

Satellite

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Lesson 3: What Does an Artificial Satellite Do?

Objectives:

- Students will learn that artificial satellites collect and return data.
- Students will learn the major types of artificial satellites.
- Students will understand the different functions of various artificial satellites.

Estimated Lesson Time:

Two classes (2 hours)

Classroom strategies:

Begin with vocabulary and motivate the discussion with the fact that satellites all collect data of some sort and send that data back to Earth. Use images/videos (stills and/or WWW) and open-ended discussions of what they think the different satellites do.

Science background Information:

First satellites were built and launched by the Soviet Union and the US. Over time, the more industrialized nations also built satellites (e.g., Canada). Now, even small countries have their own satellites (e.g., Luxembourg). For a review of satellite "firsts," see <http://www.atek.com/satellite/index.html> and the [ABCs of Satellite Communications](#). Provide background for each type of satellite:

- **Weather:** used for weather forecasts by measuring things like clouds, winds, temperature of the atmosphere from space; also used for climate changes like El Nino and global warming. First weather satellite - Explorer 7, Oct. 13, 1959.
- **Military:** used for tracking battle zones, watching for missile launches, watching for nuclear testing, as weapons, spying on hostile countries, intercepting messages, tracking incoming objects like meteoroids and defunct satellites. US launches its first spy satellite, Discoverer 1, part of top-secret Corona program, Feb. 28, 1959. Discoverer 13 (Aug. 10, 1960) is first

unqualified success.

- **Telecommunication:** used for cellular phones, long-distance phones, beepers, TV broadcasts via satellite dishes, computer connections. ECHO-1 was a plastic 30.5 m ball covered of mylar aluminized that reflected radio signals.
It enabled the first satellite telephone link and the broadcast of a TV program from California to Massachusetts on 24 Feb 1962. The first company-owned telecommunications satellite was TELSTAR, July 10, 1962. The first geostationary orbiting communication satellite was SYNCOM3, Aug. 19, 1964.
- **Navigation:** used for determining position using a large number of satellites, used by airplanes for landing, ships for navigation, geologists for prospecting, farmers for planting and fertilizing. The first Global Positioning Satellite (GPS) was launched on November 22, 1978 - GPS is now the standard navigation tool used by the military, scientists, and industry.
- **Scientific:** used for learning about the universe, for example: how stars form (astronomy - Hubble Space Telescope), how the Sun and the Earth interact (space weather - POLAR), what space is like (IMP), exploration of the planets (Pioneer - outer planets, Voyager - outer planets and Venus, Galileo - Jupiter, Mars Surveyor, Viking - Mars, Mariner - Mercury). First American satellite - Explorer-1, Feb. 1, 1958.

It is important to note that not all satellites look alike, even within the same category. Also, a single satellite might serve multiple purposes (i.e., both scientific and military).

Vocabulary:

1. Data - Things given or granted; things known or assumed as fact, and made as the basis of reasoning, measurement, or calculation; an assumption or premise from which inferences are drawn.
2. Military - Having reference to armed forces or to the army; adapted to or connected with a state of war; distinguished from civil, ecclesiastical, etc.
3. Navigation - The art or science of directing the movements of aircraft or spacecraft, esp. in regard to a craft's position and course.
4. Telecommunication - Communication over long distances, esp. by electrical means such as by telegraphy, telephony, or broadcasting; (usu. in pl.) the branch of technology concerned with this.
5. Geostationary - A satellite with an orbital period of exactly 24 hours. When placed in orbit in the Earth's equatorial plane at about 6.6 Earth radii from the Earth, the satellite will remain fixed with respect to the rotating Earth and therefore appear to be "geostationary."
6. Meteoroid - Any small rocky or icy object that fills interplanetary space. When a meteoroid enters the Earth's atmosphere we call it a meteor. If a meteor makes it to the surface of the Earth without burning up, it is called a meteorite.
7. Weather - The condition of the atmosphere (at a given place and time) with respect to heat or cold, quantity of sunshine,

presence or absence of rain, hail, snow, thunder, fog, etc., violence or gentleness of the winds. Usually on a short time scale.

8. Climate - Condition (of a region or country) in relation to prevailing atmospheric phenomena, as temperature, dryness or humidity, wind, clearness or dullness of sky, etc., esp. as these affect human, animal, or vegetable life. Usually refers to a long term time scale.

Materials and Equipment:

References on various satellites. Pictures of satellites (a typical example of each kind). Videos.

Advance Preparation:

Gather appropriate materials.

Activity:

Divide up class into five groups. Each group will be assigned one of the following types of satellites: weather satellites (GOES), telecommunication satellites (ANIK), navigation satellites (GPS), scientific satellites (TERRIERS), and military satellites (MILSTAR). Each group will try to determine the function of their type of satellite through brainstorming first, then using resources provided by the teacher. Each group will present their information to the class; teacher may need to fill in missing elements. To the extent possible, have students add the first launch of their satellite to the timeline at the appropriate date.

Homework Assignment:

Journal exercise - How many things in your life today were made possible by satellites? What would have been different if all the satellites had stopped working? (*Teacher note: In May 1998 a critical satellite failed and 90% of all beepers in the US stopped working which affected doctors on call and emergency crews. It also interrupted cell phone and television operations for several days. This was a worldwide effect.*)

References:

NOVA on Earth-crossing Asteroids and Meteor Impacts; NOVA or Discovery program on the history of spy satellites

Book with pictures and descriptions of specific satellites used in activity (maybe from a web page for each?)

Travelling in Space (Troll Associates)

Connections:

Literature: 2001: A Space Odyssey (Arthur C. Clarke)

Music: Ground Control to Major Tom (David Bowie - Ziggy Stardust and the Spiders From Mars)

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