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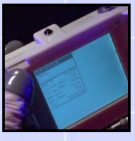
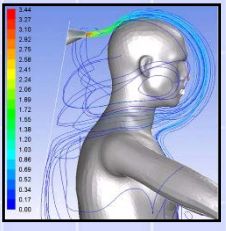
National Aeronautics and Space Administration

Save Your Breath





www.nasa.gov

Save Your Breath

Artist concept of an astronaut in the xEMU spacesuit setting up a science experiment on the lunar surface

In the 1960s and 1970s, NASA's Apollo missions landed astronauts on the Moon. In the 2020s, NASA's Artemis missions will send humans back to the Moon to stay. New technology will help us stay longer, communicate better, and explore further than ever before. The longer we stay in space, the more we learn about how to live and work far from Earth.

Life support systems give astronauts the water and oxygen they need. They also get rid of carbon dioxide and other impurities in the air. Sensors alert astronauts when an emergency occurs. This lets them fix problems before they become too dangerous. Spacesuits act like personal spaceships, made to protect astronauts from the dangers of space.

xEMU Upper Torso Development Unit

The Exploration Extravehicular Mobility Unit (xEMU) spacesuits for the Artemis missions are more comfortable, and let astronauts move and bend more easily. They also have better technology for safety and communication. The portable life support system attached to the suit holds a radio, runs the cooling system, and filters and circulates air.

NASA unveils the new spacesuits for the Artemis missions.

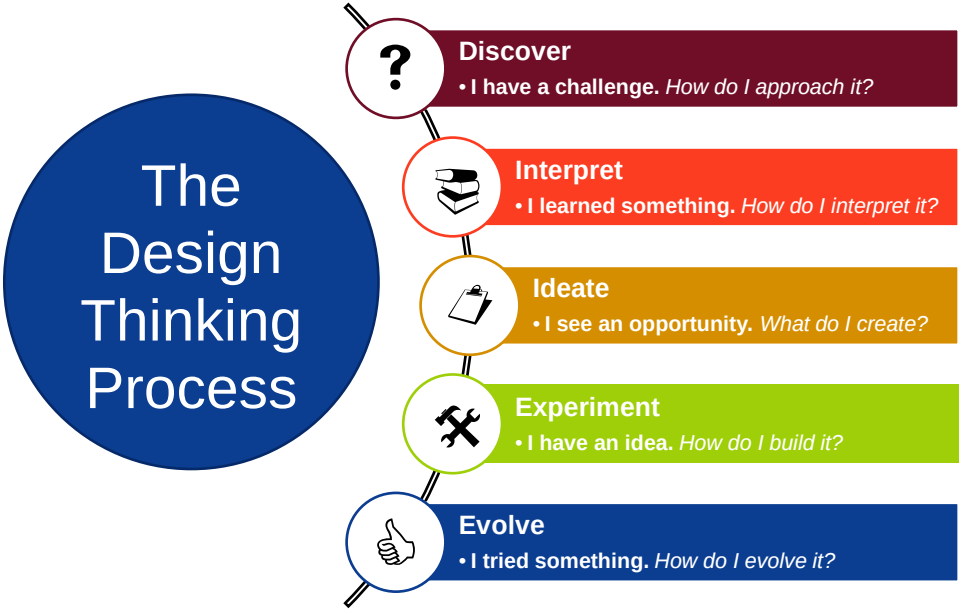
NASA's biggest goal is to keep people safe. The further we get from the safety of Earth, the harder this gets. We will use what we learn on the Moon to keep making our tools and equipment better. Then, we will be able to explore even further, and eventually land the first humans on Mars.

The Design Thinking Process

In this making project, you will create a carbon dioxide (CO_2) monitoring system for use in astronauts' helmets.

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 monitoring spacesuit CO_2 levels 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?*

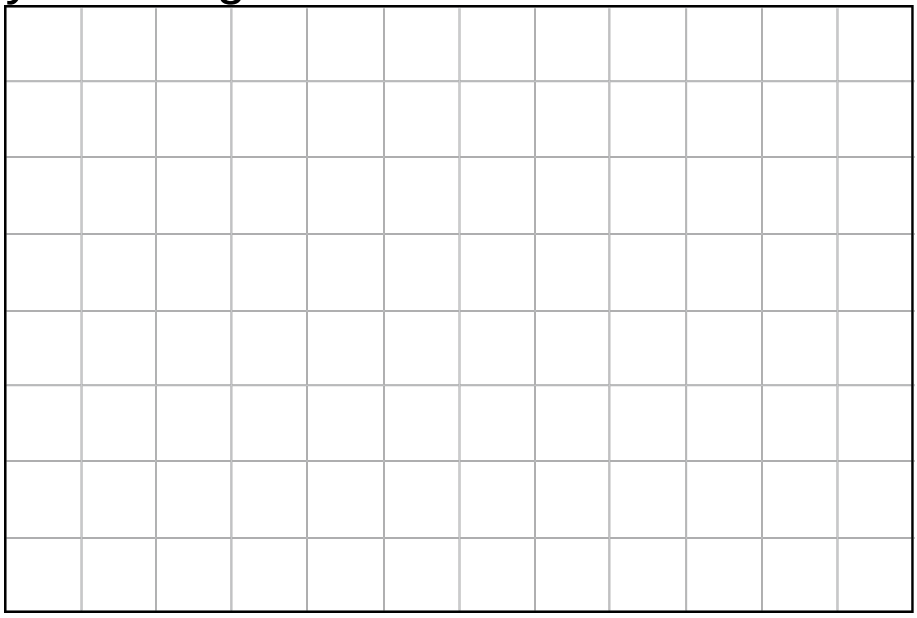
Use the things you learned to create a sketch of your solution. Label all major parts.

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:

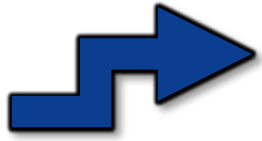
Picture of my prototype:

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

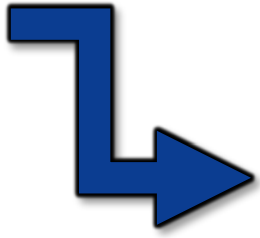
Evolve

•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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