbit analytical tools. Development of instruments for on-orbit analysis of plants, cells, small mammals and model organisms including Drosophila, C. elegans, and yeast. Instruments to support studies of bone and muscle loss, multi-generational species studies and cell and plant tissue are desired. Providing flight qualified hardware that is similar to commonly used tools in biological and material science laboratories could allow for an increased capacity of on-orbit analysis thereby reducing the number of samples which must be returned to Earth.
- Technologies that determine microbial content of the air and water environment of the crew habitat falls within acceptable limits and life support system is functioning properly and efficiently. Required technology characteristics include: 2 year shelf-life; functionality in microgravity and low pressure environments (~8 psi). Technologies that show improvements in miniaturization, reliability, life-time, self-calibration, and reduction of expendables are also of interest.
- Providing a Magnet Processing Module (MPM) for installation and operations in the Materials Science Research Rack (MSRR) would enable new and improved types of materials science investigations aboard the ISS. Essential components of the MPM include an electromagnet, which can provide field strength up to 0.2 Tesla and a high temperature insert, which can provide directional solidification processing capability at temperatures up to 1500 °C.
- Increased use of the Light Microscopy Module (LMM). Several additions to the module continue to be solicited, such as: laser tweezers, dynamic light scattering, stage stabilization (or sample position encoding) for reconstructing better 3-D confocal images.
- Instruments that can be used as infrared inspection tools for locating and diagnosing material defects, leaks of fluids and gases, and abnormal heating or electrical circuits. The technology should be suitable for hand-held portable use. Battery powered wireless operation is desirable. Specific issues to be addressed include: pitting from micrometeoroid impacts, stress fractures, leaking of cooling gases and liquids and detection of abnormal hot spots in power electronics and circuit boards.

For the above, research should be conducted to demonstrate technical feasibility and prototype hardware development during Phase I and show a path toward Phase II hardware and software demonstration and delivering an engineering development unit or software package for NASA testing at the completion of the Phase II contract that could be turned into a proof-of-concept system which can be demonstrated in flight.

Phase I Deliverables - Written report detailing evidence of demonstrated prototype technology in the laboratory or in a relevant environment and stating the future path toward hardware and software demonstration on orbit. Bench or lab-level demonstrations are desirable. The technology concept at the end of Phase I should be at a TRL of 3-6.

Phase II Deliverables - Emphasis should be placed on developing and demonstrating hardware and/or software prototype that can be demonstrated on orbit (TRL 8), or in some cases under simulated flight conditions. The proposal shall outline a path showing how the technology could be developed into space-worthy systems. The contract should deliver an engineering development unit for functional and environmental testing at the completion of the Phase II contract. The technology at the end of Phase II should be at a TRL of 6-7.