

Brussels, 21 October 2011

Galileo will boost economy and make life of citizens easier

A Must have for Europe

"If Europe really wants to be considered as a serious partner by the United States and keep control of essential functions for its economic development, it must demonstrate that it has the willingness and the means to be present in Space. Galileo is a key test case for the European Union in that respect."

Carl Bildt, ex Prime Minister for Sweden, 2001

"Galileo is of strategic importance for the independence of the European Union regarding satellite navigation and will offer a relevant contribution to the implementation of the Europe 2020 strategy for growth. It will significantly contribute to the economic recovery of Europe and address major challenges such as sustainable transport"

Antonio Tajani, European Commission Vice-President, responsible for enterprise and industry policy, 2011

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What is Galileo?

Galileo will allow the users to know their exact position in time and space, just like GPS, but with greater precision and reliability. Galileo is the Programme of the European Commission to develop a global satellite navigation system under European civilian control. It will be compatible and, for some of its services, interoperable with the American GPS and Glonass (Russia), but independent from them.

Galileo makes life easier for citizen and economy

Europe needs Galileo to be independent in a sector that has become critical for its economy and for the well-being of its citizens. The positioning and the timing signals provided by satellite navigation systems are used in many areas of the economy, including power grid synchronization, electronic trading and mobile phone networks, effective road, sea and air traffic management, in-car navigation, search and rescue service. Thus, it is estimated that already 6-7% of Europe's GDP, or €800 billion, relies on satellite navigation applications. These are among the strong benefits of Galileo:

- **Higher precision.** In a combined GPS-Galileo use, compared to GPS alone, the higher number of satellites available to the user will offer higher precision which will allow positions to be determined up to within a few centimeters.
- The number of satellites in view will grow dramatically and **become fully independent** in the case of failure to either GPS or Galileo.
- The higher number of satellites will also improve **the signals** in high-rise cities as well as in mountain regions, where buildings/hills can obstruct signals from satellites that are low on the horizon.
- Galileo will also provide a better coverage at **high latitudes than GPS**, thanks to the location and inclination of the satellites. This will be particularly interesting for northern Europe.
- **Signal for European enterprises.** By capturing the signals for testing purpose on which to base their innovative applications European industry can use the improved signal for the development of new navigation services (see example below).
- **Economic advantages:** The global annual market for navigation satellite products and services is currently valued at **124 billion Euros** (see next paragraph).
- In **moments of crisis** a special service will protect the functioning of management of critical transport and emergency services, police work and border control via its highly robust encrypted signals. It will ensure **greater protection** against spoofing and jamming.
- **Galileo will guide aircraft:** it can offer a cheaper and more efficient alternative for civil aviation users improving air traffic management, reduction of fuel consumption and safer landings.

Example: Improved mobility for elderly

A company in Graz (Austria) is developing enhanced GPS systems to improve mobility and self determination of the elderly. With the outstanding improvement of the Galileo/GPS signal the elderly can be better guided home for example when get lost in cities. The existing GPS-only receiver chipset will be replaced by an innovative miniaturised GPS/EGNOS/Galileo chipset supporting a tailored acquisition aiding functionality. The chip will be based on a 3-frequency GALILEO/EGNOS/GPS satellite navigation receiver concept. The manager of the company said: "With Galileo Europe becomes independent in using basic GPS applications, which together with Galileo can achieve considerably enhanced applications. These achievements would not have been possible with one single system".

€124 bn market value to increase to €244 bn by 2020

The global annual market for global navigation satellite products and services is currently valued at **124 billion Euros** and is expected to grow over the next decade, leading to an estimated market size of **€244 billion** in 2020.

Like the Internet, a global navigation satellite system is a service enabler rather than a standalone service. It acts as a catalyst for economic activities, leading to the creation of added value and jobs in a wide range of connected sectors (upstream and downstream markets) and at macroeconomic level through socio-economic benefits for society as a whole.

The expected **benefits of Galileo** and EGNOS can be divided into three main components:

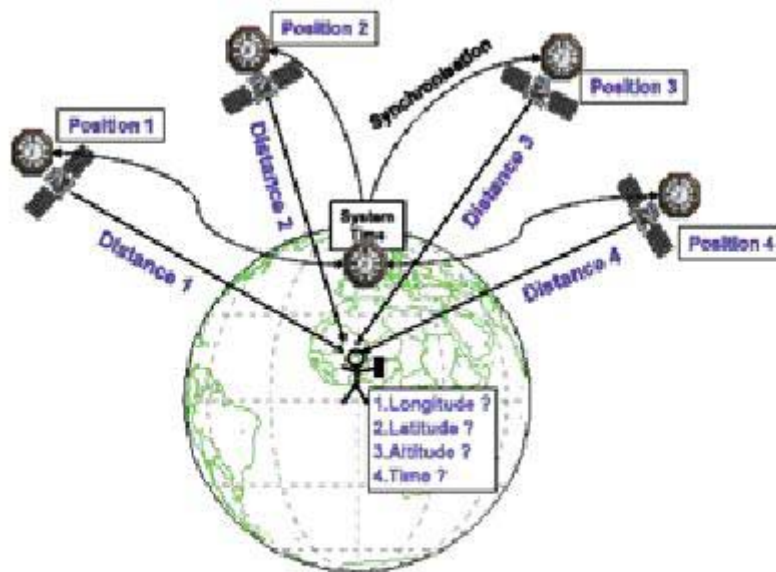
- Thanks to global navigation satellite systems (GNSS), **new business opportunities are developing**. Innovative uses of satellite navigation are emerging, such as advanced driver assistance systems, assistance for the elderly and the blind, fleet management and road user charging (tolls). Most of these applications will only become possible with the increased precision of Galileo. The cumulative direct benefits emanating from the GNSS downstream market are estimated to amount to €14 billion over the next 20 years.
- Thanks to new applications made possible by Galileo, businesses will benefit from **more efficient production processes**. For example, **agriculture** will realize increased crop productivity through more accurate seeding and spraying of fertilizers which in turn helps protect the environment and can lead to increased food production.
- **All sectors of the economy** will gain from increased speed of delivery of goods to customers with a reduced impact on the environment as well as greater safety for road users.
- **Investment in the development of Galileo** supports hundreds of European companies ranging from multi-billion-euro conglomerates to specialized SMEs. Most of the funds spent on the Galileo and EGNOS programmes flow directly into the European economy.

In addition, the **technological advances** that come about as a result of Research & Development investment in the space industry are transferred to firms in other sectors in the form of '**spill-over**' effects. Research by Oxford Economics¹ suggests that such spill-over effects are very large, with R&D investment by the aerospace sector generating a social return of around 70% - i.e. every €100 million invested in R&D leads to an increase in GDP of €70 million in the longer term in other sectors (e.g. health and medicine, transport, computer science).

The overall economic impact is estimated to be around 90 billion euro over the next 20 years (source GSA studies Market Monitoring and Forecasting).

¹ The Case for Space: The Impact of Space Derived Services and Data (*July 2009*)

System architecture is based on 30 satellites



The system that is being deployed under the Galileo Programme will be composed of 30 satellites in medium Earth orbit on three planes inclined at 56° to the equator at 23 616 km altitude. Ten satellites will be spread evenly around each plane, with each taking about 14 hours to orbit the Earth. Each plane will have one active spare, able to cover for any failed satellite in that plane. A global network of sensor stations will receive information from the Galileo satellites and send that information to control centres located in Europe. The control centres will compute integrity information and synchronise the time signal of the satellites, relaying those information back to the satellites via a global network of about fifteen up-link stations. Finally, the satellites will send the relevant timing and integrity information to the receivers.

What is satellite navigation?

Satellite navigation is based on the principle of **triangulation**: I can calculate my exact position if I know my exact distance to three points of which the exact position is known. In order to know my exact distance to those three points, the most accurate way is to see how much time it takes to get a signal from those points, knowing that the signal travels at the speed of light (approximately 300.000 kilometres per second).

EGNOS the European Geostationary Navigation Overlay Service

Already since 1st of October 2009 Europeans benefit from improved GPS signals in Europe provided by EGNOS, the European Geostationary Navigation Overlay Service. EGNOS comprises just three satellites including more than 40 ground stations, and acts as an enhancement to the US-based GPS system for safety critical applications in aviation and marine environments. It provides freely available positioning data throughout Europe to any EGNOS-enabled GPS receiver.

Among the ground stations 34 are ranging and integrity monitoring stations (RIMS) receiving signals from the US GPS satellites; there are four mission control centres to handle data processing and differential corrections counting; and there are six navigation land earth stations that manage accuracy and reliability data for sending to the three satellite transponders for relay to end-user devices.

EGNOS is hosted by the European Space Agency, the European Commission and Eurocontrol and is the first pan-European satellite navigation system. Similar services are provided in North America by the Wide Area Augmentation System (WAAS), and in Japan by the Multifunctional Satellite Augmentation System (MSAS).

What has been achieved until now by the Galileo and EGNOS Programmes?

In 2008 the European Commission was charged with the overall management of the Galileo and EGNOS Programme.

The Commission's first priority was to **launch the procurement** of space and ground segment components required to take the Galileo Programme to full operational capability. Of the six lots tendered, four were attributed in the course of 2010 and the remaining two lots were signed in June 2011 during the Le Bourget fair ([IP/11/772](#), [IP/10/1382](#), [IP/10/7](#)) This means there is **now a concrete deployment calendar** to he first system milestone, initial operational capability, which is due to be achieved in 2014. In parallel, work has continued on the first four operational satellites which are being built under European Space Agency (ESA) auspices; two of which will be launched on 20th October 2011 and a further two in 2012 aboard a Soyuz rocket from Europe's spaceport in French Guiana.

- Progress has also been made with regard to the **ground segment which consists of telemetry and telecommand centres**, Galileo sensor stations, navigation message uplink and a number of service-specific infrastructures. Two telemetry and telecommand centres have been inaugurated, with a further three in the process of completion. A total of nine sensor station sites are close to implementation and an additional eight sites will be deployed for initial operational capability (IOC). For the navigation message uplink five stations have been installed and a sixth station will follow. Finally, the two **ground control centres** in Fucino (Italy) and Oberpfaffenhofen (Germany) have also been completed.
- Meanwhile, the **Open Service of EGNOS** was launched in October 2009 and the **Safety-of-Life Service** destined for use by the aviation community was declared operational in March 2011. The system enables precision approaches and renders air navigation safer as well as helps reducing delays, diversions and cancellations of flights. In addition the free-to-use technology allows airports to increase their overall capacity and cut operating costs (IP/11/247). The system has proven its reliability and is rapidly being adopted in sectors beyond aviation, notably in agriculture and geodesy, with road and maritime applications also being evaluated.

How much have the Galileo and EGNOS Programmes cost?

The definition and validation phase of Galileo over the years 2000 and 2001 was financed by the EU and European Space Agency (ESA) and cost the EU contribution around €80 million (coming from the 5th Research and Development Framework Programme). A similar amount was contributed by ESA.

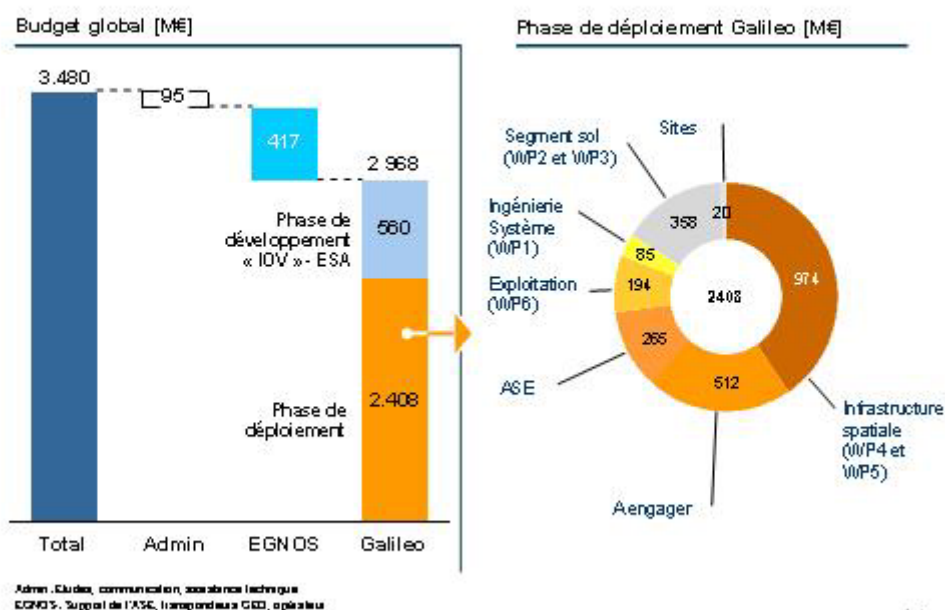
Total costs of the development phase which was launched in 2003 under the auspices of the ESA is currently around **€2400 million**, with the EU providing roughly up to two-thirds of the funding.

The **deployment phase** (so-called FOC phase) is entirely financed by the EU's budget. Of the total €3405 million made available, €560 million were re-attributed to the development and validation phase and around €2400 million are earmarked for the deployment phase of Galileo. €417 million have been set aside for EGNOS.

The total cost of implementing EGNOS to date has been around €1100 million. Of this, more than 400 million were financed by ESA, €200 million came from previous EU financing programmes and €417 million have been made available under the current budget framework.

The annual operating costs of Galileo are in the order of €800 mio per year. The revenue is estimated to be in the order of €80 million per year on average, in constant prices in 2011 (source: the Impact Assessment accompanying the new Regulation proposal).

Rapport Mensuel GNSS - Eléments budgétaires Septembre 2011



How much money is required to complete the two Programmes?

EGNOS is now operational and does not need additional budget for completion, over and above what is earmarked in the current budget. With the entry into operations of the Safety-of-Life service, EGNOS will enter the next phase of its life-cycle.

As regards Galileo, costs for the completion of the ground and space infrastructure and for the exploitation of Galileo and EGNOS are estimated at **€1bn per year** on average over the next two decades without escalation. In the Commission budget proposal from 29 June 2011, a total of **€7bn** have been proposed for the next financial perspective. A stable, long-term and sustainable governance framework for the exploitation of the Galileo and EGNOS programmes and a transition to it needs to be defined. With this mind, the European Commission will present its proposal on the repeal of Regulation 683/2008 with a new GNSS Regulation at the end of November 2011.

How was it possible to reduce the budgetary request by 500 million?

The Commission's proposal for the EU budget 2014-2020 foresees a budget of € 7000 mio. for the provision of Galileo and EGNOS. This amount is lower than initial estimations, thanks in part to an optimised approach to procurement. It takes into account notably the following factors:

- Cost containment of signed contracts: The European Commission – and Vice-President Tajani in particular – together with ESA has successfully convinced industry to contain prices of the various elements of the Galileo infrastructure.
- **Procurement of supplementary satellites:** The decision to procure a supplementary set of satellites within the current financial frame at a **fixed price** is expected to be announced after the successful launch of the first IOV satellites. This early order of the next batch of satellites means that industrial production lines can be maintained, with positive effects for the unit costs. It furthermore provides opportunities for substantial economies of scale in their production line.
- **Safety of Life re-profiling.** Changes to the implementation of the Safety-of-Life service are expected to allow for a substantial reduction in the spending for the deployment of the ground network, in particular the network of sensor stations and their operations. It will also lessen software qualification requirements, as well as reduce the cost of maintenance and replenishment of the overall infrastructure, including the space segment.
- **Length of contracts:** A number of legal and financial assumptions such as length of contracts have been optimised in order to better fit the length of the next financial frame 2014-2020.
- Needless to say, the Commission is continuously pursuing a rigorous path of **cost optimisation** in the GNSS Programmes, and the Vice-President is personally in contact with the Director-General of the European Space Agency and industry representatives to assess opportunities for savings.
- Nevertheless, it needs to be emphasised that the existence of uncertainties is inherent in this type of complex programme. This requires an effective risk management system to be set up, including the provision of appropriate contingency reserves.

When will Galileo and EGNOS be operational?

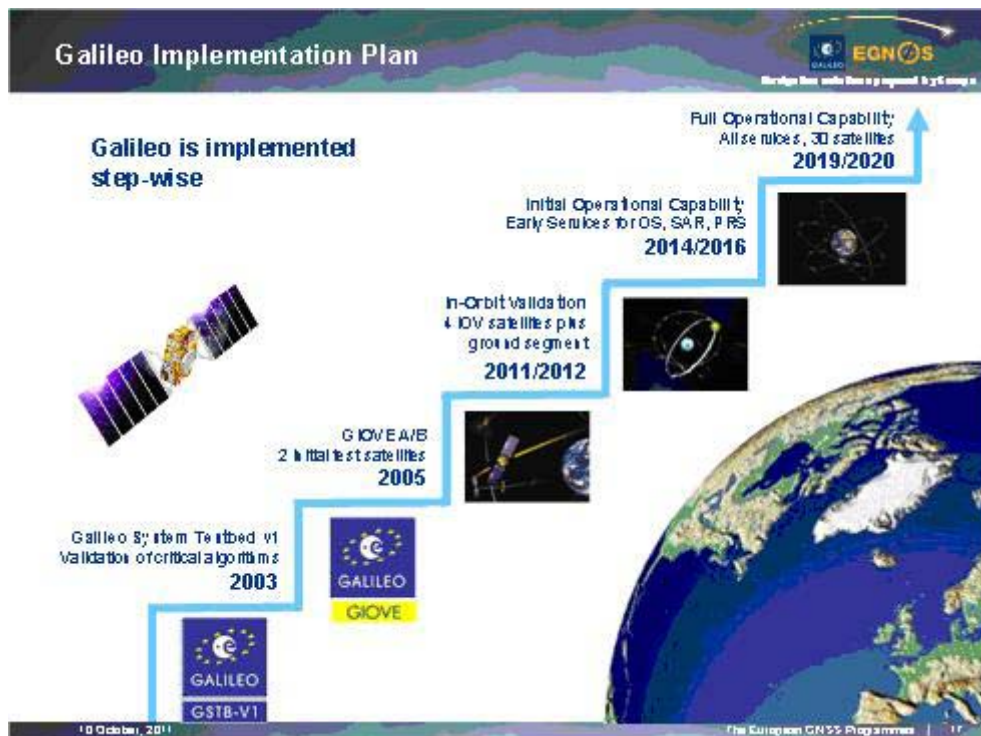
Galileo will provide 5 services.

- The first Galileo service will be the **Open Service** which can be used for free by everyone and is planned to be delivered from 2014. A wide domain of applications can be based on this service, from **in-car navigation** to high precision farming and other enhanced satellite navigation applications.
- **Public Regulated Service** (PRS) ensures that key services dependent on satellite navigation such as the police and ambulance services, continue to function in moments of crisis, terrorist threat or natural disaster. Testing and early demonstration activities are foreseen for 2014 for the PRS.
- **Search and Rescue Service** – this service is unique to Galileo – in times of emergency, for example a sailor lost at sea, not only can he send his distress signal but with Galileo he will receive a confirmation message that he has been located and that help is on its way.
- The **Safety-Of-Life Service** provides vital integrity information for life-critical applications (the Safety-of-Life service), the most common use for this is in aviation (precision approaches and en-route guidance).

- **The Commercial Service** – this is a fee-based service which opens up a huge market for commercial applications such as in mining, surveying and mapping. This service will provide the highest level of precision. The Commercial Service shall deliver both authentication and high accuracy, supported by a demonstration project at the Early OS milestone in 2014.

Galileo satellites will be launched in pairs aboard Soyuz rockets from Europe's spaceport in Kourou, French Guyana.

As of end 2012, it is expected that two satellites will be launched every quarter. The use of the Ariane-V rocket, which will be adapted to allow the launching of four satellites simultaneously, is also being considered.



Will Member States be able to use the PRS for military purposes?

- GNSS Regulation (EC) n° 683/2008 mentions, in its second recital, that the Galileo programme aims to set up the first infrastructure for radio-navigation and positioning by satellite specifically conceived for civil purposes. This has been reiterated by the Council at several occasions. Nevertheless, this primarily civil vocation of the system does not stand in the way of a potential use by the military. Indeed, although Galileo is a civil programme, nothing at the technical level prevents the services provided by the system resulting from this programme to be used for example in missions related to the safety of the Member States.
- As laid down in the PRS decision it is up to each Member State as well as other PRS-participants such as the Council and the EEAS, to decide on the use that it intends to make of the various services offered by the system to satisfy their own needs whilst respecting the common minimum standards, as contained in the Commission proposal.

History of the Galileo programme

Galileo was born in the nineties when the European Space Agency initiated research and development programmes in that area in partnership with the European Commission and the civil aviation community. For perspective, the first satellite of the GPS system was launched in 1978.

Discussions on a European system started in the late nineties and in 1999 the Council called on the Commission to develop a global system managed by public civil authorities. After the failure of negotiations on a public-private partnership, the Parliament and the Council in 2008 decided to complete the constellation using EU budget.