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**COMMUNICATION FROM THE COMMISSION  
TO THE EUROPEAN PARLIAMENT AND THE COUNCIL**

**Integration of the EGNOS programme in the Galileo programme**

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## Integration of the EGNOS programme in the Galileo programme

The Council of the European Union has variously reiterated the need to ensure optimum or appropriate integration of EGNOS in the Galileo programme<sup>1</sup>. This paper addresses that concern. It has been prepared by the Commission in close liaison with the following bodies: the European Space Agency, Eurocontrol, EOIG<sup>2</sup> and IATA. Its purpose is to propose the framework within which EGNOS can operate and be integrated in the Galileo programme.

Before considering the details of how EGNOS can be integrated in Galileo, it is worth reviewing the characteristics of EGNOS, examining its costs and advantages and what it can contribute to the Galileo programme.

### 1. Review of the characteristics of EGNOS

#### 1.1. Definition and composition of EGNOS

EGNOS is the acronym for "European Geostationary Navigation Overlay Service". It offers all users of satellite radio navigation a high-performance navigation and positioning service, superior to that currently available in Europe. The system uses the signals from the American GPS and Russian GLONASS satellite constellations but, unlike these, its purpose is purely civil and non-military. It is composed of several transponders installed in geostationary satellites and a ground network of 34 positioning stations and four control centres, all interconnected. These facilities increase the reliability of the services provided by the GPS and GLONASS signals in a geographical area covering Europe, the Atlantic Ocean, the Indian Ocean, South America, Africa, the Middle East and Central Asia. The technical advantages of EGNOS are described in point 2.2 below.

EGNOS transmits an integrity message which makes it possible to provide now services approaching those that Galileo will offer tomorrow. It is dependent on the GPS system, however.

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<sup>1</sup> Council Resolution of 5 April 2001 on the Galileo project. OJ C 157, 30.5.2001. Conclusions of the Transport Council of 26 March 2002 on the Galileo programme. Conclusions of the Transport Council of 5 December 2002 on the Galileo programme.

<sup>2</sup> EOIG is the acronym for "EGNOS Operation and Infrastructure Group", in which the following bodies are represented: AENA ("Aeropuertos Españoles y Navegación Aérea"); ANA,EP ("Aeropuertos e Navegação Aérea, Empresa Pública"); DFS ("Deutsche Flugsicherung GmbH"); ENAV("Ente Nazionale Assistenza Volo"); NATS ("National Air Traffic Services Limited"); NMA (Norwegian Mapping Authority); SWISSCONTROL, CNES ("Centre National d'Etudes Spatiales").

## **1.2. History of EGNOS**

EGNOS as a concept was first mentioned in a communication of the European Commission of 14 June 1994<sup>3</sup>. It was adopted by the Council of the European Union in its resolution of 19 December 1994 on the European contribution to the development of a global navigation satellite system<sup>4</sup> and at its meeting of 14 March 1995, where it called on the Commission to take all necessary steps to lease Inmarsat transponders for EGNOS<sup>5</sup>. Furthermore, in 1996 the European Parliament and the Council included satellite radio navigation in the Community guidelines for the development of the trans-European transport network<sup>6</sup>.

## **1.3. Development and deployment of EGNOS**

The development of EGNOS is based on a tripartite agreement between the European Community, represented by the European Commission (EC), the European Space Agency and Eurocontrol. Under this agreement, approved by the Council of the European Union on 18 June 1998<sup>7</sup>:

- the European Space Agency is responsible for the technical developments of EGNOS and its operation for testing and technical validation purposes;
- Eurocontrol provides the civil-aviation user requirements and validates the resulting system in the light of these requirements;
- the European Community contributes to the consolidation of the requirements of all users and to the validation of the system in the light of such requirements, in particular in the framework of its trans-European networks and research and development actions. It also provides for the establishment of EGNOS by taking all appropriate measures, including the leasing of geostationary transponders.

The three parties thus agreed to design, develop and deploy EGNOS up to the completion of a first implementation phase involving the use of at least two geostationary navigation transponders. The agreement does not cover the following phase, which should run in parallel with the initial period of operation of Galileo for several years and be integrated in the Galileo programme.

## **1.4. Role of EGNOS in European Union satellite navigation policy**

EGNOS is the first phase, GNSS 1, of the European Union's policy on a global navigation satellite system or GNSS; the second phase, GNSS 2, is the Galileo programme and the actual launch of a new constellation of radio navigation satellites. EGNOS should be fully operational in 2004.

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<sup>3</sup> COM(94) 248 final.

<sup>4</sup> OJ C 379, 31.12.1994, page 2.

<sup>5</sup> 1834th Council meeting on transport in Brussels, 13 and 14 March 1995; point 11.

<sup>6</sup> Decision No 1692/96/EC of 23 July 1996, OJ L 228, 9.9.1996, page 1.

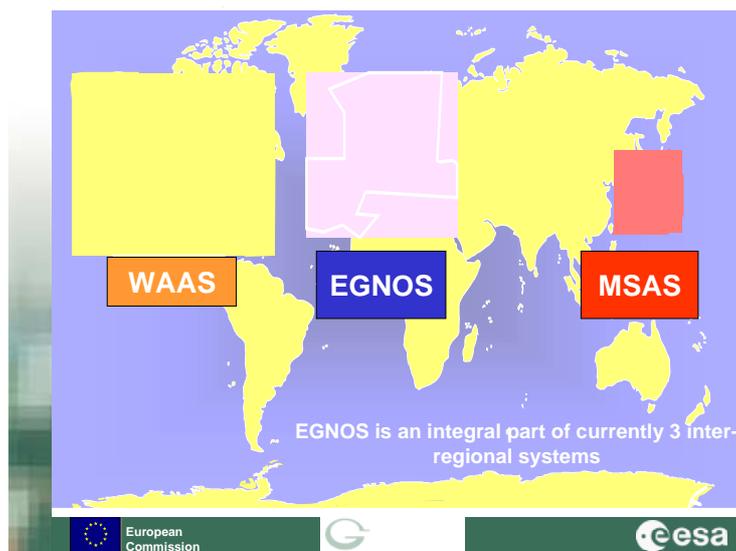
<sup>7</sup> Council Decision of 18 June 1998 (98/434/EC). OJ L 194, 10.7.1998, page 15.

In the long term a dual structure is conceivable, based on the one hand on the GPS system augmented by EGNOS and, on the other, the Galileo system. The two systems would be fully interoperable and supply complementary information. Such duality would be extremely useful, as it would further improve the reliability of the services provided by satellite radio navigation. The option of a dual structure will have to be the subject of studies at a later stage, however, in the light of developments in the Galileo programme over the next two years.

### **1.5. Place of EGNOS in the international architecture of satellite radio navigation systems**

The technology used by EGNOS is compatible with the technical standards defined at international level by the ICAO and the International Maritime Organisation (IMO).

EGNOS is also Europe's contribution to the international satellite radio navigation system drawn up by the International Civil Aviation Organisation (ICAO), based on using SBAS technology (satellite-based augmentation system) to augment radio navigation signals. When EGNOS becomes fully operational in April 2004, it will be an important regional part of this system, which is a vast network covering the entire world that is designed to augment satellite radio navigation signals to satisfy the reliability requirements of certain user communities. The SBAS-based systems that make up the network include EGNOS in Europe, WAAS (Wide Area Augmentation System) in the United States and MSAS (Multi Satellite Augmentation System) in Japan and the Far East.



EGNOS coverage can be extended outside Europe to regions such as South America, India, and Africa if the network of ground stations is suitably enlarged.

### **1.6. Financing of EGNOS up to the operational phase**

EGNOS is one of the projects selected for the trans-European networks (TENs). In this framework, it receives European Community funding of 116.4 million euros, the equivalent of about one-third of the total cost of the programme. It has paved the way for Community funding of the second global navigation satellite system (Galileo) and anticipated the new priorities accorded to the aeronautical and space sectors by the Sixth Framework Programme of Research and Development (2002-2006). In addition to financial contributions from the European Community and the European Space Agency, public administrations and corporate members of the EOIG from the civil aviation sector have provided some 100 million euros for the development of EGNOS.

**Summary table of Community support to the EGNOS project:**

<b>Year</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>Total</b>
EC contribution (in million euros)	9.5	9.5	5.5	6.0	9.5	12	16	25	23.4	<b>116.4</b>

## **2. Costs and advantages of EGNOS**

### **2.1. Cost of EGNOS**

The total cost of development and deployment of the EGNOS system, in the form due to be physically delivered by the European Space Agency in April 2004, amounts to 310 million euros<sup>8</sup>.

The annual cost of operating the EGNOS system in the next phase will amount to some 33 million euros<sup>9</sup>, which is about 15% of the total annual operating costs of Galileo.

The costs of the EGNOS approval procedure, the development of specific applications and promotion expenses will total around 14.4 million euros.

These figures cover the basic operation of EGNOS and the approval expenses for all transport modes.

**Summary table of Community contributions to EGNOS during the various phases of the programme:**

<b>Phases of the EGNOS programme</b>	<b>EC contribution (in million euros)</b>
Development and deployment	<b>116.4</b>
Integration of EGNOS in GALILEO (2004-2008)	≤ <b>33</b> /year for 2004, 2005, 2006 and pro mem. for 2007

The following table summarises the Community financial contributions to the Galileo project as a guide:

**Summary table of Community contributions to EGNOS during the various phases of the programme:**

<b>Phases of the GALILEO programme</b>	<b>Cost (in million euros)</b>	<b>EC Contribution (in million euros)</b>
Validation and development (2001-2005)	<b>1100</b>	<b>550</b>
Deployment (2006-2007)	<b>2100</b>	<i>to be decided</i>
Operational (2008-...)	<b>220/year</b>	<i>to be decided</i>

<sup>8</sup> Source: PricewaterhouseCoopers report – second phase – January 2003.

<sup>9</sup> Including operational and maintenance costs and the costs of leasing transponders.  
Source: PricewaterhouseCoopers report –second phase –January 2003.

## 2.2. Advantages of EGNOS

Of the various advantages offered by EGNOS, the general benefits should be distinguished from those of a sectoral character. EGNOS's contributions to Galileo are discussed in part 3.

### a) General advantages

EGNOS involves progress on both a technical and political level.

#### i) Technical level

One of the great merits of EGNOS is that it has enabled the European Union to develop a technical capability and know-how in the advanced sector of satellite radio navigation.

Since October 2002, the infrastructure created for the EGNOS programme has made it possible to provide successful coverage of the whole of Europe and the Mediterranean Basin in the framework of the EGNOS system test bed, or ESTB. In 2004, EGNOS will begin transmitting the first operational European satellite radio navigation signal. It will enhance the services offered by the GPS and GLONASS systems by significantly increasing their reliability for all user communities. The EGNOS signals will be available throughout Europe as an open service, i.e. one offered without technical or financial constraint to anyone with a receiver. It must be stressed that EGNOS will be available for use by everybody and anybody. Receivers for the general public with the option of receiving SBAS-based signals are already on offer on the international market.

EGNOS offers Europe's citizens satellite navigation services which are vastly superior to any service relying solely on GPS signals. **EGNOS provides substantial added value compared with the straight GPS system, because it:**

- **improves the accuracy of positioning and increases the reliability of the positioning information, by supplementing the GPS signal with signals from three separate geostationary satellites<sup>10</sup>;**
- **offers superior reception in certain places,** because additional satellites are used;
- **will provide the user with information on the reliability of the system by transmitting "integrity messages" within six seconds whenever the quality of the signals received falls below certain thresholds.**

In addition, **EGNOS transmits a Universal Time signal** (Universal Time Coordinated, UTC for short).

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<sup>10</sup> This is particularly important for professional applications. For civil aviation applications, satellite navigation depends on FDI (fault detection and isolation) and RAIM (receiver autonomous integrity monitoring) algorithms, requiring signals to be received continuously from at least six satellites.

The technical reliability and security offered by EGNOS means that it will be possible to consider providing a legal guarantee of availability, continuity and integrity for certain services<sup>11</sup>. It also means, for example, that EGNOS can be used for civil aviation in Europe for all phases of a flight, from takeoff to landing, and a wide variety of maritime and ground applications. However, although EGNOS will be primarily geared to safety-of-life applications<sup>12</sup>, it will also be of interest for commercial services and more everyday satellite navigation applications. It is destined to become the *de facto* standard in terms of quality and reliability for satellite radio navigation in Europe, the first step towards the services subsequently to be provided by Galileo.

This development will be accentuated by EGNOS's interoperability with similar systems already in use in the United States and Canada, and soon to come into service in Japan, India and China. As already mentioned, the technology used by EGNOS is recognised as an international standard by the International Civil Aviation Organisation (ICAO)<sup>13</sup> and the International Maritime Organisation (IMO)<sup>14</sup>.

## ii) Political level

EGNOS also has important political advantages. Firstly, as already mentioned, the establishment of EGNOS will complete the first phase, GNSS 1, of European policy on a global navigation satellite system, as defined in Council Decision No 98/434/EC of 18 June 1998.

In addition, the new Member States of the European Union will benefit from EGNOS services, since coverage extends to all the territories of the candidate countries for enlargement. This extension of EU policy on satellite radio navigation to the whole of geographical Europe will facilitate Galileo's market launch in third countries already interested in participating actively in the programme.

Furthermore, the safety-of-life services offered by EGNOS will be much in demand from many developing countries which still have very limited infrastructure in this area. The European Union could help them develop such capacity. Moreover, by extending its signal reception area, EGNOS could benefit regions beyond Europe and the Mediterranean Basin.

Finally, while EGNOS is mainly based on GPS signals, it is also designed to use signals from the GLONASS system. It is therefore a product of cooperation with the United States and Russia.

## **b) Sectoral advantages**

In view both of the growing role of satellite radio navigation in aircraft guidance and the direct involvement of the aviation sector in EGNOS development, the advantages of EGNOS for civil aviation should be distinguished from those benefiting other sectors of the economy.

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<sup>11</sup> This contractual guarantee does not, however, extend to the availability of signals from the GPS et GLONASS systems, over which the EGNOS operator obviously has no control. It will thus be limited to the quality of service provided by the EGNOS system itself (augmenting GPS and GLONASS signal quality, integrity messages).

<sup>12</sup> Safety-of-life services are services of very high quality and integrity for applications where human lives are at stake, such as aviation or shipping.

<sup>13</sup> EGNOS is already recognised by the ICAO, which has included it in the list of certified navigational aids (cf. annex 10 to the Civil Aviation Convention, volume 1).

<sup>14</sup> EGNOS was approved as a navigation system at the 76th session of the IMO Maritime Safety Committee.

i) Civil aviation sector:

Civil aviation has been a driving force in the use of satellite radio navigation from the outset and the first to invest in this new technology.

In future, air navigation world-wide will be based largely on satellite radio navigation. EGNOS will enable European Union air carriers to become familiar with the new technology, giving them an advantage over their competitors in planning its large-scale introduction. Airbus Industrie and several airlines have, moreover, already begun work on fitting their aircraft with EGNOS equipment.

EGNOS could also improve the operating conditions of European air carriers. However, it is difficult to quantify the environmental advantages of EGNOS in individual airports or those resulting from enhanced safety during flight phases for which there are no or few other means of guidance. In any event, EGNOS is fully in line with ICAO policy on the significant use of satellite navigation to guide aircraft in all phases of a flight and ultimately to eliminate ground support to air navigation (see footnote 13).

Last but not least, EGNOS will help combat the noise pollution suffered by people living near airports, as a result of new landing and takeoff procedures involving the overflight of less densely populated areas around airports.

ii) Other sectors:

For years, some observers thought that EGNOS would principally be geared towards civil aviation. It is now clear from surveys of several user communities that EGNOS is also of interest to many other sectors. Civil aviation has been most closely involved in the development of EGNOS simply because of the rigorous procedures and rules applied in this advanced sector.

In fact, as in the case of Galileo, EGNOS's applications extend well beyond the transport sector. In this respect, EGNOS primarily concerns two categories of users: those interested in commercial services offering a legal guarantee of reliability and those interested in safety-of-life services. EGNOS is a crucial step in the direction of establishing a full range of commercial and safety-of-life services based on satellite radio navigation.

EGNOS will be of particular benefit to the following activities:

- Maritime and inland waterway transport. These sectors could use the information supplied by EGNOS to develop new information and guidance systems for use on waterways and in ports. In addition, the IMO is currently introducing automatic identification (AIS) for merchant shipping, and reliable information on the position of ships and their movements will have an important role in any applications of EGNOS and, subsequently, of Galileo.
- Railways. The use by the civil aviation sector of safety-of-life services based on EGNOS may act as a catalyst for the adoption of comparable services by the railways, given that the existence of systems with proven reliability is essential to the introduction of technology changes relating to safety in rail transport.

- Road transport. Current road guidance systems are based on networks of ground antenna and direct reception of GPS. Road guidance will therefore benefit from the improved reception possibilities and more particularly the reliability which EGNOS offers. The same will be true of electronic payment systems for road charges already based on GPS, as EGNOS will substantially reduce the risks of invoicing errors.
- Agriculture. In Europe and the United States, farmers are already using systems equivalent to EGNOS. European farmers will use EGNOS to develop precision crop management through better management of fertilisers and pesticides, so generating savings and enabling compliance with Community rules to be monitored.
- Synchronised networks. EGNOS will be of great value to users of synchronised networks, such as financial institutions and energy utilities, which require extremely precise time measurement and for which reliability of the GPS synchronisation signal is of the utmost importance. The EGNOS integrity message will guarantee these users the reliability they require.

Finally, most of the applications for which the use of EGNOS has major advantages are of a public nature, implying macroeconomic benefits for society as a whole. This is hardly surprising, as EGNOS is mainly about improved safety of use of the GPS and GLONASS systems, and safety by its very nature is a major concern of the public authorities.

### **3. EGNOS's contributions to Galileo**

By offering the first European satellite radio navigation service, EGNOS is an essential step in the development of this technology in Europe. It has enabled Europe's industry to acquire expertise in the technologies concerned, particularly for the safety-of-life services which will distinguish Galileo from GPS. The know-how accumulated in the framework of the EGNOS programme, both on the technical and institutional level, places Europe in a good position to embark on the ambitious Galileo programme. Most of the hundreds of European engineers who have worked on EGNOS are also actively involved in Galileo. The experience gained during the validation and operational phases of EGNOS will also be invaluable for the implementation of Galileo.

EGNOS is making a significant contribution to the success of Galileo.

#### **3.1. As a precursor of Galileo**

EGNOS will significantly increase confidence on the part of receiver owners in the soundness and reliability of Europe's policy on satellite radio navigation which is, moreover, consistent with the international policy and standards.

The services offered by EGNOS are a precursor to future Galileo applications. Thanks to EGNOS, Europe is now fully party to the shaping of international policy on satellite radio navigation. In most parts of the world, countries interested in introducing new technologies can be confident, because of EGNOS, in the advantages conferred by advanced satellite navigation technologies transmitting an integrity message, of which EGNOS is now an example, and which Galileo will offer world-wide. Because it permits the implementation of a specific policy of international cooperation in the field of satellite radio navigation, EGNOS is paving the way to future international acceptance of the Galileo system.

### **3.2. By facilitating Galileo's entry into service**

The experience gained during the validation and operational phases of EGNOS, including its approval, will be invaluable for the design, development, validation, operation and approval of Galileo.

The approval and certification of procedures, equipment and standards involving satellite radio navigation in certain types of activities, particularly safety-of-life services, calls for prior verification of often lengthy study and examination phases given the highly sensitive nature of such activities, which do not tolerate any margin of error.

**The approval procedures carried out for the EGNOS services will make it possible to operate the Galileo system within the planned timeframe and as soon as it is deployed.** Without EGNOS, Galileo would suffer delays. No satellite navigation system has yet been approved. EGNOS is the first tool which will enable users in Europe and, subsequently, throughout the world to certify such systems, since it offers a quality of service that satisfies the minimum requirements in those sectors where its use makes certification necessary.

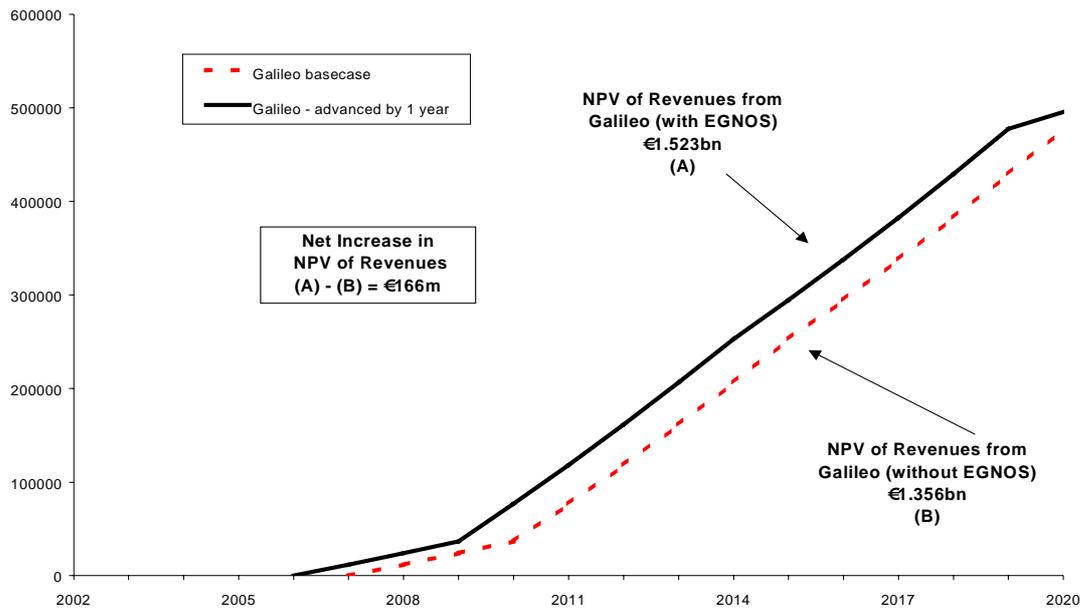
These procedures, which in particular involve a number of conformity and reliability tests in real time, are exacting and time-consuming, taking a minimum of one to two years. EGNOS, the characteristics of which are very similar to those of the future Galileo system in the case of safety-of-life services, will enable the necessary approval procedures to be launched and, in most cases, completed. The future Galileo services will therefore be available for use when the system is deployed in 2008, and sectors such as air and maritime transport will not have to wait a further one or two years, until 2009 or 2010 respectively, before being able to use them. The ability to use the services provided by Galileo in its first year of operation (2008) should translate into operational savings which, on their own, would equal the operating costs of EGNOS for a period of more than five years. The net present value of these operational savings can be put at some 166 million euros by 2020, while the operating costs of EGNOS for five years, at 2002 prices, amount to about 165 million euros<sup>15</sup>.

These figures show how important it is, for the Galileo programme, that EGNOS should come into service quickly in 2004.

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<sup>15</sup> Source: PricewaterhouseCoopers report – second phase – January 2003.

### Estimate of annual revenues from Galileo (million euros in nominal terms)



### 3.3. By permitting direct savings in operating costs

An examination of the various options for integrating EGNOS into Galileo shows that this will generate savings in operational costs for Galileo, whichever option is chosen.

Galileo's operating costs are estimated at 140 million euros per year<sup>16</sup> and those of EGNOS at 33 million euros. The cost savings resulting from integration could amount to 9% of combined operational costs, i.e. 15.1 million euros per year if the two systems continue to function independently and 12% or 21.8 million euros per year if their operation is fully integrated<sup>17</sup>.

These savings result from:

- joint use of the technical infrastructure,
- accumulation of know-how on development of the system and its operation,
- early, speedy market penetration by a European system,
- complementary, non-competitive nature of the services offered by EGNOS and Galileo,
- sharing of the distribution and user support networks.

Lastly, the experience gained with EGNOS and its integration in Galileo will result in better control of the costs of the Galileo programme, a reduction in certain technical risks of the programme and enhanced prospects of success.

<sup>16</sup> The costs of system maintenance estimated at 80 millions euros per year must be added to the operational costs.

<sup>17</sup> Source: PricewaterhouseCoopers report – second phase – January 2003.

### **3.4. By exploring and reserving the market**

More than 85% of the economic effects of the Galileo programme will concern the development of services and the sale of receivers.

**The advent of EGNOS gives the European Union the unique opportunity, firstly, to position itself now on the world market for satellite radio navigation and, secondly, to enable European technology to serve the European market.** Twenty-two European countries will shortly be equipped with EGNOS installations. It will thus be much easier for Galileo to penetrate these markets and take over the goodwill already created by EGNOS by offering better services. Failure to take this opportunity will result in potential foreign competitors of Galileo and EGNOS, such as WAAS, EGNOS's counterpart for North America, taking over European and world markets for high-precision satellite radio navigation and imposing their standard before Galileo comes on stream.

In order to promote European technology, EGNOS demonstrations can immediately begin in most parts of the world. These demonstrations would show the possibilities which an enhanced satellite radio navigation system can offer users in a specific geographical area. They would convey an excellent image of the European Union's capabilities in this field and facilitate the future introduction of Galileo on the world market. Many third countries, such as China, Israel, South Korea, Australia, the major countries of Africa, the Mediterranean and Latin America have already asked for demonstrations and tests of the system. Organising such demonstrations in various parts of the world is very important politically, for it can ease the introduction of new technologies in the developing countries, more particularly in sub-Saharan Africa. In addition, as it is an important upcoming technology, it fits in with European policy on development aid.

### **3.5. By enabling interoperability with GPS**

By augmenting the quality of the GPS signals, EGNOS facilitates the interoperability of the future Galileo system with the current GPS system, and thus satisfies the requirement of full complementarity of the two systems for the benefit of future users.

### **3.6. By favouring industrial developments**

The public sector's continued support for EGNOS can only increase private investor confidence in the European Union's political commitment to developing satellite radio navigation technologies. It thereby encourages the private sector to get involved financially, not only in EGNOS, but also in the Galileo programme and its commercial applications.

EGNOS creates immediate awareness of the "Galileo" brand on the satellite radio navigation market. This effect would be even greater if EGNOS was "debaptised" and given a name with an acronym containing the word "Galileo". This could but facilitate the rapid penetration of Galileo on the market.

## **4. Ways of integrating EGNOS into Galileo**

With regard to the future of EGNOS, three options are possible a priori: ending public subsidies to the EGNOS programme; complete independence of EGNOS activities from Galileo; full integration of EGNOS in the Galileo programme.

The three options are examined in turn below, without prejudice to the rights of the European Space Agency and Eurocontrol. In any event, these two organisations will be involved in the operation of EGNOS.

### **4.1. Options other than full integration**

#### **a) Ending public subsidies to the EGNOS programme**

Ending public subsidies to the EGNOS programme would signal the end of the programme and any prospect of operating the system. It is very unlikely that a private investor could be found who would wish to continue the programme without public support, as EGNOS's main advantages are of a macroeconomic character and, according to the studies done, operation of the system would create few sources of financial revenue.

Furthermore, ending the programme would have serious disadvantages. Above all, without EGNOS, it would not be possible to achieve rapid approval of European know-how for the new services offered by satellite radio navigation, notably commercial and safety-of-life services. All the costs relating to such approval would be borne by the Galileo programme, thus delaying Galileo's arrival on the market. The possibilities for exporting European satellite navigation technology would also be compromised if EGNOS were not used in Europe.

Terminating EGNOS would above all result in the prolonged absence of any European satellite navigation service and the capture of the entire market, including for future Galileo receivers, by American and South East Asian technologies. It would increase the risks of the Galileo programme and give more power to the foreign companies active in the satellite radio navigation sector. It would in fact mean the lack of any European participation in ICAO-approved SBAS technology. The European market would thus be wide open to the introduction of non-European systems, such as the American WAAS, together with the corresponding standards. It is also highly likely that, in this case, European users would have to bear at least part of the cost of their introduction. In view of the subsequent resulting commercial handicap for Galileo, this threat alone is sufficient justification for continuing the EGNOS programme.

Finally, terminating the EGNOS programme at the end of the development phase currently being conducted by the European Space Agency would mean that Europe had spent some 300 million euros on developing a system that never got beyond the design and testing stage.

## b) Complete independence of EGNOS from Galileo

Independent operation of the EGNOS and Galileo systems is theoretically possible, but it would spell the end of the EU's single European policy on satellite radio navigation<sup>18</sup>. According to this scenario, EGNOS and Galileo would engage in unfettered competition on the same market segments. This would result in duplication of expenditure and Galileo could not benefit from the synergies resulting from full integration.

### **4.2. Full integration of EGNOS in Galileo**

The technical and institutional aspects of fully integrating EGNOS in Galileo should be distinguished.

#### a) Technical aspects

Integrating EGNOS in Galileo does not pose any specific technical problems.

In the very early stages of European work on satellite radio navigation, the plan was for the GNSS 2 phase, i.e. Galileo, to be compatible with EGNOS, the GNSS 1 phase. For European users, the integration of EGNOS in Galileo basically means that they will have a high-quality service as they will receive signals simultaneously from the Galileo and the GPS satellite constellations.

On the equipment side, EGNOS infrastructure, such as sites and communication links, can be reused for Galileo. Moreover, the software created for the EGNOS integrity messages has contributed to the development in Europe of know-how that will be used by Galileo to build a high-quality system and reduce development costs.

On the practical side, effectively integrating EGNOS in Galileo means that the approval and implementation of EGNOS will be carried through to a successful conclusion in all the transport modes concerned. It is thus important to encourage service providers in all possible areas of EGNOS application, above all civil aviation, to take the necessary steps immediately to introduce satellite radio navigation in Europe. As already discussed in point 3, this is a prerequisite for the success of the future Galileo services.

From a more commercial point of view, as we have already seen, EGNOS can be used in practical demonstrations of the possibilities offered by highly precise, reliable European satellite navigation techniques. Thanks to EGNOS, countries which do not yet have experience of this technology will realise the value of satellite radio navigation and will subsequently be able to support the operation of Galileo services on their territory. The use of EGNOS to demonstrate, throughout the world, the possibilities offered by satellite radio navigation will raise awareness everywhere of the value of Galileo programme.

#### b) Institutional aspects

Integrating the management of the EGNOS and Galileo programmes in a single entity would be the best solution from the point of view of coordination, irrespective of whether this is a short- or long-term option.

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<sup>18</sup> Council Resolution of 5 April 2001 on the Galileo project. OJ C 157, 30.5.2001. Transport Council Conclusions of 26 March 2002 on the Galileo programme. Transport Council Conclusions of 5 December 2002 on the Galileo programme.

#### i) Short term

The operation of EGNOS must enable the system to be tested on a large scale by a large number of users, including many from outside the aviation sector. It is also intended to ensure constant improvement of the system in line with technical developments in GPS and receiver design. If EGNOS is to be operated from 2004, an operational body will have to be set up this year and a suitable operator selected, to guarantee optimum functioning of the system. Operation under a concession agreement appears to be the solution that imposes the least burden on the available budget and may encourage the main users of EGNOS to invest in the system. The European Space Agency has therefore taken steps to prospect the market for possible candidates to operate EGNOS.

The best approach to ensure that the services provided by EGNOS are fully coordinated with the future Galileo services would be to place EGNOS under the control of the Galileo Joint Undertaking, created for a duration of four years by Council Regulation (EC) No 876/2002 of 21 May 2002<sup>19</sup>. The main role of the Galileo Joint Undertaking is to ensure the unity of administration of the Galileo programme. The Undertaking's first task, as stated in Article 2 of its Statutes, is to "oversee the optimal integration of EGNOS in the Galileo programme". Consequently, the EGNOS operator should be placed under the control of the Galileo Joint Undertaking, which would be responsible for supervising activities under the concession agreement between the public authorities and the EGNOS operator.

The call for tenders to select the EGNOS operator is of course totally different to the one which the Galileo Joint Undertaking must launch over the next few months to select the future Galileo concession holder.

#### ii) Medium and long term

The solution proposed above for the short term is a preliminary stage and does not represent optimal integration. In the longer term, the most efficient scheme would be to adopt the same approach as that taken for the Galileo programme and to operate the EGNOS and Galileo systems under the contract to be concluded with the future Galileo concession holder. According to this scheme, EGNOS would be an integral part of the Galileo programme and would be offered to the future Galileo concession holder, which would have the task of managing and coordinating the two systems. As in the case of Galileo, EGNOS ownership would remain in public hands. Only the commercial management and operation would be contracted out. The concession holder would thus have an instrument enabling it to prepare the market for the arrival of Galileo, including with regard to certification procedures, which would be a major commercial advantage.

This solution requires EGNOS to be placed under the control of the Galileo Joint Undertaking immediately.

The future of EGNOS after the validation and commissioning of the Galileo system will have to be decided in due course by the users, taking account of the experience already gained in the first years of Galileo's operation.

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<sup>19</sup> OJ L 138, 28.5.2002, page 1.

### 4.3. The costs of integrating EGNOS in Galileo

The technical and institutional aspects of integrating EGNOS, as described in point 4.2 above, do not give rise to any significant cost. On the technical side, not only does integration cost nothing, but it will also provide returns owing to the synergies achieved with Galileo.

The annual cost of the basic EGNOS system, comprising the lease of transponders for signal transmission and maintenance, amounts to some 33 million euros, as indicated in point 2.1 above. This is a modest figure in view of EGNOS's contribution to the political and commercial success of the Galileo programme, as described in part 3 above. These costs, or at least a substantial part of them, should be borne by the public authorities as, on a macroeconomic level, EGNOS will be of considerable benefit to society as a whole and more particularly to those modes of transport which tend to be within the public sector. The costs relating to the approval procedures and the development of applications would be borne by the users or the future Galileo concession holder.

Furthermore, due account should be taken of the fact that there will not be an immediate return on the investment already made in EGNOS. The period beginning in 2004 is essentially a large-scale test involving numerous potential investors.

The assumption by the Galileo Joint Undertaking of the subsidies granted to the EGNOS operator would also bring about the financial integration of EGNOS in Galileo. Should the Council confirm this option, which could involve amending Article 1 of the Statutes of the Galileo Joint Undertaking annexed to Council Regulation (EC) No 876/2002 cited above, it will be necessary to examine what share of the funding could be carried by the Community budget. Additional funding could be obtained from a complementary programme of the European Space Agency<sup>20</sup>, such as the introduction of a system of Community charges on the sale of receivers.

### 4.4. Timetable for integrating EGNOS in Galileo

The integration of EGNOS in Galileo should proceed in the following three phases if the option recommended in points 4.2 and 4.3 above is adopted by the Council:

- a) **In 2003 the Galileo Joint Undertaking, following a decision by its Administrative Board on which the Commission and the European Space Agency are represented, will launch a call for tenders<sup>21</sup> to select an operator for EGNOS in accordance with its own rules of procedure. The concession holder chosen would have the task of operating EGNOS from the end of the EGNOS "Operation of Readiness Review" (ORR) in 2004 until the beginning of the operational phase of the Galileo system in 2008.** The concession holder will

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<sup>20</sup> SBAS systems, of which EGNOS is one, are evolving systems which must continually adapt to users' operational requirements. Certain new requirements expressed since the launch of EGNOS have already been taken into account in the development programme. Others are being studied and will probably be the subject of additional developments, including those to improve the system in order to reduce the operational costs in the long term and increase its reliability in the light of the recommendations of the international standardisation and certification groups. One solution would be to create a "post ORR-EGNOS" programme within the European Space Agency. This programme would be supervised by the Joint Undertaking under an agreement to be concluded with the latter and the Agency, similar to that concluded for Galileo.

<sup>21</sup> This call for tenders must be launched as quickly as possible on the basis of experience gained by the European Space Agency, which has conducted a similar exercise.

remain under the control of the Galileo Joint Undertaking during the lifetime of the latter, which is responsible for concluding the concession agreement and verifying its proper application. The contract provides that the EGNOS operator must take all necessary steps to enable the Galileo programme to profit from the experience and know-how derived from the management of EGNOS. The amount of funding for EGNOS operation may not exceed 33 million euros per annum. After the Galileo Joint Undertaking is wound up, the task of supervising the operation of EGNOS will pass to the public authority charged with monitoring the future Galileo concession holder.

- b) **From 2005 until the operational launch of Galileo, operation of EGNOS will be the responsibility of the Galileo concession holder, to be chosen before the end of 2004.** In this context, EGNOS should be managed separately from Galileo until the Galileo services are available on the market. The concession holder selected to operate Galileo will be free to renegotiate the EGNOS concession agreement concluded by the Galileo Joint Undertaking in 2004 if it is able to obtain better financial terms from other market operators.
- c) **When Galileo becomes operational in 2008, its public owners, the concession holder and the users of the two systems will evaluate respective advantages of the latter and will thus be in a position to state their views on the future development and evolution of the systems.** Such a decision will be the subject of a proposal from the Commission to the Council.

## Conclusions

It is therefore recommended that:

- the EGNOS programme should be continued and EGNOS used both as a precursor to Galileo and as an instrument enabling Galileo to penetrate rapidly the market for the various satellite radio navigation services;
- the EGNOS programme should henceforth be placed under the control of the Galileo Joint Undertaking and the Undertaking should be entrusted with:
  - the task of supervising the operation of EGNOS after the Operational Readiness Review is completed in June 2004,
  - the launch as soon as possible of a call for tenders in order to conclude a concession agreement with an economic operator charged with operating EGNOS from June 2004;
- the management of EGNOS should be an integral part of the future concession agreement for the management of Galileo;
- the basic EGNOS system should receive public funding of 33 million euros annually, from 2004 to 2008;
- the extension of EGNOS to other parts of the world should be promoted to share its operation with these regions;

- the decision whether or not to continue with operation of EGNOS after Galileo is fully deployed should be taken by the Council, on a proposal from the Commission, in liaison with the service providers and the users once Galileo becomes fully operational.