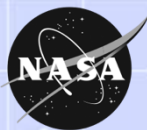
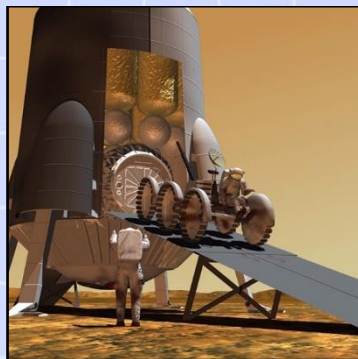
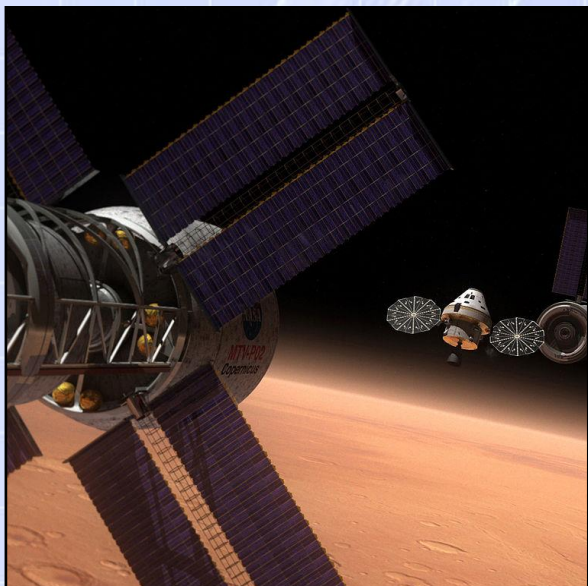


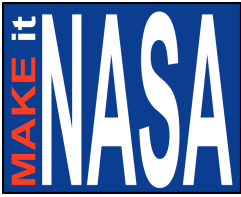


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Space Administration

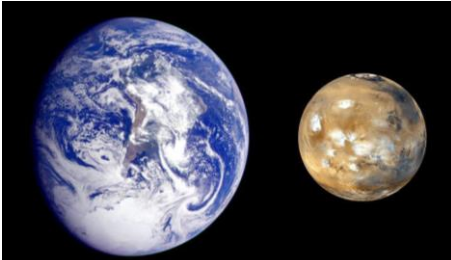


# *What Will it Take to Live on Mars?*





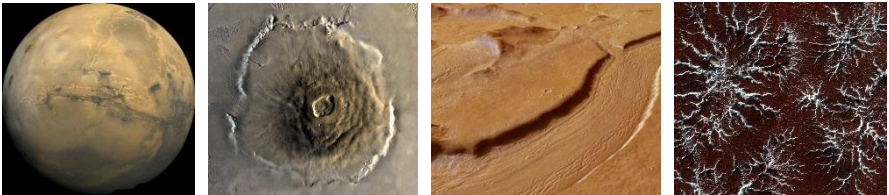
## What Will it Take to Live on Mars?



*Figure 1: A comparison of Earth and Mars*

Scientists and Engineers at NASA are working on how we can one day live on Mars. The “Red Planet” as it is sometimes called, is a very different place than Earth. Many of those differences will require new equipment and technology that are being designed and built right now.

NASA uses data collected by rovers and satellites to understand more about how Mars is different. It has only 1/3 of the gravity felt on Earth because it has only 1/10 of Earth’s mass. Humans would need to wear



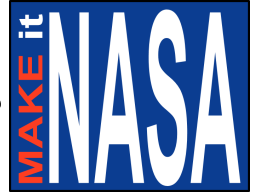
spacesuits to protect them on the surface. Mars has a much thinner atmosphere than Earth and lacks oxygen for us to breathe. Strong winds kick up large dust storms of Mars’s reddish rusty soil. We have found dry lake beds, river beds, and water ice at the planet’s poles that tells us Mars probably had rivers and lakes like Earth’s.

Mars is about 1 ½ times farther away from the Sun than Earth. This extra distance makes Mars very cold, averaging a freezing -46° Celsius (-51°F). Just getting there would take about six months. NASA is working on a new spacecraft, named Orion that can take astronauts to Mars. It will take a lot of science and creativity to get there and even more to stay.



*Figure 3: Illustration of the Orion Spacecraft*

# The Design Thinking Process

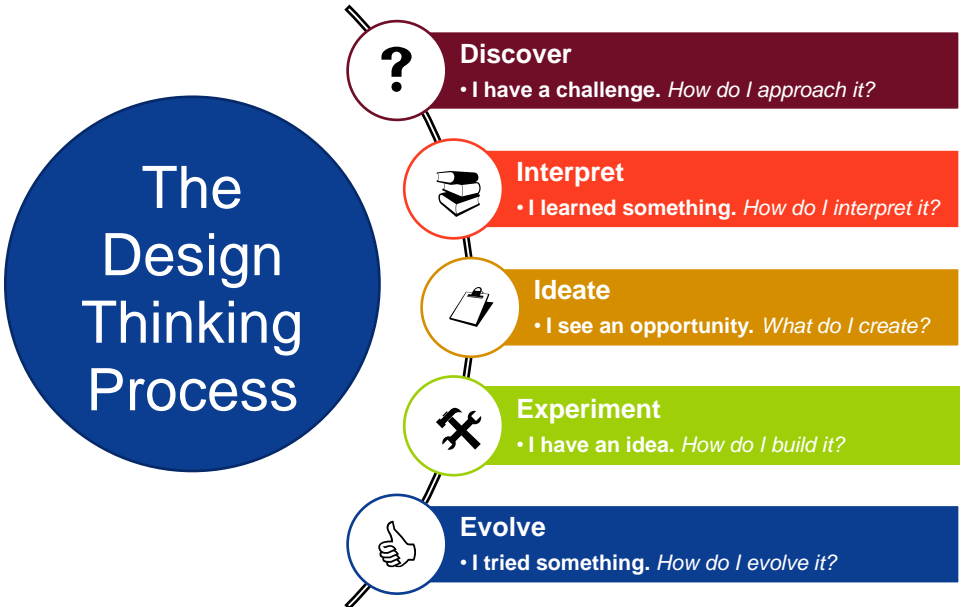


In this making project, you will create a solution to answer the question:

*“What will it take to live on Mars?”*

We will use the **design thinking process** to work through this making project.

This process has five steps:



The design thinking process is adapted from *Design Thinking for Educators*, <https://designthinkingforeducators.com/design-thinking/>.

You will use this journal to record your work through each step of the process.



## Discover

• I have a challenge. *How do I approach it?*

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...?)

Choose which problem you want to solve.



Next, brainstorm any criteria, constraints, and barriers that are part of this problem.

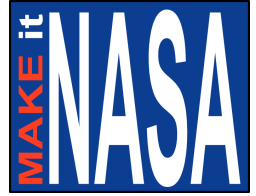
- **Criteria** are things your solution has to be able to do.
- **Constraints** are things your solution must not do.
- **Barriers** are things that could prevent you from finishing your solution.





**Discover**

• I have a challenge. *How do I approach it?*



Challenges with living on Mars that I am interested in solving:

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Circle the challenge you plan to solve.

What are the criteria, constraints, and barriers?

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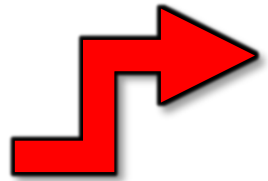


## Interpret

• 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.





## Interpret

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



What resources could teach you more about your challenge?

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What did you learn from those resources?

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## Ideate

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

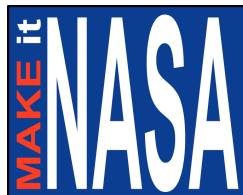
Use the things you learned to create a sketch of your solution. Label all major parts.



Describe how it works.







## Ideate

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

My challenge solution:


How it works:

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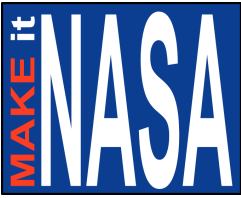
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## Experiment

• I have an idea. *How do I build it?*

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.



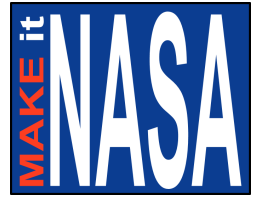
Take a picture of your model. Attach it to the next page.





## Experiment

• I have an idea. *How do I build it?*



Materials needed to make this prototype:

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Picture of my prototype:

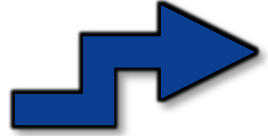
*Tape or glue a 3x5 a picture of your original prototype here.*



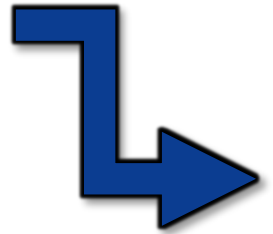
## Evolve

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

Look at your prototype. Think about what parts you want to keep.



What parts can be improved? Should anything be added? Should anything be removed?



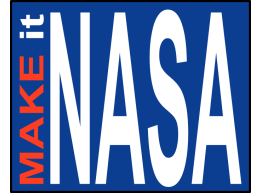
Make changes and take pictures of each finished model. These are called **iterations**.

Your pictures should show how your model improved from the first to the last iteration. You will use these pictures on your presentation board described on page 14.



## Evolve

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



What parts should be kept?

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What parts can be improved? Check off each improvement when it is completed.

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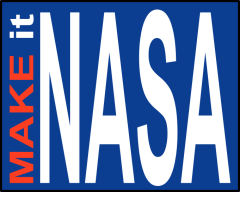
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## Share Your Story

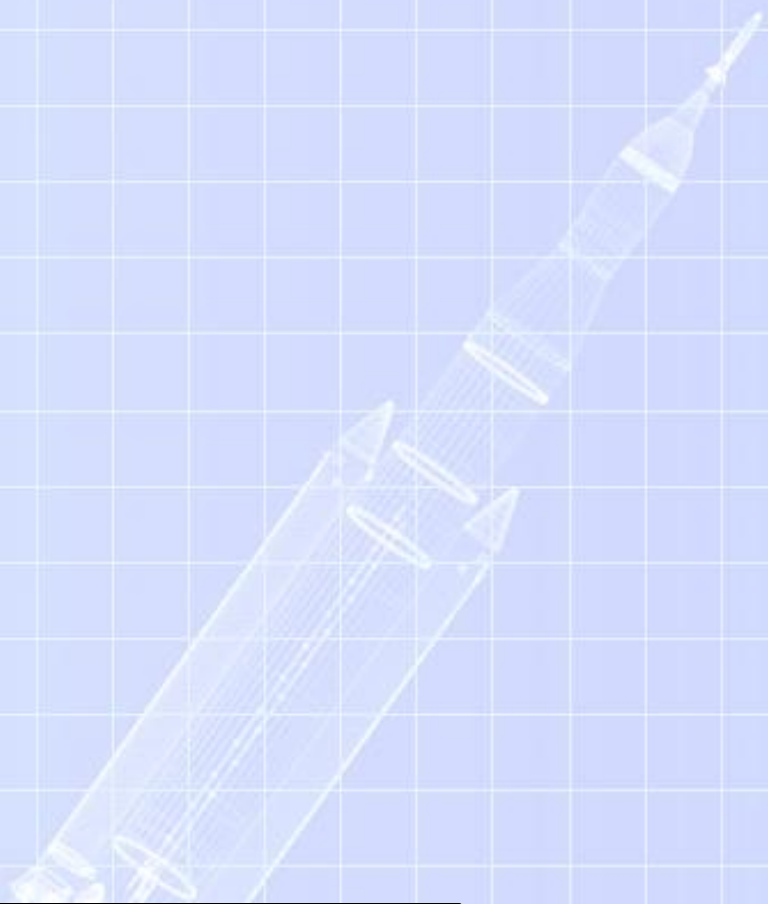
Create a presentation board to present your project.

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.





**MAKE it**  
**NASA**