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Update on GPS: Explanation of GNSS

Over the past few years, GPS manufacturers have started offering equipment labeled with "GNSS". In order to understand what GNSS stands for, and how it might impact performance, this paper provides an overview of GNSS for the casual user or the prospective buyer looking to invest in GPS or GNSS technology.

Overview

GNSS stands for **G**lobal **N**avigation **S**atellite **S**ystem which has become synonymous to mean using multiple satellite navigation systems concurrently by a GPS receiver to compute its position. What makes a GNSS receiver superior to a GPS receiver is its capabilities of receiving signals from navigation satellites other than, and in addition to, those that are of the GPS network. While the GPS network was first in operation, other countries have developed similar systems transmitting civilian-accessible signals. As a result, GNSS users can utilize more satellites to compute a position. The result is increased ***position accuracy*** and ***reliability*** which can impact those in agriculture who wish to 1) map boundaries or other farm features, 2) operate a guidance system, and 3) utilize other technologies that require global positioning.

History

In the mid-20th century, the United States military devised a method of calculating real-time position on Earth using orbiting satellites. The satellites served as signal beacons for the personnel that had the proper equipment in which to receive the signals and "triangulate" their global position in relation to the orbiting satellites. Hence, the Global Positioning System (GPS) was developed.

In later years, the Soviet Union developed its own satellite-navigation network for military use; commonly referred to as GLONASS, it is functionally similar to GPS. After the political breakup of the Soviet Union, the GLONASS network had fallen into disrepair but is now being updated. (Currently there are 18 operational GLONASS satellites; 24 satellites are expected by 2010.) The European Union later announced that they will also construct a civilian-operated satellite-navigation network, named Galileo. In addition the governments of China, Japan and India are developing satellite-navigation networks of their own---COMPASS, QZSS, and IRNSS, respectively. *Currently, GPS and GLONASS are the only operational systems*, but Galileo is expected to be operational in the future (30 operational satellites by 2013).

Figure 1. Example of a Trimble® GNSS-compatible antenna. Note the "GNSS" label on the rim. Most compatible antennas/receivers will have this label.

In summary, the Global Navigation Satellite System can be represented by:

GNSS = GPS + GLONASS + (future additional systems such as Galileo).

Benefits of GNSS over GPS

As mentioned earlier, the primary difference between equipment with GPS compatibility versus GNSS compatibility is that GNSS-compatible equipment can make use of satellites from other networks. How is that important? The United States' Department of Defense (USDoD) strives to maintain the integrity and reliability of at least 24 satellites in its network. Due to the placement of the satellite array, users will typically only be able to observe between 4 to 8 GPS satellites at any one time. At least four satellites have to be observed by any receiver; more satellites in the observation contribute to a more accurate and reliable position. Therefore, additional satellites (42 = 24 GPS + 18 GLONASS) are available for GNSS users increasing overall accuracy and reliability, especially in conditions with limited observable GPS satellites. Examples would be when operating near tree lines or buildings. With GNSS, one can move from tracking 4 to 8 satellites up to 8 to 12 allowing the receiver to compute a position in situations that were previously too difficult for standalone GPS receiver operation. To avoid confusion, *remember that GNSS receivers are, by definition, compatible with GPS; however, GPS receivers are not necessarily compatible with GNSS*.

Manufacturers are continually updating GNSS receivers to improve the accuracy of these receivers. When shopping for GNSS equipment, the general rule-of-thumb is that you will be paying for accuracy and reliability. Less-expensive units typically state accuracies within several yards of the intended target; more expensive units have additional component that could improve accuracy to within an inch or less. You should therefore consider what type of accuracy is needed for your tasks.
For additional information see ACES Timely Information Sheet - Update on GPS: L2C and L5.

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