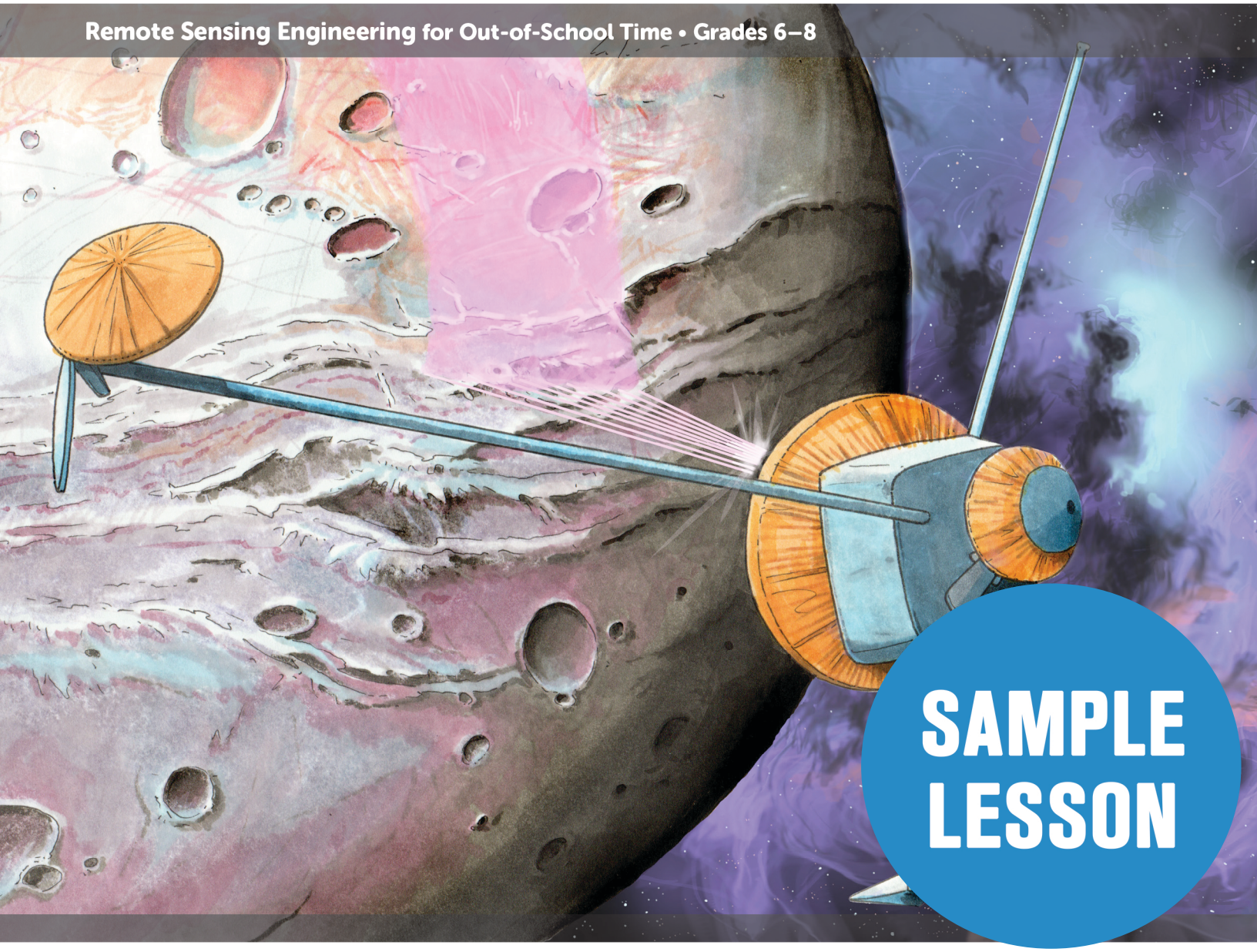
Engineering Everywhere™

Worlds Apart:
Engineering Remote Sensing Devices

Remote Sensing Engineering for Out-of-School Time • Grades 6–8



SAMPLE LESSON

Written by the Engineering is Elementary® Team
Illustrated by Ross Sullivan-Wiley and the Engineering is Elementary® Team

EiE Engineering is Elementary®
Developed by the Museum of Science, Boston
Engineering Everywhere™

In ***Worlds Apart: Engineering Remote Sensing Devices*** students are introduced to the eight-step Engineering Design Process as they work together to engineer remote sensing devices for partner scientists. Students will investigate different technologies like periscopes, optical filters, and LiDAR before engineering their own remote sensing devices to solve one of the research problems posed by the scientists.

The provided sample lesson showcases the step-by-step support educators will receive through the unit.

The full unit consists of:

- Detailed lessons plans
- Duplication masters for student handouts
- Standards alignments for Math, ELA, and science
- Online educator access
- Materials kit available for separate purchase

EiE® is the award-winning curricula development division of the Museum of Science, Boston. Our research-based, hands-on engineering and computer science curricula (PreK–8) introduce learners to the engineering design process and create the next generation of problem solvers.

Engineering Everywhere® gets kids thinking like engineers both in- and out-of-school with real-world challenges that build confidence as they collaborate, communicate, think critically, and develop other essential 21st century skills.

Visit eie.org to learn more about our curricula, resources, and professional development.

About Engineering Everywhere

The mission of Engineering Everywhere is to create engaging out-of-school time learning experiences for 6th–8th graders that positively impact youth's attitudes about their abilities to engineer. Our goal is to provide youth with personally meaningful and globally relevant challenges that empower them to problem solve, think creatively, and learn from one another.

The main ideas that guide the developers of EE are listed below.

We believe youth will best learn engineering when they:

- engage in activities that are fun, exciting, and connect to the world in which they live.
- choose their path through open-ended challenges that have multiple solutions.
- have the opportunity to succeed in engineering challenges.
- communicate and collaborate in innovative, active problem solving.

Through EE units, youth will learn that:

- they can use the Engineering Design Process to help solve problems.
- engineers design technologies to help people and solve problems.
- they have the talent and potential to design and improve technologies.
- they, too, are engineers.

As youth work through their engineering design challenges, they will have the opportunity to build their problem solving, teamwork, communication, and creative thinking skills. Most importantly, this curriculum is designed to provide a fun learning opportunity!

Unit Goals

In this unit, youth will be introduced to engineering and the eight-step Engineering Design Process as they work together to engineer remote sensing devices for partner scientists. Youth will *investigate* different technologies used in the field of remote sensing—periscopes, optical filters, and LiDAR—before engineering their own remote sensing devices to solve one of the research problems posed by the scientists.

By the end of the unit, youth will be ready to present what they learned about remote sensing and the Engineering Design Process by sharing the engineering work they have done.

Prep Activity 2 What is Technology?

Educator Preview

Overview

Youth will match technologies based on the problem they solve and *imagine* ways to *improve* the newer version.

Note to Educator:

Many people think of technologies as things that are "high-tech" or powered by electricity. Technologies are actually any thing designed by humans to solve a problem. Be sure to copy enough Technology Cards so that each youth in your group has one. **Be sure to save the *Remote Sensing Definition* chart paper for use in later activities.**

Activity Timing

Introduction:	5 min
Investigate:	10 min
Imagine and Improve:	15 min
Video:	15 min
Reflect:	10 min
	55 min

21st Century Skill Highlight

Critical Thinking

Prep Activity 2 Materials

For the whole group

- ☐ *Engineering Design Process* poster
- ☐ *Technology Match Cards*, pp.13–23 in this guide
- ☐ *Engineering Everywhere Special Report* video
- ☐ chart paper and markers
- ☐ 1 pair of scissors
- ☐ 1 roll of masking tape

For each youth

- ☐ Engineering Notebook

Prep Activity 2 Materials Preparation (10 min)

1. Post the *Engineering Design Process* poster.
2. Copy and cut out the *Technology Match Cards*, pp. 13–23 in this guide, so there is one for each student.
3. Watch and prepare to play the *Engineering Everywhere Special Report* video (10:15): eie.org/remote-sensing.

Prep Activity 2 What is Technology?

Activity Guide

Youth will learn:
- A technology is any thing designed by humans to solve a problem.
- Engineers design and *improve* technologies.
- There are always opportunities to *improve* existing technologies.

Tip

Using the term "engineer" will help youth become more comfortable with it!

Tip

Natural objects on their own are not technologies. People can turn those objects into technologies, however, if they use it to solve a problem. For example, a rock can be used to grind corn or shaped into an arrowhead.

Tip

If youth are not familiar with the technologies on the cards, have them work in groups to figure out the pairs together.

Tip

Encourage youth to find multiple connections between technologies.

Introduction (5 min)

1. Tell youth that today they are again going to be working as engineers. They will think about how engineers design and *improve* technologies.
2. Guide youth to think about the word technology. Ask:
   - **What are some technologies you can think of?** *For now, accept all answers.*
3. Write the definition of "technology": *Any thing designed by humans to solve a problem.*
4. Ask:
   - **Based on this definition, do you think people throughout history used technologies? Can you give any examples?** *Yes, things like candles and paper maps might be "old technologies," but they were designed to solve the problems of their time.*
   - **Why do you think technologies change over time?** *People's needs change, better materials are developed over time.*

Investigate (10 min)

1. Show the group a pair of Technology Cards that solve the same problem. Ask:
   - **What problem do these two technologies solve?**
2. Let youth know they will play a game to think more about technology and how it changes over time.
3. Have youth come up to the front of the room and tape a Technology Match Card to each of their backs. Explain that they will need to ask each other questions about the function of the technology without saying what it is, and find someone with a technology that solves the same problem.
4. Give youth a few minutes to talk with each other and try to find a match for their technology.
5. Once all youth have found a partner, have a few pairs share their technology matches. Ask:
   - **What are the technologies you matched? What problem do they both solve?**

- **Which technology do you think was engineered first?**
- **Why do you think the newer technology was engineered?** *People were not satisfied with the first technology, the newer technology is easier to use.*

6. Let youth know that engineers are the people who design and *improve* technologies!

Imagine and Improve (15 min)

1. Explain to youth that just as engineers throughout history *improved* the first technology in their pair, engineers today may find ways to *improve* the newer technology even more.
2. Let youth work with their technology partners to *imagine* ways to *improve* their newer technologies. Youth can record their ideas on *What is Technology?*, p. 3 in their Engineering Notebooks.
3. After about 10 minutes, have a few pairs share their improvements with the group, and ask:
   - **Are there other technologies in your life you think engineers should *improve*? Why?**

Special Report Video (15 min)

1. Let youth know you have more to share about the work of engineers. Ask:
   - **What do you think the term "remote sensing" means?**
2. Use chart paper and markers to record youth's ideas. Accept all answers for now.
3. Explain that youth will watch a short video to learn more about field of remote sensing and the types of technologies that scientists and engineers use. Play the *Engineering Everywhere Special Report* video (10:15): eie.org/remote-sensing.
4. After the video, ask:
   - **How have your ideas about "remote sensing" changed?**
5. Write "*Remote sensing: to collect information from a distance.*" on chart paper and post it on the wall. Ask:
   - **Why might scientists and engineers want to collect information from a distance?** *A place or object they want to learn about is hidden, too far away, or dangerous to visit in person.*
   - **What are some examples of remote sensing technologies that you have seen or used?** *Telescopes, binoculars, cameras, X-ray, etc.*
6. Tell youth that their challenge over the next few days is to engineer remote sensing technologies to help a group of scientists with a problem, just like they saw in the video.

Tip

Encourage youth to think creatively about what parts of their technology they might *improve*, or come up with a brand new way to solve the problem.

Tip

Help youth unpack the term "remote sensing technology" even further: "remote" refers to something that is far away or distant, and "sensing" refers to the way we collect and become aware of information.

7. Explain the scientists' problem to youth: A new moon has been discovered in the solar system and scientists are interested in learning about its landscape and features before they send astronauts to explore it. They need the help of engineers like you to design remote sensing technologies that can collect information about the moon from a distance, so they will know what to plan for in future explorations.
8. Let youth know that they will learn more about this problem and ways to solve it in the next activity.

Reflect (10 min)

1. Have youth examine the *Engineering Design Process* poster. Ask:
   - **Which steps of the Engineering Design Process did you use today?** *We* identified *a problem,* improved *a technology, and* communicated *our ideas.*
2. Have youth fill out *My Engineering Profile,* p. 4 in their Engineering Notebooks, to reflect on engineering skills they feel are strengths for them, as well as any engineering skills they would like to work on throughout the unit. Giving youth time to fill out *My Engineering Profile* will help reinforce the idea that they are engineers and guide them to reflect on themselves as engineers.

Interested in learning more about this unit or curricula?
Please contact your Regional Representative.