



Tech Logic  
LESSON SERIES

# You Can't Take It All With You

**GRADES** K-5

STUDENT  
ENGINEERING LOG





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**GRADES K–5**

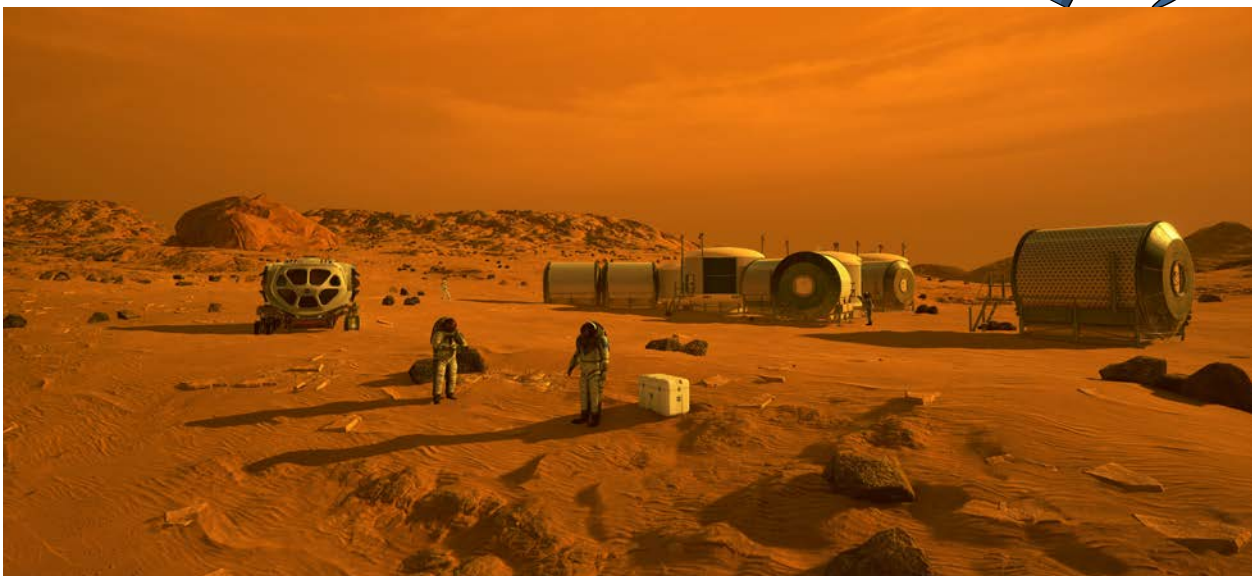
STUDENT  
ENGINEERING LOG

## INTRODUCTION

Have you ever gone on vacation? Have you ever been camping? What did you pack?

When traveling or exploring away from home, we need to bring supplies with us. The farther we go or longer we are gone, the more supplies we need to pack. Early American explorers and settlers had to plan for trips that sometimes lasted for years. They also had to plan for a new place they didn't know anything about.

Today you will learn about how NASA is getting ready to send new explorers to other planets, like Mars, and other places in space, like the Moon. You will also learn about how early American and western settlers had to use the materials around them and how NASA is doing the same thing—but in space!





## Engagement Activity: Early Explorers

You are now going to be a part of an exploration team. Your teacher will provide your group with the location where you will be traveling. As an explorer from long ago, you need to make a plan. What is it like where you will be going? What will you need to bring with you? What type of shelter will you live in?

Work with your exploration team to answer the questions below:

1. Location: \_\_\_\_\_



2. Describe what it is like at your location: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Draw a picture of the land you will explore:

3. What kinds of supplies will you need to pack to explore here?

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4. Think about what types of resources might be available where you will be. For example, are there any trees? If so, could you cut down the trees and use the wood? What tools would you need? List as many resources you can think of that are at your location:

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5. You need a shelter to protect your team of explorers. What kind of protection might you need? What is the weather like? Are there predators in your location? Write down your answers to these questions.

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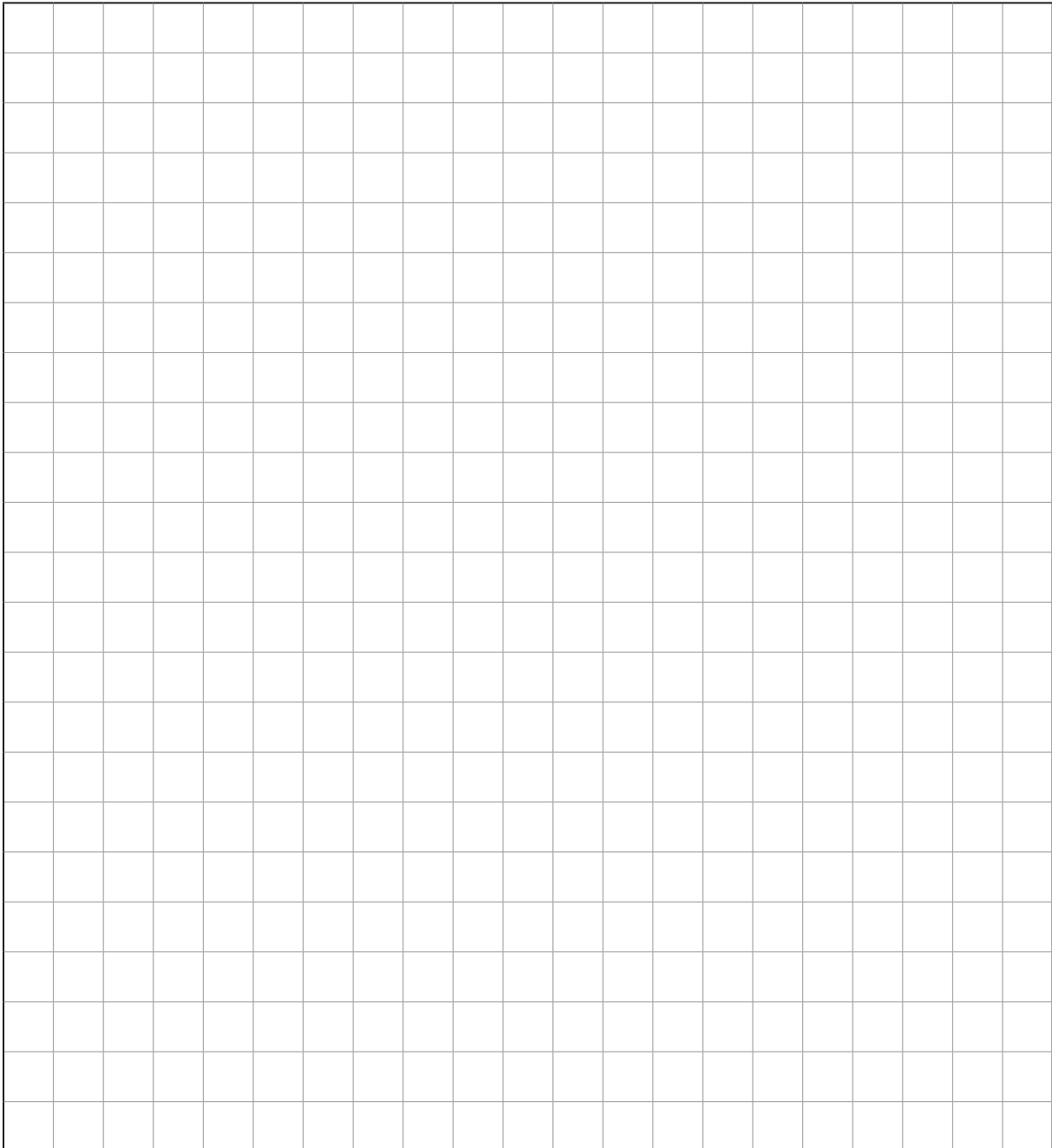
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6. Now that you know what local materials you can use and what you need protection from, design a house or some type of shelter to keep you and your exploration team safe. Your teacher will tell you the required size of your shelter. Use the space below. Be sure to list what materials you will use and what tools you will need, and create a scale to show the size of your shelter. Label any doors, windows, or other features.



### Early Explorer Stories

Now it is time to read about different ways explorers and settlers in history used the local resources they had available. Answer the questions below after reading the stories assigned to you.

7. What materials did the early explorers and settlers you read about bring with them?

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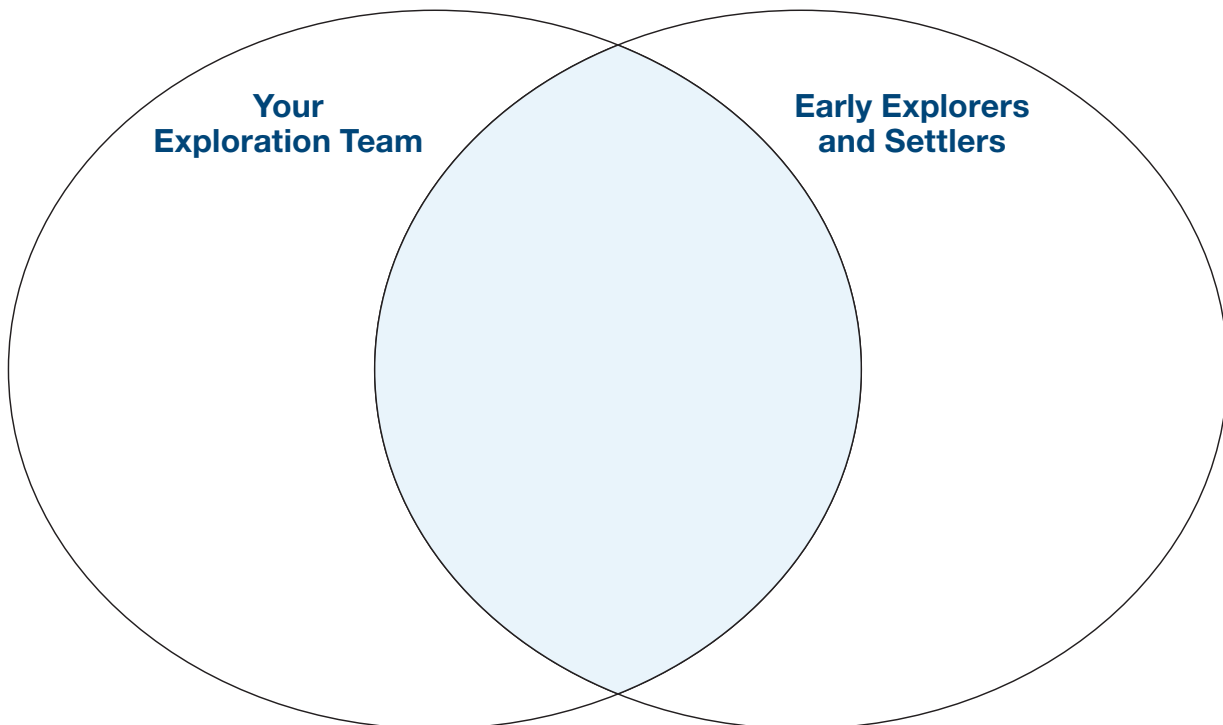
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8. What local resources did they use? \_\_\_\_\_

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9. Compare what you and your team planned to bring and use with what early explorers and settlers used. What is different? What is the same?

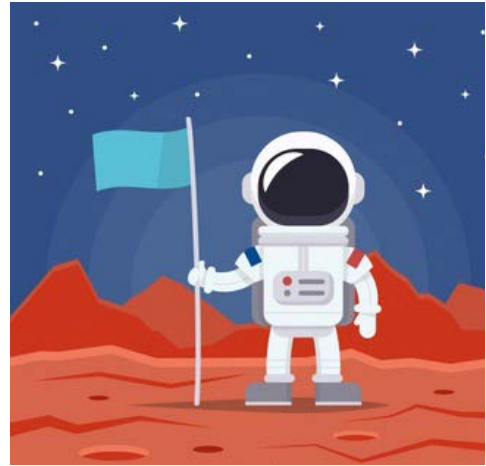




## Activity: Using Local Resources

Now it is your turn to become an astronaut explorer. For your mission, you are being sent to Mars.

Once on Mars, you will use the local resources to build a shelter. Your first task will be to create Martian bricks from the rocks and soil found on the planet. You and your team can also use a few materials and tools you brought from Earth. After that, you and your team will design and build a shelter using your Martian bricks. For the final task, you will test your shelter for maximum protection. To do this, you will use a strong light to look for leaks in your shelter.



### Task 1: Create Bricks for Your Structure

Since you can't bring everything that you need to survive on Mars, you will need to create bricks from the Martian rocks and soil. You will use these bricks to build a shelter and keep yourself and your team safe on Mars. Now you are an explorer AND an engineer! You were able to bring a few materials with you from Earth to help you. One item is a binder, which will glue the rocks and soil together. Other items include aluminum foil and wooden craft sticks, which are flat and easy to carry with you on your journey.

As you create your bricks, it is important to write down the materials you used so you can make the bricks again or so someone else can make them by following your recipe. Engineers always need to write down what materials they used, how much they used, and how they made something.

1. In a bowl or cup, stir glue into dry sand to create the mixture for your bricks.
2. Write down how much sand and glue you used in your engineering log.
3. You will use ice cube trays as molds for your bricks. To make sure your bricks do not stick to the ice cube trays, line your trays with plastic wrap or spray the trays with nonstick spray. Your teacher can help you!
4. Scoop your sand and glue mixture into one ice cube tray. Press down on your mixture to make sure it is tightly packed into each well. Set this batch of bricks aside.
5. Create a second batch of bricks, this time using both sand and gravel. In a bowl or cup, stir glue into your sand and gravel mixture. Optional: mix water into the mixture to help bind, as needed.

6. Record how much sand, gravel, and glue (and water, if used) you used in your engineering log.
7. Scoop this mixture into another lined or sprayed ice cube tray. Again, make sure your mixture is tightly packed into each well.
8. Let your bricks dry. This may take a few days. The more glue you used the longer they will take to dry. Your teacher will tell you where to put your bricks while they dry. You should check on the bricks each day. Your teacher might ask you to remove the bricks from the molds when they are partly dry in order to help them dry faster. As your bricks dry, take notes and write down your observations in your engineering log.
9. Once dry, carefully remove bricks from their molds. Are the bricks all the same size? Are they all the same quality? Are there gaps between the rocks and sand that might allow something to get inside your shelter? Record your observations in your engineering log.

## Task 2: Design and Build Your Shelter

1. Now that you have building materials, it is time for you and your team to build a shelter. Before you build your shelter, you need to make a plan. Discuss with your team. When you are ready, draw a design for your shelter in your engineering log. Make sure to label the size of your shelter and the materials you will use. Your teacher may also ask you to measure your shelter or to build it to a specific size. For your shelter design, follow these instructions and any other directions your teacher gives you:
  - Do not use glue, tape, or any other material to hold your shelter together. You can only use the building materials given to you (bricks, wooden craft sticks, and aluminum foil). If you want, you can cut the wooden craft sticks and cut or tear the aluminum foil.
  - Your shelter needs to have at least one doorway, one window, a roof, and walls (you can decide on a shelter with curved walls that come together at the top in a point, like an igloo).
  - Your shelter should block the maximum amount of light.
2. Once your team has a design, get the design approved by your teacher before you start to build.
3. Build your shelter.
4. Measure your shelter. Follow your teacher's instructions for calculating the size of your shelter. Complete this task in your engineering log.

### Task 3: Test Your Shelter

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It is time to test your shelter. Shine a bright light on your shelter and look closely for any places where light shines inside. These areas are leaks. If you have any, try to figure out where the leaks are coming from and how you might be able to fix them. If there is time, you may have the opportunity to make improvements to your shelter and retest. Write down your observations about the test and plans for improvements in your engineering log.



<b>ENGINEERING LOG</b>	Name:
	Team Members:
	Date:

### Brick Construction

List the materials and how much of each material you used to make your bricks.

#### Batch 1

Material	How much did you use?

#### Batch 2

Material	How much did you use?

Describe the steps you followed to make the bricks, including the equipment you used. If your process changed for the second batch of bricks, please write down what you did differently as well.

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### Observations

Write down your observations as your bricks dry:

<b>Observation 1</b>	How well do you think your bricks will turn out? Why?
<b>Observation 2</b>	Now that your bricks are drying, how do they look? Are they completely dry yet, or are they still wet? If so, where are they wet?

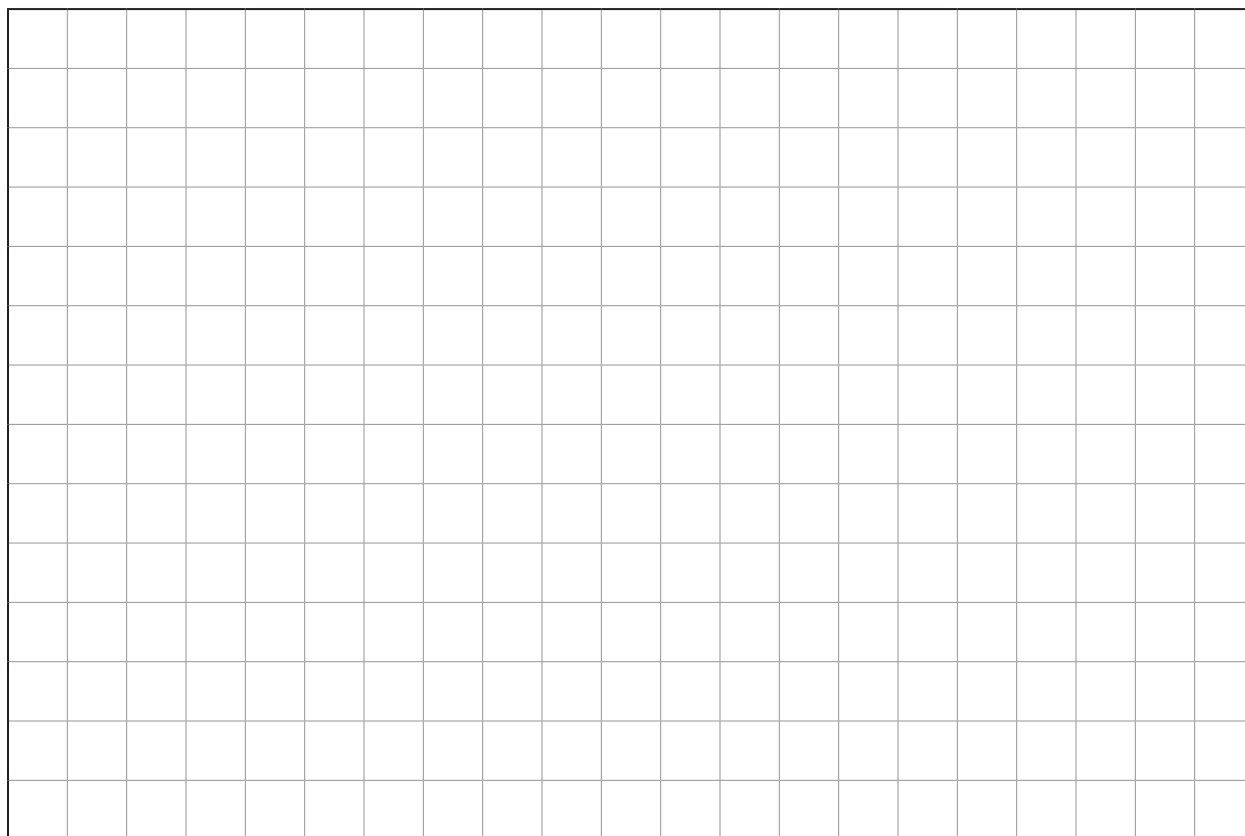
<b>Observation 3</b>	Once you took your bricks out of the molds, describe how they look. Are the rocks and sand tightly packed? Are there air holes? If so, is there a lot of space between the rock and sand?
<b>Observation 4</b>	Look at the quality of your finished bricks. Are they all the same size? If they are different sizes, why do you think that happened? What improvements could you make to create better bricks?

### Building Your Shelter

Design your shelter following your teacher's instructions. List the materials you plan to use and make sure to include your structure's measurements in your design below.

Material	How much will you use?

### Shelter Design



Shelter approval signature: \_\_\_\_\_

### Shelter Size and Calculations

Follow your teacher’s instructions and complete any needed calculations for your shelter. Show your work. Use the measurements you made when you designed your shelter to help you.

Handwritten calculation area consisting of ten horizontal lines.



### Shelter Quality Control Test

Describe any leaks in your shelter. Where are the leaks? Why? If you want, you may draw an image of the leaks.

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If you are able to make any improvements to your shelter, do so now. Before you make these improvements, write the steps you plan to take here:

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If you retest, describe your results here:

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**SHARE:** The last step in any design process is to share results. Your teacher will tell you how you will share your design, test results, and any improvements you made to your shelter.

**Congratulations! You have taken your first steps toward being a Mars explorer. Where will you explore next?**

## About This Lesson

### Author

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Wings Over the Rockies Air & Space Museum  
Denver, CO

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Washington, DC

### Acknowledgments

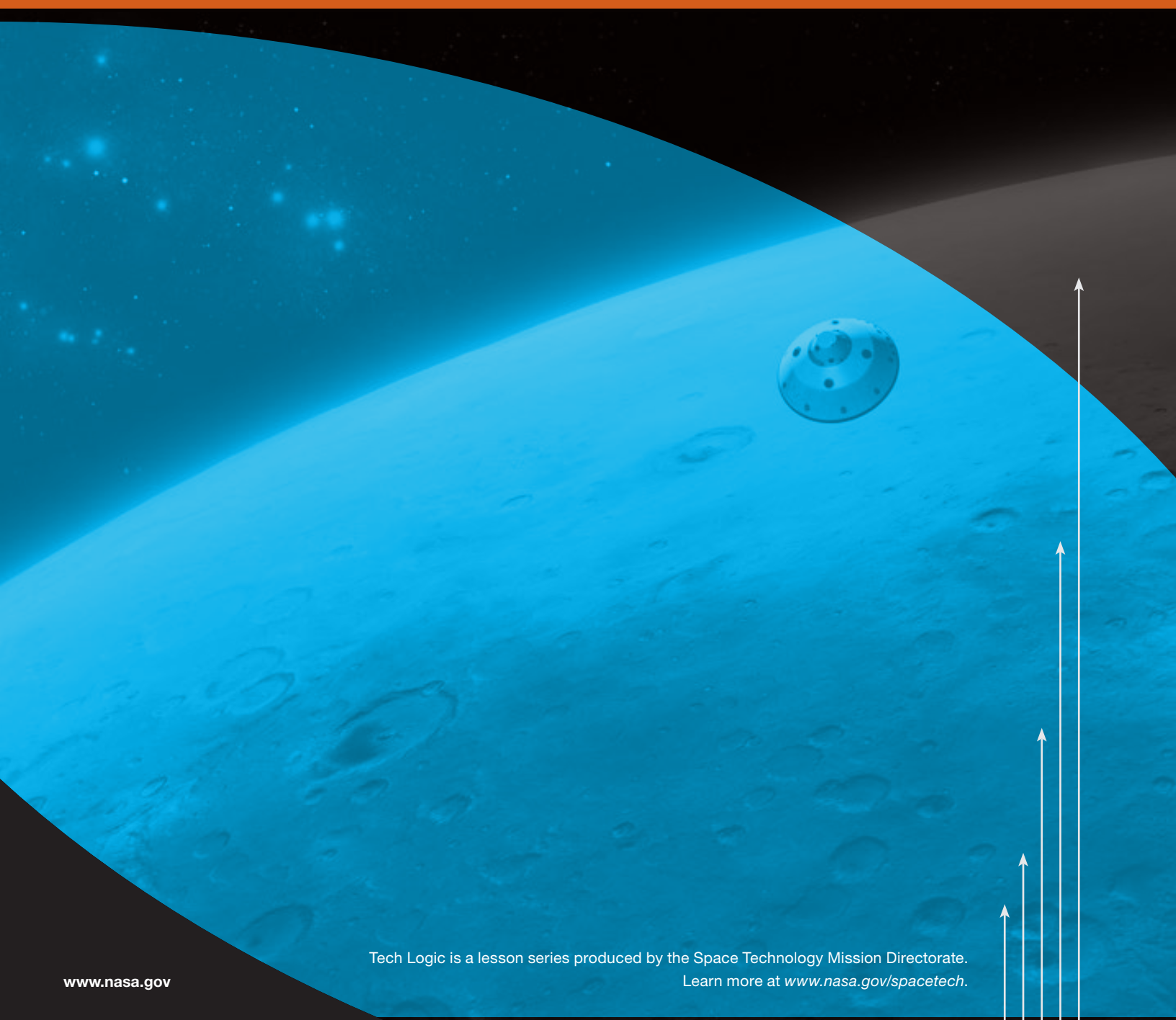
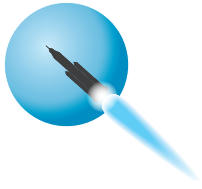
Special thanks to the Wings Over the Rockies Teacher Envoys for providing feedback, testing in classrooms, and editing this resource.

### Image Credits

**Cover:** Mars Science Laboratory spacecraft approaching Mars—NASA. **Page 1:** Illustration of Mars settlement—NASA. Hiker cartoon—iStock. **1-1:** Explorer cartoon—iStock. **2-1:** Astronaut on Mars—Designed by Freepik. **Back cover:** Illustration of Mars settlement—NASA; Sand mixture in ice cube tray and student building a structure—April Lanotte/NASA; Contour Crafting Robot on the Moon—Behnaz Farahi/NASA.

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