SPACE STATIONS

OVERVIEW
Astronauts and mission planners prepare to spend a long amount of time in space. In this activity, learners will consider the factors that drive the design of human space habitats and the lessons we can learn from astronauts about surviving in extreme situations.

LEARNING OBJECTIVES
- Learners will know that space stations must carry all equipment and supplies the astronauts will need to deal with both daily life and emergencies.
- Learners will investigate the ways space is an extreme environment that takes special care to prepare for.
- Learners will think about how astronauts have to learn how to be around each other all of the time and get along.

VOCABULARY
- **MODULE** – A small part of a space station that can be lifted by rockets and joined with others in space. Modules often have a specific job or purpose they are built for; such as places for the astronauts to sleep, science labs, or docking ports.
- **SOLAR PANEL** – Large panels made of special glass and metals that can turn sunlight into electricity for the astronauts.
- **ZERO GRAVITY** – The condition of being in freefall or far away from a planet; in space there is no longer the downwards pull of the Earth that the human body needs to keep itself healthy without care.
- **RADIATION** – Dangerous, invisible energy produced by the Sun that is much stronger in space than on Earth; astronauts must think about how to insulate against it.
- **TORUS** – A special three-dimensional shape made from a cylinder stretched to connect with itself in a circle: if you like bagels and donuts, you’re already a torus fan!

MATERIALS
Keep in mind that these materials are suggestions. Learners should feel free to experiment with different materials that they have at home.
- Recyclable and non-recyclable materials you don’t mind cutting, coloring, or gluing:
  - Paper plates
  - Cardboard tubes
  - Bottle caps
  - Straws
  - Aluminum foil
  - Plastic packaging
  - Kitchen utensils
  - Small space toys
  - The ceiling is the limit!
- Scissors
- Markers
- Tape or glue
- Paper
- Pencil
- Books, toys, and other objects your learners enjoy related to ideas of space travel: this could be factual material or science fiction action figures to connect space topics to things your learner is familiar with.
SET-UP

→ Gather materials
→ Prepare a workspace free of obstacles and big enough that you will be able to work on your station without frustration

LESSON PLAN

1) Introduce the topic of living in space to your learners. You might choose a science-fiction book to read together, watch a video (such as a tour of the ISS), or simply ask what they know about how humans might live in space for long periods of time.

   Example Questions
   
   • What would it be like to be so far from home for so long?
   • What kinds of things do astronauts have to think about bringing with them in order to make that kind of journey?
   • What rooms do you see in the space station? Do you think astronauts need all the functions and spaces associated with houses here on Earth? More? Less?
   • What would be different about living in space? What do your learners think they would look forward to about it, and what would they not enjoy?

2) Continue and expand on your conversation with a few key background topics:
   
   a. Although all space stations humans have built have been small so far, there are ideas for very large space stations that might have thousands of people living on them. You may show or describe the following two images of torus stations: https://space.nss.org/stanford-torus-exterior-view/ https://space.nss.org/stanford-torus-cutaway-view/. This design can spin in space to let people feel like they are back in normal gravity; just the same as a bucket of water will not spill if swung quickly through a loop-the-loop because things that spin experience a force ‘pulling’ them away from the middle of the spin
   
   b. Space stations might be tricky to build: working with lots of small parts is very hard in space. So instead, current space stations are built one room (or module) at a time on the ground and then each module is launched into space and joined onto the station
   
   c. Astronauts have to worry about all the normal things people on Earth do: eating, sleeping, avoiding boredom, etc, but also some dangers specific to space, like radiation.

3) Suggest to your learner that from the things that you have talked about, you could plan your very own space station. Create a list together of the features they think the station needs: this could be done by considering each problems the astronauts will face, and what they need to bring to counter that danger. You might also have your learners draw a “blueprint” before they start making.

4) From among your gathered materials, choose small objects that will represent each piece of equipment (a film canister might become an oxygen bottle; a Lego piece the space station’s computer system) and set them aside; this is everything you have to bring with you.

5) From your remaining materials, construct and decorate the structure of the space station. Depending on the materials you’ve gathered and your participant’s desires, you might create one module at a time for an International Space Station-style creation, use paper plates to make a torus, or invent brand new space technologies!
6) When you are done, reflect by asking your learners to give you a tour of the new space station, and think about if they would be happy living there for a long time.

FURTHER EXTENSION

In the Museum
During your visit to The Museum of Flight, visit the Charles Simonyi Space Gallery to try assembling a magnetic space station, learn more about how the space environment can affect astronaut health, and see tools that astronauts use over their long-duration flight.

Other Museum Programs
During your visit to The Museum of Flight, visit the Charles Simonyi Space Gallery to try assembling a magnetic space station, learn more about how the space environment can affect astronaut health, and see tools that astronauts use over their long-duration flight.

SUGGESTED READING/ ADDITIONAL RESOURCES
• The following articles have been published from the space community discussing lessons they have learned about coping with isolation:
  • https://www.nytimes.com/2020/03/21/opinion/scott-kelly-coronavirus-isolation.html
  • https://news.mit.edu/2020/astronauts-social-distancing-0324
  • https://www.nasa.gov/feature/an-astronaut-s-tips-for-living-in-space-or-anywhere

• Stanford Torus stations: https://space.nss.org/stanford-torus-space-settlement/