About GPS

Information on GPS Satellites: NAVSTAR (named by the U.S. Department of Defense):

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1.Â Â The first GPS satellite was launched in 1978.

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2.Â Â A full constellation of 24 satellites was achieved in 1994.

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3.Â Â GPS was made for civilian use in the mid 1980's

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4.Â Â Satellites orbit the earth 12,000 miles above us.

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5.Â Â They make 2 complete orbits in less than a day (24hrs.)

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6.Â Â Satellites move at a speed of about 7,000 MPH

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7.Â Â Each satellite is built to last about 10 years and replacements are constantly built and launched into orbit.

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8.Â Â They are powered by solar energy with backup batteries for solar eclipse and have small rocket

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Â Â Â Â boostersÂ toÂ steer them in the right direction.

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9.Â Â A GPS satellite weighsÂ 2,000 pounds and isÂ 17 feet across with the solar panels.

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10. Transmitter power isÂ less thanÂ 50 watts (and that ain't much)

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The system:

GPS satellites circle the earth twice a day in a veryÂ specific orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Basically, the GPS receiverÂ takes the time a signal was transmitted (by a satellite)Â and compares it toÂ the time it was received (by a GPS). The time difference tells how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position on earth (by a mathematical distance equation) and display it on the GPS unit.

A GPS receiver must communicate with at least three satellites to calculate a 2D position (latitude and longitude) and track movement.Â Locked on toÂ four or more satellites, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate speed, bearing, sunrise and sunset time, distances between waypoints, and other things.

Accuracy:

Today's GPS receivers are extremely accurate, thanks to their multi-channel design.Â OnceÂ a 12 parallel channel receiver locks onto satellites, the link is strong enough to maintain contact in most canyons, dense foliage,Â automobilesÂ and sometimes buildings.Â However, turning the unit on for the first time and locking on to Satellite communicationÂ is typically difficult in a building, canyon, car, or a locationÂ with little sky view.

Newer GPS receivers withÂ "Wide Area Augmentation System" (WAAS)Â capability can get you within 3 meters of accuracy. ThereÂ is no equipment or fees required for WAAS. Users can also get better accuracy with Differential GPS (DGPS), which corrects GPS signals within 3 - 5 meters using beacon transmitters. To use DGPS, users need a differential beacon receiver and antenna in addition to their GPS.Â

AboutÂ the signal:

GPS satellites transmitÂ 2 low power radio signals, designated L1 and L2. Civilian GPS uses the L1 frequency of inÂ a UHF band. The signals travel by line of sight, meaning they will pass through clouds, glass and plastic but will not go through most solid objects, like mentioned in the 'Accuracy' section.

A GPS signal contains three different bits of information â€” a pseudorandom code, ephemeris data and almanac data. The pseudorandom code is simply an I.D. code that identifies which satellite is transmitting information. This is shown on your Garmin GPS unit's satellite page; it identifies which satellites it's receiving.

Ephemeris data tells the GPS receiver where each GPS satellite should be at any time throughout the day. Each satellite transmits ephemeris data showing the orbital information for that satellite and for every other satellite in the system.

Almanac data, which is constantly transmitted by each satellite, contains important information about the status of the satellite (healthy or unhealthy), current date and time. This part of the signal is essential for determining a position.

GPS Signal Errors:

Ionosphere and troposphere delays â€” The satellite signal slows as it passes through the atmosphere. The GPS system uses a built-in model that calculates an average amount of delay to partially correct for this type of error.

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Signal multipath â€” This occurs when the GPS signal is reflected off objects such as tall buildings or large rock surfaces before it reaches the receiver. This increases the travel time of the signal, thereby causing errors.

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Receiver clock errors â€” A receiver's built-in clock is not as accurate as the atomic clocks onboard the GPS satellites. Therefore, it may have very slight timing errors.

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Orbital errors â€” Also known as ephemeris errors, these are inaccuracies of the satellite's reported location.

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Number of satellites visible â€” The more satellites a GPS receiver can "see," the better the accuracy. Buildings, terrain, electronic interference, or sometimes even dense foliage can block signal reception, causing position errors or possibly no position reading at all. GPS units typically will not work indoors, underwater or underground.

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Satellite geometry/shading â€” This refers to the relative position of the satellites at any given time. Ideal satellite geometry exists when the satellites are located at wide angles relative to each other. Poor geometry results when the satellites are located in a line or in a tight grouping.

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Intentional degradation of the satellite signal â€” Selective Availability (SA) is an intentional degradation of the signal once imposed by the U.S. Department of Defense. SA was intended to prevent military adversaries from using the highly accurate GPS signals. The government turned off SA in May 2000, which significantly improved the accuracy of civilian GPS receivers.

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Other GPS inaccuracies come from: human error, map errors,Â atmosphericÂ changes, and other sources of error.

Now you know how a GPS works, but selecting the right GPS for your needs is anotherÂ equation.Â The next steps are to check out our GPS Reviews and the Garmin/Magellan Comparison Chart.Â Then check out the GPS Units & Mounts we sell.