Encyclopedic Entry

GPS

global positioning system

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The global positioning system (GPS) is a network of satellites and receiving devices used to determine the location of something on Earth. Some GPS receivers are so accurate they can establish their location within 1 centimeter (0.4 inches). GPS receivers provide location in latitude, longitude, and altitude. They also provide the accurate time.

GPS includes 24 satellites that circle Earth in precise orbits. Each satellite makes a full orbit of Earth every 12 hours. These satellites are constantly sending out radio signals.

GPS receivers are programmed to receive information about where each satellite is at any given moment. A GPS receiver determines its own location by measuring the time it takes for a signal to arrive at its location from at least four satellites. Because radio waves travel at a constant speed, the receiver can use the time measurements to calculate its distance from each satellite.

Using multiple satellites makes the GPS data more accurate. If a GPS receiver calculates its distance from only one satellite, it could be that exact distance from the satellite in any direction. Think of the satellite as a flashlight. When you shine it on the ground, you get a circle of light. With one satellite, the GPS receiver could be anywhere in that circle of light. With two more satellites, there are two more circles. These three circles intersect, or cross, in only one place. That is the location of the GPS receiver. This method of determining location is called trilateration.

Aircraft, ships, submarines, trains, and the space shuttle all use GPS to navigate. Many people use receivers when driving cars. The GPS receiver plots the car's constantly-changing location on an electronic map. The map provides directions to the person's destination. Both the location and the vehicle are plotted using satellite data. Some hikers use GPS to help them find their way, especially when they are not on marked trails.

Sometimes there are obstacles to getting a clear GPS signal. Gravity can pull the GPS satellites slightly out of orbit. Parts of Earth's atmosphere sometimes distort the satellite radio signals. Trees, buildings, and other structures can also block the radio waves. GPS control and monitoring stations around the world track the satellites and constantly monitor their signals. They then calculate corrections that are broadcast to GPS receivers. These corrections make GPS much more accurate.

The original GPS system began as a project of the U.S. military. The first experimental satellite was launched in 1978. By 1994, a full 24 GPS satellites were orbiting Earth. At first, GPS available for civilian, or nonmilitary, use was not very accurate. It would only locate a GPS receiver within about 300 meters (1,000 feet). Today, an accurate signal is free and available to anyone with a GPS receiver.

GPS is American. Russia has its own version of a GPS system, called GLONASS (Global Orbiting Navigation

Satellite System). China and the European Union are currently creating systems of their own.

VOCABULARY

Term	Part of Speech	Definition
aircraft	*noun*	vehicle able to travel and operate above the ground.
altitude	*noun*	the distance above sea level.
arctic tern	*noun*	small bird that migrates from the Arctic to the Antarctic.
atmosphere	*noun*	layers of gases surrounding a planet or other celestial body.
biologist	*noun*	scientist who studies living organisms.
broadcast	*verb*	to transmit signals, especially for radio or television media.
calculate	*verb*	to reach a conclusion by mathematical or logical methods.
civilian	*noun*	person who is not in the military.
construction	*noun*	arrangement of different parts.
data	*plural noun*	(singular: datum) information collected during a scientific study.
destructive	*adjective*	harmful.
determine	*verb*	to decide.
distort	*verb*	to deform or misrepresent.
Earth	*noun*	our planet, the third from the Sun. The Earth is the only place in the known universe that supports life.
earthquake	*noun*	the sudden shaking of Earth's crust caused by the release of energy along fault lines or from volcanic activity.
ecosystem	*noun*	community and interactions of living and nonliving things in an area.
Global Positioning System (GPS)	*noun*	system of satellites and receiving devices used to determine the location of something on Earth.
GLONASS	*noun*	(Global Orbiting Navigation Satellite System) Russian GPS technology.
GPS receiver	*noun*	device that gets radio signals from satellites in orbit above Earth in order to calculate a precise location.
gravity	*noun*	physical force by which objects attract, or pull toward, each other.
grizzly bear	*noun*	large mammal native to North America.
habitat	*noun*	environment where an organism lives throughout the year or for shorter periods of time.
hike	*verb*	to walk a long distance.
humpback whale	*noun*	marine mammal native to all of Earth's oceans.
intersect	*verb*	to cross paths with.
latitude	*noun*	distance north or south of the Equator, measured in degrees.
light wave	*noun*	electromagnetic radiation visible to the human eye. Also called visible light.
location	*noun*	position of a particular point on the surface of the Earth.

longitude	*noun*	distance east or west of the prime meridian, measured in degrees.
map	*noun*	symbolic representation of selected characteristics of a place, usually drawn on a flat surface.
migrate	*verb*	to move from one place or activity to another.
military	*noun*	armed forces.
monitor	*verb*	to observe and record behavior or data.
navigate	*verb*	to plan and direct the course of a journey.
network	*noun*	series of links along which movement or communication can take place.
obstacle	*noun*	something that slows or stops progress.
orbit	*verb*	to move in a circular pattern around a more massive object.
plot	*verb*	to form a path based on calculations.
precise	*adjective*	exact.
predict	*verb*	to know the outcome of a situation in advance.
radio wave	*noun*	electromagnetic wave with a wavelength between 1 millimeter and 30,000 meters, or a frequency between 10 kilohertz and 300,000 megahertz.
satellite	*noun*	object that orbits around something else. Satellites can be natural, like moons, or made by people.
space shuttle	*noun*	vehicle used to transport astronauts and instruments to and from Earth.
sphere	*noun*	round object.
submarine	*noun*	vehicle that can travel underwater.
tracker	*noun*	device, usually attached to an animal, that follows its movements.
train	*noun*	connected railroad cars pulled by a single engine.
tsunami	*noun*	ocean waves triggered by an earthquake, volcano, or other movement of the ocean floor.

For Further Exploration

Articles & Profiles

- National Geographic News: GPS Technology Drives Global Treasure Hunt
- National Geographic Kids: Saving the Saiga

Interactives

- National Geographic Adventure: Roadside Assistance—GPS

Websites

- Geocaching: The Official GPS Cache Hunt Site
- Global Positioning System: Serving the World