

# GLOBAL POSITIONING SYSTEM - BASICS

## Definition

The **Global Positioning System (GPS)** is a U.S. space-based global navigation satellite system. It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night.

## Basics

**Global Positioning System**, also known as **GPS**, is a system designed to help navigate on the Earth, in the air, and floating on water.

A GPS receiver displays where it is, how fast it is moving and which direction, how high it is, and maybe how fast it is going up or down. Many GPS receivers contain information about places. GPS units for automobiles contain travel data like road maps, hotels, restaurants, and service stations. GPSs for boats contain nautical charts of harbors, marinas, shallow water, rocks, and waterways. Other GPSs are for aviation, hiking and backpacking, bicycling, or many other activities.

Most GPS receivers record where they have been, and help plan a journey. While traveling a planned journey, the unit predicts the time to the next destination.

### **How it works**

GPS satellites circle the earth in four planes, plus a group over the equator. This example shows the number of satellites visible to a GPS receiver at 45° North in blue. Red satellites are blocked by the Earth. A GPS unit receives radio signals from satellites in space circling the Earth. There are about 30 satellites 20,200 kilometres (12,600 mi) above the Earth. (Each circle is 26,600 kilometres (16,500 mi) radius due to the Earth's radius.) Far from the North Pole and South Pole, a GPS unit can receive signals from 6 to 12 satellites at once. Each satellite contains an atomic clock which is carefully set by NORAD several times per day.

The radio signals contain the precise time and position of the satellite. The GPS receiver subtracts the current time from the time the signal was sent. The difference is how long ago the signal was sent. The time difference multiplied by the speed of light is the distance to the satellite. GPS unit uses trigonometry to calculate where it is from each satellite's position and distance. Usually there must be at least four satellites to solve the geometric equations.

A GPS receiver can calculate its position up to several times in one second. A GPS receiver calculates its speed and direction by using its change in position and change in time.

Many inexpensive consumer receivers are accurate to 20 metres (66 ft) most anywhere on the Earth. Sometimes military and expensive commercial receivers are accurate to 30 centimetres (12 in).

## **History**

The system was created by the United States Department of Defense. In the beginning, it was only used by the U.S. military, but in 1983 President Ronald Reagan made an order to allow anyone to use the system.

Sometimes GPS receivers are part of cell phones, wrist watches, and cars.

## **Other systems**

There are other systems that act in the same way. One was put in space by Russia, called GLONASS. Another that is not yet done is Galileo, built by the European Union.

The Global Positioning System (GPS) is a U.S. space-based global navigation satellite system. It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth which has an unobstructed view of four or more GPS satellites.

GPS is made up of three segments: Space, Control and User. The Space Segment is composed of 24 to 32 satellites in Medium Earth Orbit and also includes the boosters required to launch them into orbit. The Control Segment is composed of a Master Control Station, an Alternate Master Control Station, and a host of dedicated and shared Ground Antennas and Monitor Stations. The User Segment is composed of hundreds of thousands of U.S. and allied military users of the secure GPS Precise Positioning Service, and tens of millions of civil, commercial and scientific users of the Standard Positioning Service. GPS satellites broadcast signals from space that GPS receivers use to provide three-dimensional location (latitude, longitude, and altitude) plus precise time.

GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land surveying, commerce, scientific uses, tracking and surveillance, and hobbies such as geocaching and waymarking.

Also, the precise time reference is used in many applications including the scientific study of earthquakes and as a time synchronization source for cellular network protocols.

GPS has become a mainstay of transportation systems worldwide, providing navigation for aviation, ground, and maritime operations. Disaster relief and emergency services depend upon GPS for location and timing capabilities in their life-saving missions. The accurate timing that GPS provides facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids. Farmers, surveyors, geologists and countless others perform their work more efficiently, safely, economically, and accurately using the free and open GPS signals.

Source: <http://www.juliantrubin.com/encyclopedia/electronics/gps.html>