

Private Spaceships

A Reading A-Z Level Z1 Leveled Book

Word Count: 1,846

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)
capsule (<i>n.</i>)	the detachable compartment on a spacecraft that holds people and their instruments (p. 14)
commercial (<i>adj.</i>)	relating to buying and selling (p. 5)
dock (<i>v.</i>)	to connect two vehicles in space (p. 15)
enthusiasm (<i>n.</i>)	strong excitement or interest (p. 7)
inflatable (<i>adj.</i>)	able to be filled with a gas, such as air (p. 18)
mission (<i>n.</i>)	a set purpose for doing something; a special task or assignment (p. 4)
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. 12)
robotic (<i>adj.</i>)	of or related to a device that is programmed to perform tasks (p. 5)
spacecraft (<i>n.</i>)	a vehicle used for traveling in space (p. 4)
superpowers (<i>n.</i>)	powerful countries that can enforce their desires on other nations (p. 7)

Private Spaceships



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Focus Question

How and why has space travel evolved?

Words to Know

aeronautics	mission
capsule	orbit
commercial	re-entry
dock	robotic
enthusiasm	spacecraft
inflatable	superpowers

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 Z1	
Fountas & Pinnell	W-X
Reading Recovery	N/A
DRA	60



Astronaut Dale A. Gardner holds up a "For Sale" sign during a spacewalk outside the space shuttle *Discovery* on November 14, 1984.

Conclusion

The final flight of the space shuttle marked the end of one era in space. It also marked 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?

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” that folds up into a rocket’s cargo area. When it is placed into orbit, the habitat expands and can be joined to other pieces. The company is working on a unit that will house six people in a space similar in size to the ISS.

The skin of the Bigelow habitat is made of strong fabrics like Mylar or Kevlar. Building a space station out of fabric may seem strange, but Bigelow engineers say that the fabric will actually work better than metal. NASA is looking at buying one of these habitats to expand the ISS.

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, future **inflatable** habitats will be launched and assembled into the world’s first private space station.



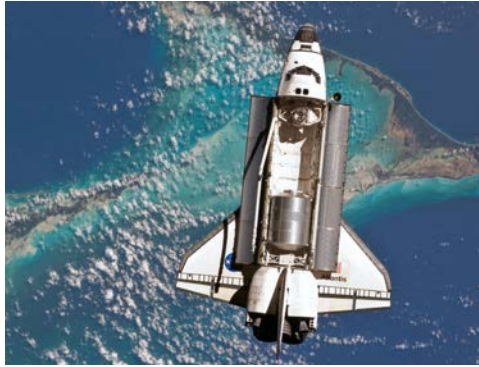
Life-sized models of Bigelow Aerospace’s inflatable space habitats.



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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.



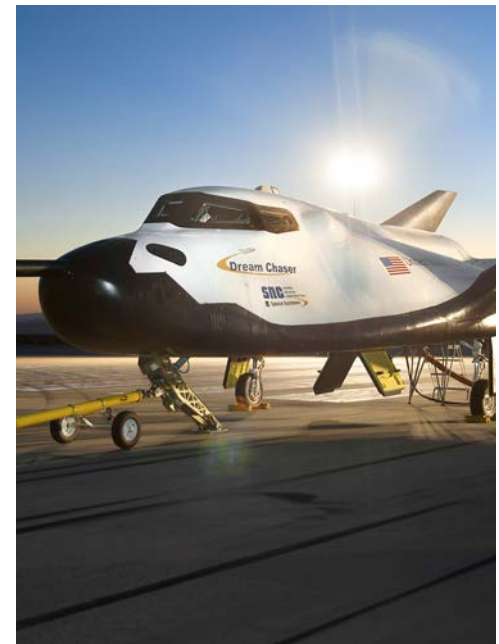
The End of an Era

In the early morning darkness on July 21, 2011, the space shuttle *Atlantis* touched down at Kennedy Space Center in Florida after spending twelve days in space. It was the 135th time a space shuttle had flown a **mission**. 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**. For thirty years, space shuttles were the focus of the space program in the United States. The shuttles carried people and scientific experiments into Earth's **orbit**. They launched, recovered, and repaired satellites, and they helped 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 and then remain docked for up to 210 days before flying back to Earth and landing safely.

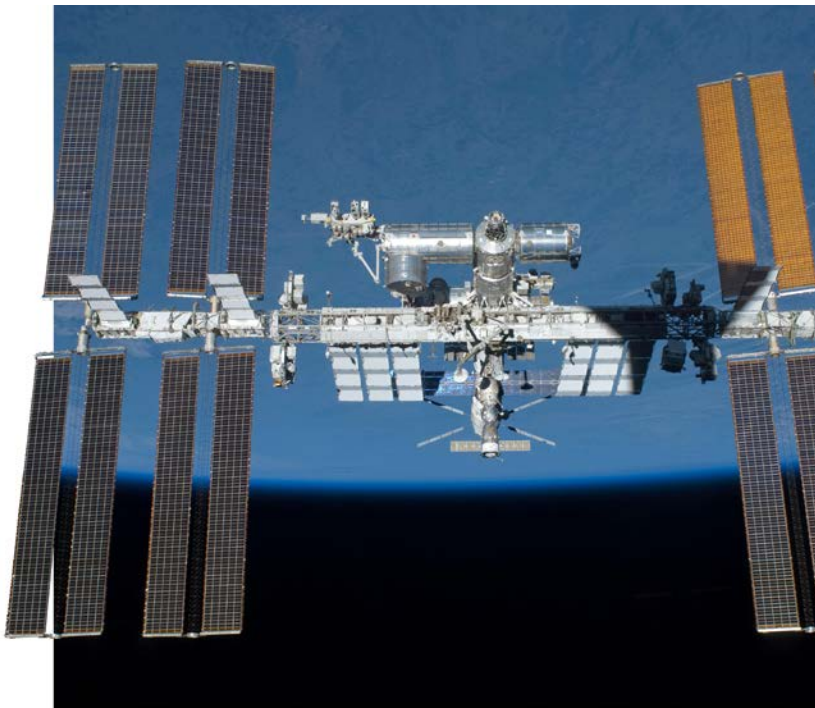


NASA judged the early spaceship designs and awarded money to four companies to develop their plans. A company called Sierra Nevada proposed a space glider called the *Dream Chaser*. It is designed to travel to space on top of a rocket but glide back down to Earth like a plane.

SpaceX created a crewed 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.

The ISS is the largest space station that has ever been built. It was created with the help of many nations at a cost of billions of dollars. It is so large that 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. 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.



The ISS is powered by large solar panels. More than 8 miles (12.9 km) of wire connect the power system.

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 grab satellites from orbit and return them safely to Earth—actions that no other spacecraft could do. However, experience had shown that using space shuttles to launch satellites or deliver people and supplies to the ISS was 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. Instead, NASA was returning to its original mission of focusing on space science and exploration. NASA also planned new missions to send **robotic** rovers and people to exciting destinations such as Mars. For the first time, the agency made the decision to turn over the more common types of missions to **commercial** companies.



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



Yuri Gagarin (inset) became the first person to travel into space when he orbited Earth aboard a Vostok rocket (main) on April 12, 1961.

The Dawn of a New Era

Commercial companies had a lot to learn, and building spaceships is challenging. Designers and engineers must build vehicles that can function safely while using dangerous fuels, traveling at high speeds, and operating in extreme temperatures. They also have to create the systems that keep spaceships flying on course.



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

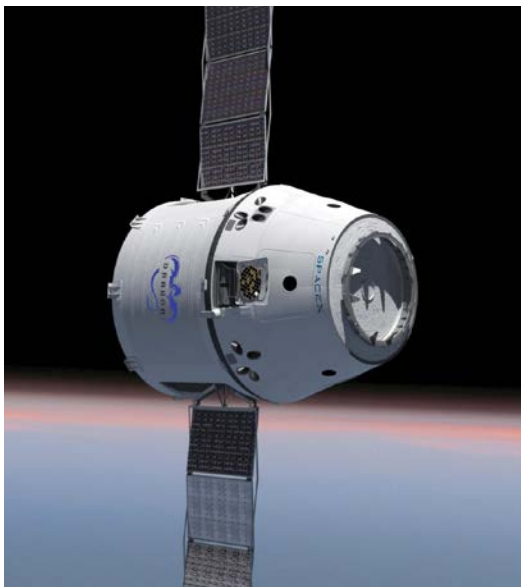
People Movers

Space stations are spacecraft that are placed in long-term orbits around Earth. Modern space stations are often put together from many pieces sent up from Earth. Once a space station is completed, crews can come aboard to work and live, and other spaceships can **dock** there.

Scientists use space stations to study the effects of long-term space missions on people and also to do experiments in low-gravity environments. Because astronauts live and work in near-weightlessness on space stations, scientists can do many experiments on board that would not be possible on Earth.

SpaceX is one company that has worked hard to develop a vehicle that can make regular deliveries to the ISS without such a high price tag. SpaceX has built a crewless, reusable spacecraft—the Dragon—and the Falcon 9 rocket. The Dragon **capsule** rides into space on top of the rocket. 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.

NASA scheduled SpaceX to begin delivering supplies and equipment to the ISS in 2012. Just as importantly, the delivery service also brings cargo back to Earth. When the Dragon leaves the ISS, it



A SpaceX Dragon capsule flies to the ISS in this artist's drawing.

splashes down in the Pacific Ocean off the coast of California. SpaceX then reuses the capsule and two parts of the rocket.

The Space Age began in the late 1950s. Only two **superpowers**—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.

By the mid-1990s, smaller, newer companies were entering the space business. What these companies lacked in experience they made up in **enthusiasm**. Computers and other advances in technology had 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 four kinds of space missions. They plan to take tourists to the edge of space and back, deliver supplies to crews already in orbit, take crews back and forth from space stations, and put up new space stations.



The Gemini-Titan Rocket helped the United States prepare to send astronauts to the Moon.



SpaceShipOne made history in 2004 when it became the first privately funded, non-governmental spacecraft to carry a person into space.

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 successfully build and pilot a spaceship into space with at least one person aboard 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 repeat the whole trip within two weeks.

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



The space shuttle *Discovery* carries cargo to the International Space Station inside its payload bay in 2001.

Space Delivery Service

People living and working in space for long periods of time need regular deliveries of supplies and equipment from Earth. 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 inexpensive ways to move cargo from Earth to the ISS. The winning companies would get money and technical assistance to build their designs. In response to NASA's announcement, even more private companies began working on new space vehicles. Many people could see the possibilities.

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* this way keeps it from getting too hot during **re-entry**, so 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 will move 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. "Space is hard," said George Whitesides, CEO of Virgin Atlantic. The company plans to continue working toward safe commercial spaceflight.



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

To win the prize, Scaled Composites used two vehicles working together. *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 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.



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

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. While \$200,000 is a great deal of money, it is less than one percent of what some people have paid to travel into space until now.

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. 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.



Anousheh Ansari on the ISS in 2006

The First Space Tourists

Year	Name	Nationality	Cost	Time in Space
2001	Dennis Tito	American	\$20 million	8 days
2002	Mark Shuttleworth	South African	\$20 million	11 days
2005	Gregory Olsen	South African	\$20 million	11 days
2006	Anousheh Ansari	Iranian/American	\$20 million	12 days
2007	Charles Simonyi	Hungarian/American	\$25 million	15 days
2008	Richard Garriott	American/British	\$30 million	12 days
2009	Charles Simonyi	Hungarian/American	\$35 million	14 days
2009	Guy Laliberté	Canadian	\$35 million	11 days

All of the early space tourists used Soyuz rockets to travel to the ISS.

Virgin Galactic will use the spaceplane *SpaceShipTwo* to carry paying tourists into space. It has its own mothership, *WhiteKnightTwo*, and uses a design that is similar to *SpaceShipOne*, though it can carry two pilots and up to six passengers. Like *SpaceShipOne*, it is designed to fly to the edge of space and back. Passengers aboard *SpaceShipTwo* will experience about six minutes of weightlessness before returning home. The passenger area has many windows to give passengers incredible views of Earth and space.