

Galileo and EGNOS

In a nutshell

Galileo and the European geostationary navigation overlay service (EGNOS) are two satellite navigation systems under civil control. Galileo is an autonomous global navigation satellite system consisting of a constellation of satellites and a global network of ground stations. EGNOS is a regional satellite navigation system that monitors, corrects and improves the accuracy of open signals emitted by existing global satellite navigation systems (GPS, Glonass). Galileo and EGNOS are infrastructures owned by the European Union, which were conceived in close cooperation with the European Space Agency. They guarantee Europe independent access to a reliable positioning satellite signal, allowing more accuracy than that offered by other accessible systems.

EU's Multiannual Financial Framework (MFF) heading and policy area

Heading 1 – Smart and Inclusive Growth

Subheading 1a – Competitiveness for Growth and Jobs

2014-2020 financial envelope (in current prices and as % of total MFF)

Commitments: €7 071.7 million (0.65 %)

2017 budget (in current prices and as % of total EU budget)

Commitments: €897.5 million (0.57 %)

Payments: €687.5 million (0.51 %)

2018 budget (in current prices and as % of total EU budget)

Commitments: €807.9 million (0.50 %)

Payments: €718.0 million (0.50 %)

Methods of implementation

Direct management (European Commission, European GNSS Agency)



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EU role in the policy area: legal basis

According to the Treaty on the Functioning of the European Union (TFEU), 'the Union shall contribute to the establishment and development of trans-European networks in the areas of transport, telecommunications and energy infrastructures' ([Article 170 TFEU](#)). The development of European global navigation satellite systems falls in this area of EU competence.

[Regulation \(EU\) No 1285/2013](#) (the 'GNSS Regulation') lays down the rules for two European satellite navigation systems, Galileo and the European geostationary navigation overlay service (EGNOS), for the period starting on 1 January 2014, together with the current multiannual financial framework (MFF, for 2014-2020).

Galileo and EGNOS objectives

The aim of European satellite navigation policy is to deliver two satellite navigation systems developed in the framework of the Galileo and EGNOS programmes. These programmes cover 'all the activities needed to define, develop, validate, construct, operate, renew and improve the European satellite navigation systems, namely the system established under the Galileo programme and the EGNOS system, and to ensure their security and interoperability' ([Article 2](#)).

The system established under the Galileo programme is defined as a civil system under civil control and as an autonomous global navigation satellite system (GNSS) infrastructure consisting of a constellation of satellites and a global network of ground stations. Although Galileo is being designed to function independently of other existing systems, it will be interoperable with the United States' GPS and Russia's Glonass.

Box 1 – Specific objectives of Galileo

- (a) to offer an open service (OS) that is free of charge to the user and provides positioning and synchronisation information intended mainly for high-volume satellite navigation applications;
- (b) to contribute, by means of Galileo open service signals and/or in cooperation with other satellite navigation systems, to integrity-monitoring services aimed at users of safety-of-life applications in compliance with international standards;
- (c) to offer a commercial service (CS) for the development of applications for professional or commercial use by means of improved performance and data with greater added value than those obtained through the open service;
- (d) to offer a public regulated service (PRS) restricted to government-authorized users, for sensitive applications that require a high level of service continuity, free of charge for the Member States, the Council, the Commission, the EEAS and, where appropriate, duly authorised Union agencies; this service uses strong, encrypted signals ...; and
- (e) to contribute to the search and rescue support service (SAR) of the COSPAS-SARSAT system by detecting distress signals transmitted by beacons and relaying messages to them.

Source: [Regulation \(EU\) No 1285/2013](#).

The EGNOS system is a regional satellite navigation system infrastructure that monitors and corrects open signals emitted by existing global satellite navigation systems, as well as the open service signals offered by the system established under the Galileo programme, when they become available. It consists of ground stations and several transponders installed on geostationary satellites. EGNOS should improve the quality of signals from existing navigation satellite systems in Member States' territories

geographically located in Europe (the Azores, the Canary Islands and Madeira are also included).

The GNSS Regulation sets out the specific objectives of both programmes in terms of the functions they are to fulfil (see Boxes 1 and 2).

Box 2 – Specific objectives of EGNOS

(a) to offer an open service (OS), which is free of charge to the user, and provides positioning and synchronisation information intended mainly for high-volume satellite navigation applications in the area covered by the EGNOS system;

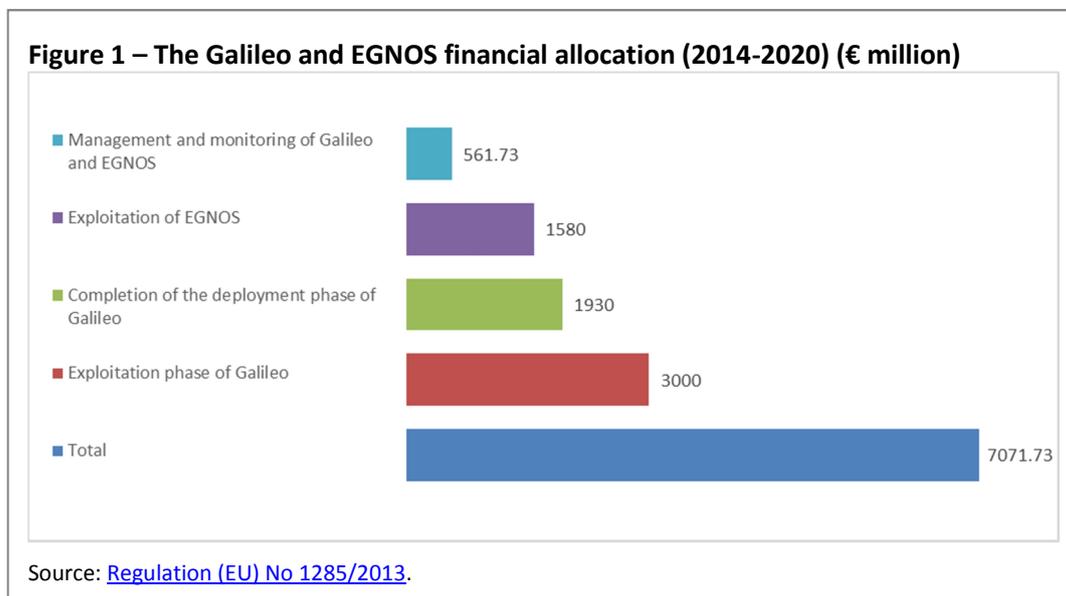
(b) to offer a service for the dissemination of commercial data, namely the EGNOS Data Access Service (EDAS), to promote the development of applications for professional or commercial use by means of improved performance and data with greater added value than those obtained through its open service; and

(c) to offer a safety-of-life service (SoL) service aimed at users for whom safety is essential; this service, which is provided free of direct user charges, fulfils in particular the requirements of certain sectors for continuity, availability and accuracy, and includes an integrity message alerting the user to any failure in, or out-of-tolerance signals from, systems augmented by the EGNOS system over the coverage area.

Source: [Regulation \(EU\) No 1285/2013](#).

Financial allocation

The allocation in current prices for the EGNOS and Galileo programmes reserved in the multiannual financial framework (MFF) for the 2014 to 2020 period is €7 071.73 million, which corresponds to 0.65 % of the total MFF. The GNSS Regulation specifies four groups of activities to be supported (see Figure 1).



The planning is based on the Galileo programme's timeline which consists of:

- a definition phase (ended in 2001);
- a development and validation phase (completed by 31 December 2013);
- a deployment phase (to be completed by 31 December 2020);
- an exploitation phase (launched progressively, the initial operational services began in 2016).

The history of the EU's satellite navigation systems is very complex. And so is the question of its financing. Two major periods can be defined for the purposes of providing a brief overview of costs incurred: from the origins of the programme to its re-profiling in 2007, and from 2007 to date.¹

Historical period of the project

In 1994, the Commission suggested developing two global navigation satellite systems (GNSS). They were described as GNSS 1 and GNSS 2. The first, based on existing GPS signals, became known as the European geostationary navigation overlay system (EGNOS). The second was given the name Galileo (in 1999) and was expected to become a self-sufficient system under civil international control. GNSS 1 would become operational first, while the development of GNSS 2 was planned to follow in three phases: definition, development and validation, and deployment.

In 2000, the cost of the Galileo project was [estimated](#) at €3 250 million, with €1 100 million needed for the development and validation phase (2001-2005) and €2 100 million for deployment of the system (2006-2007). An additional €50 million was planned for incorporating EGNOS into Galileo. The definition and development and validation phases were supposed to be financed from public sources only. In the same year, the EU contributed €550 million from the TEN-T budget to development and validation, and the European Space Agency ([ESA](#)) agreed to provide the same amount. The deployment phase was intended to be supported mainly by the private sector (€1.5 billion) with a contribution from the public sector (€600 million).

ESA was responsible for the technical part of the programme. The European Commission had to define framework conditions for financing through a public-private partnership (PPP), with the Council pushing for large-scale financial support from private sources. In 2002, the Council [decided](#) to set up the Galileo Joint Undertaking (GJU) and to entrust it with two principal tasks: overseeing the implementation of the second phase (development and validation), and preparing the framework for the final phases of Galileo under a public-private partnership (PPP), including the conclusion of a concession contract for a 20-year period.

Serious disagreements during the negotiation of the concession contract caused delays and finally led to the abandonment of the idea of a PPP. The GJU had [ended](#) its activities by 31 December 2006. The negotiation of contracts to implement the deployment phase was taken over by the GNSS Supervisory Authority (GSA), which was established in 2004 with the aim of supervising the subsequent phases of the programme.

In 2006, the development and validation phase was prolonged until the beginning of 2009 and its cost updated to a total of €1.5 billion, half of which to be borne by the EU and half by ESA. With €700 million for implementing EGNOS and €300 million provided for research (by the EU and ESA) before 2007, the total amount of public money invested in both GNSS programmes up to that point was at least €2.5 billion. This amount appears in the document from May 2007, in which the Commission [claims](#) that over the previous 10 years, 'the public sector budgets totalled over €2.5 billion'.² Galileo was still in its validation phase and EGNOS not yet up and running.

Since the re-profiling

The [re-profiling](#) of the Galileo programme in 2007 led to changes in the governance of the project and to an increase in financial support. The new scenario required €3.4 billion for the 2007 to 2013 period for Galileo to reach full operational capacity (FOC) and start

EGNOS exploitation, while only €1 billion had initially been set aside in the 2007-2013 MFF under the previous set-up. Finally, in July 2008, the European Parliament and the Council adopted a new [regulation](#) on the further implementation of the GNSS programmes that provided them with €3.4 billion from the 2007-2013 MFF.

The regulation introduced significant changes to the funding model, which resulted in both the Galileo and EGNOS projects being fully covered financially by public funds from the EU budget. From that point on, it is easier to get an overview of the costs incurred. With the same regulation, the EU claimed ownership of systems resulting from GNSS programmes, which makes Galileo the first infrastructure to be owned by the Union. Operating income was to be collected by the EU, paid into the EU budget and allocated to the programmes.

In the mid-term [evaluation](#) of the GNSS programme for 2007-2013, published in 2011, the Commission mentions the need for €1.9 billion in additional funding over the 2014-2019 period, to complete the Galileo infrastructure. The text also specifies the distribution of €3.4 billion from the 2007-2013 MFF: €560 million for Galileo development, €417 million to operation of EGNOS, and €2 407 million for Galileo deployment. The mid-term evaluation expected initial operational capacity (IOC) to be reached in 2014 to 2015 (it was achieved on 15 December 2016) and delayed the FOC date until 2019 to 2020.

When the current [GNSS Regulation](#) entered into force, the EU had already invested almost €6 billion in GNSS programmes; and more than €7 billion is currently earmarked for reaching Galileo's FOC by 31 December 2020, with operating costs on the increase. Under the current programming period, the European Commission is formally responsible for both GNSS programmes. While ESA acts as design and procurement agent on behalf of the Commission, the GSA is ensuring the uptake and security of Galileo. ESA transferred formal responsibility for oversight of Galileo operations and provision of services to the GSA, located in Prague, in July 2017.³

Funded measures and centres

The budgetary envelopes for Galileo and EGNOS refer to a relative timeline for both projects, going from the definition phase to the full exploitation phase. All steps require complex investment in space and ground infrastructure as well as in service facilities that are necessary for the GNSS to work.

The Galileo programme is now in its deployment phase, involving the fabrication and launch of the 30 satellites needed to make the system fully operational. This phase is expected to be completed by 2020. By that time, Galileo will be providing robust positioning and timing services with a high level of performance. In December 2016, the initial operational services were launched with 18 out of a total of 30 satellites in orbit.⁴ Another four satellites were [sent](#) into space on 13 December 2017.

In the past two years, critical ground infrastructure has been built. Two Galileo control centres (GCC) are situated in [Oberpfaffenhofen](#) (Germany) and [Fucino](#) (Italy). Both GCCs are fully interoperable. They are complemented by a worldwide network of sensor stations providing orbitography and synchronisation measurements; uplink stations that uplink the navigation data; two telemetry, tracking and command stations controlling the constellation; and a global data dissemination network connecting all the ground facilities.⁵ Other centres are also part of the GNSS infrastructure on the European continent.

[The European GNSS Service Centre](#) (Torrejón de Ardoz, Spain) provides the single interface for the Galileo Open Service and Commercial Service communities. It began operations in May 2013. The GSA is responsible for the management of this centre.

The [Galileo Security Monitoring Centre](#) is in charge of monitoring the system's security. Its facilities are located in Saint-Germain-en-Laye (France) with a back-up centre in Swanwick (United Kingdom). However, the UK centre is expected to be relocated to Spain.⁶

The Search and Rescue (SAR)/Galileo Data Service Provider is the entity in charge of the coordination of operations related to the [SAR/Galileo service](#). This facility is located in Toulouse (France). The SAR/Galileo service represents the European contribution to the worldwide cooperative effort on humanitarian search and rescue activities, named [COSPAS-SARSAT](#). Galileo will provide more precise information about the location and will help to pick up distress messages in close to real time. At the same time, the system will send a response signal to the user, informing them that their location has been detected and that help is on the way. This feature is new and is considered a major upgrade compared to the existing system, which does not provide user feedback.

The [Galileo Reference Centre](#) is responsible for monitoring and assessment of the performance of Galileo services, completely independently from the Galileo core infrastructure and its operations. This facility will be located in Noordwijk (the Netherlands).

In 2016, the Commission decided that the [Galileo Integrated Logistics Centre](#) would be located in Transinne (Belgium).

Assessment of Galileo and EGNOS

The European Court of Auditors (ECA) published a special report on Galileo in 2009.⁷ However, this paper covers the 2003 to 2006 period and therefore refers to a different framework that still counted on a large private-sector contribution through a PPP. The special report pointed out various problems that had led to the failure of the governance scheme for GNSS programmes in its initial format. A study on Galileo⁸ commissioned by the European Parliament and published in 2011 also concerns the project before it was re-profiled. This study draws general lessons learned from the management and funding of the project for future large-scale space initiatives.

In the opinion of the ECA, given in the report on the annual accounts of the European GNSS agency for the financial year 2015,⁹ the GSA's annual accounts were a fair reflection of its financial position as at 31 December 2015. According to the ECA, the annual accounts for the year 2015 were legal and regular in all material respects. However, ECA observed that the GSA needed clear guidelines on the agencies' budget reporting. ECA noted a high staff turnover in 2015 with 14 staff members leaving and 26 joining. According to the GSA, this relatively high turnover resulted from difficulties in attracting and retaining key staff in a very competitive and technical sector.

In 2017, the ECA issued a short report concerning the closure and liquidation of the Galileo Joint Undertaking (GJU).¹⁰ It ends with a general remark calling on the Commission to put procedures in place to ensure an efficient and cost-effective process for winding up bodies of this kind created for a specific purpose and for a limited duration.

The Commission reports annually on the implementation of the Galileo and EGNOS programmes when presenting its preliminary draft budget, as stipulated in Article 33 of

the GNSS Regulation. Moreover, reporting is carried out through quarterly progress reports that are not public. They are intended for the European GNSS Programmes Committee, assisting the Commission (in line with the provisions of Article 36(6) of the GNSS Regulation).

The European Commission's [draft general budget of the EU for 2017](#) presented an overview for the years 2014 to 2015, the first period of the 2014-2020 MFF. Among the key achievements, the Commission stressed the acceleration of the deployment of the Galileo satellites, with three successful launches and the deployment of six further satellites, and a new EGNOS service for safer aircraft landings called LPV-200. It was declared operational in 2015 and allows lateral and angular vertical guidance without visual contact with the ground until an aircraft is 200 feet above the runway. Finally, in 2015, the Council and European Parliament adopted the eCall [Regulation \(EU\) No 2015/758](#), which provides for compatibility of the [eCall](#) in-vehicle system with Galileo and EGNOS. According to this regulation, from 31 March 2018 onward all new passenger cars and light duty vehicles should be equipped with a 112-based eCall in-vehicle system.

The European Commission's [draft general budget of the EU for the financial year 2018](#) meanwhile reported on the 2014 to 2016 period. In 2016, six Galileo satellites were launched successfully. In November 2016, for the first time in the history of spaceflight, four navigation satellites were launched at the same time on an Ariane 5 rocket. On 15 December 2016, Galileo initial services were [declared](#) operational. As they are fully interoperable with GPS, their combined use can already increase positioning accuracy. Galileo's accurate timing is helping to enable more resilient synchronisation of banking and financial transactions, telecommunications and energy distribution networks to help them operate more efficiently. Galileo's Search and Rescue service helps to save lives by reducing the time it takes to detect emergency distress beacons from up to three hours to ten minutes. A range of Galileo-enabled [products](#) are now on the market. The Commission also mentions that in 2016, the framework was put in place for Galileo to reach full operational capability by 2020.

The target date for an interim evaluation of the Galileo and EGNOS programmes was set by the GNSS Regulation at 30 June 2017, but the Commission report to the European Parliament and Council on the implementation of the Galileo and EGNOS programmes and on the performance of the European GNSS Agency was [published](#) only on 23 October 2017.¹¹ According to this report, 'as of end 2016, the Galileo and EGNOS programmes are on track to respect the budget boundaries set by the GNSS Regulation for the period 2014-2020'.¹²

Other EU programmes in the same field

The [Copernicus programme](#) is a user-driven programme which provides six operational services free of charge (atmospheric monitoring, marine environment monitoring, land monitoring, climate change, emergency management and security) for EU, national, and regional institutions, as well as for the private sector. The programme builds on the initiative on global monitoring for environment and security launched in 2001. It is aimed at filling the gaps in European earth observation capacities.¹³

Main references

[Regulation \(EU\) No 1285/2013](#) of the European Parliament and of the Council of 11 December 2013 on the implementation and exploitation of European satellite navigation

systems and repealing Council Regulation (EC) No 876/2002 and Regulation (EC) No 683/2008 of the European Parliament and of the Council.

[Commission implementing decision](#) of 18 March 2016 on the adoption of the 2016 Work programme and the financing for the implementation and exploitation of the European satellite navigation programmes, C(2016) 1580 final.

Reillon V., [Galileo: Overcoming obstacles – History of EU global navigation satellite systems](#), EPRS, European Parliament, April 2017.

Endnotes

¹ For a more detailed historical overview, see V. Reillon, [Galileo: Overcoming obstacles – History of EU global navigation satellite systems](#), EPRS, European Parliament, April 2017.

² Communication from the Commission, [Galileo at a cross-road: The implementation of the European GNSS programmes](#), COM(2007) 261 of 16 May 2007, p. 7.

³ [ESA fact sheet on Galileo status](#), July 2017.

⁴ At the moment, 14 satellites are operational, 2 are under testing and 2 satellites are not working for different reasons. For more information, see <https://www.gsc-europa.eu/system-status/Constellation-Information>.

⁵ ESA brochure, [Salvage in space: recovering Galileo 5 and 6](#), 2015.

⁶ Following the decision of the United Kingdom to leave the European Union, the European Commission considered it necessary to maintain all security-related Galileo infrastructure inside EU territory. Therefore, on 18 January 2018, the GNSS committee [voted](#) 'by a large majority of members' to approve the Commission's proposal to relocate the Swanwick centre to Spain. The Commission formally took the [decision](#) on 24 January 2018.

⁷ European Court of Auditors, [The management of the Galileo programme's development and validation phase](#), Special report No 7, 2009.

⁸ European Parliament, Policy Department for External Policies, [The Galileo programme: management and financial lessons learned for future space systems paid out of the EU budget](#), 2011.

⁹ Report on the annual accounts of the European GNSS Agency for the financial year 2015, together with the Agency's reply, [OJ C449](#), pp. 214-218, 1 December 2016.

¹⁰ European Court of Auditors, [Report on the closure of the liquidation of the Galileo Joint Undertaking](#), 2017.

¹¹ Report from the Commission to the European Parliament and the Council [on the implementation of the Galileo and EGNOS programmes and on the performance of the European GNSS Agency](#), COM(2017) 616 of 23 October 2017.

¹² *ibid.*, p. 5

¹³ V. Reillon, [Securing the Copernicus programme: Why EU earth observation matters](#), EPRS, European Parliament, April 2017.

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