BUILDING A SPACECRAFT

Background Information

Satellites, or space-based observing stations, have revolutionized the science of astronomy. No longer are astronomical observations limited by atmospheric disturbances and bad weather. Instead, a whole new range of wavelengths and vantage points are made available by spacecraft instruments.

Although astronomers who work with ground-based telescopes have to deal with bad weather and atmospheric filtering, they have the advantage of being able to work directly with their equipment, and they can constantly monitor and adjust their instruments first hand.

Astronomers working with satellite-based instruments must do everything remotely. With the exception of telescopes mounted in the space shuttle's payload bay and the Hubble Space Telescope, which can be serviced by astronauts, astronomers can only interact with their instruments via radio transmissions. That means that the instruments have to be mounted on a satellite that provides radio receivers, transmitters, electric power, direction control, and other subsystems.

Devices called CCDs (charged coupled devices) collect data about stars, planets, and galaxies. This information is transmitted via radio as a string of numbers that is then decoded by computers on Earth.

The spacecraft that gather and transmit data are often in a geostationary orbit. This permits the craft to remain over one location on Earth, so it can continuously transmit to ground receiving stations. Geostationary satellites orbit in an easterly direction over Earth's equator.

Low Earth orbit spacecraft, such as the space shuttle, do not orbit as high as the geostationary satellites. Since they are in closer orbit to Earth, they travel around Earth faster than geostationary satellites, completing an orbit in about 90 minutes.

Other spacecraft are used to travel to remote regions of the solar system to observe the other planets and moons more closely. The Viking spacecraft, launched in the 1970s, traveled to Mars, where a portion of the craft split away from the main craft in orbit around the planet, descended, and landed. There it conducted experiments to determine the components of the Martian soil and atmosphere.

In the future, we will probably build even more sophisticated spacecraft. Perhaps we will send manned missions to other planets. Surely there will be more unmanned interplanetary probes designed to answer new and age-old questions about the universe.

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Objective
Upon completion of this activity, students will be able to:
- design and build a scale model of a spaceship landing craft.
- test the strength of their models by dropping them from a predetermined height.
- choose a landing site in their own neighborhood for an alien craft to explore.

Instructional Time
45 Minutes

Materials
"Building a Spacecraft" Student Worksheet
Toothpicks or Balsa Wood
Ruler
Lightweight fabric (for parachute)
Glue
Graph paper
String
Pencil/Pen

Procedure
1. Gather materials.
2. Divide students into groups of four. Assign roles of Principal Investigator (PI); Materials Specialist (MS); Quality Controller (QC); and Research Analyst (RA).
3. Distribute copies of the student worksheet to each team.
4. Review background information with your students.

Extensions
- Use a Resource Center or computer database to do research about planets that have been explored by a lander. Report on the results.
- Write a story about landing in a spaceship on an imaginary planet. What do you find there? What does it look like?

Student Name ______________________________________ Date _________________

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DIRECTIONS. Work in teams to design and build scale models of landing craft. Then you will test the strength of your models by dropping them from a height of about five meters. Next, you will choose a landing site in your own neighborhood for an alien craft to explore.

Materials

"Building a Spacecraft" Student Worksheet
Toothpicks or Balsa Wood
Ruler
Lightweight fabric (for parachute)
Glue
Graph paper
String
Pencil/Pen

Part 1–Design, Build, Test

1. Your team will design an unmanned spaceship to land on a planet. First decide what your mission will be and make sure your design includes parts to accomplish all of the tasks. Decide what your lander will look like. Not all robotic craft look like people. For example, researchers are now experimenting with insect robots, each designed to do a specific task. Write your mission goals on a separate sheet of paper. And draw your design using a sheet of graph paper and a ruler.
2. Now your team will build a scale model of your proposed craft, using inexpensive and recycled materials such as toothpicks and balsa wood. Your model should be no more than 15 cm high. Build simple boxes to represent model instruments and fit them into your lander. Include a parachute for a soft landing.
3. Test your lander model. Your teacher will select a site where you can safely drop the lander from a height of 5 meters or more.

Part 2–Reflect

1. How did your lander survive its fall? Did its structure hold up on impact? Were the instruments on board damaged?

2. What changes would need to be made for your next test model?