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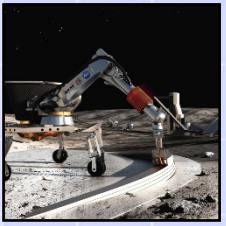
National Aeronautics and Space Administration

How Would You Measure the Moon?



www.nasa.gov

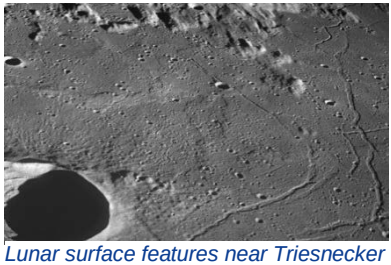
How Would You Measure the Moon?

Apollo 15 astronaut James Irwin salutes the American flag on the moon near the Lunar Module and Lunar Roving Vehicle

In the 1960s and 1970s, NASA's Apollo missions landed astronauts on the Moon. These astronauts collected lunar soil samples and brought them back to Earth. The samples changed what we know about how the solar system was formed. We have only begun learning all we can from the Moon.

Scientists believe the Moon's poles hold millions of tons of water ice. That ice can be collected and broken down to hydrogen and oxygen to power equipment on the moon or fuel rockets to fly farther into space. As humans explore farther away from Earth, we will need to use the resources available wherever we go for building materials and fuels.

NASA plans to return humans to the Moon. To help achieve this goal, NASA is teaming up with American businesses to send science missions to the Moon on robotic rovers. The scientific payloads on these rovers will test new science tools and technologies on the Moon before humans arrive.



Lunar surface features near Triesnecker crater taken aboard the Apollo 10 Command Module

Illustration of a contour crafting robot building a structure out of processed lunar soil.

We know the Moon can tell us more about how our solar system was formed. There is so much more that can be learned with robots and humans studying the Moon up close. NASA will use what is learned about living and working on the Moon to eventually send the first astronauts to Mars.

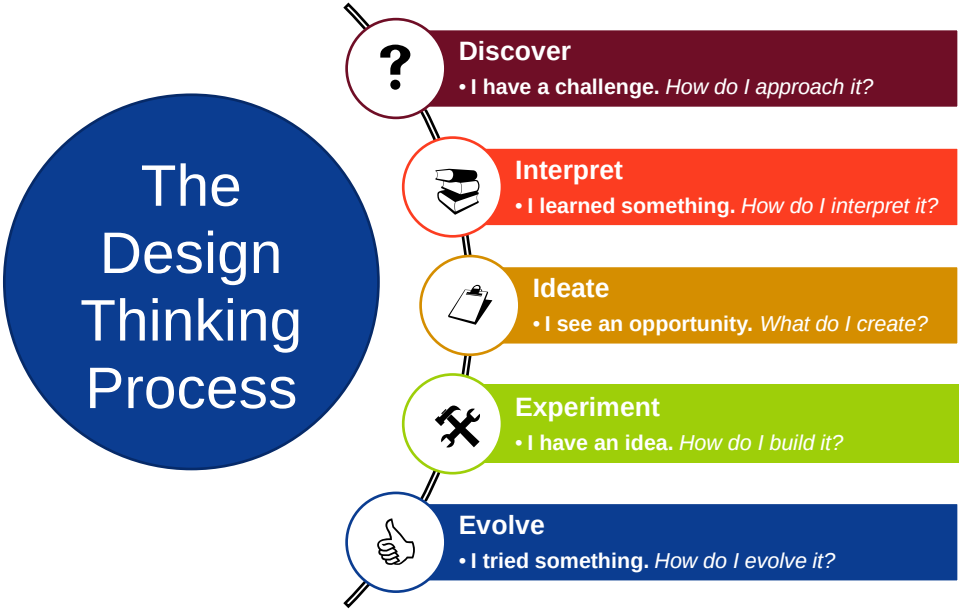
The Design Thinking Process

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

"How would you measure the Moon?"

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 studying the Moon that I am interested in solving:

Circle the challenge you plan to solve.

What are the criteria, constraints, and barriers?

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?*

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What resources could teach you more about your challenge?

What did you learn from those resources?

Ideate

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

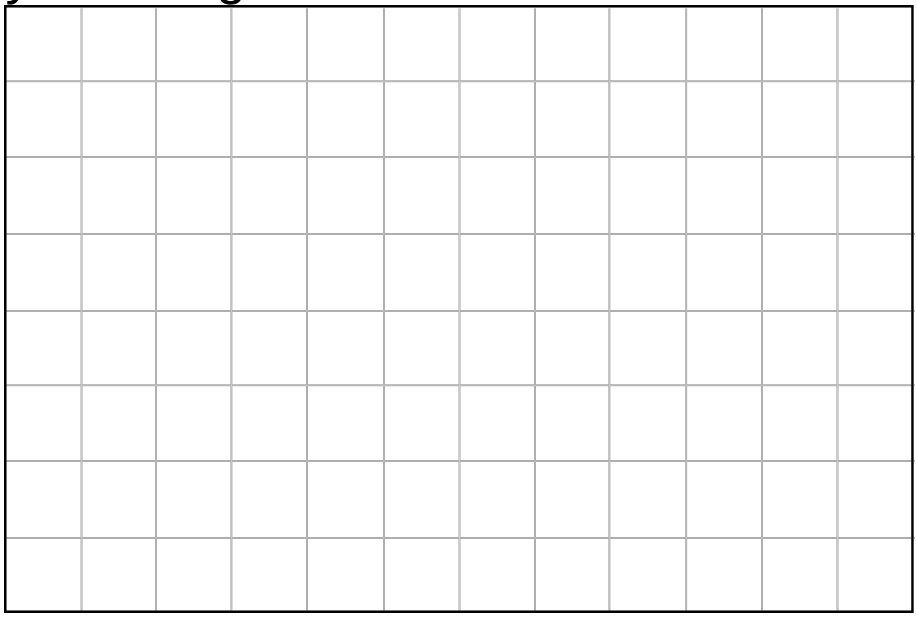
Use the things you learned to create a sketch of your solution. Label all major parts.

Describe how it works.

Ideate

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

My challenge solution:



How it works:

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?*

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Materials needed to make this prototype:

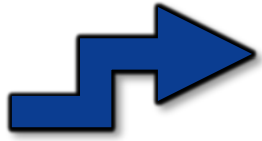
Picture of my prototype:

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

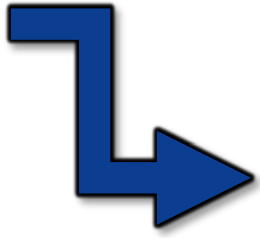
Evolve

•**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?*

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What parts should be kept?

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

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.

Notes

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