Data From Space

Goals

Students learn about the connection between space technology and a scientist's work on land.

Video Overview and Background

According to NASA, the term *artificial satellite* refers to any "manufactured object that continuously orbits Earth or some other body in space." In contrast, a "natural satellite" is a natural object that orbits a planet, such as Earth's moon. The first artificial satellite, Sputnik 1, was launched by the Soviet Union in 1957. Today, there are about 3,000 working satellites that orbit Earth.

Many scientists use data collected by satellites in their research. For example, satellites can be used to study different aspects of the universe, collect weather data, and monitor a variety of conditions on Earth. Scientists can use Global Positioning System (GPS) data to mark research sites, populations of organisms, or monitor the movement of species with the aid of tracking tags. The general public also takes advantage of GPS data when they use a navigation system in their vehicle or out on the trail.

In this video, Dr. Mike Heithaus explores the Kennedy Space Center, describes the steps of preparing the space shuttle for launch, and examines how scientists such as him use information collected by satellites.

Prerequisite Concepts

Before viewing the video, students should have a basic understanding of planetary motion, space exploration technology, the functions of satellites, and properties of Earth including rotation.

Teaching Tips

Preview the video and identify time codes where you wish to pause and give students the chance to record information or answer questions.

Activity 1—Exploring Florida's Role in Space Exploration

Video segment: 00:00–02:34

Preparation Prepare copies of the worksheet pages for students to use. In this portion of the video, Dr. Mike Heithaus explores Kennedy Space Center and discusses the space shuttle program.

Discussion Questions

- **Why is the space shuttle program ending?**
- **What steps are necessary to prepare a space shuttle for its next launch?**
- **What are some uses of the space shuttle?**

Completing the Student Page

Students use their knowledge about Earth to answer several questions. If necessary, students can use Internet or library resources to help find the answers. Then, students put together their answers to the questions and write a summarizing paragraph. Excellent resources about Kennedy Space Center include:

Official NASA Kennedy Space Center Site:
http://www.nasa.gov/centers/kennedy/home/index.html

Kennedy Space Center Visitor Site:
http://www.kennedyspacecenter.com/

Activity 2—Comparing Data Collected By Satellites

Video segment: 02:39–04:26

Preparation In this portion of the video, Dr. Mike Heithaus meets with John Fabian, a former NASA astronaut, and they discuss what it's like to go into space.

Discussion Questions

- **What happens in the vehicle assembly building?**
- **How long does it take to put together the space shuttle?**
- **What kind of information can satellites provide?**

Completing the Student Page

Students use the Internet to gather information about different satellites. All the information students need can be found on NASA's Eyes on the Earth website: http://climate.nasa.gov/Eyes/eyes.html.

Activity 3—Examining Satellite Data to Identify Plankton Blooms

Video segment: 04:31–06:04

Preparation In this portion of the video, Dr. Mike Heithaus discusses how information from satellites is useful for his research.

Discussion Questions

- **What is the crawler-transporter?**
- **What types of data can satellites collect?**
- **How does Dr. Heithaus use satellite data?**
- **Why are satellites useful for collecting data about phytoplankton blooms?**

Completing the Student Page

Students analyze satellite images and use them to answer several questions. Prior to starting this activity, you may want to help students identify locations on the maps. In order to answer questions, students will need to be able to identify Mexico and the United States, including the general locations of Alaska, California, Oregon, Washington, and Hawaii.

Activity 4—Locating A Position Using GPS Coordinates

Video segment: 06:09–08:14

Preparation In this portion of the video, Dr. Mike Heithaus discusses the final preparations necessary for the launching of the space shuttle. He then discusses how GPS data helps with navigation and watches as the astronauts leave for the launching pad.

GPS supplies data from a network of 24 satellites to GPS receivers on the ground. These satellites were initially launched by and for the use of the U.S. Department of Defense, but were made available to the general public in the 1980s. A user's location is determined by triangulating data from at least three satellites.

Discussion Questions

- **What is a shuttle's payload?**
- **What is the Global Positioning System? How does it help with navigation?**

Completing the Student Page

Students use GPS coordinates and mapping software to determine the location of humpback whales in different seasons throughout the year. Mapping software options include using Google Maps (http://maps.google.com) or MapQuest (http://atlas.mapquest.com/maps/latlong.adp). Students can insert the latitude and longitude values into the search box and the location will appear. Students should zoom out if necessary to determine the location more easily. Another option would be to use Google Earth (this requires downloading free software).

Student Page Answers

Activity 1

1. No—it has the speed of the spinning Earth.
2. Near the equator
3. West to east
4. East
5. No—liquids could freeze; plastics could crack.
6. Water—otherwise, crashes or discarded boosters could hit people or property. Boosters that fall into water can be recovered.
7. Somewhere in between which offers access to roads and cities for workers and parts, but not too close where the noise would be a problem or people could get hurt by falling debris.
8. Essay should include: warm temperatures, close to equator so rockets and shuttle have more speed when they blast off, can launch over water when they head east (direction of Earth's rotation).

Activity 2

1. Aura: about 1.5 cars, measures and observes the chemical content of the atmosphere—especially the ozone layer and air pollution
2. Quickscat: about 1 car, uses microwaves to measure wind speeds
3. OSTM: about 1 car, measures the surface height of the oceans, which can be used to determine areas of warmer water
4. Grace: smaller than a car, measures Earth's gravity field to learn about water and ice distribution
5. Landsat 7: about 1.5 cars, captures images of the Earth's surface

Activity 3

1. Whales should move out of Alaska because the water gets too cold in winter—Hawaii or Mexico are good places to go because they are the closest areas where the water is warm enough for them.
2. They should be found only as far north as Florida in the winter but move further north in the summer because the water is warm enough there. The water is too cold along the west coast of the U.S. all year.

3. No—there is very little phytoplankton there, which means there isn't much food to support the animals that they would eat.
4. No—there isn't enough plankton there. Swimming to Alaska in the summer would be good to take advantage of the plankton blooms that are there.

Activity 4

Table 1: Winter: Pacific Ocean, off west coast of Hawaii; Spring: Pacific Ocean, northeast of Hawaii and west of California; Summer: Gulf of Alaska in channel between Hoonah and Angoon; Fall: North Pacific Ocean, off west coast of Oregon

1. The whale spent the winter in Hawaii, moved north in the spring, spent the summer in Alaska, and then returned to Hawaii in the fall.
2. Students should suggest that they would spend the summers eating in Alaska and then travel to Hawaii to find warm waters.
3. Answers will vary.