

Private Spaceships

A Reading A-Z Level Z Leveled Book

Word Count: 1,688

Connections

Writing

Research to learn more about NASA. Write an essay including facts from the book and other resources. Include a timeline of at least five of the most important milestones in NASA's history.

Science

Research the topic of weightlessness during space travel. Describe why it happens and what short-term and long-term effects it has on astronauts.

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Glossary

aeronautics (<i>n.</i>)	the science or practice of flight (p. 4)
altitude (<i>n.</i>)	height above a surface (p. 10)
capsule (<i>n.</i>)	the detachable compartment on a spacecraft that holds people and their instruments (p. 11)
commercial (<i>adj.</i>)	relating to buying and selling (p. 5)
destinations (<i>n.</i>)	places where someone or something is going to (p. 5)
docked (<i>adj.</i>)	having been temporarily connected in space through the use of docking ports (p. 13)
missions (<i>n.</i>)	set purposes for doing things; special tasks or assignments (p. 5)
orbit (<i>n.</i>)	the path taken by one object in space circling around another larger object (p. 4)
re-entry (<i>n.</i>)	the act of returning to Earth's atmosphere from space (p. 10)
robotic (<i>adj.</i>)	of or related to a device that is programmed to perform tasks (p. 5)
satellites (<i>n.</i>)	natural or human-made objects that orbit Earth or other objects in space (p. 4)
spacecraft (<i>n.</i>)	a vehicle used for traveling in space (p. 4)

Private Spaceships



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Focus Question

How and why has space travel evolved?

Words to Know

aeronautics	missions
altitude	orbit
capsule	re-entry
commercial	robotic
destinations	satellites
docked	spacecraft

Front cover: XCOR Aerospace is building the Lynx suborbital spaceplane to carry passengers safely to the edge of space and back.

Title page: Pilot Michael W. Melvill celebrates after landing SpaceShipOne following a suborbital flight to space on June 21, 2009.

Page 3: The Dream Chaser spaceplane was designed to resupply the International Space Station.

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Correlation

LEVEL Z	
Fountas & Pinnell	U-V
Reading Recovery	N/A
DRA	50

Conclusion

The final flight of the space shuttle marked the end of one period in space travel. It also meant the beginning of an exciting new age of commercial spaceflight. Private companies around the world are working hard to bring their spacecraft designs from the drawing board to the real world. Companies will provide many new options for sending cargo and people into space and for staying in orbit for extended periods of time. Are you ready for the commercial space age?

The Adventure of a Lifetime

Space tourism began in 2001, when American Dennis Tito paid \$20 million to the company Space Adventures to catch a ride to the International Space Station aboard a Russian Soyuz rocket.



Anousheh Ansari on the ISS in 2006

Mr. Tito spent eight days aboard the ISS before returning to Earth. Following his flight, several other private citizens have each paid \$20 million to \$35 million to make similar trips to space. Among them were famous computer game designer Richard Garriott, and Iranian-American businesswoman Anousheh Ansari, whose family the Ansari X-Prize was named after.

Private Space Stations

What if you wanted to visit space for more than a few minutes at a time? At least one company—Bigelow Aerospace—is working to make space hotels a reality. Bigelow is creating a “balloon habitat.” The habitat folds up into a rocket’s cargo area and expands when it is placed into orbit. The company is working on a unit that will house six people in a space similar in size to the ISS.



Life-sized models of Bigelow Aerospace’s inflatable space habitats.

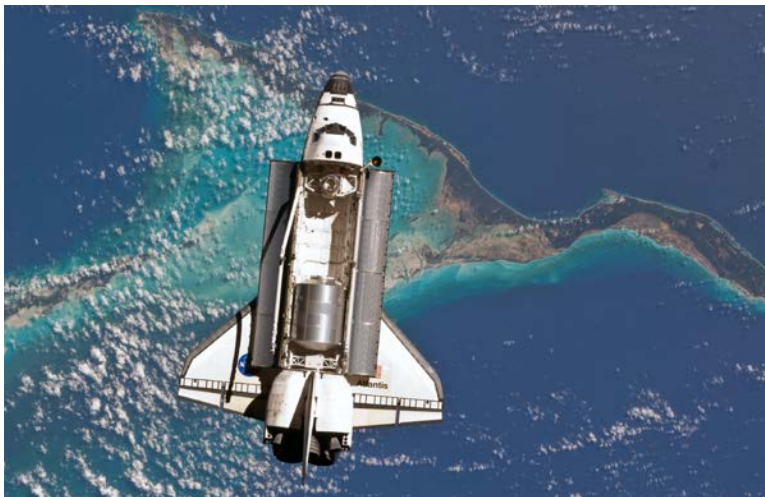
The skin of the Bigelow habitat is made of strong fabrics such as Mylar and Kevlar. Building a space station out of fabric may seem strange, but Bigelow engineers say that the fabric will actually work better than metal.

While these blow-up habitats aren’t ready yet, Bigelow sent two empty test models into space in 2006 and 2007. If things go as planned, more pieces will be launched and joined into the world’s first private space station.



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The shuttle *Atlantis* prepares to dock with the International Space Station on July 10, 2011, during the final mission of the space shuttle program.

The End of an Era

In the early morning darkness on July 21, 2011, the space shuttle *Atlantis* touched down after spending twelve days in space. It was the 135th time a space shuttle had gone into space. It was also the last time a National Aeronautics and Space Administration (NASA) space shuttle would make a journey into space.

The space shuttle was the world's first reusable **spacecraft**. Shuttles carried people and scientific experiments into Earth's **orbit**. They were used to launch, recover, and repair **satellites**, and to help assemble the International Space Station (ISS). Once *Atlantis* touched down, however, these spacecraft would only be seen on display in museums.



The *Dream Chaser*, built by SpaceDev, is designed to carry seven people back and forth to the ISS.

In 2010, NASA asked commercial companies to design spacecraft to move people back and forth to space stations. These ships would need to be able to carry seven astronauts to the ISS. Then they would need to stay **docked** for up to 210 days before flying back to Earth and landing safely.

NASA judged the early spaceship designs and awarded money to four companies to develop their plans. A company called Sierra Nevada proposed a space glider called the *Dream Chaser*. It is designed to travel to space on top of a rocket but glide back down to Earth.

SpaceX created a different version of its Dragon capsule for moving people back and forth to space stations. Two other companies, Boeing and Blue Origin, also designed capsules that would go up on a rocket and splash down into the ocean at the end of the mission.

People Movers

Space stations are spacecraft that are placed in long-term orbits around Earth. Modern space stations are often put together from many pieces. Once a space station is completed, crews can come on board to work and live.

Scientists use space stations to study the effects of long-term space missions on people and also to do experiments in low-gravity environments. Scientists can do many experiments on board the ISS that would not be possible on Earth.

The ISS is the largest one that has ever been built. It was created with the help of many nations at a cost of billions of dollars. It can be seen at night from Earth with the naked eye.

Since the first crew entered the ISS on November 2, 2000, it has never been empty.



An artist's drawing shows how the space shuttle *Atlantis* docked with the Russian *Mir* space station in 1995.

More than two hundred people from fifteen nations have visited the space station. Moving people safely back and forth from space stations such as the ISS is an important job.



Three NASA astronauts grab a malfunctioning satellite during a spacewalk outside the space shuttle *Endeavour* on May 7, 1992.

By 2011, the space shuttles were getting old, but that wasn't the only reason NASA stopped using them. They were also expensive to launch and difficult to maintain. The shuttles could be used to do some amazing things that no other spacecraft could do. They could grab satellites from orbit and return them safely to Earth. The tasks that NASA was using shuttles for were simply too expensive for NASA to continue.

Many people were sad to see the shuttle program end. NASA was getting out of the business of carrying people and things back and forth between Earth and space in order to focus on space science and exploration. The agency also planned new **missions** to send **robotic** rovers and people to exciting **destinations** such as Mars. For the first time, NASA made the decision to turn over the more common types of missions to **commercial** companies.



Yuri Gagarin (bottom right) became the first person to travel into space when he orbited Earth aboard a Vostok rocket (left) on April 12, 1961. The Gemini-Titan rocket (top right) helped the United States prepare to send astronauts to the Moon.

The Dawn of a New Era

Commercial companies had a lot to learn. Designers and engineers had to build vehicles that could function safely while using dangerous fuels, traveling at high speeds, and operating in extreme heat and cold. They also had to create the systems that keep spaceships flying on course.

When the Space Age began in the late 1950s, only the United States and the Soviet Union had the money, resources, and technology for space travel. Over time, though, more nations and even some commercial companies entered the space business. In the 1960s, private companies began building their own communications satellites. They still used the government launch vehicles to carry the satellites up into space. By the 1980s, private companies were building their own rockets for launching satellites into orbit.

Space Delivery Service

People living and working in space for long periods of time need regular deliveries of supplies and equipment. Soon after the Ansari X-Prize competition ended in 2004, NASA announced that it would offer prizes for private companies that were able to come up with creative and less expensive ways to move cargo from Earth to the ISS. In response to NASA's announcement, even more private companies began working on new space vehicles.

SpaceX is one company that has worked hard to develop a vehicle that can make regular trips to the ISS without such a high price tag. SpaceX has built a reusable spacecraft—the Dragon—that can fly without a crew. The Dragon **capsule** rides into space on top of a Falcon 9 rocket, which is also built by SpaceX. Once the capsule arrives near the ISS, it waits nearby so as not to bump into the station. Then the ISS crew uses the station's robotic arm to grab the spacecraft.

SpaceX began delivering supplies and equipment to the ISS in 2012. It also brings cargo back to Earth. When the Dragon leaves the ISS, it splashes down in the Pacific Ocean near California. SpaceX then collects the capsule and two parts of the rocket to use them again.

When *SpaceShipTwo* is ready to return to Earth, the pilot will tilt the wings to slow down the vehicle. *SpaceShipTwo* will act like a giant badminton birdie and fall back to Earth much more slowly. Slowing down *SpaceShipTwo* keeps it from getting too hot during **re-entry**. Because it heats up less, it doesn't need the heavy heat shield that many other spaceships use. Launching from *WhiteKnightTwo* allows the spaceship to use less fuel to reach space. These savings help keep down the costs.

Once the spaceplane has descended to an **altitude** of 13.2 miles (21.24 km), the pilot moves the wings back to the normal position. The spaceplane can then glide in for a landing on the big runway at Spaceport America in New Mexico. The entire flight is expected to take about two hours.

In October 2014, one pilot died when *SpaceShipTwo* crashed in California during a test flight, which reminded everyone of the risks involved with the new technology. The company plans to continue working toward safe commercial spaceflight.



A model of *SpaceShipTwo* shows the wings in the tilted position.



In the post-shuttle era, NASA will focus more on space exploration missions. This artist's drawing shows how Mars rover Curiosity was designed to be gently lowered onto the Martian surface with the help of a "Sky Crane."

By the mid-1990s, smaller, newer companies were entering the space business. What these companies lacked in experience they made up in effort. Advances in technology put space within reach of many business owners. Companies were competing with each other for a piece of the space business. Today, commercial companies are planning many kinds of space missions. They plan to take tourists to the edge of space and back, deliver crews and supplies to orbit, and put up new space stations.

A Second Space Race

In 1996, the Ansari X-Prize was announced. It was a special competition to speed up development of private spaceships. The \$10 million prize would go to the first private company to build and pilot a spaceship into space with at least one person on board and room to carry two others. To win the X-Prize, the spaceship would have to fly at least 62.1 miles (100 km) up and return to Earth. Then the team would have to do the whole trip over again within two weeks.

It took eight years for someone to claim the \$10 million prize. In 2004, the American company Scaled Composites won with its vehicle *SpaceShipOne*.

SpaceShipOne didn't take off from a runway like an airplane or blast off on top of a rocket. Instead, a plane named *WhiteKnight* carried *SpaceShipOne* up to 50,000 feet (15.2 km) and released the spaceplane from beneath its belly. Within seconds, *SpaceShipOne*'s rocket engines roared, pushing the vehicle to more than 3,000 miles per hour (4,828 kmph), almost four times the speed of sound. The small spaceplane then climbed past 62.1 miles (100 km), just beyond the edge of space.

Ticket to Ride

The company Virgin Galactic partnered with the makers of *SpaceShipOne* to make space tourism available to people all over the world. The company is already selling tickets for trips into space for \$200,000 per passenger—less than one percent of what some people have paid to travel into space.

SpaceShipTwo is the spaceplane that Virgin Galactic will use to carry paying tourists into space. It has its own mothership, *WhiteKnightTwo*, and uses a design that is similar to *SpaceShipOne*, though it is larger. Like *SpaceShipOne*, it is designed to fly to the edge of space and back. Passengers on board *SpaceShipTwo* will experience about six minutes of weightlessness before returning home.



An artist's drawing shows *SpaceShipOne*'s rocket engine igniting seconds after release from its mothership, *WhiteKnight*.