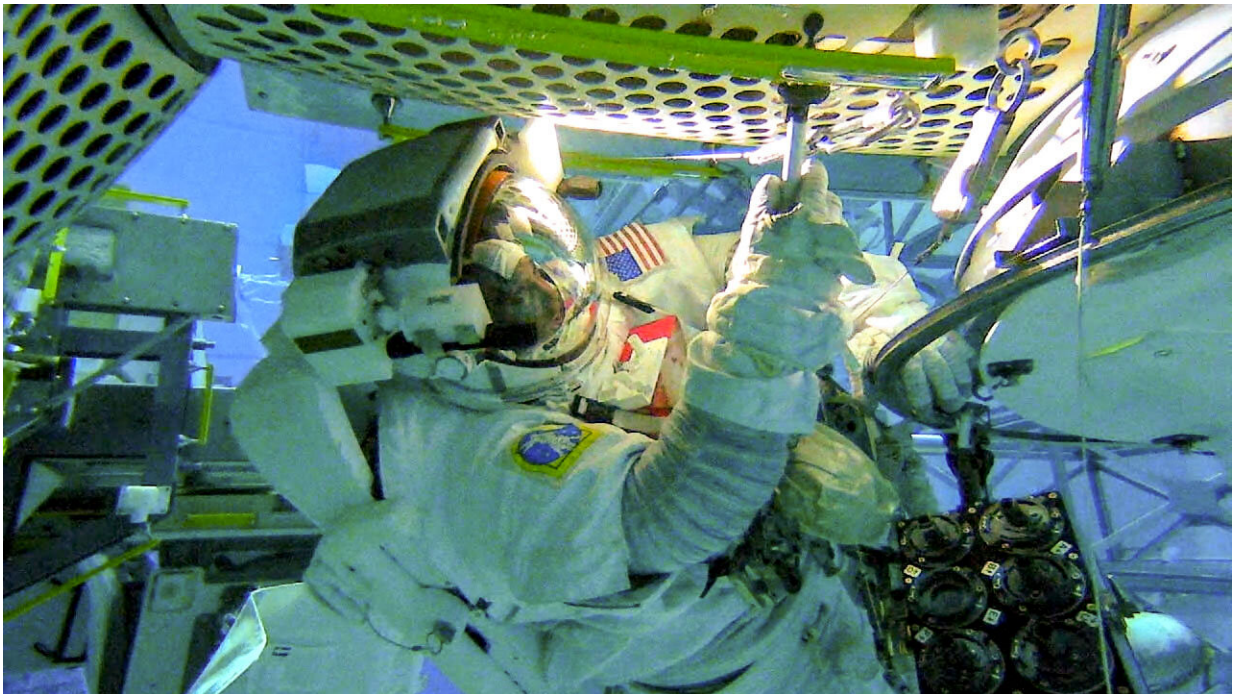


Space station research advances NASA's plans to explore the moon, Mars

May 31 2024, by Melissa L. Gaskill



NASA astronaut Victor Glover trains for the ISS External Microorganisms spacewalk in the Neutral Buoyancy Laboratory pool at NASA's Johnson Space Center in Houston. Credit: NASA

Space, the saying goes, is hard. And the farther humans go, the harder it can get.

Some of the challenges on missions to explore the moon and Mars

include preventing microbial contamination of these destinations, navigating there safely, protecting [crew members](#) and hardware from radiation, and maintaining and repairing equipment.

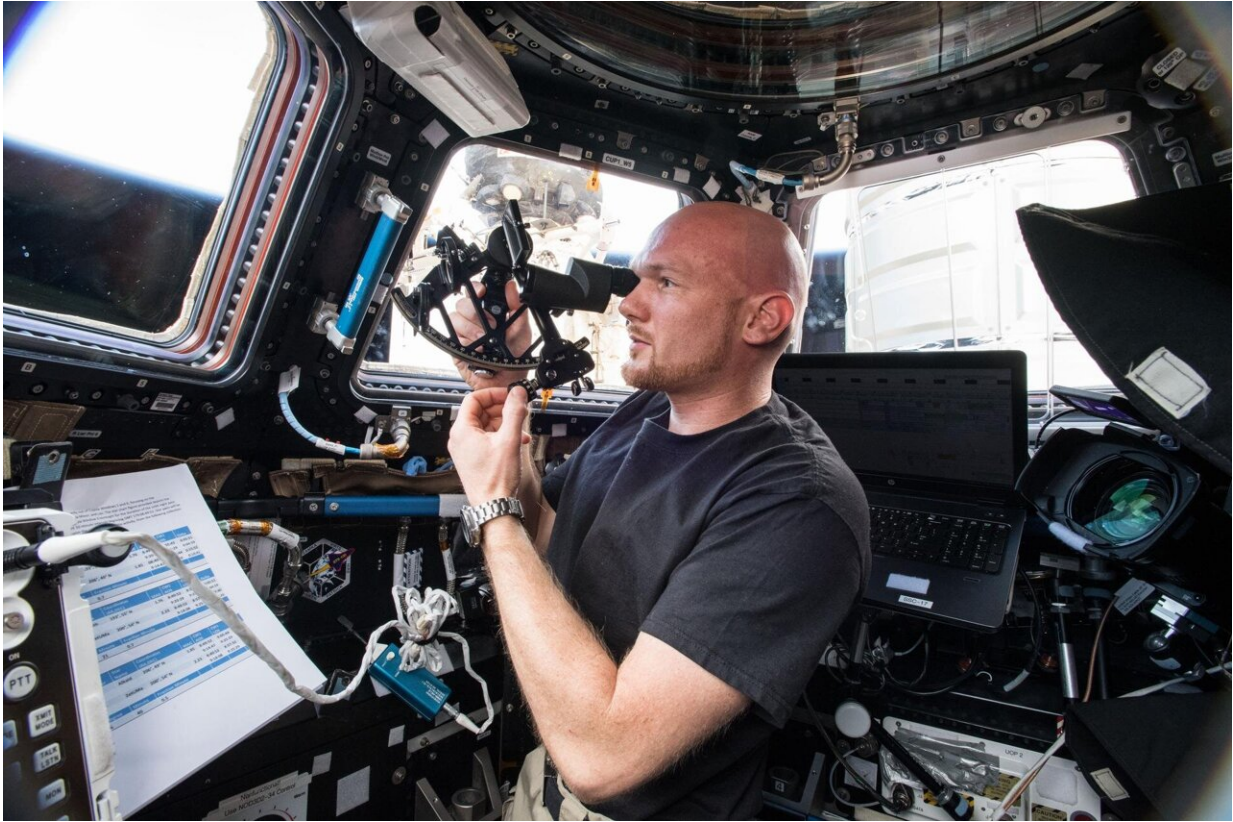
Research on the International Space Station is helping NASA scientists develop tools and processes to ensure success on these important missions. Here are highlights from some of the investigations making space a little easier.

Tracking tiny stowaways

Bacteria and fungi live in and on all humans and all around us on Earth. Most of these microorganisms are beneficial or harmless but introducing them to other celestial bodies could adversely affect our ability to study ecosystems on those other worlds.

Crew members will conduct a spacewalk to collect samples near space station life support system vents for ISS External Microorganisms, an investigation to assess whether the orbiting laboratory releases microorganisms into space. Results could provide insight into the potential for organisms to survive and reproduce in space and help researchers determine which microbes would most likely contaminate other planetary bodies visited by crewed missions.

A miniature, hand-held digital microscope designed to make in-flight medical diagnoses, the Moon Microscope, also can test water, food, and surfaces for contamination. The device images samples at high resolution and processes data on web-enabled devices such as phones or tablets. Multiple users can access the microscope simultaneously, and some applications run autonomously.



Astronaut Alexander Gerst of ESA (European Space Agency) tests the Sextant Navigation device. Credit: NASA

Getting there and back

Spacecraft must have sophisticated high-tech systems for navigating. Sextant Navigation tests the function of sextants in microgravity as an emergency backup navigation technique for Artemis and other future exploration missions. These mechanical devices have guided navigators for centuries, and Gemini and Apollo missions demonstrated they were useful for astronauts.

Refining radiation detection

Missions beyond low Earth orbit increase exposure to radiation, which can pose a hazard to human health and interfere with equipment operation. As NASA prepares for future missions, providing adequate protection is vital.

The Hybrid Electronic Radiation Assessor, or HERA, was built to serve as a primary radiation detection system for the Orion spacecraft, which will carry crews into orbit around the moon. The International Space Station Hybrid Electronic Radiation Assessor investigation modified the system to operate on the space station to provide researchers input for use on future exploration missions.



ESA (European Space Agency) astronaut Thomas Pesquet holds a mobile unit for the ESA-Active-Dosimeters experiment. Credit: NASA

Artemis HERA on Space Station further modified the radiation detection system so researchers could continue to evaluate the hardware in the space radiation environment prior to Artemis II.

Active-Dosimeters, an investigation led by ESA (European Space Agency), tested a wearable system to measure radiation exposure to crew members on the space station and how it changes with the station's orbit and altitude. Data from the wearable dosimeter improved [radiation](#) risk assessments and could lead to better protection for astronauts, including the ability to quickly respond to changes in exposure throughout future exploration missions.

Robot helpers

On future exploration missions, robotic technology can help crew members with basic tasks, monitor and maintain equipment, and conduct operations such as sample collection, reducing the need to expose astronauts to harsh environments.



Expedition 63 Commander Chris Cassidy sets up an Astrobee robotic assistant, one of a trio of cube-shaped, free-flying robots. Credit: NASA



Expedition 67 Flight Engineer Samantha Cristoforetti practices robotics maneuvers on a laptop computer. Credit: NASA

Integrated System for Autonomous and Adaptive Caretaking demonstrates using autonomous robots to transfer and unpack cargo and to track and respond to maintenance issues such as leaks and fires, which could protect valuable equipment and reduce costly repairs on future missions. The investigation uses the space station's Astrobees and Robonaut robots.

Multi-Resolution Scanning uses the station's Astrobees to test sensors and robotics to support automated 3D sensing, mapping, and situational awareness functions. On future Gateway and lunar surface missions, such systems could automatically detect defects and conduct remote

maintenance and autonomous operation of vehicles such as rovers.

Surface Avatar evaluates crew operation of multiple autonomous robots in space. The investigation also assesses crew member responsiveness to feedback on the consoles used to operate robots remotely, which supports design of effective setups for operating robots on the ground from a spacecraft orbiting above. Results contribute to the development of other uses of robotic assistance such as returning samples from Mars and asteroids.

Provided by NASA

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