

The Shuttle

Background Information

A shuttle is a vehicle that makes frequent trips to and from a destination. The Space Shuttle is a method of transportation used between outer space and the Earth. The Space Shuttle usually remains in Earth's orbit for up to 2 weeks at a time. It normally carries a six- to seven-person crew. The crew includes the mission commander, pilot, and several mission and/or payload specialists who have specialized training associated with the payloads and experiments being flown on that mission.

The Space Shuttle system can perform many types of missions. Some missions may involve deployment, servicing, or retrieval of payloads, such as communication satellites or orbiting observatories. Other missions may carry the pressurized space lab module and scientific instruments capable of making astronomical observations or studying Earth's changing environment. The Space Shuttle also transports International Space Station components for assembly on orbit. At the end of a Shuttle mission, the orbiter is piloted back to Earth and lands on an airstrip like an airplane. It is then refurbished so that it can fly another mission.

Objectives

By the end of this activity, students will be able to:

- learn about NASA's current Space Shuttle.
- design a model of a future Space Shuttle.
- further their understanding of NASA vision for space exploration.

Instruction Time

45 Minutes

Materials

- Astronomer Journal pages 32-34
- Scissors
- Pencil and colored markers
- Ruler
- Unlined paper
- Glue and/or cellophane tape
- Misc. materials, such as paper towel tubes, construction paper, aluminum foil, pipe cleaners, wooden sticks, glitter, etc.

The Shuttle

Procedure – Part 1

1. Read the following to the class: *NASA uses the space transportation system (STS), or space shuttle, to take people, supplies and hardware to the ISS. It has a unique design. The space shuttle is a special type of rocket. It consists of several different parts. The orbiter is the white triangular shaped piece, the only part of the shuttle that travels into space. The orbiter houses the crew and carries the components of the ISS in the payload bay. The orbiter needs two white solid rocket boosters and a large orange external tank to reach space. Like many rockets, the space shuttle has several different steps in its launch sequence.*
2. Explain to the class that the International Space Station (ISS) is a huge spacecraft that stays in space and so the Space Shuttle is needed to take astronauts between Earth and the ISS.
3. Students should cut apart the Shuttle Launch Sequence cards on page 32 of their Astronomer Journals.
4. Students should try to put the Shuttle Launch Sequence cards in order as best they can.
5. When all students have attempted to put the cards in order, read the following script and have them check their work: *The countdown begins, and the rocket engines ignite. The space shuttle lifts off the launch pad at Kennedy Space Center in Florida. Kennedy Space Center is located near the Atlantic Ocean, on the coast of Florida, close to Cape Canaveral. The space shuttle travels into the sky, leaving a trail of smoke. The solid rocket boosters contain solid propellant. This solid fuel is the consistency of a pencil eraser. The solid rocket boosters burn for about two minutes and help the orbiter to travel high into the sky. The propellant is then completely used. There is no longer any need for the solid rocket boosters. At approximately the two-minute mark, the boosters jettison, or separate, from the external tank and orbiter. They descend into the Atlantic Ocean beneath large parachutes. Ships are waiting to recover the solid rocket boosters and pull them back to shore. People carefully check the boosters and prepare them for launch again on another shuttle flight. The large orange external tank remains attached to the orbiter. Inside the external tank are liquid hydrogen and oxygen. Hydrogen and oxygen are normally found in gaseous form. In the external tank, hydrogen and oxygen are so cold that they exist in a liquid state. Liquid hydrogen and oxygen are good rocket propellants. The external tank supplies fuel to the three main rocket engines at the aft end of the orbiter. At approximately eight minutes after liftoff, the external tank has no more propellant. The external tank has completed its task to get the orbiter into space. There is no longer any need for the external tank. It separates from the orbiter and tumbles to Earth. As it falls through the Earth's atmosphere, it becomes very hot. The external tank burns up before it reaches the Earth's surface. Approximately 40 minutes later, the orbital maneuvering system*

The Shuttle

(OMS) engines fire to complete the vehicle's trip to orbit. The orbiter circles, or orbits, the Earth. It often brings hardware, people, and supplies to the ISS.

6. After hearing the script, students should glue their launch sequence onto a blank piece of paper, labeling each picture with a number according to its order in the launch sequence.

Procedure – Part 2

1. Read orally with the class the K-4 NASAexplores article, “Designing Tomorrow’s Space Ships Today.”
2. Discuss with the class the importance of exploration. Stress that man has always entered new frontiers, and this requires designing the safest and least expensive means of transportation.
3. Have students draw a picture of their design of a new Space Shuttle. Remind students their designs should have reusable parts to save on costs.
4. Students should make a model of their design using materials of your choice. For example: paper towel tubes, construction paper, aluminum foil, pipe cleaners, wooden sticks, etc.

Expected Results & Explanations

Upon completion of this activity, students should have a better understanding about the Shuttle Transportation System. For students today, the idea of space travel is as common as automobiles and airplanes. This activity allows students to better understand the process of the space shuttle and NASA’s plans to retire the space shuttle by the year 2010. The idea of a new crew vehicle will take some getting used to by students and adults.

The Shuttle

Space Shuttle Lift-Off Sequence

