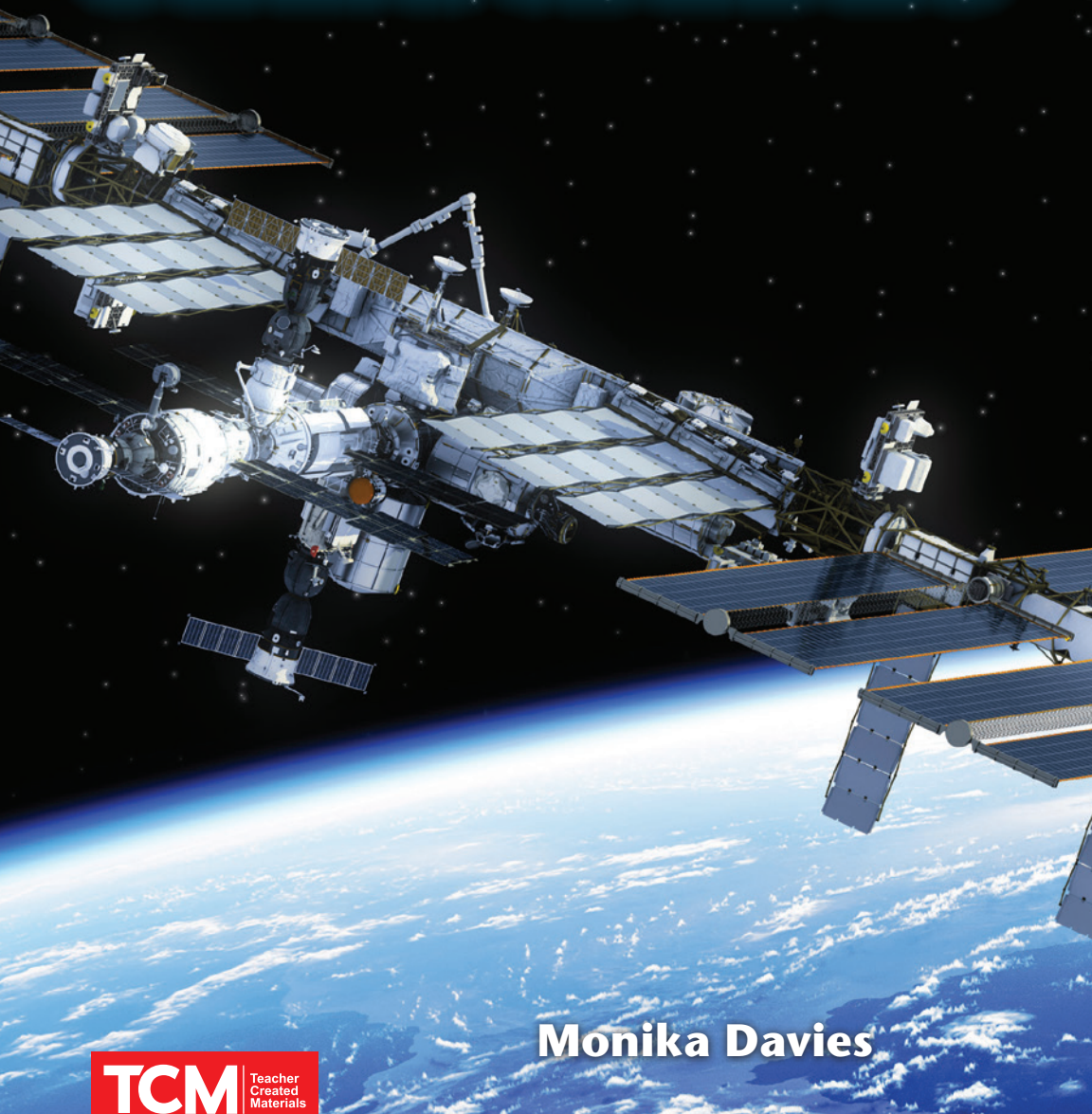




Smithsonian

SPACE TECHNOLOGY



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**image from NASA's James
Webb Space Telescope**

Beyond Earth

For centuries, humans have looked to the skies and wondered what lay beyond the stars. The universe surrounding Earth has been both awe-inspiring and **elusive**. For thousands of years, humans could only scan the skies with their eyes. Then, in 1610, Galileo Galilei used a telescope to peek into the greater universe. He identified stars and discovered features on the moon.



International Space Station

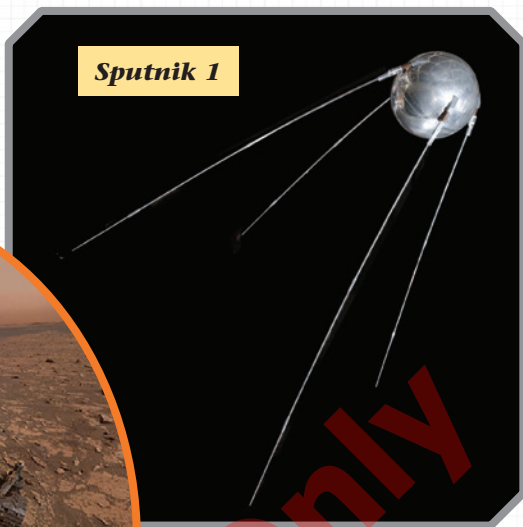
Thanks to space technology, humans have started to explore space. Space technology is any technology that is used beyond Earth. This includes a mix of tools and software. Space technology consists of satellites, **rovers**, shuttles, and much

more. These tools have given people answers about the universe up close and their place in it.

In 1957, the first piece of space tech began to **orbit** Earth. Since then, humans have made tracks on the moon. An entire space station was built to orbit the planet. And rovers have rolled and researched across Mars.

Without space technology, space exploration would not exist. Many discoveries would remain uncovered. In the past, space technology has guided humans to new places. In the future, space technology holds a lot of potential for exploring the universe.

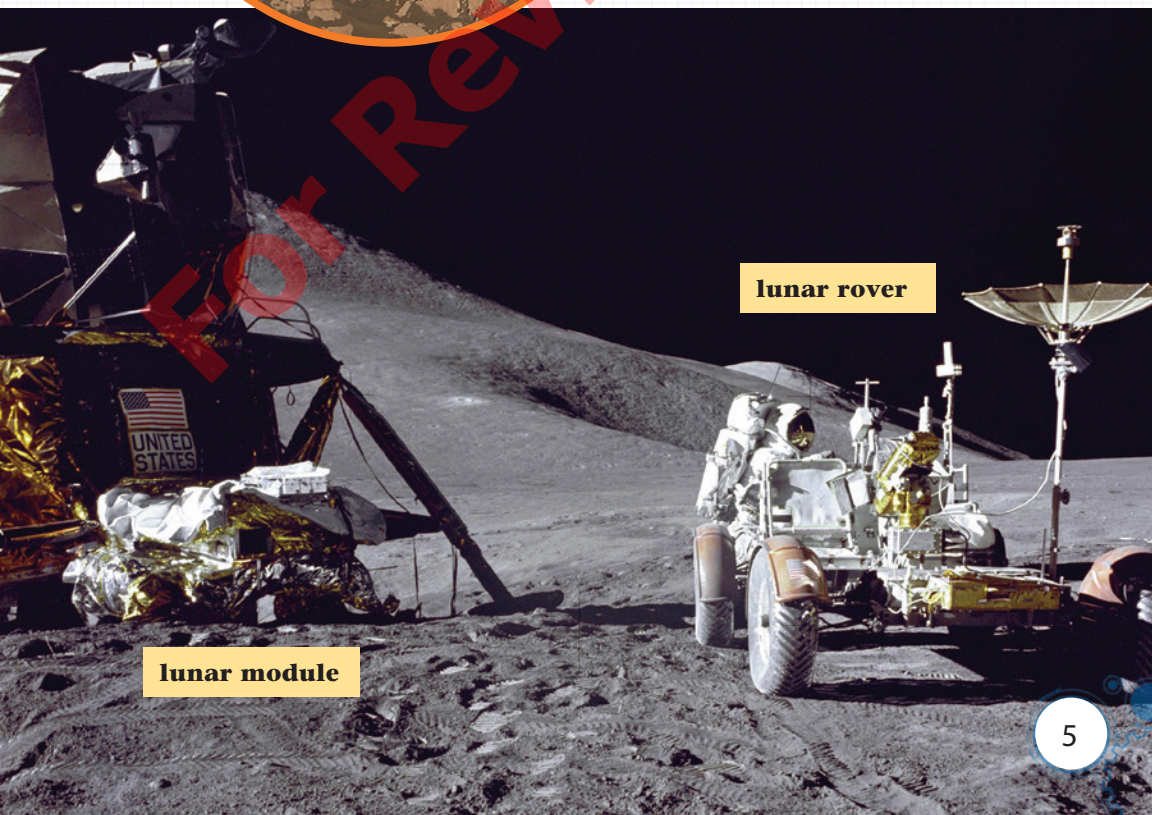
Sputnik 1



Curiosity Mars rover



lunar rover



lunar module

Moonshot

Earth only has one moon. This bright light in the night sky has captivated humans for centuries. In 1962, the United States set a lofty goal: put a human on the moon. This led to the Apollo Program, a plan for human spaceflight. This program existed between 1960 and 1972, and it flew astronauts 11 times. Countless hours and immense efforts were invested in the program. Getting to the moon required **innovative** minds and technology.

On July 20, 1969, more than half a billion people held their breath as they watched the Apollo 11 mission on television. People worldwide watched as Neil Armstrong put the first human footprint on the moon. Viewers cheered as he said, "That's one small step for man, one giant leap for mankind."

The *Saturn V* rocket was used for several Apollo missions.



Rockets and Orbit

Gravity keeps people grounded on Earth. To go beyond the planet, humans need to overcome Earth's gravity. A spacecraft alone is not powerful enough to accomplish this. So, rockets are required to blast into space. Rockets carry spacecraft, which quickly boost up into Earth's atmosphere. Once a rocket is a certain distance away from Earth, it releases the spacecraft. The energy from the rocket gives the spacecraft speed to move in one direction. Meanwhile, Earth's gravity pulls on it in another direction. The balance between these forces keeps the spacecraft in orbit.

FUN FACT

As of 2022, you can still see the astronauts' tracks from 1969 on the moon! We know this thanks to NASA's Lunar Reconnaissance Orbiter. The orbiter took images of the moon that show the tracks are still visible. There is no air or water on the moon to erode them, so it will take an extremely long time for the tracks to vanish.



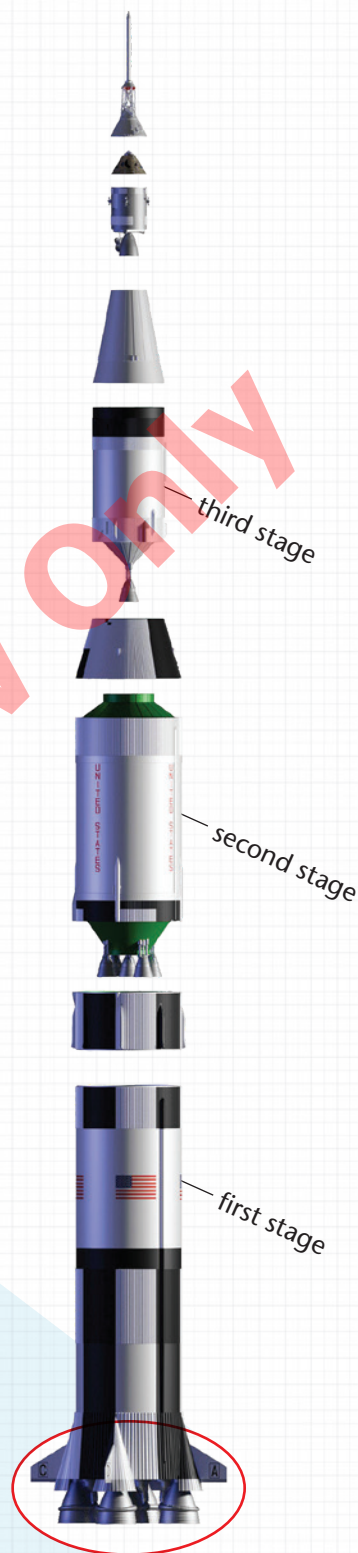
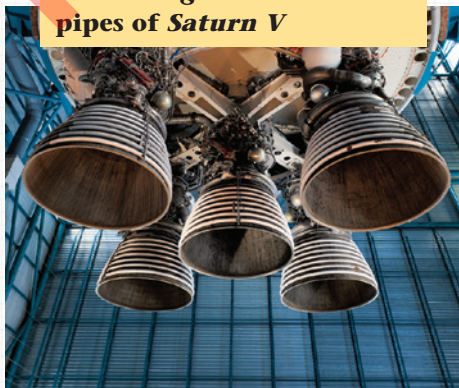
"That's one small step for man, one giant leap for mankind." –Neil Armstrong

Saturn V

For nine Apollo missions, the *Saturn V* rocket played a **pivotal** role. It served as the push that got astronauts to the moon. This towering rocket stood taller than the Statue of Liberty in New York. Built to thrust a spacecraft into orbit, it was the most powerful rocket of its time. There were three stages, or parts, to the rocket. The first stage sat at the bottom of the rocket and contained fuel and five F-1 engines. These five engines produced a tremendous amount of power!

The second stage contained five J-2 engines, while the third had a single J-2 engine. In each stage, the engines used fuel until they ran out. Then, that part of the rocket would release, and the engines that made up the next stage would start. Without this powerful three-part rocket, astronauts would have never gotten to the moon.

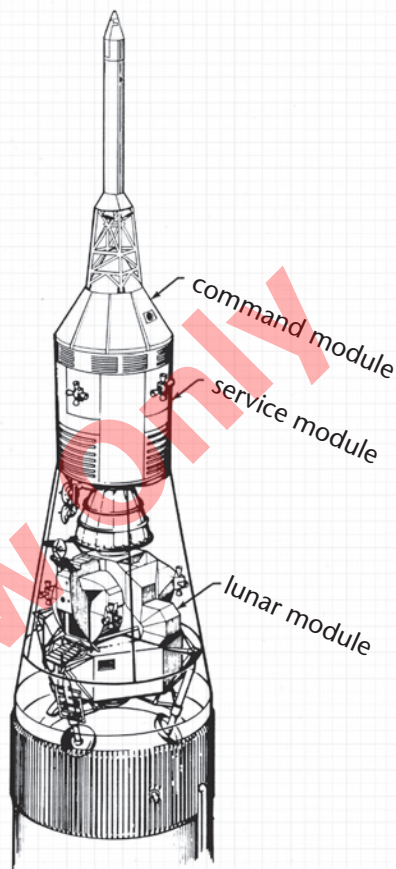
rocket engine and exhaust pipes of *Saturn V*



Modules, Modules, Modules

At the top of every rocket sat an Apollo spacecraft. While rockets helped launch astronauts into the atmosphere, the spacecraft was the technology that carried them beyond Earth.

The Apollo spacecraft was also made of three parts, or modules. First, there was a cone-shaped command module. Behind the command module sat the service module. The lunar module was then attached to the service module. Each module served a purpose and was instrumental in getting astronauts to the moon.



NASA Art Program

In 1962, the head of NASA, James Webb, created a new program at NASA. It was known as the Artist's Cooperation Program. Multiple artists began to document the goal of putting a human on the moon. Some artists painted pictures of launch headquarters. Other artists painted America's first spacewalk. These paintings helped show the creativity behind space missions.



oil painting of a rocket launch

STEAM CHALLENGE

Define the Problem

NASA is planning to send more advanced rovers and other technology to Mars. Astronauts will be on board, too. The spacecraft carrying precious cargo needs to be able to slow down and land safely. Before NASA builds a full-scale spacecraft, they want to see a smaller model in action. To mimic the technology, you must design a model of a Mars lander that can safely land a marshmallow when dropped to the ground.



Constraints: You may only use the materials provided to you. There can be no lid on the cup containing the marshmallow.



Criteria: A marshmallow will represent delicate space equipment or astronauts. It will be placed in a cup to represent a cabin. When dropped from 2 feet (61 centimeters), the lander should remain upright and the marshmallow should stay in the cup.



CAREER ADVICE

from Smithsonian

Do you dream about working on space technology?

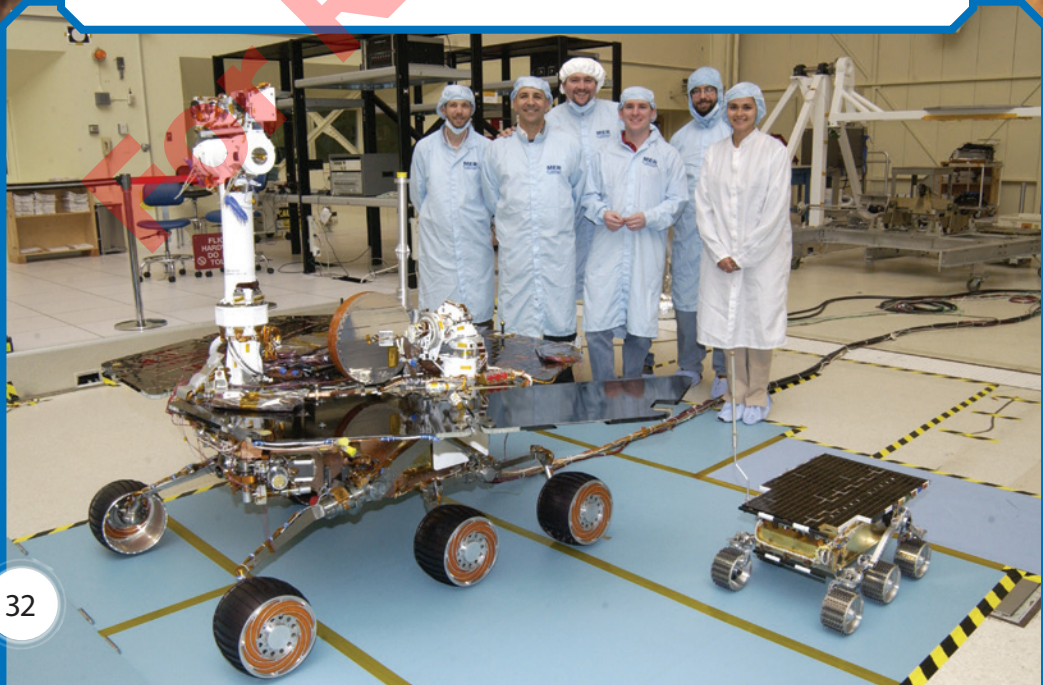
Here are some tips to keep in mind
for the future.

"Make sure to read as much as you can about math, science,
and space."

– *Michael Neufeld, Senior Curator,
National Air and Space Museum*

"Follow your passions and really dig into whatever you choose
to do. Being a good problem solver is an asset no matter what
you do."

– *Margaret Weitekamp, Chair of Space History and Curator,
National Air and Space Museum*



Read and Respond

1. What are 2–3 pieces of space technology that helped astronauts reach the moon?
2. Describe low-Earth orbit technology, and give an example of it.
3. What facts would you select to show the importance of space technology, and why?
4. How does past technology from the Apollo missions compare to present-day technology used on Mars?
5. What do you predict is next for space technology and space exploration?
6. Do you agree or disagree that it is valuable to explore beyond Earth? Explain.

