



NASA SBIR 2015 Phase I Solicitation

Z5 Assistive Free-Flyers

Lead Center: ARC

The Assistive Free-Flyers (AFF) topic area focuses on technology to enhance the capabilities and performance of small, free-flying robots that assist humans. AFF's can complement astronauts in space by performing tasks that are tedious, highly repetitive, dangerous or long-duration. AFF's can also provide side-by-side assistance to astronauts by carrying tools/materials, providing procedure support, etc.

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AFF's can potentially be applied to a wide variety of tasks including in-flight maintenance, spacecraft health-management, environmental monitoring surveys (air quality, radiation, lighting, sound levels, etc.), and automated logistics management (inventory, inspection, etc.).

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AFF's can be used when humans are present to off-load routine work, to increase human productivity, and to handle contingencies. AFF's can also be used when humans are not present, such as during "pre-deployment" and quiescent periods, to perform spacecraft caretaking. In particular, AFF's could be used to enable mobile monitoring, maintenance, and repair of spacecraft before, and between, crews.

Subtopics

Z5.01 Payload Technologies for Assistive Free-Flyers

Lead Center: ARC

Participating Center(s): JPL, JSC

The objective of this subtopic is to develop technology that can be integrated as external payloads on assistive free-flyers (AFF). AFFs are small free-flying robots that assist humans in exploration, surveillance, inspection, mapping, and other work. Current AFFs include space free-flyers, micro UAVs, drones, etc. A key characteristic of AFFs is that they can perform assistive tasks while co-located in human environments. On the International Space Station (ISS), for example, the SPHERES robots have shown how AFF's can perform environment surveys, inspection, and crew support.

During 2015-2017, STMD will develop a new AFF as part of the Human Exploration Telerobotics 2 (HET-2) project. This new robot will carry out inventory, sound monitoring, and other routine tasks on the ISS. Proposals are sought to create AFF payloads that can be integrated for application-specific functions, or that can provide general

capability enhancements in three areas:

- Sensor Payloads - Compact sensors that can be used for environment monitoring, including detection of combustibles, air quality (CO₂ levels), illumination (light spectrum), radiation, etc.
- Logistics Devices - Devices that facilitate automated logistics management, particularly inventory scanners (RFID, barcode, etc.) and mechanisms to support tagging/tracking.
- Appendages - Mechanisms that can be used for docking/perching, prodding/pushing, etc. This includes deployable structures, universal end-effectors (e.g., jamming granular gripper), and devices incorporating gecko or electrostatic adhesion.

Deliverables to NASA:

- Identify scenarios and use cases.
- Develop concepts.
- Construct prototypes.
- Perform technology demos.

Proposals are highly-encouraged that leverage the SPHERES engineering units and HET-2 free-flyers at the NASA Ames Research Center. Phase II efforts should deliver documentation and sufficient units to support future research/testing on ISS.