

# LESSON 2: DESIGNING YOUR SPACECRAFT

## Module 4: **Astrobiology Adventures: Plan, Build, Explore**



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| OVERVIEW         | <p>Students will learn about the different parts of a spacecraft. They will then build their own spacecraft using LEGOs, keeping in mind their chosen careers, and their mission plan to visit the planet they chose in Lesson 1.</p> <p><b>Duration: 60-120 minutes.</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| SUCCESS CRITERIA | <ul style="list-style-type: none"> <li>• Students can discuss the design (shape, size, materials) of their spacecraft and why it is important for their mission.</li> <li>• Students can discuss challenges engineers may face when designing and building a spacecraft.</li> <li>• Students can name at least three different parts of a spacecraft.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| NGSS STANDARDS   | <ul style="list-style-type: none"> <li>• K-2-ETS1-1: Ask questions, make observations, and gather information to define a problem that can be solved through the development of a new or improved object or tool.</li> <li>• K-2-ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function.</li> <li>• Crosscutting Concept: <i>Patterns</i>. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.</li> <li>• Crosscutting Concept: <i>Scale, proportion, and quantity</i>. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.</li> <li>• Science and Engineering Practices: <i>Constructing Explanations and Designing Solutions</i>. Use materials to design a device that solves a specific problem or a solution to a specific problem.</li> <li>• Nature of Science: <i>Science is a Human Endeavor</i>. Most scientists and engineers work in teams.</li> </ul> |

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| K-2 AZ STATE STANDARDS | <p>Kindergarten:</p> <ul style="list-style-type: none"> <li>• Social Studies (K.H2.1): Explain the benefits of cooperation and compromise as ways to solve problems.</li> <li>• Career Development (CD.K.2): Identify different types of jobs and explain why people work.</li> </ul> <p>First Grade</p> <ul style="list-style-type: none"> <li>• Social Studies (1.E1.1): Identify different occupations and the skills and education needed for those jobs in our community.</li> <li>• Career Development (CD.1.2): Explain why people have different jobs and how jobs help the community.</li> </ul> <p>Second Grade</p> <ul style="list-style-type: none"> <li>• Career Development (CD.2.3): Describe how different jobs require different skills and education.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| MATERIALS              | <ul style="list-style-type: none"> <li>• LEGOs or other building materials</li> <li>• "Parts of a Spacecraft" PowerPoint (available on AABC website)</li> <li>• Paper for brainstorming spacecraft design</li> <li>• Markers or crayons</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| VOCABULARY             | <ul style="list-style-type: none"> <li>• <b>Spacecraft:</b> A vehicle designed to travel in space, carrying astronauts, equipment, or tools to other planets or into orbit around Earth.</li> <li>• <b>Solar Panels:</b> Big panels that catch sunlight and turn it into electricity to power a machine such as a spacecraft.</li> <li>• <b>Engine:</b> A part of a machine, such as a car or a spacecraft, that helps it use energy to move around.</li> <li>• <b>Airlock:</b> This is a special door on a spacecraft that lets astronauts go into space. It keeps the air that astronauts need to breathe inside the spacecraft!</li> <li>• <b>Radiator:</b> Helps the spacecraft get rid of extra heat and sends it into space, like an air conditioner.</li> <li>• <b>Robotic Arm:</b> A big mechanical arm on the outside of the spacecraft that helps grab things.</li> <li>• <b>Docking Port:</b> A special spot where spaceships connect, like plugging two pieces together.</li> <li>• <b>Crew Capsule:</b> Like a space taxi for astronauts. It brings them to the space station or a spacecraft and then goes back to Earth.</li> <li>• <b>Living Quarters:</b> The part of a spacecraft where astronauts live, sleep, eat, and do science.</li> <li>• <b>Antenna:</b> How the spacecraft talks to Earth! It sends and receives messages, like a space phone or walkie-talkie</li> </ul> |

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### SET UP

- Prepare to show the "Spacecraft Parts" PowerPoint presentation.
- Have LEGOs divided so that groups of students can simultaneously work on their spacecraft.

### LESSON PROCEDURE

#### **Introduction (10-20 minutes)**

- Begin by asking the students: "What do you think a spacecraft looks like?" and "What do you think is inside a spacecraft?"
- Show the "Parts of a Spacecraft" PowerPoint to the students. As you go, it may be helpful to write down each word on a poster or whiteboard for future reference.
- Tell the students they will be designing and building their spacecraft. Suggested requirements:
  - Their spacecraft must have at least three spacecraft parts mentioned in the PowerPoint. (You might choose to increase/decrease this number to fit the needs of your class).
  - It should also include at least one part or tool that will help them fulfill their mission goals they determined in Lesson 1 (For instance, if they want to bring back rock samples, they need a shovel to dig them up or a container for storing them.)
  - Each student needs to review their chosen job/role and ensure that they include things on the spacecraft that will allow them to do their job.
- Give students time with their group to discuss and plan their design. You might require them to draw a rough draft before starting with the LEGOs.

#### **Activity: Build a Spacecraft! (40-90+ minutes)**

- Provide each student or group with a set of LEGO bricks.
- Allow time for students to build their spacecraft.
- Walk around to offer guidance, ask questions, and help students needing support with their builds. Encourage them to work as a team if they're in groups. Check to ensure that they are including the requirements that you have laid out for them.

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### LESSON PROCEDURE

#### Conclusion (5-10 minutes)

- If time allows, have each group share their spacecraft with the class.
- Recap the Lesson with some of the following prompts:
  - What important part did you include in your spacecraft?
  - What more would you add to your spacecraft if you had more time?
  - Aerospace engineers design new spacecraft, just like you did today. Would you enjoy being an Aerospace Engineer? Why or why not?
  - What challenges do you think aerospace engineers face when designing a spacecraft?
  - Today, you created a “manned” spacecraft, meaning people can ride in the spaceship to another world. An “unmanned” spacecraft means no people, just tools like cameras and rovers. We have only ever sent manned spacecraft to the Moon. Farther places like Mars or Jupiter – those have all been unmanned missions. Why do you think that is?

**Note to Teacher:** Save the spacecraft creations for use in Lesson 3.

### EXTENSIONS AND TAKE HOME ACTIVITIES

- Space Mission Story: Have students write or tell a short story about a mission they will take on their spacecraft.
- Spacecraft Fact Sheet: Ask students to create a fact sheet or poster about their spacecraft, labeling its parts and explaining how it works.
- NASA International Space Station Activity Book. [This activity book](https://www.nasa.gov/wp-content/uploads/2015/09/iss_activity_book_1.pdf?emrc=b7a0c2) has worksheets and coloring pages about the International Space Station ([https://www.nasa.gov/wp-content/uploads/2015/09/iss\\_activity\\_book\\_1.pdf?emrc=b7a0c2](https://www.nasa.gov/wp-content/uploads/2015/09/iss_activity_book_1.pdf?emrc=b7a0c2)).

This module was created by Lauren Bollinger, an elementary school educator at Bloom Elementary in Tucson, AZ, in collaboration with the Arizona Astrobiology Center. It is supported and distributed by the University of Arizona's Astrobiology Center with funding from the Marshall Foundation, Tucson, AZ. For more information, contact Lauren James at [laurenjames@arizona.edu](mailto:laurenjames@arizona.edu). Lesson kits are available for checkout from the Arizona Astrobiology Center – <https://astrobiology.arizona.edu/>