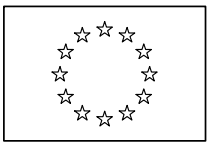

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COMMISSION STAFF WORKING PAPER

European Global Navigation Satellite System Impact Assesment Executive Summary

Accompanying the document

Proposal for a Regulation of the European Parliament and of the Council on further implementation of the European satellite navigation programmes (2014 – 2020)

{COM(2011) 814 final}
{SEC(2011) 1446 final}

ELECTRONIC VERSION ONLY

1. PROBLEM DEFINITION

1.1. Policy context

Rationale

Global Navigation Satellite System (GNSS) technologies, with their ability to provide highly reliable accurate measurements of position, velocity and time, are fundamental to improving efficiency in many sectors of the economy and in many areas of citizens' daily life. The experience of the US GPS (Global Positioning System) has demonstrated the advantages of satellite navigation so well that it is now regarded in the USA as the fifth utility[1], alongside water, electricity, gas and telephone. The US military and civil users have developed a considerable dependence on the GPS. Several other countries are now building their own GNSS.

Nowadays, satellite navigation users in Europe have no alternative other than to use satellite signals from the US GPS or Russia's GLONASS (*Global'naya Navigatsionnaya Sputnikovaya Sistema*) for positioning, navigation and time. Europe's dependence on the satellite radio navigation provided by the GPS is estimated to represent 6% to 7% of the EU-27 GDP, i.e. €800 billion[2]. Yet the military operators of these systems can give no guarantee to maintain an uninterrupted service. This means that the European economy increasingly relies on a military infrastructure that is not controlled by Europe and not primarily designed to serve European economic purposes. The European Geostationary Navigation Overlay Service (EGNOS) system and the satellite navigation system established under the Galileo programme will give the EU independent access to GNSS technologies. This strategic move has the potential to generate direct and indirect socio-economic benefits for the European Union.

The European Union has long recognised the need to have its own global satellite navigation system[3]. This political objective has a number of goals, including setting up the first global satellite navigation and positioning infrastructure under civilian control, completely independent of existing systems. The added value of the European GNSS lies not only in ensuring Europe's independence with regard to a critical technology but also in yielding major macro-economic benefits for the European Union, catalysing the development of new services and products based on GNSS and generating technological spin-offs to boost research, development and innovation[4].

Although independence in global satellite navigation is the main driver behind the Galileo programme, interoperability with existing and future satellite navigation systems, particularly the US GPS, is an important added value. Once the system set up under the Galileo programme is operational, market users will benefit from the interoperability and multiplication of satellite navigation systems providing increased reliability and precision, and

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1 The White House, Office of the Press Secretary. Press briefing by Assistant Secretary of Transportation, Gene Conti, 1 May 2000.

2 COM(2010) 308 of 14.6.2010, Impact assessment, accompanying document to the Communication of the European Commission on Action Plan on Global Navigation Satellite System (GNSS) Applications.

3 Council Resolution on the European contribution to the development of a Global Navigation Satellite System (GNSS) of 19 December 1994.

4 A detailed analysis was given in the Commission Communication on the status quo of the Galileo and EGNOS programmes published in 2007 (COM(2007) 261 final and COM(2007) 534/2).

most receivers will operate using data from several systems. Users also need back-up systems in the event of system failure or voluntary interruption of signals, which shows the value added of a civilian system.

Governance and financial framework

The European satellite navigation programme Galileo was launched in 2001. Initially the project was based on a Public-Private-Partnership with the Galileo Joint Undertaking (GJU) acting as a common management and funding platform.

In 2006, GJU was replaced by the European GNSS Supervisory Authority (GSA), in charge of managing the public interest aspects of the European GNSS programmes. The European Space Agency (ESA) was responsible for the technical management and implementation of the GNSS programmes with a combined funding of € 2.8 billion from the EU and the ESA.

Adopted in 2008, the GNSS Regulation[5] made the EU the sole political body in charge of steering and fully funding the European GNSS policy. The GNSS Regulation set out the EU funding for the Galileo and EGNOS programmes for 2007-2013. The budget of €3.4 billion was split across the remaining of Galileo development phase, the Galileo deployment phase and the operation of EGNOS.

The Commission's proposal for the next multiannual financial framework for the EU Budget 2014-2020[6] proposes financing the GNSS programmes fully from the EU budget with a proposed ceiling of € 7 billion.

1.2. Identified problems

Progress on implementing the European satellite navigation programmes is hampered by two key problems:

(1) The system established under the Galileo programme will not be fully operational and will not independently provide all five services in 2013 as planned. Since its development phase, the Galileo programme has encountered cost overruns and delays in delivering the system, the effects of which were partly prevented by a number of mitigation measures. However, the schedule set by the GNSS Regulation (according to which, by 2013, the system established under the Galileo programme is fully operational and provides independently the Open Service (OS), the Safety-of-Life service (SoL), the Commercial Service (CS), the Public Regulate Service (PRS) and the Search and Rescue service (SAR)) cannot be met.

(2) There is no definite financing and governance framework for the exploitation phase of both Galileo and EGNOS programmes after 2013. The GNSS Regulation covers the period 2008-2013, hence the development and deployment phase of the Galileo programme and the start of the exploitation phase of EGNOS. Due to cost overruns and delays, the deployment phase of the Galileo programme will be completed in 2018/2019 and the exploitation phase will start gradually in 2014. As the GNSS Regulation does not lay down the financing and governance framework for Galileo and EGNOS programmes after 2013, a new legal basis is needed for the systems to be operational, maintained and managed in the long term.

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5 Regulation (EC) No 683/2008 on further implementation of the Galileo and EGNOS programmes.

6 COM(2011) 500 of 29.6.2011 'A Budget for Europe 2020'.

The deployment and exploitation phases of the Galileo programme will run in parallel for around five years (2014–2019). During this period, governance of the Galileo deployment phase should provide continuity, consistency and credibility towards third parties and achieve continuity of service without disruption for end users. The issue of governance of the Galileo exploitation phase needs to be considered and should gradually adapt to needs and to the experience gained from providing initial services. Governance for EGNOS operations needs to be set up urgently.

1.3. Who is affected, in what ways and to what extent?

The two problems outlined above hamper the provision of services planned by the GNSS Regulation: without funding and an adequate governance framework, the infrastructure available in 2014 will not fully deliver any service. This would affect EU citizens, industry and public authorities at various levels:

- The growth of the European navigation applications industry depends on the availability of a European GNSS. If there is no European GNSS, this whole new sector will fail to emerge;

- Several economic sectors rely on the existence of a GNSS:

- Positioning information it provides drives transport activities in all forms and hence logistics systems that provide goods to EU consumers;

- Timing information is used to synchronise telecommunications networks and increasingly to power management systems, especially for the development of smart grids.

Of course, these industries do not rely today on a European GNSS and have so far satisfactorily relied on the US GPS. The very fact that US GPS provides a cost-effective solution to positioning and timing needs has accelerated the adoption of GPS-based devices in all aspects of EU citizens' daily life. Therefore, the US GPS is seamlessly becoming a single point of failure of EU critical infrastructure, which means that a disruption of GPS signal provision would have a major impact on European society.

2. ANALYSIS OF SUBSIDIARITY

The EU's right to act is based on Article 170 of the Treaty on the Functioning of the European Union[7] and the GNSS Regulation on the further implementation of the European satellite navigation programmes (EGNOS and Galileo)[8].

The establishment of satellite navigation systems cannot be sufficiently achieved by the Member States as it exceeds the financial and technical capacities of any single Member State. Therefore, it can be only achieved by action at EU level.

The GNSS Regulation states that the European Union is the owner of all tangible and intangible assets created or developed under the programmes. As owner of all related tangible and intangible assets, the European Union must ensure that all conditions to operate and

[7] OJ EU C 83/47 of 30.3.2010.
[8] OJ EU L 196/1 of 24.7.2008.

exploit the systems are in place when the first positioning, navigation and timing services are provided in 2014-2015. Therefore, governance must be of European nature.

3. OBJECTIVES

The general objective of this proposal as enshrined in Article 170 of the TFEU[9] is '*to contribute to the establishment and development of trans-European networks*' and is also cited in the flagship initiative of the **Europe 2020 strategy**[10]: '*to develop an effective space policy to provide the tools to address some of the key global challenges and in particular to deliver Galileo* [...]'.
The political objectives are to:

- Set up a first global satellite navigation system (GNSS) under **civilian control** completely **independent of other existing systems**, to provide uninterrupted GNSS services and a strategic advantage for Europe

- Improve the resilience of Europe's economic infrastructure by providing a **backup system in the event of signal failure** from other systems

- **Maximise socio-economic benefits** for Europe by relying on more accurate, available and robust signals by unlocking the potential of high-precision satellite navigation to a much fuller extent than currently possible

- **Build Europe's technical capability** to develop, deploy and operate complex large-scale infrastructures.

These political objectives were the basis for defining the European satellite navigation policy in the GNSS Regulation, which aims to provide the EU with two satellite navigation systems established under the EGNOS and Galileo programmes:

- The aim of the Galileo programme is to establish the first global satellite navigation, positioning and timing infrastructure specifically designed for civilian purposes. The system established under the Galileo programme is completely independent of other existing or potential systems and the signals emitted by the system can be used to provide five services (Open Service, Safety-of-Life service, Commercial Service, Public Regulated Service, Search and Rescue service).

- The aim of the EGNOS programme is to improve the quality of signals from existing global navigation satellite systems which can be used to provide three services (Open Service, Safety-of-Life service, EGNOS Data Access Service).

9 OJ EU C 83/124 Official Journal of the European Union 30.3.2010.

10 Communication from the Commission COM(2010) 2020 of 3 Mars 2010 on 'Europe 2020 — A strategy for smart, sustainable and inclusive growth', p15.

4. POLICY OPTIONS

4.1. Policy options to tackle problem 1: How to make progress in implementing and exploiting the European GNSS programmes

4.2. Galileo

The following options could be considered to find a way forward on implementing Galileo infrastructure:

(a) **Space segment**: At Initial Operational Capability (IOC) planned in 2014-2015, all 18 already procured satellites should be deployed, out of the 30 planned for Full Operational Capability (FOC). With the specific orbital characteristics of Galileo in mind, three theoretically and technically feasible final constellations can be considered:

(1) Deploying 18 satellites as a final constellation;

(2) Deploying 24 satellites as a final constellation;

(3) Deploying 30 satellites as a final constellation.

(b) **Ground segment**: At IOC (2014-2015), only an intermediate ground infrastructure[11] (v2) will be deployed, allowing Galileo to provide navigation signals for OS, PRS and SAR. A subsequent ground infrastructure upgrade (v3) is currently planned for deployment between IOC and FOC to enable the provision of the stand-alone Safety-of-Life service and to implement full PRS capability. Three technically feasible ground infrastructure configurations can be considered:

(1) Ground infrastructure v2, as will be reached at IOC, with **no SoL-service**;

(2) Ground infrastructure v3 with **SoL service only available in interoperability** with the US GPS (this would require fewer ground facilities and make the infrastructure simpler);

(3) Ground infrastructure v3 with **SoL service available on a stand-alone basis**;

Table 1: Policy options for problem 1

Option	Space segment	Ground segment	Services
(1) Baseline option	(A.3)	(B.3)	Services can be **provided stand-alone** as defined in the Galileo Mission Requirements Document
(2) Revised services option	(A.3)	(B.2)	Services can be provided stand-alone as defined in Galileo Mission Requirements Document, except for **SoL service that can be provided only in**

[11] The ground infrastructure comprises over 50 ground stations around the world.

			cooperation with GPS
(3) Reduced services option	(A.2)	(B.2)	Services can be provided stand-alone **but not as defined in the Galileo Mission Requirements** Document (reduced service level). SoL can be provided only in cooperation with GPS.
(4) Degraded services option	(A.1)	(B.1)	Services **cannot be provided stand-alone**, only in interoperability with GPS, **not as defined** in Galileo Mission Requirements Document.
(5) Termination of programme	none	none	none

EGNOS

The EGNOS system is already in use, but requires operations, maintenance and evolution of its services over the next years. Therefore, only two policy options can be envisaged: (1) Continuation of the programme or (2) Termination of the programme.

As EGNOS SoL is already operational, continuation of the programme is the only possible option: having declared the Safety-of-Life service operational, the Commission has secured the commitment of end-user communities to use EGNOS. This is leading end-users, in particular in the aviation sector, to heavily invest in adapting their systems to EGNOS. This calls for a long-term commitment of the Commission to provide EGNOS services.

4.3. Policy options for problem 2: Governance scheme to exploit both systems

The governance framework needs to be defined based on the management functions, organisation and legal forms. As regards the functions and their organisation, two levels of management need to be considered: (1) *political supervision* of the programmes, that remain the responsibility of the Commission, on behalf of the EU, to set the general objectives and mission requirements, and to decide on and monitor the budget, (2) *programme management* to be carried out by one entity, ensuring that systems achieve the aim stated by the political supervision level on time and to cost, including coordinating and monitoring all activities involved in achieving this aim.

4.3.1. Options for programme management

Given that the EU retains responsibility for political supervision of the programmes, there are four policy options for programme management:

(1) European Commission

(2) EU joint undertaking

(3) EU regulatory agency

(4) EU public company

Using the pre-screening criteria, focusing on feasibility, option 1 (European Commission) and option 2 (EU joint undertaking) were rejected. Options 3 and 4 were analysed further.

5. IMPACT ASSESSMENT

5.1. Analysis of impacts for problem 1: Way forward on further implementation of the European GNSS programmes

The impact of the five options on completing the full operational capability of the system established under the Galileoprogramme can be assessed from the point of view of benefits (indirect benefits and direct revenues), costs (infrastructure completion and exploitation costs) and competitiveness of the EU industry.

5.1.1. Analysis of benefits

The European Space Agency has performed simulations to assess navigation performance, expressed in terms of **navigation accuracy** and **availability**. The objectives for Galileo's performance were set by the Galileo Mission Requirements Document on an accuracy of 4 meters horizontally and 8 meters vertically (dual frequency service), with an availability of 99.5%.

Table 2: Simulated navigation accuracy by Galileo infrastructure option[12]

(m)/availability 99.5%	**Horizontal accuracy**		**Vertical accuracy**	
	Mean accuracy (99.5%)	*Worst user-location accuracy*	Mean accuracy (99.5%)	*Worst user-location accuracy*
(1) Baseline option	3.3	*3.7*	7	*7.4*
(2) Revised services option	3.3	*3.7*	7	*7.4*
(3) Reduced services option	8	*25*	11.5	*30*
(4) Degraded services option	80	*250*	138	*451*
(5) Termination of Galileo programme	N/A	*N/A*	N/A	*N/A*

Options 1 and 2 meet the objectives, even for the worst user locations, while option 3 approaches these requirements. The accuracy of option 4 is insufficient for the vast majority of users. These values show a sharp degradation of performance if the number of satellites is decreased.

The number of satellites affects **service continuity**, i.e. navigation at the Earth's surface, which is less even with a lower number of satellites, and the **robustness of the system,** i.e. the sustainability of system performance under perturbations such as satellite failure. Option 4 will be less robust as the unforeseen breakdown of one or more satellites would lead to a sharp deterioration in navigation performance and even in service provision failure. Options with larger constellations would be less affected by such events.

[12] These simulations are dependent on a number of assumptions that will be updated according to how the system will actually perform once deployed, e.g. Orbit Determination and Time Synchronisation (ODTS) accuracy.

Table 3 shows the availability of services to be provided by the system established under the Galileo programme alone and in combination with the US GPS under various policy options[13].

Table 3: Availability of services per infrastructure option

		Availability of service as per MRD				
		OS	**PRS**	**SAR**	**CS**	**SoL**
(1) Baseline option	**Stand-alone**	Yes	Yes	Yes	Yes	Yes
	With GPS	*Yes*	*N/A*	*Yes*	*N/A*	*Yes*
(2) Revised option	**Stand-alone**	Yes	Yes	Yes	Yes	No
	With GPS	*Yes*	*N/A*	*Yes*	*N/A*	*Yes*
(3) Reduced services option	**Stand-alone**	Close to MRD but limited robustness	MRD compliant but limited robustness	Yes	Yes	No
	With GPS	*Yes*	*N/A*	*Yes*	*N/A*	*Yes*
(4) Degraded services option	**Stand-alone**	Mediocre accuracy and poor continuity	Mediocre accuracy and poor continuity	Yes longer localisation time and poor robustness	Reduced capacity limited to Augmentation	No
	With GPS	*Reduced service level*	*N/A*	*Reduced service level*	*N/A*	*Degraded service level*
(5) Termination of the programme	**Stand-alone**	No	No	No	No	No
	With GPS	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

Service available as per mission requirements | Service reduced | Service degraded | Service not available

The prospect of interoperating with the US GPS, especially for options 3 and 4, would lead to a major improvement in the accuracy of the navigation, velocity and time services but has several consequences:

- The system established under the Galileo programme will be **partially or fully dependent on interoperability with US GPS**. Europe will not be able to be one of the leaders of GNSS innovation. It will lose its capacity to influence future navigation standards and will weaken the competitiveness of its industry in the area of applications and downstream technology developments precisely where most of the navigation market is booming;

- The system established under the Galileo programme will not become a separate global navigation satellite system as desired by the stakeholders, but rather an **add-on to the US GPS**. Consequently, the failure of one system will impact the combined performance of the systems perceived by the users.

[13] This table is based on the information available in September 2011 from the European Space Agency and is deliberately simplified.

These considerations are important as regards the provision of OS, PRS and CS services. As regards SAR and SoL services:

- The SAR service is operational with 18 equipped satellites, and thus its performance does not depend on the number of satellites envisaged under the various infrastructure options, though the degraded option 4 SAR could generate longer localisation time and poor robustness due to potential satellite breakdown;

- The SoL service alternatives mainly depend on deployed ground infrastructure. Option 1 will be able to provide a stand-alone SoL service, options 2 and 3 will only be able to provide a SoL service in interoperability with the US GPS and option 4 will not provide the SoL service.

5.1.1.1. Indirect benefits

The total cumulative monetised benefits (economic, social and environmental) of the GNSS programme until 2034 will depend on the chosen option. They have been modelled over a 20-year period in order to take into account a complete lifecycle of the system established under the Galileo programme, using a model developed by the European GNSS Agency.

The total indirect benefits presented in Table 4 are equal to the sum of the benefits generated by three sources:

- upstream market and spill-over (investment in space infrastructure and spill-over effects of research and development investment)

- downstream market growth (growth of the GNSS application market)

- public benefits (external effects divergently or indirectly generated by GNSS applications such as benefits for public institutions, society and users).

Table 4: EGNSS indirect benefits per option — 2014-2034

	Economic benefits		*Social and env. benefits*	
(€ bn/constant prices 2011)	Upstream market growth	Downstream market growth	Public benefits	**Total benefits**
(1) Baseline option	19.94	26.43	87.41	133.77
(2) Baseline revised services option	19.94	26.43	87.41	133.77
(3) Reduced services option	17.30	20.64	73.43	111.37
(4) Degraded services option	14.83	15.36	64.84	95.04
(5) Termination of Galileo programme	6.76	1.27	15.02	23.05

Source: European GNSS Agency

The indirect benefits of EGNOS are included in all options. The last option implies Galileo programme termination, but EGNOS is exploited and services are offered. EGNOS is consequently the only source of benefits under option 5.

5.1.2. Direct revenues

Apart from socio-economic benefits, direct revenues are expected to be generated through services provided by the GNSS programmes. Possible revenue streams

include the Commercial Service (access fees for authentication services and High Precision Positioning Service) and the Public Regulated Service (license fees on receivers, activation fees on receivers and access fees for signals)[14]. Additional indirect revenues for services where automated denial of access is hardly conceivable (e.g. Safety of Life) could be envisaged through indirect charging mechanisms but at present there is no legal framework for such mechanisms.

Table 5: EGNSS potential direct revenues per option

(EUR bn)/constant prices 2011	PRS min. and max. revenues	CS revenues	**Total average 2014-2034**
(1) Baseline option	0.24 – 0.34	1.32	1.61
(2) Baseline revised services option	0.24 – 0.34	1.32	1.61
(3) Reduced services option	0.24 – 0.34	0.00	0.28
(4) Degraded services option	0.00	0.00	0.00
(5) Termination of Galileo programme	0.00	0.00	0.00

Expected revenues from public regulated services and commercial services are no more than € 1.61 billion over the 20-year period, which is less than 10% of the total costs for the next 20 years. It is clear that the European GNSS will not be profitable enough to be run on an independent basis and will need public financing in the future. Direct revenues will never have the potential to offset the operation costs of the programmes.

5.1.3. Analysis of costs

The options vary regarding the number of deployed satellites and the specifications of the ground segment. For each option, costs have been assessed not only to complete the infrastructure, but also to cover the exploitation phase for Galileo and EGNOS. The cost estimations have been modelled over the same period as the benefits: 2014-2034, which corresponds to three seven-year periods of the EU multiannual financial framework.

Table 6: European GNSS programmes costs per option 2014-2034

(€ bn)/constant prices 2011	EU MFF 2014-2020	EU MFF 2021-2034 (2021-27, 2028-34)	**Total**
(1) Baseline option	7.8	12	19.8
(2) Baseline revised services option	7.0	11.5	18.5
(3) Reduced services option	6.5	10.8	17.3
(4) Degraded services option	5.6	10	15.6
(5) Termination of Galileo programme	2.4	1.4	3.8

5.1.4. Sector-specific impacts

The analysis reviews the impact on the competitiveness of the sector(s) targeted by the initiative, their suppliers (upstream sectors) and their clients (downstream sectors and end-users). The value chain analysis covers four main segments:

[14] Potential revenue generated by the PRS will depend on political choices to be made.

- **Upstream**: European space industry contributing to the building of the global satellite navigation system

- **Service provision**: European industry supplying commercial or public positioning, navigation or timing services

- **Downstream**: European applications industry, which depends on service provision, supplying the hardware and software needed to exploit satellite signals

- **End-users**: industries using services and applications.

It focuses on the European applications industry and end-users, where the highest impact on competitiveness is expected.

Table 7: Summary of the competitiveness impact

	(1-2) Baseline and revised services options	**(3-4) Reduced and degraded services options**	**(5) Termination of Galileo programme**
Upstream	+ +	+	–
Service provision	+ +	+	–
Downstream	+	+	–
End-users	+ +	+ +	0
Total	**+ +**	**+**	**–**

–: negative impact on competitiveness +: positive impact on competitiveness

The review of the impact on competitiveness of the different options shows that the baseline and revised services options are likely to boost significantly EU innovative competitiveness, with the creation of new markets/business sectors and with spill-over effects improving business processes and stimulating innovation in other sectors. A positive impact is also expected in terms of cost and price competitiveness.

5.2. Analysis of impacts for problem 2: Governance scheme to exploit both systems

The options for problem 2 are assessed qualitatively in terms of their compliance with the governance objectives defined in the Financial Regulation, i.e. feasibility, decision making, robustness, scope for evolution, impact on EU economy, consistency with EU policies and promotion of EU interests and EU control and accountability. These objectives are grouped by the criteria of effectiveness, efficiency and coherence.

	Effectiveness	Efficiency	Coherence
EU regulatory agency	• High feasibility • Fast decision making • **Strong robustness:** Proven legal scheme. Under umbrella of Art 340 and 343 of Treaty on the Functioning of the European Union	• **Medium scope for development,** requiring amendments of the EU legal basis establishing the agency • Positive impact on EU economy	• Strong consistency with EU policies • Strong EU control and accountability
EU public company	• **Very poor feasibility:** Neither precedent nor clear rules for the EU to create an EU public company. • Fast decision making and flexibility • **Poor robustness:** operation would be based on the national law of the Member State of incorporation	• Poor scope for development • Ambiguous impact on EU economy	• Medium consistency with EU policies and EU control and accountability

6. COMPARISON OF OPTIONS

6.1. Comparing the options for problem 1: How to make progress in further implementing the European GNSS programmes

Effectiveness

Effectiveness related to compliance with the general policy objectives is based on a qualitative comparison of the technical characteristics of the options and their impacts.

Table 8: Compliance with general policy objectives

	Set up an Independent GNSS		Increase resilience of EU economic infrastructure		Build Europe's technical GNSS capability	
(1) Baseline	●	100 %	●	100 %	●	100 %
(2) Revised services	◕	75 %	●	100 %	●	100 %

(3) Reduced services option	◕	75%	◑	50%	●	100%
(4) Degraded services option	○	0%	○	0%	◔	25%
(5) Termination of Galileo programme	○	0%	○	0%	○	0%

○: No compliance to objective ●: Full compliance with objective

Efficiency

The efficiency of the policy options is assessed based on the indirect benefits, direct revenues and costs of each option, depending on the number and quality of the services enabled.

Table 9: Cost-benefit analysis of policy options: 2014-2034

(€ bn) Constant prices 2011 and discounted prices at 4%	**Indirect benefits**		**Direct revenues**		**Costs**		**Net benefits**	
	Constant prices	Discount. prices	Constant prices	Discount. prices	Constant prices	Discount. prices	Constant prices	Discount. prices
(1) Baseline	133.77	81.26	1.61	1.05	19.8	14.65	115.58	67.66
(2) Baseline revised services	133.77	81.26	1.61	1.05	18.5	13.69	116.88	68.63
(3) Reduced services option	111.37	67.59	0.28	0.20	17.3	12.80	94.35	54.99
(4) Degraded services option	95.04	57.53	0.00	0.00	15.6	11.54	79.44	45.99
(5) Termination of Galileo programme	23.05	14.00	0.00	0.00	3.8	2.81	19.25	11.19

Coherence

Options 1 (Baseline) and 2 (Revised services) are both in line with the EU political framework, have a very positive effect on the competitiveness of the EU industry and have the potential to yield strategic benefits for the EU.

Options 3 (Reduced services) and 4 (Degraded services) are similar: both partially inconsistent with the EU's objectives and priorities and both have a fairly positive effect on competitiveness.

Option 5 (Termination of the Galileo programme) is not at all consistent with the EU's declared objectives and has a negative impact on competitiveness.

As a conclusion, taking into account all impacts, aspects of **efficiency, effectiveness and coherence** and in particular the potential cost savings, option 2 (Revised services) would appear to be the preferred option.

6.2. Comparing the options for problem 2: Governance scheme to exploit both systems

Following a comparison of impacts of the EU Regulatory Agency and EU public company, the **EU regulatory agency** appears to be the best suited to fulfil the objectives of programme management as this set-up is highly coherent, effective and efficient from the EU's point of view.

Due to the general concerns over the growth in the number of EU agencies, it is unlikely that the European Parliament or the Council of the EU will accept the creation of a new EU

regulatory agency. Out of the existing EU regulatory agencies, the European GNSS Agency is the most suitable candidate as it is a part of existing governance structures of the GNSS programmes and it has initial expertise in the relevant field.

However, the European GNSS Agency in its current form cannot take over immediately the programme management tasks of the exploitation phase as its current mandate is limited to security and market-related issues and it does not have sufficient financial and human resources.

7. MONITORING AND EVALUATION

Output indicators will be drawn from the features, quality and specifications of EGNOS and Galileo services and the extent to which they correspond to those set out by the GNSS Regulation, the on-target date delivery within the target costs and the stability, sustainability and efficiency of the governance scheme. The competitiveness of the European-based GNSS industry, the use of services, including market penetration, the number of jobs created and the indirect and direct benefits provided by the GNSS programmes will be result indicators.

The Commission will ensure that all contracts and agreements concluded in the framework of the GNSS programmes will provide for supervision and financial control by it. The focus in all monitoring and evaluation mechanisms will be on minimising programme cost overruns and delays in delivering services. To do this the Commission will propose a strategic framework listing the main measures, estimated budget and timetable by 30 June 2014, an annual work programme with detailed measures and indicators, an annual implementation report evaluating the fulfilment of these measures and an interim evaluation focusing on quantitative and qualitative results achieved by 30 June 2017, in time to prepare the next multi-annual financial framework.

In addition to these standard measures, the Commission will, when exercising its powers of political supervision over the Galileo and EGNOS programmes, improve the monitoring and evaluation mechanisms over the programme management entity by requesting detailed annual management plans and implementation reports, by steering regular programme progress meetings and by carrying out financial and technological audits.

In addition, programmes monitoring should involve Member States, for example by using their technical capabilities to provide input on technical monitoring of the programmes and to propose key performance indicators against which the programmes will be evaluated.

Lastly, in the day-to-day management, the Commission will propose a risk management mechanism and management tools to minimise the probability of programme cost overruns based on better cost estimation, taking stock of previous experience and actual system implementation.