SiRF

GPS Glossary

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This glossary provides supplementary information for students of GPS Fundamentals. While many of the terms can have other definitions from those presented here, these definitions are specifically applicable to the GPS system. When a definition uses a term that is defined elsewhere in this glossary, the term defined elsewhere will be written in *italics*.

Term	**Description**
2dRMS	Two times the *RMS Error*. In two-dimensional position estimates, 2dRMS encompasses 95 to 98 % of the measured points.
Almanac	A reduced version of the *Ephemeris* of a satellite. Almanacs for all satellites in the GPS system are transmitted by all satellites in *Subframes* 4 and 5 of the *Navigation Message*, and are used by receivers to predict *Visibility* of satellites once the receiver's location and the current time are known. To learn the almanac of all satellites currently in the GPS system can require up to 12.5 minutes since only one or two almanacs are transmitted during each *Frame*.
Anti-Spoofing	Encryption of the *P code* into *P(Y) code* to prevent false GPS signals from distracting receivers which are using the *P code* to navigate. Abbreviated *AS*.
AS	See *Anti-Spoofing*.
Azimuth	The angle between local true north and a satellite as observed by a GPS receiver. The angle is typically measured from 0º to 360º going clockwise (some systems use 0º to 180º going east from north, and 0º to -180º going west from north).

Term	Description
C/A Code	Coarse/Acquisition Code, one of the signals modulated onto the GPS carriers. The C/A Code is composed of a 1023-bit pattern called a *Gold Code* that is used to modulate the L_1 carrier. The *chipping rate* is 1.023 MHz, so the full pattern takes 1 ms to complete a cycle. The *Navigation Message* is exclusive-ORed with the C/A Code at a 50 bps rate, so that each bit of the *Navigation Message* includes 20 complete cycles of the C/A Code pattern.
Carrier Phase	An alternative means of measuring *Pseudorange* by tracking the phase of the received carrier. Carrier Phase measurements can generally be tracked to small fractions of a cycle, but suffer from the inability to determine the integer number of cycles between the satellite and receiver without assistance from another receiver, thus cannot be used for autonomous range measurements. Carrier phase measurements are generally much smoother than *C/A Code* pseudorange measurements, and are often used to smooth the pseudorange measurements. Carrier phase measurements generally require stronger signals than C/A code pseudorange measurements, and are thus subject to *cycle slips*.
CDMA	Code-Division Multiple Access. A method of allowing several transmitters to use the same frequency at the same time. Each transmitter's carrier is modulated by a *PRN Code* that is unique on that frequency, and receivers detect each transmitter by generating a copy of the *PRN Code* and searching for it in the data stream from the RF section. GPS satellites use CDMA to allow each satellite to transmit on the same frequency at the same time. Each satellite is assigned a unique *Gold Code* which can be detected in the receivers.
CEP	Circular Error Probable, a two-dimensional error estimate equal to the radius of a circle in the measurement plane centered on the true location of the measurement, which encompasses 50 % of the measured points. Note: some authors modify this definition to refer to different percentages of points encompassed, and then add the percentage after the term. For example, an error estimate that represents the radius of a circle encompassing 95 % of the points measured might be indicated as CEP 95.

Term	Description
Chipping Rate	The bit rate of a *PRN code* used to modulate a *CDMA* signal.
Clock Bias	The difference between GPS time and the time in a receiver. This value is normally computed as one of the four unknowns solved for in a GPS receiver (the other 3 unknowns are the 3-dimensional position). The clock bias is a common error in each *pseudorange* measured.
Clock Drift	The rate at which *Clock Bias* changes in a GPS receiver. It may be the result of changes in the crystal oscillator of the receiver, and it may contain a term that is designed into the receiver's architecture. In some SiRF receivers, the architecture adds a Clock Drift which is equivalent to having an added 18,000 m/s velocity on every satellite's *Doppler*. This drift, equal to 96.25 kHz, is removed in the signal processing.
Clock Offset	An ambiguous term used in SiRF documentation that may refer to *Clock Bias* or *Clock Drift*, depending on the source document. In general, Clock Offset values related in units of time (ns, ms, seconds) are describing Clock Bias while Clock Offset values related in terms of frequency (Hz, kHz) describe Clock Drift.
Cold Start	A receiver start-up process where the receiver does not know sufficient information to predict satellite *visibility*. Generally this means that the receiver lacks either the current time or an estimate of its current position (or both). It also usually implies that there are no *ephemerides* available in the receiver, although *almanacs* are normally considered to be present. Since the receiver cannot predict which satellites are visible it must have some default stategy to locate satellites and then estimate which others might be visible.

Term	Description
Control Segment	That portion of the GPS system consisting of the Master Control station located at Schreiver Air Force Base, Colorado Springs, Colorado, USA (alternate location: Moffet Field, Sunnyvale, California, USA), and several other control and monitoring stations located around the Earth. The Control Segment is responsible for monitoring the operation of all satellites in the *Space Segment*, and sending them data for their *Navigation Message* as well as adjusting satellite location and operation as it may be required.
Correlator	A device which compares a bit stream from the received RF signals against a bit stream generated in the signal processor and provides an output proportional to the rate of agreement between the two.
Cycle Slips	A problem experienced when tracking *Carrier Phase*. A cycle slip occurs when the process of tracking the carrier phase suffers from a loss of lock on the signal. Since without outside information all carrier phase measurements are relative, loss of lock means that the relationship between the carrier phase and the *C/A Code Pseudorange* must be restarted. This also normally means that any smoothing of the C/A code pseudorange must be restarted.
Data Word	The smallest division of the *Navigation Message*. Each data word is 30 bits long, consisting of 24 data bits in the MSB end, and 6 parity bits in the LSB end. The bits are numbered 1 to 30 starting at the MSB. Data words are grouped into *Subframes*, each consisting of 10 data words.
Datum	A set of reference measurements from which surveys are conducted. Datums are tied to a *Reference Ellipsoid* and are generally only used in specific regions of Earth. Since GPS positions are computed in the *WGS-84* reference frame, it may be necessary to translate those positions into a local datum before the measurements will match local maps.
dB-Hz	Unit of measure for carrier-to-noise density ratio, C/N_0. It is a measure of the power density in 1 Hz bandwidth.
dBm	Decibels relative to 1 mW. A unit of power defined as 10 $\log_{10}$(Signal Power / 1 mW). L_1 GPS signals at the Earth's surface are specified to have a minimum signal strength of -130 dBm when received by a 3 dB_i linearly polarized antenna when the satellite is at least 5º above the horizon.
DGPS	See *Differential GPS*

Term	Description
Differential GPS	A form of GPS where corrections from a source other than the GPS satellites are used to improve the quality of the position. Several forms of differential GPS have been used. The most common is where the corrections are applied to *pseudoranges* before the receiver computes the position. *RTCM SC-104* has published a standard for sending corrections over radio beacons and other media that has become a standard within the GPS community. In addition, the US Federal Aviation Agency (FAA) has developed a system using geostationary satellites broadcasting on the GPS L_1 frequency to supply corrections that apply over a very wide area. Similar systems exist or are being developed in Europe (*EGNOS*) and Asia (*MSAS*).
DOP	Dilution Of Precision, a factor that influences the error in a GPS position fix. It is a measure of the geometry between the available satellites and the receiver, and the number of satellites available. DOP is the general term; specific types of DOP are defined, including *GDOP* (geometric dilution of precision), *PDOP* (position DOP), *TDOP* (time DOP), *HDOP* (horizontal DOP) and *VDOP* (vertical DOP). All of these values are interrelated.
Doppler	A shift in a received signal's frequency caused by the relative motion between the transmitter and the receiver. Since GPS satellites are in orbit around the Earth, their velocity relative to an observer on the Earth is such that the transmitted L_1 signal can be observed to have as much as ±4.2 kHz frequency change. In GPS receivers, Doppler must be compensated for before the received signal can be properly detected and tracked. Any satellite which is rising in elevation will have a Doppler greater than 0 (the received frequency will be greater than 1575.42 MHz), Doppler will be exactly 0 when the satellite reaches its highest elevation, and all setting satellites will have a negative Doppler. Therefore, the actual Doppler on a satellite tracked over its entire transit across the sky will start positive and will constantly decrease until the satellite sets.
Earth-Centered, Earth-Fixed	A coordinate system with the origin located at the center of the Earth and with axes which are tied to the Earth so that the system rotates with the Earth. In such a system, there is a clear mathematical relationship between X, Y, Z coordinates in the system and latitude, longitude and altitude with respect to the Earth's surface.
ECEF	See *Earth-Centered, Earth-Fixed*.

Term	Description
EGNOS	Europe's *Satellite-Based Augmentation System*.
EHPE	Estimated Horizontal Position Error, a measure of the error in a GPS position in the horizontal plane.
EHVE	Estimated Horizontal Velocity Error, a measure of the error in the velocity from a GPS solution in the horizontal plane.
Elevation	The angle between the horizon and a satellite as observed by a receiver. 0º represents a satellite located right on the local horizon, while 90º represents a satellite located directly upward from the observer.
Elevation Mask	An angle defined as the minimum elevation at which a satellite will be used in a solution. Typically GPS receivers limit the minimum elevation at which they will use a satellite because low-elevation satellies tend to suffer more from multipath and other signal problems. Typical elevation masks might be from 5º to 15º, with higher angles generally used by receivers which need more precise positions, such as survey receivers.
Ellipsoid	A mathematical figure created by rotating an ellipse about its minor axis. Geodysists represent the surface of the Earth by an ellipsoid that aligns its minor axis with the Earth's spin axia, and whose major axis is in the plane of the equator. Several ellipsoids have been defined to represent the Earth, each generally based on extensive surveys. GPS positions are normally computed in accordance with the *WGS-84 Reference Ellipsoid*.
EPE	Estimated Position Error, a measure of the error in a GPS position in three dimensions.
Ephemerides	Plural of *ephemeris*. Pronounced eff-em-air'-e-dees.
Ephemeris	The factors that describe an orbit. In GPS, the ephemeris is the information broadcast by a GPS satellite in *subframes* 2 and 3 (some references also include subframe 1) of the *Navigation Message*. The GPS ephemeris consists of Keplerian elements and harmonic correction terms. Subframe 1, often considered part of the ephemeris, contains information to correct the satellite's clock, and an ionospheric correction term useful for receivers that only receive one frequency from the satellite.
ETE	Estimated Time Error, a measure of the error in the time computed in a GPS receiver.
EVPE	Estimated Vertical Position Error, a measure of the error in a GPS position in the vertical axis.

Term	Description
f_0	The frequency basis of the GPS system. In the satellites, f_0 is 10.23 MHz, and all other frequencies in the satellite are derived from and are coherent with this frequency. Sometimes receivers which do not use the *P code* (which has a 10.23 MHz *chipping rate*) but only use the *C/A Code* (which has a 1.023 MHz chipping rate) call 1.023 MHz f_0.
Frame	A collection of 5 *Subframes* of the *Navigation Message*. Each frame consists of subframe 1 followed by subframe 2 … followed by subframe 5, in order, and takes 30 seconds to transmit. The first frame transmitted in a GPS week (starting at midnight between Saturday and Sunday) contains the first version (page 1) of subframes 4 and 5. The second frame of the week contains page 2, and will be followed by pages 3 to 25, in order. Together these 25 subframes constitute a superframe, which takes 12.5 minutes to broadcast. Following completion of the superframe, the process will repeat throughout the rest of the week. Because the order of frames, and subframes within them, is fixed, it is possible to predict exactly when any specific subframe or page will be next broadcast.
GDOP	Geometric Dilution of Precision, see *DOP*
Gold Code	A type of *PRN* code used in GPS satellites for the *C/A Code* modulation. Gold codes are characterized by having about an equal number of ones and zeroes over the full pattern. The gold codes used in GPS are 1023 bits long and can be generated using two linear feedback shift registers and an integer bit delay between the two shift registers.
GPS	The Navstar Global Positioning System, a navigation system composed of 21 or more satellites in 20,000 km orbits about the Earth, controlled by a network of control and monitoring stations, which provides world-wide, all-weather navigation capabilities.

Term	Description
GPS Time	Time as kept in the GPS system. GPS time is typically reported in *Time Of Week* in seconds since midnight between Saturday and Sunday, and *GPS Week*, which is counted from week 0 which started at midnight, Sunday, January 6, 1980. GPS Time has been counted continuously in 604,800 second weeks since its inception. In that time, *UTC Time* has been adjusted with *Leap Seconds*, so that at present GPS Time is ahead of UTC Time (the week starts earlier in GPS Time than it does in UTC Time) by the total number of Leap Seconds which have been added. As of January, 2005, GPS Time was 13 seconds ahead of UTC Time. Other than Leap Seconds, the U.S. Government constantly adjusts GPS Time to maintain it as close as possible to UTC Time. Historically, the seconds in GPS Time and UTC Time are maintained to within about 20 ns of each other.
GPS Week	GPS Time's coarse measure of time. GPS Week 0 was the week which started at midnight between Saturday and Sunday, January 5-January 6, 1980. The current GPS Week number is broadcast by each satellite in Subframe 1 as a 10-bit number. Since a 10-bit number can only specify 1024 values, the week number as broadcast is considered the actual week number modulo 1024. The second cycle of 1024 weeks started in August, 1999. It is up to each GPS receiver to resolve the GPS Week number as broadcast by the satellites into the proper cycle, and it is not unusual for receivers to occasionally err in this matter, resulting in a date being reported that is either 1024 weeks earlier than reality, or 1024 weeks later than reality.
Hand-Over Word	The second word of each *Subframe* of the *Navigation Message*. The Hand-Over Word contains the time at which the next subframe will start (see *Z Count*), the number of the current subframe (1-5), and some bits that specify the configuration of this satellite.
HDOP	Horizontal Dilution of Precision, see *DOP*
Hot Start	A receiver start-up process where the receiver has all the information required for a *cold start*, and in addition has sufficient valid *ephemerides* in memory to compute a solution once the satellite signals are found.
HOW	See *Hand-Over Word*.

Term	Description
I/Q Sampling	*CDMA* signals, while transmitted at radio frequencies, are converted into digital bit streams for decoding by receivers. This is generally done in two separate streams which are phased so that one set of samples is 90º later than the other. The first-sampled stream is called the in-phase, or I, sample, and the later stream is called the quadrature, or Q, sample. Sampling can be 1 bit, where each sample is a 1 or 0 depending on whether the received and down-converted signal is above or below a threshold, or it can be 2 or more bits, representing the establishment of intermediate thresholds. Generally more bits per sample represents greater gain in the signal processing.
L_1	One of the GPS satellite transmitting frequencies. L_1 is 1575.42 MHz. The carrier is modulated with both *C/A Code* and *P Code* signals. The C/A code is further modified by the addition of a *Navigation Message* exclusive-ORed with the *PRN Code*. Most commercial receivers for consumers use only the C/A code on this signal for navigation.
L_2	One of the GPS satellite transmitting frequencies. L_2 is 1227.60 MHz. The carrier is modulated with the *P Code* signal. Newer satellites will add *C/A Code* modulation as well. This signal is the secondary signal from the satellites, and is typically used in conjunction with the L_1 signal to determine and remove the error caused by the signals passing through the ionosphere. Since the signal changes caused by the ionosphere change with frequency, knowing the relative changes between L_1 and L_2 permits the receiver to compute the ionospheric effects and remove it.
MSAS	Japan's *Satellite-Based Augmentation System*.
Navigation Message	The information broadcast by GPS satellites that provides *ephemeris*, *almanacs* and other data needed by a GPS receiver to operate properly. The navigation message is a series of 30-bit data words, each consisting of 24 bits of data and 6 bits of parity information. Data words are organized into groups of 10 called *subframes*. The navigation message is added to the GPS carrier at 50 bps by exclusive ORing the bits of the message with the *PRN Code*.

Term	Description
Orbital Plane	Satellites orbiting the Earth travel in an elliptical path that forms a plane in space. The plane's orientation with respect to the Earth is used to describe the satellite's orbit. The plane intersects the plane of the equator at an angle called the inclination angle, and it intersects the equator at two points. The point below where the satellite's path crosses the equator when the satellite is passing from the southern hemisphere to the northern hemisphere is called the ascending node. Since the satellite's orbit is stable in inertial space, and since the Earth is rotating in that space, the ascending node appears to rotate around the Earth in the opposite direction of the Earth's rotation. The GPS system defines 6 orbital planes for GPS satellites, each inclined at approximately 55º to the equator, and spaced approximately 60º apart from each other.
Orbital Slot	The specific placement of a GPS satellite in its *Orbital Plane*. Orbital slots are generally equally spaced about the orbit, with 4 or 5 slots designated in each orbital plane. Normally, 1 satellite occupies a slot.
P Code	The Precise code, a modulation applied to the GPS L_1 and L_2 carriers using a 10.23 MHz *Chipping Rate*. Since the P code is at ten times the *C/A Code* chipping rate, it offers up to ten times the resolution, and thus more precise positioning. The *PRN Code* used for the P code is much longer than the *Gold Code* used for the C/A code, thus making the acquisition of that code much more difficult. The C/A code is usually used to aid in this acquisition. When *Anti-Spoofing* is activated, the P code is encrypted into the *P(Y) Code* to prevent unauthorized users from using it.
P(Y) Code	Encrypted version of the *P Code*, sent in place of standard P code when *Anti-Spoofing* is active.
Page	One of the versions of *Subframe* 4 or subframe 5 in the *Navigation Message*. Each *Frame* consists of 5 subframes, consisting of the current subframes 1-3, then one of the 25 possible versions of subframes 4 and 5. For subframe 5, pages 1-24 consist of *almanacs* for satellites 1-24, respectively. Page 25 of subframe 5 consists of the health information for satellites 1-24. Subframe 4's 25 pages include almanacs for satellites 25-32, the health of satellites 25-32, information about the ionosphere and relationship between *GPS time* and *UTC time*, and other information used by users authorized to decode the encrypted *P(Y) Code*.

Term	Description
PDOP	Position Dilution of Precision, see *DOP*
PRN Code	Pseudo-Random Number Code, a sequence of ones and zeros which appears to be random, but which is created using a defined process that can be easily replicated by those who know the process. In GPS satellites, a PRN code of 1023 bits long is used to modulate the carrier to generate the *Spread-Spectrum* signal. The GPS PRN code is added to the carrier at a 1.023 MHz *Chipping Rate*, so that it takes exactly 1 ms to transmit the entire sequence. The PRN code used by the GPS satellites is called a *Gold Code*, and is characterized as having about an equal number of ones and zeros over the code. Each GPS satellite uses a unique code, and the signal from that satellite is detected by the receiver generating a copy of the PRN code and looking for a match in the received signals.
Pseudorange	The distance between a GPS satellite and a receiver as measured in the receiver before correcting for the *Clock Bias* in the receiver.
Range Rate	The rate of change of the distance between a satellite and a receiver. Directly related to the *Doppler* on the GPS signal, since it is the range rate which causes the Doppler shift in the signal.
Reacquisition	The process of a receiver to relocate the signal from a GPS satellite after a temporary blockage. Reacquisition specifically implies that the receiver was previously tracking this satellite, and that the signal was simply lost temporarily due to, for example, the receiver passing a building or going through a tunnel.
Reference Ellipsoid	The model of the Earth that is defined for a particular geodetic system. GPS uses *WGS-84*, which defines the Reference Ellipsoid as having a semi-major axis (in the plane of the equator) of length 6378137 m, and flattening (defined as $f = (a-b)/a$) of 1/298.257223563.
Reference Station	In *Differential GPS*, the GPS receiver and associated equipment that provides corrections for other receivers.
RMS	Root Mean Square, the square root of the mean of the squared error in a position. May be 1, 2 or 3 dimensional. In 2-dimensional cases the RMS error encompasses 63 to 68 % of all measured points.
RTCM SC-104	Radio Technical Commission for Maritime Services, Special Committee 104, a body that defined a standard method of encoding Differential GPS information for transmission over various media, such as navigation beacons, serial data ports, etc.

Term	Description
SA	See *Selective Availability*
Satellite Based Augmentation System	A form of *Differential GPS* where corrections are broadcast from satellites, usually geosynchronous, on the GPS L_1 frequency. The United States has implemented such a system called the Wide Area Augmentation System, or WAAS. Europe has implemented a system called European Geostationary Navigation Overlay System, or EGNOS. Japan's equivalent system is called Multi-Function Satellite (MTSAT) Satellite Augmentation System, or MSAS.
SBAS	See *Satellite Based Augmentation System*.
Segment	A portion of the GPS system. The three segments are the *Control Segment*, *Space Segment* and *User Segment*.
Selective Availability	An artificial error that can be activated in GPS satellites to make position solutions created from the *C/A Code* vary as much as 150 m over time. The intent of the error was to reduce the accuracy of weapons navigating with the GPS system. Selective Availability was effectively turned off in May, 2000, by order of President Clinton. *Differential GPS* was developed in part to provide a means of correcting for Selective Availability. Abbreviated *SA*.
SEP	Spherical Error Probable, a three-dimensional error estimate that defines the radius of the smallest sphere, centered at the true position, that encompasses 50 % of all measured points.
Space Segment	That portion of the GPS system consisting of the satellites in orbit. The Space Segment is defined as having 21 operational satellites and 3 on-orbit spares, for 24 total satellites. However, in recent years the system has contained as many as 30 operational satellites.
Spread Spectrum	A method of modulation of a carrier that results in the signal's energy becoming distributed over a wide band of frequencies instead of being concentrated at one or a very few frequencies. GPS satellites use

Term	Description
Subframe	A group of 10 data words that make up part of the *Navigation Message*. Each subframe starts with a *Telemetry Word*, then a *Hand-Over Word*, then 8 words that contain the information for that subframe. A subframe requires 6 seconds to broadcast. There are 5 subframes, numbered in order 1-5, that are broadcast in sequence to form a *frame*. Subframe 1 contains information about the clock in the satellite that is broadcasting it, as well as the current *GPS week number*. Subframes 2 and 3 contain the *ephemeris* for the satellite broadcasting it. Subframe 5 contains either an *almanac* of one of the satellites in the range of PRN code 1-24, or the health of satellites 1-24. Subframe 4 contains various data items: an almanac for one of the satellites in the range of PRN code 25-32, the health of satellites 25-32, information about the current ionosphere activity and relationship between GPS time and UTC time, or other information for users authorized to use the encrypted P(Y) code. For subframes 4 and 5, there are 25 possible versions, called pages, which are broadcast in sequence in successive frames. All satellites generally broadcast the same information in subframes 4 and 5 at the same time. Subframes 1-3 contain information that is unique to the satellite broadcasting it, and which is typically rebroadcast unchanged over a period of 2 or more hours. All GPS satellites start sending the first bit of the first word of subframe 1 at midnight between Saturday and Sunday, and the frame that is started at that time can be expected to contain page 1 of both subframes 4 and 5. From that point through the rest of the week, subframes are broadcast in sequence from 1 to 5, with pages also being sent in sequence from 1 to 25.
Super Frame	The top level of organization of the *Navigation Message*. A super frame consists of 25 *frames* broadcast in sequence over a 12.5 minute period. The 25 frames within a super frame will generally differ by each containing a different page of subframes 4 and 5.
TDOP	Time Dilution of Precision, see *DOP*
Telemetry Word	The first word in each *Subframe* of the *Navigation Message*. The telemetry word contains a preamble in the first 8 bits (0x8B) followed by 14 bits of information for users authorized to decode the encrypted *P(Y) Code* called the TLM Message, and 2 reserved bits. Abbreviated *TLM*.

Term	Description
Three-dimensional position	In GPS positions a position computed from at least 4 satellites, which together provide sufficient information to compute position in three dimensions and *clock bias* in the receiver.
Time Of Week	GPS Time's fine measure of time. Time Of Week is the number of seconds that have elapsed since midnight between Saturday and Sunday, and it ranges from 0 to 604799. In addition to Time Of Week, GPS Time also consists of the *GPS Week* number. Abbreviated *TOW*.
Time To First Fix	The period of time between turning on (or resetting) a GPS receiver and obtaining a position solution from the receiver. Abbreviated *TTFF*. Normally a receiver specification will give multiple numbers for Time To First Fix, depending on how much information the receiver has when it starts searching for satellites. See *cold start*, *warm start*, *hot start*.
TLM	See *Telemetry Word*.
TOW	See *Time Of Week*.
TTFF	See *Time To First Fix*.
Two-dimensional position	In GPS positions, a position valid only in the horizontal plane. Generally this is a position computed from only 3 satellites, meaning that some factor must be constrained to make the solution valid. A typical method of permitting such solutions to be computed is to assume a fourth satellite located at the center of the Earth, whose *pseudorange* is equal to the local radius of the Earth plus the assumed altitude.
User Segment	That *segment* of the GPS system composed of all receivers currently using the system for navigation, timing, or other purposes. The User Segment has no formal organization.
UTC Time	Coordinated Universal Time, the international time standard referenced to the Greenwich Meridian. UTC Time is typically reported in hours, minutes and seconds after midnight of the current day, plus the current year, month and day.
VDOP	Vertical Dilution of Precision, see *DOP*.
Visibility	The term that describes whether a satellite is above the local horizon. Receivers must have a valid *almanac*, the approximate current time, and their own approximate position in order to calculate the visibility of a satellite.
WAAS	The United State's *Satellite-Based Augmentation System*.

Term	Description
Warm Start	A receiver start-up process where the receiver knows its approximate position and the approximate time, so it knows from stored *almanacs* which satellites are likely to be visible. It does not, however, have valid *ephemerides*, so once it locates satellites it must obtain the *ephemeris* from each satelite's *navigation message*.
WGS-84	World Geodetic Survey, 1984, a world-wide survey that defined a model of the Earth consisting of a 3-axis coordinate system and a reference ellipsoid which approximates the shape and size of the Earth. GPS navigation is all referenced to this model. For details on the model and its relationship to other defined datums, see document NIMA tr8350.2, "Department of Defense World Geodetic System 1984, Its Definition and Relationships with Local Geodetic Systems" available from http://earth-info.nga.mil/GandG/tr8350/tr8350_2.html.
Z Count	The time that is reported in the Hand-Over Word. Each Hand-Over Word contains the Z Count that represents the time at which the next subframe will begin transmitting. Z Count represents time in terms of 1.5 second counts. Since each subframe requires 6 seconds to transmit, there are 4 Z counts between each subframe, and the 2 LSBs of the Z Count are therefore always 00. These 2 LSBs are not actually broadcast, but are assumed. To convert Z Count into Time Of Week in seconds, multiply the value by 6.