Genre Informational Text

Essential Questions

How can working as a team lead to great accomplishments? How can a supportive team make it easier to persevere?

One Small Step

by Vidas Barzdukas

ON JULY 20, 1969, HALF A BILLION PEOPLE around the world sat glued to their television sets. They were about to witness an amazing event that was beyond their wildest imaginations. Days earlier, a manned spacecraft named *Apollo 11* had blasted off from Kennedy Space Center in Florida. Sitting inside the spacecraft were three astronauts: Neil Armstrong, Michael Collins, and Buzz Aldrin. Their mission? To be the first people to successfully land on the moon.

For more than a decade, engineers and scientists at the National Aeronautics and Space Administration (NASA) had been working feverishly. Their goal was to successfully launch a person to the moon and return him safely back to Earth. However, a successful landing was anything but a sure thing. Anything could go wrong in outer space. Accidents and faulty equipment had caused deaths before. Even Richard Nixon, the president of the United States at the time, had prepared a speech in case the mission failed. It began, "Fate has ordained that the men who went to the moon to explore in peace will stay on the moon to rest in peace. . ." The question on the world's mind was: Would the astronauts land safely on the surface of the moon?

A President's Dream

In May 1961, President John F. Kennedy had a dream: that the United States would land on the moon before the end of the decade. At the time, the United States was involved in a "space race" with Russia. In 1957, Russia had become the first nation to send a satellite into orbit around Earth. Challenged by this accomplishment, Kennedy urged the United States to overtake the Russians in the "space race" by landing a person on the moon.

NASA would face numerous challenges and setbacks on their way to fulfilling Kennedy's dream.

Project Mercury

In 1958, Project Mercury marked the start of NASA's space program. Project Mercury's goal was to send a spacecraft into orbit around Earth and study how an astronaut performed in outer space.

Today, blasting a person into outer space is pretty unremarkable. In 1958, however, shooting a rocket into the sky proved nearly impossible. The first rocket for Project Mercury exploded on the launching pad. The second rocket flew only four inches off the ground before it crashed. (Fortunately, these rockets did not have any astronauts onboard.) Although these initial attempts proved to be disasters, they did allow engineers to discover glitches with the rockets and fix them.

Seven astronauts were chosen for Project Mercury. During Mercury's first manned mission, Alan Shepard became the first American in space. Shepard's flight aboard *Freedom 7* lasted only fifteen minutes before descending back to Earth. John Glenn, the third Mercury astronaut to go to space, was the first American to orbit Earth. Later Mercury astronauts spent more time in space, providing valuable information to scientists on the ground.

Project Gemini

During Project Mercury, NASA scientists perfected how to blast astronauts into space and bring them back safely to Earth. The astronauts also practiced how to live, work, and fly a spacecraft in space. With the start of Project Gemini, astronauts would now begin training for an even bigger trip: the moon.

The word *gemini,* meaning "twins," was chosen by NASA because its new spacecraft could hold two astronauts instead of one. The two-man teams performed more ventures than the astronauts on the Mercury missions. They walked in space and orbited Earth for more than a week. Two teams of astronauts in separate spacecraft also rendezvoused in space and connected their spacecraft. This last test would be critical for NASA's goal of reaching the moon.

Gemini astronaut Ed White became the first American to perform a spacewalk.

Despite its successes, Project Gemini also experienced some setbacks. During one mission, astronauts Neil Armstrong and David Scott were almost killed when a malfunction caused their spacecraft to spin out of control. In addition, the heavy spacesuits the astronauts wore during their spacewalks caused the men to tire easily. Unfortunately, the fatigue caused some of the astronauts to cut their training short. Despite these adversities, NASA considered Project Gemini a resounding success, paving the way for the final stage of the moon landing.

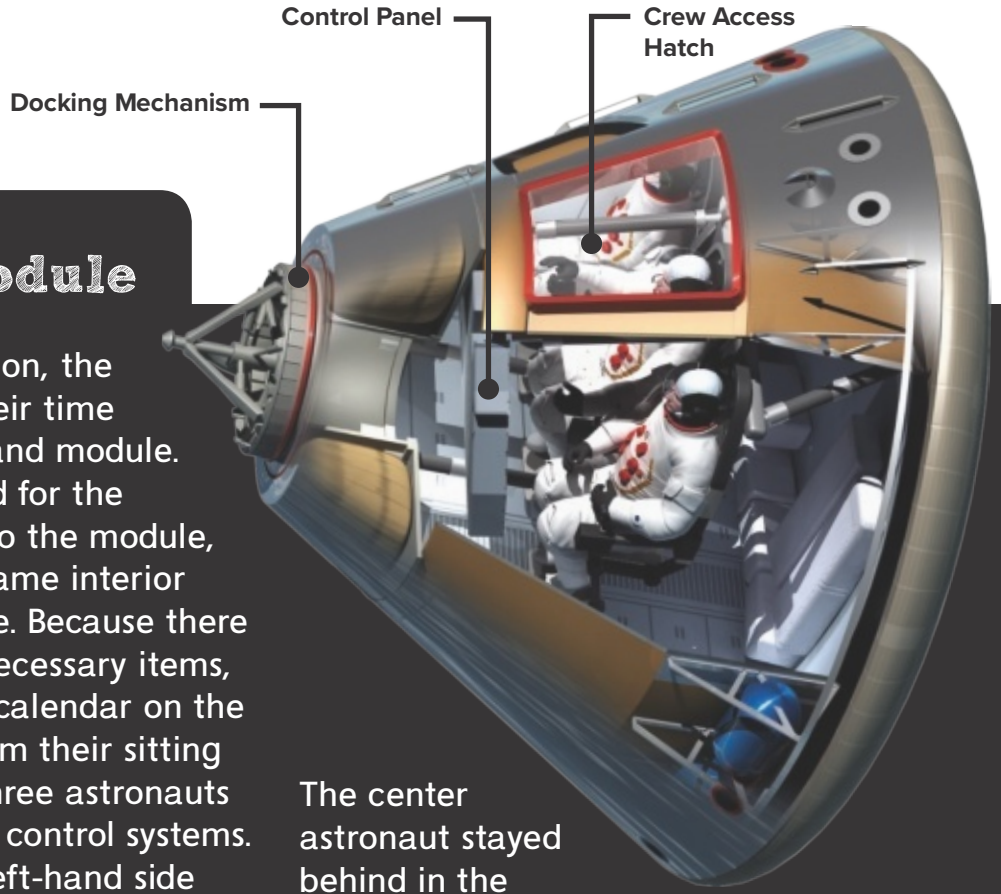
Apollo

What made Apollo different from Mercury and Gemini was the sheer size of the program. More than four hundred thousand people worked on the Apollo project. Teams of engineers, designers, and electricians worked tirelessly for years. One team worked on building the spacesuits and backpacks the astronauts would wear on the moon. Another team calculated the exact trajectory the rocket would take. Others designed the experiments the astronauts would perform on the lunar surface. Without these dedicated individuals, the astronauts would never have made it to the moon.

Mathematician Katherine Johnson worked on the trajectory the Apollo 11 mission would take to the moon.

The Mercury and Gemini programs had launched astronauts into space, but the Apollo program needed to land astronauts on the moon. Therefore, NASA needed larger and more powerful rockets to send the spacecraft out of Earth's orbit and into outer space. NASA called these enormous rockets *Saturn V*. The Saturn V rockets were as tall as a 36-story building and had three separate sections. Each section would burn its engines until it was out of fuel. Then the section would detach from the rest of the rocket and fall back to Earth. This first section catapulted the rocket high into the air. The second section pushed it farther away from Earth's surface. The third part sent the spacecraft toward the moon.

Apollo missions used two different types of spacecraft. The first was called the command module. During the mission, the command module would orbit around the moon. Unlike the smaller spacecraft used in the Mercury and Gemini missions, the Apollo command module had enough room for three astronauts. The second spacecraft was called the lunar module. This module was only big enough for two astronauts. The lunar module's job was to transport the two astronauts from the command module orbiting the moon to the moon's surface, and then back again.



About the Module

During the Apollo mission, the crew spent much of their time in the cramped command module. Everything they needed for the mission was packed into the module, which had about the same interior space as an automobile. Because there was little room for unnecessary items, the astronauts drew a calendar on the wall of the module. From their sitting position, each of the three astronauts had access to different control systems. The astronaut on the left-hand side operated the flight controls. The center astronaut operated the guidance and navigation systems. Finally, the right-hand astronaut managed the spacecraft subsystems.

The center astronaut stayed behind in the command module when the lunar module descended to the moon's surface. He had the important task of retrieving the astronauts once they were ready to leave the moon.

Tragedy Strikes

By the end of 1966, NASA was feeling confident. The Mercury and Gemini programs were successful despite their difficulties. Remarkable teams of scientists and engineers had built machines of grand size capable of spaceflight! Humans had traveled into space and orbited around Earth! And if those feats weren't enough, astronauts had left the safe confines of these amazing machines to walk in outer space.

Then on January 27, 1967, tragedy struck. During a routine training mission, astronauts Gus Grissom, Edward White, and Roger Chaffee were killed when a fire roared through their command module. Engineers concluded that a spark from a frayed wire had caused something inside the module to catch fire. The module was filled with 100 percent oxygen, which feeds fire. The fire spread quickly, dooming the three astronauts trapped inside.

Edward H. White II, Virgil I. "Gus" Grissom, and Roger B. Chaffee were members of the crew for the first manned Apollo space flight.

Needless to say, everyone at NASA mourned the loss of their esteemed colleagues and friends. The astronauts understood the extreme dangers associated with space travel, and they continued despite those risks. However, no one expected astronauts to perish before leaving Earth.

After identifying the issue, NASA replaced the command module's hatch so that it could be opened quickly. Everything inside the module was made fireproof. The wires would now be better protected and insulated. Scientists also decided that they would no longer pump 100 percent oxygen into the command module during a training mission. As a result of the tragedy, the modules were developed to be safer during missions.

Starting Over

With the tragedy of Apollo 1 behind them, NASA continued on its mission to send astronauts to the moon. Toward this effort, they began by completing several pilotless test flights of the Saturn V rocket and landing module. Then, in the fall of 1967, NASA sent its first manned Apollo mission into space since the tragic fire. This mission would allow astronauts to pilot the completely redesigned command module. Tension mounted as Apollo 7 blasted off from Kennedy Space Center from the same launching pad where the fire took place nearly two years before. Any pressure or doubt NASA had quickly faded as the new command module completed its mission successfully.

Apollo missions 8 and 9 also went off without a hitch. Then on May 18, 1969, Apollo 10 blasted off from the Kennedy Space Center. Its mission was to orbit the moon and scout the lunar surface for possible landing sites. In addition, astronauts needed to know whether two different spacecraft orbiting the moon could talk to each other and to Mission Control on Earth.

However, just as the astronauts guided the lunar module back to the command module, the lunar module began to suddenly flip end over end. The astronauts needed to act quickly. Otherwise, the module would tumble out into space or crash into the moon. The astronauts fired their rocket thrusters and stopped the spin to regain control of the craft. Everyone aboard the spacecraft and at Mission Control breathed a sigh of relief. It was an important lesson for everyone aboard to remain alert at all times.

The stage was now set. Apollo 10 was a dress rehearsal for one of the greatest feats in history. It was time to land a man on the moon.

The prime crew of the Apollo 7 stand on the deck of the NASA Motor Vessel Retriever. Their mission was to test the command module.

Above: The flight path that took the astronauts to the moon and back; *left to right:* Apollo 11 astronauts Neil A. Armstrong, Michael Collins, and Edwin E. "Buzz" Aldrin, Jr.

Apollo 11

Astronauts had been in Earth's orbit. But could a person survive outer space in a tiny capsule for an entire week? Would they be able to move and work in a gravity-free vacuum? Could they change spacecraft for the return trip at 25,000 miles per hour to Earth? In 1963, scientists and engineers weren't so sure. Maybe President Kennedy was asking the impossible.

The astronauts aboard Apollo 11—Neil Armstrong, Michael Collins, and Buzz Aldrin—might have been thinking just that. Apollo 10 had successfully orbited the moon. However, no one had ever landed on the moon or blasted off from it. Apollo 11 would be the first to try.

On July 20, 1969, Neil Armstrong and Buzz Aldrin climbed into the lunar module, which was called "Eagle." Michael Collins would stay behind, inside the command module, and orbit the moon. As the lunar module undocked from the command module and began its descent, Armstrong scanned the moon for their landing site. Armstrong was a veteran of the Gemini missions. He commanded the module when it nearly tumbled out of control. He knew first-hand the risks and dangers involved in space flight.

Landing on the moon is very different than landing on Earth. On Earth, a plane uses its wings to ride on the air. The moon, however, has no atmosphere. The only way for Armstrong to control the Eagle was to fire its rocket engine. By tilting the engine, Armstrong could control how the lunar module moved up, down, forward, and backward. Although a computer controlled the engine's thrust, Armstrong steered the lunar module as it skimmed over the surface of the moon. He didn't want the Eagle crashing into a boulder or landing inside a deep crater.

Armstrong knew that the lunar module only had enough fuel for one attempt at a moon landing. If anything went awry, they would be forced to abort the mission. Even worse, if they burned too much fuel on the descent, they might land on the moon with no fuel left to blast off again.

Suddenly an alarm went off in the lunar module. The computer was processing too much information. It threatened to shut down. Armstrong and Collins waited anxiously for orders from Mission Control. Finally, Mission Control radioed back and told them to keep going.

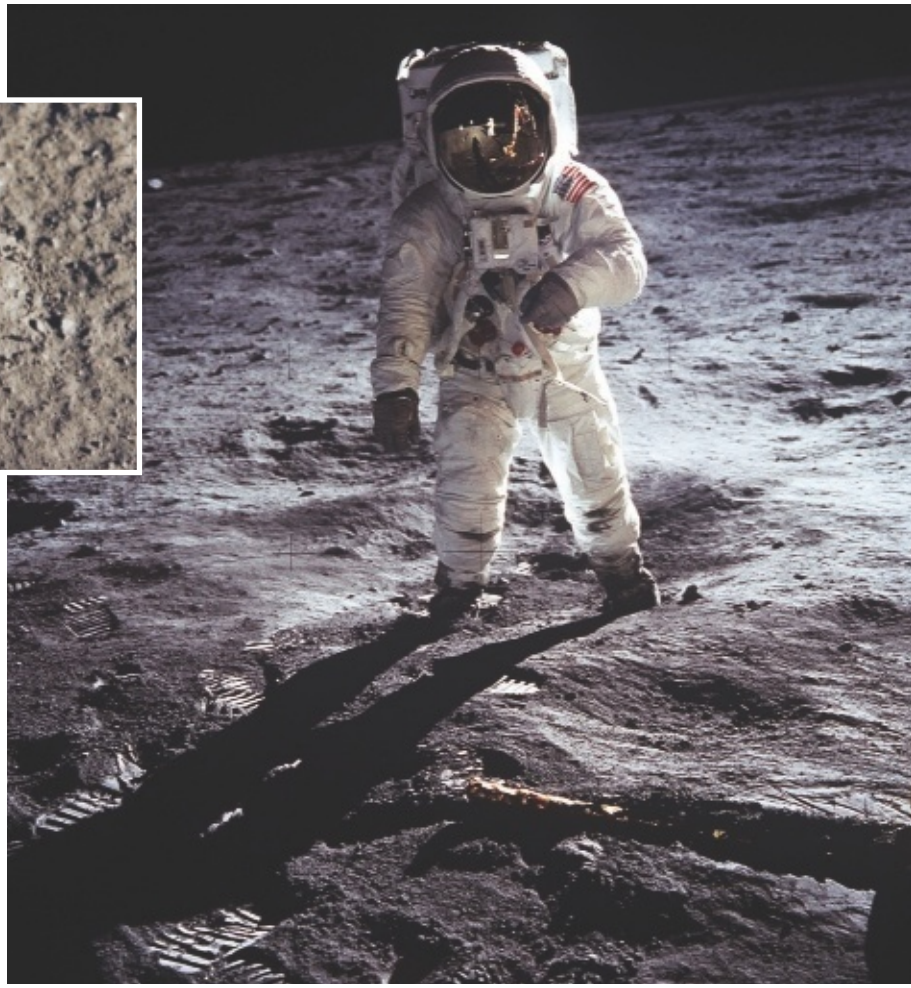
The computer glitch was not the only problem the Eagle faced—it was also being guided by the computer into a giant crater filled with enormous boulders. Realizing the danger this posed, Armstrong regained control of the lunar module and found a safer landing spot. The module flew lower and lower until Armstrong saw that the engine's thrust was blowing up dust from the lunar surface. They were almost there!

Scientists and engineers coordinate with the Apollo astronauts from the Mission Operations Control Room in the Mission Control Center.

Then Mission Control sent another warning: The astronauts only had sixty seconds of fuel left. Then they only had thirty seconds left. If Armstrong did not land the Eagle now, he would be forced to abort the mission.

Finally, the Eagle landed softly on the lunar surface. Moments later, Armstrong's voice crackled over the radio waves. "The Eagle has landed." Back on Earth, scientists and engineers and just about everyone working at NASA cheered in celebration!

The United States had won the "space race." After almost a decade of significant successes and tragic failures, NASA had fulfilled President Kennedy's dream of landing on the moon by the end of the decade. They had accomplished not one impossible feat but several. The magnitude of what NASA had achieved is best summed up by Armstrong's famous line as he descended the ladder and stepped onto the moon's surface: "That's one small step for man, one giant leap for mankind."



Above, the footprint left on the moon's Sea of Tranquility; *right,* Buzz Aldrin posing for a photo on the moon's surface.

Essential Question
Why is it important to believe in yourself?

It Couldn't Be Done

by Edgar Albert Guest

Somebody said that it couldn't be done,
But he with a chuckle replied
That "maybe it couldn't," but he would be one
Who wouldn't say so till he'd tried.
So he buckled right in with the trace of a grin
On his face. If he worried he hid it.
He started to sing as he tackled the thing
That couldn't be done, and he did it!

Somebody scoffed: "Oh, you'll never do that;
At least no one ever has done it";
But he took off his coat and he took off his hat
And the first thing we knew he'd begun it.
With a lift of his chin and a bit of a grin,
Without any doubting or quiddit,
He started to sing as he tackled the thing
That couldn't be done, and he did it.

There are thousands to tell you it cannot be done,
There are thousands to prophesy failure;
There are thousands to point out to you one by one,
The dangers that wait to assail you.
But just buckle in with a bit of a grin,
Just take off your coat and go to it;
Just start in to sing as you tackle the thing
That "cannot be done," and you'll do it.


UNITED
STATES
INTEGRATED
TEST STAND
Nº 1

Respond

Comprehension

You will answer the comprehension questions on these pages as a class.

Text Connections

1. Based on the information in "One Small Step," explain what the "space race" was and who was involved.
2. Why does the poet choose not to identify the characters in "It Couldn't Be Done"?
3. What would be the benefit of entire Apollo teams working on only one thing at a time, such as spacesuit or experiment design?
4. Twice Neil Armstrong faced situations where things seemed to be going wrong during a space mission. What character qualities helped him survive?
5. Using "The Inventor's Secret: What Thomas Edison Told Henry Ford" and "One Small Step," identify characteristics of the process of invention that are shared by both enterprises.
6. How do you think the moon landing changed the way people around the world viewed space travel?

Did You Know?

The very first living animals sent into space were a group of fruit flies sent by United States military scientists in 1947. Once their container parachuted to the ground, scientists discovered that the flies had survived the trip.

Look Closer

Keys to Comprehension

1. Explain why the *Eagle* could not use wings to glide to a landing on the moon like a plane would. Use quotes from the text to support your answer.
2. Describe the tasks assigned to Apollo missions 7, 10, and 11, as described in the text, and explain why this progression is logical.

Writer's Craft

3. Explain the reason NASA gave Project Gemini its name, based on the meaning of the word *Gemini*.
4. Compare and contrast how the chronology of events is illustrated in "Queen of the Track" and "One Small Step."
5. Explain how the series of stanzas in "It Couldn't Be Done" fit together. How is the third stanza different than the first two?

Concept Development

6. How does the author use evidence to support the argument that the Apollo 11 astronauts faced many challenges?

Write

From time to time, people have discussed building some type of station on the moon. Write a short science fiction story describing what life might be like in such a station.

Read this Science Connection. You will answer the questions as a class.

Text Feature

Important terms in informational text are sometimes **bold** so that they stand out.

Seeing the Stars from Space and Earth

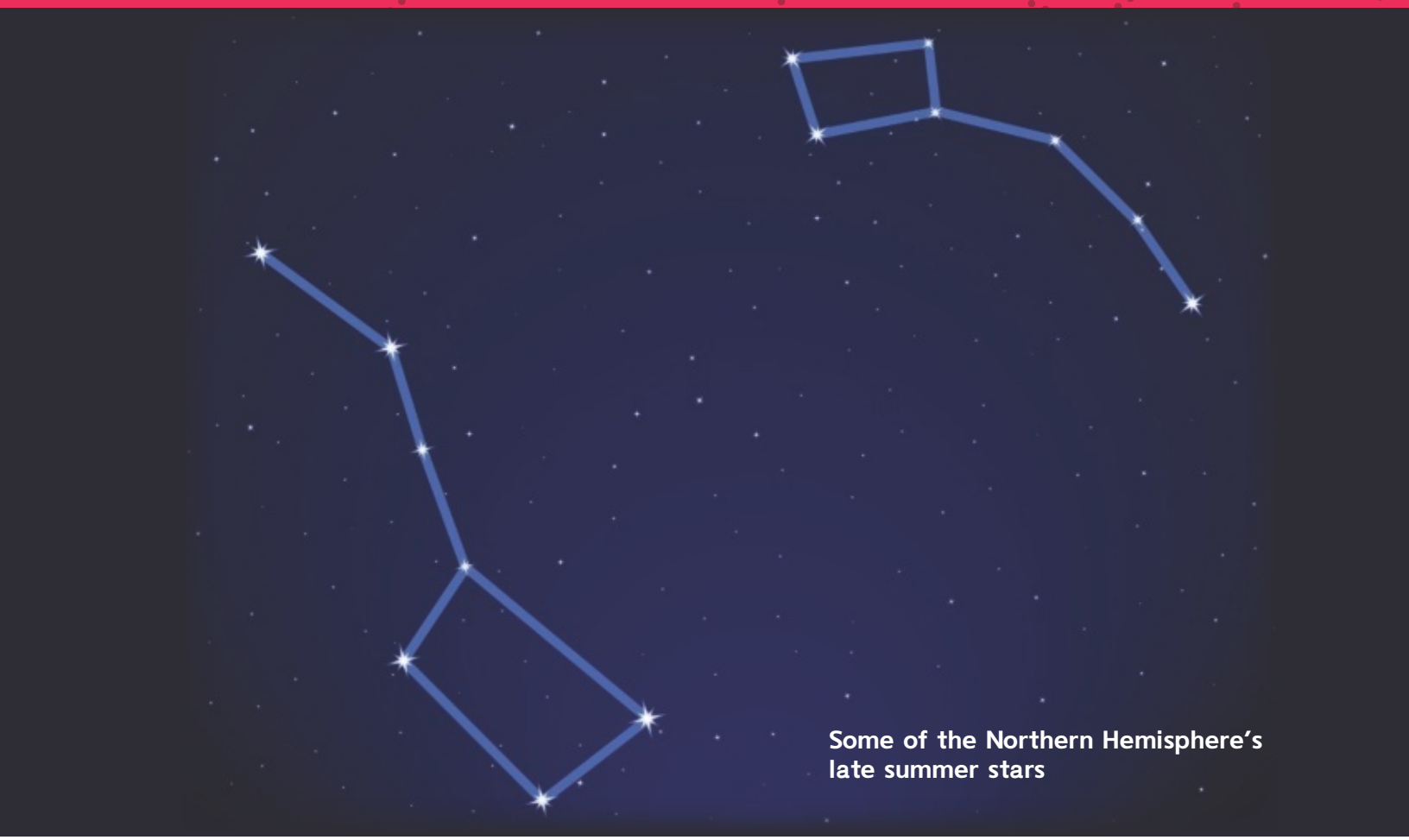
When astronauts are onboard the International Space Station and orbiting Earth, do they see the same constellations we do? At first, you might think that the star groupings look different from up there. After all, astronauts have a different place from which to look, right?

It turns out, however, that astronauts on the Space Station *do* see the same constellations that we see from Earth. To understand why, you have to think about the magnitude of the distances in space. The stars are extremely far away from Earth. When astronauts are at the Space Station, they are still quite close to Earth. They are not much closer to the stars.

The stars are so far away from Earth that, although they are all actually moving through space, we cannot see that movement from Earth for a very long time. This true movement of stars is called their **proper motion**. Over thousands of years, our constellations change slightly because of proper motion. However, it is not something you notice when stargazing.

But wait a minute—then why do the stars seem to move slowly across the sky each night? And why are there constellations that you can only see at certain times of year?

Well, the stars appear to move across the night sky for the same reason the sun seems to move across the sky—Earth rotates on its axis. And the reason the constellations shift through the year has to do with the Earth's revolution, or circular movement, around the sun. At different times of year, the Earth is in slightly different locations relative to the sun, and the constellations shift slightly in our sky. However, this is called **apparent motion** because it does not have anything to do with the actual movement of the stars themselves. Apparent motion is a result of the constant movement of planet Earth.



Some of the Northern Hemisphere's late summer stars

1. Contrast the apparent and proper motion of stars.
2. Research the Big Dipper, a group of stars that is part of the constellation Ursa Major. Find out what position the Big Dipper is in at the beginnings of summer, fall, winter, and spring in North America.
3. Using what you learned about the Big Dipper, create a graphic representation, or star chart, showing the star group's seasonal positions.

Go Digital

People who live in the Northern and Southern Hemispheres see different constellations due to their positions on Earth. Research some well-known constellations of the Southern Hemisphere. Do the two hemispheres share any constellations?