GLOSSARY
of terms
used in JNS manuals

GLOSSARY

A

Accuracy	The degree of conformance between the estimated or measured position, time, and/or velocity of a GPS receiver and its true time, position, and/or velocity as compared with a constant standard. Radionavigation system accuracy is usually presented as a statistical measure of system error and is characterized as follows: Predictable - The accuracy of a radionavigation system's position solution with respect to the charted solution. Both the position solution and the chart must be based upon the same geodetic datum. Repeatable - The accuracy with which a user can return to a position whose coordinates have been measured at a previous time with the same navigation system. Relative - The accuracy with which a user can measure position relative to that of another user of the same navigation system at the same time.
AFRM	see Automatic File Rotation Mode
Almanac	A data structure that contains orbit information about all satellites, clock corrections, atmospheric delays and some other related parameters. It is broadcast by a GPS satellite and is intended to facilitate rapid satellite acquisition within GPS receivers. Generally speaking, almanac data must be acquired before GPS navigation can begin.

Ambiguity	Unknown number of full wavelengths counting from the reference satellite to the antenna phase center.
Analog	A type of transmission characterized by variable waveforms representing information, contrasted with digital. A standard clock with moving hands is an analog device, whereas a clock with displayed and changing numbers is a digital device. The human voice and audible sounds are analog. Modern computers are invariably digital, but when they communicate over telephone lines, their signals must be converted to analog using a modem (a modulator/demodulator). The analog signal is converted back into a digital form before delivering it to a destination computer.
Anti-jamming	Sophisticated technique used in JNS receivers to suppress in-band interference.
Application software	These programs accomplish the specialized tasks of the user, while operating system software allows the computer to work. A computer-aided dispatch system is application software, as is each word processing program.
ASCII	Acronym for American Standard Code for Information Interchange. The standard code used for information interchange among data processing systems, data communications systems, and associated equipment.
Automatic Vehicle Location AVL	A type of system using any sort of technology to track or locate a vehicle.
Automatic File Rotation Mode AFRM	In this mode the receiver will periodically close/open log-files at scheduled (evenly spaced) times.
Availability	The percentage of time that the services of a navigation system can be used within a particular coverage area. Signal availability is the percentage of time that navigational signals transmitted from external sources are available for use. Availability is a function of both the physical characteristics of the operational environment and the technical capabilities of the transmitter facilities.

AVL	see Automatic Vehicle Location
Azimuth	The horizontal direction of a celestial point from a terrestrial point, expressed as the angular distance from a reference direction, usually measured from 0° at the reference direction clockwise through 359°.

B

Bandwidth	The difference between the limiting frequencies within which performance of a unit/device, in respect to some characteristic, lies within specified limits.
Base station	Also referred to as a reference station. Base station is a receiver set up on a known location and intended to collect data for rover receivers running in differential mode. In code differential, for example, the base station calculates the pseudorange error for each satellite and, through differential correction, improves the accuracy of a roving GPS receiver's position.
Baseline	The three-dimensional vector that represents the distance and direction from one survey station to another. It is the result of processing GPS observations that were collected simultaneously at each station.
BINEX	BINEX, for "BINary EXchange", is an operational binary format standard for GPS/GLONASS/SBAS research purposes. It has been designed to allow encapsulation of all (or most) of the information currently allowed for in RINEX OBS, GPS RINEX NAV, GLONASS RINEX NAV, RINEX MET, IONEX, SP3, SINEX, and so on, plus other GNSS-related data and metadata as encountered, including next-generation GNSS.
bit	Abbreviation for binary digit. A character used to represent one of the two digits in the numeration system with a base of two, and only two, possible states of a physical entity or system.
Bit Rate	In a bit stream, the number of bits occurring per unit time, usually expressed in bits per second.

Block I, II, IIR, IIF	The various generations of GPS satellites: Block I were prototype satellites that began being launched in 1978; 24 Block II satellites made up the fully operational GPS constellation declared in 1995; Block IIR are replenishment satellites; and Block IIF refers to the follow-on generation.
Boolean value	Type of variable widely used in mathematical logic, programming languages, etc. Takes two values, "true" and "false". In the context of JNS manuals, we normally use "on" and "off" or "yes" and "no", which are synonymous with "true" and "false".

C

C/A code	The coarse/acquisition or clear/acquisition code modulated onto the GPS L1 signal. This code is a sequence of 1023 pseudorandom binary biphase modulations on the GPS carrier at a chipping rate of 1.023 MHz, thus having a code repetition period of 1 millisecond. The code was selected to provide good acquisition properties. Also known as the "civilian code."
Carrier	A radio wave having at least one characteristic, such as frequency, amplitude or phase, that may be varied from a known reference value by modulation.
Carrier frequency	The frequency of the unmodulated fundamental output of a radio transmitter. The GPS L1 carrier frequency is 1575.42 MHz.
Carrier phase	GPS measurements based on the L1 or L2 carrier signal. One of the parameters of carrier wave which is measured by JNS receiver.
Carrier-aided tracking	A signal processing strategy that uses the GPS carrier signal to achieve an exact lock on the pseudorandom code.

Cartesian system coordinate	Earth-fixed spatial Cartesian system (X, Y, Z). The Z-axis coincides with the mean rotational axis of the earth (Polar motion, CIO Pole). The mean equatorial plane perpendicular to this axis forms the (X-Y) plane. The (X-Z) plane is generated by the mean meridian plane of Greenwich. The Y-axis is directed so as to obtain a right handed system.
CDMA	see Code division multiple access
CEP	see Circular error probable
Channel	A channel of a GPS receiver consists of the circuitry necessary to receive the signal from a single GPS satellite.
Checksum	Checksum is the "additional" part of a transmitted message that allows verification/correction of the informative part of the message on the receiver side.
Chip	The length of time to transmit either a "0" or a "1" in a binary pulse code. Also, an integrated circuit.
Chip rate	Number of chips per second. For example, C/A code = 1.023 MHz.
Circular error probable CEP	In a circular normal distribution, the radius of the circle containing 50 percent of the individual measurements being made, or the radius of the circle within which there is a 50 percent probability of being located.
Civilian code	- see C/A code.
Clock bias	The difference between the clock's indicated time and true universal time.
Clock offset	Constant difference in the time reading between two clocks.
CMR	Compact Measurement Record format.
Code division multiple access CDMA	A method of frequency reuse whereby many radios use the same frequency but each one has a unique code. GPS uses CDMA techniques with Gold's codes for their unique cross-correlation properties.
Code phase GPS	GPS measurements based on the C/A code.

Common tracking	Sophisticated technique used in JNS receivers to substantially improve the tracking characteristics of an individual channel by means of using all tracking data from this and the other receiver channels all together.
Computer-aided dispatch	An automated system for processing dispatch business and automating many of the tasks typically performed by a dispatcher. Abbreviated CAD (not to be confused with computer-aided design which is also known as CAD) is application software with numerous features and functions. A basic CAD system provides the integrated capability to process calls for service, fleet management and geographical referencing.
Control segment	A world-wide network of GPS monitor and control stations that ensure the accuracy of satellite positions and their clocks.
CRC Cyclic Redundancy Checking	Cyclic Redundancy Checking is a method of checking for errors in data transmitted on a communications link. Cycle slip A discontinuity of an integer number of cycles in the measured carrier beat phase resulting from a temporary loss-of-lock in the carrier tracking loop of a GPS receiver.
Cycle slip	A discontinuity in the measured carrier beat phase resulting from a temporary loss-of-lock in the carrier tracking loop of a GPS receiver.

D

Data message	A message included in the GPS signal which reports the satellite's location, clock corrections and health. Included is rough information about the other satellites in the constellation.
DATUM	DATUM is a reference object that describes the position, orientation and scale relationships of the corresponding reference ellipsoid to the Earth. Although most modern geodetic datums are formally defined with respect to the center of the Earth, historically, they are also dependant of fundamental points on the surface of the Earth.

Delay mode	JNS receivers support two RTK modes, delay and extrapolation. When a rover receiver is running in delay mode, the RTK engine will compute the position only for the epochs for which the differential correction data (from the base) are available on the rover end. Due to the data transfer latency and other reasons, the differential correction data are always delayed at the rover. Thus the name of the mode. Note that delay mode is normally used for static surveying in RTK applications.
DGPS	see Differential positioning
Differential positioning DGPS	A technique used to improve positioning or navigation accuracy by determining the positioning error at a known location and subsequently incorporating a corrective factor (by real-time transmission of corrections or by postprocessing) into the position calculations of another receiver operating in the same area and simultaneously tracking the same satellites.
Digital	Generally, information is expressed, stored and transmitted by either analog or digital means. In a digital form, this information is seen in a binary state as either a one or a zero, a plus or a minus. The computer uses digital technology for most actions.
Dilution of Precision DOP	A description of the purely geometrical contribution to the uncertainty in a position fix. Standard terms for the GPS application are: GDOP: Geometric (3 position coordinates plus clock offset in the solution) PDOP: Position (3 coordinates) HDOP: Horizontal (2 horizontal coordinates) VDOP: Vertical (height only) TDOP: Time (clock offset only) RDOP: Relative (normalized to 60 seconds)
Distance root mean square (drms)	The root-mean-square value of the distances from the true location point of the position fixes in a collection of measurements. As typically used in GPS positioning, 2 drms is the radius of a circle that contains at least 95 percent of all possible fixes that can be obtained with a system at any one place.

Dithering	The introduction of digital noise. This is the process the DoD used to add inaccuracy to GPS signals to induce Selective Availability.
DOP	see Dilution of precision
Doppler shift	The apparent change in the frequency of a signal caused by the relative motion of the transmitter and receiver.
Doppler-aiding	A signal processing strategy that uses a measured doppler shift to help the receiver smoothly track the GPS signal. Allows more precise velocity and position measurement.

E

Earth-centered earth-fixed ECEF	Cartesian coordinate system where the X direction is the intersection of the prime meridian (Greenwich) with the equator. The vectors rotate with the earth. Z is the direction of the spin axis.
ECEF	see Earth-centered earth-fixed
Elevation	Height above mean sea level. Vertical distance above the geoid.
Elevation mask	The angle below which satellites will not be tracked by a GPS/GLONASS receiver.
Elevation mask angle	That angle below satellites should not be tracked. Normally set to 15 degrees to avoid interference problems caused by buildings and trees and multipath errors.
Ellipsoid	In the context of JNS manuals, a 3D-rotation body generated by rotating an ellipse around the earth's polar axis.
Ellipsoid height	The measure of vertical distance above the ellipsoid. Not the same as elevation above sea level. GPS receivers output position fix height in the WGS-84 datum.
Ephemeris	The predictions of a satellite's orbit that are broadcast by the satellite within the data message.

Epoch	In GPS, an epoch is the moment at which a measurement is made by a receiver. Measurement interval or data frequency, as in making observations every 15 seconds. "Loading data using 30-second epochs" means loading every other measurement.
Ethernet	Ethernet is the most widely-installed local area network (LAN) technology. The IEEE standard 802.3 defines the rules for configuring an Ethernet network. It is a 10 Mbps, CSMA/CD (Carrier Sense Multiple Access / Collision Detection) baseband network that runs over thin coax, thick coax, twisted pair or fiber optic cable.
Event signal	JNS receiver is capable of receiving an external device's event signals and measuring their reception times in the selected time scale.
Extrapolation mode	JNS receivers support two RTK modes, delay and extrapolation. When a rover receiver is running in extrapolation mode, its RTK engine will update the position for the current epoch irrespective of whether the differential correction data for this epoch have been received from the base or not. If the differential correction data for the current epoch are not received from the base yet, the RTK engine will extrapolate the most recent of the base's carrier phase measurements to the current epoch. Note that extrapolation mode is normally used when dynamic surveying is carried out in RTK.

F

Fast-multiplexing channel	see Fast-switching channel
Fast-switching channel	A single channel which rapidly samples a number of satellite ranges. "Fast" means that the switching time is sufficiently fast (2 to 5 milliseconds) to recover the data message.

FCN Frequency Channel Number (GLONASS)	Frequency Hopping Repeated switching of frequencies during radio transmission according to a specified algorithm, to minimize unauthorized interception or jamming of radio communications.
Frequency band	A particular range of frequencies.
Frequency spectrum	The distribution of signal amplitudes as a function of frequency.

G

Geodesy	The science related to the determination of the size and shape of the Earth (geoid) by direct measurements.
Geodetic datum	A mathematical model designed to best fit part or all of the geoid. It is defined by an ellipsoid and the relationship between the ellipsoid and a point on the topographic surface established as the origin of datum.
Geoid	The particular equipotential surface that coincides with mean sea level and that may be imagined to extend through the continents. This surface is everywhere perpendicular to the force of gravity.
Geoid height	The height above the geoid is often called elevation above mean sea level.
Geometric Dilution of Precision (GDOP)	see Dilution of Precision
GLONASS system time	High precision time scale using the atomic hydrogen maser oscillator (H-maser) of the GLONASS Central Clock (instability does not exceed 5*10-14 per day).

GNSS Global Navigation Satellite System	Organizing concept of a European system that would incorporate GPS, GLONASS, and other space-based and ground-based segments to support all forms of navigation.
GPS	The U.S. Department of Defense Global Positioning System: A constellation of 24 satellites orbiting the earth at a very high altitude. GPS satellites transmit signals that allow one to determine, with great accuracy, the locations of GPS receivers. The receivers can be fixed on the Earth, in moving vehicles, aircraft, or in low-Earth orbiting satellites. GPS is used in air, land and sea navigation, mapping, surveying and other applications where precise positioning is necessary.
GPS ICD-200	The GPS Interface Control Document is a government document that contains the full technical description of the interface between the satellites and the user.
GPS system time	GPS system time is referenced to the Master Clock (MC) at the USNO and steered to UTC (USNO) from which system time will not deviate by more than one microsecond.

H

Handover word	The word in the GPS message that contains synchronization information for the transfer of tracking from the C/A to the P -code.
Hardware	The physical components of a computer system. Reference is often made to "hardware" and "software"; in that context, "hardware" consists of the computer, input and output devices and other peripheral equipment.

I

Integrated Doppler	A measurement of Doppler shift frequency or phase over time.

Integrity	The ability of a system to provide timely warnings to users when the system should not be used for navigation as a result of errors or failures in the system.
Interface	A shared boundary between various systems or programs. An interface is also the equipment or device that makes it possible to interoperate two systems. For example, it is common to interface the 911 telephone system with a computer-aided dispatch (CAD) system. Both hardware and software are needed to provide that interface.
Ionosphere	The band of charged particles 80 to 120 miles above the earth's surface, which represent a nonhomogeneous and dispersive medium for radio signals.
Ionospheric delay	A wave propagating through the ionosphere experiences delay. Phase delay depends on electron content and affects carrier signals. Group delay depends on dispersion in the ionosphere as well and affects signal modulation (codes). The phase and group delay are of the same magnitude but opposite sign.
Ionospheric refraction	The change in the propagation speed of a signal as it passes through the ionosphere.

K

Kalman filter	A numerical method used to track a time-varying signal in the presence of noise.

L

L1 signal	The primary L-band signal transmitted by each GPS satellite at 1572.42 MHz. The L1 broadcast is modulated with the C/A and P-codes and with the navigation message.
L2 signal	The second L-band signal is centered at 1227.60 MHz and carries the P-code and navigation message.

L-band	The group of radio frequencies extending from 390 MHz to 1550 MHz. The GPS carrier frequencies (1227.6 MHz and 1575.42 MHz) are in the L-band.
Log file	A receiver's internal file to which various message types are recorded (raw data measurements, time tags, position&velocity estimates, ephemeris and almanac data and many more).

M

MDT	see Mobile Data Terminal.
MinPad	User's interface allows the user to control and display the operation of the receiver.
Mobile Data Terminal MDT	A device, typically installed in a vehicle, that consists of a small screen, a keyboard or other operator interface, and various amounts of memory and processing capabilities.
Modem	A modulator/demodulator. When two computers communicate over telephone lines and similar media, digital signals must be converted to analog during transmission, then back again to digital at the destination. Modems are always used in pairs, one at each end. They are rated according to the speed, typically in "bits per second," at which the information can pass through the transmission medium.
Monitor stations	One of the worldwide group of stations used in the GPS control segment to track satellite clock and orbital parameters. Data collected at monitor stations are linked to a master control station at which corrections are calculated and from which correction data is uploaded to the satellites as needed.
Multi-base	Differential mode in which the rover is allowed to receive and use differential corrections from more than one reference station.

Multichannel receiver	A receiver containing multiple independent channels, each of which tracks one satellite continuously, so that position solutions are derived from simultaneous calculations of pseudoranges.
Multipath	Interference caused by reflected GPS signals arriving at the receiver, typically as a result of nearby structures or other reflective surfaces. Signals traveling longer paths produce higher (erroneous) pseudorange estimates and, consequently, positioning errors.
Multiplexing channel	A receiver channel through which a series of signals from different satellites can be sequenced.

N

NAD-83	North American Datum, 1983
Nanosecond	One billionth (10^{-9}) of a second.
Nav message	The 1500-bit navigation message broadcast by each GPS satellite at 50 bps on the L1 and/or L2 signals. This message contains system time, clock correction parameters, ionospheric delay model parameters, and the vehicle's ephemeris and health. The information is used to process GPS signals to give user time, position, and velocity.
NMEA	National Marine Electronics Association

O

Observation	The period of time over which GPS data is collected simultaneously by two or more receivers.
Oscillator	An electronic circuit designed to produce an ideally stable alternating voltage or current.

P

P-code	The precise or precision code of the GPS signal, typically used alone by U.S. and allied military receivers. A very long sequence of pseudo-random binary biphase modulations on the GPS carrier at a chip rate of 10.23 MHz which repeats about every 267 days. Each one-week segment of this code is unique to one GPS satellite and is reset each week.
PDOP Position dilution of precision	A unitless figure of merit expressing the relationship between the error in user position and the error in satellite position, which is a function of the configuration of satellites from which signals are derived in positioning (see DOP). Geometrically, PDOP is proportional to 1 divided by the volume of the pyramid formed by lines running from the receiver to four observed satellites. Small values, such as "3", are good for positioning while higher values produce less accurate position solutions. Small PDOP is associated with widely separated satellites.
Phase lock	The technique whereby the phase of an oscillator signal is made to follow exactly the phase of a reference signal. The receiver first compares the phases of the two signals, then uses the resulting phase difference signal to adjust the reference oscillator frequency. This eliminates phase difference when the two signals are next compared.
PLL Phase lock loop	An electronic circuit that controls an oscillator so that it maintains a constant phase angle relative to a reference signal.
Point Positioning	A geographic position produced from one receiver in a standalone mode.
PPS	see Precise Positioning Service
Precise Positioning Service PPS	The highest level of military dynamic positioning accuracy provided by GPS, using the dual-frequency P-code.
PRN Pseudo-Random Noise	A sequence of digital 1's and 0's which appears to be randomly distributed like noise, but can be exactly reproduced. Each NAVSTAR and GLONASS satellite has its own unique C/A and P pseudo-random-noise codes and are often referred to by their PRN number.

Pseudolite (shortened form of pseudo-satellite)	A ground-based differential GPS receiver that simulates the signal of a GPS satellite and can be used for ranging. The data portion of the signal may also contain differential corrections that can be used by receivers to correct for GPS errors.
Pseudorandom noise	see PRN
Pseudorange	A distance measurement, based on the correlation of a satellite-transmitted code and the local receiver's reference code, that has not been corrected for errors in synchronization between the transmitter's clock and the receiver's clock.

R

Radionavigation	The determination of position, or the obtaining of information relative to position, for the purpose of navigation by means of the propagation properties of radio waves. GPS is a method of radionavigation.
RAIM	see Receiver Autonomous Integrity Monitoring.
Range rate	The rate of change between the satellite and receiver. The range to a satellite changes due to satellite and observer motions. Range rate is determined by measuring the Doppler shift of the satellite beacon carrier.
Receiver Autonomous Integrity Monitoring RAIM	The satellite-based navigation community's term for fault detection.
Relative navigation	A technique similar to relative positioning, except that one or both of the points may be moving. A data link is used to relay error terms to the moving vessel or aircraft to improve real-time navigation.

Relative positioning	The process of determining the relative difference in position between two locations, in the case of GPS, by placing a receiver over each site and making simultaneous measurements observing the same set of satellites at the same time. This technique allows the receiver to cancel errors that are common to both receivers, such as satellite clock and ephemeris errors, propagation delays, and so forth.
Reliability	The probability of performing a specified function without failure under given conditions for a specified period of time.
RINEX	Receiver INdependent EXchange format. A set of standard definitions and formats that permits interchangeable use of GPS data from dissimilar GPS receiver models or postprocessing software. The format includes definitions for time, phase, and range.
RMS value	A typical value of a number (n) of values of a quantity (x1,x2,x3...) equal to the square root of the sum of the squares of the values divided by n.
Rover	Any mobile GPS receiver collecting data during a field session.
RTCM	Radio Technical Commission for Maritime Services.
RTK	Real Time Kinematic.

S

SA	see Selective availability
Satellite constellation	The arrangement in space of a set of satellites. In the case of GPS, the fully operational constellation is composed of six orbital planes, each containing four satellites. GLONASS has three orbital planes containing eight satellites each.
Selective availability SA	A DoD program that controls the accuracy of pseudorange measurements, degrading the signal available to nonqualified receivers by dithering the time and ephemerides data provided in the navigation message.

SEP	see Spherical Error Probable
Sleep mode	You can switch your JNS receiver to a low power consumption mode. In this mode, the receiver's processor is allowed to go into a sleep state while idling.
Space segment	The portion of the GPS system that is located in space, that is, the GPS satellites and any ancillary spacecraft that provide GPS augmentation information (i.e., differential corrections, integrity messages, etc.)
Spherical Error Probable SEP	The radius of the sphere that will contain 50% of the expected errors in three dimensions.
Spread spectrum	The received GPS signal is wide-bandwidth and low-power (-160 dBW). The L-band signal is modulated with a PRN code to spread the signal energy over a much wider bandwidth than the signal information bandwidth. This provides the ability to receive all satellites unambiguously and to give some resistance to noise and multipath.
SPS	see Standard positioning service
Squaring-type channel	A GPS receiver channel that multiplies the received signal by itself to obtain a second harmonic of the carriers that does not contain the code modulation. Used in "codeless" receiver channels.
Stand-alone positioning mode	Mode in which a JNS receiver computes its position "autonomously", i.e. without using measurements and some other data from any other receivers. The position is identified with respect to a well-defined coordinate system, commonly a geocentric system.
Standard deviation (sigma)	A measure of the dispersion of random errors about the mean value. If a large number of measurements or observations of the same quantity are made, the standard deviation is the square root of the sum of the squares of deviations from the mean value divided by the number of observations less one.

Standard Positioning Service (SPS)	The normal civilian positioning accuracy obtained by using the single frequency C/A code. Under selective availability conditions, guaranteed to be no worse than 100 meters 95 percent of the time (2 drms).
Static positioning	Location determination accomplished with a stationary receiver. This allows the use of various averaging or differential techniques.
SV	Satellite vehicle or space vehicle.

U

Universal time coordinated UTC	An international, highly accurate and stable uniform atomic time system kept very close, by offsets, to the universal time corrected for seasonal variations in the earth's rotation rate. Maintained by the U.S. Naval Observatory. GPS time is directly relatable to UTC: UTC-GPS = seconds. (The changing constant = 5 seconds in 1988.)
URA	see User range accuracy
USB	Universal Serial Bus is a "plug and play" interface between a computer and add-on devices.
User interface	The hardware and operating software by which a receiver operator executes procedures on equipment (such as a GPS receiver) and the means by which the equipment conveys information to the person using it: the controls and displays.
User Range Accuracy URA	The contribution to the range-measurement error from an individual error source (apparent clock and ephemeris prediction accuracies). This is converted into range units, assuming that the error source is uncorrelated with all other error sources. Values < 10 are preferred.
User segment	The part of the whole GPS system that includes the receivers of GPS signals.

USNO	U.S. Naval Observatory.
UTC	see Universal time coordinated.

W

| WAAS	Wide Area Augmentation System.
Wait state	A wait state is a situation in which a computer program or processor is waiting for the completion of some event before resuming activity.
WGS-84 (World Geodetic System 1984)	The mathematical ellipsoid used by GPS since January, 1987.
World geodetic system	A consistent set of parameters describing the size and shape of the Earth, the positions of a network of points with respect to the center of mass of the Earth, transformations from major geodetic datums, and the potential of the Earth (usually in terms of harmonic coefficients).

Y

Y code	The encrypted version of the P-code.

Notes:

JAVAD®
NAVIGATION SYSTEMS
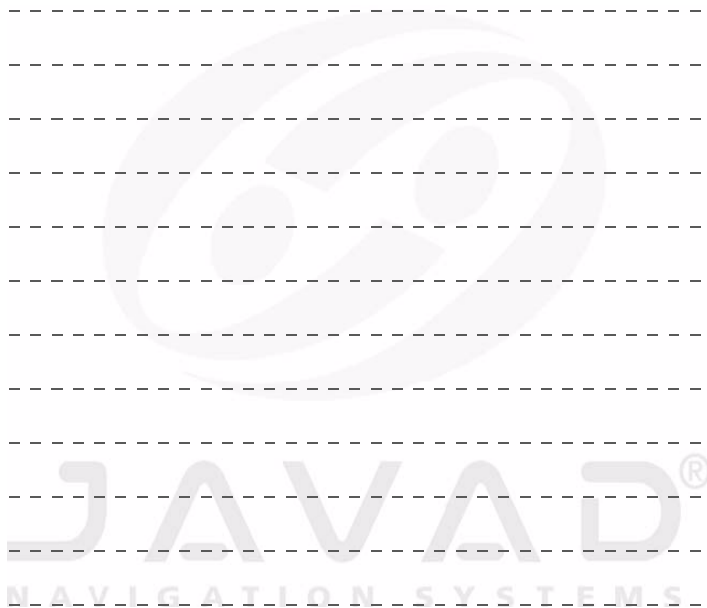
1731 Technology Drive, San Jose, CA 95110 USA
Phone: +1(408)573-8100
Fax: +1(408)573-9100
www.javad.com

Glossary of Terms used in JNS Manuals
Rev 1.0 09/06
©2006 Javad Navigation Systems