Mission Briefing: Working in Space Module

Being an astronaut comes with a lot of hard work and the added challenge of figuring out how to do that work in space! While astronauts don't have to worry about the hazards on Earth, their work environment comes with other dangers including some that can't even be seen, like space radiation. In this module students will learn about the people at NASA who are responsible for ensuring mission safety, and the ones who make sure that astronauts always have the right tool for the job. The working in space module is a great way to introduce students to the dangers of working in space and the tools astronauts need in order to perform research and experiments in space.

Mini-Mission

Time: 15 minutes

Objectives:
- Engage students in thinking about what barriers exist to working in space
- Ignite a discussion with students on what they think it is like to work in space

Consider asking questions like:
- What type of tasks do you think astronauts need to complete in space?
- How do you think completing some tasks differ in space versus here on Earth?
- What challenges do you think astronauts face trying to complete tasks in space?
- How do you think astronauts overcome these challenges?

Prompt your students to do a little research prior to starting the next two missions. Students should investigate the barriers that need to be overcome in order to work in space. They should try to identify several obstacles and how we currently overcome them. Ask students to record their thoughts on how easy or hard it would be to work in space in their Engineering Design Notebook.

Mission: Staying Safe in Space

Time: 45–90 minutes

Objectives:
- Design and build an alert system
- Investigate safety needs in space

STEAM Practices:
- Meet design constraints
- Communicate best fit solutions
- Explore cuase and effects

Mission Briefing

Brief students on the mission by saying:
Think about hazards that we face on Earth like storms such as tornadoes and hurricanes. We are lucky to have alert systems that warn us when these dangers are coming. While astronauts don't face these dangers, they do face dangers like radiation from solar energy particle storms.

Have students capture their initial thoughts about hazards in space in their Engineering Design Notebook.

Extend Student Curiosity about the Mission
Build curiosity with your students using these resources. Consider asking your students some prompting questions to discuss or to reflect on in their Engineering Design Notebook.

- How can you solve a problem you cannot see?
- What protections are needed when exploring space?

Read this article with your students:

5 Harzards of Human Spaceflight

Watch these videos with your students:

Hazard 1: Space Radiation

Orion Backstage: Evaluating Radiation Protection Plans for Astronauts

Career Connection

Connect the Mission to Careers at NASA

Connect students to an actual career at NASA to learn more about what people do each day. Share with students:

At NASA, safety is a top priority. Safety Officers assure safety and enhance the success of all NASA activities through the development, implementation and oversight of agency wide policies and procedures. In this episode, students will meet Leo, the LEGO® Space Team Safety Officer. Leo works to ensure the health and safety of the public, workforce, facilities and property during the launch, flight, landing, and testing of spacecrafts.

Let's meet a NASA Safety Officer

Pedro Lopez is the Safety Lead for Human Rating, Crew Survival, and Enterprise Verification and Validation, Exploration Systems Development (ESD) Safety and Mission Assurance! Pedro's job is to make sure all ESD Programs (Orion, Space Launch Systems, and Exploration Ground Systems) as well as Gateway meet the certification requirements for transporting and housing human beings to space.

For more about Pedro Lopez check out this inspiring article:

Meet Pedro Lopez

The Mission

Explain the mission to students by saying:

Now it's your turn to create a prototype model that will alert the astronauts that there is danger. Consider what type of device will best alert the astronauts to ensure their safety. Think about other types of alarms that you have seen. Will your alert system include sounds? Or lights? Or throw a ball? Or have a waving mechanism? What do you think is the best way to get everyone's attention? What do you think is the most important information for your device to include for the astronauts?

Have them brainstorm and sketch out their ideas. Make sure they explain the task they're trying

to complete with their device. Remind them to build, test, and iterate on their models and to test it several times. Also encourage them to try different ideas. If something doesn't work, they can try something new!

Be sure to leave enough time for all students to share their prototypes and explain why this is the best fit for the problem they were trying to solve.

Additional Inspiration Lessons

Consider completing these lessons from LEGO® Education prior to students completing their mission to scaffold their engineering skills.

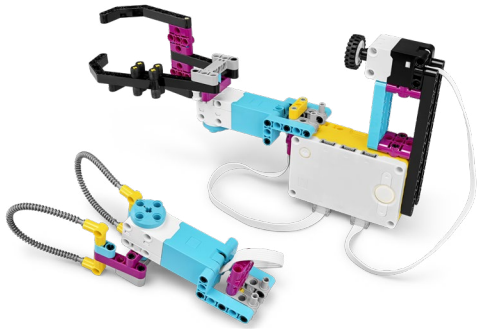
- LEGO® Education SPIKE™ Prime Wind Speed
- LEGO® Education BricQ Motion Prime Strike the Ball
- LEGO® Education BricQ Motion Essential Cheering Crowd

Differentiation for All Learners

For younger or less experienced designers, consider providing scaffolding through giving students a specific list of constraints to include in their model such as the prototype needs to make a sound. Requiring only one element is better to set students for success.

For older or more experienced designers, consider requiring students to include multiple dimensions to their prototype such as two steps like a sound and waving mechanism.

Mission: The Right Tool for the Job



Time: 45–90 minutes

Objectives:
- Design and build a tool that can be used in space
- Investigate needs for tools in space
- Compare completing tasks in space to on Earth
- Think about how scientists design tools to use in space

STEAM Practices:
- Ask questions and define problems
- Meet design constraints

Mission Briefing

Brief students on the mission by saying:
Ask them to think about tools you use to complete different jobs. For example, you might use a shovel to dig a hole or a pencil to write a letter. Astronauts use specialized tools too, like tools needed to repair a spacecraft. Ask students to think about what types of tools might be used when in a spacecraft or exploring the surface of the Moon or Mars. Have students grab their Engineering Design Notebook and write down their ideas.

Extend Student Curiosity about the Mission
Build curiosity with your students using these resources. Consider asking your students some prompting questions to discuss or to reflect on in their Engineering Design Notebook.

- What factors in space change the way we use our tools?
- What tasks need to be completed in space that we might need tools for?
- How do scientists help design tools that astronauts will use in space?

Read these article with your students:
Dust: An Out-of-This World Problem
JSC's Preparations for the Next Moon Walk are Underway (Underwater)

Watch this video with your students:
NASA Prepares to Explore the Moon: Spacesuits and Tools

Career Connection

Connect the Mission to Careers at NASA

Connect students to an actual career at NASA to learn more about what people do each day. Share with students:

Meet Sofie, Scientist for the LEGO® Space Team. Scientists involved with a mission are focused on studies relevant to mission success, safety, and benefits for humanity. This can include fields such as solar radiation, human research, physical science, biology and biotechnology, and earth and space science.

This requires the development of many specialty tools for conducting science experiments while in space. These tools are developed to ensure ease of use for the astronauts. Scientists study places on Earth that are similar to places on the Moon, for example, to help design tools to be used in space.

Let's meet a NASA Scientist

Kelsey Young is a Planetary Geologist at NASA. That means she studies how other planets (and moons and asteroids and comets and whatever else is floating out there) form and evolve over time. She works in different field sites all over the world and in the ocean. Kelsey uses sites on earth that resemble other planets, to study how planetary surfaces form and evolve and also to determine how astronauts will explore other planets in the future. She is part of multiple teams who work to simulate specific aspects of spaceflight, including the NASA Johnson Space Center led NEEMO (NASA Extreme Environment Mission Operations) team which conducts underwater missions to simulate space flight.us.

Learn more about Kelsey Young

Kelsey Young Dives Into Fieldwork With Aplomb

Meet Former NASA Intern Kelsey Young

The Mission

Explain the mission to students by saying:

Tell your students it's now their turn to create a tool that astronauts can use in space and will complete a task. Think about what task you are designing for and what the tool needs to do. What features does the tool need in order to accomplish this task? What features will you include in your tool?

Have them brainstorm and sketch out their ideas. Make sure they explain what task they are trying to complete with their tool. Build, test and iterate on their deisgns. Remind them to try different ideas and that if it doesn't work, it's ok to try something new.

Be sure to leave enough time for all students to share their prototypes and explain why this is the best fit for the problem they were trying to solve.

Additional Inspiration Lessons

Consider completing these lessons from LEGO® Education prior to students completing their mission to scaffold their engineering skills.

- LEGO® Education SPIKE™ Prime Super Cleanup
- LEGO® Education BricQ Motion Prime Free Kick
- LEGO® Education BricQ Motion Essential Weightlifter

Differentiation for All Learners

For younger or less experienced designers, consider providing scaffolding through giving students a specific type of tool to design. Find example images of the tool to provide inspiration and set students for success. Be sure to provide more than one image so that all students are not trying to prototype the exact same model.

For older or more experienced designers, consider having students create a prototype tool that can accomplish two tasks. Challenge students to brainstorm two tasks that need to be completed and a way to develop a multi-use tool that can complete both tasks.