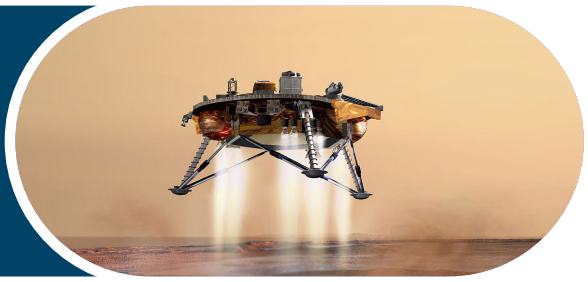
DIGITAL DISCOVERY WORKSHOPS

Teacher Toolkit: Stick the Landing | Grades 3–8

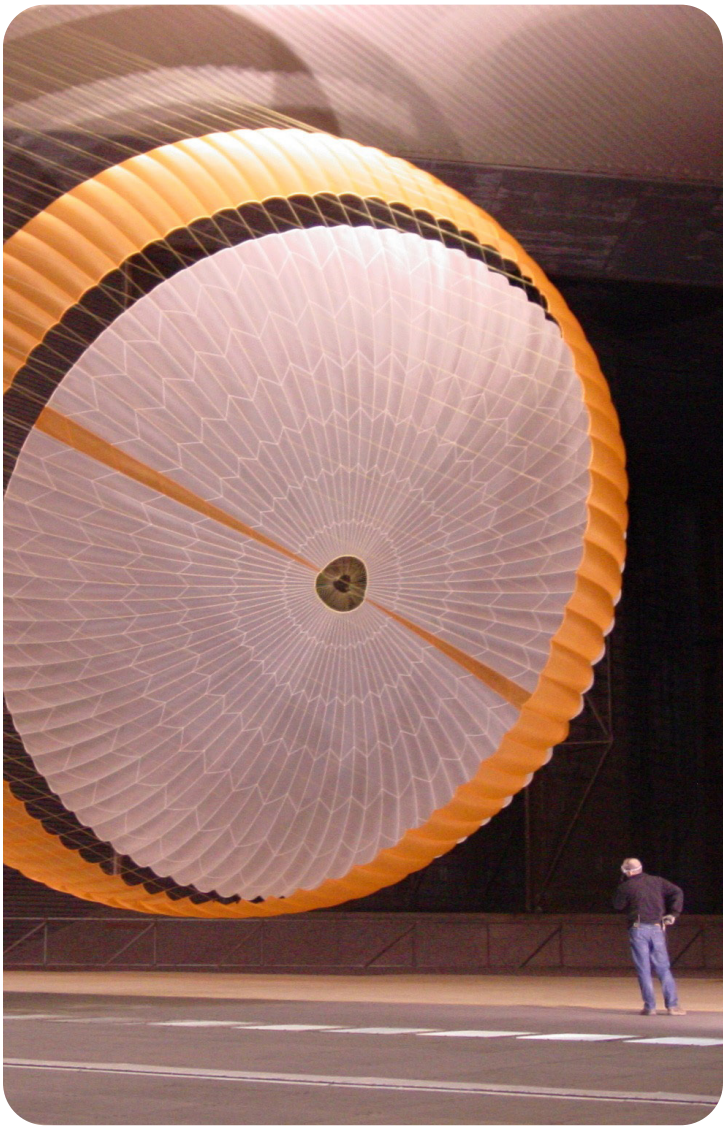


PROGRAM OVERVIEW

Get familiar with the program content.

Program Description

Over the course of three sessions, use the steps of the engineering design process to build, test and refine your own model of a Mars lander in your learning space. Dive into past and future missions to Mars and carefully consider the criteria and constraints for both real Mars missions and your own lander model. Learn how engineers are just one of the many careers that contribute to complex solar system missions.



Program Objectives
Understand how real STEM professionals collaborate to accomplish large projects.
Work through the engineering design process to design, build, test, and redesign a Mars lander.
Work together to set the criteria and constraints of the design challenge.
Assess different designs based on how well they meet the criteria and constraints.
Iterate subsequent designs using lessons learned via hands-on tinkering and discovery.

Program Key Words (English/Spanish)
Engineering / la ingeniería
Design Process / el proceso de diseño
Model / un modelo
Criteria / los criterios
Constraints / los restricciones

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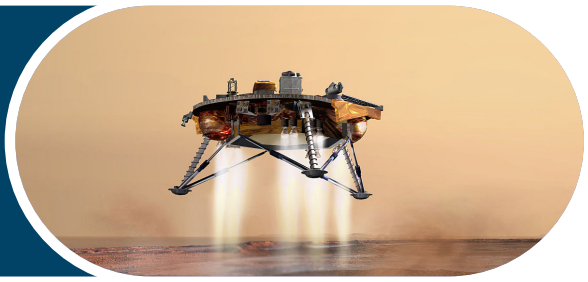
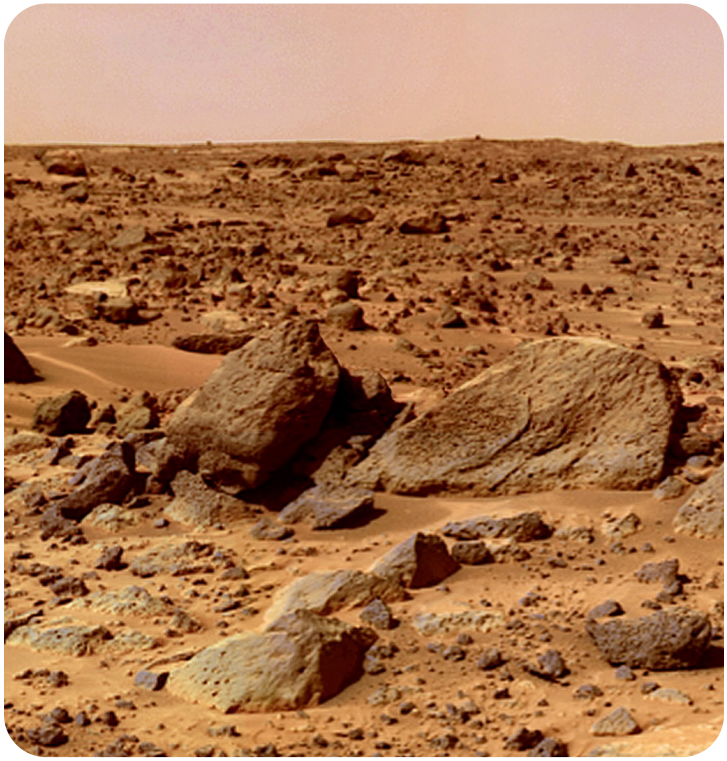


Required Materials List:

- Basic crafting tools: paper, tape, glue, scissors, writing utensils.
- At least five types of building materials, such as: paper clips, paper cups, string or yarn, plastic or cardboard recyclables, craft supplies, tissue paper, bubble wrap, rubber bands, straws, foil, etc.
- Use or substitute anything else you have that you'd like to use!
- One Pringle or similar potato chip per student (to represent the fragile astronaut).
- One Engineering Notebook per student. **Click to download** (print double-sided and change setting to flip on the short end).
- *Optional*: PacSci Bucks template. **Click to download** (print 1 page per student, cut into individual bucks).

View Supported NGSS



BEFORE THE PROGRAM

Prepare for your program series.

PRE-PROGRAM CHECK IN

Email **edprograms@pacsci.org** for an optional but recommended 15-minute check in with your PacSci educator before the program series begins. In this check-in, we will:

- Review the session outline and expected class time work.
- Discuss strategies for student interaction and engagement.
- Ask how we can tailor the program to your students' needs.
- Share tips and tricks for facilitating the building and testing of landers in the classroom.
- Answer any other questions about the program!

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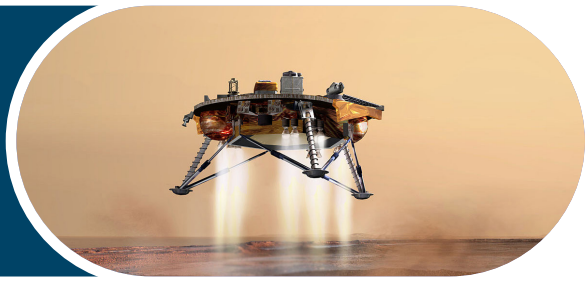
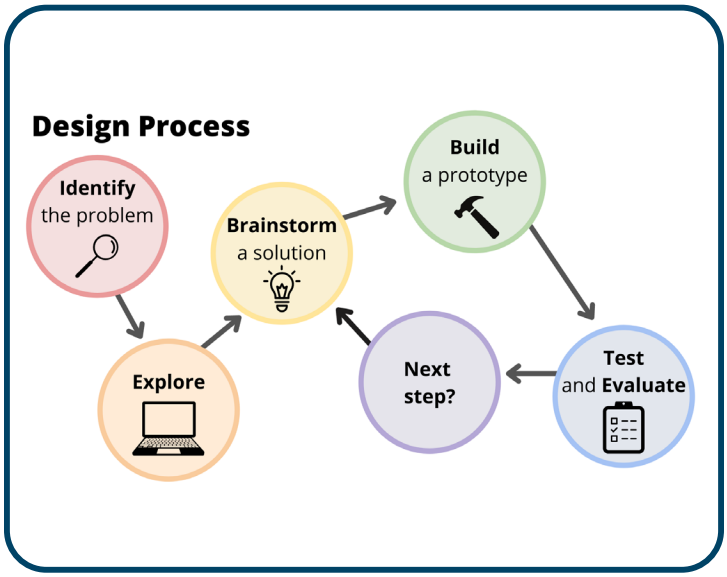


OPTIONAL DISCUSSION PROMPTS

Use these questions to lead an optional pre-program discussion in your class.



- What do you think of when you hear the word "engineering"? Make a list, word cloud, or drawing to represent your thoughts, either individually or as a group.
- The engineering process breaks down a big challenge into smaller steps. Think of a small challenge that you might do in your everyday life, such as brushing your teeth, getting to school or making a sandwich. Using words or pictures, break down the steps you would take in order to accomplish that task.
- Visit **NASA's Mars Exploration Program website**. What is one thing you learned from the website? What is one question you have about Mars exploration?

PREPARING FOR EACH PROGRAM SESSION

Prep for each session of the three-part series

SESSION ONE

Materials to prep before the session:

❑ Print out of **Engineering Notebook PDF**, one per student.
- Tip: print double-sided and change setting to **flip on the short end**.

During the session we will...

Explore the topic of Mars exploration. Introduce the engineering process and the engineering challenge of building a model Mars lander.

Tasks to complete before the next session:

❑ Provide time for students to draw their designs for their model lander, typically 5–15 minutes.

❑ Confirm with your PacSci educator a list of building materials students will have available.

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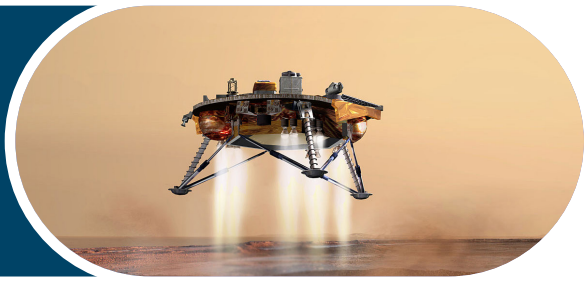

SESSION TWO

Materials to prep before the session:

- ❑ Engineering Notebooks.
- ❑ Basic supplies such as paper, tape, glue and scissors.
- ❑ At least five types of additional building materials such as: paper clips, paper cups, string, plastic or cardboard recyclables, craft supplies, tissue paper, bubble wrap, rubber bands, straws, etc.
- ❑ Optional: Print and cut **PacSci Bucks**, one sheet per student (or pair if building together).

During session two, students will need to "buy" their materials and begin building their model landers. Feel free to set up materials in whatever way works best for your learning space, or see next page for a recommended set up strategy.

Set up three stations around the room; one station for each level of materials cost ($1, $5 and $10). Allow approximately five students up at a time to visit the stations and obtain their materials.

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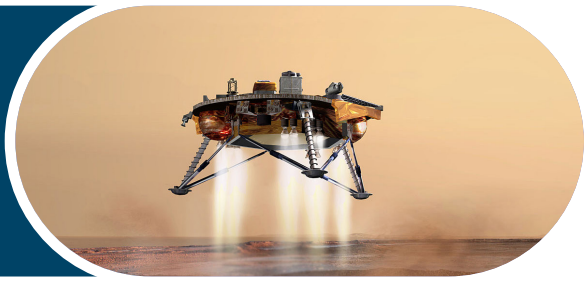

SESSION TWO CONTINUED

During the session we will...

Learn about different design techniques used for previous Mars landers. Select building materials. Start building our model landers.

Before the next session:

❑ Provide time for students to finish building their model landers, typically 20-40 minutes.

SESSION THREE

Materials to prep before the session:

❑ Engineering Notebooks.

❑ Completed lander models.

❑ A can of Pringles or similar (one chip per student will represent a fragile astronaut).

During the session we will...

Discover the variety of careers and skills that are needed for Mars missions. Test our model landers and draw a re-design.

After the series:

❑ Optional: Provide class time for students to make updates to their lander designs based on test results.

AFTER THE PROGRAM SERIES

These optional extension resources can be used within the learning space, or shared with students to do at home with their families.

ACTIVITY GUIDES

- In our engineering series, we followed the design process to create and refine a model of a Mars lander. Use your engineering skills to design something different, like a **Filtration Station** | **Estacion de Filtrado** to clean water, or a **Wind Powered Car** | **Vehículos Impulsados Por El Viento** to move a vehicle with a renewable energy source. Activity time: 1-2 hours each.
- Explore how to design inventions for different types of users and their needs in **Design a Solution** | **Diseña una Solución**. Activity time: 30-60 minutes.

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Show us how you're being curious! Share your results with us.

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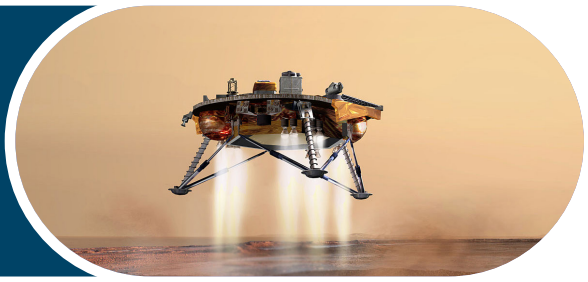
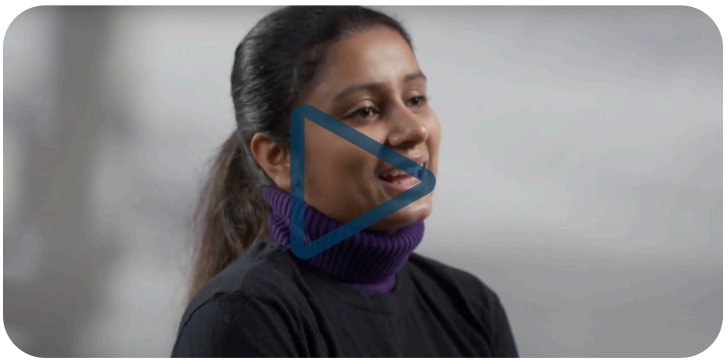
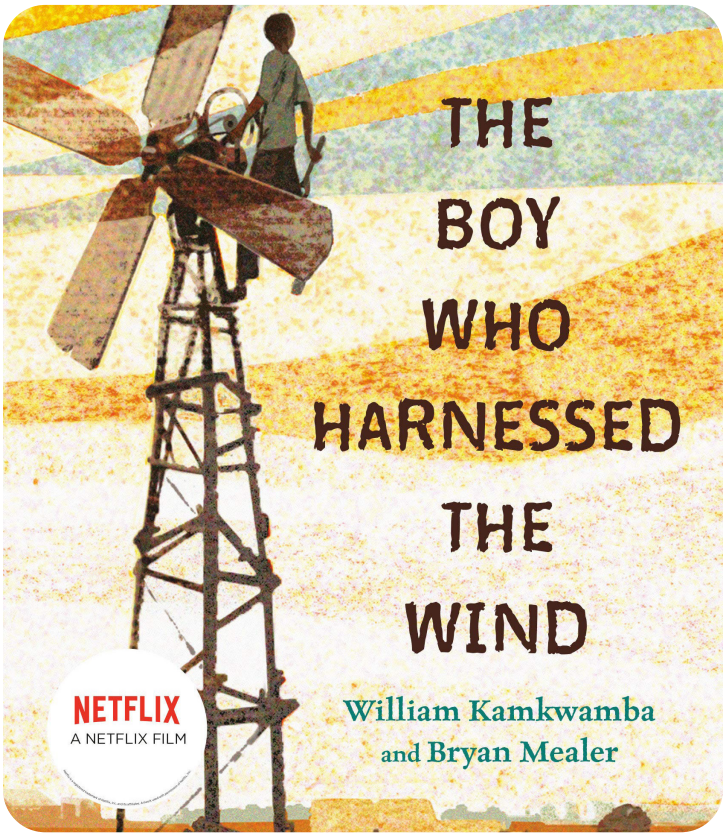


ADDITIONAL RESOURCES

- **Paper Mars Helicopter**: Apply the engineering process to another type of device on Mars- a helicopter! What similar and different considerations might you have compared to the lander we designed in our program? Activity Time 30-60 minutes.
- Once a rover lands safely on Mars, it needs to be able to safely move around. Help the Perseverance Rover navigate with **Explore Mars: A Mars Rover Game**. This game is best played on individual devices. Activity time: 30-40 minutes.





STEAM VIDEO

- Visit PacSci's **Career Corner playlist** and select one of the Engineering themed videos to meet some real engineers and learn about the work they do. Activity time: 5-10 minutes per video.
- Take a virtual tour of **NASA's Jet Propulsion Laboratory** to see where many robotics engineers plan missions into space. Activity time: 30-60 minutes.

READING LIST

- Check out the **Stick the Landing reading list** for STEAM books related to the program themes.

For more activities with simple materials, check out the **Curiosity at Home** / **Curiosidad en Casa** *web page. Explore activity sheets by age group and topic in both English and Spanish.*

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Show us how you're being curious! Share your results with us.

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