



## 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

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capability enhancements in three areas:

- Sensor Payloads - Compact sensors that can be used for environment monitoring, including detection of combustibles, air quality (CO<sub>2</sub> 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.