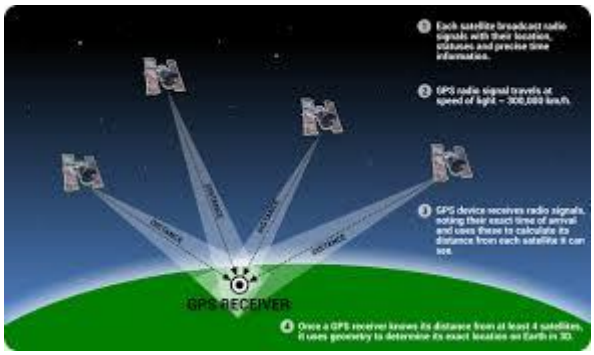
GPS

What is GPS?

GPS image GPS or Global Positioning System is a network of orbiting satellites that send precise details of their position in space back to earth. The signals are obtained by GPS receivers, such as navigation devices and are used to calculate the exact position, speed and time at the vehicles location.

GPS is well-known for its military uses and was first developed by the US to aid in its global intelligence efforts at the height of the Cold War.

Ever since the early 1980s, however, the GPS has been freely available to anyone with a GPS receiver. Airlines, shipping companies, trucking firms, and drivers everywhere use the GPS system to track vehicles, follow the best route to get them from A to B in the shortest possible time.



The very first GPS system was developed in the 1960s to allow ships in the US Navy to navigate the oceans more accurately. The first system had five satellites and allowed ships to check their location once every hour. Today, portable Navigation device devices can give drivers their precise location to within a few meters, which is accurate enough to navigate roadways. Military applications have much higher precision so that a location can be pinpointed within a few centimeters.

The US NAVSTAR Global Positioning System (GPS) is the only fully operational Global Navigation Satellite System (GNSS) currently providing positioning data with global coverage. The European Union is currently developing its own GPS known as the Galileo positioning system, which will be operational by 2013. China has a local system it may expand globally, while Russia is currently restoring its GLONASS system.

How does GPS work?

There are three parts to a GPS system: a constellation of between 24 and 32 solar-powered satellites orbiting the earth in orbits at an altitude of approximately 20000 kilometers, a master control station and four control and monitoring stations (on Hawaii, Ascension Islands, Diego Garcia and Kawajale) and GPS receivers such as the one in a car.

Each of the satellites is in an orbit that allows a receiver to detect at least four of the operational satellites. The satellites send out microwave signals to a receiver where the built-in computer uses these signals to work out your precise distance from each of the four satellites and then triangulates your exact position on the planet to the nearest few meters based on these distances.

In fact, signals from just three satellites are needed to carry out this trilateration process; the calculation of your position on earth based on your distance from three satellites. The signal from the fourth satellite is redundant and is used to confirm the results of the initial calculation. If the position calculated from distances to satellites “A-B-C” do not match the calculation based on “A-B-D” then other combinations are tested until a consistent result is obtained.

The process of measuring the distance from satellite to GPS receiver is based on timed signals. For example, at 16h45m precisely, the satellite may begin broadcasting its signal. The GPS receiver will also begin running the same random

sequence at 16h45m local time, but does not broadcast the sequence. When the receiver picks up the signal from the different satellites, there will be a time lag, because the microwaves take a fraction of a second to travel from the satellite to the receiver. The time lag is easily converted into distance to each satellite. The slight difference between signals from each satellite is then used to calculate the receiver's position.

What signal does GPS use

There are currently between 27 and 32 global positions system (GPS) satellites in orbit around the earth. Of these, three act as backups. Each satellite transmits a regular GPS signal that is carried by radio waves in the microwave part of the electromagnetic spectrum.

Each GPS satellite continuously broadcasts a navigation message at 50 bits per second on the microwave carrier frequency of approx 1600 MHz .FM radio, for comparison, is broadcast at between 87.5 and 108.0 MHz and Wi-Fi networks operate at around 5000 MHz and 2400 MHz More precisely, all satellites broadcast at 1575.42 MHz (this is the L1 signal) and 1227.6 MHz (the L2 signal).

The GPS signal gives the precise "time-of-week" according to the satellite's onboard atomic clock, the GPS week number and a health report for the satellite so that it can be discounted if faulty.Each transmission lasts 30 seconds and carries 1500 bits of encrypted data. This small amount of data is encoded with a high-rate pseudo-random (PRN) sequence that is different for each satellite. GPS receivers know the PRN codes for each satellite and so can not only decode the signal but distinguish between different satellites.