

# EXPLORE HUMANS *in* SPACE

## INTERNATIONAL SPACE STATION



# EXPEDITION 59



Soyuz MS-11 Launch: December 3, 2018  
Landing: June, 2019



**ANN McCLAIN (NASA)**  
Flight Engineer

**Born:** Spokane, Washington  
**Interests:** Weightlifting, rugby, golf, biking, fitness training and running  
**Spaceflights:** First flight  
**Bio:** <https://go.nasa.gov/2s8ryrB>  
**Twitter:** @AstroAnimal



**DAVID SAINT-JACQUES (CSA)**  
Flight Engineer

**Born:** Saint-Lambert, Quebec  
**Interests:** Mountaineering, cycling, skiing and sailing  
**Spaceflights:** First flight  
**Bio:** <https://go.nasa.gov/2VBcqAu>  
**Twitter:** @Astro\_DavidS



**OLEG KONONENKO (Roscosmos)**  
Commander

**Born:** Türkmenabat, Turkmenistan  
**Spaceflights:** Exp. 17, 30/31, 44/45  
**Bio:** <https://go.nasa.gov/2QviZ3S>  
**Twitter:** Text



Soyuz MS-12 Launch: March, 2019  
Landing: September, 2019



**CHRISTINA KOCH (NASA)**  
Flight Engineer

**Born:** Grand Rapids, Michigan  
**Interests:** Backpacking, rock climbing, paddling and sailing  
**Spaceflights:** First Flight  
**Bio:** <https://go.nasa.gov/2QCRhbX>  
**Twitter:** @Astro\_Christina



**NICK HAGUE (NASA)**  
Flight Engineer

**Born:** Belleville, Kansas  
**Interests:** Exercise, flying, snow skiing and scuba  
**Spaceflights:** Soyuz MS-10  
**Bio:** <https://go.nasa.gov/2Qz3qZ1>  
**Twitter:** @AstroHague



**ALEXEY OVCHININ (Roscosmos)**  
Flight Engineer

**Born:** Rybinsk, Russia  
**Spaceflights:** Exp 47/48  
**Bio:** <https://go.nasa.gov/2QAQBgu>

EXPEDITION  
**59**

Expedition 59 began in March 2019 and ends in June 2019. This expedition will include research investigations and technology demonstrations not possible on Earth to advance scientific knowledge of Earth, space, physical and biological sciences.



# SCIENCE ON THE



During Expedition 59, 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.

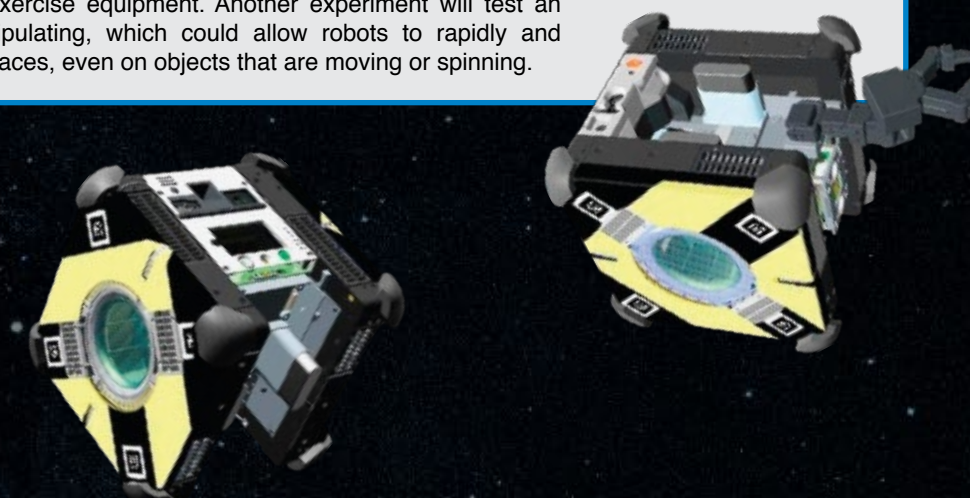
## Tissue Chips

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 Expedition 59 patch celebrates the International Space Station's role as a microgravity science laboratory. The crew, made up of scientists, doctors, engineers and pilots, will conduct hundreds of experiments for the benefit of mankind and our fragile environment on planet Earth.

The patch shape depicts the cupola windows. Through these windows, astronauts have made many significant observations of Earth's ecosystems and they have discovered and documented real-time events like volcanic eruptions and earthquakes.

The position of the Earth at the top of the patch depicts where the Earth would be seen by an astronaut from the cupola. It represents the explorers' unique perspective on his or her home. The image at the center of the patch is the station itself, the largest single structure humans have ever put into space, an engineering marvel.

The station is overlaid on an atom, the basic building block of all matter. The atom has three electron orbits with the flags of Russia, the United States of America and Canada, representing the home countries of the Expedition 59 crew. Like electrons in an atom, international cooperation is the basic stabilizing force that enables large scale space exploration.

To achieve great deeds, humans from all across the globe must work together in peace with a shared vision. The Expedition 59 patch celebrates the massive scientific accomplishments of the space station while highlighting the importance of global teamwork in understanding our planet and continuing with bold exploration in the future.

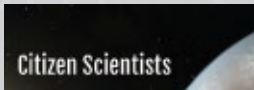


**Space Station Research Explorer** At any given time on board the space station, a large array of different experiments are underway within a wide range of disciplines. Here, you can search the database of experiments to learn more about each experiment's objectives, descriptions, results, and imagery,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



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



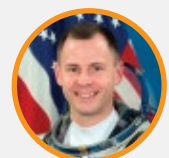
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