

Recommendations

Galileo is at the crossroad. Both the Commission and ESA must rely on a consistent Mid Term Plan and organization to achieve success and keep the momentum to continue to deploy the full constellation. Short term savings, although understandable in the context of the crisis, could damage the entire process and put into jeopardy the investments made by the Union and the Member States so far.

Long term and ambitious commitments in the months to come will generate important savings to the program and allow the markets to take-up, bringing returns to the citizen and to the economy.

In the mean time the Commission should certainly provide a detailed lesson's learnt on the procurement process that ESA has conducted in 2009/2010 and propose how to further improve and meet the European objectives of Galileo.

▶ A LONG TERM COMMITMENT FOR GNSS INFRASTRUCTURE DEVELOPMENT AND CONTINUOUS SERVICE PROVISION

- Secure the necessary funding to achieve the timely availability, operation, full performance and evolution of the European GNSS systems
- Ensure and support seamless and sufficient industrial activities
- Implement an action plan to cover long term issues like operations, obsolescence management, system and missions evolutions, risk management, industrial and procurement, etc.
- In order to maintain the ambitious schedule the commission shall implement recommended risk mitigation measures like dual procurement in all critical work packages.
- Improve the governance, organisation and decision making processes in view of the systems exploitation

▶ DOWNSTREAM BUSINESS AND APPLICATIONS

- Develop Innovations and Intellectual Property in Europe
 - Encourage European Industries to innovate and file patents
 - Support entrepreneurial programs
 - Support business development at national, regional and global markets
- Avoid signal access fees or charges possibly detrimental to markets growths. Macro-economic returns and VAT will be much more profitable to the EU.

▶ INTERNATIONAL COOPERATION

- Support cooperation based on reciprocity.
- Develop policies to ensure that international cooperation is to the benefit of Europe.
- Safeguard IPR to European Industries

▶ LAUNCHERS

Galileo is an important aspect of European independence and sovereignty. The European launcher, Ariane 5 – capable of launching 4 satellites at a time – should be the core launcher for Galileo. Soyouz launchers, launched from Europe space port in Kourou, should complement Ariane 5. Next to strategic and technical reasons, there are also economic reasons: Ariane is produced in Europe and generates employment and tax return. ■

4.5. International Activities

International cooperation is a key feature for the success of Galileo on a global scale. The main international activities of the European GNSS Programmes are

- to ensure Galileo compatibility and interoperability with other GNSS,
- to further secure the needed GNSS frequency allocation,
- to establish worldwide GNSS standards,
- to ensure security of the space segment and network of ground stations, while :
 - keeping a stricter control of sensitive GNSS technologies developed thanks to European funding and
 - preserving European know-how, IPRs and competitiveness.

An objective is to create global market opportunities for the European GNSS technologies and applications industries.

Some examples of open issues

- access policy to governmental services for non-European partners,
- Industrial and IPR policy,
- a specific Galileo technology export control regime
- ambitions and plans of China regarding frequencies and power. ■

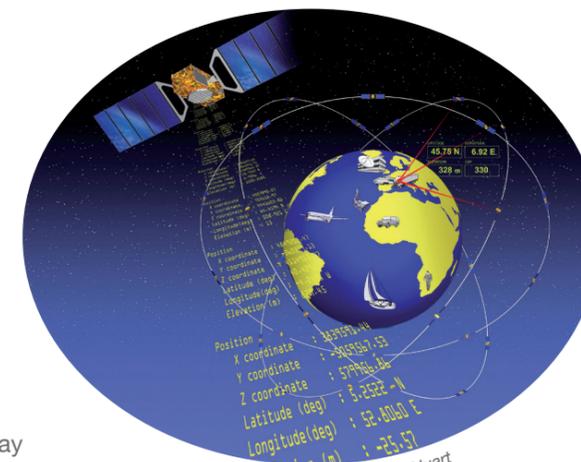
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The European Radio Navigation programmes provide the European Union with two satellite navigation systems: EGNOS and Galileo.

- The European Geostationary Navigation Overlay Service augments the quality of GPS and Glonass signals in terms of accuracy and integrity. EGNOS consists of a constellation of 3 satellite navigation payloads in geostationary orbit above Europe and a network of about 50 stations. EGNOS is the first ever infrastructure owned by the Union. It is operational since the year 2009 and exceeds expectations.
- Galileo will be the first global Radio Navigation Satellites System specifically designed for civilian purposes which will provide Europe with a State of the Art and autonomous infrastructure. Galileo consists of a constellation of 27 satellites, with 3 active spares, guaranteeing signals availability and integrity. The satellites will be monitored and controlled by a worldwide network of ground stations and operated from two Control Centres based in Oberpfaffenhofen and Fucino.

1. Benefits of European Satellite Navigation Programmes for the Citizens and the Economy

Satellite navigation has become essential in day to day life and socio-economic prosperity. Today satellite navigation already builds the backbone of growing multi-billion-euro markets.

Led by the European Union, managed by the European Commission and implemented by the European Space Agency (ESA) Galileo will bring a new generation of global position and timing-based services for the benefit of road, maritime, rail and air transport, agriculture, telecommunications, fisheries etc. The improved accuracy and reliability of Galileo with its guaranteed service features which are tailored to user needs, will provide unparalleled service quality in global satellite navigation, positioning and timing.

Galileo and its precursor EGNOS enable a huge range of safety and liability critical services, applications and business opportunities in the navigation, positioning and timing markets.

Galileo will shortly realize Europe's technological independence on positioning, navigation and timing products and services, already being at the origin of thousands of highly skilled jobs in Europe.

EGNOS and Galileo are both at the heart of Europe's ambition to be the most competitive and dynamic knowledge-based economy. Together they stimu-

About ASD EUROSPACE

- ▶ Eurospace was created in 1961 as the Association of European space manufacturing industry. It became ASD Eurospace, as the Space Group of ASD, in 2005.
- ▶ ASD Eurospace 51 member companies provide the backbone of the European space sector with the capacity to design, develop, produce and operate complete space systems (launchers and satellites) for commercial and institutional customers in Europe and the World.
- ▶ With a consolidated turnover of 4.7 B€ and employment of 30500 in 2004, the European space manufacturing sector is a strategic asset for Europe.

Navigation Working Group

This position paper was prepared by ASD Eurospace Navigation Working Group. The Navigation WG is a forum where space industry can formulate its position with a view to presenting it to the authorities of the European Union, ESA and, more generally, all parties involved, public and private, whenever the evolution of the Global Navigation Satellite System programme makes it desirable. The Eurospace Navigations WG is currently chaired by Dr Helmut Blumenhofer (Thales).

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late the European industry, enhance technological independence and improve the GNSS performance for users worldwide.

The development of satellite radio navigation is fully in line with the Lisbon Strategy as well as its successor "EU2020" and other Community policies such as transport policy as set out in the Commission's White Papers.

2. Global Navigation Satellite Systems (GNSS)

Since Galileo was launched, the global satellite navigation landscape has changed. Competitors have become stronger and the market has continued to grow. The US NAVSTAR GPS (Global Positioning System) has consolidated its world-wide leadership role. The Russian GLONASS is expected to reach its full operational capability soon. Both Galileo (EU) and COMPASS/BEIDOU (China) are still under development. In addition there exists several regional augmentation systems, a concept invented with EGNOS in Europe in the early 90s, which are, either fully operational (EGNOS-EU, WAAS-US, MTSAT-Japan), or about to be (Gagan-India).

European non-dependence on critical infrastructures is of utmost importance. Galileo will however be compatible and interoperable with GPS, GLONASS and possibly COMPASS/BEIDOU. Compared to the other GNSS, which are operated by the military, Galileo will be under civilian control, thus becoming the new cornerstone amongst the global navigation satellite system (GNSS) for civil applications.

3. Programme Implementation and Development Framework

In 2007, the EC re-profiled the European GNSS programmes by establishing a new legal and financial framework for the period of 2008-2013.

The new framework budget includes the completion of the Galileo IOV phase and the financing of the Galileo deployment phase (Full Operational Capability - FOC) until 2013 for the first part of the Galileo Services. This budget also addresses EGNOS operations and preparatory activities in relation to the exploitation of both programmes. The total amount earmarked for these activities is EUR 3405 million, including EUR 400 million made available from the Seventh Framework Programme for Research and Technological Development.

3.1. EGNOS

The EGNOS industrial Partners (50 industrial partners in 11 Member States) are proud of what has been achieved since the initial Contract award.

Thanks to the coordinated efforts of EC, ESA and Eurocontrol together with the Industrial Prime and team, EGNOS now offers unrivalled performances over the ECAC area.

The Commission has recently managed the smooth continuity of the program when taking the ownership, managing the operations hand-over from the European Space Agency on 1st April 2009 and awarding the operation and exploitation of the system to the European Satellite Services Provider (ESSP) in Toulouse.



EGNOS will help improve transport services and trace vehicles © ESA

The EGNOS Open Service were then officially declared operational to all "non safety critical" users on 1st October 2009. The ultimate milestone of System Certification aiming at safety critical applications and aviation in particular will be completed in fall 2010. On this occasion, all the EGNOS signals will be declared fully operational.

EGNOS has been designed as a multi-modal system that benefits to a wide range of users. EGNOS complies with availability, continuity and integrity requirements derived from aviation standards.

3.2. Galileo

More than 1000 engineers and technicians are presently working on the development of Galileo. Its progression also relies on the successful performances of the Galileo In-Orbit Validation Elements (the GIOVE A and B satellites) which are exceeding expectations.

Galileo will offer the following five services:

- Open Service (OS), a free service which aims mainly at the mass markets. Its positioning accuracy will be in the meter level which suits vehicle navigation and location based services.
- Commercial Service (CS), an encrypted service offering guaranteed accuracy at the decimetre level for specialised and professional applications. This signal will be made available on a fee-base to users.

- Safety of Life Service (SoL) will automatically inform users within a 6 second time-to-alarm of any signal failure possibly affecting its specified performance. This signal will allow safety critical applications like aviation and other transport means on land and water.
- Public Regulated Service (PRS) is dedicated to Government users. The signals will be encrypted and are designed to be more jamming resistant. They will be used for security, law enforcement as well as for strategic infrastructure (e.g. energy, telecoms, finance).
- Search and Rescue Service (SAR): the SAR payloads receive distress signals and transfers it to a Rescue Coordination Centre. A return signal will be sent back to the users advising that help is on the way.

4. Current Challenges and Open Issues

Today, the Galileo In-Orbit Validation (IOV contract) challenging industrial activities are in progress and the first four satellites of the constellation are under manufacturing.

The contract for 14 Full Operational Capability (FOC) satellites was awarded in January 2010, so that an initial operational capability will be reached by 2014 based on 18 Satellites. The full capability needs 12 additional satellites.

Europe must keep the momentum to roll-out the full constellation, associated ground segment and operation to allow the Galileo services to be broadcasted at full performance world-wide. Long term commitments and support are needed from the European Commission.

4.1. Budgetary Challenges

Galileo is presently entering in its most resources-demanding phase during which industry must count on the Public Sector commitments.

The restructuring of the European GNSS programmes implied a new budget, new rules and a new road-map. It also meant a new organization and budget allocation.

Now that the first FOC contracts have been awarded, the estimation for the complete constellation and the ground segment shows a lack of about 1.5 billion Euros (the latest contracts have not even been awarded yet). This money has to be made available before 2011, in order to have a completion date in 2016.

The Mid Term Review decisions on budgets are of utmost importance to meet both, programme schedule and performances. Missing this milestone will unavoidably and significantly delay Galileo by a few years, also meaning additional costs and schedule because of in-

dustrial activities discontinuity and loss of competences. This would have a negative impact on the Galileo markets acceptance and economical benefits.

Furthermore short term savings possibly found in slicing, reducing or de-scoping industrial contracts will undoubtedly turn into tremendous expenses in the following years. What is at stake is neither more nor less the program success.

In addition, an average yearly budget of 750 to 800M€ per annum from 2014 to 2034 is identified necessary to complete and operate Galileo and to develop its applications. For reference, the GNSS global market of products and services was worth 124bn in 2008 and is expected to double by 2030,

4.2. Galileo Competitive Environment

Considering the increasing competition, especially from the US, Russia and China, full backing and ambitious commitments from the European Union and Member States are needed more than ever before.

4.3. EGNOS

Today EGNOS is operational and already serves non-safety critical positioning applications. EGNOS is expected to be certified and to serve as a navigation source in aviation and other safety critical transportation systems from year 2010 onward. Therefore the goal must be to achieve certification for its operational use in safety critical applications as soon as possible and launch the first aviation services to airlines.

Open Issues and further challenges are

- Permanent operations
- Certification
- Full ICAO compliance
- Marketing
- Promotion of the Commercial Data Distribution Services (CDDS)
- Full EGNOS coverage in Europe
- Extension beyond Europe (with a focus on Africa).

4.4. Evolution and Post-FOC Studies

Possible scenarios and means for operation and exploitation of Galileo after 2013 are to be identified. This includes all commercial aspects of the exploitation as well as the legal, contractual and financing structures of the different exploitation models.

Some examples of open issues are

- access policy to governmental services,
- concept of operations,
- pricing policy,
- IPR policy,
- liability policy,
- exploitation policy,
- standards.