



NASA SBIR 2016 Phase I Solicitation

H14 International Space Station (ISS) Demonstration & Development of Improved Exploration Technologies and Increased ISS Utilization

The Human Exploration and Operations Mission Directorate (HEOMD) provides mission critical space exploration services to both NASA customers and to other partners within the U.S. and throughout the world: operating the International Space Station (ISS); ensuring safe and reliable access to space; maintaining secure and dependable communications between platforms across the solar system; and ensuring the health and safety of astronauts. Additionally, the HEOMD is chartered with the development of the core transportation elements, key systems, and enabling technologies required for beyond-Low Earth Orbit (LEO) human exploration that will provide the foundation for the next half-century of American leadership in space exploration. In this topic area, NASA is seeking technologies that address how to improve and lower costs related to use of flight assets; maximize the utilization of the ISS for in-situ research and as a test bed for development of improved space exploration technologies; and utilize the ISS as a platform for in-space commercial science and technology opportunities.

NASA seeks to accomplish these objectives by achieving following goals:

- Investing in the near- and mid-term development of highly-desirable system and technologies that provide innovative ways to leverage existing ISS facilities for new scientific payloads.
- Increasing investments in Human Operations and research to prepare for long-duration missions in deep space.
- Conducting technology development and demonstrations to reduce cost and prove required capabilities for future human exploration.
- Developing exploration precursor robotic missions to multiple destinations to cost-effectively scout human exploration targets.
- Developing communication and navigation technologies.
- Enabling U.S. commercial spaceflight opportunities.

Through the potential projects spurred by this topic, NASA hopes to incorporate SBIR-developed technologies into current and future systems to contribute to the expansion of humanity across the solar system while providing continued cost effective ISS operations and utilization for its customers, with a high standard of safety, reliability, and affordability.

NASA is investing in technologies and techniques geared towards advancing the state of the art of spacecraft systems through the utilization of the ISS as a technology test bed. For technologies that could benefit from demonstration on ISS, proposals should be written to indicate the intent to utilize ISS. 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.

Subtopics

H14.01 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. Additionally, NASA is supporting commercial science, engineering, and technology to provide low earth orbit commercial opportunities utilizing the ISS. 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 and support hardware, with the potential of reducing crew time needs, and those that promote commercial enterprise ventures 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.
- 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 micro-meteoroid impacts, stress fractures, leaking of cooling gases and liquids and detection of abnormal hot spots in power electronics and circuit boards.
- Innovative technologies and flight projects that can enable significant terrestrial applications from microgravity development or in-space manufacturing and lead to private sector and/or government agency product development within a number of discipline areas, including biotechnology, medical applications, material sciences, electronics, and pharmaceuticals. This includes modifications to existing flight instruments as well as the development of novel flight hardware for deployment on the ISS.

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.