

Galileo

An ocean of possibilities



At the end of this decade all users of positioning data will be given unbounded access to satellite-based navigation systems controlled by civilians. With the introduction of the European Galileo, the United States will no longer hold their present monopoly of delivering satellite data for positioning tasks, and this system will possibly for the whole future ensure unbounded access to accurate navigation data. When GPS was introduced it was a very advanced and epoch-making system, but only a step in the evolution. The system has several weak points, however, it has demonstrated developing possibilities in accuracy, coverage, and security in disturbance as well as time indication accuracy. The developing of Galileo has focused on these issues, and it will be a new type of generation satellite navigation system.

Increasing applicability, new applications.

Positioning has a steady increasing market growth in step with better applicability and decreasing costs for the necessary equipment. At ground level it can be used for traffic monitoring, control and management. Additionally, emergency vehicles can be provided with accurate positions of and the fastest way to the place of accident. Transport agencies, independent of whether they are road- or railways based, will always know the whereabouts of the vehicles, thus the best way to the recipient.

For the shipping business, safe navigation is a total must. The combination of satellite based signals and electronic chart navigation will be safe also in

high speeds and in difficult fairways. And, like for ground-based transport the tractability of goods is possible. For offshore operations, with regards to oil prospecting and production, positioning has been and will be a key to success, especially in terms of placing drilling rigs, drilling holes, production platforms, oil pipes at the sea bottom, or with operations at the sea surface.

The greatest potentials for a very accurate and reliable navigation system have been made possible within the airport management. The very critical operations are now based on different types of ground-based systems. With a nearly one hundred percent reliable satellite system, the management can be both more effective and cheaper.

In addition to the large application fields, it is worth mentioning all the possibilities for use within building projects, agriculture, forestry etc., and at last, the very large mass market for the general public.

Not well supported of all

The development of the Galileo system has at times had a strong political over-tone. It is not a secret that the U.S. officials do not support a nearly similar but competing navigation system. Their active counteracts, in addition to European hesitation have on several occasions almost destroyed the project, and even at present some doubt the project will ever become operative.

However, one hopes, and it is still highly probable that the system will be built. Some of the positive factors are listed below. The negative factors lay mainly in the fact that a similar system for free



Airport management seriously needs accurate and reliable positioning data, and it is probably in this field the Galileo's very high accuracy and reliability will have the largest market.



The mass market comprises among others equipment to boats, cars, pedestrians, and like here, hunters.



Harbour management is likely one of the fields where accurate positioning will provide improved service. Here from the little and well-functioned harbour Svolveær, but the large benefit will come from the large international harbours. The Norwegian Coastal Express, here in harbour, are depends on all forms of satellite data for safe travels between the many islands and rock awash, in all types of weather.



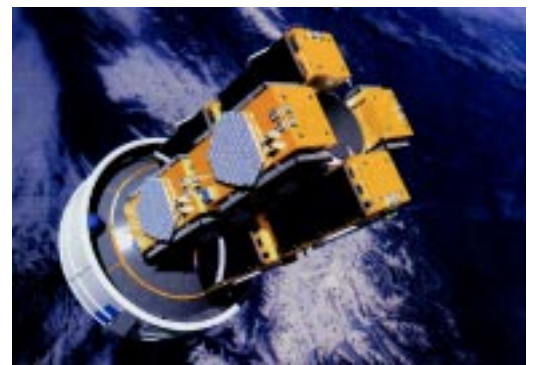
Ground based transport is one of the fields that applies positioning based on satellite, something which is increasing, both for cars and cargo.

use does exist, and the high developing and building costs for the system. Also, the expressed doubt whether Galileo ever will become commercially profitable. But the positive factors are far weightier.

How are advantages in preference to the American Global Positioning System (GPS)?

- Firstly the system's civilian control. A system under one nation, and in addition under military control, will never be a reliable system for the users.
- GPS is based on 24 satellites, while Galileo will have 30 satellites in orbit. That will give greater availability, especially in cities and hilly terrain. In addition, the system is adjusted to higher accuracy at high latitudes.
- Galileo has been given three more civilian frequencies than GPS and that gives more accurate positioning and better security in terms of disturbance. The safety to deliberate or unintentional disturbance will be much better with better technique and broader frequency bands. The clock and time indication has also been further developed and the satellites will have the last upgraded system onboard, in addition it will be given possibilities for further upgrading if necessary.
- The satellites are equipped with some new services that will increase the usefulness. That is diagnosis for the satellites combined in the navigation signals, equipment for search and rescue services, various paying services etc.
 - The system uses the latest developed technology. GPS is based on technology developed in the seventies and the eighties, and since then the technology has improved greatly.
 - Galileo, operational from 2008, will come at the right time, because the introduction of the next generation of GPS, GPS-3, is delayed until 2015. Galileo will therefore establish its service before the new American system, and can take valuable shares of the market.

- In spite of the fact they are competing systems, they can join forces, and the combination of GPS and Galileo gives nearly 60 satellites in orbit and signals on 5-6 frequencies, a very winning combination.
- Unlike GPS, where signals are free for the users, but without guarantees for accuracy or function, Galileo will offer some services for which users will pay a subscription fee. In return, Galileo will furnish legally binding service-quality guarantees, meaning that Galileo managers are liable for any inaccuracies in the satellites' navigation or timing information that result in losses for users.



The satellite geometry has been designed for launch of multiple satellites

Facts about Galileo.

Galileo will be built around the same principle as GPS, but with some adjustments to better the availability and accuracy and application of the latest of new technology. The satellite segment comprises of 30 satellites (27 operational and three active spares) placed in an altitude of 23 616 kilometre in three orbital planes with an inclination of 56 degrees to equator.

The Galileo satellites are of the medium-size class, weighing some 650 kg in final orbit and generating some 1500-Watt electrical power. The satellite geometry has been designed for launch of multiple satellites with Ariane 5 or similar launcher. The satellite body around its earth-pointing (yaw) axis allows the solar arrays to rotate and point directly towards the sun. ESA has initiated a number of technology development activities to guarantee availability of critical on-board equipment for Galileo. This equipment includes the main elements of the Galileo satellite navigation payload, the two satellite clocks, and several units connected to the main tasks for the satellites and to management. In addition, several new types of technology applications have been, and will be developed, for the Galileo ground segments.

The ground segment for Galileo gets an extended version of the already developed EGNOS Ground Segment. That is a very comprehensive system, and will require construction on several dozen dedicated ground stations to communicate with the satellite constellation. The ground segment will in all likelihood consist of:

- Two telemetry, tracking, and control stations to monitor the satellite constellation.
- Between 18 and 20 reliability and integrity stations to assure the signals' accuracy.
- A number of stations to collect information from the atomic clocks onboard.
- A Galileo control centre, with backup, to provide the codes needed to encrypt Galileo data that is limited to specific users.
- A security office, responsible for management of the different categories to access to Galileo satellites.

The Galileo programme comprises the following phases:

- The development and validation phase (2001 – 2005).
- Development of the satellites and ground-based components.
- Launch of the first experimental satellite late in 2004.
- Four operational satellites launched in 2005 – 2006 for validation of space and ground segment.
- Validation of the system “in orbit”.
- The deployment Phase (2006 – 2007).
- Construction and launch of the remaining satellites.
- Installation of the complete ground segment.
- The commercial operation phase (from 2008).

EGNOS

EGNOS is Europe's first step into the satellite navigation market. It will use signals from the military GPS and Glonass, and make them suitable for safe critical applications such as flying aircraft and navigation ships in narrow channels. Consisting of three geostationary satellites and a network of Ground stations, EGNOS will achieve its aim by transmitting a signal containing information on the reliability and accuracy of the positioning signals sent out by GPS and GLONASS. It will allow users in Europe and beyond to determine their position within 5 m compared to about 20 m at present.

The system will be fully operational in 2004. In the meantime, a test signal broadcast by two Inmarsat satellites, allows potential users to test and use the service already now.

