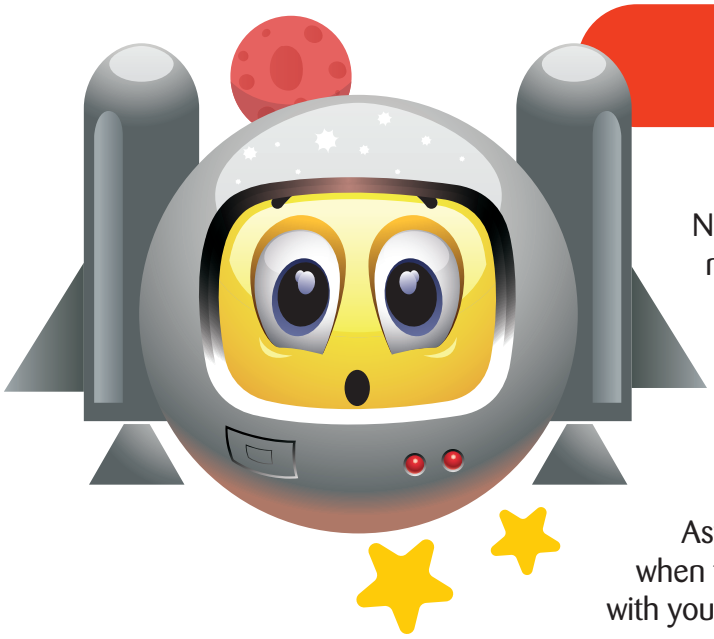


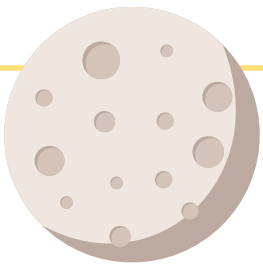
Mission to Mars

NASA's Artemis program will land the first woman and next man on the moon by 2024, and will use innovative technologies to explore more of the lunar surface than ever before. Building on what they learn from the Artemis program, they hope to take the next giant leap — sending astronauts to Mars. You can dive deeper into the Artemis program at **www.nasa.gov/specials/artemis**.

Astronauts are allowed a few personal items to bring with them when they travel to space. You have to pack light so it can travel with you on the spaceship.

What would you pack for your trip to the moon — and beyond?
Draw or make a list here.

Why would you bring what you selected?
Write or draw your answer here.

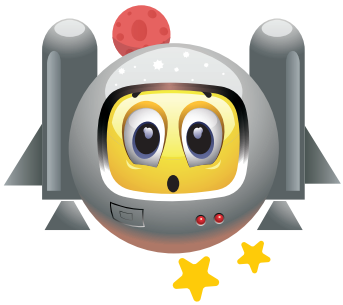


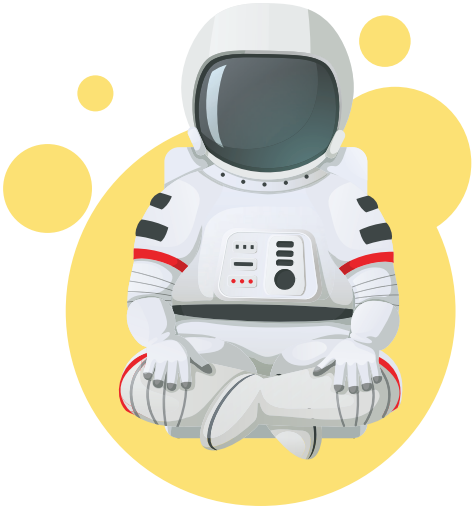
Museum of Virginia Science

www.smv.org

Share your special items!
Take a picture of what you would pack, post it on a social media site and tag the Museum so we can see what you would take into space.

Mission to Mars





Moon Habitat Challenge

For astronauts to live on the moon and Mars, NASA engineers must design a habitat that provides everything they need to survive. This is no easy feat! The moon and Mars are very different from the Earth, and without specially designed gear, people cannot survive.

Among other things, the shelter must provide protection from temperature extremes on the moon, provide an atmosphere so the astronauts can breathe, sleeping quarters, food, water and waste disposal, plus protection from radiation, space dust and debris. That's a lot of work for this habitat! The initial basecamp would be setup like a week-long camping trip, intending to be temporary. But ultimately, engineers must design a habitat that is much more permanent, yet easy to construct and transport when considering a trip to Mars.

Can you design and build a lightweight Artemis-inspired astronaut habitat? NASA has a great STEM challenge for you at **https://spaceplace.nasa.gov/moon-habitat/en/**. Heads up: it requires a lot of newspaper so stock up before you get started!

Let the exploration begin!

STEM Spotlight

Hansel Gill is the Subsystem Manager for Manufacturing and Production for the Space Launch System (SLS) for NASA's Artemis project. Gill helps lead the crew designing the upper stage hardware of the Orion spacecraft that will take astronauts back to the moon. Gill interned at NASA during high school and fell in love with space! He earned degrees in industrial and system engineering as well as mathematics, and worked in metallic materials engineering before joining NASA. Explore more of the team working on the Artemis project at **www.nasa.gov/about/people**.

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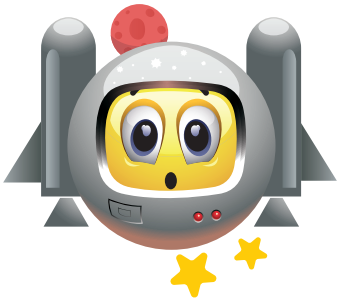
Mission to Mars



Learn more about the next generation spacesuits here:

www.nasa.gov/feature/what-are-the-next-generation-spacesuits

Find out more about spacesuit basics here:

www.nasa.gov/feature/spacewalk-spacesuit-basics

Build a Better Spacesuit

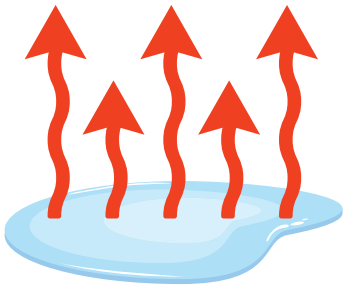
Just like a habitat, astronauts need a well-designed spacesuit in order to walk outside their ship or habitat while on the moon and Mars. The spacesuit acts as a mini-habitat, providing protection a person needs to survive in space. NASA engineers are working hard on a new and improved spacesuit design for the Artemis mission.

As you can see from the spacesuit requirements from the NASA links, spacesuits have a lot of work to do! Interestingly, we think of space as cold — and it is! And spacesuits help keep an astronaut warm. But, it's even harder to cool the astronaut down. Because there is no atmosphere in space, there are no cooling breezes/air currents to help move heat away from the astronaut as they work inside their suit.

This process of a fluid (air is a fluid) carrying off heat is convection. It's a pretty efficient way to get rid of heat. A human body generates and gives off heat and without convection currents, the astronaut can quickly overheat. A suit must be designed to prevent this from happening. One reason spacesuit exterior fabric is white is to reflect the heat from the sun. There are also about 300 feet of cooling tubes woven into the fabric of a special cooling garment.

What You'll Need

- Paper towels
- Index card or a hand fan (something stiff)
- Water



What You'll Do

- Using the index card or hand fan, wave it above the skin on your arm about 10 times. What do you observe?
- Next, dip the paper towel in water and use it to wet the surface of your arm.
- Wave the index card about 4 inches above your wet arm and fan it about 10 times. What do you observe?
- Which action cooled you down more quickly?

What Happened?

The wet skin should feel cooler when fanned than the dry skin. The cooling effect is due to the evaporation of the water from the skin. Convection currents (the fanning of the air) take heat away from your skin whether it is wet or not, but evaporation is an even better method to lose heat. Because water absorbs heat better than air, as it evaporates, it takes more heat (energy) away from your skin and cools you down more quickly. This is why you sweat. The cooling tubes in an astronaut's suit are filled with a liquid that helps recreate this process.

For a bigger challenge, try this water-cooling spacesuit activity from NASA: **www.nasa.gov/stem-ed-resources/sfs-keeping-your-cool.html**