



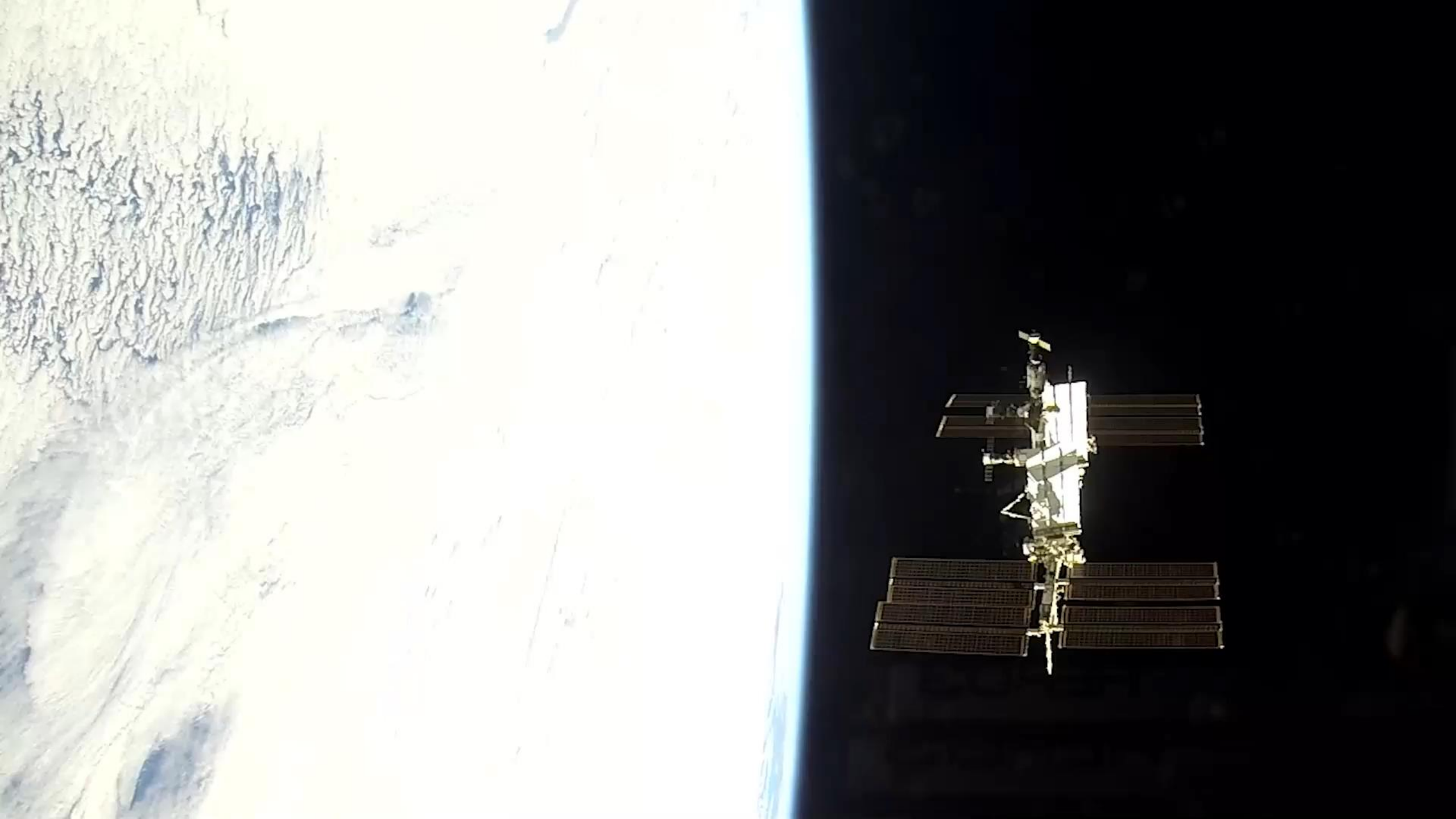
ISS NATIONAL LABORATORY

# Opportunities and Capabilities onboard the ISS

Ryan Reeves, PhD – Director of Science and Technology



August 16, 2023



A photograph of a rocket launch at night. The rocket is positioned vertically in the center-left, with a bright, glowing fire trail extending upwards. A massive, billowing plume of white and orange smoke surrounds the base of the rocket, spreading across the lower half of the frame. The background is dark, making the light from the launch stand out.

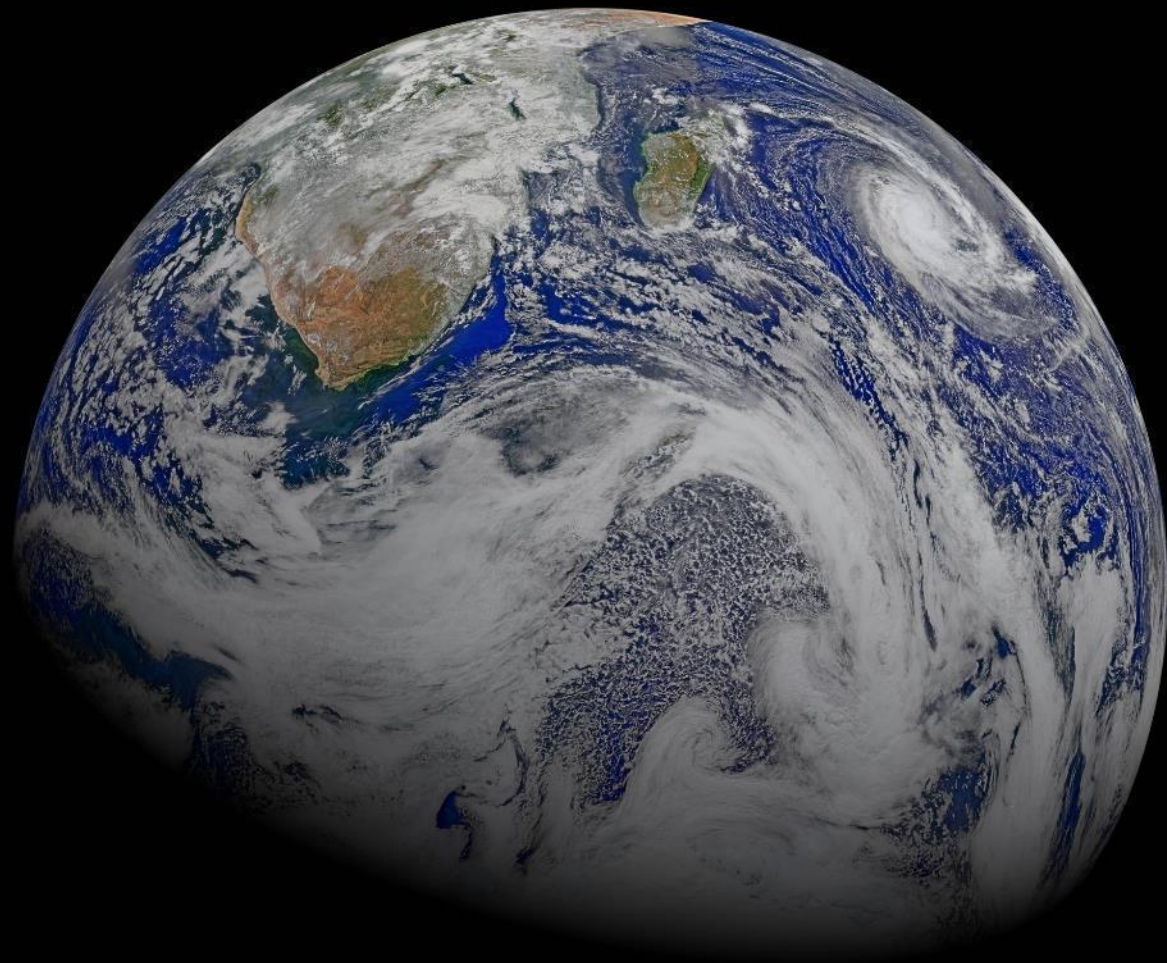
# ISS National Lab Mission:

We manage the premier space laboratory, providing expertise, connection and inspiration to visionaries.

# ISS National Lab Vision:

To be the leading source for innovation in space, enabling life-changing benefits for humanity.





# International Space Station: *A Lab Off the Earth, For the Earth*

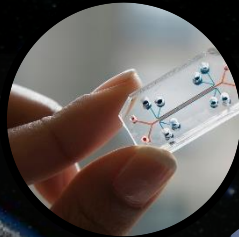
A world-renowned laboratory in space enabling more than 4,400 researchers in 109 countries to conduct more than 3,000 experiments in persistent microgravity.



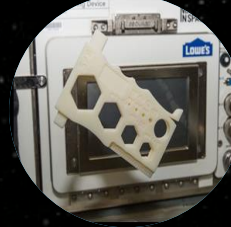
**Student (STEM) Activities and Workforce Development**



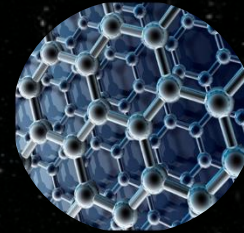
**Human Research**



**Biology & Biotechnology**



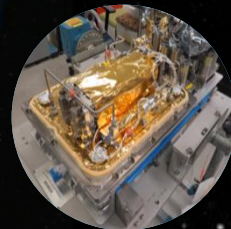
**Combustion**



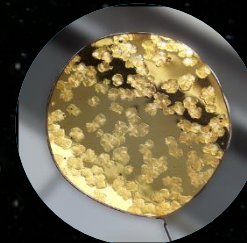
**Fluids & Materials**



**Earth & Space Observation**



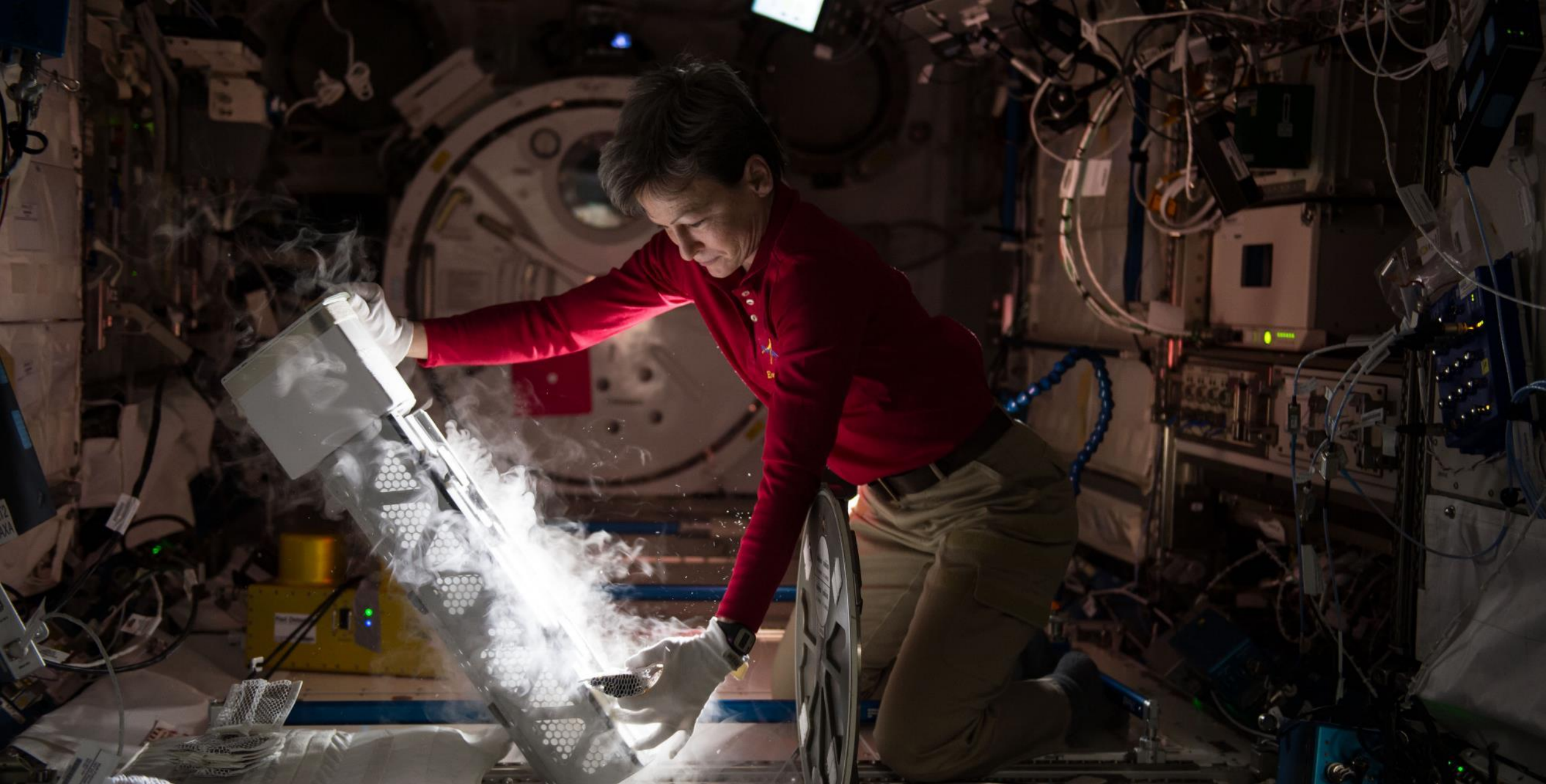
**Technology Demonstration**



**In-Space Manufacturing Applications (InSPA)**



Source: NASA.



**How Can You Send Your Research to the ISS?**



# ISS National Lab Portfolio

**FUNDAMENTAL SCIENCE**



**IN-SPACE PRODUCTION APPLICATIONS**



**TECHNOLOGY DEVELOPMENT & DEMONSTRATION**



**STEM EDUCATION OUTREACH**

**COMMERCIAL UTILIZATION**





# ISS National Lab On-Ramps

## Pathways for access to ISS National Lab resource allocation

TRL	Path	Next Solicitation Release (projected)
Low	<b>Sponsored Programs:</b> Joint solicitations with other government agency partners (e.g., DoD, NSF, NIH). MassChallenge Technology in Space Prize.	Likely late Fall 2023
Medium	<b>Technology Development/Demonstration NLRA:</b> Released semi-annually.	Jan & May 2024
Medium-High	<b>In-Space Production Applications NLRAs and NRAs:</b> Released annually by technology focus	Sept 2023 (Biomanufacturing) Feb 2024 (Materials)
All	<b>Resource Request Form (RRF):</b> Mechanism for Commercial Service Providers to propose R&D projects for their commercial platforms and services contracted thru B2B contracts.	Continuous



# FY24 Solicitations Schedule

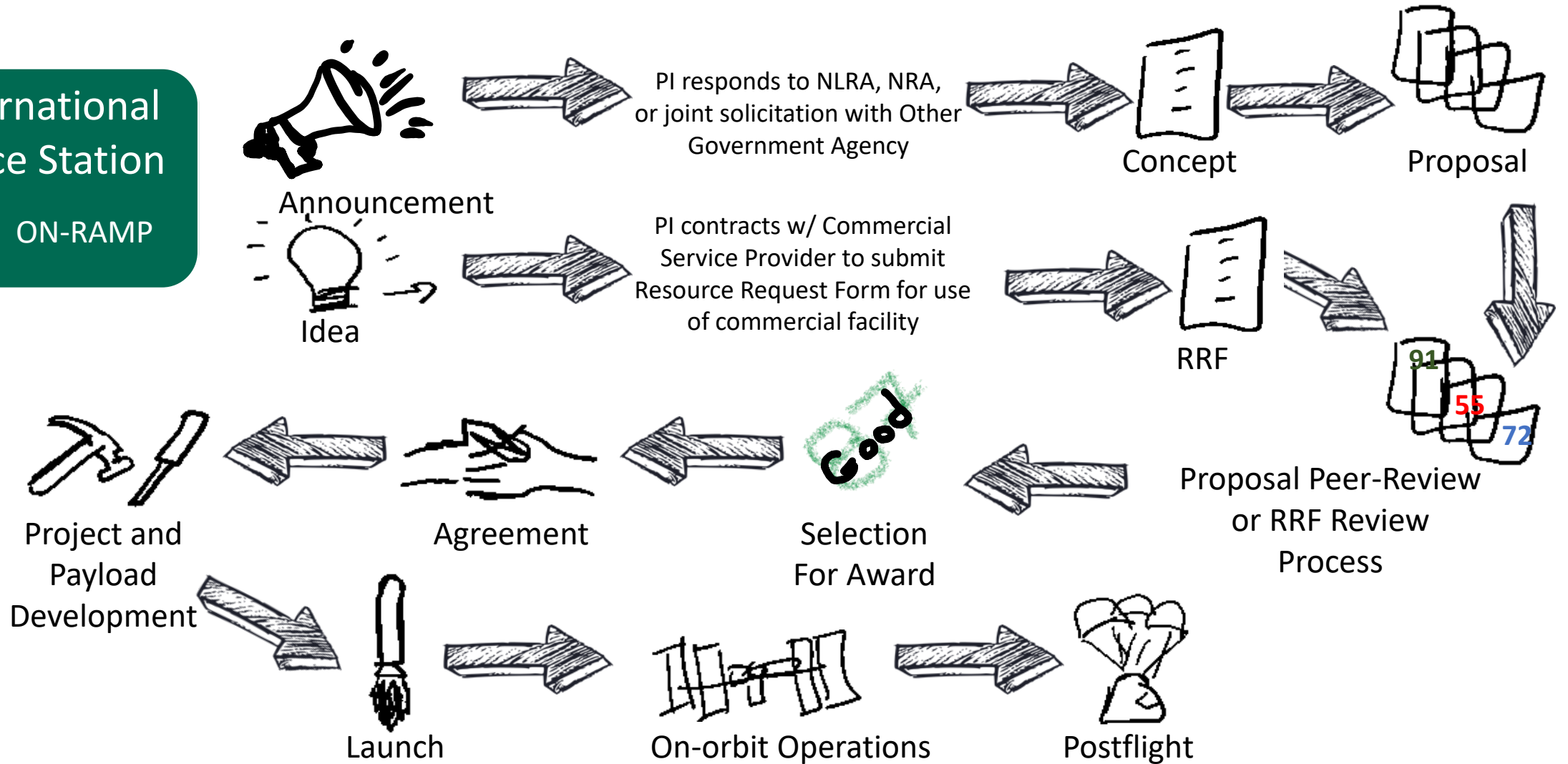
Planned Solicitation	Release	Concept Summary Submission Period	Full Proposals Due	Project Selection
NLRA: Technology Advancement and Applied Research Leveraging the ISS National Lab	January 2024	Cycle 1: January-April 2024	Cycle 1: June 2024	Cycle 1: September
	May 2024	Cycle 2: May-June 2024	Cycle 2: October 2024	Cycle 2: December
NLRA: Igniting Innovation: Science in Space to Cure Disease on Earth	August 2023	August-September 2023	March 2024	May 2024
NLRA: In-Space Production Applications: Tissue Engineering and Biomanufacturing	September 2023	September-November 2023	February 2024	April 2024
NLRA: Leveraging the ISS National Lab to Enable K-12 Education, Higher Education and Digital Engagement	January 2024	January-March 2024	May 2024	July 2024
NLRA: In-Space Production Applications: Advanced Manufacturing and Materials	February 2024	February-April 2024	June 2024	August 2024
Technology in Space Prize (funded by Boeing and CASIS in partnership with MassChallenge)	July 2024	July-August 2024	October 2024	December 2024

[www.issnationallab.org/research-on-the-iss/solicitations/](http://www.issnationallab.org/research-on-the-iss/solicitations/)

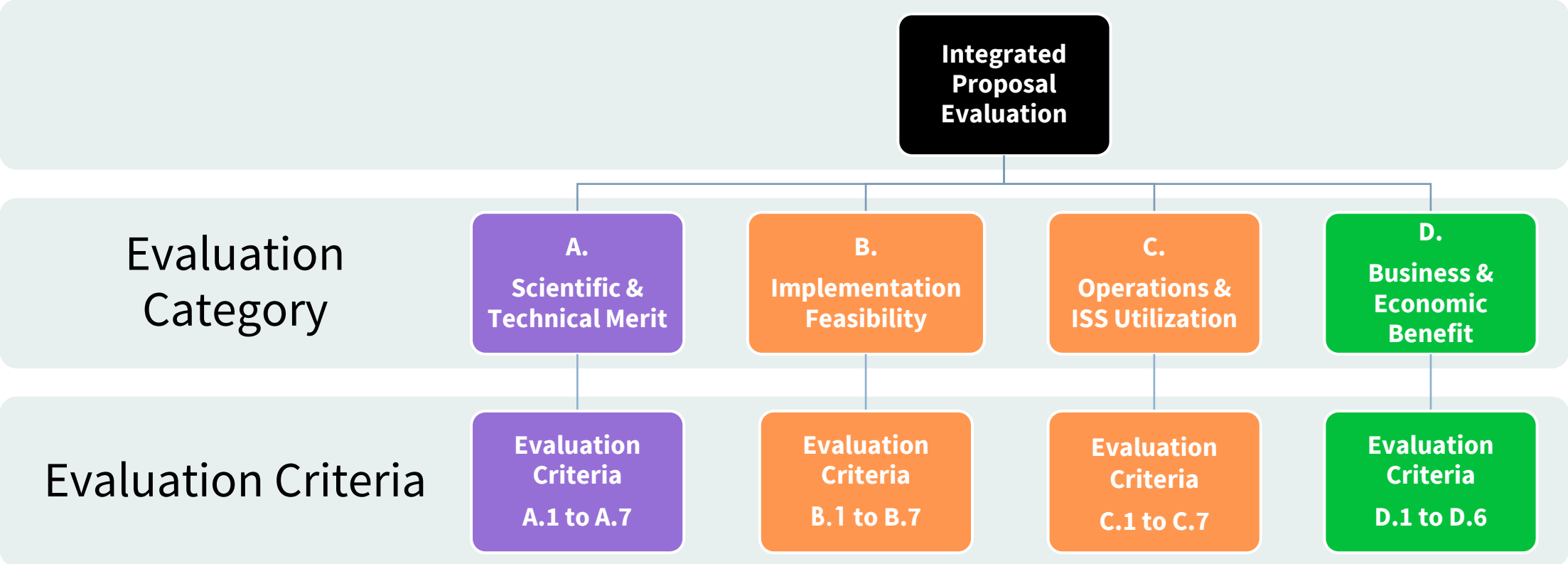


# ISS NATIONAL LAB ROADMAP

International Space Station  
ON-RAMP



# Proposal Evaluation



Each evaluation category has 6 or 7 evaluation criteria. Note that scientific and technical merit review includes peer-review by subject matter experts in the field. See the NLRA's *Proposal Evaluator Instructions* for details on evaluation methodology.

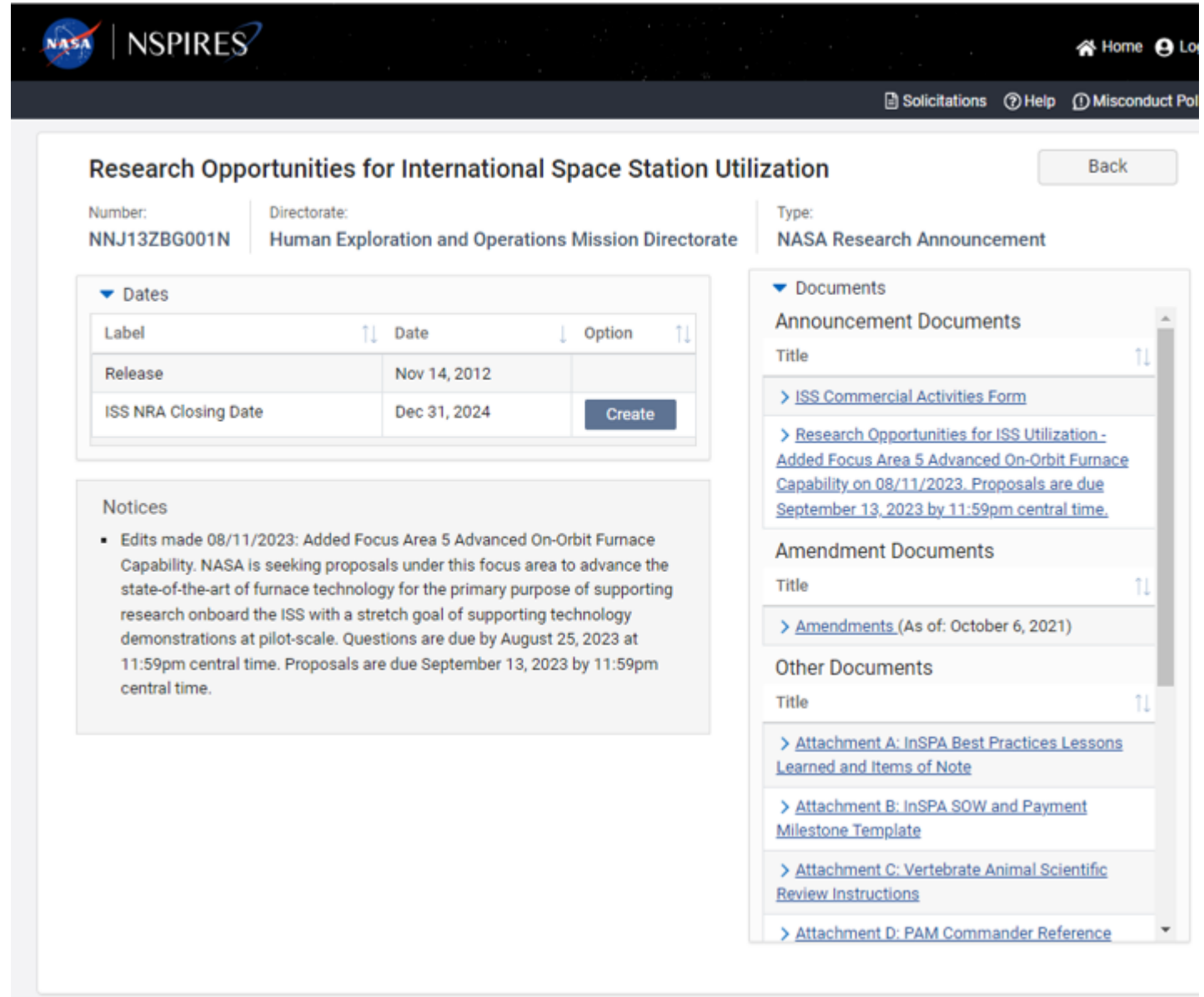


# NASA InSPA NRA

NASA in coordination with the ISS National Lab has made funding and flight opportunities available in topic areas of:

- Tissue Engineering and Biomanufacturing
- Advanced Materials and Manufacturing

NNJ13ZB001N – Research Opportunities for International Space Station Utilization  
Focus Area 1



**Research Opportunities for International Space Station Utilization** Back

Number: **NNJ13ZB001N** | Directorate: **Human Exploration and Operations Mission Directorate** | Type: **NASA Research Announcement**

Label	Date	Option
Release	Nov 14, 2012	
ISS NRA Closing Date	Dec 31, 2024	<a href="#">Create</a>

**Notices**

- Edits made 08/11/2023: Added Focus Area 5 Advanced On-Orbit Furnace Capability. NASA is seeking proposals under this focus area to advance the state-of-the-art of furnace technology for the primary purpose of supporting research onboard the ISS with a stretch goal of supporting technology demonstrations at pilot-scale. Questions are due by August 25, 2023 at 11:59pm central time. Proposals are due September 13, 2023 by 11:59pm central time.

**Documents**

Announcement Documents

Title

- [ISS Commercial Activities Form](#)
- [Research Opportunities for ISS Utilization - Added Focus Area 5 Advanced On-Orbit Furnace Capability on 08/11/2023. Proposals are due September 13, 2023 by 11:59pm central time.](#)

Amendment Documents

Title

- [Amendments \(As of: October 6, 2021\)](#)

Other Documents

Title

- [Attachment A: InSPA Best Practices Lessons Learned and Items of Note](#)
- [Attachment B: InSPA SOW and Payment Milestone Template](#)
- [Attachment C: Vertebrate Animal Scientific Review Instructions](#)
- [Attachment D: PAM Commander Reference](#)





**What Facilities Are Available on the ISS?**



# First, A Couple Points Courtesy of Legal

- This is just a snapshot and specific hardware is used as examples and not as endorsements.
- Only covering US-based hardware. The International Partners have additional hardware.
- The facility landscape on the ISS is dynamic
- Your best resource will be the companies that own/operate the facilities
- The ISS National Lab can help you to identify facilities to meet your needs (IP Portal)



# External Facilities

**Payload deployment & transfer:**  
Nanoracks BISHOP Airlock

**Station interface:**  
Nanoracks Nanode

**Payload deployment:**  
Craig Technologies SSIKLOPS  
Nanoracks Kaber

**Materials exposure/testing:** Aegis  
Aerospace MISSE-FF

**Real-time analysis:**  
Nanoracks Plate Reader

**Payload testing:**  
Nanoracks NREP

**Incubator & freezer:**  
BioServe's SABL

**Earth observation:**  
Teledyne Brown  
Engineering  
MUSES

**Temperature control:**  
BioServe's SALI

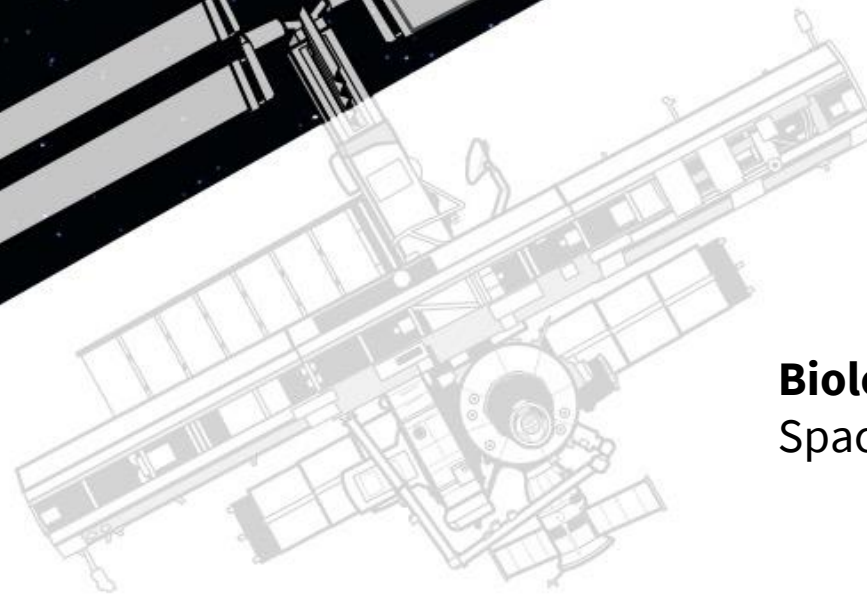
**Biological & physical lab hardware:**  
Space Tango TangoLabs

**Manufacturing facility:**  
Redwire's AMF

**Tissue printing:**  
Redwire's BFF

**Research platform hardware:**  
Redwire's MVP

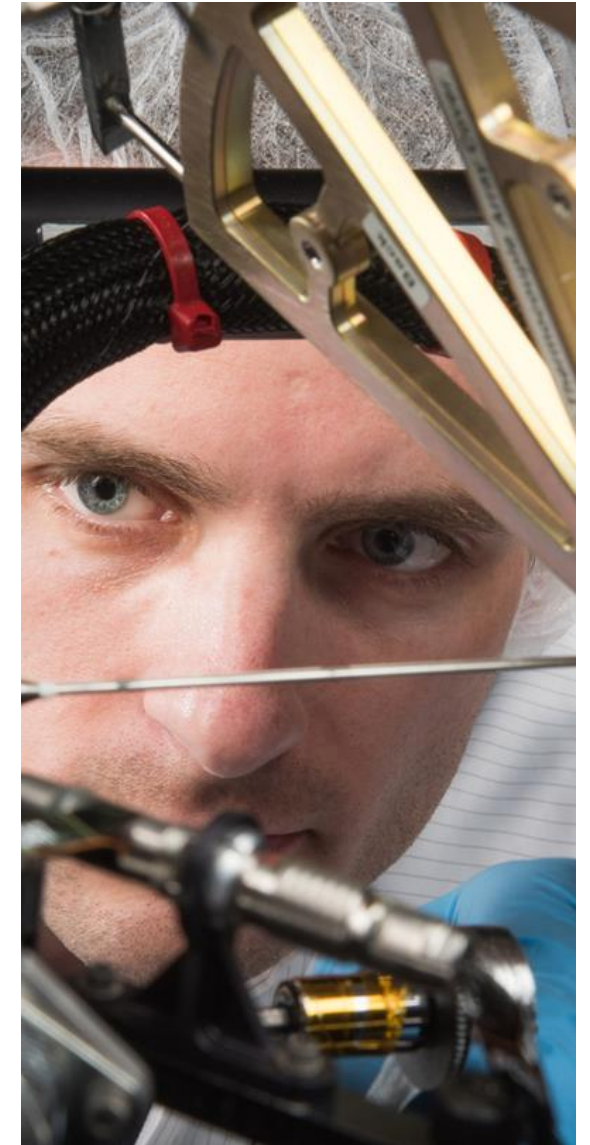
# Internal Facilities





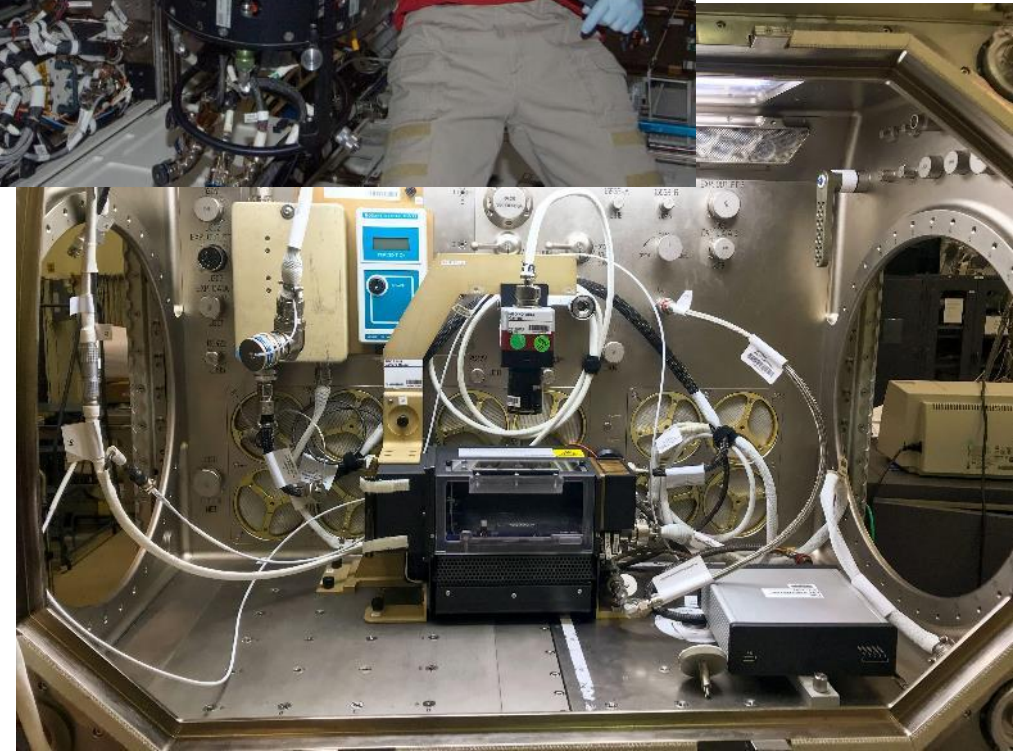
# Physical Sciences Facilities

- **Combustion:** Solid, liquid, and gaseous contained combustion with characterization suite
- **Fluids:** Boiling, condensation, complex fluids, magnetic fluids, rheology, flow chemistry
- **Materials Science:** Furnaces, crystallization (organic and inorganic), additive manufacturing
- **Quantum Physics:** Cold Atom Lab, external platform for quantum sensing and communications
- **Characterization:** Optical and fluorescence microscopy, SEM, cameras
- **General Purpose Labware:** Glovebox, vortexer
- **Customizable Hardware:** Cubelabs and other modular options



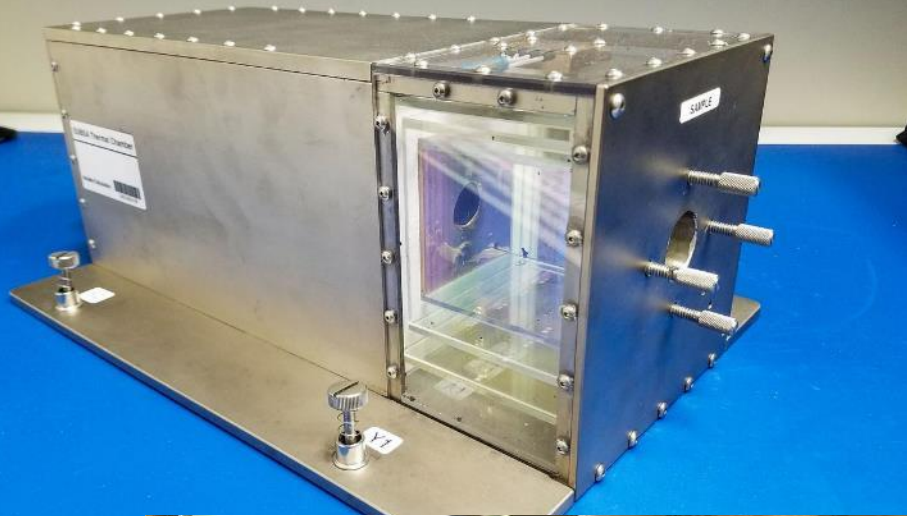
# Combustion Facilities

- The Combustion Integrated Rack (CIR) is a facility that enables combustion research on the ISS. There are several inserts that have been developed for solid, liquid, and gaseous combustion (e.g. SoFIE and ACME).
- The Burning and Suppression of Solids (BASS) hardware can support the burning of solid fuel samples with forced flow.
- Both CIR and BASS were developed at NASA Glenn Research Center and are supported by ZIN Technologies



# Furnaces

- PFMI – max temperature 130 °C – operated by Techshot/Redwire
- SUBSA – max temperature 850 °C – operated by Techshot/Redwire
- Low Gradient Furnace/Solid Quenching Furnace – max temperature ~1200 °C – operated jointly by NASA MSFC/ESA
- Levitation furnaces ELF and EML – max temperature 2000-2100 °C – operated by JAXA and ESA respectively
- Several other options recently validated or in development





# Multipurpose Facilities

- The Nanoracks NanoLab modules, Space Tango TangoLabs, and other multipurpose facilities enable a broad range of experiments. These modules are highly customizable and have supported tissue engineering, fluid physics, material science, and flow chemistry experiments.



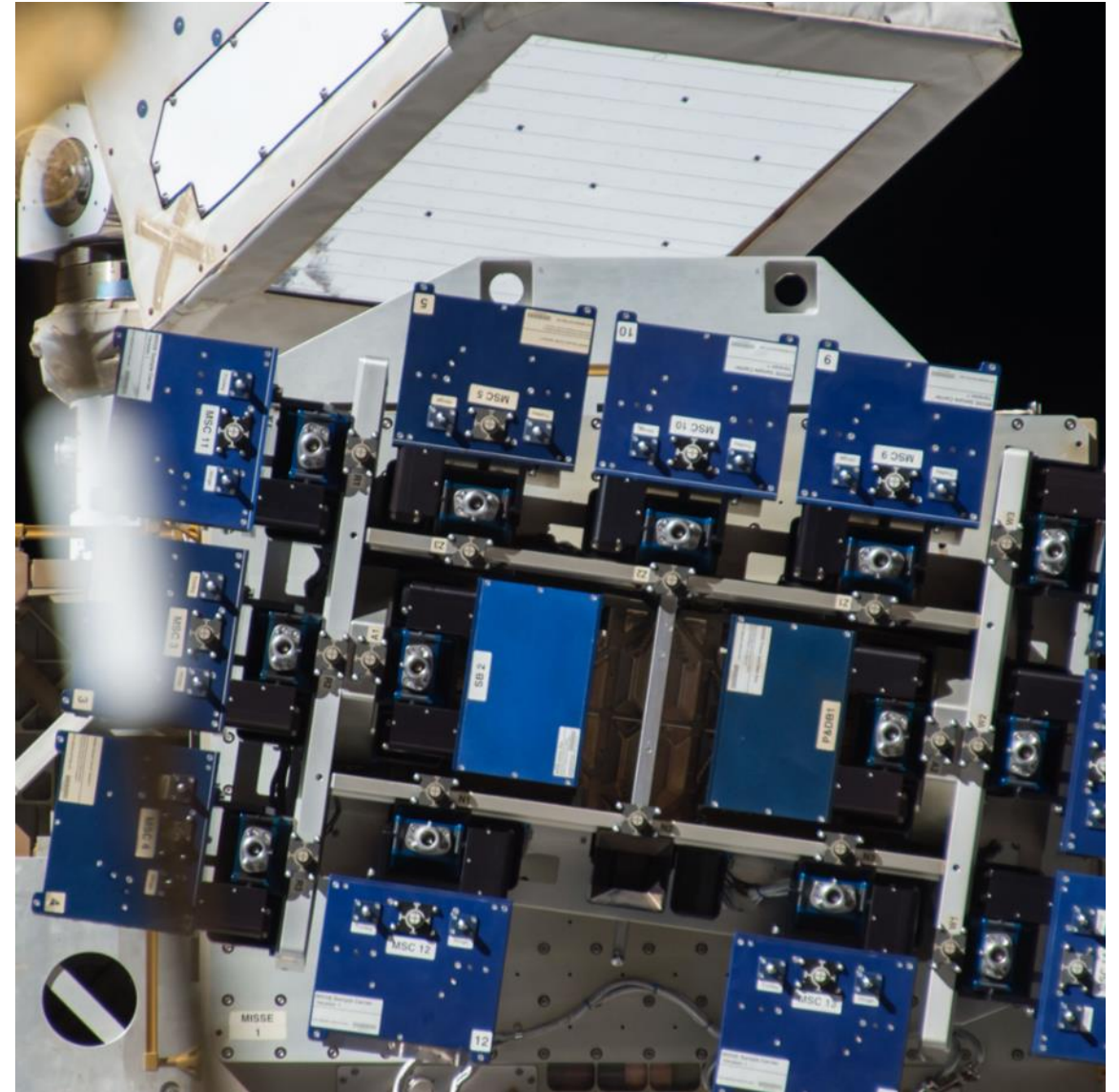
# Multiuser Characterization Facilities

- Optical and fluorescence microscopy - KEyence Research Microscope Testbed (KERMIT) operated by Leidos
- Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) – Mochii owned/operated by Voxa



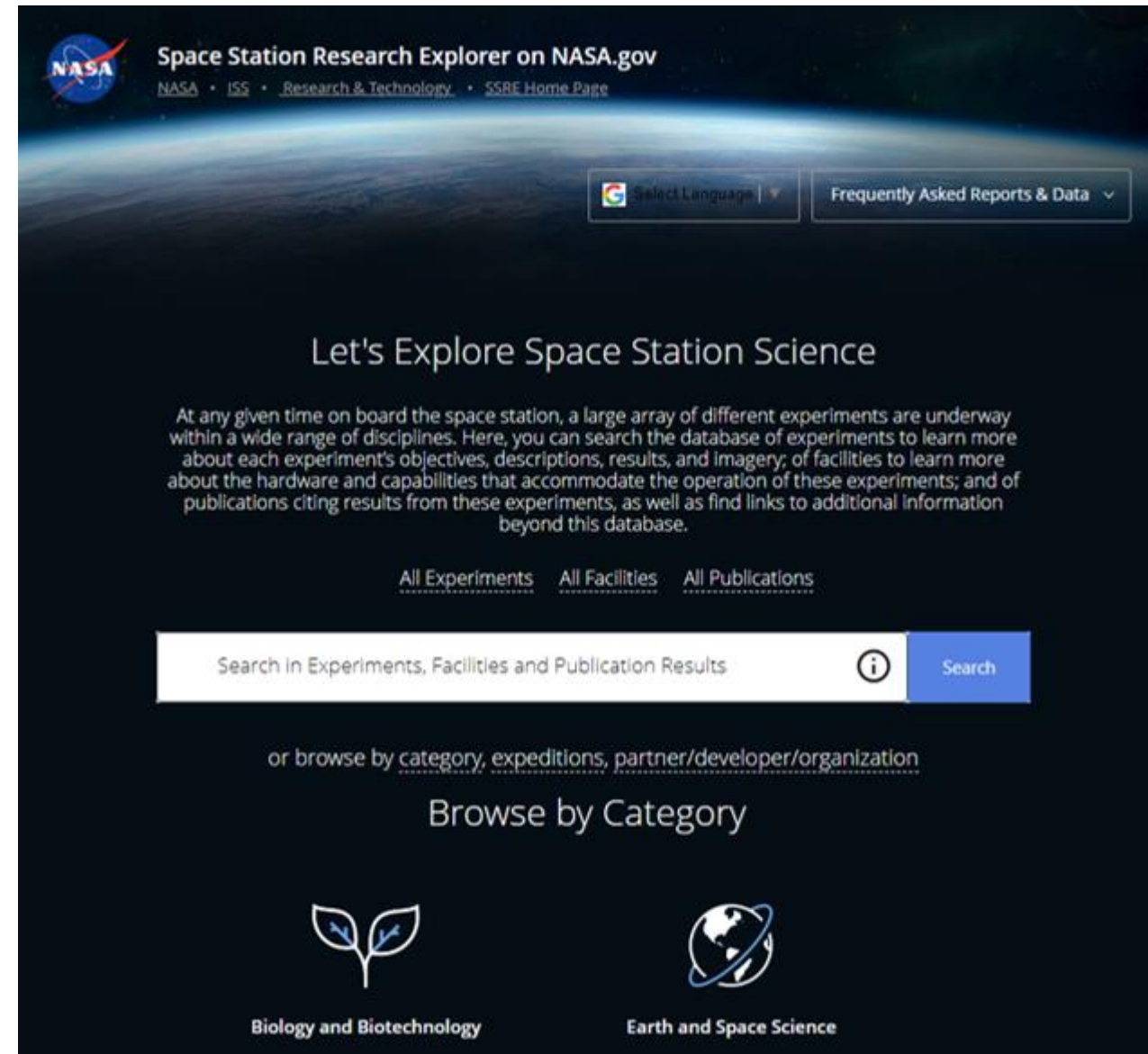
# External Facilities

- **Satellite Launching Capabilities:** CubeSats and SmallSats
- **Exposure Platforms:** Material space exposure, device testing, communications
- **Earth Observation and Remote Sensing:** Cameras, hyperspectral imagers, spectrophotometers



# Additional Facility Resources

- NASA Space Station Research Explorer website
  - [https://www.nasa.gov/mission\\_pages/station/research/experiments/explorer/index.html](https://www.nasa.gov/mission_pages/station/research/experiments/explorer/index.html)
- ISS National Lab Implementation Partners
  - <https://www.issnationallab.org/implementation-partners/>
- ISS National Lab IP Portal
  - [Ops@ISSNationalLab.org](https://Ops@ISSNationalLab.org)



Space Station Research Explorer on NASA.gov  
NASA · ISS · Research & Technology · SSRE Home Page

Select Language | Frequently Asked Reports & Data

## Let's Explore Space Station Science


At any given time on board the space station, a large array of different experiments are underway within a wide range of disciplines. Here, you can search the database of experiments to learn more about each experiment's objectives, descriptions, results, and imagery; of facilities to learn more about the hardware and capabilities that accommodate the operation of these experiments; and of publications citing results from these experiments, as well as find links to additional information beyond this database.


[All Experiments](#) [All Facilities](#) [All Publications](#)

Search in Experiments, Facilities and Publication Results Search

or browse by [category](#), [expeditions](#), [partner/developer/organization](#)

### Browse by Category

 **Biology and Biotechnology**

 **Earth and Space Science**







# UPWARD

MAGAZINE OF THE ISS NATIONAL LAB | [ISSNATIONALLAB.ORG/UPWARD](http://ISSNATIONALLAB.ORG/UPWARD) | FEBRUARY 2023

FUELING THE LOW  
EARTH ORBIT ECONOMY  
ORBIT FAB'S GAS STATIONS IN SPACE

ON PAGE 2



VOLUME  
6  
ISSUE  
1

VIEW FROM THE CUPOLA  
AMELIA SMITH,  
UPWARD MANAGING  
EDITOR

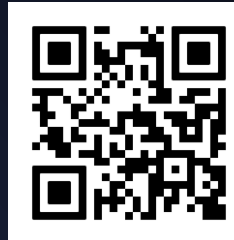
MIGHTY MICE TO THE  
RESCUE

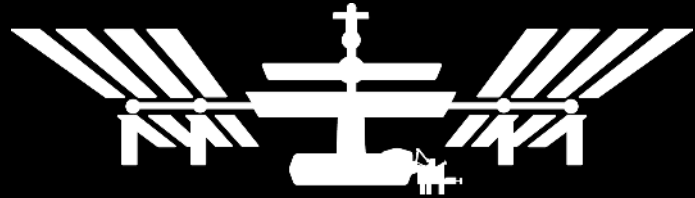
SPACE CRYSTALS AND  
THE SEARCH FOR A  
CANCER CURE



ISS NATIONAL LABORATORY

Magazine of the ISS National Lab  
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research-on-the-iss/solicitations/](https://www.issnationallab.org/research-on-the-iss/solicitations/)

**Rreeves@ISSNationalLab.org**



SpaceX



# THANK YOU

Discover the unique advantages of research in microgravity with the ISS National Lab.



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All images courtesy of NASA or the ISS National Lab unless otherwise stated.



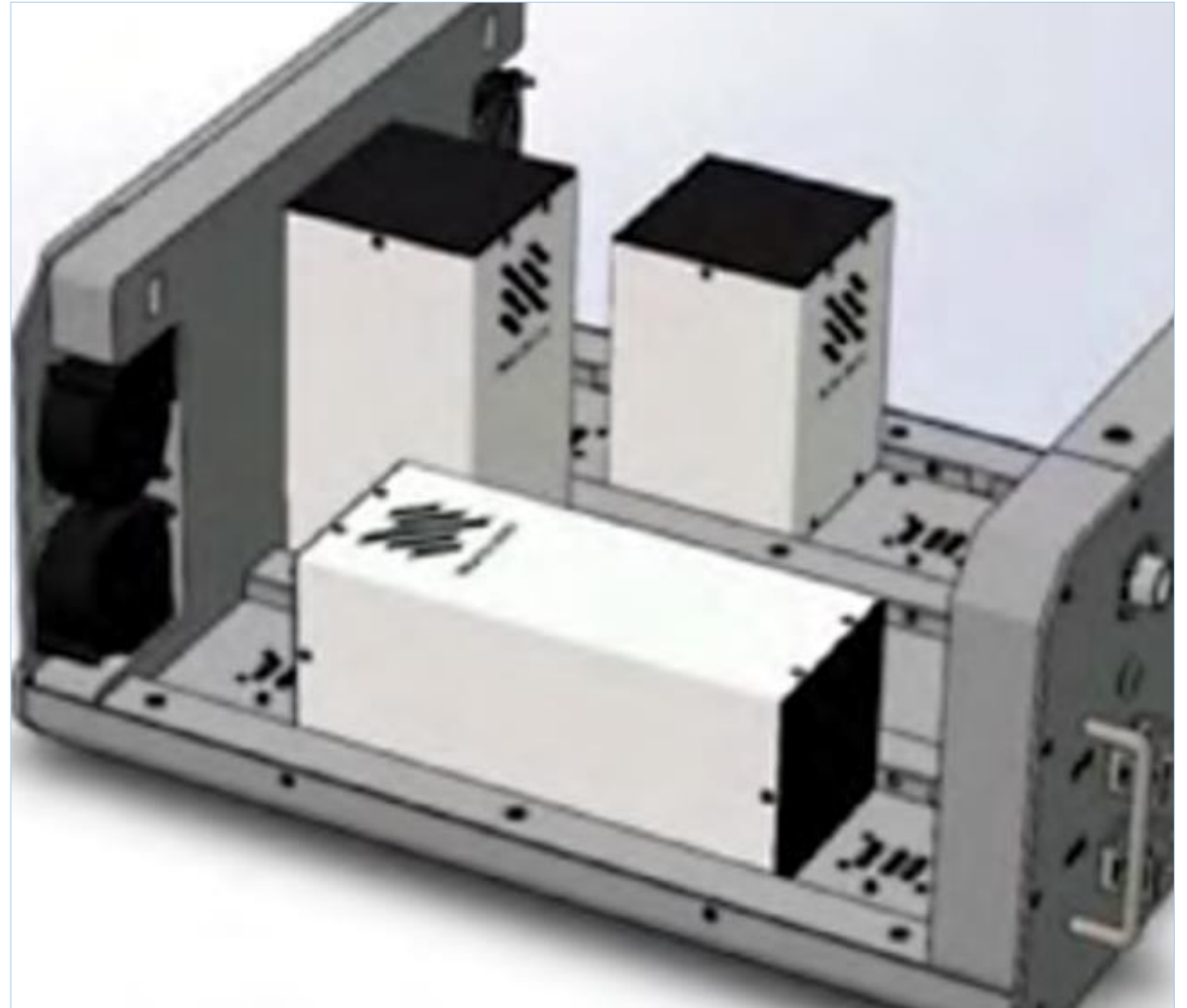
# Back-up Slides

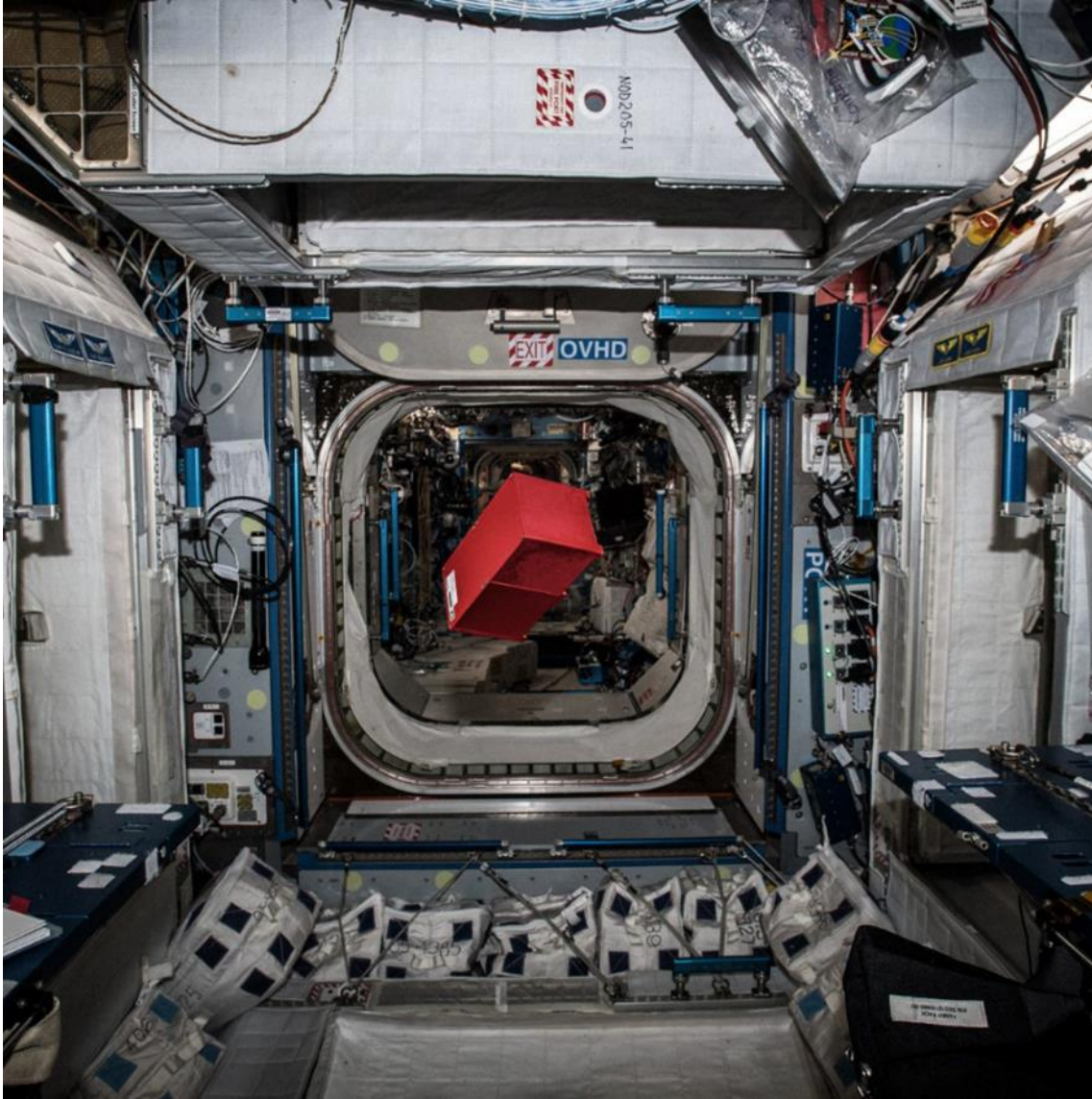
- Facilities
- Research Examples



# Nanode Platform

- The Nanoracks Nanode serves as an interface between individual Nanolab modules and the ISS.
- Nanode provides mechanical mounting points and electrical connections for power, data, and communication capabilities.





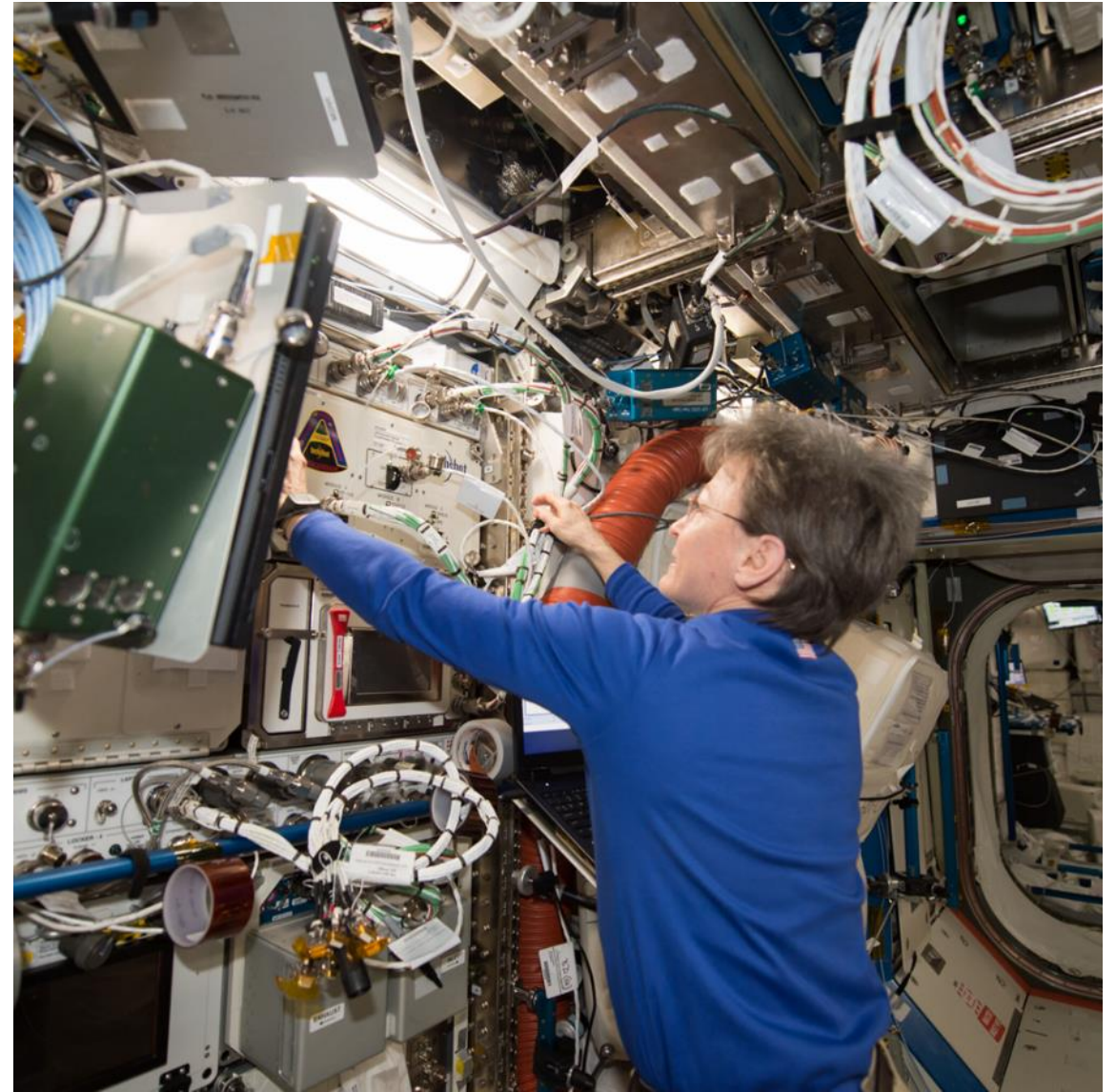
# TangoLabs

- The multipurpose Space Tango TangoLabs enable a broad range of experiments that examine how biological and physical systems respond to microgravity—with applications in tissue engineering, regenerative medicine, pharmaceutical development, biofuels, materials science, and education.



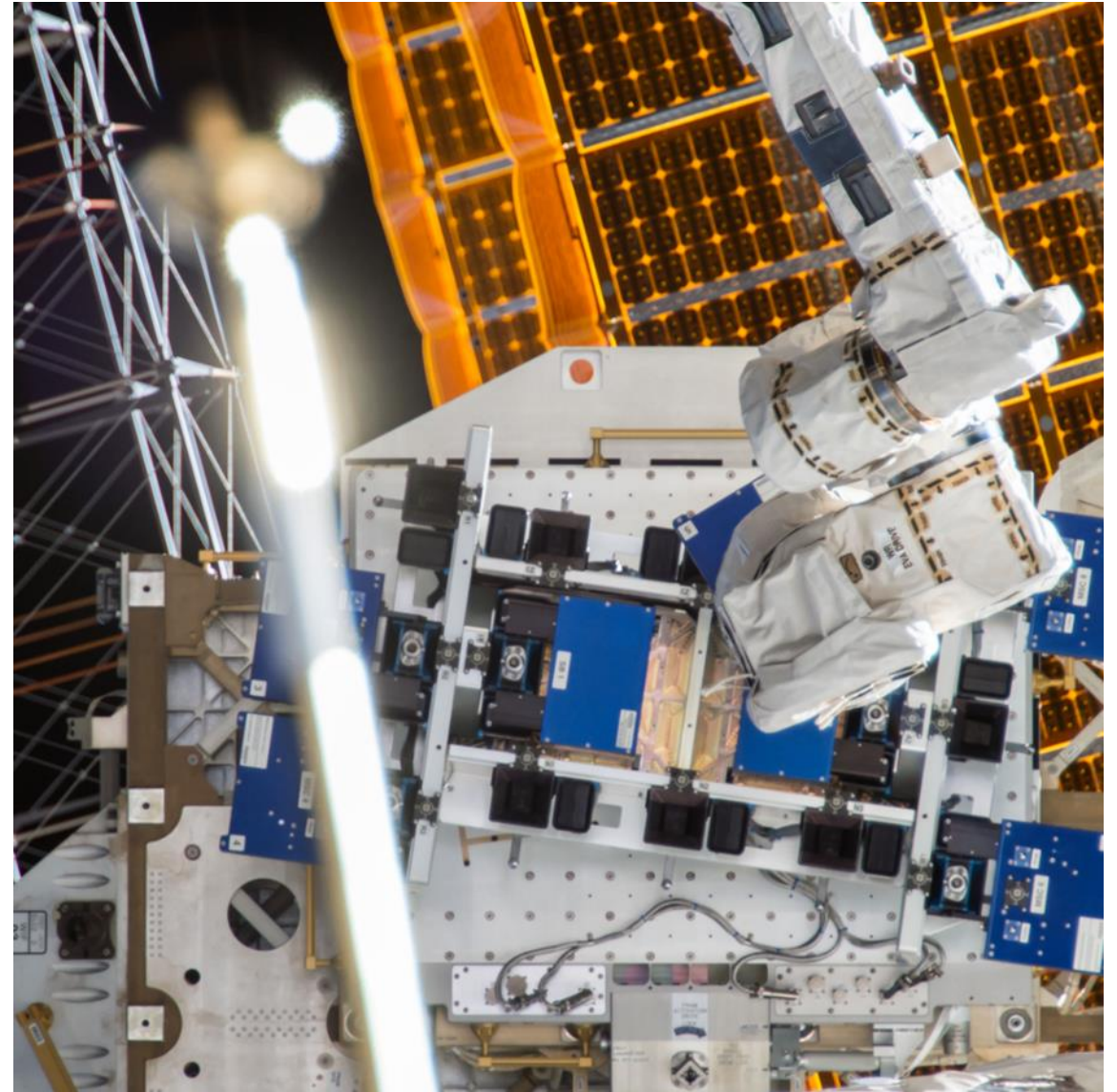
# Advanced Space Experiment Processor (ADSEP)

- Redwire's ADSEP "is a single middeck locker processing facility designed to conduct life and physical-science research. This processor is fully automated and has multi-use applications.



# Materials ISS Experiment Flight Facility (MISSE-FF)

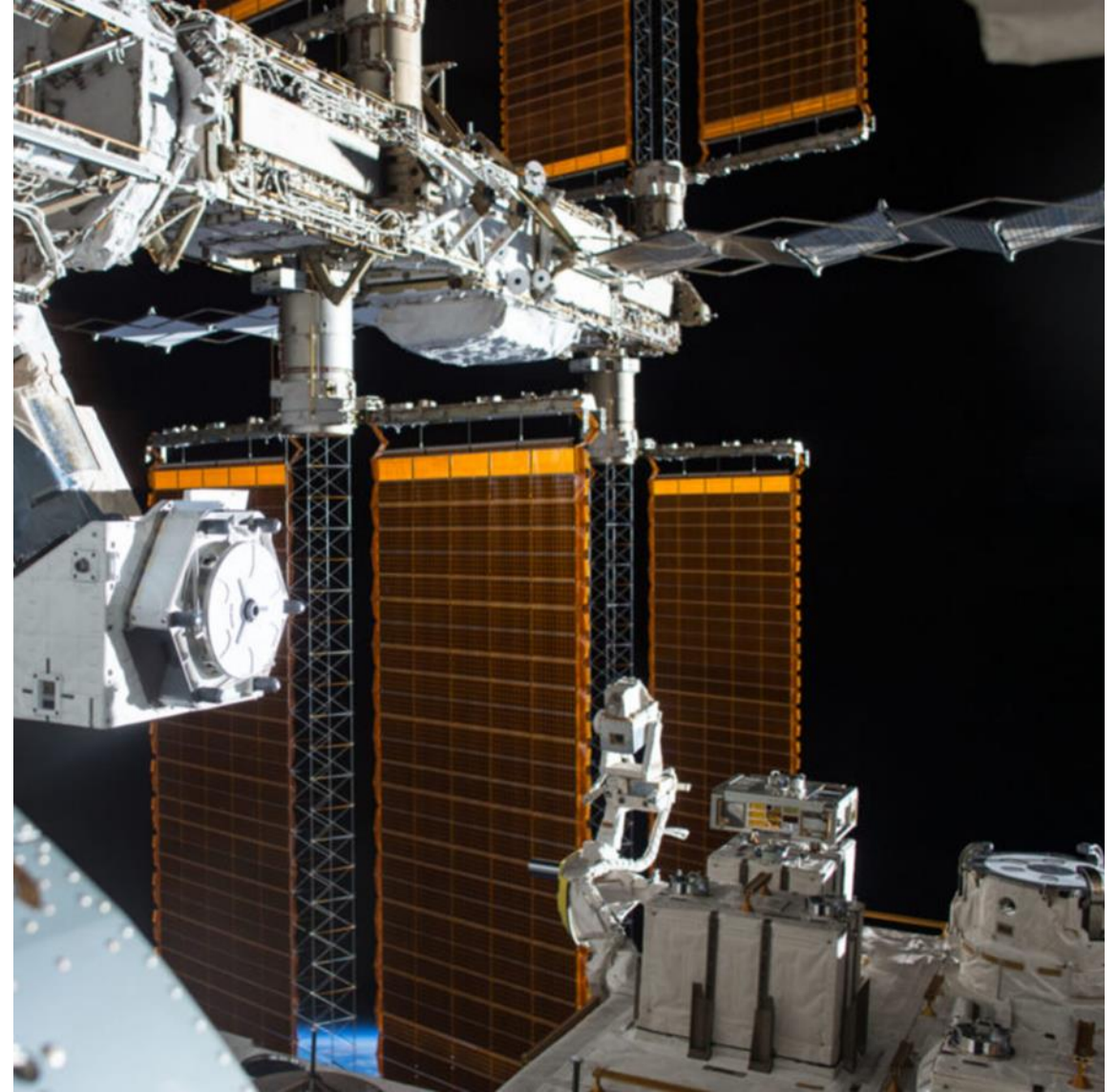
- The Aegis Aerospace MISSE-FF is a materials-science and component-testing platform on the ISS exterior.
- MISSE-FF allows researchers to test how materials react when exposed to extreme conditions in LEO, including ultraviolet radiation, atomic oxygen, ionizing radiation, ultrahigh vacuum, charged particles, thermal cycles, and more.

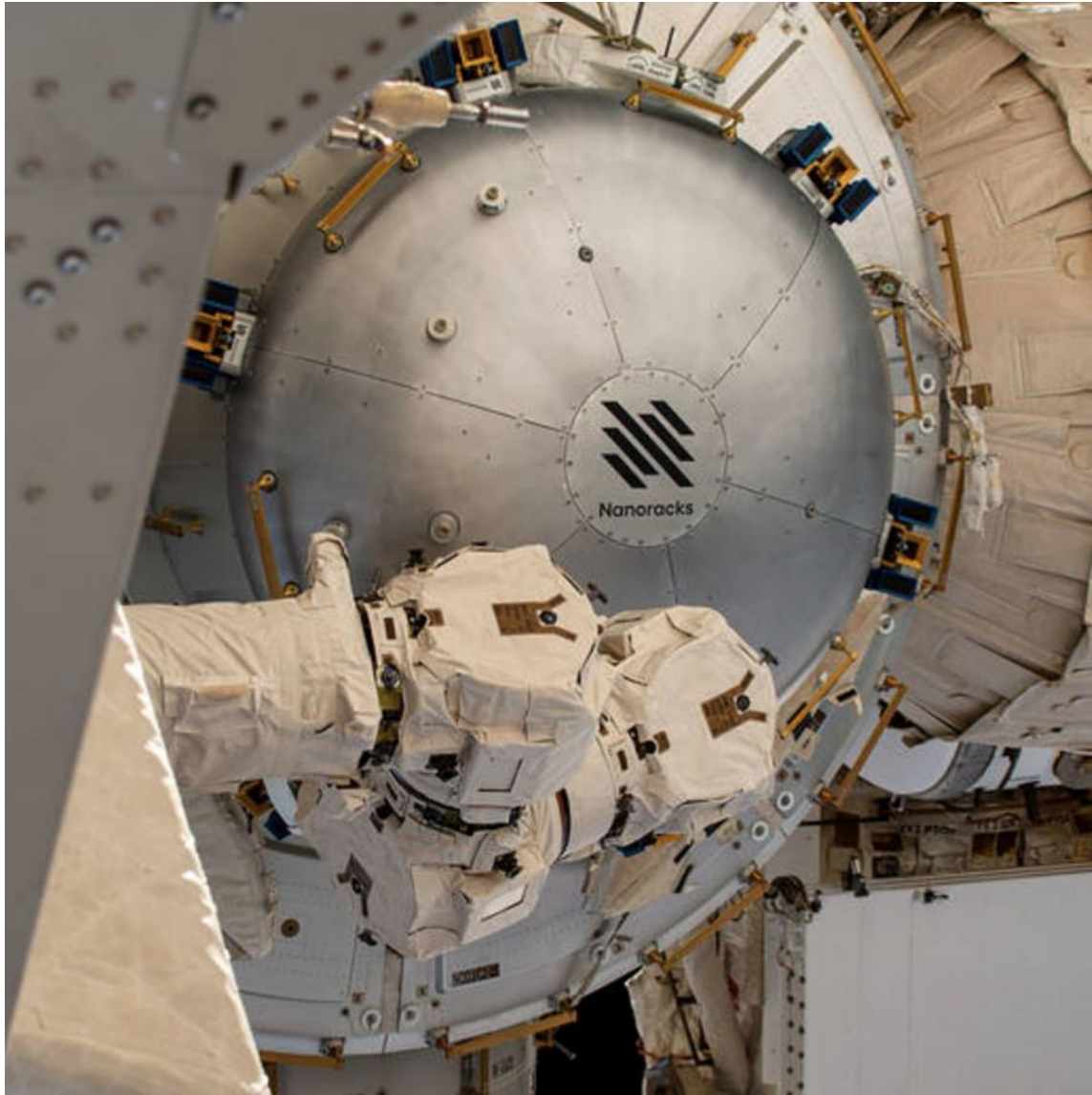




# Nanoracks External Platform (NREP)

- NREP is a payload hosting platform on the exterior of the ISS that provides power, communication, and operations to payloads.
- NREP can be used for testing in the harsh space environment, technology demonstrations, and Earth observation.





# Bishop Airlock

- The Nanoracks Bishop Airlock enables the transfer of payloads between the interior and exterior of the ISS. It can also deploy satellites, serve as a mount for Earth-imaging sensors, and house payloads for external exposure.
- The Bishop Airlock is about five times larger in volume than the JAXA airlock, accommodating satellites of up to 150 kilograms.



# Space Station Integrated Kinetic Launcher for Orbital Payload Systems (SSIKLOPS)

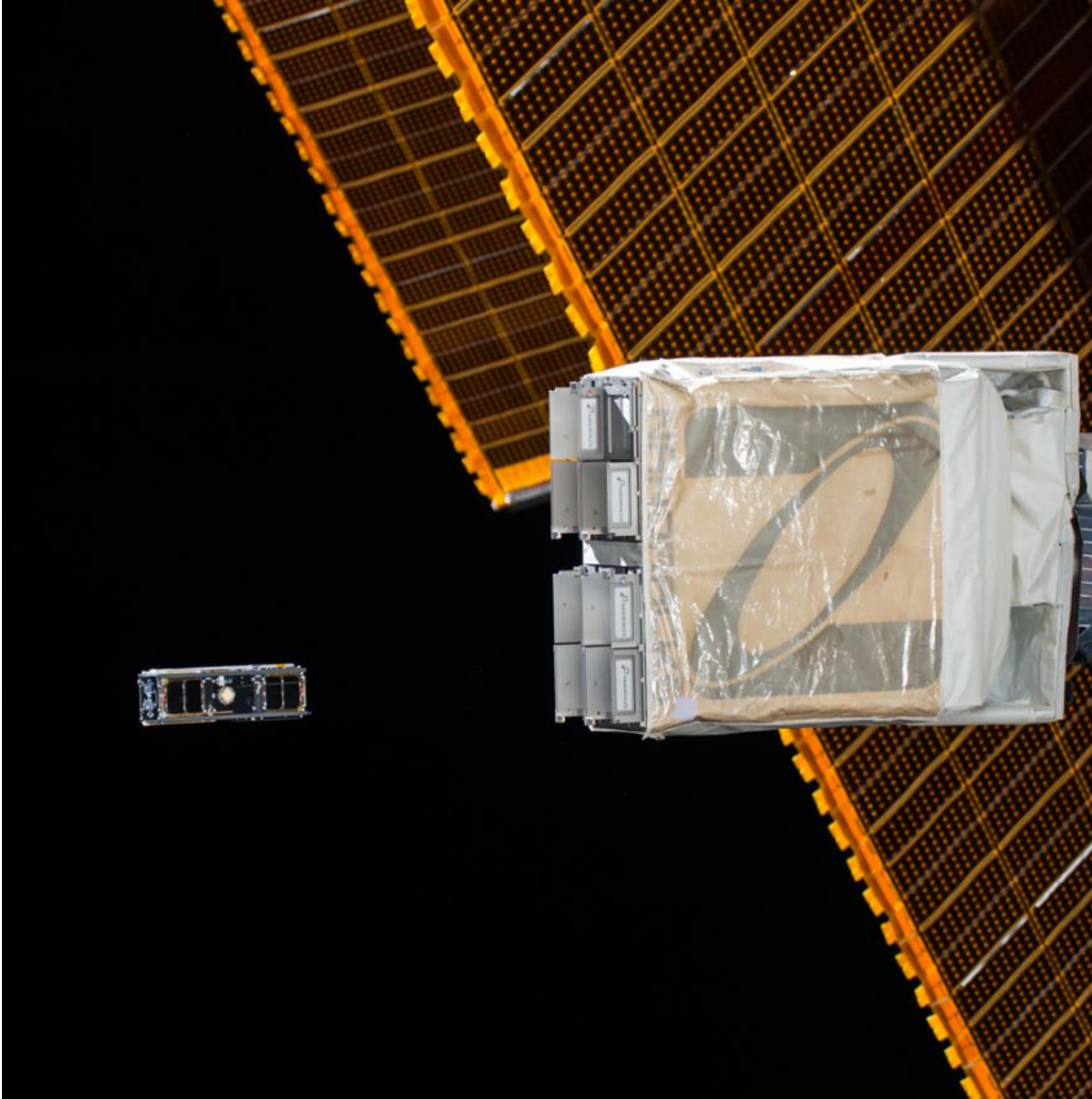
- Craig Technologies' SSIKLOPS platform robotically deploys satellites from the ISS.
- SSIKLOPS can be used to deploy satellites with a mass up to 110 kg and can accommodate satellites with uncommon shapes.



# Nanoracks Kaber Microsat Deployer (KABER)

- Nanoracks' KABER is a reusable system that enables microsatellite deployment from the ISS.





# CubeSat Deployer (NRCSD)

- The Nanoracks NRCSD is the first commercial SmallSat deployer on the ISS that mechanizes deployment, maximizing the capabilities of every airlock deployment cycle.





# Fluids Integrated Rack (FIR)

- The FIR is a modular facility that enables fluid physics research on the ISS.
- The FIR can host payloads in many areas, such as multiphase flow, boiling heat transfer, colloids, gels, wetting and capillary action, and liquid and vapor evaporation and condensation.

