What you need to know about...

GPS technology

by Marlene Orton

Applications for you

GPS (Global Positioning System) is commonly used by pilots, mariners and surveyors. Increasingly, commercial GPS technology has been adapted to large scale farming, engineering and construction particularly in pipeline and cable deployment, oil-rig positioning, mapping earthquake damage, surveying toxic waste sites, vehicle dispatch and fleet management and policing. GPS information or geospacial data is generally displayed on a map or a Geographic Information System (GIS). GIS is the software used to display the data. GPS is the means to collect the data. Marrying GPS with the Internet, cellular telephones and wireless technology is already under way. Internet-enabled systems, for example, allow data to be streamed to different IP addresses and information be transferred to other contacts by email.

What it is

The Global Positioning System is a network of 24 US military satellites that circle the globe twice a day, transmitting information to earth-based receivers. The US Defense Department de-classified the GPS system in the 1980s allowing civilian use. In May 2000, the American military also turned off Selective Availability (SA), which caused deliberately imprecise signals – a security measure to prevent military adversaries from using GPS. With military declassification, the technology took off commercially over the last decade, especially in the last two years. No subscription fees or setup charges are needed to use GPS. Early GPS-based receivers were large as freezers priced at $100,000 or more. Today GPS receivers easily fit in one hand or on a wrist band and consumer models for bikers and hikers can cost as little as $100.

Occasionally, the terms GLONASS and GPS are seen together. GLONASS is the Russian Global Orbiting Navigation Satellite System, comparable to the American system, but with 21 satellites. Use of GPS is more prevalent, developed commercially more quickly by North American industry and the technology consequently more advanced.

How it works

GPS works similar to sonar technology used medically with ultrasound and other transponder units based on triangulating information. The GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Distance measurements from several satellites allow the receiver to map a user's position based on a universal grid called the universal transverse mercator.

A GPS receiver must be locked onto at least three satellite signals to calculate latitude and longitude and track movement. With four or more satellite signals, the receiver can pick up latitude, longitude and altitude. With this information, a more sophisticated unit can calculate speed, bearing, track, trip distance, distance to destination, even sunrise and sunset time.

Differential GPS or DGPS corrects GPS signals, offering still greater precision. Both the US and Canadian Coast Guard operate with DGPS correction units, designed to overcome signal errors partly owing to the fact that earth is not a perfect sphere.

Other signal errors occur when GPS signals are reflected off large objects such as tall buildings or when dense foliage and electronic interference block reception. The more satellites a receiver can lock onto for signals, the better the accuracy.

Where to get it

The world's best known and most reliable high-end systems are made by Trimble Navigation Ltd., based in Sunnyvale, CA (**www.trimble.com**), and Thales Navigation (sounds like TAL-less) of Santa Clara, CA (**www.thalesnavigation.com**). A subsidiary of Thales is Magellan, which develops consumer GPS products. Other major developers include Garmin International Ltd., based in Kansas City, KS (**www.garmin.com**) and NovAtel, (**www.novatel.com**) founded in

1978 by the Alberta Government and now a Calgary-based public company whose majority shareholder is BAE Systems Canada Inc.

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Users say...

Some GPS receivers claim accuracy to within 15 metres on average. "The level of precision that you get in terms of your location varies depending on the level of sophistication," explains David Wilson, an environmental engineer with Jacques Whitford, a pan-Canadian company headquartered in Halifax specializing in environmental, geotechnical and risk management consulting. Major clients include the Department of National Defence.

"With very cheap and cheerful units, you won't get any better than 20 metres in terms of precisely where you are," says Wilson. "With more expensive units, you can get down to below a metre of accuracy and also the more sophisticated units come with pre-loaded maps of cities and even streets."

Additionally, highly sophisticated units can provide continuous tracking, the kind most people associate in spy films when the bad guys are followed heading up one street and down another in a getaway car.