



GPS Ireland talks about Global Navigation Satellite Systems (GNSS)

(GPS - What's New!)

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So almost everyone uses GPS in one form or another these days so you might well be interested in hearing a little more about it.

Why would your thoughts be about GPS? Well, because you are either a direct or an indirect GPS user.

You may as well want to know something about it for now and for the future. It may well help you in some decisions, perhaps money saving, and a better understanding means better use. Let's see if it is true.

If you are a surveyor or someone who needs to capture or use position related data we both can agree that GPS is there for you; it is one of the normal measuring techniques to get your job done in a very effective manner.

You could be sailing on your boat have a smartphone with GPS, use a related App or use GPS with Computer, Network or internet systems - (GPS allows computer and telecom systems to synchronize their clocks continuously)

You could be a photographer with a camera that uses the GPS to geotag your pictures

You could be a hill walker... Or a property planner checking boundaries.

If watch movies, the sound and image in films are synchronised using GPS timing...

You could be a driver obeying the traffic lights also synchronised using the same GPS time.

Or you could follow a satnav for navigation to places you want to arrive at quickly and efficiently.

You could be a farmer looking at a GPS lightbar trying to navigate along straight lines while fertilising crops, or using it for working out the size of the field you have just mowed the silage on.

All forms of transport use GPS in one way or another these days - Trains, Planes, Boats, Bikes, and Automobiles and, of course, people themselves.....

Many of us use GPS in one of these many ways;- some professional, some as consumers.

Want to know more? - Nothing too technical, I promise...

First of all, the term GPS is now more and more being replaced with the term GNSS (Global Navigation Satellite Systems - a collective term for a variety of related services).

Why? Well, because lately GPS (Global Positioning System) is not the only working Satellite Navigation system anymore. Also called NAVSTAR, GPS is a fully operational for about 17 years;- it was developed and controlled by U.S. DoD in conjunctions with the US Dept of Transport, and has a growing number of commercial users and applications day by day. However, there is another service with full operational capability; - declared just a short while ago on 8th December 2011. It is GLONASS, the Russian Global Navigation Satellite

System. And there are others... not yet in their final stage but being worked on quite intensely.

Naturally, and thankfully, today the general movement is towards international GNSS interoperability. It is nice to be in the stage where we can see more focus on cooperation allowing technology to bring us closer together and move forward much more effectively. This is opening so many opportunities and growth for developers as well as end users.

What should we know about the two;- Navstar GPS and GLONASS?

Any GPS/GNSS receiver is designed to receive a signal from (at the moment 30-32) Navstar GPS satellites.

GNSS receivers allow the use of both GPS and GLONASS simultaneously. GLONASS has 24 satellites in orbit available for position calculation and significantly improves position fix and accuracy especially in areas challenging for the signal reception (e.g. narrow streets in built up areas, places with overhanging trees, areas with high multipath - shiny surfaces causing reflection of the signal). Meaning if you have GNSS receiver you are on the top of the game for now.

Also with NAVSTAR GPS modernisation is working full power ahead. The process of fielding three new civilian signals L2C, L5, and L1C is in place. Full value and capability of all these signals will be gained when they are broadcast from more than 17 satellites which should happen before 2020, with L2C signal planned to be available on all 24 satellites by 2016.

Getting these signals out there requires launching new satellites to replace older ones. As you may have guessed, it takes a lot of time and even more money.

In general, NAVSTAR GPS modernisation will provide reduced vulnerability to interference, resistance to hostile jamming and

improvements to accuracy and integrity; it will introduce new capabilities to meet the higher demands of military and civilian users as well as support civil aviation and other applications.

What about Galileo and Beidou?

The European global positioning system called Galileo fell well behind its plan of being fully up and running by 2008 with 30 satellites in orbit. However, the plans for completion of the system remain reasonably solid and European Commission guarantees financing and governing the Galileo and EGNOS development until 2020.

There are just 2 Galileo Satellites in space at the moment.

The European Commission is looking to complete the 30-satellite constellation by the year 2019, with two scheduled to launch during every quarter, beginning this year.

Aside from funding difficulties over the last couple of years Galileo also had to face two actions at the European Court of Justice against a US company called Galileo International Technology over its name. The US company lost both times.

It may be too early to tell when and how widely Galileo's signals will be made available to the general public in the end but the intention is good even though the justification may be hard to agree.

Receivers compatible with GLONASS manufactured for survey industry are now widely available and commercial products and applications are emerging. For instance the iPhone 4S comes with both GPS and GLONASS capabilities. Samsung High Fidelity Position app offers similar compatibility. Nokia is working with GLONASS and they are also planning to include Galileo satellites into their system if it will enhance the user experience.

EGNOS (European Geostationary Navigation Overlay Service), part of the Galileo system, augments the two satellite navigation systems now operating;- the US Navstar GPS and Russian GLONASS systems. It makes them suitable for safety critical applications such as flying aircraft or navigating ships through narrow channels. EGNOS also improves accuracy on any GPS/GNSS receiver used in European territory, if available but it is a line of sight service. Make sure to enable EGNOS in the settings on your unit if you want to receive its correction signal. In general, the accuracy of any receiver can be improved to 1-3metres with EGNOS if a suitable correction bearing satellite is in sight. This can be very beneficial for basic handheld GPS users if trying to maximise accuracy for basic data capture.

Please remember GPS/GNSS positioning doesn't work indoors. In general, it doesn't but there are some smart technologies changing this fact and allowing position determination further inside. The GPS signal cannot penetrate inside as it is blocked by any dense material. However, as you have surely noticed some material like glass or plastic is not a problem. You can see your satnav working in the car; it would pickup the signal even if it was in your glove compartment. Just make sure that if you are renting a car the front window is not tinted with metallic or reflective (anechoic) film - the GPS in your satnav would not like that very much.

Threats to Satellite Positioning

Space weather events have a huge influence on GNSS performance and are of a particular concern. In particular, explosions on the face of the sun (sun spot or solar flare activity) cause errors with Satellite positioning as a result of interfering with the signal.

This should be something to remember if your position changes suddenly on the display of GPS by an unexpected amount. And you should be very conscious of this if you are a surveyor, and even more if

working on a project somewhere near the equator where its effects are worst felt.

Solar activity is cyclical, peaking approximately every 11 years. The next solar peak is predicted to occur in 2013. During these periods of activity, accuracy of position calculation as well as GNSS equipment performance can be significantly degraded. Worst affected areas are near equator and also close to the north and south poles.

Solar eruptions causing GNSS signal delays and therefore errors in position calculation on the ground are a concern mostly because of their random nature.

What can you do in the case of extreme solar eruptions? Nothing much;- just be aware. Therefore, build more error and quality checks into your use of GPS/GNSS and don't assume the accuracy is the same location to location and day to day because it will not be!

What other threats are there to GNSS? Well of course there is always Governments running out of money to keep satellites update. That happened to Galileo before it was ever built, but there has been much discussion about the US Government's intentions and the US Air Force's ability to keep NAVSTAR GPS up to date. For everyday users, looking for 10/15m accuracy, this is never really going to be a concern but for those using only GPS looking for survey grade accuracies then keeping the system up to date and operational may always be a concern. However when coupled with GLONASS and/or others this will be less of a concern.

Right now as I write the biggest concern is this thing called Light Squared;- an attempt to build an Internet broadband service using Satellites. Great idea but guess what - the frequency bands to be used are very close to those used for GPS and tests so far have shown it to be a significant threat to the GPS signal. Already there are moves to adjust Light squared but as usual nothing is ever straight forward!

However, I think GPS will win out in the end and Light squared will be developed so it does not interfere with GPS - why? - Well in the first instance because of the billions of tax dollars that GPS earns for Uncle Sam and secondly because GPS, whilst guaranteed available for civilian use, is still major military asset and a very important one too!! Let's see how this pans out over the next few months.

Hopefully this little background into what is happening in the Satellite Navigation front will be of interest to you. Next Month (March 2012) - the benefits and drawbacks of VRS services....