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**COMMISSION STAFF WORKING DOCUMENT**

**INTERIM EVALUATION**

**of Galileo and EGNOS programmes and evaluation of the European GNSS Agency**

*Accompanying the document*

**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**

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## 1. EXECUTIVE SUMMARY

This Staff Working Document represents the mid-term review of Galileo and EGNOS, the EU satellite navigation programmes, and of the European GNSS Agency (GSA). The EU satellite navigation programmes were designed to set up the first global satellite navigation system under civilian control and autonomous from other existing systems, reinforce the resilience of the European economic infrastructure, maximise socio-economic benefits and ensure Europe's technical capability regarding complex large scale infrastructures. Together with Copernicus, Galileo and EGNOS form the backbone of a European space policy intended to stimulate innovation and increase the competitiveness of European space industry beyond the limits of the space domain and drive major socio-economic and strategic benefits across several key industries and markets.

The interim evaluation assesses the progress of the Galileo and EGNOS programmes towards their objectives over the period 2014-2016. It aims to inform stakeholders and public on the status of the programmes, to contribute to improving their implementation and to provide evidence-base for preparing the subsequent programming period.

The interim evaluation finds that the original rationale for EU intervention in the field of satellite navigation and the objectives and challenges identified at the programme launch are still highly **relevant** also in light of current needs of the EU. The EU economy and society are increasingly dependent on satellite navigation applications and services, which makes a potential disruption in the provision of satellite navigation services very costly in terms of revenues to business, and more importantly, in terms of human safety. The EU clearly needs to maintain and operate independent satellite navigation programmes, to secure the availability of those applications and services.

Looking at **effectiveness**, the Galileo and EGNOS programmes have achieved all the milestones set for the period and progress is being made towards delivering on all programme implementation objectives set for 2020. The Galileo programme has recovered the initial delay in the launch of the satellites inherited from the previous period and increased in 2014 with the wrong insertion in orbit of the first two Full Operational Capability (FOC) satellites. In addition, the deployment of the ground segment has been pursued and the initial provision of the Open Service (OS), pilot Public Regulated Service (PRS) and Search and Rescue (SAR) contribution to COSPAS-SARSAT has been declared. The EGNOS service provision was improved, in particular through the declaration of the LPV-200 service and the provision of APV-I service over 98,98% of the targeted area (the EU-28 plus Norway and Switzerland). The next generations of the EGNOS and Galileo systems are being prepared. However, a number of factors may influence the programmes' effectiveness: governance complexity, security and technical aspects' implementation.

Looking at **efficiency**, as of end of 2016, the Galileo and EGNOS programmes were implemented within the budget limits set by the GNSS Regulation. While some data needed to calculate the Cost and Schedule Performance Indexes requested by the GNSS Regulation to monitor the efficiency of the programme implementation were not available for Galileo deployment and exploitation, the programme remains within its budget limits. Implementation of EGNOS exploitation remains well in line with planning. The governance of the programmes has overall contributed to the efficient implementation and the progress of the programmes. Nevertheless, some limits to full efficiency of the programmes can be identified. Indeed, the European GNSS programmes governance is marked by a good transparency of the information flow among the main stakeholders, but this is at the cost of a heavy

administrative burden, affecting the efficiency of the programmes. Moreover, the current organisation of responsibilities and control processes is complex and not fully in line with the culture, competencies and structure of the key three governance actors.

As for the security governance, the declaration of Galileo Initial Services and the overlap of the deployment and exploitation phases have posed challenges that should be further addressed. In particular, the independence of operation of the organisations (EC, GSA, ESA) responsible for security requirement implementation and verification should be maintained.

The Galileo and EGNOS programmes have a high level of internal **coherence** and coherence with other EU policies and GNSS systems. Substantial efforts have been undertaken to ensure complementarity between the Horizon 2020 programme, the Navigation Innovation and Support Programme (NAVISP) and the Fundamental Elements initiative. The programmes are closely aligned with the Space Strategy for Europe and the Space Industrial Policy communications. Initiatives for Galileo and EGNOS compatibility and interoperability with other GNSS systems have been mainly successful (e.g. ITU coordination agreements).

The implementation at EU level of the Galileo and EGNOS programmes by the European Commission has brought a high **added value** compared to what could be achieved by the Member States at national, regional or local level. The size and complexity of the programmes require an implementation at EU level, as no viable alternative exists to ensure the appropriate return on investment.

The **performance of the GSA** has been positive in overall. The GSA has successfully achieved important objectives for the progress of Galileo and EGNOS programmes and for the development of GNSS downstream markets through an effective implementation of both core tasks entrusted directly on the basis of the GNSS Regulation and tasks delegated by the Commission through contractual arrangements. The Agency has achieved most of its activities on time and within budget limits.

## 2. INTRODUCTION

This Commission Staff Working Document presents the interim evaluation of the two European Global Navigation Satellite Systems (GNSS) programmes, Galileo and EGNOS, and the evaluation of the European GNSS Agency (GSA). The interim evaluation of the Galileo and EGNOS programmes is required by Article 34 of the Regulation (EU) No 1285/2013<sup>1</sup> ('the GNSS Regulation'), and the evaluation of the European GNSS Agency is required by Article 26 of the Regulation (EU) No 912/2010<sup>2</sup> ('the GSA Regulation'). As the GNSS Regulation entrusts the GSA with a key role in the implementation of the European GNSS programmes, the interim evaluation of the programmes and the evaluation of the Agency are carried out together in line with the Commission's Better Regulation Guidelines<sup>3</sup>.

The interim evaluation is an in-depth evidence-based assessment of the implementation of the Galileo and EGNOS programmes and of the performance of the European GNSS Agency in the period between 1 January 2014 and 31 December 2016. The evaluation of the implementation of the programmes concerns the extent to which the objectives of the programmes were met in terms of results and impacts, of the effectiveness of the use of resources, European added value, continued relevance of the objectives and coherence with other EU policies. The evaluation of the performance of the GSA concerns the Agency's impact, effectiveness, smooth running, working methods, requirements and use of the resources entrusted to the GSA, application of the Agency's policy on conflicts of interest as well as the independence and autonomy of the Security Accreditation Board (SAB).

The interim evaluation aims to inform stakeholders and the public in general on the status of the programmes, to contribute to improve their implementation in the period 2017-2020 and to provide evidence to prepare the next programming period (beyond 2020).

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<sup>1</sup> 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. JO L 347/1 of 20.12.2013.

<sup>2</sup> Regulation (EU) No 912/2010 of the European Parliament and of the Council of 22 September 2010 setting up the European GNSS Agency, repealing Council Regulation (EC) No 1321/2004 on the establishment of structures for the management of the European satellite radio navigation programmes and amending Regulation (EC) No 683/2008 of the European Parliament and of the Council. JO L 276/11 of 20.10.2010.

<sup>3</sup> European Commission: Better Regulation Guidelines on Evaluation and Fitness Checks. [http://ec.europa.eu/smart-regulation/guidelines/ug\\_chap6\\_en.htm](http://ec.europa.eu/smart-regulation/guidelines/ug_chap6_en.htm)

### 3. BACKGROUND TO GALILEO, EGNOS AND GSA

#### 3.1. Key objectives

**The European GNSS programmes, Galileo and EGNOS, fully owned by the European Union, are fundamental for both European economy and security.** Positioning and timing signals provided by satellite navigation systems are used in many critical areas of European economy such as mobile phone networks, in-car navigation, traffic management, power grid synchronisation or electronic trading. It is estimated that almost 11% of the EU economy is impacted by satellite navigation services<sup>4</sup>. Therefore, European independence in satellite navigation is a primary driver behind the Galileo and EGNOS programmes.

The Galileo and EGNOS programmes have four strategic objectives:

- (1) **to guarantee continuous and autonomous access to satellite navigation services for Europe** interoperable with other GNSS systems, notably US GPS;
- (2) **to ensure resilience** of the European economic infrastructure;
- (3) **to maximise socio-economic benefits** for European economy and society;
- (4) **to build Europe's technical capacity** to develop, deploy and operate complex large-scale space infrastructures.

Both Galileo and EGNOS have constantly been reaffirmed by the Council of the European Union and the European Parliament as key strategic programmes for Europe<sup>5</sup>. Recently, the Space Strategy for Europe<sup>6</sup> confirmed the commitment of the Commission to ensure continuity, sustainability and evolution of the Union's space programmes.

**Galileo is the European global navigation satellite system under civilian control,** providing a range of positioning, navigation and timing services to users worldwide, compatible and interoperable with other GNSS systems, like GPS. The Galileo programme was launched in 1999, started its deployment phase in 2014 and its exploitation phase in December 2016, providing three Initial Services: the Open Service (OS), the Public Regulated Service (PRS), and the Search And Rescue (SAR) service. The objective of the Galileo programme is to complete the deployment of the infrastructure and to reach Full Operational Capability (FOC) by 2020.

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<sup>4</sup> Analysis of GNSS impact on the EU Economy, November 2016. Study conducted by VVA, GMV, Kontor Qwentes and LS.

<sup>5</sup> SEC(2011)1447.Commission Staff Working Paper, Impact Assessment, p.15.

<sup>6</sup> Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Space Strategy for Europe. COM(2016) 705 final. 26.10.2016.

### **Summary Box: Galileo infrastructure, services and implementation phases**

#### **Galileo infrastructure:**

- *Space segment:* generates and transmits Galileo signals with a specific Galileo signal structure, as well as stores and retransmits the navigation message sent by the Control Centres. The space segment is planned to comprise 30 satellites in total: 24 operational satellites plus 6 spare satellites.
- *Ground segment:* monitors the satellites and their functioning, generates the navigation data to be sent to end users. It is composed of various stations and control centres.
- *User segment:* is composed of Galileo receivers, whose main function is to receive Galileo signals, compute coordinates and provide a very accurate time.

#### **Galileo services:**

- *Open Service (OS)* is free of charge to the users, providing positioning and synchronisation information intended mainly for high-volume satellite navigation applications for mass-market applications.
- Contribution by the means of Galileo OS to *integrity-monitoring services* aimed at users of safety-of-life applications in compliance with international standards.
- *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 OS.
- *Public Regulated Service (PRS)* restricted to government-authorized users, for sensitive applications which require a high level of service continuity.
- *Search and Rescue (SAR)* service to locate people in distress, by detecting distress signals transmitted by beacons and relaying messages to them. This service is Europe's contribution to the international search-and-rescue activities, known as COSPAS-SARSAT.

#### **Galileo implementation phases:**

- *1999-2001:* definition phase to design the structure of the system and its elements.
- *2002-2013:* development phase aimed at reaching In Orbit Validation (IOV) of the Galileo system. It verified and validated the system with four satellites and first ground infrastructure prior to the full deployment of its infrastructure.
- *2014-2020:* deployment phase aims at completing the infrastructure and reaching Full Operational Capability (FOC) by 2020. This phase is ongoing and it includes the deployment of all 30 satellites and the upgrade of ground infrastructure needed for FOC.
- *2016-2020:* exploitation phase started in December 2016 and is running in parallel to the deployment phase until 2020. This phase consists of service provision, management and operation of the space, ground and user segments, maintenance of infrastructure and constant update of the system.

**The European Geostationary Navigation Overlay Service (EGNOS) is the European regional Space-Based Augmentation System (SBAS) used for monitoring and correcting open signals emitted by existing global navigation satellite systems, like GPS or Galileo, over European territory. EGNOS checks the integrity of the information received, and provides an alarm in case the position information is unreliable. This is fundamental for safety critical applications such as flying aircraft. The EGNOS programme has completed the deployment of its infrastructure and is operational since 2009, providing three services: the Open Service (OS), the Safety-of-Life (SoL) service and the EGNOS Data Access Service (EDAS).**

### Summary Box: EGNOS infrastructure and services

#### EGNOS infrastructure:

- *Space segment*: broadcasts corrections and integrity information for other GNSS (GPS or Galileo) satellites. It is composed of three geostationary satellites over Europe, each of them carrying one communication transponder.
- *Ground segment*: receives signals from the GNSS satellites and corrects the data to send back to the satellite transponders. It is composed of various stations and control centres.
- *User segment*: is composed of EGNOS receivers, which are similar to GPS receivers but equipped with a special software that allows the receiver to lock onto the code used by the EGNOS satellites and compute the EGNOS corrections to the GPS/Galileo signals.

#### EGNOS services:

- *Open Service (OS)*: free of charge to users, provides positioning and synchronisation information intended mainly for high-volume satellite navigation applications in the area covered by the EGNOS system such as road-tolling or agriculture.
- *Safety-of-Life (SoL) service*: for safety critical transport applications, such as civil aviation and maritime. It provides enhanced and guaranteed performance and features an integrity warning system.
- *EGNOS Data Access Service (EDAS)*: for enhanced applications, it provides terrestrial commercial data service and is offered on a controlled access basis (e.g. through Internet or mobile phones).

**The European Union (EU) is fully financing the Galileo and EGNOS programmes** and is the owner of all assets developed under these programmes. The European Commission (EC), on behalf of the EU, is responsible for the management and the security of both Galileo and EGNOS programmes. The deployment of the Galileo programme is entrusted to the European Space Agency (ESA). The exploitation of both Galileo and EGNOS is entrusted to the European GNSS Agency (GSA)<sup>7</sup>, and Working Arrangements were concluded between ESA and the GSA in 2015 and 2016. The key tasks of ESA and the GSA are:

- *European Space Agency*: in charge of design, procurement and deployment of Galileo infrastructure, system operations and signal provision during deployment phases, maintenance of system infrastructure and R&D for the evolution of the systems, technical support to exploitation.
- *European GNSS Agency*: in charge of the system exploitation, operational activities including systems infrastructure management, ensuring security accreditation of the European GNSS systems through the SAB, operation of the Galileo Security Monitoring Centre (GSMC), acting as a competent designated PRS authority, promoting and marketing of the Galileo and EGNOS services.

Annex 3 shows the intervention logic of the European GNSS programmes for the purpose of this interim evaluation. It describes the links between the problems to be tackled, the needs to be fulfilled, the objectives to be achieved and the expected impacts on European society and economy.

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<sup>7</sup> In line with the Commission Implementing Decision amended in 2016 and the corresponding Delegation Agreements.



### 3.2. Baseline

The baseline for the interim evaluation is the status of the programmes at the **beginning of 2014**.

**The Galileo system** was verified and validated in orbit with four satellites and first ground infrastructure (development phase) at the end of 2013. Then, in 2014, the Galileo programme started the full deployment of its infrastructure, which is expected to be completed by 2020. In parallel to the deployment phase, the exploitation phase with the provision of Galileo Initial Services was expected to start gradually between 2014 and 2015.

The progress in the implementation of the Galileo programme marked a relevant change in the programme governance. ESA was in charge of Galileo's deployment phase, but with the progress with the deployment of the system and the phasing-in of the exploitation phase, ESA would gradually hand over to the GSA the responsibilities for system maintenance, improvement and R&D activities related to system and infrastructure evolution. These tasks were reflected in Delegation Agreements between EC/GSA and EC/ESA and Working Arrangements between ESA and the GSA that were under preparation at that time.

At the end of 2013, the market uptake of Galileo was entrusted to the GSA as a core task. The main objectives for Galileo market uptake in the period 2014-2016 were to implement the EC GNSS Application Action Plan, to elaborate regulatory measures to secure the market uptake of Galileo services, and to manage and monitor Horizon 2020 activities.

**The EGNOS system** was already fully operational at the beginning of 2014. Ensuring the provision of EGNOS services, their evolution and security were the key stakes. Moreover, EGNOS services were expected to be reinforced by the enlargement of the EGNOS coverage in the EU-28 area and beyond. For this purpose, negotiations with neighbouring and third countries were planned. As for EGNOS exploitation phase, the GSA has been in charge of service provision.

At the end of 2013, the market uptake of EGNOS had well progressed. More than 70% of receiver models on the market were SBAS capable, with SBAS comprising the American Wide Area Augmentation System (WAAS), EGNOS and the Japanese Multi-functional Satellite Augmentation System (MSAS)<sup>8</sup>.

**The GNSS Regulation allocated a financial envelope of EUR 7 071, 73 million for the implementation of the programmes in the period 2014-2020.** This represented a very substantial commitment by the EU, in addition to more than EUR 3 500 million already invested in the previous MFF (2007-2013)<sup>9</sup>.

### 3.3. Evaluation questions

In line with the 'Better Regulation' guidelines, this interim evaluation addresses questions, which are structured around the five evaluation criteria:

- **Relevance:** assessment of whether the objectives of the European GNSS programmes are still relevant and how well they still match the current needs and problems;

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<sup>8</sup> GSA: GNSS Market Report, Issue 3, p.8.

<sup>9</sup> Communication from the Commission to the European Parliament and the Council concerning the revision of the multiannual financial framework (2007-2013). COM(2009)171 final, 8.4.2009.

- **Effectiveness:** how successful European GNSS programmes have been in achieving or progressing towards their objectives;
- **Efficiency:** the relationship between the resources used by European GNSS programmes and the benefits they are generating;
- **Coherence:** to what extent the European GNSS programmes were coherent with other EU policies;
- **EU added value:** assessment of the value resulting from European GNSS programmes.

**In addition, in line with the GSA Regulation, there are specific questions on the GSA evaluation:** assessment of the GSA's performance and impact. Detailed evaluation questions are provided in Annex 4.

### 3.4. Method

**The interim evaluation is based on the comparison of several data sources contextualised with input from the stakeholder consultation.** The interim evaluation is based on an evaluation study contracted by the European Commission to an external consultant (PwC France) and support from the Inter-Service Group (ISG) comprising of other Commission services. The preparatory work for the interim evaluation started in July 2016, the ISG validated the terms of reference for an external evaluation study and the external contractor started to work in November 2016.

The external consultant elaborated an **evaluation framework** which contains is structured around the five evaluation criteria (as described in Chapter 3.3 Evaluation Questions), type of data collection and source of the data. This evaluation framework was deemed as appropriate by the ISG to obtain all necessary information to reply to all evaluation questions.

#### 3.4.1. Data collection

The **stakeholder consultation** is primarily based on a stakeholder survey of key actors (policy makers, industry, user associations) carried out by an external contractor during February and March 2017 by two different methods: face-to-face/telephone interviews and targeted consultation by means of web questionnaires. A total of 97 stakeholders were consulted: 71 in direct interviews, 25 via web questionnaires and 2 via written contributions.

The **face-to-face/telephone interviews** method implied direct interactions with selected stakeholders in the form of semi-structured interviews. For these interviews, 12 different interview guidelines were developed, tailored to specific categories of stakeholders. Targeted consultation implied distribution of **web questionnaires** to a large number of stakeholders. The questions were general so that all types of stakeholders with interest in the programmes could answer them. In addition to a general questionnaire, a specific questionnaire dedicated to EGNOS civil aviation stakeholders (i.e. airports and airlines) was prepared and distributed to collect information on EGNOS service performance.

Another source of **stakeholders' input** was coming from **dedicated meetings** on the interim evaluation, for example the GSA Administrative Board on 26 March 2017, the European GNSS Programmes Committee on 26 April 2017 and a meeting with representatives of the downstream industry on 11 May 2017.

For this interim evaluation derogation from the standard open public stakeholder consultation was granted as an online **public consultation on the European Space Strategy** was conducted earlier in 2016. In this public consultation, specific questions were asked related to market uptake of the services and data generated from Galileo and EGNOS by current and future users, as well as the evolution of these programmes in the future. The responses to the questions concerning the Galileo and EGNOS programme have been taken into consideration in the formulation of the answers to the evaluation questions (see Annexes 5 and 6 for more details).

The **secondary data collection** involved reviewing various documents and literature relevant for the evaluation. Among the key data sources of the desk research were the Galileo and EGNOS monitoring reports<sup>10</sup>, in-depth market analysis carried out by the GSA<sup>11</sup>, relevant policy papers of the European Parliament and of the European Space Policy Institute, the GSA readiness review carried out by the Commission, together with legal documents<sup>12</sup>.

#### *3.4.2. Challenges and limitations to the interim evaluation*

**The results presented in the mid-term review are based on solid evidence and are robust.** The stakeholder consultation covers the full spectrum of the value chain, with all stakeholder categories represented. Even though some parts of the value chain had a lower number of respondents, it is compensated by the fact that the major players were all interviewed.

However, three factors can be identified as limitations in the data collection:

1. Limited feedback from web-questionnaires: Only 25 replies were collected from the online questionnaire. This was linked to the fact that the web-questionnaires circulated during a short period (6 weeks). To compensate the low rate feedback, additional interviews were carried out.
2. Unavailability of earned value management data for the Galileo deployment and exploitation phases: This data is needed to calculate the Schedule Performance Indexes (SPI) and Cost Performance Indexes (CPI). It has not been released by ESA and industry. As only part of the data set was available, it was not possible to calculate the SPI and CPI for the Galileo programme.
3. Benefits of the Galileo programme: the interim evaluation was carried out after three years of the seven years duration of the programmes. While EGNOS is operational and is providing services and tangible benefits for many years, the Galileo programme has entered into its operational phase only at the end of the evaluation period. Therefore, even if the market uptake of Galileo services is gradually growing, the use of Galileo services will be much more evident after 2-3 years of operations. To provide information on initial benefits of Galileo services, the findings of the GSA market report especially in the area of Galileo-enabled chipsets and devices were used.

These limitations were taken into account in formulation of the findings and conclusions.

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<sup>10</sup> Quarterly and annual reports of the Commission, ESA and the GSA.

<sup>11</sup> GNSS Market Reports 2015 and 2017, GNSS User Technology Report.

<sup>12</sup> GNSS and GSA Regulations, Commission Implementing Decisions, Delegation Agreements, Working Arrangements, etc.

#### 4. IMPLEMENTATION STATE OF PLAY

**In the last three years, the Galileo programme made significant progress.** In particular, the Galileo programme has succeeded in the deployment of the space segment with a total of 14 satellites launched in the evaluation period (in addition to the 4 satellites launched in 2011). In 2014 two satellites were launched into an incorrect orbit, which caused that the Galileo launches were put on hold until March 2015. The launch schedule was then accelerated with additional launch in 2016 and the launch of four satellites on the Ariane-5 launcher in November 2016. The procurement of the remaining satellites (to complete the constellation of 24 satellites plus six in orbit spares), planned for 2016, was postponed to 2017. In parallel, the deployment of the ground segment has continued on track with the deployment of major elements (e.g. entry into operation of the Galileo Security Monitoring Centre at the end of 2016). The deployment of the infrastructure allowed for a major step forward in the programme - the declaration of the Galileo Initial Services in December 2016. With this declaration, Galileo programme moved into exploitation phase, providing three Initial Services (OS, SAR and PRS).

To reinforce **Galileo market uptake**, important initiatives were conducted to showcase the benefits of the Galileo services to the downstream industry, such as a conference promoting European Space solutions for sustainable transport held in Prague in June 2014. The EU Space Strategy adopted in October 2016 emphasized the need to reinforce activities aiming at introducing the use of Galileo and EGNOS services in sectorial policies. For instance, the eCall in-vehicle system established in April 2015 will be using Galileo/EGNOS services and thus contribute to the market uptake of Galileo/EGNOS in the automotive sector. Already today, leading GNSS companies representing more than 95% of the GNSS chipset market produce Galileo-ready chips<sup>13</sup>.

**The EGNOS programme also made significant progress in the period 2014-2016.** The EGNOS infrastructure was reinforced with an additional transmitter on the Astra-5B satellite launched in March 2014 and with the deployment of additional ground stations.

Also, the EGNOS services were continuously provided over the 98,98% of the EU-28 territory, and even improved in aviation, with the declaration of the new LPV-200 service (Localizer Performance with Vertical Guidance) in September 2015. In addition, the last version of the EGNOS system was qualified and has been operational, allowing for improvement of GPS satellites monitoring. However, the extension of the EGNOS service coverage to the remaining 1.02% of the EU-28 territory remains an objective (eastern part of Cyprus, the Azores, and the northern parts of Norway and Finland).

**EGNOS market uptake** has been proceeding at different paths according to the sectors. One key sector with a large number of EGNOS users is aviation: more than 230 airports in 20 countries are using EGNOS landing approach procedures at the end of 2016<sup>14</sup>. The second key area of EGNOS use is agriculture, to increase efficiency and productivity thanks to precision farming (e.g. more precise use of fertilizers or herbicides). In other sectors, such as maritime, transport and rail, the EGNOS market uptake is slower.

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<sup>13</sup> GSA: GNSS market Report, Issue 5 (2017), p. 7.

<sup>14</sup> European GNSS Agency: Summary of Achievements in 2016, p. 6.  
[https://www.gsa.europa.eu/sites/default/files/2016\\_gsa\\_summary\\_report.pdf](https://www.gsa.europa.eu/sites/default/files/2016_gsa_summary_report.pdf)

**The governance scheme for Galileo and EGNOS has been progressively implemented during the period 2014-2016.** Delegation Agreements were concluded between the Commission and ESA on the Galileo deployment phase, and between the Commission and the GSA on Galileo and EGNOS exploitation phases. Working Arrangements between the GSA and ESA for both Galileo and EGNOS programmes were concluded. The role of the GSA in the operational management of the programmes has gradually increased.

The Commission entrusted budget to ESA and the GSA to carry out the deployment and exploitation tasks set in the Delegation Agreements, through Commission Implementing Decisions (CID) (see table 1 below).

*Table 1: Overview of the variation of the budget allocated to ESA and the GSA over the period 2014-2016*

Entrusted entity	Activity	Budget allocated under the 2014 CID <sup>15</sup> (EUR million)	Budget allocated under the 2015 CID <sup>16</sup> (EUR million)	Budget allocated under the 2016 CID <sup>17</sup> (EUR million)	Variation (EUR million)
ESA	Galileo deployment	1 770	1 770	2 485	+ 715
GSA	Galileo exploitation	490	790	2 400	+ 1 910
GSA	EGNOS exploitation	1 450	1 450	1 552	+ 102

**The security governance of the programmes was reinforced with the Council Decision 2014/496/CFSP** that enhanced the process of security threat management under emergency circumstances. Moreover, the Common Minimum Standards for access to the Public Regulated Service were adopted by the Commission in September 2015. In addition, the Galileo Security Monitoring Centre became operational at the end of 2016.

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<sup>15</sup> Commission Implementing Decision on entrusting budget implementation tasks to the European GNSS Agency and the European Space Agency linked to the deployment and exploitation of the European GNSS Systems (EGNOS and Galileo). C(2014)809/F1. 14.02.2014.

<sup>16</sup> Commission Implementing Decision on entrusting budget implementation tasks to the European GNSS Agency and the European Space Agency linked to the deployment and exploitation of the European GNSS Systems (EGNOS and Galileo). C(2015) 7898 final. 18.11.2015.

<sup>17</sup> Commission Implementing Decision on entrusting budget implementation tasks to the European GNSS Agency and the European Space Agency linked to the deployment and exploitation of the European GNSS Systems (EGNOS and Galileo). C(2016) 4321 final. 13.07.2016.

## 5. HOW RELEVANT ARE THE EUROPEAN GNSS PROGRAMMES?

**Ensuring Europe's autonomy in satellite navigation and maximising socio-economic benefits from Galileo and EGNOS remain key objectives for the EU.** The importance of European satellite navigation services for European economy and security are clearly recognised by all stakeholders. The deployment and operations of the Galileo and EGNOS systems need to continue in the future, as outlined in the Space Strategy for Europe. The EU clearly needs to maintain and operate independent satellite navigation programmes to secure the availability of those applications and services ensuring global coverage, including the circumpolar area. In addition to ensuring Europe's autonomy in critical technology, satellite navigation services generate socio-economic benefits and contribute to strengthening EU's science and knowledge base. Compatibility and interoperability with other GNSS systems, in particular with the GPS system, need to be pursued to provide users with greater reliability and precision.

## 6. HOW EFFECTIVE ARE THE EUROPEAN GNSS PROGRAMMES?

### 6.1. Galileo infrastructure deployment and services provision

**The Galileo programme has achieved its key objective set out for the evaluation period - the system was declared operational and is providing Initial Services.** This reassured both industry players to continue investing into Galileo enabled products, and the political stakeholders that Galileo is progressing at good pace toward Full Operational Capability (FOC) (especially with respect to other competing GNSS systems). The Declaration of the Initial Services provided an excellent opportunity to raise awareness about Galileo beyond the space community, thanks to the global outreach.

**In the evaluation period, the space segment of Galileo was enhanced with 14 additional satellites. This was one of the enablers for the Initial Services declaration.** Despite the delays in the launch schedule, the majority of consulted stakeholders have positively perceived the progress of the space segment as a major programme achievement. Stakeholders indicated a high level of satisfaction concerning the way the programme has addressed the delays of the launch schedule. Some uncertainties persist about when the programme would complete launch activities. The procurement of the remaining satellites, planned to be awarded in 2016, was postponed to 2017. However, the programme seems to be back on track to meet the 2020 FOC objective.

**Delays in the deployment schedule** were created after two Galileo satellites were launched into an incorrect orbit in August 2014, which generated major difficulties and led to the postponement of the Galileo Initial Services declaration, planned in 2015, to 2016. The satellites have been repositioned into a more convenient orbit and have been used for the provision of the Galileo Search And Rescue service, but their use for navigation and positioning purposes is subject to ongoing testing. To complete the technical investigation, further launches were then put on hold until March 2015. Since March 2015 however, the launch schedule was accelerated and culminated with the launch of four Galileo satellites together on an Ariane 5 rocket in November 2016, accumulating a two year delay with respect to the planned target date of end 2014. **Usage of Ariane 5 launcher** is also seen as a major achievement reached during the evaluation period, especially among the European GNSS committee representatives and upstream industry representatives, who see a great value in utilisation of the European launcher. Indeed, the qualification and utilisation of Ariane 5 is perceived as a positive factor despite the fact that it was delayed by two years.

**In addition, the progress in the deployment of the ground segment and the entry into operation of the Galileo Security Monitoring Centre (GSMC) were important achievements that were conditional to the provision of the Galileo Initial Services. In particular, the GSMC operations are considered as an important achievement for ensuring the security of the system.**

*6.1.1. Galileo Key Performance Indicators*

The key performance indicators related to the Galileo infrastructure deployment and service levels are required by Article 34 (2) of the GNSS Regulation.

On 31 December 2016, there were 18 Galileo satellites in orbit. However, not all of them were operational. One satellite has not been usable since May 2014 due to a technical issue. The two satellites launched in August 2014 into an incorrect orbit have been used only for the provision of the SAR service and their use for navigation and positioning purposes was subject to ongoing testing. Also, the last 4 satellites launched in November 2016 were undergoing in-orbit testing. Thus, out of the 18 satellites in orbit, 11 were operational and usable to provide Galileo services since December 2016.

**Indicator 1: Galileo infrastructure deployment: Cumulative number of operational satellites**

Baseline 2013	Milestones foreseen			Target 2020
	2014	2015	2016	
4	6	12	16	30
	Actual results			
	3	9	11	

**Indicator 2: Galileo infrastructure deployment: Ground infrastructure elements availability**

Baseline	Milestones foreseen			Target 2020
	2014	2015	2016	
IOV initial configuration in June 2011	IOV final configuration	Ground Segment Version 2.0	System Build 1.5.0	System Build 2.0
	Actual results			
		GMS Version 2.1/GCS 2.0	SB 1.5.0	

**Indicator 3: Galileo services provision: Number of operational services**

Baseline	Milestones foreseen			Target 2020
	2014	2015	2016	
Number of services implemented	0	3	3	5 services
	Actual results			
	0	0	3	

## 6.2. EGNOS infrastructure deployment and services provision

**The implementation of the EGNOS programme progressed well.** The declaration of the LPV-200 service in aviation in September 2015 emerged from stakeholder consultation as a major achievement for EGNOS during the evaluation period. Thanks to this declaration, the EGNOS system now provides the highest quality guided approach services available today to airline and aerodrome operators, with an increase in flight and landing safety, and benefits related to the optimization of fuel consumption.

Stakeholders using EGNOS expressed an extremely high level of satisfaction concerning the maturity of the EGNOS system and the overall performance of the services. About half of the consulted stakeholders active in the downstream of the EGNOS value chain have expressed a level of satisfaction ranging from good to excellent, about a quarter have considered the service provision as fair, no one has considered the service provision as poor or very poor<sup>18</sup>.

**Some Member States (MS) expressed dissatisfaction and concern about the incomplete coverage of EU-28 with EGNOS services.** The EGNOS system covers the entirety of the EU Member States, but the quality of the signal is not homogeneous yet. Currently 98,98% of the EU MS, Norway and Switzerland land mass is covered by APV-I (Approach with Vertical Guidance) services. The majority of the MS are covered with a signal enabling the provision of LPV-200 (Localizer Performance with Vertical Guidance) services, while in other MS it has not been possible to declare the services yet. More precisely, the EGNOS services are available mainly in the western and central regions of Europe, while there are some limitations in the northern (e.g. Finland), southern (e.g. Madeira, Canary Islands, Azores) and eastern (e.g. Cyprus, Romania) regions. This is also visible when looking at the distribution map of declared EGNOS based approach procedures in Europe: the majority of the procedures are concentrated in aerodromes in the western and central European regions. Thus, the priority for EGNOS remains to cover the entire territories of EU-28 with EGNOS services.

**In addition, consulted system users expressed their concerns about the obsolescence and refurbishment of the current version of the EGNOS system, versus the development of the new EGNOS version** that will ensure compatibility with the Galileo system and with the changes in the GPS signals planned for 2026<sup>19</sup>. In the opinion of the consulted stakeholders, the programme does not properly address the obsolescence of the current EGNOS version and is therefore putting at risk the continuity of the EGNOS operations. Indeed, all efforts are focused on the development of the new EGNOS version, including a new generation of ground stations which are not compatible with the current EGNOS version. This exposes the programme to risks. In case of a delay in the delivery of the new EGNOS version, the continuation of the EGNOS operations might be jeopardised, either due to the obsolescence of the current ground stations or due to the incompatibility with the Galileo system and the new GPS signal.

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<sup>18</sup> PwC aggregation of web-questionnaire results

<sup>19</sup> According to current baseline, the GPS will discontinue the current signal in 2026, two year after the FOC declaration of GPS L5 planned in 2024.



### 6.1.2. EGNOS Key Performance Indicators

The key performance indicators related to the EGNOS infrastructure deployment and service levels are required by Article 34 (2) of the GNSS Regulation.

<b>Indicator 1: Progress of the EGNOS coverage extension versus agreed coverage extension</b>							
Baseline	Milestones foreseen						Target 2020
	2014	2015	2016	2017	2018	2019	
EGNOS Service Evolution Plan v2.0 established in 2015 <sup>20</sup>	n/a	Establishment of an updated EU coverage extension plan for EU-28 in December 2015 Establish EGNOS Service Evolution Plan v2.0	Report on advancements in coverage	Report on advancements in coverage	Report on advancements in coverage	Report on advancements in coverage	Coverage of EU-28 with EGNOS in line with the EGNOS Service Evolution Plan
	n/a	Actual results					
	n/a	EGNOS Service Evolution Plan v2.0 was established	98.98% coverage of EU28-NO-SW land masses for APV-I				

<b>Indicator 2: EGNOS service availability index based on the number of airports with EGNOS-based approach procedures with an operational status versus the total number of airports with EGNOS - based approach procedures</b>							
Baseline	Milestones foreseen						Target 2020
	2014	2015	2016	2017	2018	2019	
Service availability index: 100%  Total number of airports with EGNOS procedures: 93 (2013)			Maintain the service availability index: 99%	Maintain the service availability index: 99%			Maintain the service availability index constantly at least on 99%
	Actual results						
Total number of airports with EGNOS procedures with an operational status: 93 (2014)	Service availability index: 97.72%	Service availability index: 99.9%	Service availability index: > 99%				
	Total number of airports with EGNOS procedures:	Total number of airports with EGNOS procedures:	Total number of airports with EGNOS procedures:				
	93	174	230				

<sup>20</sup> The Service Evolution Plan (SEP) was agreed between the Commission and GSA and constitutes the baseline for the implementation of the EGNOS mission and security requirements. It defines the extension of EGNOS services over the European territory in terms of their availability which is depicted in a form of 'availability maps'.

	132	Total number of airports with <i>operational status</i> : 173	Total number of airports with operational status: 230				
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### 6.3. Galileo and EGNOS market uptake

**The European GNSS industry has grown and accounted for 25% of the global GNSS market in 2015<sup>21</sup>.** European manufacturers represented the majority of manufacturers for the road and maritime market segments. European system integrators represented the majority of integrators for the maritime, agriculture and surveying market segments.

**Although the Galileo programme is not fully operational yet, it has already generated major benefits in Europe,** like the development of navigation, positioning and timing services. The declaration of Galileo Initial Services enabled chipset and receiver manufacturers to start leveraging on more performant GNSS signals. Already today, leading GNSS companies representing more than 95% of the GNSS chipset market produce Galileo-ready chips. Following widespread adoption in high-precision devices, a number of Galileo-ready devices has already hit the mass market, including smartphones and in-vehicle navigation systems<sup>22</sup>. Initial Services are the first step towards full operational capability, foreseen in 2020, and more benefits are expected in the next years, with a larger market uptake.

The regulatory measures taken by the EU in the automotive sector (eCall and Digital Tachograph) are pushing for adoption of solutions integrating GNSS-based technologies, whilst at the same time ensuring compatibility with Galileo and EGNOS. These regulations are expected to produce large benefits in the prevention, management and recovery of emergencies. The stakeholder consultation identified a need, for the next phase of the Galileo programme, to shift the focus from the deployment and operation of the infrastructure to the development of downstream and applications.

**As for EGNOS, major socio-economic benefits have already been produced, especially in three industrial domains with the largest market penetration: aviation, agriculture and surveying.** In other sectors, such as maritime and rail, the GSA has been implementing market penetration roadmaps. However, due to the general inertia to the adoption of new technologies and the existence of alternative ground-based technologies, the market uptake is slower in these sectors. The downstream stakeholder consultation has enabled to identify the need for further initiatives that would increase market penetration and technology adoption.

<sup>21</sup> GSA: GNSS Market Report, Issue 5 (2017), p.13.

<sup>22</sup> GSA: GNSS Market Report, Issue 5 (2017), p.7.

### 6.1.3. Market Trend Key Performance Indicators

The key performance indicators related to the market levels are required by Article 34 (2) of the GNSS Regulation.

Indicator 1: Market share of EU GNSS industry in worldwide GNSS downstream market							
Baseline <sup>23</sup>	Milestones foreseen						Target 2020
	2014	2015	2016	2017	2018	2019	
EGNOS present in number of receiver models in 2012 : 63%	63%	63%	75%	75%	78%	82%	85%
	35%	35%	45%	40% <sup>24</sup>	42%	44%	
Galileo present in number of receiver models in 2012: 35%	Actual results						70%
	63%	63%	68%				
	35%	35%	38% <sup>25</sup>				

## 7. HOW EFFICIENT ARE THE EUROPEAN GNSS PROGRAMMES?

### 7.1. Funding

**For the period 2014-2020, the European Union allocated a total budget of EUR 7 071,73 million for the Galileo and EGNOS programmes.** This envelope covers programme management activities, Galileo deployment and exploitation activities, EGNOS exploitation activities and risks associated to these activities. On the evaluation period, some reallocations between budget lines have been carried out. 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.

### 7.2. Key Performance Indicators

The Schedule Performance Index (SPI) and the Cost Performance Index (CPI), as required by Article 34 (2) of the GNSS Regulation, are monitored based on the Earned Value Management technique, which enables to monitor and forecast project performance based on the scope, the schedule and the cost of the project. The Schedule Performance Index (SPI) measures the schedule efficiency of a project by comparing the Earned Value (EV) to the Planned Value (PV) of a project. This aims to assess how close a project is to performing

<sup>23</sup> The market share indicator is based on the percentage of Galileo and EGNOS receivers in the total number of receiver models worldwide. The baseline for this indicator was established in 2014 and the data is included in the 2014 market report of the European GNSS Agency and will be measured annually. The trend of the production of Galileo and EGNOS enabled model receivers suggests that receiver manufacturers are gradually integrating Galileo and EGNOS into their products and that the milestone target for this indicator is likely to be reached.

<sup>24</sup> As the 2016 Galileo milestone value was forecasted back in 2012 to re-adjust the value due to what happen it the meantime.

<sup>25</sup> Out of the 417 devices on the market in 2016, 68% were supporting EGNOS and 38% Galileo .In 2016 there were 38 new models launched in the market out of which 82 % were EGNOS capable and 42% Galileo.

work as it was scheduled: if  $SPI > 1$ , then the project is ahead of schedule. The Cost Performance Index (CPI) measures the cost efficiency of a project by comparing the Earned Value (EV) to the Actual Costs (AC) of a project. This aims to assess how close the spending of a project is to what was budgeted for a work performed: if  $CPI > 1$ , then the project is coming in under the estimated budget.

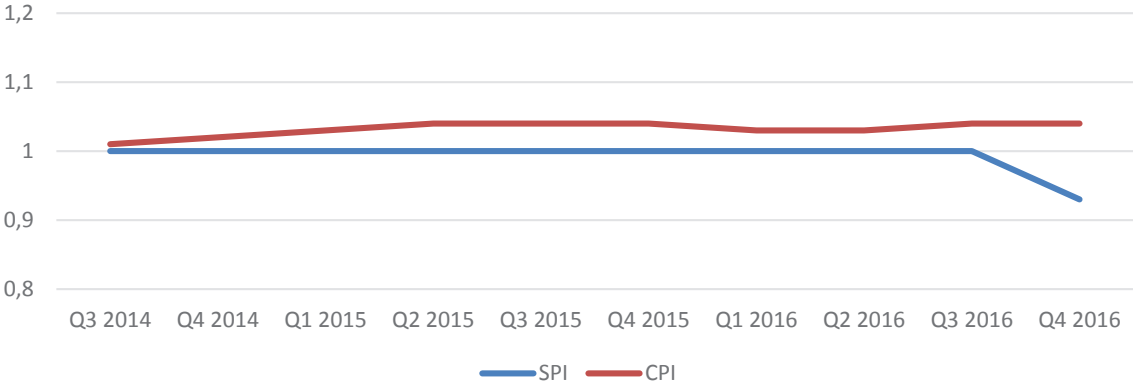
ESA and GSA are required in the Delegation Agreements (Annex: Project Management Plan) to report on a number of indicators, including the SPI and the CPI, that are used to follow up the progress of the Galileo and EGNOS programmes, and to allow for a strong financial control of the programmes.

7.1.1. EGNOS SPI and CPI

The Schedule and Cost Performance Indexes for EGNOS exploitation show an implementation well in line with the planning. As the Delegation Agreement on EGNOS with the GSA was signed in April 2014, the reporting of the SPI and CPI started 3 months after, hence in Q3 2014.

EGNOS	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016
Schedule Performance Index	1	1	1	1	1	1	1	1	0.94	0.93
Cost Performance Index	1.01	1.02	1.03	1.04	1.04	1.04	1.03	1.03	1.04	1.04

Figure 1: Evolution trend of EGNOS SPI and CPI over the reporting period



The schedule efficiency of EGNOS service provision has been excellent from Q3 2014 to Q2 2016 as the project was fully on time. In Q3 2016, a slight decrease is indicated due to a delay in the signature of various Change Contract Notices with respect to the planned date.

The EGNOS cost efficiency was also very positive as the CPI has been above 1 throughout the reporting period, which implies that the total costs for service provision were actually lower than the value of work completed according to the budget assigned each quarter.

### 7.1.2. Galileo SPI and CPI

The data to calculate the Schedule and Cost Performance Indexes are only partially available, indicating the planned and actual commitments for Galileo deployment. The remaining data were not provided by ESA and industry. Thus, it is not possible to calculate the SPI and CPI for most cost items of the programme.

## 7.3. Governance

**The new European GNSS governance scheme has been progressively implemented during the evaluation period** and it has contributed to the efficient implementation and the progress of the Galileo and EGNOS programmes over the period. All consulted stakeholders have estimated that the new governance scheme has brought more robust management processes, which have contributed to maintain the programmes within budget boundaries and to mitigate partially risks and the impact of unforeseen events on the programmes. In addition, the new governance scheme is based on a comprehensive set of communication lines and coordination mechanisms between EC, ESA and the GSA, and has thus provided a good flow of information among the governance actors.

However, consulted stakeholders have underlined that this was at the cost of administrative burden, affecting the efficiency of the programmes. Indeed, this information-sharing framework has lengthened the decision-making process. Problems were identified for the level of information provided, the structure of reporting and the availability of key indicators. In addition, the good information flow among governance stakeholders has required an important effort in terms of reporting and attendance of meetings. Moreover, the current organisation of responsibilities and control processes in the new governance scheme has often required lengthy discussions among the governance actors, thus affecting the reactivity of the decision-making process. Indeed, the EC has entrusted through Delegation Agreements Galileo and EGNOS programmes implementation tasks to ESA and the GSA, and shall oversee the execution of these delegated tasks by the agencies. Such control is necessary to ensure the proper programmes' implementation and overall coordination of EU GNSS programmes with other EU policies, but requires both agencies to perform additional activities to ensure consensus with the EC on the way tasks are executed. Finally, the governance actors play a role that is not necessarily fully in line with their culture, competencies and/or structure.

**Thus, the consulted stakeholders have recognized that the governance scheme is logically aligned with the evolution of the programme phases** (i.e. transition from Galileo deployment to the overlapping deployment/exploitation phases). However, they have expressed strong concerns concerning responsibilities and risk sharing, effort required to monitor the programmes' implementation, and levels of friction among governance actors. As a consequence, the governance scheme is often pointed out as complex and inappropriate for operational programmes with a service-driven approach such as Galileo and EGNOS. While the revision of the delegation agreements in 2016 has tackled the issues addressed in the previous paragraph at least partially, further alternatives to optimise the programme governance were discussed. Most of them focused on supporting the scale-up of the GSA through a transfer of responsibilities. This being said, and although the contribution of the governance scheme is difficult to isolate, this new governance scheme has enabled, at least partially, the substantial progress achieved by the programmes over the period 2014-2016.

**The security governance scheme, which was set up before the overall European GNSS governance scheme, has also contributed to the efficient implementation and the progress of the programmes.** Indeed, all relevant bodies and processes are today up and running, which has allowed the involved actors to fulfil their tasks, ensuring the accreditation of all the deployed elements of the European GNSS systems, the accreditation of the Ariane 5 as a launcher for Galileo satellites, and the accreditation of Galileo Initial Services. These achievements have enabled the subsequent Declaration of Galileo Initial Services in December 2016.

However, the implementation of system security requirements still necessitates attention and work. Consulted stakeholders from the Security Accreditation Board (SAB) and the European GNSS programmes have underlined that the current set-up internal to the main actors of the programme governance (i.e. EC, ESA and the GSA) does not fully ensure independency from the programme activities. Best practices suggest internal security organisations to report directly to the head of the organisation and have independent access to resources (i.e. dedicated personnel).

In addition, the security governance shall cope with new security challenges triggered by the declaration of Galileo Initial Services and the initiation of the programme exploitation phase. First, Galileo has become an operational system and has thus generated the interest for malicious attacks to the infrastructure and to the operations. These threats shall not be underestimated and the infrastructure related to the monitoring of the security of the system, especially the Galileo Security Monitoring Centre (GSMC), needs to be commensurate with these threats. Second, the Declaration of Galileo Initial Services has marked the beginning of the overlap between the Galileo system deployment and exploitation phases. This means that up to 2020, new elements will be added to the system in parallel to the service provision. This needs to be well managed to avoid that the overlap of the two phases would create security issues. From a governance point of view, because ESA will be responsible for the system deployment and the GSA will be responsible for the system operation, the interaction between the two entities will have to be closely monitored by the Commission, to avoid that system deployment leads to security issues. Third, there are some issues related to the independence of the organisations responsible for security requirement implementation and verification: the SAB and the GSMC. The SAB is established under the GSA and works independently with no reporting to the GSA Executive Director. Nevertheless, the Executive Director is responsible for the operation of the GSA and for the allocation of internal resources, including to the SAB. This represents a potential situation of conflict of interest that needs to be addressed. The GSMC is also established under the GSA and, being one of the Agency's core tasks, it is implemented and operated under the responsibility of the GSA Executive Director. Nevertheless, for security issues, the GSMC also reports to entities external to the GSA (e.g. HR, EEAS, Commission, Council, national PRS authorities). This reporting should be unbiased from any programme decisions related to the other responsibilities of the GSA Executive Director (e.g. system operations).

## **8. HOW COHERENT ARE THE EUROPEAN GNSS PROGRAMMES WITH OTHER EU POLICIES?**

**The European GNSS programmes have shown a high level of internal coherence**, both in the governance and in the R&D activities. The new governance scheme has been progressively implemented during the evaluation period (e.g. signature of the Delegation Agreements and Working Arrangements). Stakeholders have considered the overlap and duplication of efforts as inherent to this transition period. But the settling of these agreements and the upcoming hand-over process between ESA and the GSA are expected to smooth out the overlap and substantially improve the overall coherence of the governance. Moreover, the R&D activities are overall coherent. There are three different tools supporting GNSS related R&D activities: the EU Horizon 2020 programme, the Fundamental Elements initiative financed under the Galileo and EGNOS programmes and the ESA Navigation Innovation and Support Programme (NAVISP). There are limited inconsistencies between them and efforts are made to increase synergies.

**Galileo and EGNOS have also shown a high level of coherence with other EU policies.** Stakeholders knowledgeable about EU policy (e.g. Members of the European Parliament, the European GNSS programmes Committee, and the programme management) have seen a strong alignment of the European GNSS programmes with the Space strategy for Europe communication of October 2016 and with the Space Industrial Policy communication of February 2013. Also, alignment with other EU policies has been ensured.

**The European GNSS programmes have also made efforts towards coherence with other GNSS systems.** During the evaluation period, initiatives for Galileo and EGNOS compatibility and interoperability with other GNSS systems have been mainly fruitful, even though efforts must be maintained to enhance global results. Coordination agreements have been signed with the US Global Positioning System (GPS), the Indian Regional Navigation Satellite System (IRNSS) and the Japanese Quasi-Zenith Satellite System (QZSS). Partial achievements have been reached with the Chinese GNSS system BeiDou. However, little progress has been made in cooperation activities with the Russian system GLONASS.

## **9. WHAT IS THE EU ADDED VALUE OF THE EUROPEAN GNSS PROGRAMMES?**

The added value of the European GNSS lies not only in ensuring Europe's independence with regard to a critical technology but also in securing important macro-economic benefits for the European Union, catalysing the development of new services and products based on GNSS and generating technological spin-offs beneficial for research, development and innovation<sup>26</sup>.

The Declaration of Galileo Initial Services in December 2016 was a major step towards reaping the benefits of Galileo's added value. Just a few months after declaring Galileo services operational a number of Galileo-ready devices such as smartphones and car navigations hit the mass market. All main chipsets (sold by 17 major suppliers worldwide, representing 95% of the market) that are used in smartphones, tablets, cars, professional survey equipment, etc. use Galileo.

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<sup>26</sup> SEC(2011)1447.Commission Staff Working Paper, Impact Assessment, chapter 2.1.

These chipsets are embedded in consumer and professional products that we can buy today. Based on the main products on sale, the GSA estimates that more than 100 million user devices enabled for EGNOS and/or Galileo services are today in the hands of European citizens. From 2018, all new car models sold in the European Union will rely on EGNOS and Galileo to calculate the position of emergency calls in case of accidents.

In addition, the potential number of users is expected to become bigger: shipments of GNSS devices in the European Union are expected to grow from 210 million units in 2015 to almost 290 million in 2020<sup>27</sup>, representing a much larger base of users for EGNOS and Galileo.

**Continuation of the programmes' implementation at EU level is a condition for the achievement of Galileo and EGNOS initial and current objectives.** The size and complexity of the programmes require an implementation at EU level, as no viable alternative exists to ensure the appropriate return on investment. The implementation at EU level is the only way the programmes can be carried out and the results achieved. The discussion on the EU added-value has been characterised by the highest consensus among all stakeholders on the necessity to ensure continuity of the EU action.

**Stopping the Galileo and EGNOS programmes** would have severe political, economic and scientific consequences. The EU would lose its credibility as a strategic partner providing global satellite navigation system vis-à-vis its own citizens, industries and international partners. The overall investment into Galileo and EGNOS (of more than 10 billion EUR since 2007) and expected indirect economic impacts would be lost together with the potential for innovation and building up a high-tech knowledge base in Europe. From the global perspective, the position of Galileo as a global satellite navigation system would be lost.

## **10. HOW IS THE EUROPEAN GNSS AGENCY PERFORMING?**

**The GSA has successfully achieved important objectives for the progress of the Galileo and EGNOS programmes and for the development of European GNSS downstream markets** through an effective implementation of both core and delegated tasks. Key achievements of the Agency include the implementation in particular of testing activities that were required for the declaration of Galileo Initial Services; the contribution to the transition to Galileo exploitation phase with the award of the Galileo Service Operator (GSOp) contract; the management of the EGNOS operation contract and other responsibilities having led to a continuous EGNOS service provision; the smooth implementation of FP7, Horizon 2020 and Fundamental Elements R&D projects and downstream market development through monitoring, communication and promotion activities. The Agency's results have been in line with expectations and have been delivered within budget limits.

The results of the Agency have been appreciated by various stakeholders. The EU Member States representatives shared a rather positive opinion on GSA results, pointing out the successful contribution to Galileo and EGNOS programmes' implementation, a good implementation of EU rules in the activities, a transparent reporting on the Agency's activities and results, and a willingness to achieve the objectives despite difficulties. The representatives of the downstream industry also shared a positive feedback on the GSA: 79% of respondents to the questionnaire estimated that the Agency had a positive or very positive impact on market development in the evaluation period.

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<sup>27</sup> European GNSS Agency: GNSS Market Report, Issue 5 (May 2017), p.13.



**Processes implemented by the GSA are defined by the legal framework governing the Agency with which the GSA is compliant.** This compliance allows a good level of monitoring and evaluation of the Agency activities and contributes to the effective implementation of the programmes. However, this is at the cost of a substantial administrative burden, which may have an impact on the efficiency of both the Agency and its stakeholders. The Agency has also been proactive to improve the effectiveness and efficiency of its delivery process. For example, the GSA has been certified ISO-9001 for its quality management system. Nevertheless, the Agency faces some issues, in particular related to its capacity to hire appropriate profiles in terms of seniority and expertise. This is due to a low attractiveness (salaries, reputation, location) and leads to a need to outsource a part of GSA activities, which increases costs and slows down internal capabilities building. This issue has become more prominent with the growing responsibilities and budget of the Agency. Between 2014 and 2016 with the increasing responsibilities entrusted to the GSA, the total budget managed by the Agency has grown by 85,9%, and the GSA staff has increased by 22,1%.

## 11. CONCLUSIONS

According to the evidence presented in the interim evaluation, the programmes demonstrated that the implementation of the GNSS Regulation and GSA Regulation has marked good results in overall: the milestones set for the evaluation period were achieved, the implementation of actions occurred within budget limits and there is a high degree of coherence of the programmes with other EU policies. The relevance of the programmes and of the GSA is unquestioned. The EU added value is very high compared to what could be achieved at national or regional level.

The results of this interim evaluation will help to optimise the implementation of the Galileo and EGNOS programmes in the short and medium term. It is clear that in the remaining three years of the current financial perspective as well as in the future one, efforts will need to be made to address a number of challenges. The most important will be:

1. increasing market uptake of the Galileo and EGNOS services by demand driven measures, stimulating development and use of innovative applications, supporting the competitiveness of the European companies on the global GNSS market, promoting the use of European satellite navigation technology and services worldwide;
2. ensuring continuous provision of Galileo and EGNOS services in the future: reaching full operational capability of Galileo by 2020, enlarging the coverage of EGNOS services to the entire territory of the EU-28 Member States, preparing the next generation of Galileo and EGNOS services and infrastructure;
3. optimising the current governance scheme for the Galileo and EGNOS programmes, which should reflect the operational phase of these service-driven programmes, reducing the administrative burden for the key actors, reducing the complexity of the decision making process, taking into account the new security challenges such as cybersecurity and the need for clear roles and responsibilities of the actors responsible for security requirements implementation and verification.

## ANNEX 1 – ACRONYMS AND GLOSSARY

<b>Name or abbreviation</b>	<b>Description</b>
<b>APV-I service</b>	Approach with Vertical guidance (EGNOS service for civil aviation).
<b>COSPAS-SARSAT</b>	The International COSPAS-SARSAT Programme is a treaty-based, non-profit, intergovernmental, humanitarian cooperation of 43 nations and agencies dedicated to detecting and locating radio beacons activated by persons, aircrafts or vessels in distress, and forwarding this alert information to authorities that can take action for rescue.
<b>CPI</b>	Cost Performance Index
<b>CS</b>	Commercial Service (of the Galileo system)
<b>EC</b>	European Commission
<b>EDAS</b>	EGNOS Data Access Service
<b>EGNOS</b>	European Geostationary Navigation Overlay Service. The EGNOS system is the European Satellite-Based Augmentation System (SBAS). The EGNOS programme aims to establish the EGNOS system.
<b>ESA</b>	European Space Agency. ESA is an international organisation with 22 Member States, two of which Norway and Switzerland are not members of the EU.
<b>EU</b>	European Union
<b>European GNSS programmes</b>	Galileo programme and EGNOS programme
<b>FOC</b>	Full Operational Capability (of the Galileo system)
<b>Galileo</b>	The Galileo system is the European Global Navigation Satellite System (GNSS). The Galileo programme aims to establish the Galileo system.
<b>GDP</b>	Gross Domestic Product
<b>GLONASS</b>	Globalnaya navigatsionnaya sputnikovaya sistema. It is the Russian Global Navigation Satellite System (GNSS).
<b>GNSS</b>	Global Navigation Satellite System
<b>GPS</b>	Global Positioning System. It is the American Global Navigation Satellite System (GNSS).
<b>GSA</b>	European GNSS Agency
<b>GSMC</b>	Galileo Security Monitoring Centre
<b>GSOp</b>	Galileo Service Operator
<b>IOV</b>	In-Orbit Validation (of the Galileo system)
<b>IRNSS</b>	Indian Regional Navigation Satellite System. It is the Indian Global Navigation Satellite System (GNSS).
<b>LPV-200 service</b>	Localizer Performance with Vertical guidance (EGNOS service for civil aviation)
<b>MS</b>	Member States of the European Union
<b>MSAS</b>	Multi-functional Satellite Augmentation System. It is the Japanese Satellite-Based Augmentation System (SBAS).
<b>NAVISP</b>	Navigation Innovation and Support Programme (ESA programme supporting GNSS related R&D activities)
<b>OS</b>	Open Service (of the Galileo and EGNOS systems)
<b>PRS</b>	Public Regulated Service (of the Galileo system)
<b>QZSS</b>	Quasi-Zenith Satellite System. It is the Japanese Global Navigation Satellite System (GNSS).
<b>SAB</b>	Security Accreditation Board
<b>SAR</b>	Search and Rescue service (of the Galileo system)
<b>SBAS</b>	Satellite-Based Augmentation System
<b>SoL</b>	Safety of Life service (of the EGNOS system)
<b>SPI</b>	Schedule Performance Index
<b>WAAS</b>	Wide Area Augmentation System. It is the American Satellite-Based Augmentation System (SBAS).

## ANNEX 2 – PROCEDURAL INFORMATION

### 1. Lead DG: DG Internal Market, Industry, Entrepreneurship and SMEs (DG GROW)

### 2. Organisation and timing

The Staff Working Document on interim evaluation of the Galileo and EGNOS programmes and evaluation of the European GNSS Agency accompanies the Report from the Commission to the European Parliament and Council on the implementation of the Galileo and EGNOS programmes and on the performance of the European GNSS Agency.

To take stock of the expertise available in other Commission services, an Inter-Service Group (ISG) was set up in July 2016, comprising of the following Directorate-Generals: DG GROW, SG, SJ, DG BUDG, EEAS, DG CONNECT, DG RTD, DG JRC, DG MOVE. The ISG met seven times between July 2016 and July 2017 and was consulted throughout the evaluation process.

### 3. Evidence used in the interim evaluation

#### *Stakeholder consultation*

An extensive stakeholder consultation was carried out by the external contractor during February and March 2017. Two different methods were used: face-to-face/telephone interviews and targeted consultation by means of web questionnaires. A total of 97 stakeholders were consulted: 71 in direct interviews, 25 via web questionnaires and 2 via written contributions.

The **face-to-face/telephone interviews** method implied direct interactions with selected stakeholders in the form of semi-structured interviews. For these interviews, 12 different interview guidelines were developed, tailored to specific categories of stakeholders. Out of a base of over 100 key stakeholders, a total of 85 have been selected to be interviewed in 72 different entities. 32% of the sample was made of representatives of core user organisation, while other users counted for the remaining 68%. In terms of geographical composition, European users accounted for 86% of the sample, while the remaining 14% consisted of international users in USA, Canada, Switzerland and Australia. A feedback of 71 stakeholders received in the direct interviews was used for the interim evaluation.

Targeted consultation implied distribution of **web questionnaires** to a large number of stakeholders. The questions were general so that all types of stakeholders with interest in the programmes could answer them. In addition to a general questionnaire, a specific questionnaire dedicated to EGNOS civil aviation stakeholders (i.e. airports and airlines) was prepared and distributed to collect information on EGNOS service performance. Only limited feedback of 25 replies was collected via the online questionnaire. This was mainly due to the fact that the questionnaires were online for a relatively short period of time (6 weeks). To compensate the low rate feedback, the focus was on receiving input from additional direct interviews.

Another source of **stakeholders' input** was received during **dedicated meetings** on the interim evaluation, for example the GSA Administrative Board on 26 March 2017, the

European GNSS Programmes Committee on 26 April 2017 and a meeting with representatives of the downstream industry on 11 May 2017. GSA and ESA were consulted during the whole process of the interim evaluation.

For this interim evaluation derogation from the standard open public stakeholder consultation was granted as an online **public consultation on the European Space Strategy** was conducted earlier in 2016. In this public consultation, specific questions were asked related to market uptake of the services and data generated from Galileo and EGNOS by current and future users, as well as the evolution of these programmes in the future. The responses to the questions concerning the Galileo and EGNOS programme have been taken into consideration in the formulation of the answers to the evaluation questions.

#### *Desk research*

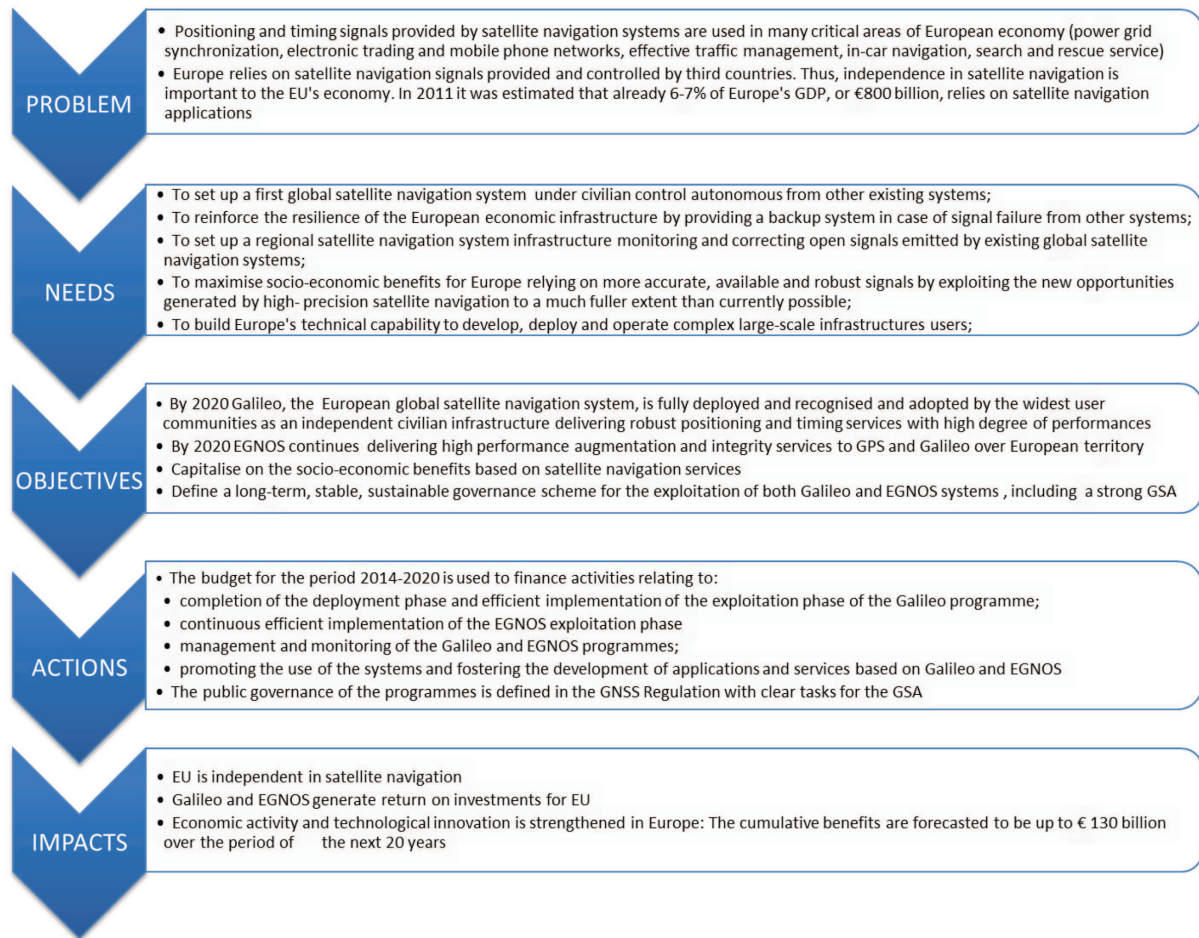
The **secondary data collection** involved reviewing various documents and literature relevant for the evaluation. Among the key data sources of the desk research were the Galileo and EGNOS monitoring reports (quarterly implementation reports, annual reports from the Commission, GSA and ESA), in-depth market analysis carried out by the GSA (Market Reports, User Technology Report), relevant policy papers of the European Parliament and of the European Space Policy Institute, the GSA readiness review carried out by the Commission, together with legal documents (applicable Regulations, Commission Implementing Decisions, Delegation Agreements between EC and ESA as well as between EC and GSA, Working Arrangements between GSA and ESA).

#### **4. External expertise**

The interim evaluation is based on an evaluation study contracted by the European Commission to an external consultant (PwC France). The contractor started to work in November 2016 and submitted the final evaluation study in July 2017. The evaluation study fulfils the contractual conditions. It applies methodologies to collect, analyse, judge and present primary and secondary data to answer the evaluation questions. The evaluation provides a very good overview of the Galileo and EGNOS programmes implementation as well as of the European GNSS Agency and its performance of the last three years (2014-2016).

With regarding to the timing of the evaluation study, it was expected that the study is finalised by end of March 2017. However, due to delays caused by the need to substantially redraft the interview guidelines in January 2017, the launch of the stakeholder consultation was postponed to mid-February. Also due to the number of direct interviews that needed to be carried out, the stakeholder consultation was only finalised at the end of March 2017. In addition, more contacts with the contractor were needed, to reflect the requirements of the ISG.

## ANNEX 3 – INTERVENTION LOGIC



## ANNEX 4 – DETAILED EVALUATION QUESTIONS

Main evaluation questions	Sub-questions per evaluation criteria
To what extent are the European GNSS programmes still <b>relevant</b> regarding the current needs of the EU?	<ul style="list-style-type: none"> <li>To what extent is an autonomous global satellite navigation system necessary for EU?</li> <li>To what extent is a European regional satellite augmentation system necessary for EU?</li> <li>Do the objectives of Galileo and EGNOS still correspond to the current needs of the EU?</li> </ul>
To what extent were the <b>effects</b> (benefits) achieved at the lowest cost?	<ul style="list-style-type: none"> <li>To what extent were the resources spent for implementing the programmes used efficiently?</li> <li>To what extent does the governance of the programmes (as set out in chapter III of the GNSS Regulation) contribute to the efficient implementation of the programmes?</li> <li>What is the performance of the programmes in terms of cost and schedule performance indexes (see Article 34(2) (a)(iii) and (iv) GNSS Regulation and Article 34(2)(b)(iii) and (iv) GNSS Regulation)?</li> </ul>
To what extent have the European GNSS programmes been <b>effective</b> in achieving their objectives?	<ul style="list-style-type: none"> <li>At system/service level, what progress has been made with regard to infrastructure deployment, service level and coverage extension (see Article 34(2)(a)(i) and (ii) GNSS Regulation and Article 34(2)(b)(i) and (ii) GNSS Regulation) compared to intended milestones/targets?</li> <li>Where results have not been achieved, what factors have hindered their achievement?</li> <li>To what extent have the programmes contributed to the maximisation of socio-economic benefits, and the creation of know-how in Europe compared to set aims?</li> </ul>
To what extent are the European GNSS programmes internally <b>coherent</b> and coherent with other initiatives with similar objectives?	<ul style="list-style-type: none"> <li>To what extent are Galileo and EGNOS coherent with other programmes and policies of the EU?</li> <li>To what extent do the actors involved (Commission, GNSS Agency, Member States and ESA) act to avoid duplication of efforts?</li> <li>To what extent are Galileo and EGNOS coherent with other GNSS systems?</li> </ul>
What is the <b>EU added value</b> of Galileo and EGNOS?	<ul style="list-style-type: none"> <li>What is the additional value of Galileo and EGNOS programmes implemented at EU level compared to what could be achieved by Member States at national, regional and/or local levels?</li> <li>To what extent do the issues addressed by Galileo and EGNOS programmes continue to require action at EU level?</li> <li>What would be the most likely consequences of stopping or withdrawing the existing EU intervention?</li> </ul>
To which extent is the <b>GSA performing</b> well?	<ul style="list-style-type: none"> <li>What impact has the Agency made in achieving its objectives?</li> <li>Are the Agency's results so far in line with the expectations?</li> <li>Is the Agency delivering its results in an efficient manner in terms of smooth running, working methods, and use of resources?</li> <li>To what extent are the internal mechanisms for programming, monitoring, reporting on and evaluating the Agency adequate for ensuring accountability and appropriate assessment of the overall performance of the Agency while minimising the administrative burden of the Agency and its stakeholders (established procedures, layers of hierarchy, division of work between teams or units, IT systems, initiative for streamlining and simplification, etc.)?</li> <li>To what extent are the activities of the Agency coherent with other EU policies?</li> <li>What would be the impacts, including financial, in case of a change of scope and nature of the Agency's tasks?</li> <li>To what extent has the Agency applied its policy on conflicts of interest?</li> <li>Have there been circumstances that may have impaired the independence and autonomy of the Security Accreditation Board?</li> </ul>

## ANNEX 5 – STAKEHOLDER CONSULTATION

An extensive stakeholder consultation was carried out by the external contractor during February and March 2017. Two different methods were used: face-to-face/telephone interviews and targeted consultation by means of web questionnaires. A total of 97 stakeholders were consulted: 71 in direct interviews, 25 via web questionnaires and 2 via written contributions.

### *Direct interviews*

First, 71 stakeholders from all categories were consulted through face-to-face or phone interviews (thus 72% of the total number of consultations), including:

- 4 European Parliament Members
- 19 representatives from the European GNSS Programmes Committee (SAB representatives)
- 8 representatives from the EC (DG GROW)
- 5 representatives from the GSA programme management
- 4 representatives from the ESA programme management
- 8 representatives from upstream industries
- 5 representatives from midstream bodies (security, operations, service)
- 3 representatives from the GSA downstream market development
- 6 representatives from downstream industries
- 9 representatives from national space agencies and industry associations.

The identification of stakeholders of the Galileo and EGNOS programme were driven by the ecosystem of the respective programmes and by geographical considerations. Wide coverage of the programme ecosystem ensured evaluation of feedback from all categories of stakeholders contributing to the implementation of Galileo and EGNOS programmes, including GNSS receiver manufacturers and EGNOS Safety-of-Life service users. These stakeholders included in particular:

- Policy makers: EU Parliament Members
- Decision-makers: European GNSS Committee and GSA administration Board members
- Programme partners: DG GROW, ESA and the European GNSS Agency
- Industry: space and ground segment manufacturers, operators and downstream industry
- Other entities including National space agencies, associations

Wide geographical coverage ensured the identification of stakeholders from the largest possible number of EU Member States. As a result, most countries in the EU-28 were represented plus Norway and Switzerland.

In addition, 2 representatives of the European GNSS Programmes Committee were consulted through written contributions.

### *Online questionnaires*

Second, 25 stakeholders from all categories were consulted through web-questionnaires (thus 26% of the total number of consultations), including a general questionnaire and a specific questionnaire dedicated to EGNOS civil aviation stakeholders. Most questions were in closed form, but the stakeholders were also given the possibility to complete their answer with an open text box. Those stakeholders included:

- 1 representative from the European GNSS Programmes Committee
- 1 representative from the GSA programme management
- 3 representatives from the GSA market development
- 3 representatives from upstream industries
- 11 representatives from downstream industries
- 5 representatives from associations
- 1 representative from another category.

### *Dedicated meetings*

From March to May 2017, the Commission services organised or participated to dedicated meetings during which the interim evaluation was discussed with key stakeholders. On 26 March 2017, the GSA organised a dedicated workshop on the interim evaluation as a part of the GSA Administrative Board meeting. The conclusions of this workshop were used as an input for elaborating the interim evaluation. The European GNSS Programmes Committee met on 26 April, a dedicated ad-hoc meeting on the interim evaluation of the programmes. On 11 May a special meeting with the representatives of the downstream industry was organised to get direct feedback. GSA and ESA were consulted during the whole process of the interim evaluation.

### *Public consultation*

A standard open public stakeholder consultation was not organised for this interim evaluation as an online public consultation on the European Space Strategy was conducted between April and July in 2016. In this public consultation, specific questions were asked related to market uptake of the services and data generated from Galileo and EGNOS by current and future users, as well as the evolution of these programmes in the future. The responses to the questions concerning the Galileo and EGNOS programme have been taken into consideration in the formulation of the answers to the evaluation questions.

### *Findings*

All relevant stakeholders had the opportunity to provide inputs. The Commission's minimum standards on the coverage of the whole Galileo and EGNOS programmes' value chain and of the geography of the European Union have been met.

Stakeholders have provided in general positive feedbacks and good levels of satisfaction. However, there have been some diverging views among stakeholders, especially between the stakeholders with a direct involvement in the programmes and a visibility on the internal processes (e.g. governance actors, European GNSS Programmes Committee members, upstream industries) and the stakeholders with no direct visibility on the internal processes (e.g. downstream industries, users).



## ANNEX 6 – METHODS AND ANALYTICAL MODELS USED IN PREPARING THE EVALUATION

The external contractor PwC France established an evaluation framework to use the inputs of the stakeholder consultation to answer the evaluation questions. This evaluation framework, which is provided in PwC France's evaluation study, establishes the Key Performance Indicators (KPIs) used to answer the questions and sub-questions of the evaluation criteria, the type of data gathering activity used to evaluate the KPIs (I: Stakeholder interview; Q: stakeholder questionnaire; D: desk research), and the targeted stakeholder category or the document used as source of information.

### Evaluation framework

KPI	Type of data collection			Audience for interviews and surveys/ Source for desk research	
	I	Q	D		
<b>Effectiveness</b>					
<b>Question 1A: At system/service level, what progress has been made with regard to infrastructure deployment, service level and coverage extension (see Article 34(2)(a)(i) and (ii) GNSS Regulation and Article 34(2)(b)(i) and (ii) of the GNSS Regulation) compared to the intended milestones/targets?</b>					
1 (a)	Number of Galileo satellites declared ready for operations			X	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
2 (a)	Number of EGNOS payloads declared ready for operations			X	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
3 (a)	Number of successful satellite ‘Launch Readiness Reviews’ executed in the period 2014-2016			X	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
4 (a)	Number of successful EGNOS payloads ‘Launch Readiness Reviews’ executed in the period 2014-2016			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
5 (a)	Number of On-Orbit Galileo satellites declared operational in the period 2014-2016			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
6 (a)	Utilisation of the Ariane 5 launcher			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
7 (a)	Number of On-Orbit EGNOS payloads declared operational in the period			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports

KPI		Type of data collection			Audience for interviews and surveys/ Source for desk research
		I	Q	D	
	2014-2016				Reports
8 (a)	Elements of the core Galileo Ground Segments declared operational in the time frame 2014-2016			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
9 (a)	EGNOS system releases			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
10 (a)	Galileo service declarations			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
11 (a)	EGNOS service declarations			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
12 (a)	Availability of Galileo SDD			x	EC – Quarterly Progress Reports ESA – Technical Annexes to the Progress Reports
13 (a)	EU-28 land mass provided with APV-I service	x			GSA/ESSP
14 (a)	EU-28 land mass provided with VLP-200 service	x			GSA/ESSP
15 (a)	Total number of airports with EGNOS procedures (A)	x			GSA/ESSP
16 (a)	Total number of airports with EGNOS procedures with an operational status (B)			x	EC – Quarterly Progress Reports GSA – Annual Report
17 (a)	EGNOS service availability index based on the number of airports with EGNOS procedures with an operational status versus the total number of airports with EGNOS procedures (B/A)			x	GSA Annual implementation report, FP6, FP7, Horizon2020 Website EC – Quarterly Progress Reports
18 (a)	EGNOS coverage extension vs planned service coverage area	x		x	GSA Annual Implementation Report, FP6, FP7, Horizon2020 website

KPI		Type of data collection			Audience for interviews and surveys/ Source for desk research
		I	Q	D	
					EC – Quarterly Progress Reports  GSA/ESSP
19 (a)	Establishment of international partnership in strategic area of extensions (to be repeated for each area of extension)			x	GSA Quarterly Implementation Report, FP6, FP7, Horizon2020 Website
20 (a)	Activities initiated to raise awareness in the areas of extension			x	GSA Quarterly Implementation Report, FP6, FP7, Horizon2020 Website
21 (a)	Number of installed RIMS			x	GSA Quarterly Implementation Report, FP6, FP7, Horizon2020 Website
<b>Question 1B: Where results have not been achieved, what factors have hindered their achievement?</b>					
1 (b)	Exogenous factors	x	x		EC, GSA, ESA, OHB, Airbus D&S
2 (b)	Anticipation of policy changes	x	x		EC, GSA, ESA, OHB, Airbus D&S
3 (b)	Anticipation of risks and/or opportunities	x			EC, GSA, ESA, OHB, Airbus D&S
<b>Question 1C: To what extent has the programme contributed to socio-economic benefits, and the creation of know-how in Europe compared to set aims.</b>					
1 (c)	Impacts on EU MS GDP, employment and tax revenues	x			EC, ESA, GSA
2 (c)	Number of jobs in the upstream industry			x	European GNSS Agency, Market Report 2015
3 (c)	Number of jobs in the downstream industry			x	European GNSS Agency, Market Report 2015
4 (c)	EU industry share of GNSS global market (Galileo)			x	Draft General Budget of the European Commission for the financial year 2016 and for the year 2018
5 (c)	EU industry share of GNSS global market (EGNOS)			x	Draft General Budget of the European Commission for the financial year 2016 and for the year 2018

KPI		Type of data collection			Audience for interviews and surveys/ Source for desk research
		I	Q	D	
6 (c)	Percentage of European farmers relying on EGNOS to enhance precision agriculture			x	GSA Website
7 (c)	Reduction in the amount of labour needed for organic farming when using EGNOS			x	GSA Website
8 (c)	Safety-of-Life Service contribution to the reduction of CO <sub>2</sub> emissions			x	GSA Website
9 (c)	Safety-of-Life Service contribution to the reduction of flight delays and cancellations			x	GSA Website
10 (c)	Impact on technologies and new products	x	x		Industrial/Commercial partners (potentially ESA and EUROSPACE)
11 (c)	Networking and image return	x	x		Industrial/Commercial partners (potentially ESA and EUROSPACE)
<b>Efficiency</b>					
<b>Question 2A: To what extent were the resources spent on implementing the programmes used efficiently?</b>					
1 (a)	Change of costs and commitments			x	Quarterly Implementation Reports
2 (a)	Programme costs and commitments			x	Quarterly Implementation Reports
3 (a)	EU intervention cost efficiency			x	Quarterly Implementation Reports
4 (a)	H2020 Projects			x	GSA Website
5 (a)	Schedule implementation			x	GSA Quarterly Implementation Report
<b>Question 2B: To what extent does the governance of the programmes (as set out in chapter III of the GNSS Regulation) contribute to the efficient implementation of the programmes?</b>					
1 (b)	Programme reporting	x	x		GSA, ESA, EC
<b>Question 2C: What is the performance of the programmes in terms of cost and schedule performance indexes (see Article 34(2)(a)(iii) and (iv) GNSS Regulation and Article 34(2)(b)(iii) and (iv) GNSS</b>					

KPI	Type of data collection			Audience for interviews and surveys/ Source for desk research	
	I	Q	D		
<b>Regulation)?</b>					
1 (c)	Cost and schedule			x	EC – Quarterly Progress reports  GSA – Annual Implementation reports
<b>Coherence</b>					
<b>Question 3A: To what extent are Galileo and EGNOS coherent with other programmes and policies of the EU?</b>					
1 (a)	Coherence of the EGNSS programme policies with policies of the EU	x	x		Programme management
2 (a)	Internal consistency of the EGNSS programme policies		x		Programme management, Upstream and Downstream
3 (a)	Coherence of the EGNSS programme policies with other EU policies		x		Programme management, Upstream and Downstream
4 (a)	Coherence of the EGNSS programme policies with the EU Space Policy		x		Programme management, Upstream and Downstream
5 (a)	EU countries having declared their interest in GNSS-based tolling			x	GNSS Market Report, issue 4 (2015) and issue 5 (2017)
6 (a)	EU countries having successfully implemented GNSS-based tolling systems			x	GNSS Market Report, issue 4 (2015) and issue 5 (2017)
7 (a)	Flexibility for new organisation		x		Programme management, Upstream and Downstream
8 (a)	Coherence of the EGNSS programme policies with H2020 RTD Objectives		x		Programme management, Upstream and Downstream
9 (a)	Coherence of the EGNSS programme policies with policies of the EU		x		Programme management, Upstream and Downstream
<b>Question 3B: To what extent do the organisations involved (Commission, GNSS Agency, Member States and ESA) take measures to avoid the duplication of efforts?</b>					
1 (b)	Perimeter duplication	x	x		Programme Management
2 (b)	Occurrence of overlaps	x	x		Programme Management

KPI		Type of data collection			Audience for interviews and surveys/ Source for desk research
		I	Q	D	
3 (b)	Efficiency of determination of duplications	x			Programme Management
4 (b)	Duplications of efforts in service provision	x			Midstream actors
5 (b)	Efficiency of redundancy determination	x			Midstream actors
<b>Question 3C: To what extent are Galileo and EGNOS coherent with other GNSS systems?</b>					
1 (c)	Coherence with other GNSS	x	x	x	Infrastructure development entities/GSA Market Report, GSA GNSS Technology report
<b>EU Added Value</b>					
<b>Question 4A: What is the additional value of Galileo and EGNOS programmes compared to what could be achieved by Member States at national, regional and/or local levels?</b>					
1 (a)	Added value of European intervention for project management	x	x		DG GROW, GPS, GLONASS, BEIDOU, Prime contractors
2 (a)	Added value of financial risks compared to national initiatives	x	x		GSA, National Space Agencies
3 (a)	Added value for operational risk mitigation	x			GSA and Prime contractors
4 (a)	Added value on cooperation modalities and impact on bureaucracy		x		ESA, EC, GSA
5 (a)	Added value of European intervention for funding	x			ESA, EC, GSA
6 (a)	Added value of a European competitive landscape	x			Procurement entity
<b>Question 4B: To what extent do the issues addressed by Galileo and EGNOS programmes continue to require action at EU level?</b>					
1 (b)	Importance of EU level actions	x			EC, GSA, Members States
<b>Question 4C: What would be the most likely consequences of stopping or withdrawing the existing EU intervention?</b>					
1 (c)	Importance of EU intervention	x			Member States, DG GROW, ESA

KPI	Type of data collection			Audience for interviews and surveys/ Source for desk research	
	I	Q	D		
<b>GSA evaluation</b>					
<b>Question 5A: What impact has the GSA made in achieving its objectives?</b>					
1 (a)	EGNOS-based approach adoption	x	x		ESSP, Airlines, National Aviation Authorities
2 (a)	Advancement against market adoption strategy	x	x		GSA, Long lead-time user communities (EU Agencies/Bodies, Governmental bodies, Commercial)
3 (a)	EGNSS Market uptake	x	x		GSA, Long lead-time user communities (EU Agencies/Bodies, Governmental bodies, Commercial)
4 (a)	Number of engaged/certified manufacturers and operators	x	x		Industrial/Commercial partners (potentially ESA and EUROSPACE)
5 (a)	Stakeholder satisfaction	x	X		Industrial/Commercial partners (potentially ESA and EUROSPACE)
<b>Question 5B: Are the Agency's results so far in line with the expectations?</b>					
1 (b)	Security Accreditation Board Meetings	x			EC, GSA, ESA
2 (b)	Security accreditation and certification	x			EC, GSA, ESA
3 (b)	Operational readiness of the GSMCs	x			EC, GSA
4 (b)	Established and accredited interfaces to CPA	x			EC, GSA
5 (b)	Ramp-up of personnel for GSMC operations	x			EC, GSA
6 (b)	Technical support to Competent PRS Authorities	x			EC, GSA, National POC
7 (b)	Reports to the European Parliament and Council	x			GSA
8 (b)	Service & system evolutions	x			GSA, Long lead-time user communities (EU Agencies/Bodies, Governmental bodies,

KPI		Type of data collection			Audience for interviews and surveys/ Source for desk research
		I	Q	D	
					Commercial)
9 (b)	EGNOS system releases	x			GSA, ESA
10 (b)	Promotion of applications & services	x			GSA, industrial partners, long-lead time users
11 (b)	Number of promotional activities	x			GSA, industrial partners, long-lead time users
12 (b)	Fundamental elements	x		x	GSA interview/ FP6, FP7, Horizon2020 Website/GSA Website
<b>Question 5C: Is the Agency delivering its results in an efficient manner in terms of smooth running, working methods, and use of resources?</b>					
1 (c)	Use of resources				GSA Annual Implementation Reports
2 (c)	Use of (human) resources	x			GSA
3 (c)	Working methods	x			GSA
4 (c)	GSQ resources and allocation plan vs assigned tasks and objectives	x			GSA
5 (c)	Resource optimisation	x			GSA
6 (c)	Costs vs benefits	x			GSA
7 (c)	Reporting quality			x	GSA Quarterly Implementation Report
8 (c)	Staff integration			x	GSA Quarterly Implementation Report
9 (c)	Work organisation	x			GSA
<b>Question 5D: To what extent are the internal mechanisms for programming, monitoring, reporting and evaluating the Agency adequate for ensuring accountability and appropriate assessment of the overall performance of the Agency while minimising the administrative burden of the Agency and its stakeholders (established procedures, layers of hierarchy, division of work between teams or units, IT systems, initiative for streamlining and simplification, etc.)?</b>					
1 (d)	Internal mechanisms	X			EC, GSA
<b>Question 5E: To what extent are the activities of the Agency (GSA) coherent with other EU policies?</b>					
1 (e)	Coherence of the GSA with intra-European policies	x			Members of the European Parliament



KPI		Type of data collection			Audience for interviews and surveys/ Source for desk research
		I	Q	D	
2 (e)	Coherence of the GSA with market segments	x			Downstream actors
3 (e)	Coherence of GSA RTD activities with H2020	x			Downstream actors
4 (e)	Coherence of GSA activities with EU Common Approach	x			Members of the European Parliament