

“GPS” POSITIONING/TRACKING SYSTEM ACCURACY & RELIABILITY

Robert Reed 11/20/08

The reliability and accuracy of the GPS positioning and tracking systems utilized in the transportation industry for monitoring drivers, equipment, or cargo can be an issue in incidents or a crash investigation. The multiple systems utilized may have varying degrees of performance, accuracy and reliability. A standard for GPS accuracy has not been defined. Position accuracy is a function of the GPS receiver performance, configuration parameters, satellite visibility of the antenna, and satellite constellation. Every system manufacturer uses its own means of defining, measuring and calculating position accuracy. The user guide or patent for the device usually lists the accuracy and reliability of the system. Empirical testing can be utilized to demonstrate the performance of a GPS system.

HISTORY

GPS was envisioned in the 1950's and eventually developed into the Star Wars military application for guidance and tracking of missiles. The original military application evolved into dual-use technology for both military and civilian use in 1983 when President Reagan made GPS freely available for civilian use as a common good due to the shooting down of Korean Airlines flight 007 by the USSR for straying into its airspace. GPS was developed under the Department of Defense and is maintained through them and the Department of Transportation. Civilian and private companies also have developed and maintain their own systems for use in the transportation and communications industry.

ACCURACY

The use of Selective Availability (SA) was a program for intentional degradation technique to add error to reduce the accuracy and reliability of civilian GPS signals. This alteration caused horizontal position errors on the order of 100 meters (approx. 328 feet) 95% of the time. Since Selective Availability (SA) was discontinued on May 1, 2000 the accuracy has increased dramatically. The basic GPS signal has went from 100 meters to nearly 20 meters (approx. 65 feet) and the GPS time improved to 20-30 billionths of a second. The accuracy to below 20 meters is possible with increased capabilities from multiple satellites and other features for enhanced navigation receivers. The current and basic receivers required no changes in hardware or software for reception of the civil GPS signal without SA. The accuracy and reliability of tracking and positioning GPS systems increased beyond their stated capabilities. These enhanced GPS signals created many more civil uses in transportation and navigation for cars, boats, aviation, trains, fleet management, highway/waterway maintenance, search and rescue, roadside assistance, emergency preparedness and many other applications. The expanding use of GPS coordinates to mark accidents scenes and extensive use in map resources and telematics of many commercial motor vehicles provides many applications that enter accident investigations, reconstructions and litigation matters. Persons involved must know the capabilities and accuracy of these systems. Remember, the stated capabilities of a system must be reviewed and tested for performance before being relied upon for accuracy and reliability.

GUIDELINES AND TESTING

The requirements for testing and use of a GPS mobile communications positioning or tracking system for safety and security in the transportation industry is disseminated in two reports under the sponsorship of the Department of Transportation. The performance constraints and requirements for location accuracy of satellite-based communications system with default configuration parameters shall be 100 meters, 95% of the time. This level of accuracy takes into consideration the uncontrollable variables that may affect performance.

They usually test to well within these parameters and more closer to the 20 meter range. Modern navigation devices can be accurate to 15 feet and more precise with enhanced capabilities of using multiple satellites and systems.

The FCC E-911 program for cell phone emergency phone calls and position broadcast has parameters of 50 meters (approx. 164 feet) 67% of the time and 150 meters (approx. 492 feet) 95% of the time for cell phones using GPS technology. Cell phones using the network technology for location (number of cell towers) has parameters of 100 meters (approx. 328 feet) 67% of the time and 300 meters (984 feet) 95% of the time. These parameters show the performance of modern GPS signals. Enhanced GPS is also utilized by Police, Courts, legal surveying, for surveillance, monitoring and legal decisions upon maps and land.

Positioning and tracking GPS systems may not use as many satellites as navigation devices and therefore do not have same performance. Navigation devices use over four satellites and may use as many as 24 to 32 satellites depending on the accuracy needed to perform their function in a reliable manner. The GPS civil community has developed into an entire industry. Integration with the Internet and cellular technology along with other innovations has extended the use of GPS into everyday occurrences. If you rent a car you will be tracked as most all car and truck rental agencies utilize GPS tracking imbedded into their units.

* This article is established to provide resources and some understanding of the basic functions and requirements of mobile communication, positioning and tracking systems utilized in transportation and commerce. It also explains that the use and needs in accident reconstruction and investigations may require review and testing of these systems for reliance upon their accuracy.

ABOUT THE AUTHOR

Robert Reed is a nationally known trucking and transportation consultant/expert that has worked with the legal community, police agencies and private industry on matters involving GPS and communication system for over 18 years. He has utilized GPS systems while employed in the transportation industry to monitor cargo, drivers and equipment and knows the practical applications, use, and performance of these systems He has performed studies and tests of these systems and can assist others that may need assistance. Any comments or questions are welcomed via rrxpert@sbcglobal.net.

REFERENCE

- US DOT Report No. FMCSA-MCRRT-06-005 – March 2006
- US DOT Report No. FMCSA-MCRRT-06-001 – August 2005
- US DOT Report No. FMCSA-MCRRT-06-002 – December 2005
- www.fmcsa.dot.gov
- www.fcc.gov
- www.ngs.noaa.gov
- Various GPS System User Manuals