NASA SBIR 2019 Phase I Solicitation

Z4.01 MISSE Experiments

Lead Center: LaRC

Participating Center(s): LaRC, MSFC

Technology Area: TA12 Materials, Structures, Mechanical Systems and Manufacturing

As NASA strives to explore deeper into space than ever before, lightweight structures and advanced materials have been identified as critical needs. The Lightweight Materials, Structures, Advanced Assembly, and Construction focus area seeks innovative technologies and systems that will reduce mass, improve performance, lower cost, be more resilient, and extend the life of structural systems. Reliability will become an enabling consideration for deep space travel, where frequent and rapid supply and resupply capabilities are not possible. Improvement in all these areas is critical to future missions. Applications include structures and materials for launch, in-space and surface systems, deployable and assembled systems, integrated structural health monitoring (SHM), and technologies to accelerate structural certification. Since this focus area covers a broad area of interests, this specific subtopic is chosen to enhance and or fill gaps in the space and exploration technology development programs, as well as to complement other mission directorate structures and materials needs.

Specific interests include:

- Improved performance and cost from advances in composite, metallic, and ceramic materials systems, as well as nanomaterials and nanostructures.
- Improved performance and mass reduction in innovative lightweight structural systems, extreme environments structures, and multifunctional/multipurpose materials and structures.
- Improved cost, launch mass, system resiliency, and extended life time by advancing technologies to enable large structures that can be deployed, assembled, constructed, reconfigured, and serviced in-space or on planetary surfaces.
- Improved life and risk mitigation to damage of structural systems by advancing technologies that enhance nondestructive evaluation and structural health monitoring.
- Improved approaches that provide the development of extreme reliability technologies.

Space technology experiments are solicited to fly on a new space environmental effects platform on the outside of the International Space Station (ISS). The new platform is called the MISSE-FF (Materials International Space Station Experiment - Flight Facility). The MISSE-FF provides experiment accommodations for both active experiments (requires power and/or communications) and passive experiments. The technology can be materials or non-materials (e.g., devices). The physical size of the experiments can vary, depending on the technology being demonstrated (2 inches by 2 inches, up to 7 inches by 14 inches). The depth is a maximum of 3 inches. Of particular interest are space technologies that would mature in TRL (technology readiness level) due to successful demonstration in the space environment. The proposal should justify the need for spaceflight exposure and justify that the ISS environment is adequate to collect the data they need. NASA's commercial partner Alpha Space Test and Research Alliance, LLC (Alpha Space) plans to service the MISSE-FF every 6 months. The MISSE-FF data

will be made available to the global community of researchers through the NASA MAPTIS (Materials and Processes Technical Information System) database.

Phase I deliverables could be data from ground-based testing the candidate technology and/or passive samples for flight on the MISSE-FF. Phase II deliverables could include an active technology experiment, packaged and ready for flight on the MISSE-FF. The experiments would fly free of charge with standard services on the NASA surface area allocation of the MISSE-FF. Standard services include the mechanical integration of the experiment/samples with the flight hardware, monthly high-resolution images of the samples on orbit, and space environmental data (ultraviolet radiation, temperature, and contamination), as well as pointing/orientation data.

Any optional services desired from Alpha Space should be included in the proposal budget. Optional services include power, communications, and additional space environmental data (atomic oxygen and ionizing radiation). If an experiment requires a data acquisition unit, then that would need to be an integral part of the proposed experiment.

The award of an SBIR contract does not guarantee that the technology will be flown as a MISSE experiment. The developed technology has to be nominated in a subsequent and separate process and then selected for a MISSE mission by the NASA Flight Opportunities Program (FOP) jointly with the International Space Station Program (ISSP).

In addition to space environment exposure in Low Earth Orbit (LEO) on-board the International Space Station, limited numbers of payloads may be selected for flight aboard commercial lunar landers in the coming years. Thus in addition to the above described MISSE experiments, please consider and justify (need for lunar environment, data acquisition approach) environmental exposure experiments for the lunar environment according to the following opportunity:

NASA has plans to purchase services for delivery of payloads to the Moon through the Commercial Lunar Payload Services (CLPS) contract. Under this subtopic, proposals may include efforts to develop payloads for flight demonstration of relevant technologies in the lunar environment. The CLPS payload accommodations are yet to be precisely defined, however at least for early missions, proposed payloads should not exceed 15 kilograms in mass and not require more than 8 watts of continuous power. Smaller, simpler, and more self-sufficient payloads are more likely to be accommodated. Commercial payload delivery services may begin as early as 2020 and flight opportunities are expected to continue well into the future. In future years it is expected that payloads of higher mass and with higher power requirements might be accommodated. Selection for award under this solicitation will not guarantee selection for a lunar flight opportunity.

Relevance to NASA

The Space Technology Mission Directorate (STMD), Human Exploration and Operations Mission Directorate (HEOMD), and Science Mission Directorate (SMD) could use the space technologies resulting from this subtopic. The Flight Opportunities Program (FOP), International Space Station Program (ISSP), Advanced Exploration Systems (AES) Program, and In-space Robotic Manufacturing and Assembly (IRMA) Project would particularly benefit from the technologies developed and tested under this subtopic.

References:

- Thibeault, Sheila A.; Cooke, Stuart A.; Ashe, Melissa P.; Saucillo, Rudolph J.; Murphy, Douglas G.; de Groh, Kim K.; Jaworske, Donald A.; and Nguyen, Quang-Viet: MISSE-X: An ISS External Platform for Space Environmental Studies in the Post-Shuttle Era. Presented at the 2011 Aerospace Conference, Big Sky, Montana, March 5-12, 2011. Published in the Proceedings of the 2011 Aerospace Conference, published by IEEE, pp.13, 2011.
- https://www.alphaspace.com/