



1 Background

The United States and Russia provide the two global satellite navigation systems currently available: GPS and GLONASS. A third system, Galileo, being built and operated in Europe, is due to come on-line in 2013/2014. The three systems will be fully interoperable, which means that users will be able to determine a position by picking up signals from any combination of satellites belonging to any of the three systems.

The first navigation satellite was launched in 1978 and was the forerunner of the US **GPS** system, which was originally developed for the US Department of Defense. The GPS system is presently operated from the Shriever Air Force Base in Colorado.

The first satellite in the Russian **GLONASS** system was launched in 1982. Following the dissolution of the Soviet Union, the operational capabilities of the GLONASS system degraded due to lack of funding. The system is now in the process of being restored to full functionality. GLONASS is operated from a system control centre near Moscow.

Europe's approach to Global Navigation Satellite Systems (GNSS) has begun with the European Geostationary Navigation Overlay Service (**EGNOS**). EGNOS is the first pan-European satellite navigation system. It augments the US GPS satellite navigation system and



makes it suitable for safety critical applications such as flying aircraft or navigating ships through narrow channels.

EGNOS is a joint project of the European Space Agency (ESA), the European Commission and Eurocontrol, the European Organisation for the Safety of Air Navigation, which was started in the mid-1990s as GNSS-1, as a counterpart to GPS. After first successful test signals in 2003, the regular signal has been available since 2006. After the successful completion of its development, ownership of EGNOS was transferred to the European Commission on 1 April 2009. **EGNOS operations are now managed by the European Commission** through a contract with an operator based in France, the European Satellite Services Provider. EGNOS Open Service has now passed certification for aviation and has been **available since 1 October 2009**.

EGNOS positioning data are freely available in Europe through satellite signals to anyone equipped with an EGNOS-enabled GNSS receiver. Consisting of three geostationary satellites and a network of ground stations, EGNOS functions by transmitting a signal containing information on the reliability and accuracy of the positioning signals sent out by GPS. It allows users in Europe and beyond to determine their position to within 1.5 metres. EGNOS Certification is now being managed by the European Commission, who has announced that both Safety of Life and Commercial services are expected to be operational in 2010.¹

EGNOS is a precursor to **Galileo**, the full global satellite navigation system under development in Europe. Galileo is a joint initiative between ESA and the European Commission. When fully deployed, Galileo will be the **first civilian positioning system to offer global coverage**. It will be Europe's own global navigation satellite system, providing a highly accurate, guaranteed global positioning service under civilian control. It will be **inter-operable with GPS and GLONASS**, the two other global satellite navigation systems.

A user will be able to fix a position with the same receiver from any of the satellites in any combination. By offering dual frequencies as standard, however, Galileo will deliver **real-time positioning accuracy down to the metre range**, which is unprecedented for a publicly available system. It will guarantee **availability of the service under all but the most extreme circumstances** and will inform users within seconds of a failure of any satellite. This will make it suitable for applications where safety is crucial, such as running trains, guiding cars and landing aircraft.

The first experimental satellite, GIOVE-A (Galileo In-Orbit Validation Element A), was launched on 28 December 2005. The fully deployed Galileo system consists of **30 satellites** (27 operational + 3 active spares). Once this is achieved, the Galileo navigation signals will

¹ http://www.esa.int/esaNA/GGG63950NDC_egnos_0.html



provide good coverage even at latitudes up to 75 degrees north, which corresponds to the North Cape, and beyond. The large number of satellites, together with the optimisation of the constellation and the availability of the three active spare satellites, will ensure that the loss of one satellite has no discernible effect on the user.

Over the next years, **six satellites will be launched** and, with these **in the orbit, the GNSS will be able to fully function and provide the same services as GPS**. The six satellites will be launched consecutively at three points of time: the first two in **mid-November 2010**, two more in **2011**, and two additional ones in **2012**. In 2013/2014, the system will be fully operational, with all 27 (plus three) satellites. The launch of the first two satellites marks a milestone for the Galileo project as it represents a tangible success and major step towards the final system after a long period of uncertainty for the project.

Galileo will allow positions to be determined accurately for most places on Earth, even in high-rise cities where buildings obscure signals from satellites low on the horizon. This is because the number of satellites available from which to take a position is more than doubled. By placing satellites in orbits at a greater inclination to the equatorial plane than GPS, Galileo will achieve better coverage at high latitudes. This will make it **particularly suitable for operation over northern Europe, an area not well covered by GPS**.

With Galileo, Europe will be able to exploit the opportunities provided by satellite navigation to the fullest extent. **GNSS receiver and equipment manufacturers, application providers and service operators will benefit from novel business opportunities.**²

Early this year, on 7th January 2010, the European Commission announced the award of three of the six contracts for the procurement of Galileo's initial operational capability. **ThalesAleniaSpace of Italy** has been awarded the contract for system support services. **OHB System AG of Germany** has been awarded the contract for the order of the first 14 Galileo satellites, while the contract for launch services went to **Arianespace of France**. The contracts will allow Galileo to be launched early in 2014 along with three of the five services to be provided through the global navigation satellite system (GNSS): the **Open Service**, the **Public Regulated Service** and the **Search And Rescue Service**. The **Safety-of-Life Service** and the **Commercial Service** will be tested as of 2014 and will be provided as Galileo reaches full operational capability with the 30 satellites.

² http://www.esa.int/esaNA/GGGMX650NDC_galileo_0.html