Contracts and Promising Test

Updates Galileo, EGNOS, Glonass and GPS

A lot of effort is being put in the development of Global Satellite Navigation Systems (GNSS). First of all there is the European Geostationary Navigation Overlay System (Egnos), a differential GPS or Space Based Augmentation System (SBAS) based upon geo-stationary satellites. Furthermore Galileo is under full development as a European counterpart to GPS. Finally the development of Glonass and GPS is continuing. This article describes the current state of GNSS. In the future you will find regular updates in this magazine concerning GNSS.

By Huibert-Jan Lekkerkerk

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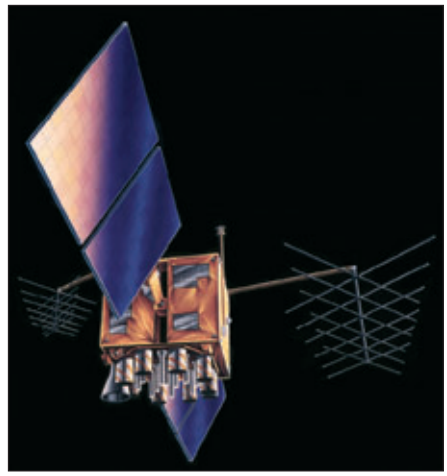
Egnos

When discussing Egnos, we need to discriminate between Egnos itself and the Egnos System Test Bed (ESTB). The latter has been transmitting test signals for quite some time now, allowing manufacturers to develop Egnos compatible products. Furthermore the ESTB is used by ESA for testing the Egnos performance. The ESTB signals are currently broadcasted via the Inmarsat satellite AOR-E at PRN 120. These signals are also available from the Internet via SISNet. In the future Egnos signals will become available via SISNet as well.

On 28 July 2005 Egnos was officially declared operational by the ESA. This however does not mean that the system can be used broadly. According to planning, the system will provide a fully operational, open service in the first quarter of 2006. The corresponding Egnos version is 2.1, which will also support the standard SBAS message type 0/2. All WAAS compatible receivers, making Egnos available to a larger number of receivers, can decode this message. The first test results of Egnos are promising, with ESA having measured a precision of 1 meter.



Artist impression GPS Block IIR-M (source: www.wslfweb.org).

Currently Egnos signals are broadcasted via the Artemis satellite (PRN 124) and the Inmarsat satellite IOR-W (PRN 126).

Galileo: GIOVE-A

The first Galileo satellite, GIOVE-A, was launched on the 28th of December at 06:19 CET from Baikonur, Kazakhstan. After a successful flight GIOVE-A separated from the Soyuz rocket at 10:01 CET on the same day. GIOVE-A proceeded to the start-up procedure, which was completed faster than expected. At the moment the satellite, which was built by the British firm Surrey Satellite Technology Ltd, is fully operational and broadcasting Galileo signals.

By launching GIOVE-A, the Galileo project has secured the frequencies claimed earlier with the International Telecommunications Union (ITU). GIOVE-A will be used for testing new technologies and surveying the radio environment in the medium altitude satellite orbit.

Positioning Signals

GIOVE-A has been equipped with Rubidium atomic clocks. These clocks will eventually, together with a mother clock, perform the timing of positioning signals. The precision of the Rubidium clocks tested in GIOVE-A is in the order of 10 nanoseconds per day. The clocks in the operational Galileo satellites will have a precision of 1.9 nanoseconds per 12 hours, or 3.6 seconds per day. The expected life time of the GIOVE-A satellite is 2 years.

The mother clock, which is not available in GIOVE-A, will have a precision of 0.45 nanoseconds per 12 hours. This calculates to a

Results

probable error of 1 second per 1.6 million years. This mother clock, which operates on the principle of the excitation of hydrogen atoms, will be tested on board GIOVE-B. The launch of GIOVE-B is planned later on in 2006.

Contracts

Furthermore two important Galileo contracts were awarded in December 2005:

- EADS Astrium awarded a € 6 million contract to LogicaCMG for the development of the operating system of the GPS constellation;

- The Canadian government awarded the second contract of USD 500,000 to Novatel for the development of a Galileo Safety of Life services receiver.

Glonass-M

On christmas day 2005 three Glonass satellites were also launched from Baikonur using a Proton-K rocket. These satellites were put into orbital plane 3 but are not active at the moment. As soon as these are active the Glonass constellation will consist of 13 satellites. Of the new satellites two are of the improved type (Glonass-M) and one is of the old type. The expected life time of the improved type of satellite is 7 years. This in contrast with the average life time of the current (old) type which is 3 years. According to Russian sources the expectation is that the Glonass constellation will consist of 18 satellites in 2007. However, due to the short life time of the old type of satellites a constant series of launches will have to take place to replace unusable satellites. Out of 13 satellites currently active, three satellites have an age of over 3 years. Furthermore there are satellites that have been in operation for almost 3 years.

GPS-Block IIR-M

In september 2005 the first Block IIR-M GPS satellite was launched from Cape Canaveral using a Delta rocket. This launch was originally set for December 2004 but had been postponed several times. This launch was the first of a series of eight with the possibility to transmit the C/A code in the L2 frequency band, also called the L2C code. Furthermore these satellites broadcast an improved military code, the M-code, on both the L1 and L2 frequency bands. It is expected that from 2007 onward the Block IIF generation will be launched. This generation will not only transmit the L2C and M code, but will also transmit signals in the L5 frequency band.

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