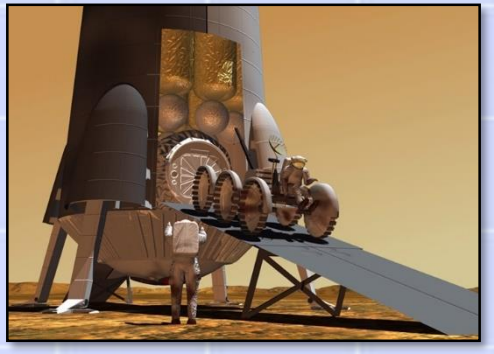




What Will it Take to Live on Mars?

MAKE it NASA

What Will it Take to Live on Mars?

Agenda

- Introductions and NASA Content Overview
- Applying Design Thinking to a Making Activity
  - Discover
  - Interpret
  - Ideate
  - Experiment
  - Evolve
- Conclusion

Share Your NASA Experience

Share your NASA experiences, pictures and videos

- Facilitators participating at NASA professional development workshops
- Students using NASA content
- Your organization connecting with NASA Subject Matter Experts

@NASAGRC_Edu – NASA Glenn Office of STEM Engagement on Twitter

@NASAGlenn official accounts: 

@NASAedu – NASA Office of STEM Engagement official Twitter account

- Be sure to use the hashtag #NASAGlennSTEM

What Will it Take to Live on Mars?

- Students design and build an element critical for astronauts to live and work on Mars.

- Products could pertain to how astronauts would get to Mars, live and work on the planet's surface, or return to Earth.

The Student Journal

- This document will help students organize their thoughts and track their progress through the challenge.

- Instructions on the left-side pages; student work on the right-side pages.

Working in Teams

Making projects are all about individual creativity, however the best ideas rarely come from just one person. For this project, it is highly encouraged to have students work in teams of two or more.

Assign roles to team members or have students select their own roles.

- **Design Engineer** – sketches, outlines, patterns, or plans the ideas the team generates
- **Technical Engineer** – assembles, maintains, repairs, and modifies the structural components of the design
- **Operations Engineer –** sets up and operates the prototype to determine what parts work like they should and what can be improved.
- **Technical Writer/Videographer –** records and organizes information, data, and prepares documentation, via pictures and/or video to be reported and published.

Design Your Mission Patch

- Establish a mission/project name – Many NASA missions are named based on the work they do.

- Design a mission patch – Scientists and engineers that work on NASA missions and spacecraft are unified under mission patches that are designed with symbols and artwork to identify the group's mission.

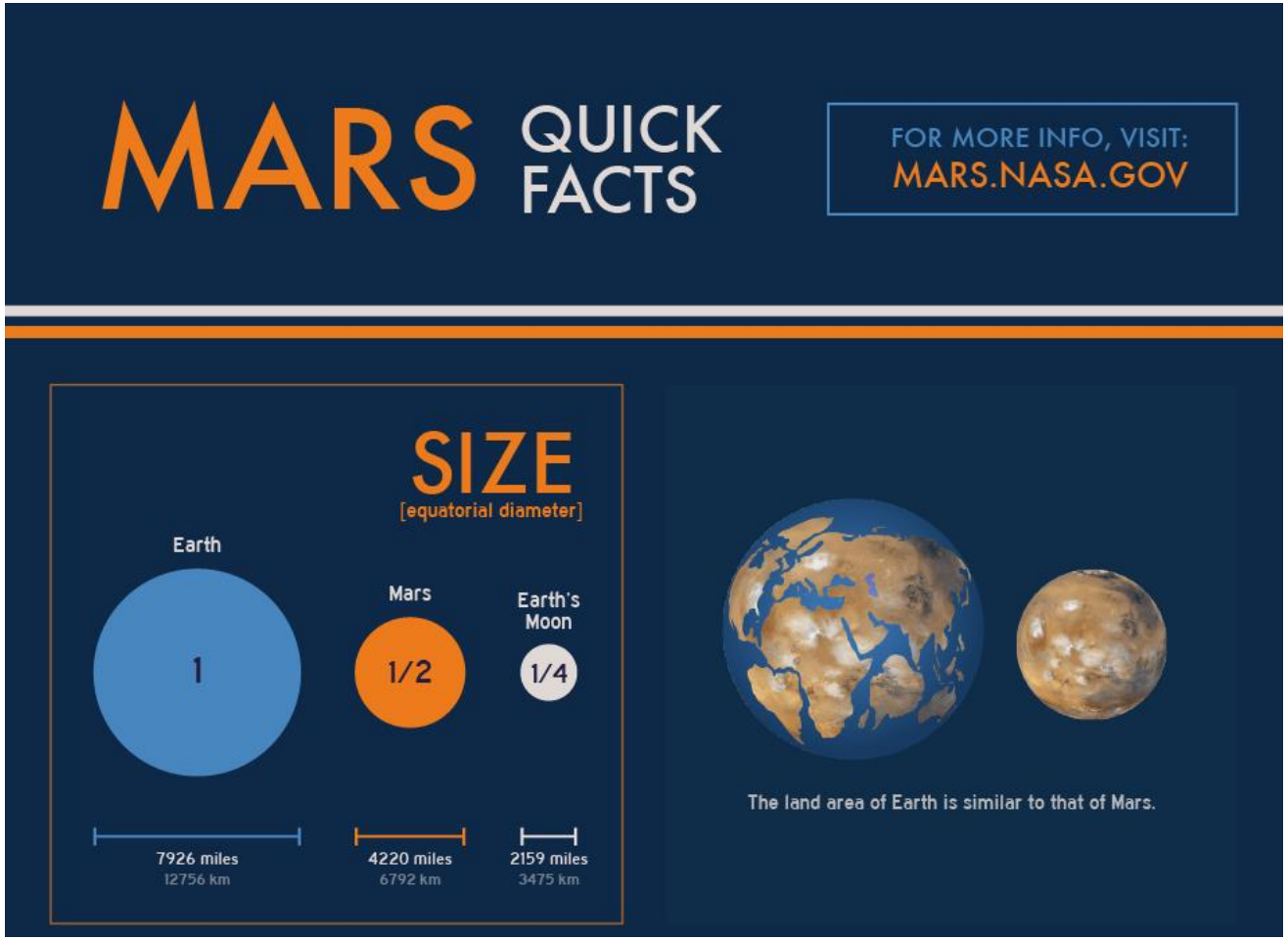
- Create a vision statement – This is a short inspirational sentence or phrase that describes the core goal of the team's work. NASA's current vision statement is:
  - "We reach for new heights and reveal the unknown for the benefit of humankind."

Why Send People to Explore Mars?

https://youtu.be/EhY0tqE4ERg

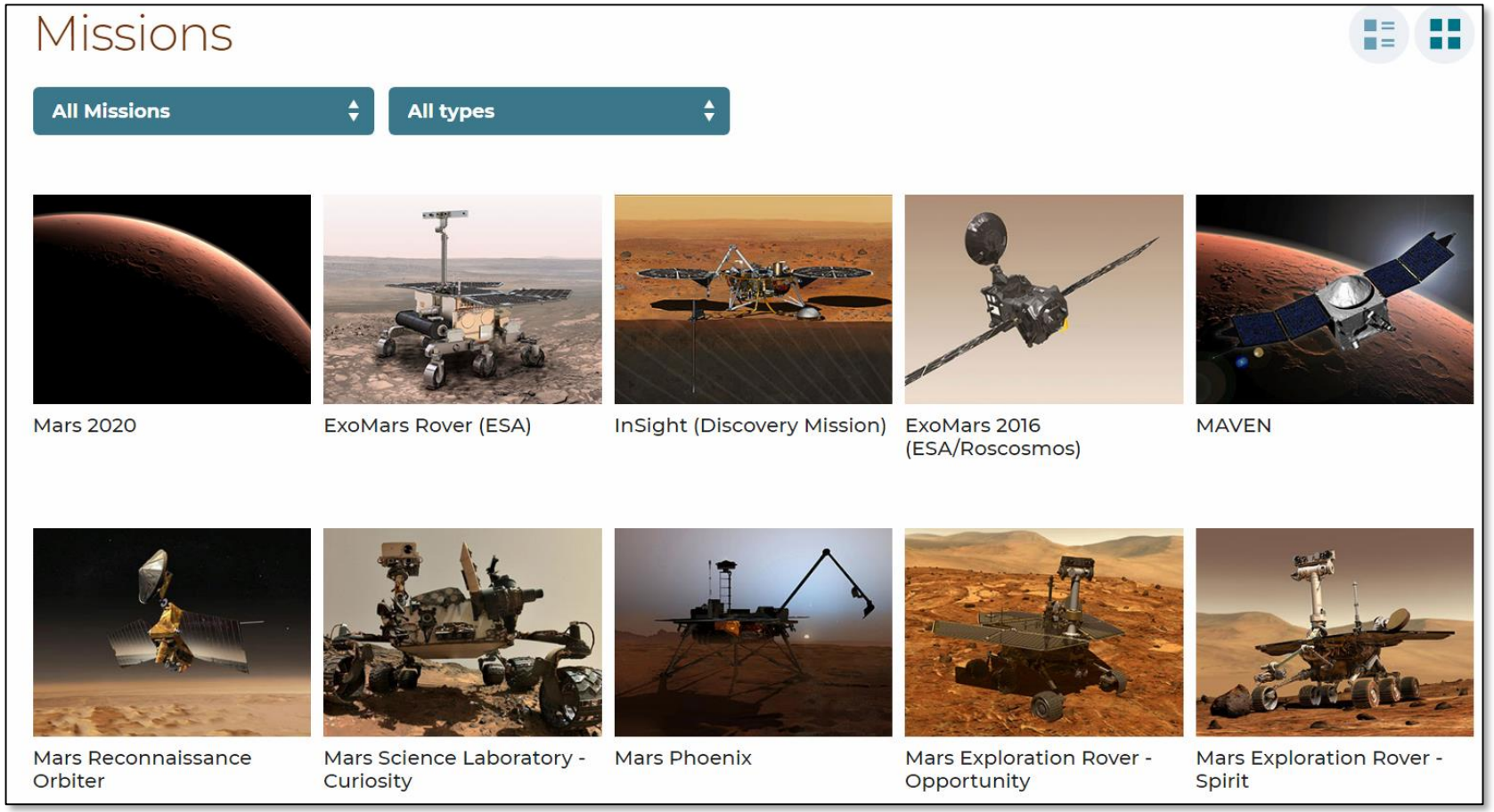
The Basics of Mars

https://mars.nasa.gov/all-about-mars/facts/



Missions to Mars

https://mars.nasa.gov/mars-exploration/missions/



The Design Thinking Process

- This process can be used to solve any problem that requires designing and making a solution.

- Adapted for student use from *Design Thinking for Educators*

https://designthinkingforeducators.com/design-thinking/.

- To make a great solution, first you have to understand the problem.

- Make a list of challenges that need to be solved. These are questions that need answers. (How can…? How would…? How does…?)

- Next, brainstorm any criteria, constraints, and barriers that are part of this problem.
  - **Criteria** are things your solution has to be able to do.
  - **Constraints** are things your solution must not do.
  - **Barriers** are things that could prevent you from finishing your solution.

- Student teams will research one aspect of a mission to Mars, decide on a product that needs to be created to support that aspect, and build a prototype model.

- The teams will evaluate and improve the prototype, and present their final model, key design features, and how it supports the astronauts on their mission.

Some examples of challenge questions:

- Getting There
  - How will we entertain ourselves on the way?
  - How will we prevent overexposure to radiation?
  - How can we exercise in such a small space?
- Living There
  - How will we transport/build a structure to live on Mars?
  - How will we get and use resources from the planet?
  - How will we adapt to the considerably reduced gravity?
  - How will we produce food?
  - How will we suit up to go outside?
  - How will we get around the surface?
  - How will we handle medical issues so far from home?
  - What tools we use to do science on Mars?
- Coming Home
  - How will we return to Earth safely?
  - How will we bring samples back from Mars?

Interpret

• **I learned something.** *How do I interpret it?*

- To begin solving this challenge, you will need to find answers to the criteria, constraints and barriers you listed.

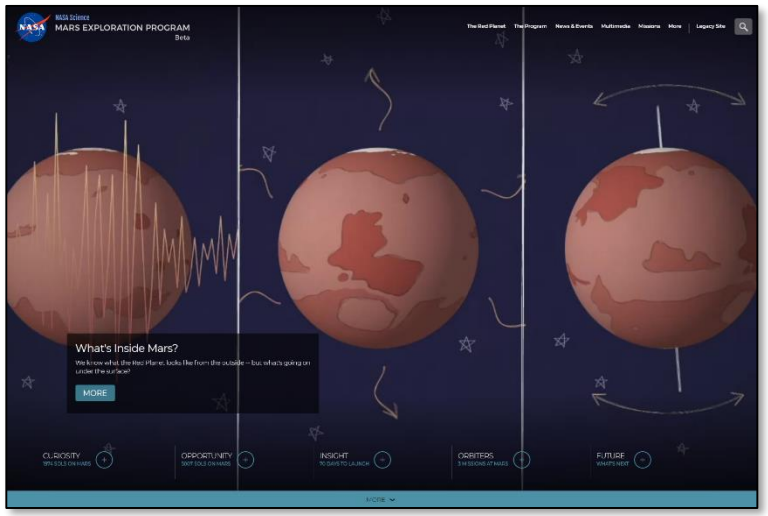
- Brainstorm resources you could use to get more facts about your challenge. You could use books, experts or trustworthy sources on the Internet.

- Access the sources you listed. Write down the key ideas that you learned. Think about how those ideas should affect your solution.

NASA Resources for This Activity

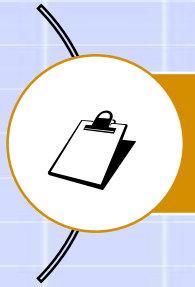
Sample of NASA Resources

- https://mars.nasa.gov/
- https://mars.nasa.gov/allaboutmars/facts/
- https://mars.nasa.gov/imagine/students/
- https://mars.nasa.gov/participate/marsforeducators/soi/
- https://mars.nasa.gov/multimedia/videos/
- https://mars.nasa.gov/participate/
- https://mars.nasa.gov/participate/marsforeducators/



NASA Resources for This Activity

- A sheet of NASA website resources has been provided for you.
- Review these resources and determine which will be most helpful for your students. Things to consider:
  - What problems are your students trying to solve? Do the sources help answer their questions?
  - Are they at an appropriate reading level for your students? Will you have to help them through?
- NASA has a lot of information, but also consider additional resources from other reputable sources



Ideate

• **I see an opportunity.** *What do I create?*

- Use the things you learned to create a sketch of your solution. Label all major parts.

- Describe how it works.

- Build your solution for the first time. This model is called a **prototype**.
- Think about what materials you need to make each part of your model.
- Take a picture of your model. Add it to your journal.

Resources can come from a variety of places.

Six Suggested Starter Categories for an Elementary Makerspace (Fontichiaro, 2016)

Craft	Engineering	Code	Circuits (& Computing)	Digital Design	Needle & Thread
• Origami • Modeling Clay • Wikki Stix • Scrapbooking • Junk Box creations • Recycled Materials • Challenges	• Tinkertoys • LEGO • K'Nex • BuildWithChrome.com	Robots: • Dash & Dot • Sphero • Ozobot Animation: • Scratch • Blockly • Hour of Code Apps: • Hopscotch • Scratch Jr. • Daisy the Dinosaur	• Arduino • Raspberry Pi • Lego Mindstorms • Snap Circuits • Squishy Circuits • littleBits • K'Nex with electrical components • Circuit blocks	• Canva.com • Picmonkey.com • Makebeliefcomix.com • Pixton.com • 3-D printers • Laser cutters	• Hand sewing • Machine sewing • Knitting • Crochet • Fashion Hacking • Embroidery • Cross Stitch

Suggested “Recycled” Materials

- Aluminum foil
- Bottle caps
- Bottles
- Cereal boxes
- Cookie boxes
- Craft/popsicle sticks
- Drink cans
- Egg cartons
- Egg shells
- Empty baskets
- Empty cans
- Fishing line
- Food storage containers
- Hangers
- Jelly jars
- Leaves
- Magazines
- Milk/juice cartons
- Newspapers
- Old cards
- Paper bags
- Pasta jars
- Old CDs
- Old toys
- Pinecones
- Plastic bags
- Plastic cups
- Plastic utensils
- Rocks
- Scrap wood
- Spoons
- Empty soda bottles
- Empty yogurt containers
- Straws
- Sticks
- String
- Toilet paper/ paper towel rolls
- Toothpicks
- Wire

Evolve

• **I tried something.** *How do I evolve it?*

- Look at your prototype, both the hardware and the code.
  - What parts you want to keep?
  - What parts can be improved?
  - Should anything be added?
  - Should anything be removed?

- Discuss your plan with other creators. What do they think could be improved?

Evolve

• **I tried something.** *How do I evolve it?*

- Make changes and take pictures of each finished model. These are called **iterations**.

- Your pictures should show how your model improved from the first to the last iteration. You will use these pictures on your presentation board

Share Your Story

- Create a presentation board to present your project.

- Be sure to include:
  - Your original problem
  - What you learned from research
  - Your brainstorm ideas
  - Your first sketch
  - Photos of your prototype
  - Notes from what you improved
  - Photos of all iterations
  - Your final solution model

- Practice presenting your project to others. Be ready to answer questions based on your experience.

Sample Making Project Rubric

	UNSATISFACTORY	COMPETENT	PROFICIENT	DISTINGUISHED
TECHNIQUE/ CONCEPTS	Work lacks understanding of concepts, materials and skills.	Work shows some understanding of concepts, materials and skills.	Work reflects understanding of concepts and materials, as well as use of skills discussed in class.	Work shows a mastery of skills and reflects a deep understanding of concepts and materials.
HABITS OF MIND	Student passively attempts to fulfill assignment without much thought or exploration of possibilities. Student refuses to explore more than one idea.	Developing exploration of possible solutions and innovative thinking. Student has more than one idea but does not pursue.	Student explores multiple solutions and innovative thinking develops and expands during project.	Consistently displays willingness to try multiple solutions and ask thought provoking questions, leading to deeper, more distinctive results. Student fully explores multiple ideas and iterations.
REFLECTION & UNDERSTANDING	Student shows little awareness of their process. The work does not demonstrate understanding of content.	Student demonstrates some self-awareness. Work shows some understanding of content, but student cannot justify all of their decisions.	Student shows self-awareness. Work demonstrates understanding of content and most decisions are conscious and justified.	Work reflects a deep understanding of the complexities of the content. Every decision is purposeful and thoughtful.
CRAFTSMANSHIP	Work is messy and craftsmanship detracts from overall presentation.	Work is somewhat messy and craftsmanship detracts somewhat from overall presentation.	Work is neat and craftsmanship is solid.	Work is impeccable and shows extreme care and thoughtfulness in its craftsmanship.
RESPONSIBILITY	Frequent illegal absences, tardiness, disrespect for classmates and teacher. Disregard for materials and work such as refusal to clean up or throwing out work.	Student is sometimes illegally absent, tardy, or disrespectful. Must be persuaded to assist in clean up and to take work home.	Student is most often present, on time, and respectful. Usually participates willingly in clean up and takes pride in work.	Student is consistently present, punctual, and respectful of classmates and teacher. Self-directed clean up and ownership of work.
EFFORT	Work is not completed in a satisfactory manner. Student shows minimal effort. Student does not use class time effectively.	Work complete but it lacks finishing touches or can be improved with a little effort. Student does just enough to meet requirements.	Completed work in an above average manner, yet more could have been done. Student needs to go one step further to achieve excellence.	Completed work with excellence and exceeded teacher expectations. Student exhibited exemplary commitment to the project.

Created by Lisa Yokana, https://www.edutopia.org/blog/creating-authentic-maker-education-rubric-lisa-yokana

Thank You for Participating!