

# EXPLORE HUMANS<sub>in</sub>SPACE

## INTERNATIONAL SPACE STATION



# EXPEDITION 65



Soyuz MS-12 Launch: April 23, 2021  
Landing: October, 2021



**AKIHIKO HOSHIDE (JAXA)**  
Commander

**Born:** Tokyo, Japan  
**Spaceflights:** STS-124, Exp 32/33  
**Bio:** <https://go.nasa.gov/3cmYQev>  
**Twitter:** @Aki\_Hoshide



**SHANE KIMBROUGH (NASA)**  
Flight Engineer

**Born:** Killeen, Texas  
**Spaceflights:** STS-126, Exp 49/50  
**Bio:** <https://go.nasa.gov/3srcdja>  
**Twitter:** @astro\_kimbrough



**MEGAN MCARTHUR (NASA)**  
Flight Engineer

**Born:** Honolulu, Hawaii  
**Spaceflights:** STS-125  
**Bio:** <https://go.nasa.gov/3ssq1dm>  
**Twitter:** @Astro\_Megan



**THOMAS PESQUET (ESA)**  
Flight Engineer

**Born:** Rouen, France  
**Spaceflights:** Exp 50/51  
**Bio:** <https://go.nasa.gov/3lZ02rG>  
**Twitter:** @Thom\_astro

Soyuz MS-11 Launch: April 9, 2021  
Landing: October 17, 2021



**MARK VANDE HEI (NASA)**  
Flight Engineer

**Born:** Spokane, Washington  
**Spaceflights:** Exp 53/54  
**Bio:** <https://go.nasa.gov/2vzY0a8>  
**Twitter:** @Astro\_Sabot



**OLEG NOVITSKIY (Roscosmos)**  
Flight Engineer

**Born:** Cherven, Belarus  
**Spaceflights:** Exp 33/34, 50/51  
**Bio:** <https://go.nasa.gov/3crxMuJ>

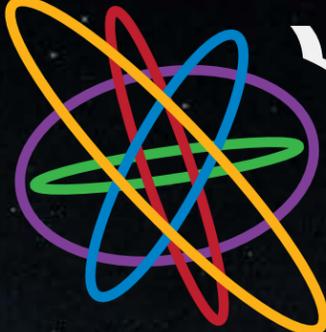


**PYOTR DUBROV (Roscosmos)**  
Flight Engineer

**Born:** Khabarovsk, Russia  
**Spaceflights:** First flight

EXPEDITION  
**65**

Expedition 65 began in April 2021 and ends in October 2021. This expedition will include research investigations focused on biology, Earth science, human research, physical sciences and technology development, providing the foundation for continuing human spaceflight beyond low-Earth orbit to the Moon and Mars.



# SCIENCE ON THE



During Expedition 65, researchers will use tissue chips to study changes in the human body caused by microgravity, conduct research on regolith simulants in the Hermes research facility, test free-flying robots inside the station and study the complex dynamics of the Earth's atmospheric carbon cycle using the Orbiting Carbon Observatory 3 space instrument.

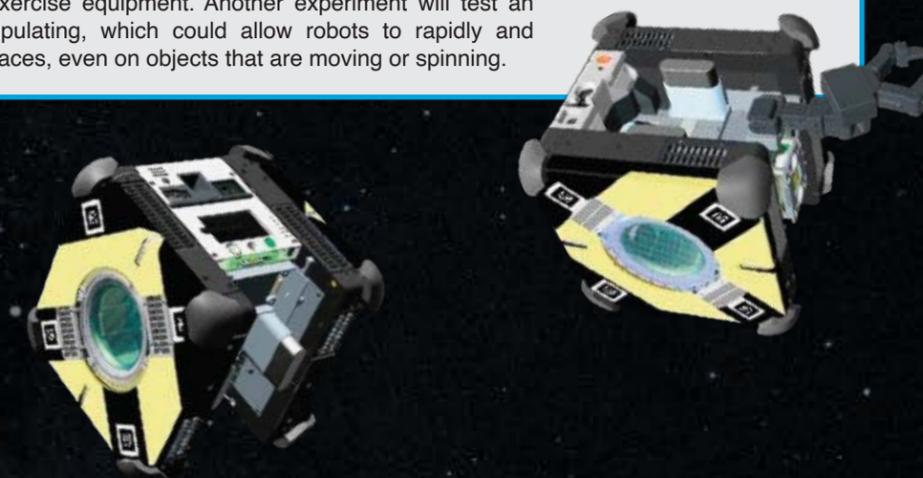
## Tissue Chips

A cutting-edge system for research is heading to the International Space Station, and could help save time and money for pharmaceutical development. Researchers are using a new technology called "tissue chips" that could offer more insights into predicting the effectiveness of potential pharmaceuticals in humans. Tissue chips are bioengineered devices that mimic the function of human organs. Fluid that mimics blood can be passed through the chip to simulate blood flow, and can include drugs or toxins. The effects on the cells can then be observed. Exposing tissue chips to microgravity provides additional research benefits. In microgravity, changes occur in human health and human cells that resemble accelerated aging and disease processes. This allows scientists to make observations over the course of a few weeks that might take months in a laboratory on Earth. This research may also help us advance tissue chip technologies for more efficient pharmaceutical testing on Earth, and could be used for understanding how diseases develop in healthy tissues.



## Astrobee

Astrobee is NASA's next generation of free-flying robots aboard the International Space Station. The self-contained, cube-shaped robots are designed to help scientists and engineers develop and test technologies for use in microgravity to assist astronauts with routine chores, and give ground controllers additional eyes and ears on the space station. The autonomous robots, powered by fans and vision-based navigation, perform crew monitoring, sampling, logistics management, and accommodate up to three investigations. They are operated remotely from the ground. Two of the first investigations being tested on the Astrobee robots involve monitoring the acoustic environment using an audio sensor on the free-flying robot, which could detect anomalies in the sound of components inside a machine, providing autonomous monitoring of the health of infrastructure such as life support and exercise equipment. Another experiment will test an adhesive for robotic grasping and manipulating, which could allow robots to rapidly and controllably attach to and detach from surfaces, even on objects that are moving or spinning.



## Hermes

Hermes is an experimental microgravity facility that enables science experiments, microgravity exposure testing, testing of engineering components, testing of CubeSats, concept trials, and any payloads that fit within the Hermes design and operations constraints. It is open to any investigation that benefits from microgravity exposure. Hermes is a microgravity facility for regolith research. Future missions, crewed and robotic, that visit small bodies should know how to interact with a loosely-aggregated surface. Best way to sample material? How do you set anchors? How do you safely move and process material for "living off the land"? What materials properties should you expect for the surface? How much will fly free when disturbed? Experiments housed in Hermes could help answer these questions.



## Orbiting Carbon Observatory 3

The Orbiting Carbon Observatory 3 (OCO-3) is a space instrument designed to investigate important questions about the distribution of carbon dioxide on Earth as it relates to growing urban populations and changing patterns of fossil fuel combustion. OCO-3 will be installed on the Japanese Experiment Module-Exposed Facility and will observe the complex dynamics of the Earth's atmospheric carbon cycle. OCO-3 continues the global carbon dioxide record started by OCO-2, but adds complementary information with sampling at all sunlit hours, a unique feature of sampling from orbiting laboratory. In addition to global sampling, OCO-3 capabilities allow for targeted local mapping of emissions hotspots.

Understanding carbon sources and sinks can help in forecasting and reducing the long term risks of increased atmospheric heat retention. OCO-3 also demonstrates how space platforms can be used to study the Earth's atmosphere and its effects on climate. Increasing demand for geospatial data means increasing use of spacecraft and space hardware for generating data.



The International Space Station Expedition 65 patch depicts the space station as it appears during the time the crew will be onboard. The space station flying over the Earth represents the overall reason for having a space station; to benefit the world through scientific research and international cooperation in space. When this expedition begins, the space station will have provided continued human presence in space for more than twenty years. Blue, the background color of the patch, symbolizes reliability. The stars represent the crew onboard the space station, as well as mission control centers located on three continents. Those stars, in that field of blue, also symbolize the thousands of space workers throughout the space station partnership who continue to contribute to the success of our International Space Station.

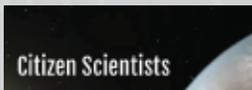


**Space Station Research Explorer** At any given time on board the space station, a large array of different experiments are underway within a wide range of disciplines. Here, you can search the database of experiments to learn more about each experiment's objectives, descriptions, results, and imagery, as well as find links to additional information beyond this database.

[https://www.nasa.gov/mission\\_pages/station/research/experiments/explorer/](https://www.nasa.gov/mission_pages/station/research/experiments/explorer/)

**STEMonstrations** STEMonstrations fit the need for students and educators to have high quality, informative videos that cover the wide range of topics outlined in the Next Generation Science Standards (NGSS). Astronauts film videos instructing students in biology, chemistry, physics, Earth science, and space science. The videos align to a "Try This" one- to two-page lesson plan where students and educators can make connections to topics they are working on in the classroom.

<https://www.nasa.gov/stemonstrations>



**Citizen Science Projects** For years, solar system and exploration have brought excitement and inspiration to people of all ages. This is especially true now, with new opportunities for students and citizen scientists to directly participate in expanding our knowledge of the solar system. Amateur astronomers and students with wide ranges of equipment and expertise are making valuable contributions to our growing understanding of our nearest celestial neighbor. Learn how you can become part of the adventure!

<https://science.nasa.gov/citizenscientists>

**Sally Ride EarthKAM** Sally Ride EarthKAM (Earth Knowledge Acquired by Middle school students) is a NASA educational outreach program that enables students, teachers, and the public to learn about Earth from the unique perspective of space. Students can "program" the camera to take pictures of the Earth from space and study the images they receive.

<https://www.earthkam.org/>

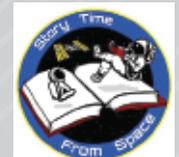


**Spot the Station** Watch the International Space Station pass overhead from several thousand worldwide locations. It is the third brightest object in the sky and easy to spot if you know when to look up. Visible to the naked eye, it looks like a fast-moving plane only much higher and traveling thousands of miles an hour faster!

<https://spotthestation.nasa.gov/>

**Story Time from Space** While in space, astronauts videotape themselves reading books to children on Earth. In addition, cross-content curriculum is designed to support the Next Generation Science Standards and Common Core.

<http://storytimefromspace.com/>



**Amateur Radio on the ISS** ARISS lets students worldwide experience the excitement of talking directly with crew members of the International Space Station, inspiring them to pursue interests in careers in science, technology, engineering and math, and engaging them with radio science technology through amateur radio.

[www.ariss.org/](http://www.ariss.org/)

**In-flight Education Downlinks** Wouldn't it be great if students could talk with an astronaut aboard the International Space Station about what it is like to live and work in space? Well, they can! Educational organizations located in the United States can host an in-flight education downlink with space station crew members. Students pose questions and watch as astronauts answer the questions and demonstrate science, technology, engineering and mathematics concepts in ways that are impossible on Earth.

<https://www.nasa.gov/audience/foreducators/stem-on-station/downlinks.html>



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