



FUTURE U.

Now You See Me, Now You Don't

Overview

Learn to communicate like a mechanical systems engineer!

Can you imagine trying to fix a spacecraft you cannot see? Become a mechanical systems engineer and challenge yourself to try!

In this activity families will use building blocks to build identical spacecrafts. Then, using phones or walkie talkies, go to different rooms in the house to break and fix their spacecrafts together in the roles of the astronaut and mechanical systems engineer. They will focus on communicating with detailed instruction and asking/answering clear and concise questions.

Background

The International Space Station (ISS) is the largest construction project in the history of mankind. Partners from around the world have worked on it, including the United States, Canada, Russia, and Japan. Since the beginning, Boeing has designed and built modules for the ISS, and to this day continues to maintain them. But how can Boeing engineers fix something in space when they are on the ground?

At Johnson Space Center there are mock-ups, or replicas, of spacecrafts and even the football field-sized ISS. These mock-ups are the perfect place to train astronauts, but also where Boeing engineers can work from the ground to help astronauts fix things that are broken in orbit. A *mechanical systems engineer* replicates and fixes those problems that the astronauts are facing. Without being able to directly see or touch the problem, they guide the astronauts on how to fix the problems on the real spacecrafts!

Space is an unforgiving place and when something is not working properly, it could be dangerous for the astronauts. Whether it is a broken toilet, or the heating and cooling are amiss, it is the job of the *mechanical systems engineer* to listen to the astronaut's problem very carefully, talk with other engineers from around the world for advice and collaboration, replicate the problem in the mock-up on the ground, and then use clear communication to tell the astronaut exactly how to fix the problem in orbit.

Astronauts rely on *mechanical systems engineers* for all the big and small mechanical problems they face in orbit.

Spacey Spotlight

Captain Sunita (Suni) Williams, an Indian American woman, is a United States Navy officer and astronaut. She was a member on Expeditions 14 and 15 to the ISS, as well as the flight engineer on Expedition 32 and commander of Expedition 33. She held records for most spacewalks by a woman (seven) and most spacewalk time for a woman (50 hours, 40 minutes).



Victor Glover is a NASA astronaut with three Masters Degrees—Master of Science in Flight Test Engineering, a Master of Science in Systems Engineering, and a Master of Military Operational Art and Science! He is the first African American ISS crew member to live on the International Space Station. In 2021 he has had multiple spacewalks, working with mechanical systems engineers to fix a broken external camera, upgrade the Columbus module, and prepare for the installation of new solar arrays. Before working with NASA, Glover was a U.S. Navy pilot and served as a legislative fellow in the U.S. Senate.



Now it is your turn to become a *mechanical systems engineer*! Grab a family member and your tub of building blocks and let's get started!

Materials

- Building blocks
- 2 Walkie Talkies or 2 Cell Phones

Activities

1. With your family member, decide who will be the astronaut and who will be the Boeing mechanical systems engineer. (Don't worry: you can switch roles later on!)
2. Using the exact same building blocks, work together to build identical spacecrafts or modules from the ISS.
3. Each of you grab a walkie talkie or cell phone and head to different rooms in the house with your models. Don't have either? No problem! Just shut a door between the two of you so you can hear each other but you can't see each other.
4. The astronaut breaks a section of their model and calls the mechanical systems engineer for advice on how to fix it.
5. The astronaut should speak slowly and clearly as they explain exactly what is broken and where it is. Use descriptive language explaining the color and shape, the function of the part, and what it is next to in your model.
6. The mechanical systems engineer asks precise questions to fully understand and then breaks the exact same part of their model.
7. The mechanical systems engineer then speaks slowly and clearly as they explain step by step how to fix the problem. While giving instructions, use sequencers to organize your thoughts and words (first, next, then, last).

8. The astronaut asks clarifying questions along the way to ensure they are doing the same thing at the same time.
9. When you are both certain that the problem is fixed the astronaut can fly back to Earth and compare their model with the mechanical systems engineer.
10. Switch it up! Reverse roles and do the activity again.

Extension

- Hear James Dickson explain his job in the Boeing virtual field trip video from 11:50-14:40 here: <https://www.boeingfutureu.com/virtual-field-trips/space>
- Tour modules on the ISS virtually with Suni Williams: https://www.nasa.gov/mission_pages/station/main/suni_iss_tour.html

Check out these library books!

- Butterfield, Moira. (1985). Satellites & Space Stations. Tulsa, OK: EDC Publishing.
- Jones, Stanley P. and Tripp, L. Octavia. (1998). African-American Astronauts, Guion S. Bluford Jr., Charles F. Bolden Jr., Frederick D. Gregory, Bernard A. Harris Jr., Mae C. Jemison. Mankato, MN: Capstone Press.
- Lusted, Marcia Amidon. (2005). The International Space Station. Farmington Hills, MI: Lucent Books.

References

- <https://www.boeingfutureu.com/virtual-field-trips/space>
- <https://www.nasa.gov/astronauts/biographies/sunita-l-williams/biography>
- <https://www.nasa.gov/astronauts/biographies/victor-j-glover/biography/>
- https://www.nasa.gov/centers/hq/library/find/bibliographies/childrens_space_resources/
- https://en.m.wikipedia.org/wiki/Victor_J._Glover