

Appendix B

Definitions

—A—

Accuracy: The degree of conformity of a given measurement with a standard value for that measurement. Accuracy relates to the quality of a result.

Adjusted position: A survey monument with coordinates that are established from a network of fixed positions with published horizontal and/or vertical coordinates.

Adjustment: The process of determining and applying corrections to observations for the purpose of reducing errors in a network adjustment. This process is typically achieved using a least-squares method of adjustment.

Aerial photography: Any photography of the ground taken from an elevated position. The term usually refers to images in which the camera is mounted to an aircraft.

Aerial survey: The use of aerial photography to make reliable measurements to specific features on the surface of the Earth. Aerial surveys are part of the preliminary survey collection process.

Aerial target: A target placed or painted on the ground with an established horizontal and vertical position relative to a datum. The entire network of aerial targets makes up the photo control.

Altitude: (1) The vertical angle between an object and a horizontal plane. (2) The vertical distance of an object above a datum.

Ambiguity: In global satellite navigation, the unknown number of wave cycles of a GPS signal between satellite and receiver. If the wavelength is known, the distance to a satellite can be computed once the number of cycles is established. See also initialization.

Analytical aerial triangulation: A photo-triangulation procedure in which the spatial solution is obtained by computational routines. Analytical aerial triangulation is often referred to as bridging.

Angle: The difference in direction between two convergent lines. It may be classified as horizontal, vertical, oblique, or spherical depending on the surface it is measured (e.g. horizontal plane, vertical plane, inclined plane, or curved surface).

Annotated photography: A photograph used to identify natural and man-made features within the project limits.

Definitions

Antenna height: The vertical distance from the survey datum point of a monument to the antenna reference point. The vertical distance may be directly measured or may be calculated using the radius of the antenna and the antenna slant height.

Antenna phase center: The exact point on a GPS antenna whose position is being determined. Because the phase center moves with the changing direction of a satellite signal it is neither a physical point nor a stable point. The phase center may be averaged over all possible directions or modeled as a function of elevation and azimuth of the signal.

Antenna Reference Point (ARP): A specific point on the antenna where the vertical distance is measured from the survey datum point to determine the antenna height. The antenna phase center is measured from the antenna reference point.

Anti-spoofing: A feature that allows the U.S. Department of Defense to transmit an encrypted Y-code in place of P-code. The Y-code is intended to be useful only to authorized (primarily military) users. Anti-spoofing is used with Selective Availability to deny the full precision of GPS to civilian users.

Arbitrary coordinates: Coordinates that are not based on a specific datum but on an arbitrary origin. Typical coordinate values for northing; easting; and elevation are 10,000; 50,000; and 1,000.

ASCII file: A text file specifically formatted with binary notation for computer readable data.

Assumed north: Any direction assumed to be 0°.

Astronomic north: The direction determined by a celestial body. Polaris, the North Star, is typically used to define astronomic north. This meridian is very close to the geodetic meridian, and the two have sometimes been used interchangeably.

Attribute: A specific characteristic of a natural or man-made feature. The data collector will prompt the user to enter a response to further define the feature in a collection survey.

Autonomous positioning: A mode of operation in which a GPS receiver computes positions from satellite data alone, without reference to data supplied by a ground-based station. The least precise form of positioning that a GPS receiver can produce.

Azimuth: A horizontal angle measured clockwise from a defined reference. The angular measurement will range from 0° to 360°. The azimuth is typically based on geodetic north unless otherwise specified.

Azimuth line (photogrammetry): A line radial from the principal point, isocenter, or nadir point of an aerial photograph. The line represents the direction to the corresponding image point on an adjacent photograph taken in the same flight line. This line is used extensively in radial triangulation.

Azimuth mark: A survey marker, together with its associated triangulation station, provides an accurate azimuth to orient local traverse surveys.

—B—

Backward azimuth: The direction of a given line measured from its ending point back to the beginning point. The difference between the forward azimuth and the backward azimuth is always 180 degrees.

Backsight: A sighting or measurement from an instrument point to a known point for the purpose of establishing new coordinates or orientation.

Bandwidth: A measure, in hertz, of the information carrying capacity of a GPS signal.

Baseline: A three-dimensional (3-D) vector generated between GPS receivers simultaneously collecting data by post-processing software.

Base station: A stationary GPS receiver set up on a fixed control point collecting RTK survey data. The base station communicates with rover receivers via a radio data link.

Baud rate: A unit of speed in data transmission per second from one binary digital device to another.

Bearing: The direction of a line as given by the angle between a north-south meridian and that line. Bearings may be measured clockwise or counter clockwise from the meridian and are accompanied by the letters associated with the quadrant in which the line falls (e.g. NE, NW, SE, or SW).

Bench mark: A fixed point with an established elevation relative to a datum.

Block adjustment: The adjustment of strip coordinates or photograph coordinates for two or more strips of photographs.

Blunder: A significant, unpredictable mistake caused by human error that often leads to large discrepancies. They are typically the result of carelessness, miscommunication, fatigue, or poor judgment. A blunder is also known as a gross error.

Bridging, analog: The photogrammetric measurement of points in a stereoscopic model and their adjustment to points of horizontal and vertical control. The horizontal position and elevation for intermediate points between the photo control are known as bridged supplemental control points.

Broadcast ephemeris: The positional data which describes the predicted path of each satellite. Each satellite periodically transmits a broadcast ephemeris within the GPS signal to receivers operated by the user segment.

Definitions

Broken-back curve. Two horizontal curves turning in the same direction and separated by a relatively short tangent distance.

—C—

C-factor: An empirical evaluation which expresses the vertical (elevation) measuring capability of a stereoscopic system. The C-factor is generally defined as the smallest contour interval which can be plotted to a required accuracy. The C-factor is often used to determine the flight height from which aerial photographs should be taken for topographic mapping at the smallest contour interval accurately plotted from using a particular aerial camera and instrument system. The practicable flight height is the contour interval multiplied by the C-factor.

Calibration: A procedure used to relate GPS positions to a set of local coordinates. The GPS positions are defined by the WGS 84 Datum and expressed in terms of latitude and longitude. The local northing and easting coordinates are defined by a state plane or surface coordinate system. The WGS 84 positions are rotated, translated, and scaled to fit the local coordinate system. A calibration is also referred to as a one-step transformation.

Camera station: The point in space occupied by the camera lens at the moment of exposure.

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 an un-modulated carrier wave generated by a radio transmitter. The L1 carrier frequency is 1575.42 MHz and the L2 carrier frequency is 1227.6 MHz.

Cartesian coordinate system: A coordinate system used to determine the location of a point by x and y coordinates in a plane or grid. Cartesian coordinates are also used to define a point in a three-dimensional (3-D) model with x, y, and z coordinates. The Cartesian coordinate system is also known as the rectangular coordinate system.

Cartography: The art and science of making geographical maps of the physical features of the Earth.

Central meridian: A reference meridian in the center of a state plane zone using the transverse Mercator conformal projection.

Channel: The hardware and software necessary for a GPS receiver to track the signal from a single GPS satellite. Multi-channel receivers are able to simultaneously track multiple satellite signals.

Choke ring: The portion of a GPS antenna consisting of concentric metal rings located around and below the antenna ground plane, for the purpose of reducing multipath effects.

Circular curve: A continuous arc of constant radius connecting two tangents.

Clock offset: The constant difference in time between a GPS receiver's clock and the satellite's clock. Clock offset is also referred to as clock bias.

Closed traverse: A traverse that begins and ends at the same point or a traverse that begins and ends at two points with previously established positions.

Closure: The termination of a survey at the starting point or at another fixed point to check the accuracy of the horizontal and/or vertical measurements.

Coarse/Acquisition Code (C/A Code): A pseudo-random code modulated onto the L1 GPS carrier signal. This code enables the receiver to compute distances to each satellite for navigational and positioning applications. The C/A code is available for civilian GPS use. See also precise code

Collection rate: The rate at which a GPS receiver collects data from a satellite signal. See also epoch.

Collimation error: The vertical angle between the actual line-of-sight of a digital level and the ideal horizontal line.

Compass: A radio-based satellite navigation system being developed by China.

Compound curve: Two or more adjoining circular curves turning in the same direction.

Computer aided drafting and design: The use of computer technology to generate two-dimensional (2-D) and three-dimensional (3-D) models of existing and proposed planimetric and topographic features.

Constrained: A method used to hold (or fix) a quantity such as an observation or coordinate value as true in a network adjustment.

Continuously Operating Reference Station: A stationary, geodetic quality, dual-frequency GPS receiver and antenna owned and operated by government entities, academic institutions, or private organizations. Over 1200 CORS sites form a nation-wide network of the highest quality horizontal positions throughout the United States. The raw data from each site is collected, processed, and distributed by the NGS to the public on a continuous basis.

Contour: A line on a map connecting points of equal elevation.

Contour interval: The vertical distance between contour lines.

Contour map: A map that portrays relief by means of contour lines.

Control Segment: The component of GPS which monitors the satellites and their orbits. The ground monitor stations are located in Hawaii, Kwajalein, Ascension Island, Diego Garcia, and Colorado Springs. See also space segment and user segment.

Definitions

Control survey: A survey, referenced to the National Spatial Reference System, used to establish horizontal and/or vertical positions for project control monuments.

Conventional survey: Traditional survey measurements made with optical surveying instruments such as a total station or digital level.

Coordinate: A linear or angular quantity used to designate the position of a point relative to a defined origin within a reference system.

Coordinate system: A two or three-dimensional reference system used to define the location of a point with coordinates relative to an origin. See also polar coordinate system and Cartesian coordinate system.

Crab: The angle between the flight line and the fore and aft axes of a vertical camera; crab is indicated by the edges of the images not being parallel. Also called yaw in air navigation.

Cross section: A profile of the ground taken at a right angle to the center line or another reference line.

Curvature and refraction: Corrections applied to the vertical angle measurement to compensate for the curvature of the Earth and the refraction caused by the Earth's atmosphere.

Cycle: One complete wave of a radio signal.

Cycle slip: A temporary loss of lock of a satellite signal by a GPS receiver. The discontinuity requires an ambiguity resolution to achieve a fixed solution. See also ambiguity and initialization.

—D—

Data collector: A controller face plate used to operate optical total stations or GPS receivers and to store raw measurement data. Data collectors can be directly attached to the surveying instrument or can be connected via a cable or Bluetooth wireless technology.

Datum: An established point, line, or surface used for the determination of horizontal and/or vertical positions on the Earth's surface.

Datum adjustment factor: A dimensionless scale and elevation factor used to convert a distance between points on a state plane grid (state plane coordinates) to an equivalent distance between points on the ground (surface coordinates).

Deflection angle: A horizontal angle measured between the back sight and the foresight in a traverse.

Differential GPS: An enhancement to GPS that utilizes a stationary, ground-based reference station to broadcast satellite signal corrections. GPS signals are continuously corrected by comparing the difference between the fixed position of the reference station and the computed position indicated by the satellite system.

Differential leveling: Using a leveling instrument to determine differences in height between two points through a series of back sight and foresight measurements.

Digital Elevation Model (DEM): A digitally spaced grid of elevation points, collected over bare earth for a specific area, and referenced to a geographical coordinate system. The most common kind of DEM files are created by the [USGS](#) from satellite or high altitude aerial photography.

Digital Terrain Model (DTM): A digitally spaced grid of elevation points and terrain break lines, collected over bare earth for a specific area, and referenced to a geographical coordinate system. The DTM is generally created from low altitude aerial photography or field collected surveys for use during the preliminary engineering and design phases of a project.

Dilution of Precision (DOP): An indication of the geometric quality of the satellite constellation relative to a GPS receiver at the time of measurement. DOP takes into account the location of each satellite relative to other satellites in the constellation. A lower DOP value indicates a higher probability of accuracy. See also GDOP, PDOP, HDOP, VDOP, and TDOP.

Direction: The angle between a line and an arbitrarily chosen reference line. See also azimuth and bearing.

Direct measurement: The determination of a quantity using an instrument specifically calibrated for the purpose of measurement. See also indirect measurement

Discrepancy: The difference between two or more measured values of the same quantity.

Displacement, height: Displacement of images radially inward or outward with respect to the photograph nadir, according as the ground objects are, respectively, below or above the elevation of the ground nadir.

Displacement, relief: Displacement of images radially inward or outward from the nadir point of the photograph. Relief displacement of images is caused by differences in elevation of the corresponding ground objects whether below or above, respectively, the elevation of the ground nadir.

Displacement, tilt: Displacement of images on a tilted photograph radial from its isocenter. Tilt displacement is outward or inward with respect to the isocenter, according to whether the images are on the low or high side of the isometric parallel (the low side is the closest to the Earth or the object plane).

Definitions

Distortion: Any shift in the position of an image on a photograph which alters the perspective characteristics of the photograph. Causes of image distortion include lens aberration, differential shrinkage of film or paper, and motion of the film or camera.

Doppler shift: The apparent change in frequency of a signal caused by the relative motion of a satellite and the receiver.

Dual-frequency: A GPS receiver capable of utilizing L1 and L2 satellite signals to determine more precise positions. A dual-frequency receiver has the ability to compensate for errors introduced by the signals travelling through the ionosphere.

—E—

Easting: A value indicating the eastward (positive) or westward (negative) grid position or linear distance from a north-south reference line. The easting is also referred to as the x coordinate in a Cartesian coordinate system. See also northing.

Elevation: The vertical distance of a point or object from a reference datum, generally mean sea level.

Elevation mask: The lowest angle above the receiver's horizon that satellite data is tracked for post-processing. An elevation angle of ten to twenty degrees is typical.

Elevation factor: A dimensionless scale factor used to convert a distance on the ground to an equivalent distance projected onto the ellipsoid.

Ellipsoid: A mathematically defined surface that approximates the size and shape of the Earth. The ellipsoid is created by rotating an ellipse around the polar (or minor axis) to match the Earth's actual shape.

Ellipsoid height: The vertical distance of a point or object above or below the reference ellipsoid.

Ephemeris: The orbital data (altitude, speed, and position) broadcasted within the GPS signal by each satellite. The ephemeris data is transmitted to the satellites by the control segment. See also broadcast ephemeris and precise ephemeris.

Ephemeris error: Any deviations in the satellite orbit are referred to as ephemeris errors. These errors are caused by the gravitational attraction of the sun and moon and also by solar radiation.

Epoch: The measurement interval of a GPS receiver. An epoch varies according to the type of GPS survey. Typical epoch lengths are 10 seconds for static surveys, 5 seconds for rapid-static surveys, and 1 second for RTK surveys.

Equator: The intersection of the Earth's surface with the plane perpendicular to its axis of rotation. The equator is located at 0° latitude and divides the Earth into northern and southern hemispheres.

Error: The difference between a measured value of a quantity and its true value. The true value of a measurement is often determined by taking the mean value for a series of repeated measurements.

Eye Base: The interpupillary distance between the eyes of an individual.

—F—

Feature codes: A group of letters, numbers, or symbols that define a specific feature being surveyed. The feature code also determines how a point, line, or shape will be plotted in a mapping file.

Feature code list: A complete list of feature codes divided into distinct categories of survey data. The feature code lists are typically updated every two to three years.

Field inspection (photogrammetry): The process of comparing aerial photographs with conditions as they exist on the ground and of obtaining information to supplement or clarify that which is not readily discernible on the photographs themselves.

Firmware: The internal operating system that enables an electronic or computing device to perform its basic operation.

Fixed position: A survey monument with published horizontal and/or vertical coordinates used to establish adjusted positions for subsequent control networks.

Fixed solution: During an RTK initialization, the GPS receiver calculates the integer numbers of carrier-phase wavelengths between the antenna and each satellite. This process is known as fixing the integers. After the integers are determined, the position becomes a fixed solution. This is the most precise type of solution and must occur prior to any RTK collection. See also ambiguity and initialization.

Flight line: A line drawn on a photo or map to indicate the intended track of the aircraft when taking aerial photographs.

Flight line target: An aerial target placed on or near the flight line to relate distances on the ground surface to the aerial photography.

Flight map: The map on which the desired flight lines are indicated and the position of exposure previous to the taking of air photographs, or the map on which are plotted, after photography, selected air stations and the tracks between them.

Flight strip: A succession of overlapping aerial photographs taken along a single course.

Definitions

Float solution: During an RTK initialization, the GPS receiver calculates the integer numbers of carrier-phase wavelengths between the antenna and each satellite. This process is known as fixing the integers. Before the integers are fixed, the position is referred to as a float solution. Because the position of the receiver has not yet been fixed, any RTK collection with this solution is suspect and should not be used. See also ambiguity and initialization.

Focal length: A general term for the distance between the center, vertex, or rear node of a lens (or the vertex of a mirror) and the point at which the image of an infinitely distant object comes into critical focus. The term must be preceded by an adjective such as “equivalent” or “calibrated” to have precise meaning.

Foresight: A sighting or measurement from a known instrument point to an unknown point for the purpose of establishing new coordinates or orientation.

Forward azimuth: The direction of a given line measured from its beginning point to an ending point.

—G—

Galileo: A radio-based satellite navigation system being developed by the European Union.

Gap (aerial photography): Any space between aerial photographs failing to meet minimum ground coverage requirements. The gap may be space not covered by any photograph in line of flight or between separate flights, or the space where specified end lap or side lap was not obtained. Also called “hiatus.”

Geocentric: Relating to the center of the Earth. Modern ellipsoids are centered about the Earth’s mass to more closely approximate the true size and shape of the Earth. WGS 84, a geocentric ellipsoid, was developed to provide more accurate global mapping.

Geodesy: The science of measuring and monitoring the size and shape of the Earth and the location of points on its surface.

Geodetic datum: A mathematical model of the Earth designed to fit part or all of the geoid. It forms the basis for the computation of horizontal control surveys in which the curvature of the Earth is considered.

Geodetic north: A direction or reference defined by a meridian that runs through the north and south geodetic poles. Surveys are typically based on geodetic north unless otherwise specified.

Geodetic pole: Either of two points located on the Earth’s surface at 90° latitude. The Earth’s axis of rotation is defined by a line connecting the north and south geodetic poles.

Geodetic survey: The method of surveying that takes into account the curvature of the Earth by performing computations on the ellipsoid. Unlike plane surveys, geodetic surveys do not experience a loss of accuracy over very large areas.

Geoid: A theoretical surface perpendicular at every point to the direction of gravity that closely approximates mean sea level. The Earth's mass is unevenly distributed, meaning that certain areas of the planet experience more gravitational "pull" than others. Because of these variations in gravitational force, the geoidal surface is an irregular shape.

Geoid separation: The distance between the ellipsoid and geoid at a given point. A positive value indicates that the geoid is above the ellipsoid while a negative value indicates that the geoid is below the ellipsoid.

Geomatics: The discipline of collecting, storing, and processing geographic or spatially referenced information using a variety of surveying methods.

Geometric Dilution of Precision (GDOP): An indication of the geometric quality of the satellite constellation. The GDOP value is a measure of ability of a GPS receiver to accurately determine a 3-D position and clock offset.

Global Positioning System (GPS): A worldwide radio-navigation system formed from a constellation of satellites orbiting the Earth and ground control stations. The Global Navigational Satellite System (GNSS) is operated by the United States Department of Defense.

Global Navigation Satellite System (GLONASS): A radio-based satellite navigation system developed by the former Soviet Union. It is currently operated by the Russian Space Forces, a branch of the Russian Federation's Ministry of Defense.

GPS almanac: Data transmitted from GPS satellites regarding the operational status of the entire satellite constellation. This data includes clock corrections and atmospheric delay parameters.

GPS time: A measure of time used by the NAVSTAR GPS system. GPS time is based on UTC but does not add periodic leap seconds to correct for changes in the Earth's period of rotation.

GPS network: A group of GPS receivers usually with multiple setups collecting and recording satellite data for an extended period of time. The data from these GPS observations are adjusted by proprietary post-processing software to produce horizontal and vertical positions for each receiver setup position.

GPS session: A period of time during which GPS data is simultaneously collected by several receivers. When multiple GPS sessions are collected and the data is post-processed, baselines are generated between simultaneously collected receiver setups to establish a GPS network.

Grid: A two-dimensional (2-D) plane of uniformly spaced horizontal and vertical lines intersecting at right angles. A grid is used for locating specific points referenced to an origin.

Grid declination: The angular difference in direction between grid north and true north for any point within a state coordinate system.

Definitions

Grid distance: The straight line distance computed from the grid coordinates of two points. In the state plane coordinate system, an elevation scale factor is used to convert grid distances to ground distances.

Grid north: An azimuth based on the central meridian of a state plane zone. All other points in that zone use the same line of direction as north. However, only at the central meridian will grid north agree with true north.

Grid scale factor: A dimensionless scale factor or ratio that converts positions on the ellipsoid to positions on the state plane grid.

Gross model: The total area that is covered by the overlap of two consecutive aerial photos.

Ground control: In photo mapping, control obtained from field surveys as distinguished from control obtained by photogrammetric methods.

Ground distance: The horizontal distance measured between two points on the Earth's surface.

Ground plane: A large flat metal surface, or electrically charged field, surrounding a GPS antenna used to deflect multipath signals.

Guard stake: A stake driven near a survey point used to protect and identify a survey point.



Hardware: The physical components of an electronic device upon which an operating system is installed to perform the desired functions.

Height of instrument: The vertical distance measured from a specific mark on the instrument to a point on the ground that the instrument is centered over.

High Accuracy Reference Network: A nationwide GPS survey network which forms the highest order of horizontal control. Inaccuracies of individual survey monuments led to a readjustment of the NAD 83 datum to create a more accurate reference system. The HARN was implemented using the latest GPS technologies and procedures.

Horizontal angle: Any angle measured in a horizontal plane to establish a direction relative to a specific reference.

Horizontal control: A network of survey monuments with published x and y coordinate values only. These monuments are used to provide positional coordinates for WYDOT control.

Horizontal datum: A collection of points on the Earth's surface that have been assigned precise latitude and longitude measurements. The horizontal datum forms the basis for the development of new horizontal positions.

Horizontal Dilution of Precision (HDOP): An indication of the geometric quality of the satellite constellation. The HDOP value is a measure of ability of a GPS receiver to accurately determine a 2-D horizontal position.

Horizontal distance: The linear distance measured on a horizontal plane to determine the distance between two points.

Horizontal plane: A level surface which is perpendicular to the direction of gravity.

Human errors: Errors caused by physical limitations and inconsistent setup and observation methods of the surveyor.



Indirect measurement: The determination of a quantity by means of calculation and not by direct measurement. See also direct measurement.

Inertial navigation system: A system that processes the measurements of an aircraft's velocity and displacement from a known starting point by sensing the accelerations acting on the aircraft in known directions.

Inertial Measurement Unit (IMU): A compact component of an inertial navigation system that has three accelerometers mounted on a gyro-stabilized platform that measures acceleration.

Initialization: The process used by a GPS receiver to calculate the integer number of carrier-phase wavelengths between the antenna and a satellite. This process is known as fixing the integers. Before the integers are fixed, the position is referred to as a float solution. After the integers are fixed, the position becomes a fixed solution. See also ambiguity.

Instrumental errors: Errors caused by imperfectly constructed, adjusted, or calibrated surveying equipment.

Invert: The inside bottom of a pipe or culvert.

Inversing: Computing the length and azimuth of a line from the coordinates of its endpoints.

Ionosphere: The uppermost layer of the Earth's atmosphere that ranges in altitude from 50 to 500 kilometers. It consists mainly of ionized (or charged) particles caused by solar radiation. Increased ionosphere disturbances are caused by solar particles and magnetic fields emitted by the sun.

Ionospheric correction: A solution that uses a combination of GPS measurements to model and remove the effects of the ionosphere on GPS signals.

Ionospheric modeling: The time delay caused by the ionosphere varies with respect to the frequency of the GPS signal. Because of this, the L1 and L2 signals are affected differently.

Definitions

When dual-frequency receivers are used, the carrier phase observations for both frequencies can be used to model and eliminate most of the ionospheric effects.



L1 Signal: The primary L band carrier used by GPS satellites to transmit satellite data. The frequency is 1575.42 MHz and is modulated by the C/A code and the P-code (or Y-code).

L2 Signal: The secondary L band carrier used by GPS satellites to transmit satellite data. The frequency is 1227.6 MHz and is modulated by P-code (or Y-code).

Lambert projection: A conformal conic map projection used to represent the surface of a sphere onto a plane. This type of projection superimposes an imaginary cone over the sphere. The scale varies north to south but not from east to west to maintain accuracy along an east-west axis.

Latitude: A measurement in a north-south direction expressed as degrees of departure parallel to the equator. Latitude is 0° at the equator and 90° at the poles. The length of a degree of latitude varies from 68.7075 statute miles at the equator to 69.4034 miles at either pole.

L-band: The group of radio frequencies which carry data from orbiting satellites to GPS receivers.

Least-squares: A method of adjustment to reduce or eliminate random errors that occur in surveying observations. Random errors conform to the laws of probability and are normally distributed throughout each survey. The least-squares method develops a “best-fit” model by minimizing the sum for all of the squared residuals.

Level loop: A method using a leveling instrument to establish elevations through a series of back sight and foresight measurements. The level loop will begin at a point with a known or assumed elevation and return to the same point.

Level run: A method using a leveling instrument to establish elevations through a series of back sight and foresight measurements. The level run will begin at a point with a known elevation and end at another point with a known elevation.

Lock: The state in which a GPS receiver receives and recognizes a satellite’s signal. If the signals are interrupted, the receiver experiences a loss of lock.

Longitude: A measurement in an east-west direction expressed as degrees of departure from the prime meridian, located in Greenwich, England. Longitude is arbitrarily set as 0° at the prime meridian and measured up to -180° westward (W) or +180° eastward (E) at its opposite meridian. The length of a degree of longitude at the equator is 69.1703 statute miles and converges to 0 at either pole.

—M—

Magnetic declination: The angular amount that a magnetic compass needle points eastward or westward from true north.

Magnetic north: The direction based on the magnetic north and south poles. In the northern hemisphere, magnetic north is the direction that a compass needle will point toward. The Earth's magnetic poles are not at the same location as the geodetic poles and are constantly changing.

Magnetic pole: Either of two regions located near the north and south geodetic poles where the Earth's magnetic field is the most intense. These regions are variable and are in constant motion. In the northern hemisphere, the needle of a compass points to the north magnetic pole. Conversely, in the southern hemisphere, the needle of a compass points to the south magnetic pole.

Map: A graphical representation with an established scale and orientation of natural and man-made features. See also planimetric map and topographic map.

Map distortions: On map projections, distortions are differences in line lengths between the ellipsoid and the grid plane.

Map projection: A method of representing (or projecting) the surface of a sphere onto a plane. Projections are necessary for creating maps, however certain distortions will occur. See also Lambert projection and transverse Mercator projection.

Map scale: The ratio between a distance on a map to a corresponding distance on the surface of the Earth. Map scale may be expressed as an equivalence relationship, (1 inch = 1 mile), as a numerical fraction (1/63,360 or 1:63,360), or graphically by a bar scale.

Mean sea level: The average (or mean) height of the ocean's surface for all tidal stages measured over a 19-year period. Mean sea level is used as a standard for determining land elevations. Near coastal areas, mean sea level is established with numerous tide gauging stations. In areas far away from the shore, mean sea level is established by the geoid.

Measurement: The process of obtaining the magnitude of a quantity, such as an angle or distance, with a calibrated instrument. A measurement is typically qualified by a defined unit of measure, such as a foot or acre. A measurement is also referred to as an observed value.

Meridian: A line of longitude that passes through the North and South poles.

Misclosure: The difference in a measurement or a series of measurements from an established value. Misclosure is also known as the error of closure.

Model: Two photographs [or images] with sufficient overlap of the same object or location, which enables the observer, with the aid of a stereoscope, to obtain the impression of 3 dimensional viewing. Approximately 60 degrees of overlap is preferred.

Definitions

Mosaic, photographic: An assembly of aerial photographs whose edges usually have been torn or cut and matched to form a continuous photographic representation of a portion of the Earth's surface, often called an aerial mosaic. "Controlled mosaic": A mosaic oriented and scaled to horizontal ground control; usually assembled from rectified photographs. "Uncontrolled mosaic": A mosaic in which the photographs have not been adjusted by the reference to ground control.

Multipath: A GPS signal that has reached the receiver's antenna by more than one path. This is typically caused by a signal that has been reflected off of another surface before reaching the GPS antenna.

Multipath Error: The positional error resulting from GPS signals that have travelled different paths from the satellite to the receiver. The receiver interprets the slightly longer travel time as a longer travel distance from the satellite.

Multispectral Image: An image that contains two or more spectral bands.

—N—

Nadir: The direction pointing directly below a particular location along the plumb line, opposite the zenith.

National Geodetic Survey: The United States government agency that maintains the national geodetic datum and all geodetic survey control networks within the U.S. and its territories.

National Spatial Reference System: A highly accurate, nationwide reference network of survey monuments and geodetic data maintained by the NGS. The NSRS is the primary source for geodetic control in Wyoming.

Natural errors: Environmental conditions or significant changes in environmental conditions that cause variations in surveying measurements. Wind speed, air temperature, atmospheric pressure, humidity, gravity, earth curvature, and atmospheric refraction are natural error sources.

Navigational Satellite Timing and Ranging (NAVSTAR): The official name for the global positioning system used by the U.S. Department of Defense.

Near-Infrared: Pertaining to the electromagnetic spectrum with wavelengths just shorter than the infrared region, but longer than the visible spectrum region.

Neat model: The portion of the stereo model that is utilized in photogrammetric procedures.

Normal: A straight line perpendicular to a surface or to another line. In geodesy, normal is the direction perpendicular to the surface of the ellipsoid.

North: One of the four cardinal directions. North is the most commonly used reference for defining an azimuth direction. See also geodetic north, astronomic north, magnetic north, grid north, and assumed north.

North American Datum of 1927: A horizontal reference datum which used the Clarke Ellipsoid of 1866 to represent the shape of the earth. The geodetic center of the datum was designated by a survey monument located in Kansas near the geographic center of the contiguous United States. All other geodetic positions were established through a nationwide adjustment of over 25,000 existing control monuments.

North American Datum of 1983: A horizontal reference datum based on the GRS 80 geocentric ellipsoid. NAD 83 was created to remove inaccuracies and to correct distortions in the previously created NAD 27 horizontal datum. This readjustment resulted in the publication of coordinate data for approximately 250,000 geodetic control monuments throughout the United States.

North American Vertical Datum of 1929: A vertical reference datum comprised of geodetic leveling data completed throughout the United States and Canada. Elevations of existing bench marks were adjusted and referenced to tidal gauges measuring mean sea level. This adjustment established the 1929 Sea Level Datum, which was later renamed the National Geodetic Vertical Datum of 1929.

North American Vertical Datum of 1988: An adjustment of the NGVD 29 datum to remove inaccuracies and correct distortions to provide a more accurate vertical reference. Many disturbed or destroyed monuments were replaced and much of the first-order vertical control network was re-leveled. Mean sea level was determined by a single tidal gauge located in Quebec to eliminate the local variations at each tidal station.

Northing: A value indicating the northward (positive) or southward (negative) grid position or linear distance from an east-west reference line. The northing is also referred to as the y coordinate in a Cartesian coordinate system.



Oblique photograph: A high oblique includes the horizon while a low oblique does not. A photograph taken with the camera axis intentionally directed between the horizontal and the vertical.

Ocular: The eye piece in the telescope of an optical surveying instrument. The ocular is the lens closest to the eye of the viewer and is used to focus the image.

Observation time: The period of time required for GPS receivers to collect data. Observation times vary from over three hours to a few seconds depending on the type of survey (static, rapid-static, or RTK), the distance between receivers, and the required positional precision.

Definitions

On-line Position Users Service (OPUS): An NGS program that provides positional solutions to GPS data submitted in a RINEX format. The data is processed in a GPS network using information from the three closest CORS stations.

On-The-Fly: An initialization method that allows the rover to be moving while the integer ambiguities are resolved. This technique is only possible with dual-frequency RTK systems that continuously perform “background” initializations as an ongoing quality check.

Open traverse: A traverse that does not geometrically close or a traverse that does not begin and end at points with previously established positions.

Order of accuracy: A mathematical ratio defining the general accuracy of the measurements made in a survey. The orders of accuracy are divided into four categories and range from first-order down to fourth-order.

Orientation: The process of establishing a direction with respect to a reference system.

Origin: A fixed point of reference in a coordinate system where the axes of the system intersect. The origin is also referred to as the point of beginning.

Orthometric Height: The elevation of an object or point above mean sea level. Because mean sea level is determined by the geoid in areas far from the coast, orthometric elevation is also defined as the distance above the geoid. The orthometric elevation is the sum of the geoid separation and ellipsoid height.

Ortho Photogrammetry: Photographs which have been “corrected” so as to be usable as a scalable map. In other words, a simulation of a photograph taken from an infinite distance, looking straight down with the perspective removed.

Outlier: An observation or measurement which is identified by statistical analysis as having a residual too large for its estimated error. Outliers are typically an indication of measurement error.

Overlap: (1) The amount by which one photograph includes the same area as covered by another, customarily expressed as a percentage. (2) That area of a map or chart which overlaps the same geographical area on an adjoining map or chart. (3) An area included within two surveys of record, which by the record is described as having one or more common boundary lines with no inclusion of identical parts.

Overlapping pair (photogrammetry): Two photographs taken at different exposure stations in such a manner that a part of one photograph shows the same terrain as shown on a part of the other photograph. This term covers the general case and does not imply that the photographs were taken for stereoscopic examination. See also “stereoscopy.”

—P—

Panchromatic Image: A type of black-and-white image that is sensitive to all wavelengths of visible light. This type of images has a much higher resolution than a multispectral image.

Parallax: The apparent displacement of an object when viewed from different positions.

Parts per million: A factor applied to measured slope distances to correct for the refraction affects of the Earth's atmosphere. The correction value is determined using observed pressure and temperature readings with specific instrument constants.

Pass point: A natural image or marked point visible on a photograph for which the horizontal position and/or elevation has been or will be determined by photogrammetric use of the photograph and its stereoscopically adjacent photographs. A pass point is used for the orientation of photographs in photogrammetric instruments in the same manner in which supplemental control points are used.

Peg test: A diagnostic test performed with a digital level to determine the collimation error.

Photo control: A network of aerial targets placed on the ground with published horizontal and vertical coordinate values. These targets are identifiable on the aerial photography and used for correlating the photo images to the actual ground surface. The two types of aerial targets are flight line targets and wing points.

Photogrammetry: The science of making reliable measurements by the use of aerial photography.

Photographic interpretation: The determination of the nature and description of objects that are imaged on a photograph.

Phototriangulation: The process for the extension of horizontal and/or vertical control whereby the measurements of angles and/or distances on overlapping photographs are related into a spatial solution using the perspective principles of the photographs. Generally, this process involves using aerial digital photography and is called aerotriangulation or aerial triangulation.

Picture point: A feature that can be easily identified on an aerial photograph and can be tied horizontally or vertically for use in aerial triangulation.

Pixel: The smallest element of a digital image that can be assigned a gray level. A pixel can be one dot on a panchromatic image, three dots (red, green, and blue) on a color image, or a cluster of these dots on a pan sharpened image.

Plane survey: A method of surveying in which the Earth's spherical surface is flattened to provide the two-dimensional (2-D) surface. Plane surveying uses simple Cartesian coordinates to simplify calculations rather than using the more complex spherical coordinates. Because accuracy rapidly declines outside of small areas, plane surveys are not useful for regional or national mapping.

Definitions

Planimetric map: A two-dimensional (2-D) map that is a graphical representation of the horizontal positions of natural and man-made features. Objects shown in a plan-view do not indicate relief and are referred to as planimetric features.

Plumb: A vertical line following the direction of gravity. Plumb is also defined as being perpendicular to a horizontal line.

Polaris: The brightest star in the Ursa Minor (Little Dipper) constellation. Polaris is often referred to the Pole Star, or North Star. Due to its proximity to the north celestial pole, it is used to determine astronomical north.

Polar coordinate system: A reference system used to determine the location of a point located in a plane. The position of each point is determined by a radial coordinate and an angular coordinate from a defined origin.

Position Dilution of Precision (PDOP): An indication of the geometric quality of the satellite constellation. The PDOP value is a measure of ability of a GPS receiver to accurately determine a 3-D position.

Post-processing: A procedure used to adjust raw data to determine the best solution for each occupied position in a GPS network. The receivers must run concurrently and include information from the same satellites. A least-squares method is typically used to adjust the data collected by each receiver.

Precise Code (P-Code): A pseudo-random code modulated onto the L1 and L2 GPS carrier signals. Access to the precise code (or P-code) is restricted by the U.S. Government to authorized users only. It is encrypted and reset every seven days to prevent use from unauthorized persons. See also Y-code.

Precise ephemeris: The positional data which describes the exact position of each GPS satellite as it occurred in the past. The precise ephemeris is typically made available to the public within three to seven days.

Precision: Relating to the quality of the operation and is distinguished from accuracy, which relates to the quality of the result. Precision is the extent to which a given set of measurements agree with their mean.

Prime Meridian: The meridian that passes through the Royal Observatory in Greenwich, England from which all other longitudes are reckoned. The prime meridian (arbitrarily defined as 0° longitude) and its opposite meridian (at 180°) divide the Earth into the eastern and western hemispheres.

Prism: A transparent optical element typically made of glass with flat, polished surfaces that refract light. The prism is set on a tribrach and tripod and set over a project control monument to reflect the signal back to an optical total station for the purpose of measuring distances.

Prism constant: The horizontal distance offset between the center of a prism and the point being measured. Prism constant is also referred to as a prism offset.

Project Control: A network of survey monuments with published x, y, and z coordinate values. These monuments are used to provide horizontal and vertical positions for WYDOT projects and provide the basis for photo control, preliminary collection, and construction staking surveys.

Projection: The translation of a set of coordinates from a curved surface to a plane. A projection is used to create flat maps that represent the surface of the Earth. See also Lambert projection and transverse Mercator projection.

Pseudo-Random Code (PRC): A complicated sequence of “on” and “off” pulses transmitted in the signal of each GPS satellite. GPS receivers use the PRC code to identify and lock onto the satellite.

Pseudo-Range: The time shift or delay of GPS signals travelling between orbiting satellites and the receiver’s antenna. The apparent distance between satellite and receiver is then calculated by multiplying the time shift (delay) by the speed of light. The pseudo-range measurement contains inaccuracies associated with clock, ephemeris, and atmospheric errors. When these errors are corrected or compensated for, the actual distance or range is determined.

—R—

Radiometric Adjustment: The refinement of an image by measuring the intensities of radiation in some band of wavelengths in any part of the light spectrum.

Random Errors: Errors not directly related to the conditions or circumstances of the observation. Random errors are unpredictable and are equal to the misclosure after all possible systematic errors and blunders have been eliminated. These errors are also referred to as accidental errors.

Range: An east-west designation used to describe the position of a township relative to a Principal Meridian.

Rapid-static surveying: A method of GPS surveying using occupation times of up to 20 minutes to collect raw GPS data. The data from the rapid-static network is post-processed to achieve sub-centimeter precision.

Real-Time Kinematic survey: A “radial” survey that utilizes two or more GPS receivers communicating with a wireless data link. The base receiver remains stationary while rover receivers collect data while in motion or for short periods of time over specific points.

Receiver Independent Exchange (RINEX): A standard format that allows raw GPS data to be used regardless of the GPS receiver or post-processing software.

Definitions

Rectangular coordinate system: A reference system used to determine the location of a point located in a plane. The position of each point is determined by an x and y value relative to a defined origin.

Redundancy: The amount by which a control network has more observations than necessary to compute the coordinates of the network. Redundancy improves the accuracy of coordinate positions by comparing measurements of the same quantity.

Registration: (1) The matching of details of a map overlay with the details of the base map in their respectively correct horizontal and/or coordinate position. (2) The position correlation of cultural and topographic details printed using different color so as to comprise an accurate topographic or planimetric map.

Relief: Differences in elevation on the Earth's surface. Contours are used to depict relief on topographic maps.

Resection: The process of establishing the position of an instrument setup by taking measurements to two or more known points.

Residual: The amount of correction or adjustment of an observation or a series of observations necessary to achieve zero closure. Residuals are computed when adjusting level loops, traverses, and GPS networks. See also misclosure.

Reticle: The crosshair in the telescope of an optical surveying instrument used to align the line of sight.

Reverse Curve: Two adjoining circular curves turning in opposite directions.

Right-of-Way: The legal limits of a utility or access route.

Root Mean Square (RMS): A statistical measure of the magnitude of a varying quantity and is used to express the accuracy of a measurement. The RMS is calculated by taking the square root of the arithmetic mean (or average) of the squares of a set of numbers.

Rotation: In coordinate transformations, a rotation is the angle through which a coordinate axis is moved around the coordinate system origin.

Rounds: Multiple measurements from an instrument setup to two or more known survey points to determine coordinates for an unknown point.

Rover: A mobile GPS receiver moving from point to point collecting RTK data. Each rover communicates with a base station via a radio data link.

—S—

Satellite Constellation: The arrangement of satellites that is visible to a GPS receiver at any one time. An ideal constellation is one in which the satellites are equally spaced throughout the visible sky. Only the satellites above the elevation mask will be utilized.

Satellite geometry: The relative positions of available GPS satellites at a given time. See also constellation.

Scale factor: A multiplier used to convert distances as they are projected through the ellipsoid, state plane grid, and ground surfaces. The conversion from state plane to ground coordinates is a two-step process. See also grid scale factor and elevation factor.

Section: A square tract of land one square mile in area. A section forms one of the 36 subdivisions of a township.

Sidereal day: The time taken for one complete revolution of the Earth with reference to another object (i.e. star or satellite).

Side-shot: An observation or measurement that does not have redundancy.

Signal-to-noise ratio (SNR): An indicator of the strength of a satellite signal.

Single-frequency: A GPS receiver is capable of utilizing L1 satellite signal only. A single-frequency receiver cannot compute precise positions over longer distances due to its inability to compensation for ionospheric effects.

Skyplot: A plot that shows the location of visible GPS satellites for a given latitude, longitude, and time.

Slope distance: The shortest distance between two points. The slope distance is the hypotenuse of the horizontal and vertical distances.

Software: The collection of computer programs and related data that provide instructions for an electronic device to perform specific functions.

Space segment: The component of GPS that operates in space (i.e. the satellites). See also control segment and user segment.

Spiral curve: A transitional curve of constantly changing radius placed between a tangent section and a circular curve.

State plane coordinates: Two-dimensional (2-D) Cartesian coordinates in a state plane zone. State plane coordinates are also referred to as grid coordinates.

Definitions

State plane zone: A geographic zone or coordinate system defined by a plane. These zones use a simple Cartesian coordinate system to specify locations rather than the more complex spherical coordinate system of latitudes and longitudes.

Static survey: A method of GPS surveying using long occupation times (up to 3 hours) to collect raw GPS data. The raw data from the static network is post-processed to achieve sub-centimeter precision.

Station Setup: Placing an instrument over a point and defining its orientation relative to a back sight point or points.

Stereocomparator (photogrammetry): A stereoscopic instrument for measuring parallax, which usually includes a device for measuring photo coordinates of image points.

Stereocompilation: (1) The procedure of producing a map from aerial photographs by means of stereoplotting instruments. (2) The map data produced with stereo plotting instruments.

Soft Copy Stereoplotter: A PC Workstation loaded with stereo compilation software and stereo viewing components, to view digital aerial photography for the purpose of collecting 3 dimensional topographic data. The digital photography must have approximately 60% image overlap to the adjacent photo image for optimal stereo viewing.

Stereoscope: An instrument used for viewing two stereo overlapping photographs or diagrams to obtain an optical impression of a three-dimensional view.

Stereoscopic fusion: The process that combines two perspective views to give an optical impression of a three-dimensional model.

Stereoscopic principle (photographic mapping): The formation of a single, three dimensional image by binocular vision of two photographic images of the same terrain taken from different exposure stations. With proper equipment all measurements needed in map construction can be made from this visual model.

Strip adjustment: Similar to a block adjustment but limited to a single strip of photographs.

Surface Coordinates: State plane coordinates that have been adjusted by a datum adjustment factor (DAF). Surface coordinates are also referred to as ground coordinates.

State plane coordinates: Two-dimensional (2-D) Cartesian coordinates in a state plane zone.

Super elevation: The banking of a curved section of roadway to counteract the effects of centrifugal force.

Surveying: The science and art of taking accurate measurements to determine the location of specific features relative to a defined datum. Surveying utilizes elements of geometry, engineering, trigonometry, mathematics, physics, and law.

Survey observation: A single measurement made with a conventional surveying instrument. GPS receivers perform observations (or occupations) by continuously tracking and analyzing satellite signals.

Survey Monument: A fixed point with an established horizontal and vertical position relative to a datum. The entire network of survey monuments make up the project control. Permanent survey monuments are typically comprised of an aluminum cap set on an aluminum rod which is driven to refusal and encased in concrete.

Systematic Errors: Repetitive errors caused by surveying equipment, observation methods, or certain environmental factors. These errors tend to have the same magnitude and direction (positive or negative) and will accumulate in a series of measurements. In some cases, they can be corrected by simply subtracting a constant from the data. Systematic errors are also referred to as cumulative errors.

—T—

Target: A sighting device typically placed vertically to allow distance and/or angle measurements with optical surveying equipment. A target may be a prism, level rod, or any other object that provides a sharply defined, stationary point.

Target height: The vertical distance measured from the center of the prism to a point on the ground.

Tilt (photogrammetry): The angle between the photograph perspective center and the plumbline (or other exterior reference direction). The direction of tilt is expressed by swing (when referred to the axes of the photograph) or azimuth (when referred to the exterior coordinate system). In aerial photography, tilt may be separated into its component angles, with the x axes being the one more nearly in the direction of flight. In aerial-camera orientation, a positive x tilt results from the left wing of the aircraft being lowered, displacing the nadir point in the positive y direction. Similarly, a positive y tilt results from the nose of the aircraft being lowered, displacing the nadir point in the positive x direction.

Time Dilution of Precision (TDOP): An indication of the geometric quality of the satellite constellation. The TDOP value is a measure of ability of a GPS receiver to accurately determine clock offset.

Tolerance: The maximum amount of misclosure that allows a measurement or series of measurements to meet defined accuracy standards.

Topographic map: A three-dimensional (3-D) map that is a graphical representation of the horizontal and vertical positions of natural and man-made features. A topographic map usually shows the same features as a planimetric map but uses contours or comparable symbols to indicate relief.

Definitions

Total station: A conventional surveying instrument used to measure and record angles and distances.

Township: A quadrangle with boundaries conforming to meridians and parallels. Each township is typically six miles to a side and contains thirty-six sections. Irregular townships with fewer than 36 sections have been created to correct for the Earth's curvature and survey errors. See also section and range.

Tracking: The process of receiving and recognizing signals from a satellite.

Transformation: A process used to transform coordinates from one coordinate axis system to another. Common transformations are used to convert coordinates from the WGS 84 datum to a local coordinate system. See also calibration.

Translation: In coordinate transformations, translation is the amount of shift needed to align the origins of the coordinate systems.

Traverse: A continuous series of angular and distance measurements for the purpose of establishing control point positions. A traverse starts from two fixed points to provide a beginning position and azimuth. Angles and distances are measured throughout the traverse at intermediate points. The traverse is then completed at two fixed points to check the ending position and azimuth.

Transverse Mercator projection: A conformal map projection used to represent the surface of a sphere onto a plane. This type of projection superimposes an imaginary cylinder over the sphere. The scale varies east to west but not from north to south to maintain accuracy along a north-south axis.

Triangulated Irregular Network (TIN): Derived from the Delaunay triangulation. A TIN is a vector based representation of the terrain surface made up of irregularly spaced nodes and lines, arranged in a network of non overlapping triangles. TIN's are usually generated from Digital Terrain or Elevation Models.

Triangulation: 1) A method of surveying in which the location of a point is determined by creating a triangle with two other fixed points. The distance between the two fixed points and the angle between each fixed point and the new point is measured. The location of the new point is then solved for trigonometrically with one known side and two known angles. 2) In Photogrammetry, a stereoplotter is used to establish horizontal and vertical control by measuring angles and distances on overlapping images and is related into a spatial solution using the perspective principles of the photo images. See phototriangulation.

Tribrach: A centering device used for mounting survey instruments onto a stable tripod.

Troposphere: The portion of the atmosphere closest to the Earth's surface. The troposphere is the densest layer of the atmosphere and is comprised of mostly water vapor and varies in

temperature, pressure, and humidity. Because of this variability, errors are more difficult to predict and model.

Tropospheric modeling: Errors caused by the troposphere are smaller than ionospheric errors, and can only be approximated by a general calculation model. This effect is much more localized, and changes more quickly than the ionospheric effects.

True value: A theoretical exact measurement that is error free. However, measurements are never completely error free and the true value is determined by taking the mean in a series of repeated measurements.

Turning point: In differential leveling, a stable point where an elevation is temporarily determined before the leveling instrument is moved. The turning point is then used to establish the height of instrument after resetting. A turning plate, railroad spike, wooden hub, and a prominent point on a solid rock are examples of turning points.

—U—

Universal Time Coordinated (UTC): A time standard based on local solar mean time at the Greenwich Meridian. Universal time is also known as Greenwich Mean Time.

User Segment: A collective name for the GPS receivers that utilize GPS satellite signals. See also control segment and space segment.

U.S. survey foot: A unit of length used specifically for surveying. One meter is equal to 39.37÷12 U.S. survey feet. The U.S. survey foot differs slightly from the international foot measurement.

—V—

Vector: A three-dimensional (3-D) line between two points with delta x, delta y, and delta z values.

Vertical: A direction parallel to the direction of gravity. See also plumb.

Vertical angle: Any angle measured in a vertical plane to establish a direction relative to a specific reference.

Vertical control: A network of survey monuments with published vertical coordinates. These monuments are used to provide elevations for WYDOT control.

Vertical datum: A collection of points on the Earth's surface with elevations referenced to mean sea level. The vertical datum forms the basis for the development of new vertical positions.

Definitions

Vertical Dilution of Precision: An indication of the geometric quality of the satellite constellation. The VDOP value is a measure of ability of a GPS receiver to accurately determine a vertical position.

Vertical distance: The linear distance measured in a vertical plane to determine the distance between two points. When measuring the true vertical distance, correction factors are applied to compensate for curvature and refraction errors.

Vertical plane: A vertical surface which is parallel to the direction of gravity and perpendicular to the horizontal plane.

—W—

Wide Area Augmentation System (WAAS): A system of ground stations and geosynchronous satellites that broadcast GPS correction information. WAAS is being developed by the Federal Aviation Administration (FAA).

Wing point: An aerial target placed off of the flight line near the edge of the photography to relate distances on the ground surface to the aerial photography.

Witness post: A delineator driven near a survey station to aid in its recovery and identification.

World Geodetic System: A geocentric ellipsoid model developed to closely approximate the true size and shape of the Earth. The Department of Defense adopted the 1984 revision (WGS 84) for its worldwide navigation in 1986.

—X—

X, Y, and Z: Coordinate designations in a rectangular coordinate system. The x value refers to an easting value in the east-west direction, y refers to a northing value in the north-south direction, and z refers to elevation.

—Y—

Y-code: An encrypted form of the information contained in the P-code. Satellites transmit Y-code in place of P-code when Anti-Spoofing is in effect.

—Z—

Zenith: The direction pointing directly above a particular location along the plumb line.

Zenith angle: An angle, used as a reference for measuring vertical angles as measured downward from the zenith. The zenith angle is defined as 0° directly overhead and 90° at the horizon.