

INNOVATION NOTEBOOK

Aerospace engineers create technology used in outer space, but they also provide scientists with the tools and data to do important work here on Earth. Aerospace technology makes it possible for scientists to collect data on deforestation, fires, archaeology—even volcanoes!

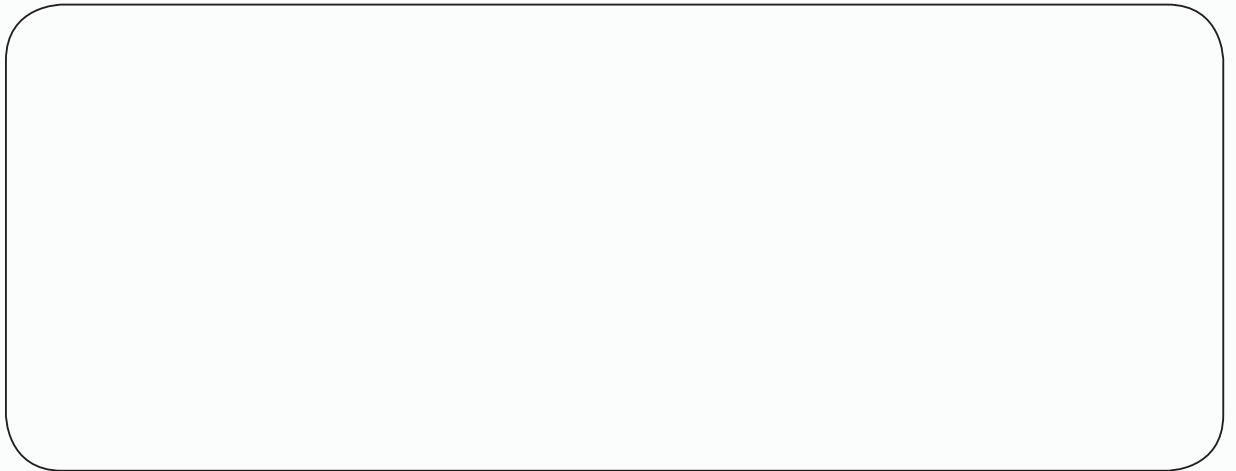
PART 1 BRAINSTORM

What problems would you like to solve that are difficult to observe from the ground?

Choose one problem and circle it. Think about what you can invent to observe this problem.

PART 2 DRAW

Sketch an innovation that will gather data about the problem. Label each machine part with a brief description of how it supports the mission.



PART 3 WRITE


Describe the innovation, how it works, and how it solves the problem. Be specific and detailed.

ENGINEERING

ON
THE

FLY

ELA and Science
Lessons About
Aerospace Careers

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- Class set of magazines
 - Profiles of cool aerospace jobs

Visit [scholastic.com/talentfortomorrow](https://www.scholastic.com/talentfortomorrow) for more teaching materials!

How to Use This Program These lessons can be used individually or sequentially in ELA or science classes. The first lesson has a bit more emphasis on ELA, and the second has a bit more emphasis on science, though both are cross-curricular. We hope you and your students enjoy them!

LESSON A ANALYZING A NEWS STORY

GOAL Students will work in groups to create an innovative engineering solution to help scientists observe animal habitats in harsh weather conditions. They'll cite evidence from an article to support their analysis of Operation PolarEye.

TIME REQUIRED: 45–60 minutes

MATERIALS

- ☆ Student magazine
- ☆ “The Engineer’s Challenge” activity sheet
- ☆ Writing/drawing paper (filming optional)

- 1 Prepare students to read the magazine** by asking them what they think aerospace engineers do, and how their work might support research about the environment. Review how context clues can help determine the meaning of engineering and technology vocabulary.
- 2 Hand out the student magazines.** Discuss what the bolded words in the article might mean and how students arrived at those definitions.
- 3** After reviewing the central idea as a class, have students **analyze the article by thinking about how aerospace technologies and environmental conservation** are connected. How do the two come together to support a common cause?
- 4** Discuss how non-technical skills like **clear communication, collaboration, problem solving, and planning** are important for engineers working on a project together. Then ask students to cite evidence from the article to support their analysis.
- 5 Separate students into groups of four.** Hand out activity sheet. Have groups follow directions to engineer their own weatherproof drone. Encourage students to do research on potential problems to solve or on aerospace engineering. Have groups share proposals with the class. Discuss why failure is an important part of the engineering process.

LESSON B ENGINEERING TO SOLVE PROBLEMS

GOAL Students will innovate a solution to gather data about something that’s difficult to observe from the ground. They will describe the aerospace innovation and how it will be created and used.

TIME REQUIRED 45–60 minutes

MATERIALS

- ☆ Student magazine
- ☆ “Innovation Notebook” activity sheet
- ☆ Block of ice, water, and a clear container
- ☆ Infrared and other images downloaded from [scholastic.com/talentfortomorrow/images.pdf](https://www.scholastic.com/talentfortomorrow/images.pdf)

- 1 Engage students with a demonstration** using a block of ice in a pan of water. Invite them to brainstorm what data points can be gathered as they observe the ice melting, first at eye level and then while standing looking down from above (e.g., width, depth, rate, circumference, air bubbles). Point out that the overhead view is how aircraft and satellite observation works, but on a larger scale.
- 2 Review the key concepts in the student magazine.** Ask what kinds of data might be useful for studying polar bear habitats (e.g., images of changing ice borders, polar bear migration patterns). Have students discuss with a partner, then share with the class.
- 3 Discuss the mechanics and engineering principles** of how data is gathered by unmanned aerial vehicles (UAVs) via cameras, sensors, etc. Show students images taken by different cameras, such as infrared, thermal, and standard.
- 4 Ask students to brainstorm other things** humans want to observe from above that cannot easily be observed on Earth (e.g., deforestation) or that we can’t get close to (e.g., hurricanes, forest fires). Hand out the activity sheet. Divide students into small groups and direct them to share and discuss their work with their peers.



SIGN UP FOR THE TEAM AMERICA ROCKETRY CHALLENGE!

Your students will get hands-on experience in physics and engineering at the world’s largest student rocket competition. More info at rocketcontest.org.

THE ENGINEER'S CHALLENGE

Aerospace professionals often combine their expertise by working in teams to solve problems and tackle complex projects. In this activity, you will take on a specific aerospace job and work in a group to develop a proposal for a prototype for testing.

1. YOU'RE HIRED!

As a group, read the job descriptions to the right. Have each person **choose a role**.

2. BRAINSTORM

Representing the different job roles you selected, **brainstorm a new innovation** that allows scientists to **observe animals in harsh conditions** to solve a problem (e.g., how to count a population of bees living near a volcano). What components could help your prototype work? Examples: a weather-protective shield, multiterrain landing gear, a high-resolution camera, flight and navigational controls, and more from your imagination.

3. PERSUADE

As a team, **write and illustrate (or film!) a persuasive proposal** convincing your company to build your prototype for testing.

Part 1 Describe the problem to solve.

Part 2 Describe your solution.

Part 3 Write a plan for building and testing your prototype.



BONUS Failure-Busting Log

Imagine you are a field test engineer. Your mission: Test the Operation PolarEye hexacopter and write several entries about field tests completed before its design flaws were worked out. **Each entry should include:** What the hexacopter did wrong during the test, a description of how the errors were discovered, and your proposed solutions to fixing them. As you write, try to capture the voice of a real engineer who is passionate about their work.