



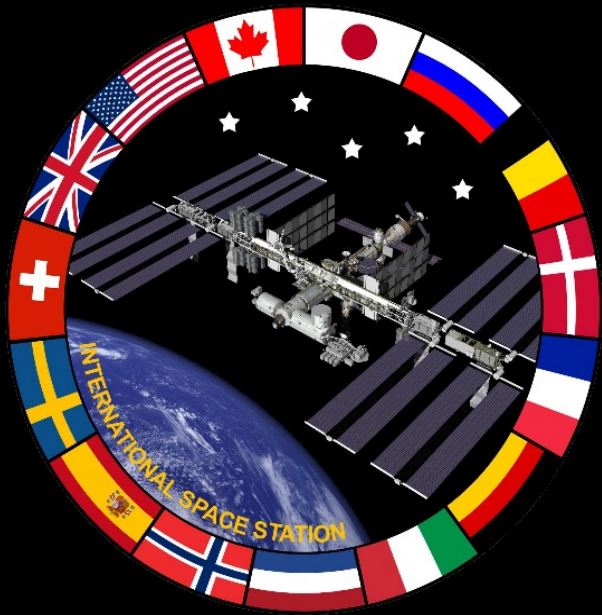
International Space Station Status

Robyn Gatens

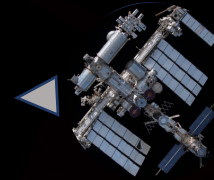
International Space Station Director
Space Operations Missions Directorate

April 25, 2024

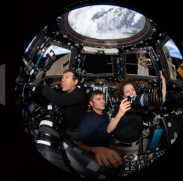
Agenda



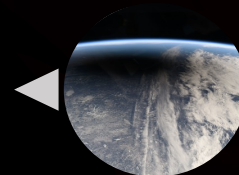
ISS Increment Overview



ISS Operational Status



Utilization Highlights



LEO Transition

ISS Mission Goals – The Decade of Results

Enable Deep Space Exploration

Validate Exploration Technologies and Reduce Human Health Risks

26 NASA tech demos initiated since 2018
~20 human health risks continuing to be characterized and countermeasures developed

Over 500 payloads have flown through the ISS National Lab; 75% from the **commercial** sector
\$1.8 billion of capital raised by startups post-flight
>20 In-Space Production Applications Awards to date
2 Private Astronaut Missions

Foster Commercial Space Industry

In partnership with Commercial LEO Office
Incubate in-space manufacturing, support commercial LEO facilities and customers

Conduct Research to Benefit Humanity

Life-saving medical research & applications, understanding climate change, sharing discoveries with all

> 3900 investigations
> 5300 investigators represented
> 4000 scientific results publications
~4.6 million images of Earth captured

Involves **100,000+** people at **500** contractor facilities in **37** U.S. states and **16** countries
>10 million student activities in 2023
18 million people follow social media accounts

Inspire Humankind

Broaden reach of space benefits, engage public, create diverse future STEM workforce

Enable International Collaboration

Maintain & expand international partnerships, set norms & standards

~more than 2000 international-led investigations through Expedition 69
117 countries/areas with ISS research and education participation
1st ISS increment UAE astronaut

>23 years continuous presence in space
>267 cargo and crew missions to ISS

Provide a Continuous LEO Infrastructure and Destination

Ensure continuous human presence in LEO - no gap; provide destination for crew & cargo transportation

ISS Increment Overview

Increment 71 Overview



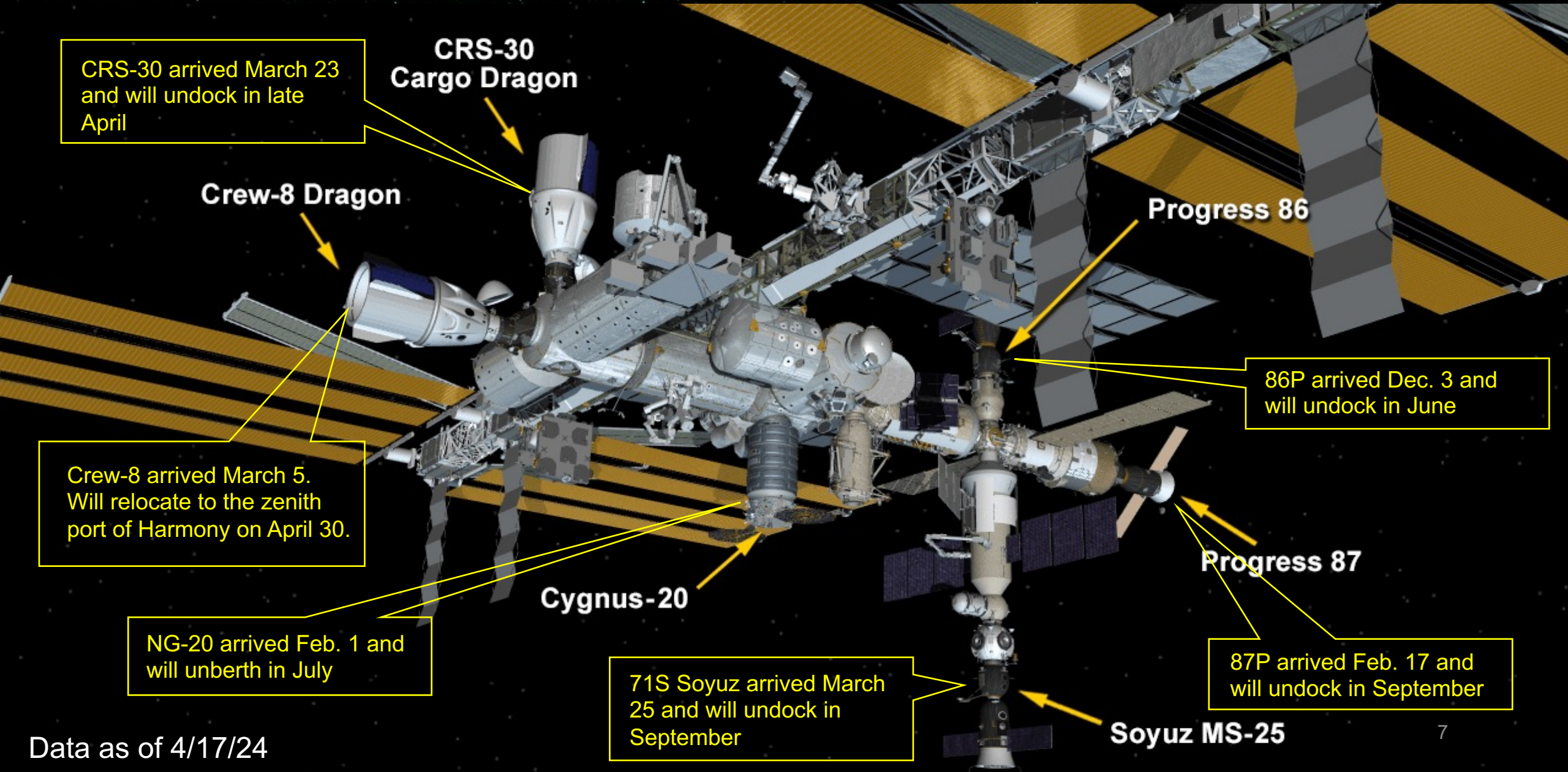
- Soyuz 70S Undock
- SpaceX CRS-30 Undock
- SpaceX Crew-8 Relocate (Enables CFT docking)
- RS EVA 62
- Boeing Crew Flight Test (CFT)
- Progress 86 Undock
- Progress 88 Launch/Dock
- US EVAs (RFG, ERDC R&R, IROSA prep)
- Northrop Grumman CRS-20 Unberth
- Northrop Grumman CRS-21 Launch
- Progress 87P Undock
- Progress 89P Launch/Dock
- SpaceX Crew-9 Launch/Dock
- SpaceX Crew-8 Undock
- Soyuz 72S Launch/Dock
- Soyuz 71S Undock



Flight Engineers Alexander Grebenkin (Roscosmos) Tracy Caldwell-Dyson (NASA), Michael Barratt (NASA), Nikolai Chub (Roscosmos), Matt Dominick (NASA), Commander Oleg Kononenko (Roscosmos), Jeanette Epps (NASA) .

ISS Operational Status

Current Configuration



CRS-30 arrived March 23 and will undock in late April

**CRS-30
Cargo Dragon**

Crew-8 Dragon

Progress 86

86P arrived Dec. 3 and will undock in June

Crew-8 arrived March 5. Will relocate to the zenith port of Harmony on April 30.

Progress 87

87P arrived Feb. 17 and will undock in September

NG-20 arrived Feb. 1 and will unberth in July

Cygnus-20

71S Soyuz arrived March 25 and will undock in September

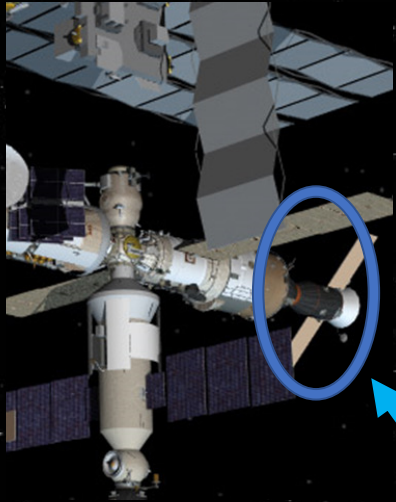
Soyuz MS-25

Recent/Upcoming Spacewalks (EVAs)



- **RS EVAs – No Russian EVAs since last NAC report in Nov**
 - RS EVA #61 – MLM Radiator isolation, payload deploy (Oct 25)
 - RS EVA #62 planned April 25
- **U.S. EVA 89 – Completed Nov 1**
 - SARJ lubrication, BGA survey, RFG removal deferred due to time constraints
- **U.S. EVA 90 – Radio Frequency Group (RFG) Retrieval– June 2024**
 - RFG retrieval
 - Swap sample collection of different surfaces with canisters which will be returned to ground for analysis
- **U.S. EVA 91 – Camera Port 9 (CP9) External High-Definition Camera (EHDC) R&R – June 2024**
- **U.S. EVA 92 – ISS Roll-Out Solar Array (IROSA) Prep 2A – June 2024**

ISS Significant Items of Interest



ISS Atmosphere Leak Location
(Aft end of Service Module)

- **Atmosphere Leak**

- PpK investigation has been ongoing since 2019
- The leak rate increased in February 2024 and has been monitored closely.
- Hatch closed when access to docked Progress not needed. Following pressurization and leak checks, hatch was opened April 8-9 to allow retrieval of consumables.

- **End-of-life Deorbit Planning**

- RFP released September 19 to develop US Deorbit Vehicle, proposals came in March 4, 2024; contract award targeted summer 2024

- **Debris Re-Entry impacts Florida home**

- Stanchion used to mount old batteries to HTV pallet survived re-entry and impacted home in Naples, FL
- NASA investigation determining cause of debris survival, which was not predicted by models.



Utilization Highlights

ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station

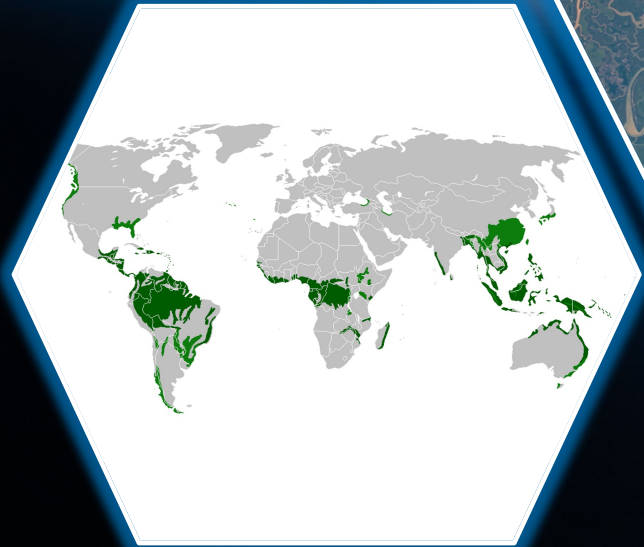
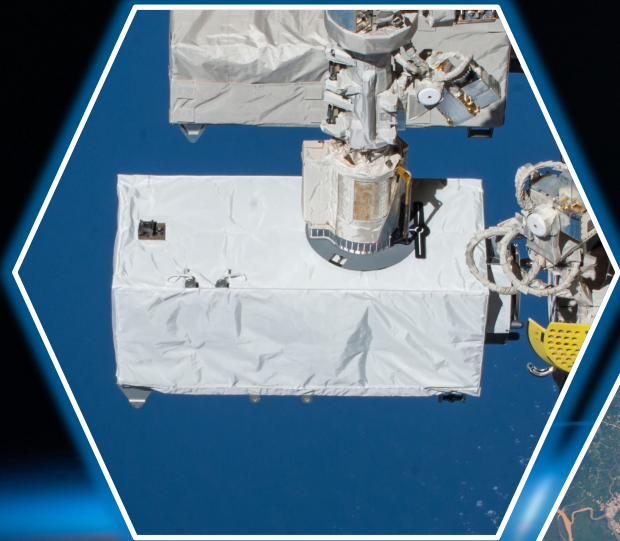
ECOSTRESS- NASA SMD



ECOSTRESS provides the first-ever high-resolution thermal infrared measurements of the surface of Earth from the International Space Station. These measurements enable ECOSTRESS to answer key questions related to water stress in plants and changes in climate.

Tropical Forests are Approaching Critical Temperatures

ECOSTRESS-NASA SMD



OVERVIEW

Due to climate change, average temperatures have increased 0.5 °C per decade in some tropical regions. This study is important in mitigating climate change impacts to rain forests, which are a primary source for oxygen production.

RESULTS

Data and simulated models show that metabolic functions for photosynthesis in tropical rainforests begins to fail beyond 46.7° C (114 ° F).

IMPACT

ECOSTRESS allows for frequent and detailed measurements of plant-water interaction. ECOSTRESS data can help sustain food production, ecosystems, and monitor the health of the planet.

Doughty, Christopher E., Keany, Jenna., Wiebe, Benjamin., Rey-Sanchez, Camilo., Carter, Kelsey., and others. "Tropical Forests are Approaching Critical Temperature Thresholds." *Nature*, 2023. doi: <https://doi.org/10.1038/s41586-023-06391-z>

Planning for Construction on the Lunar Surface

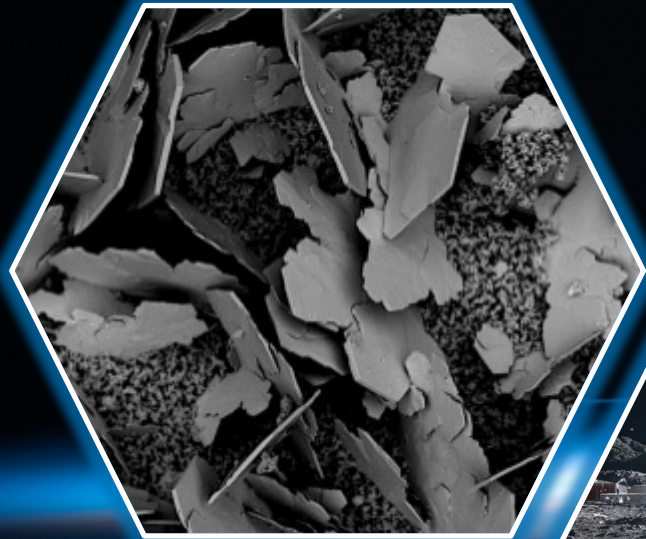
MICS (NASA BPS)



The Microgravity Investigation of Cement Solidification (MICS) experiment aims to better understand the process of cement solidification. Researchers use different cement pastes to describe hydration reaction and microstructure formation in a microgravity environment. Results could help develop concrete for extraterrestrial bodies and improve Earth-based cement.

Analyzing Microstructures of Cement Formed in Microgravity

MICS (NASA BPS)



OVERVIEW

As part of the human exploration roadmap, it is important to develop methods for civil engineering, construction, and *In Situ* manufacturing of industrial materials.

RESULTS

Researchers used artificial intelligence to create 3D models from image scans of cement samples formed on the ISS. This method allows for prediction of mechanical and physical properties that can only be adequately captured in 3D.

IMPACT

Exploration missions will require cost-effective infrastructure to protect astronauts and equipment. This research helps scientists understand how different building materials solidify in microgravity.

Saseendran, V., Yamamoto, N., Collins, P., Radlińska, A., Mueller, S., & Jackson, E. "Unlocking the Potential: Analyzing 3D Microstructures of Small-Scale Cement Samples from Space Using Deep Learning." *NPJ Microgravity*, 2024.

doi: <https://doi.org/10.1038/s41526-024-00349-9>

Mitigating Headward Fluid Shifts

Thigh Cuff- HRP



Researchers will test veno-constrictive thigh cuffs as a potential countermeasure for headward fluid shifts in both ground-based and spaceflight studies. This investigation could provide a preventative mechanism for Spaceflight Associated Neuro-ocular Syndrome (SANS).

International Space Station

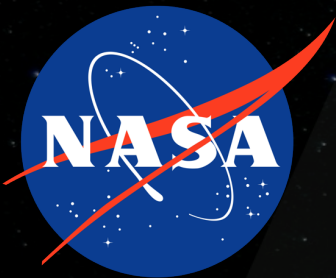
Science Instruments

Commercial Facility
 Earth Science
 Space Science
 Technology Demonstration



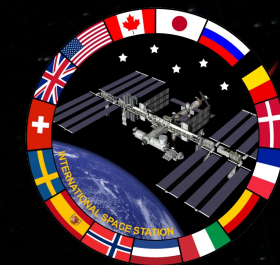
External Logistics Carriers – ELC-1, ELC-2, ELC-3
 External Stowage Platforms – ESP-3
 Alpha Magnetic Spectrometer
 Columbus External Payload Facility
 Kibo External Payload Facility

ISS National Laboratory
 NASA
 European Space Agency
 Japanese Aerospace Exploration Agency



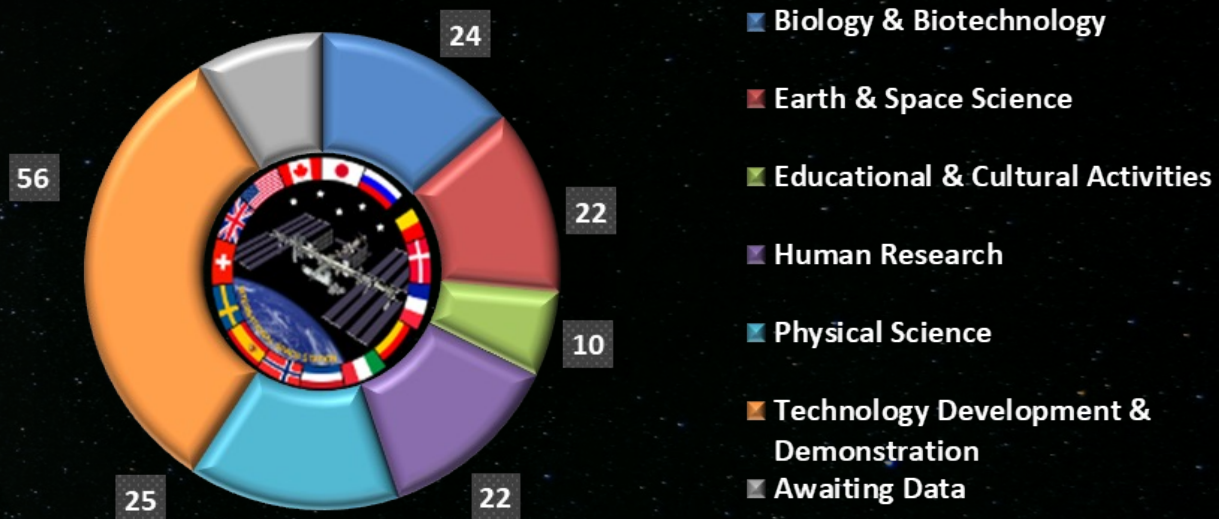
ISS Research Statistics

Working data as of January 31, 2024



Expedition 71 Research and Technology Investigations

Agency	New Investigations	Total Investigations
CSA	0	5
ESA	5	29
JAXA	6	22
NASA/U.S.	16	103
ROSCOSMOS	Awaiting Data	
TOTAL	27	159



Estimated Number of Investigations Expedition 0-70: 3930*

*Pending Post Increment Adjustments

Education on Station

STEMonstrations



UAE Collaborated on two STEMonstrations video products.

Eclipse



NASA Astronaut Alvin Drew joined NASA OSTEM, ISS National Lab, Story Time From Space, Space Foundation, and many others ISS Partners April 8 at the Dallas Arboretum and Botanical Garden for the eclipse.

In-Flight Education Downlinks



- 6 Education Downlinks
- Total in person audience reach 20,707
- Proposal period for In-Flight Education Downlinks Expedition 72 is now open through May 21, 2024

Conferences and Events



- ARISS 40th Anniversary Conference
- Space Exploration Conference for Educators
- National Science Teachers Association

Space Station Public Engagements

NASA launches new app to help stargazers spot the Space Station



DOWNLOAD THE ALL-NEW **SPOT THE STATION APP**



ISS National Lab Status (CASIS)



- Continuing to see more demand than resources available
- Igniting Innovations Solicitation full proposals have been received, selections will be announced Summer 2024
- Registration open for ISS Research and Development Conference in Boston, MA July 30th – August 1st
 - Early bird registration is open
- Relunched Upward Magazine
 - www.issnationallab.org/upward
- National Laboratory in LEO
 - ISS continuing to work on formal action from National Space Council to develop strategy for future National Lab in LEO
 - Internal NASA workshop to define strategy planned for May 6th and 7th
 - Groups from Federal Workshops have been meeting throughout the year to explore opportunities and programs for collaborative LEO research

LEO Transition

LEO Strategic Framework

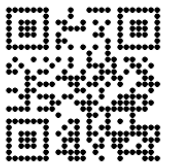
- Agency working on a LEO Strategic Framework, following a process similar to M2M strategy and objectives development
- Will include goals and objectives for LEO microgravity environment to be implemented through and beyond ISS transition to CLDs.
- Will outline benefits of microgravity research and operations in LEO, such as:
 - Scientific discoveries
 - Supporting deep space exploration
 - Enabling commercialization
 - Building a skilled workforce
 - Collaboration with International Partners
 - Inspiring future generations
- Agency will solicit input from stakeholders similar to M2M process

Resources

National Aeronautics and
Space Administration



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