Satellites All over the Place

GNSS update

In the last few months progress has been made in the development of satellites for all major GNSS. Planning, however, is still the major problem. With Galileo, the problems are still financial; with GPS and Glonass the problem lies with the built quality of the satellites. With GPS the satellites last too long, whereas with Glonass they don't last long enough.

By: Huibert-Jan Lekkerkerk

Galileo

Funding

After some discussion the EC (European Commission) has decided that the remaining 2.4 billion euros for Galileo has to come from public funds. There is an agreement for 300 million euros to come out of the EU research budget. For the remaining amount the EC wants to use unspent farm subsidies. The member states are divided over this, although all have stated in a joint resolution that development of Galileo should continue.

Giove-A

The test campaign using the first test satellite, Giove-A, has been completed. Analyses of the transmitted signals have resulted in adjustments to the spacecraft's signal generation unit. As a result Giove-A will transmit optimized signals until its expected end of service life in March 2008.

Giove-B

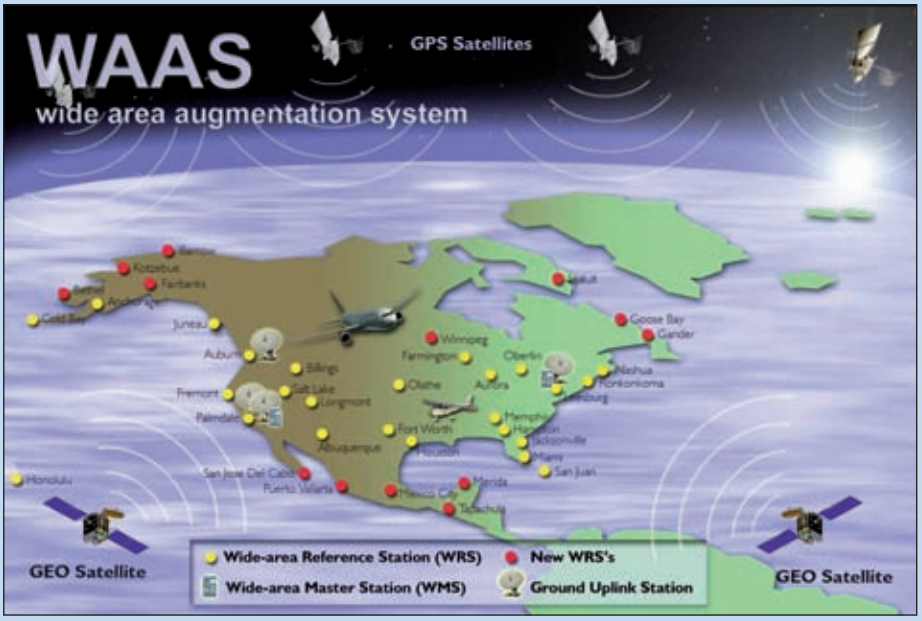
Giove-B, the second test satellite, was shipped to Noordwijk for extensive testing in early September 2007. After completion of the tests it will be transported to Baikonur, Kazakhstan for launch on a Soyuz-Fregat rocket. The launch was scheduled for the end of 2007 but has been postponed to March 2008 due to problems with the rocket. If it is not launched before Giove-A shuts down, Galileo runs the risk of losing its claim on the Galileo signal frequencies with the International Telecommunications Union (ITU).

Operational satellites

In 2009, the first two satellites of the operational Galileo constellation should be launched, followed in 2010 by the next two operational satellites. They will be used for in-orbit verification of the Galileo system before being joined by the 26 additional spacecraft required for full operations by the end of 2013.

GPS-Galileo Common Civil Signal

Europe and the USA have reached an agreement to use an interoperable signal on the L1C (GPS) and L1F (Galileo) frequency band. The signal will use the MBOC modulation technique. Introduction for GPS is expected to be on the GPS III blocks of satellites, while Galileo will employ the signal in the Galileo Open Service on all operational satellites.



Extension of the WAAS network to Mexico and Canada (source: www.nstb.tc.faa.gov)

GPS

IIF almost ready

The first of 12 GPS Block IIF satellites, which will offer an extended design life of 12 years and a new civil signal on the L5 frequency (1176.45MHz), is expected to be launched sometime in 2008. The L1-L2-L5 signal combination enables high accuracy 'tri-lane' phase navigation.

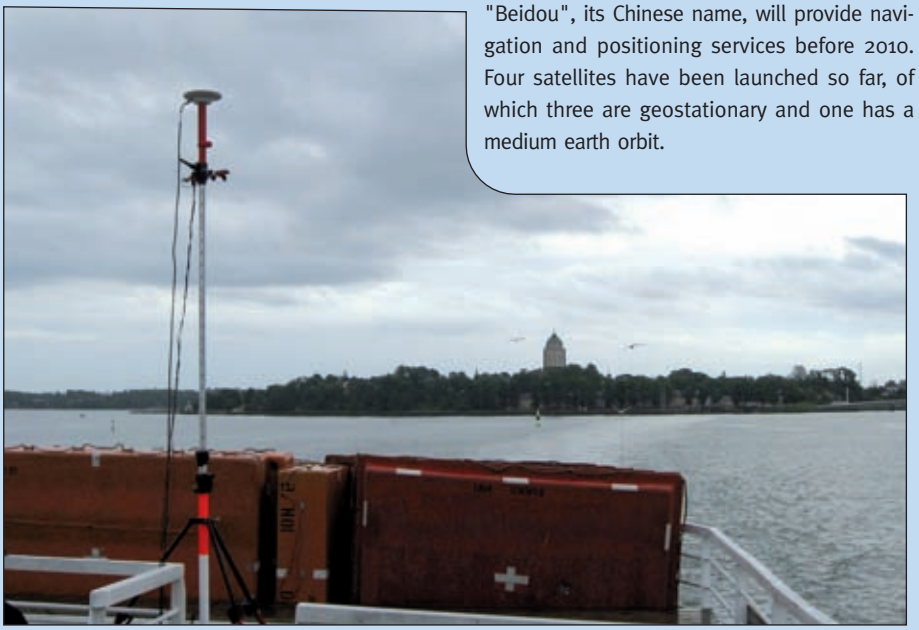
IIR-M test bed

The first of the Block II-R satellites, built by Lockheed Martin, has surpassed its design life of 10 years. Of the 21 Block II-R satellites built, the final 8 were designated as Block IIR-M. There are currently three IIR-M spacecraft on-orbit with the fourth scheduled for launch in late 2007. The remaining four IIR-M satellites are available for launch to replace broken-down satellites in the current constellation.

The IIR-M satellite to be launched is currently being reconfigured to transmit the L5 signal, the signal that will be included in the Block IIF satellites. It is possible that this test bed will be launched for signal testing or that the USA will want to claim the L5 frequency with the ITU as Galileo did with its frequencies using Giove-A. If the latter is the case then the launch of Block IIF may be delayed.

Selective Availability

The next generation of GPS satellites, GPS III, will no longer have SA (Selective Availability). In May 2000 the use of SA was stopped on the current satellites although the option to switch it on is still available. By eliminating this possibility in the next generation of satellites, the US has removed one uncertainty over GPS performance that has been a major concern to all civil GPS users.



Pseudolite station in Helsinki Harbor (source: www.esa.int)

Block IIIA

The launch of the first of eight IIIA satellites is to take place in 2013. In total a further eight GPS IIIB and sixteen GPS IIIC satellites are planned. One of the reasons for the delay of the Block III satellites is that all current satellites are lasting significantly longer than expected. Another reason may be the slowdown of the Galileo program, creating less political pressure on the development of GPS III. GPS III will have the capability of transmitting M-code, the enhanced military code.

GLONASS

Satellites and funding

Glonass has been allocated a total of 134 million euros for 2006 and 280 million euros for 2007. The system is scheduled to become operational in 2008. However, the system continues to be plagued by failing satellites. In early October only nine satellites were operational, with an additional one to become operational later this year and three temporarily switched off.

Change of geodetic system

Glonass has made the change to ITRS (International Terrestrial Reference System). Earlier the system used a geodetic system designed for the former USSR. This new version of the PZ-90 reference system is interoperable with the WGS84 system used by GPS and the ETRS89 system to be used by Galileo.

Beidou

China has reportedly started using Beidou for monitoring the transportation of dangerous chemicals. The system, in contrast to other GNSS, transmits data from the ground back to a control station via a satellite link. Current planning shows that the system, known as CNSS (Compass Navigation Satellite System) or "Beidou", its Chinese name, will provide navigation and positioning services before 2010. Four satellites have been launched so far, of which three are geostationary and one has a medium earth orbit.

IRNSS

India plans to build its own GNSS called IRNSS (Indian Region Navigation Satellite System) using a constellation of three geostationary and four geosynchronous satellites at a cost of 290 million euros. The first launch should take place around 2010 with a complete constellation being available in 2012. The satellites are expected to be launched by home-built PSLV (Polar Satellite Launch Vehicle).

EGNOS

Pseudolites

In June a test with pseudolites (earthbound satellite-like navigation transmitters) was performed in Finland's Helsinki Harbor. Regular coverage for both GPS and Egnos is poor in northern latitudes. With the use of pseudolites, the navigation solution reportedly had a precision compatible to that of GPS and Egnos.

Helicopter Trials

Trials using Egnos for helicopter landings in Lausanne, Switzerland have been successful. Using a steeper descent than usual, helicopters made various Egnos-assisted landings. The use of vertical guidance allows the pilot to remain longer at a higher altitude, thus circumventing adverse weather conditions.

Africa

ESA has signed an agreement with the African and Madagascan air authorities for the use of Egnos over the African continent. The extension of Egnos to Africa involves the installation of reference stations on African soil. Egnos transmissions already cover both Africa and Europe.

WAAS

Mexico and Canada

The WAAS network has been extended to Canada and Mexico with the integration of nine new reference stations into the network. The expansion also benefits US users with more accurate corrections around the former fringes of the WAAS coverage.

Satellites

WAAS has stopped using the AOR-W (PRN 122) and POR (PRN 134) satellite as of July 2007. In the same month the Telesat geostationary satellite (PRN 138) became active, giving better coverage over the US and northeastern Canada.

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