Fly Foundational Robots

Mission Background

Fly Foundational Robots (FFR) is an In-space Servicing, Assembly and Manufacturing (ISAM) mission that brings together NASA and industry partners to fly and operate a commercial robotic arm in low Earth orbit (LEO). FFR accomplishes three major goals for NASA ISAM:

- Demonstrating advanced robotic mobility, manipulation, and autonomy in LEO.
- Testing foundational robotic behaviors necessary for future servicing and assembly operations.
- Enabling collaboration across government, industry, and academia to advance in-space robotics.

Advancing In-space Infrastructure

Acting as an in-space platform and destination for robotic demonstrations, FFR supports the growing space economy by accelerating the flight of commercial robotic manipulation systems and bolstering near-term goals of satellite servicing, lunar exploration, and debris mitigation, while simultaneously paving the way for long-term ambitions like interplanetary economies. Realizing this capability requires incremental testing—starting with in-space demonstrations robotic operations before progressing to larger servicing and refueling missions. FFR is a key step toward facilitating scalable orbital infrastructure and provides a rare opportunity to flight-test robotic systems in an operational space environment. The FFR mission will enable testing of practical robotic tasks that are needed to repair and refuel spacecraft, construct habitats and infrastructure in space, maintain life support systems on lunar and Martian surfaces, and eventually serve as robotic assistants to astronauts during extended missions.

The Fly Foundational Robots (FFR) spacecraft with robotic arm payload envisioned in orbit, image provided by Motiv Space Systems.

How the Mission Works

NASA's Fly Foundational Robots demonstration is funded through the NASA Space Technology Mission Directorate's ISAM portfolio and managed by NASA's Goddard Space Flight Center in Greenbelt, Maryland. Motiv Space Systems of Pasadena, California, will supply and operate the mission's robotic arm system through a NASA Small Business Innovation Research Phase III award. Astro Digital of Littleton, Colorado, will provide the spacecraft for the flight test of Motiv's robotic payload through NASA's Flight Opportunities program managed by NASA's Armstrong Flight Research Center in Edwards, California.

FFR Overview

The FFR payload consists of a robotic arm from small business Motiv Space Systems capable of dexterous manipulation, autonmous tool use, and walking across structures in space. Astro Digital will provide the spacecraft bus in order to demonstrate Motiv's robotic arm in space. NASA, serving as the inaugural guest roboticist, will manipulate the robotic arm by deploying and executing software on the FFR payload.

Orbital Replacement Unit

A key capability enabled by robotics on space systems is the ability to repair or upgrade the space system by installing modular components (orbital replacement units, or ORUs) to extend or enhance the functionality of the space system. FFR's robotic platform is equipped with the Motiv's robotic arm and an ORU. The ORU provides relevant use for the robotic arm, demonstrates the use of commercial power and data interfaces, and gives the spacecraft the capability to swap modular elements in-space. As part of the inaugural Guest Roboticist tasks, the robot arm will manipulate and reposition the ORU. After is it detached from an interface on the payload, it will be repositioned on a subsequent interface by the robotic arm; demonstrating the use of various separable interfaces.

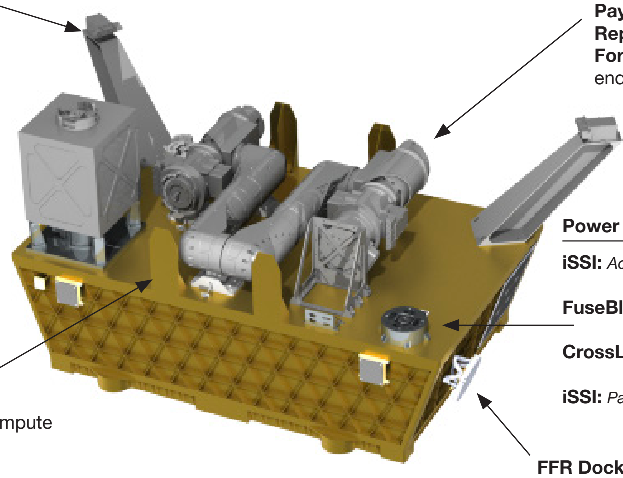
Guest Roboticist

For testing on FFR's in-space robotic testing platform, NASA is looking for partners from industry, government agencies, and academia to fill the role over time. The Guest Roboticist program invites external partners to engage directly with the FFR mission by:

- Contributing algorithms, modules or experimental payloads for robotic inspection, manipulation, or navigation.
- Demonstrating approved technologies in orbit with the robotic platform.
- Participating in mission operations planning or post-mission data analysis.
- Supporting testbed integration, simulation, and pre-flight verification.

Future FFR Missions

FFR has the capability to host future follow on payloads. Future ORU must incorporate a CrossLink Passive Cleat to allow FFR Robotic Arm grasp and at least one interface compatible with Deck ORU attachment points. FFR is designed to accommodate Rendezvous and Proximity Operations (RPO) and Docking for future FFR Follow-on missions with commercially available interfaces to demonstrate rapid development of technology.



Goddard Space Flight Center

8800 Greenbelt Rd

Greenbelt, MD 20771

www.etd.gsfc.nasa.gov/capabilities/in-space-servicing-assembly-and-manufacturing