



# Galileo Study Phase II Executive Summary



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## IMPORTANT NOTICE

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# 1 Introduction

This report has been prepared under Phase II of the Inception Study to support the Development of a Business Plan for the Galileo Programme. PricewaterhouseCoopers (“PwC”), as leader of a consortium, has been asked to report on a range of topics, principally grouped under the following headings:

- The Procurement Plan for the Galileo Public Private Partnership (“PPP”);
- Intellectual Property Rights (“IPR”): study of the possibilities of generating revenues by IPR protection of the Galileo chipsets through royalties for the licensing of technology; and
- EGNOS (European Geo-stationary Navigation Overlay System): the optimal way to proceed with EGNOS in relation to the Galileo Programme.

PwC is acknowledged as the leading financial adviser on planning and implementing PPPs. The PwC team includes PPP experts with experience of models in 12 of the 15 EU Member States working for either government or bidders across the transport, environmental management, defence, social services, telecommunications and energy sectors. It therefore has a broad range of relevant skills including:

- Planning and implementing procurement strategy;
- Providing project management;
- Structuring and arranging financing for PPPs;
- Developing incentive-based payment mechanisms;
- Evaluating tenders and negotiating with tenderers; and
- Advising on affordability and value for money issues.

Examples of some of the major PPPs that PwC has worked on include:

- Acting as financial adviser to the Concessionaire on the €1.3 billion (\$1.4 billion) Northern Concession, a 170km toll road north east of Porto, in Portugal, the largest ever non-recourse financing of a European toll road;
- Advising the Department of the Environment, Transport and the Regions (DETR) and London Transport on the major PPP programme to secure investment in London Underground over 30 years;
- Acting as financial advisors to the Italian Ministry of Public Works on the Messina Bridge project, where our role included an option study to assess connecting options between Sicily and the mainland; and
- Advising the private sector on a €120m (US\$450m) schools PPP project in Germany.

The other members of the study consortium for Phase II are Denton Wilde Sapte, who provided input on legal issues, Ovum on satellite navigation markets and services and Satel Conseil on system costs. In addition we have drawn heavily on work on EGNOS undertaken by ESYS Plc for the EC “Galilei” Study<sup>1</sup>.

## 1.1 Phase I - Inception Study for the Galileo Business Plan

During Phase I of this study PwC, as leaders of a consortium, were asked to provide an independent review of the Galileo Programme, including the:

- Services which should be offered and the revenue which could be generated;
- Specification and cost of the system;
- Case for public and private sector investment;
- Structure for a Public Private Partnership; and
- Strategy for procuring and financing the system.

Phase I demonstrated that there was a case for public sector support to Galileo, and that the private sector would be willing to participate in certain circumstances in a PPP. The PPP model recommended was a Concession and this model has been taken as the basis for our work in Phase II.

## 1.2 The Concession model

Phase I recommended that the PPP should be implemented by awarding a Concession. Under this approach the Joint Undertaking, created by the EC/ESA to manage the Concession award process, would be responsible for the Development Phase of the Galileo Project. The Joint Undertaking would subsequently award a Concession for the Deployment and Operation of Galileo to a private sector consortium through a competitive tender. Instead of public and private sectors being co-investors in a corporate joint venture, representing one suggested approach, there would be a clear separation between the functions and responsibilities of the private and public sectors during the Deployment/Operations phase. This approach allows:

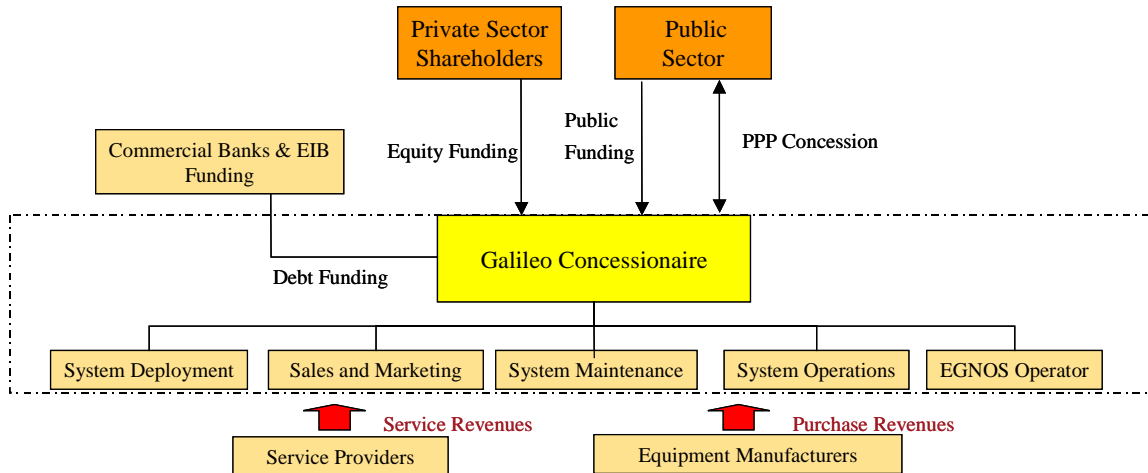
- Clear separation of roles with each party investing in a separate entity; and
- The public and private sector each to concentrate on what they do best.

The suggested Concession model is summarised below:

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<sup>1</sup> PwC has not independently verified the work of these parties.

**Figure 1 - The Concession Model (Deployment & Operations)**



The Concessionaire is expected to generate revenue from royalties on chipset sales (paid by equipment providers who incorporate a Galileo chip in their products to allow users to receive the Open Access Service) and from service providers (who use specialised encrypted signals to offer other value-added services based on the integrity service, on the commercial service, on improved service performances, etc).

Under the Concession agreement the PPP Concessionaire would commit to implement within a specified timeframe, and subsequently operate, a satellite navigation system fully meeting system performance requirements, set out in the Galileo Mission High Level Definition document, and supporting public interest as well as commercial services. This system will be based on:

- The 4 satellites, and associated ground segment elements of the Galileo system, which will be procured by the public sector during the Development Phase. Contracts for this infrastructure are scheduled for award in 2003. The Concessionaire would have the right to utilise these assets;
- The remaining 26 satellites (with up to 8 more to cover potential failures) and the remainder of the ground segment which the Concessionaire would be responsible for procuring, launching and financing; and
- Eventually, the EGNOS system, depending on the final integration model chosen by EU ministers.

The term of the Concession would be negotiated but would need to be sufficient for the Concessionaire to earn a satisfactory return on its capital investment.

## 2 The PPP Process

### 2.1 Introduction

The principal objective of a PPP should be to achieve value for money for the public sector by transferring appropriate risk and responsibility to the private sector in a way that creates incentives to optimise the benefits to the public sector. Specific objectives for the Galileo PPP include:

- The optimisation of procurement efficiency by giving the private sector responsibility for ensuring that the system performance and specifications meet the performance requirements of the commercial market as well as the public sector;
- The optimisation of revenue generation from the market;
- Reduction in the need for public expenditure (in the light of the Council decisions of March 26, 2002) and an ability to spread the public contribution over a longer period; and
- The optimisation of whole life costs by introducing private sector efficiencies.

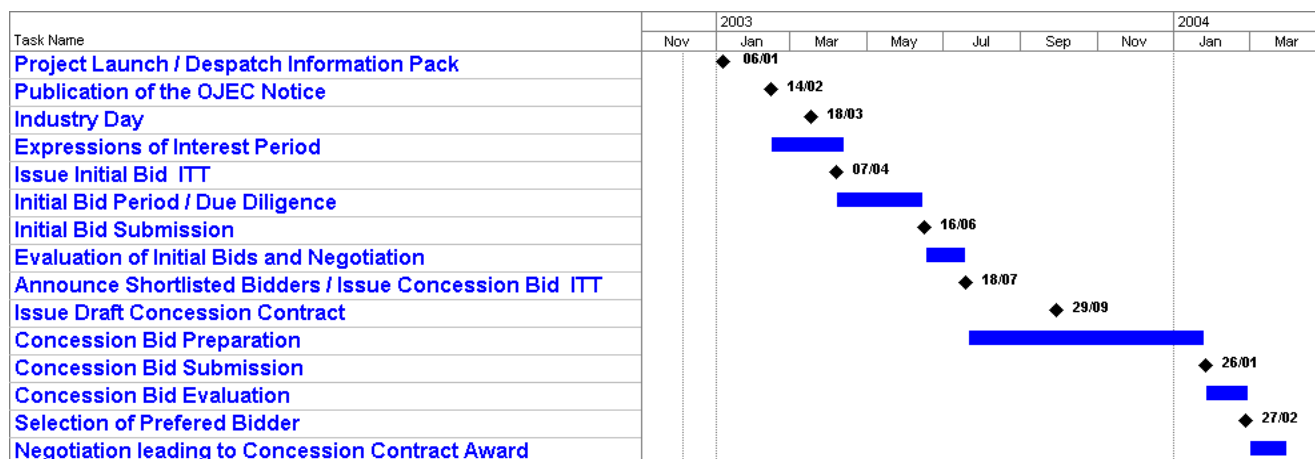
In order to meet these objectives the private sector must be able to influence and control the specification, design, procurement, financing, commercialisation and operation of the system. The issue of control is particularly important, because the price for investing while assuming a risk that industry cannot control will be high and if the private sector does not control key parts of the process, it will be much less able to bring efficiencies to bear. This calls for an early award of the Concession.

### 2.2 The PPP Bidding Process

#### 2.2.1 Overview of the Proposed Procurement Plan

The proposed Procurement Plan assumes a start date of mid-January 2003 and the overall timeframe envisaged for the procurement process is approximately 14 months, concluding with a Concession award in March 2004. In our view this timetable represents the earliest feasible contract award timetable and takes an aggressive approach to managing the process, driven by the need to maintain momentum and ensure a Concessionaire is appointed as early as possible. It depends, amongst other things, on very early action to launch the procurement process and intensive work to prepare Concession documentation as well as significant parallel working at key points in the process. It also depends on the appointment of the Galileo Joint Undertaking (“JU”) Director, key senior JU personnel and advisers by January 2003 and early action to finalise the Initial Bid Invitation to Tender (“ITT”), and accompanying Information Memorandum (“IM”), which will need to be released in spring 2003.

**Figure 2 - Proposed Procurement Plan**



The proposed Procurement Plan includes three distinct phases of the bidding process for bidders, as shown in the table below. Initial Bids will result in the selection of a limited number of bidders who will then develop full Concession Bids supported by detailed Business Plans. Restricting the number of bidders in the final Concession Bid Phase will minimise costs and provide an acceptable risk-reward ratio for the bidders. These three bid phases would be preceded by a short preparatory phase during which the JU will finalise preparations for the PPP.

**Table 1: Phases of the PPP Bidding Process**

Phase	Requirements	Result	Timeframe
<b>Expression of Interest Phase</b>	Simple expression of interest in response to OJEC notice	Interested parties are provided with ITT and IM	10 weeks during which all interested parties can register their interest for subsequent receipt of bidding documents. <b>Total 10 weeks</b>
<b>Initial Bid Phase</b>	Interested parties present financial and technical credentials for evaluation	Two or more bidders are selected to prepare a full business plan for the Concession	10 weeks for submission 4 weeks for evaluation <b>Total 14 weeks</b>
<b>Concession Bid Phase</b>	Two bidders develop business plans for the Concession contractor	Concession awarded to winning bidder	26 weeks for submission 5 weeks for evaluation 20 weeks for main negotiations (in parallel with preparation of bids) 4 weeks for final negotiations <b>Total 35 weeks</b>



*Note:* In addition to the above, approximately 10 weeks will be required for syndicating finance, to be concluded following signing of the Concession Contract.

### **2.2.2 Bid selection criteria**

Selection criteria will be needed both for the Initial and Concession Bid Phases. It is essential to define the bid evaluation criteria and procedures comprehensively for Initial Bids at the earliest possible stage and ensure that the bid evaluation criteria reflect the objectives of the PPP.

During the Initial Bid phase the criteria are primarily qualitative, with a potential financial component in the form of the level of Bidders' requests for a contribution to Bid costs, subject to a JU policy decision on whether any support will be available. At this stage the critical components in the evaluation can be broadly summarised as:

- Breadth and depth of skills; and
- Credibility of approach to business plan development and level of innovation suggested, particularly in relation to the services to be offered and revenue generated.

Concession Bid evaluation criteria would be likely to include:

- Financial implications for the public sector (including revenue/profit sharing proposals);
- Innovation in service provision;
- Credibility/achievability of proposed business plan; and
- Underlying evidence supporting the business plan (offers for system supply, offers of financing, market research and any agreements or memoranda of understanding with potential customers and partners).

The JU would retain the right to terminate the process if progress in bid preparation was unsatisfactory or the quality of responses did not demonstrate clear benefit to the public sector, for example by reference to a public sector alternative for procurement and operations of the Galileo system (see below).

### **2.2.3 Time required for preparation of Concession bids**

We have proposed a model that requires Concession Bids to be submitted after a short period of Business Plan Development of about 6 months. This may result in bidders taking a conservative view on the revenue that could be generated from operating the Galileo system. However, it has the advantage of minimising the overall timetable for commencement of Galileo operations, reducing the scope for 'drift' in the bidding process as a result of an extended bid development period, improving competitive tension and reducing any cost of funding bid development.

Under the proposed Procurement Plan Concession bids are due to be received in January 2004 in advance of both the system Critical Design Review and the In Orbit Validation Review of the Development Phase, scheduled for Autumn 2004 and 2006 respectively. In the event that any change to design was required as a result of these reviews, there would be a change mechanism with an adjustment to the financial arrangements between the public sector and the Concessionaire.

#### **2.2.4 Public Sector Comparator**

It is recommended that a Public Sector Comparator be constructed for Galileo, to quantify the costs and revenue generating potential of undertaking the project under public sector control. It would provide a benchmark against which to measure the overall benefit of private sector bids for the PPP and consequently improve the public sector negotiating position. The Public Sector Comparator will create an additional incentive for bidders to offer competitive solutions to the PPP competition.

A key component of the comparison of the public sector solution and the Concession bids will be the creation of a risk register to:

- Identify each risk and whether it is to be transferred to the Concessionaire, retained by the public sector or shared between the parties; and
- Quantify the potential impact on costs or revenues if the risk is realised.

#### **2.2.5 Scope for competition**

Competition between Concession bidders is crucial to achieving value for money. Effective competition has two components:

- At least two credible bidders for the role of Concessionaire; and
- The ability of each competing Concessionaire to procure the Galileo system in a cost effective manner.

In the context of Galileo, achieving these objectives is complex on account of:

- The Development Phase, under the technical management of ESA, that is essential for development of the necessary technology within Europe; and
- The technical complexity of the project and the difficulty of forecasting revenues on account of the nascent nature of the market for satellite based navigation services.

These issues are discussed further below.

## 2.2.6 Development Phase implications

### *Satellites*

Technical management of the Development Phase will be undertaken by ESA, under the guidance and supervision of the JU. The Development Phase work will be carried out in the EU and ESA Member States. It is likely that the Development Phase prime contractor will be a consortium comprising virtually all the potential European prime contractors for the full Galileo constellation. This consortium will consequently be very well placed to provide the subsequent Deployment Phase satellites.

It may be possible to seek competitive procurement for the Deployment Phase satellites from outside Europe, given the technical “know how” related to satellite navigation systems already possessed by some other countries. However, we believe potential Concessionaires would not want to rely exclusively on such competition in order to achieve cost effective procurement. Therefore we recommend that the JU should negotiate pricing and detailed contract terms for the Deployment phase at the time of the award of the Development Phase contract when it will be able to exert maximum leverage. This contract would be an option for Concession bidders either to accept, or to negotiate alternative terms if, for instance, a bidder wanted to submit a variant bid.

The ability of the Concessionaire to raise finance for the acquisition of the Galileo system in the debt markets will be crucial. Lenders to projects such as Galileo are not prepared to accept unmitigated completion risk, i.e. the risk that a project is not completed on time, within budget and to the required performance specifications. Lenders will therefore almost certainly require the Concessionaire to have in place a single lump-sum turnkey contract with a credible prime contractor covering delivery of the entire system including satellites, launches and ground segment.

Negotiating the Deployment Phase contract would need to reflect the likely requirements of financiers for such a lump-sum turnkey contract.

### *Ground Segment*

The ground segment comprises software intensive systems, off-the-shelf equipment and specialised buildings. It is estimated that 60% of the overall ground segment cost will be incurred in the Development phase, a large component of which will be software costs. Moreover once the software is developed it would not be commercially sensible on account of cost, or practicable on account of timescales involved in certification, for alternative software to be used in the Deployment Phase. The software will therefore need to be made available to the Concessionaire by the JU and the contractual arrangements in the Development Phase will have to ensure this is possible.

The balance of the ground segment to be built in the Deployment Phase will be the remaining off-the-shelf equipment and specialised buildings. The equipment will comprise commodity items and although there is scope for competition, the ability to generate value for money for the public sector will be limited. The ability of the private sector to generate value for money improvements will mostly be in relation to the specialised buildings. Although the scope for value for money improvements from private sector improvements of the ground segment will be limited, this is not a major concern as the ground segment in total only represents some 20% of the Concessionaire's capital investment.

### 2.2.7 Potential Bidding Consortia for the Concession

The competencies required by the Concessionaire will include: procurement and operation of sophisticated satellite systems, market development for exploitation of navigation products and services embodying new technology and structuring complex financing packages. It is likely that credible bidders will require the formation of consortia<sup>2</sup>.

Based on PwC's informal contacts with industry we consider it likely that there may be only a small number of credible consortia formed principally from within Europe, as a result of the technical complexity of the project and the difficulty of forecasting revenues on account of the nascent market for satellite based navigation services. There would be additional interest from non-European bidders, but these consortia would be likely to form around potential prime contractors for the space segment. In order to stimulate interest we recommend that key companies in the following sectors are approached proactively by the JU as soon as possible (based on contact lists already assembled):

- Space manufacturers primarily as potential candidates for the prime contract for the space segment;
- Satellite operators on the grounds that they possess the core competencies of satellite procurement and operation, regulation and marketing of satellite services;
- Handset manufacturers for their interest in various commercial markets;
- Private equity houses and banks who could act as catalysts for the formation of consortium;

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<sup>2</sup> For instance in the Skynet 5 PPP for satellite based communications services, the preferred bidder is a consortium comprising Astrium (a European space and satellite contractor and manufacturer), supported by Logica (a software consultancy and integrator), Cogent (an optical network specialist) and BAE Systems (a prime contractor, naval and military systems specialist and systems integrator) as system suppliers. It also involves Serco (a support services and facilities management company), Qinetiq (an applied science and technology company) as a provider of complex management services in high-end technology, Cable and Wireless (a global communications company), Stratos (a remote location communications group) and General Dynamics Decision Systems (a provider of secure communication and information technology) as service providers.

- Ground segment equipment providers as potential candidates for the supply of the ground segment;
- Telecommunications companies are existing providers of positioning services and, therefore, are potentially providers to Galileo customer group;
- Service providers for their interest in distributing and packaging the services;
- Car & truck manufacturers for the benefits expected from developments in car navigation sector;
- Concession operators and utilities companies for their general interest and expertise in management of concessions and utilities;
- Insurance companies as potential providers of equity to the project, and for their general interest in insurance related applications (e.g. “pay as you drive” insurance schemes and location services for stolen vehicles); and
- Air, rail & maritime sectors for their interest in Galileo applications.

Other groups of companies should also be approached for their potential interest as stakeholders in the project or their expected involvement at various stages of the project (for example, as promoter, advisor or user of the services) as opposed to being equity shareholders.

Some or all of the likely prime contractors in the space (and ground) segment during the Development Phase would be expected individually to have an interest in leading or acting as members of a Galileo Concession bid. Involvement of individual Development contractors in the Concession may be of great value through their familiarity with the Galileo project, enabling them to develop bids more quickly and effectively and, potentially, to identify novel solutions that offer enhanced value for money. However there may be a concern that if the Development Consortium were itself bidding for the Concession other bidders would not be able to negotiate with them effectively for system supply<sup>3</sup>. We therefore advise that:

- Appropriate provisions ensuring fair treatment for all bidders are incorporated into the Development Contract;
- The JU has the power to monitor and if necessary intervene in the terms being offered for the Deployment Phase;
- It may be necessary, if other routes are not satisfactory, to consider disallowing a bid from the Development Contractors as a Consortium. However, even if this were the case, bids from individual consortium members should probably be permitted - as competitive tension within the consortium is likely to ensure arm’s length dealings with other bidders.

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<sup>3</sup> An example of a UK procurement where the presence of incumbents may have been a factor in deterring third party bidders is the privatisation of the two Royal Dockyards at Rosyth and Devonport. Both were contracturised at the time of privatisation and despite detailed information being made available to a wide range of interested parties, only the incumbent contractor managers eventually submitted bids.

The risk of bidders not being able to negotiate effectively with the Development Consortium could be mitigated through negotiation by the JU of the turnkey contract option for the Deployment Phase.

### **2.2.8 Use of Variant Concession bids to maximise competitive tension**

The services to be provided by the Concessionaire under the Concession Contract will be specified in terms of an output specification (based on the Galileo Mission High Level Definition document). The output specification provides clarity to bidders in their bid preparation and a consistent base against which all bids can be judged and is crucial to the Procurement Process. Compliant bids will have to address these requirements in full.

However, we recommend that in addition to the compulsory submission of compliant bids, bidders also be encouraged to submit variant bids that do not match the exact output specification requested, but which the bidder believes offer better value-for-money. Providing the opportunity for innovative thinking from bidders should:

- Help to maximise competitive tension (as bidders will be aware that a ‘standard’ bid may not be sufficient to win); and
- Provide industry participants with the opportunity to bring their expertise to bear on the output specification.

Examples of possible variant bids could include the provision of an alternative set of characteristics or range of services.

### **2.2.9 Conclusion**

In summary, in order to maximise competition, the JU should:

- Stimulate participation in the Concession process by companies outside the space sector;
- Establish arrangements to ensure any participation by the Development Phase consortium as a bidder for the Concession is not prejudicial to other bidders;
- Encourage variant bids for the Concession; and
- Encourage alternative sources of supply for the Deployment Phase assets and negotiate an option for procurement of Deployment Phase assets at the time of award of the Development contract.

### **2.2.10 Public Interest Issues**

A number of potential public interest issues will need to be taken into account in finalising the Galileo Concession terms and Concession agreement. These may assist in

determining any future Galileo Regulatory regime, finalisation of which will be a key feature of the implementation of the programme.

The following examples highlight key matters that should be considered in the drafting of a Concession agreement to be concluded between the JU (or its successor) and the Concessionaire to ensure that its operations, as the publicly mandated supplier of navigation services in Europe, are conducted in the public interest:

- Obligations to obtain and maintain licences;
- Access by service providers to ensure that consumers can choose between different suppliers;
- Universal service obligations;
- Coverage/rollout obligations;
- Pricing controls in relation to any services for which the Concessionaire is the dominant supplier;
- Publication and disclosure of data to provide a high degree of transparency for consumers and any regulator;
- Co-operation with the Galileo regulatory body and sector specific regulatory bodies;
- Powers of audit and inspection;
- Appointment of a safety officer/committee;
- Liability – to establish a commercial contractual framework, including a level of liability, within which the Concessionaire will guarantee its level of service. This is required to deal with potential exposures arising should a failure of the Concessionaire result in claims against service providers from end-users; and
- Security - the Concessionaire should be obliged to establish and maintain appropriate procedures to ensure the security of its infrastructure and services. These will need to cover both technical and operational security (addressing such issues as potential interference with the service, unauthorised access and denial of service as well as maintaining appropriate service records relating to security issues). In addition, the Concessionaire would be expected to observe relevant security procedures with regard to issues that may affect the national security of the EU and its member States.

### 2.3 Next Steps for the Procurement Process

Once the JU is established and staffed, the most important next steps for the procurement process are:

- Incorporation of a turnkey approach into Development contracts;
- Finalisation of the Output Specification and ITT bidding requirements;
- Establishment of groups to undertake Risk Analysis and any PSC development; and

- Commencement of detailed preparation of the ITT, Information Memorandum and draft Business Plan Development Contract.



## 3 IPR and Revenue Generation for the Galileo Concessionaire

### 3.1 Background

A key part of the work undertaken in Phase I of this study was to identify revenue streams for the Galileo Concessionaire (through the Galileo Operating Company). The vast majority of Galileo users will use the Open Access Service for which, by definition, no charge can be made. Phase I envisaged that revenue for the Concessionaire could be generated from the sale of Galileo-enabled receivers through charging a royalty on the IPR incorporated in the Galileo chipset. It was suggested that one possibility that could enable this would be for the Galileo signal to be encoded and for the Galileo chipset to contain software to decode the signal. Such an approach might address the concerns of some industry sectors regarding management of an encryption key if the signal were encrypted and the code regularly changed.

We recommended that this issue should be explored in more depth. In Phase II we have assessed the implications of the output of certain other EC work on IPR protection for the revenue generating potential of the Galileo chipsets and considered other sources of additional revenue that may be open to the Concessionaire.

### 3.2 Conclusions on Revenue Generation from IPR

We have concluded that the solution proposed in Phase I (for the signal to be encoded and for the chipset to contain software to decode the signal) is technically feasible. In addition to the encoding approach the Concessionaire could potentially generate license fees in connection with:

- Copyright in software on pre-programmed or programmable chips; and
- Software relating to the signal waveform - assuming new innovation was achieved, perhaps as a result of the need for compatibility and interoperability with the existing American Global Positioning System (“GPS”) signal.

It is possible that the Concessionaire itself will not generate the new IPR referred to above. Arrangements that facilitate revenue generation for the Concessionaire will therefore need to be made by the JU to ensure that the Concessionaire can access revenues, predominantly through contractual arrangements with third parties who generate the relevant IPR in the Development Phase. IPR may be generated under ESA Development contracts or through work undertaken by Concession bidders, but could also come from new techniques for processing signals and developments by manufacturers of bi/multi-frequency receivers for common applications (such as in-car navigation), although access to IPR generated by manufacturers would need to be negotiated.

Given the clear ‘value-added’ in purchasing a GPS/Galileo enabled receiver compared to a GPS-only receiver, and consequently significant demand for the product, we believe that a royalty on Galileo chipsets may be acceptable provided the following conditions are achieved:

- The level of royalty was not so high as to make the end product (the receiver or terminal) too costly in comparison to a GPS-only product; and
- All chipset manufacturers were charged the same ‘royalty’ so as to keep competition between them even.

Chipset manufacturers suggested that the proposed level of chipset royalties proposed in Phase I of €0.45 per chipset needs to be viewed in the light of:

- The cost of a GPS chipset, currently in the region of \$10-11 but falling at around 15% per annum. The royalty could therefore represent a high proportion of the chipset cost by the time Galileo becomes operational; and
- Royalties on an entire GPS chipset of \$0.10–\$1.00 are currently being paid whereas the proposed Galileo coding would only take up a part of the combined GPS/Galileo chipset, and thus the proposed level of royalty may be disproportionate.

We conclude that provided the conditions outlined above are achieved a licence fee as high as €0.50 per chipset may be achievable. It is emphasised that this figure is much lower than the cost of complete navigation systems (integrated receiver systems). Concession bidders will therefore need to carefully examine the potential for direct revenue generation through the sale of Galileo chipsets in order to gain a better understanding of the true market acceptance of such a charge and examine the issue of the size of the fee that may be chargeable per item of equipment. The proposed level of royalty could be one of the criteria for bid evaluation in the final Concession bid.

### 3.3 Additional Revenue Streams

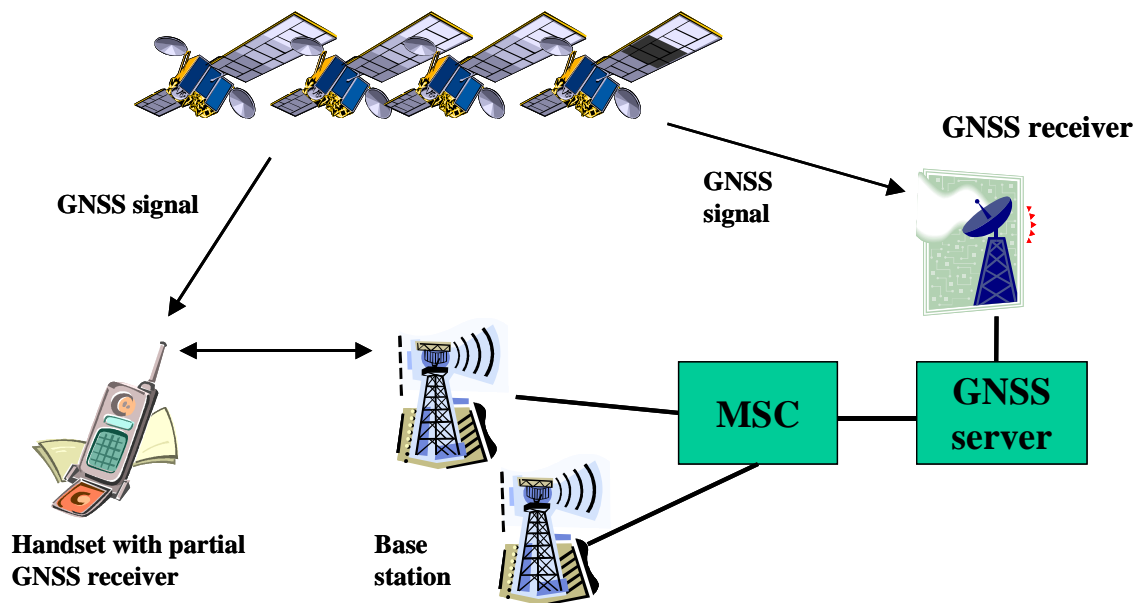
In addition to reviewing the potential of generating revenue from chipset royalties, we have considered other sources of revenue that may be open to the Concessionaire, apart from charges for simple commercial services. Two have been identified. We expect Concession bidders to analyse each and form their own views as to their viability as part of their due diligence during the Business Plan Development Phase. We also expect bidders to examine the potential for other sources of revenue not explored in this paper.

#### *Assisted GNSS*

Assisted GNSS is based on the combination of a navigation signal from a Global Navigation Satellite System and a communication signal via a cellular network such as GSM. Using assisted GNSS, the user would benefit from a reduction in the time required for position determination following activation or reactivation of the terminal (improved

time to “cold start” and “warm start”), and improved availability of the positioning in urban areas, for all of which he could be willing to pay a premium. Revenue generation for the Concessionaire could come through providing the "navigation" data to users of the Galileo signal via a cellular network. This would be ongoing ‘service revenue’ as opposed to the one-off nature of the ‘royalty revenue’ discussed earlier in this paper. Figure 3 below demonstrates how this technique works in practice.

Figure 3 – Assisted-GNSS<sup>4</sup>



Note: MSC - Mobile Switching Centre

Concession bidders should be encouraged to develop a view on the demand for this specific service as opposed to the demand for Galileo chipsets as a whole. The service implies that the Concessionaire would need to create relationships with the cellular operators in order to ensure that this type of service could in fact be offered to Galileo users at an early stage in operations and should also be explored in preparing Concession bids.

### *Authentication*

There are two forms of authentication, which may generate revenues:

<sup>4</sup> Derived from “Geolocation and Assisted GPS” Djuknic & Richton (Bell Labs/Lucent technologies)”

- User Authentication; and
- Signal Authentication.

#### *User Authentication*

User authentication is the process of determining whether someone or something is, in fact, who or what it is declared to be. The use of the Galileo signal is a way of creating a time-dependent location signature that is virtually impossible to forge and would provide additional benefit to those service providers (such as banks or air-traffic controllers) wishing to be certain of the identity of their ‘customers’. If Concession bidders considered this additional revenue source potentially viable, it would need to be pursued further with chipset and receiver manufacturers and service providers, as the authentication capability would need to be built into chipsets themselves in good time for early market penetration and acceptance.

#### *Signal Authentication*

We believe that users of the Galileo signal might be willing to pay a small subscription fee for the ability to be certain the signal they were receiving was in fact from Galileo rather than another source. Authentication would provide protection against ‘spoofing’, for example, by terrorists.

With authentication, there is a possibility that some airline ground infrastructure could in time be dispensed with, thereby releasing savings for airlines so that a more significant contribution from the aviation sector may be negotiable by the Galileo Concessionaire. We note that incorporation of signal authentication would require amendment to the Galileo signal structure.

Whilst the market for an authentication message is by no means developed, the benefits of this technology are clear, and we would encourage PPP bidders to closely examine this method of revenue generation as a further means of strengthening the business case for the Galileo Concessionaire.

### **3.4 Levy on GNSS Terminals**

The Member States could consider imposing a levy on the sales of all GNSS terminals (Galileo and GPS) within Europe. Part of the proceeds of such a levy might be passed on to the Concessionaire as a contribution to revenues. However, in considering the application of a levy the following would need to be addressed:

- Mechanisms to transfer levy revenues to the Galileo Concessionaire;

- Appropriate legislation would need to be enacted by each Member State to give effect to the levy; and
- The imposition of a levy would need to be carefully co-ordinated with any efforts by the Concessionaire to generate its own per-terminal revenue.

### 3.5 Further work

We believe that the appropriate parties to lead further work on revenue generation for the Concessionaire are the potential Concessionaries during the Business Plan Development phase. However, in the interim, the JU should:

- Address the issue of how satellite design would be affected by decisions relating to enabling “soft encryption”, authentication and assisted-GNSS revenues for the Concessionaire so as to minimise any design change later in the ESA Development Phase;
- Commence preparation for being the proprietor of IPR in order to be in a position to manage the IPR, if generated. This might also include, for example, managing the transfer to the JU of IPR generated by contractors under the ESA Development Programme;
- Put legal mechanisms in place, where necessary, to ensure that the Concessionaire has access to the IPR associated with whatever publicly funded technical advance creates the possibility for a royalty;
- Set up working groups with members of relevant user communities and other parts of the Galileo value chain. This would facilitate communication between individual Concession bidders and the users and manufacturers in order that the former can better understand the concerns connected to and implications of any decisions they make regarding market revenues in the course of their due diligence in the Business Plan Development Phase; and
- Furthermore, the EC could examine with the Member States, the possibility of imposing a ‘levy’ on the sale of GNSS receivers within the EU and the mechanism for achieving this.

In addition, it would be extremely beneficial if further analysis were performed to better assess the potential for encoding to provide revenue generation, in a manner consistent with the requirements of those industries concerned about the implications of encryption. Whilst the JU should take into account the existing conclusions of EC studies in this area when drafting the Concession ITT, it will be for the Concession bidders themselves to determine the relative importance of revenue from these industry sectors to the overall Galileo business case.

**It will be up to bidders to develop their own cases for revenue generating services and schemes.**

## 4 EGNOS

### 4.1 Introduction

EGNOS, The European Geo-stationary Navigation Overlay Service, is the European contribution to the first step of the Global Navigation Satellite System (GNSS1). It is being developed under a 1998 tripartite agreement, approved by the Council of the European Union, to provide regional satellite-based augmentation services to aviation, maritime and land users in Europe. ESA together with the EC and Eurocontrol are currently implementing the programme. It will augment both the existing American military-run GPS and the Russian GLONASS satellite systems by providing various transport communities such as civil aviation and maritime, with new services such as guaranteed availability, accuracy, integrity and continuity service levels.

The EGNOS service will cover Europe and has been designed for an expected lifetime of 15 years. Satellite Based Augmentation Systems similar to EGNOS, such as the American Wide Area Augmentation System (“WAAS”) and Japan’s MSAS, are also being developed in other parts of the world. Together with EGNOS, these systems will provide global seamless interoperability and greatly enhance the current versions of existing satellite navigation systems.

Our work reflects the Resolutions<sup>5 6 7</sup> of The Council of the European Union that require an action plan to be presented for the optimal integration of EGNOS into the Galileo programme (covering technical, operational, financial and institutional aspects) as soon as possible and not later than the end of 2003. Consequently, eight EGNOS-related tasks have been undertaken, culminating in the provision of high-level recommendations on the optimal way to proceed with EGNOS in relation to the Galileo programme, as follows:

- Analysis of EGNOS in terms of macro-economic benefits to all sectors under its coverage;
- Qualitative analysis of the benefits derived from EGNOS for the development of Galileo services;
- Assessment of potential for further business development among the axes identified in the EGNOS roadmap;
- Quantify the potential for the generation of revenues up until 2020;

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<sup>5</sup> Official Journal of the European Communities. *Council Resolution of 5 April 2001 on Galileo.* OJ C 157, 30.5.2001

<sup>6</sup> Official Journal of the European Communities. *2420<sup>th</sup> Council Meeting – Transport and Telecommunications.* Brussels, 25/26 March 2002

<sup>7</sup> Official Journal of the European Communities. *Council Regulation (EC) No 876/2002 of 21 May 2002 setting up the Galileo Joint Undertaking.* OJ L 138, 28.5.2002

- Review EGNOS cost projections assembled to date, assess their completeness, and provide new costs for components and operating costs not already foreseen, up until 2020;
- Identification of potential cost-savings for Galileo;
- Analysis in terms of Net Present Value and Internal Rate of Return of the revenue and cost projections for EGNOS until the year 2020; and
- High-level recommendations on the optimal way to proceed with EGNOS in relation to the Galileo programme (in terms of ownership and service provision at a technical, legal and commercial level).

The first five tasks above were undertaken as part of other EC studies.

## 4.2 Overview of the case for Integration

For the EGNOS programme, there were in principle three options open to ESA and the EC:

- To discontinue the EGNOS programme;
- To continue with current EGNOS procurement and run it as a stand-alone programme; and
- To formulate a plan to integrate EGNOS into the Galileo programme, and thus have one consolidated satellite navigation product for Europe.

The Council of the European Union has decided to proceed with the final option above. However, we include for completeness a summary of the consequences of the first two other options, as set out in other EC studies.

### *Discontinuation of the EGNOS programme*

If it had been decided not to proceed with EGNOS beyond Operational Readiness Review (ORR) the consequences would potentially have been as follows:

- A likelihood that the European Air Traffic Service Providers requiring Space-Based Augmentation Services (SBAS) would resort to the US-developed WAAS technology;
- A loss of institutional credibility to design, build and deliver large technologically challenging projects in Europe;
- An adverse impact on the Galileo PPP procurement process and long-term support by Member States;
- Potential competition between the WAAS and Galileo in Europe and hence a negative impact on the Galileo business case;

- Greater risks for the development of the Galileo safety-case and certification, and, associated with this, a missed opportunity to prepare the market for Galileo; and
- Delayed European GNSS independence from GPS, which may have resulted in greater US domination of the product development sector.

### *Continuation of EGNOS as a stand-alone system*

If EGNOS had proceeded as a stand-alone programme, it could have led to the following consequences:

- Continued confusion amongst users as to the two-system approach to European satellite navigation;
- Loss of any potential cost savings for the Galileo programme;
- Competition for revenues between EGNOS and Galileo in some market sectors from 2008 onwards, undermining the business case for Galileo, adversely impacting on Concession bidders' confidence in Galileo market revenues, and consequently reducing the value for money that might be obtained from the PPP procurement of Galileo; and
- A funding requirement to develop applications for EGNOS which if not addressed could have worsened the business case for EGNOS and increased the need for public sector financial support during operations.

### *The agreed way forward - Integration with Galileo*

The optimal integration of EGNOS with Galileo should provide a number of benefits, including:

- Sending a clear message to users and other countries outside the EU that Europe has a single integrated policy on satellite navigation;
- Avoiding potential competition for revenue with Galileo in some market sectors from 2008 onwards (where the two systems are not controlled by the same authorities), giving Concession bidders more confidence in the Galileo business case (including GPS/EGNOS services) and being a positive factor in encouraging them to bid seriously;
- Providing an opportunity for EGNOS to stimulate the market for satellite navigation services to the benefit, rather than detriment, of the Galileo product, giving Concession bidders greater certainty and confidence over future revenue streams;
- Providing an opportunity for the Galileo Concessionaire to prepare for the market entry of Galileo through the exploitation of EGNOS;
- Enabling Galileo to benefit directly from the research and development performed under the EGNOS development programme;



- Facilitating allocation of some of the budget available for Galileo applications development to EGNOS applications, without the need to adjust the specification of the 6th framework programme;
- Early safety-case<sup>8</sup> preparation and certification which could save time and therefore cost in performing similar tasks for Galileo; and
- The opportunity for further cost savings from integration.

Given the above, we have performed detailed analysis of the issues relating to integration, the results of which are outlined in section 4.5 below.

### 4.3 EGNOS: Costs, Benefits and Revenues

#### 4.3.1 Costs

EGNOS costs were reviewed and further costs estimated until 2020. These comprise the formal budget of the different programme elements together with estimates of additional costs that are likely to be incurred during the different programme elements up to 2020. The estimated costs of the EGNOS programme up to Operational Readiness Review are €79m, and out of this, implementation costs of €310m will be funded approximately one third each by selected European Air Traffic Service Providers, by each of the ESA Member States and by the EC.

Subsequent operating costs are planned to settle at between €30m-35m per annum, and are broken down in Table 2 below.

**Table 2 - Breakdown of Annual Operating Costs (€m 2002 prices)**

	Average Annual Cost	% of Annual Operating Cost
Technical Operations	18.6	57%
Maintenance	10.5	32%
Communications	3.8	11%
<b>Total</b>	<b>32.9</b>	<b>100%</b>

#### 4.3.2 Macroeconomic User Benefits

Estimated benefits from EGNOS on a stand-alone basis have been quantified for five applications based on the potential for further business development (Section 4.3.5), as shown in Table 3 below. The total accrued (2002 to 2020) net benefits for non-aviation applications in areas covered by EGNOS are estimated at just over €15billion (or €8.7bn on an Net Present Value basis) and the majority of these are expected to be in Europe.

<sup>8</sup> A safety-case is a document, or collection of documents, that presents the arguments for believing that a proposed potentially-dangerous system is acceptably safe

It should be noted that the benefits calculated here are not directly comparable with the benefits previously calculated for Galileo in Phase I work because:

- The benefits calculated here cover a longer period (2004-2020) than those for Galileo (2008-2020); and
- The EGNOS benefits have been calculated for all areas in the EGNOS coverage area. The Galileo benefits were calculated for the current Member States of the EU only.

**Table 3 – Benefits to non-aviation applications from EGNOS (2002 – 2020)**

<b>Market Sector</b>	<b>Benefit (€bn)</b>	<b>Benefit (NPV €bn)<sup>9</sup></b>
Road Transport	12.7	7.5
Precision Farming	1.9	1.1
Hydrographic Survey	0.3	0.1
Train Protection and Control	0.1	0.0
Inland Waterways	0.1	0.0
<b>Total</b>	<b>15.1</b>	<b>8.7</b>

In addition to these five sectors, there are many potential benefits from EGNOS for the civil aviation community. It is important to stress three points:

- EGNOS may be a cost-effective solution, particularly for the general aviation sector after the decommissioning of some terrestrial navigation aids in line with Eurocontrol’s strategy for the European Civil Aviation Conference (ECAC) region;
- All parties recognise that EGNOS constitutes a crucial step along the path to a comprehensive satellite navigation solution for the aviation community based on dual independent constellations (i.e. EGNOS and Galileo); and
- EGNOS provides direct support to the development of Galileo, contributing to the evolution of a successful safety-case for Galileo as well as to establishing standards and procedures for users of the Galileo’s safety of life service.

### 4.3.3 Revenues

The commercial airline community is the only part of the civil aviation sector from which revenue might be derived, based on use of EGNOS for the en route and approach phases of flight. Charges could be based on existing Eurocontrol mechanisms, although there is no clear precedent for how they should be calculated and this is an institutional and political rather than a market driven question. To provide an example, €12m per annum would be recovered if the EGNOS Operator were able to recover 30% of its annual operating costs from the aviation community. This is broadly consistent with estimated cost-savings from decommissioning VHF Omni-ranging and Non-Directional Beacons.

<sup>9</sup> Net Present Value has been calculated using a real annual discount rate of 6%

There are a number of non-aviation applications that would benefit from the freely available EGNOS signal-in-space. However, it is not yet clear how revenues can be extracted directly by the EGNOS service provider. New mechanisms for revenue collection, perhaps involving alternative EGNOS delivery routes (Section 4.3.5), would need to be assessed on a case-by-case basis.

#### 4.3.4 Business Assessment

Using the cost and revenue forecasts produced under the other EC studies, it has been possible to form a view as to the stand-alone viability of the EGNOS business from a commercial perspective, assuming that the EGNOS procurement timetable was to continue as currently planned, culminating in the award of an EGNOS concession contract for the combined provision of operations and services. As the forecasts of revenue are not predicted to rise above operating costs until after 2020, the above-mentioned analyses would suggest that on a stand-alone basis, the programme would need further financial support to be viable. Any private company expecting ‘normal’ returns is therefore only going to accept an EGNOS contract with guaranteed financial support from the public sector. Given the need for this financial support, the public sector may wish to integrate EGNOS and Galileo in order to gain the benefits of cost reductions from integration detailed in section 4.4 below.

#### 4.3.5 Potential for Further Business Development

The EGNOS development has been driven mainly by civil aviation requirements. When complete, it will provide services to a core region equivalent to the union of the ECAC region and the European Maritime Core Area. There are three main strategies for further EGNOS business development: geographical expansion, market sector expansion (beyond aviation) and use of delivery mechanisms other than geostationary satellites.

Geographical expansion could be realised either by *extending* the core service area or by *replicating* EGNOS in other areas of the world. Political, commercial and technical constraints mean that the African continent is a realistic candidate for extension. Other potential candidates are likely to be best served by independent EGNOS replication, such as in South America and India. If Europe is to be able to capture future revenues in these markets however, it will be important that EGNOS is utilised in Europe rather than the US-led GPS/WAAS service until Galileo is operational. Failure to do so may mean limiting the market for future EGNOS/Galileo services outside Europe.

Market-sector expansion could be based on EGNOS being able to meet requirements that cannot be met by GPS alone. Six candidate market sectors have been identified, although no revenue has been allocated to them as a willingness to buy EGNOS receivers and to use its signal does not necessarily imply a readiness to pay for the service. Mass-market applications are not included because they are not considered to be performance-driven and hence do not benefit from the augmentation to GPS provided by EGNOS.

**Table 4 – Candidate market sectors and applications for further EGNOS business development**

<b>Market Sector</b>	<b>Application</b>	<b>Market Sector</b>	<b>Application</b>
<b>Civil Aviation</b>	Air navigation	Maritime	Hydrographic survey
<b>Rail</b>	Train protection, control and command on low density lines	Professional	Time and frequency GIS and mapping Precision farming
<b>Inland Waterways</b>	Ship navigation	Road Transport	Truck/LCV telematics

Using different delivery mechanisms can potentially overcome the physical and commercial limitations of geostationary satellites that broadcast signals free of direct user charges. Candidate technologies include the Internet, Digital Audio Broadcast, and mobile telephony. Each of these is effective in urban environments where geostationary satellite visibility can be limited, and the point-to-multi-point communications give opportunities for revenue generation.

## 4.4 EGNOS: Impact on Galileo

### 4.4.1 Qualitative Assessment of the Benefits of EGNOS to Galileo

Two hypothetical *extreme* scenarios – stand-alone and integrated – were used to assess the benefits of EGNOS to Galileo and the issues related to the optimal integration of EGNOS into Galileo. The former was based on maintaining independence between the EGNOS and Galileo functional and commercial facets, while the latter was based on providing an integrated revenue-oriented product line to the global customer base. A consultative process was undertaken as part of the other EC studies. This was based on questionnaires and interviews with potential industry and institutional stakeholders in the programme that considered six facets of integration - institutional, commercial, operational, technological, services and products. More than 80% of the responses indicated a preference for the integrated scenario for all these facets. The benefits of EGNOS to Galileo were also assessed qualitatively by considering the impact of EGNOS on various criteria that will be important for Galileo's success. A summary of these benefits by category is shown in Table 5 below.

**Table 5 – Summary of benefits of EGNOS to Galileo**

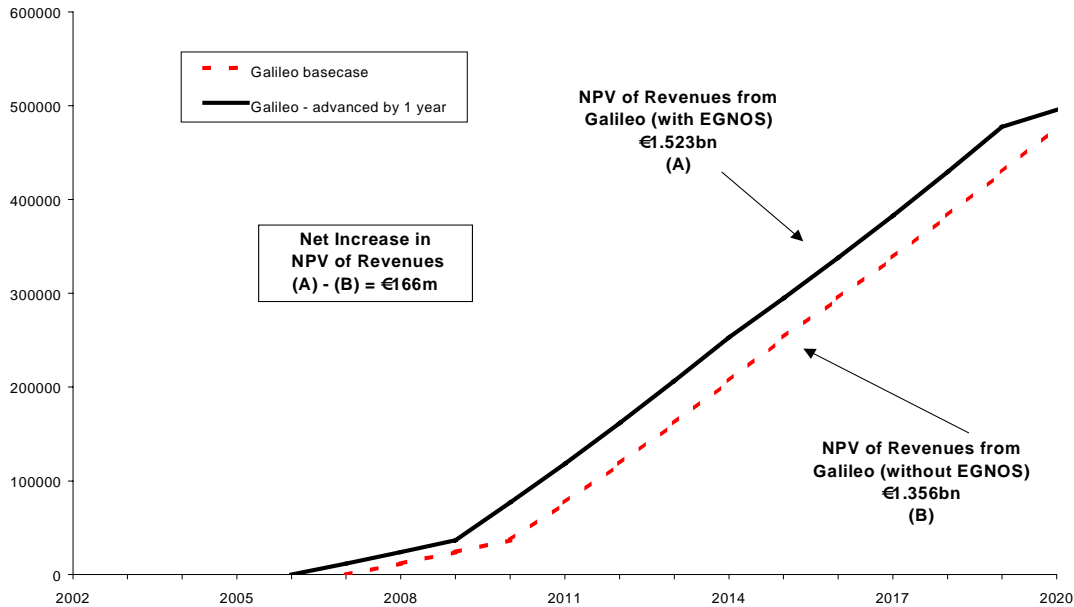
<b>Success Category</b>	<b>Benefit</b>
<b>Financial</b>	<ul style="list-style-type: none"> <li>• Improved Galileo business case based on integrated institutional and commercial structures and service provision mitigating competition risk</li> <li>• Early market development and revenues from EGNOS</li> <li>• Improved private sector investor confidence from continued public sector support of EGNOS; and</li> <li>• Improved cost control because EGNOS experience might mitigate some</li> </ul>

Success Category	Benefit
	technical risks.
<b>Programmatic</b>	Improved likelihood that Galileo open access and safety-of-life services will be introduced in 2008 and 2010 respectively, based on <ul style="list-style-type: none"> <li>• A successful EGNOS safety-case mitigating Galileo safety-case risks</li> <li>• EGNOS providing an early opportunity to develop standards and procedures for safety-related applications; and</li> <li>• EGNOS development experience mitigating some technical risks.</li> </ul>
<b>Procurement</b>	Improved business case of Concessionaire bidders, based on <ul style="list-style-type: none"> <li>• Early revenues from EGNOS</li> <li>• Continued public-sector support of EGNOS having a positive impact on private sector investor confidence</li> <li>• Integrated service provision mitigating competition risks; and</li> <li>• Optimised public/private sector risk allocation from optimal integration of EGNOS into Galileo.</li> </ul>
<b>Market Take-up</b>	Improved market take-up based on <ul style="list-style-type: none"> <li>• EGNOS increasing market awareness of Galileo</li> <li>• A successful EGNOS safety-case mitigating risks linked with the Galileo safety-case; and</li> <li>• Early development of standards and procedures mitigating risks associated with Galileo safety-of-life services.</li> </ul>

This assessment has focused on the qualitative benefits of EGNOS to Galileo, which can be reinforced from a quantitative perspective. Drawing on the analysis of Galileo market revenues from our Phase I work and EGNOS analysis from our Phase II work, figure 4 below illustrates the effect that EGNOS integration could have on the Galileo market revenues compared to the stand-alone scenario. It illustrates that if integrating EGNOS enabled the capture of Galileo revenues for the Galileo Concessionaire to be brought forward by 1 year, then the increase in total Galileo revenues achieved up to 2020 would be €166m in Net Present Value terms. Assuming that the steady state operating costs of EGNOS will be €32.9 per annum (in 2002 prices), this would indicate that up to 5 years of EGNOS costs in cash terms (or six years in Net Present Value terms) could be justifiably supported by the public sector in order to match the additional revenues generated by this support.

In the event that even further advantage could be obtained, by bringing forward services by up to two years (probably the maximum feasible given the EGNOS procurement timescales), then there would be a proportionate increase in the advantage to Galileo revenues.

Figure 4 – Estimated Annual Galileo Market Revenues (€m nominal)



Additional to increased revenue potential, bringing forward the introduction of Galileo services by one year would also have the effect of increasing the level of economic benefits of Galileo to Europe, thereby further justifying public sector support for the EGNOS operating costs.

In addition, we believe that using EGNOS to prepare markets for Galileo services outside Europe, in competition with the GPS/WAAS offering, will improve the Galileo business case, and ensure the markets outside Europe are still open to Galileo when it commences operations in 2008.

#### 4.4.2 Potential Cost Savings for Galileo

Analysis of integration options suggests that *operating* cost savings could be achieved. Galileo operating costs are estimated at €140m per annum and those of EGNOS at €36m per annum. The savings due to the integration could represent up to 9% of the combined operating costs in the case where the two systems remain functionally independent (i.e. €5.1m per annum) and up to 12% if they are fully integrated (i.e. €1.8m per annum). It is unlikely that any capital cost savings can be made as a result of the integration of the two systems. Integration could however also be beneficial to the EGNOS programme in reducing costs by up to €35m during the period 2004-2009. These estimates should be considered as indicative. The actual savings will depend heavily on the final configuration of both EGNOS and Galileo and on the final organisational and management structure put in place by the JU and the Concessionaire.

In addition to financial cost savings it is expected that the Galileo development programme will continue to benefit directly from the research and development performed under the EGNOS development programme, and that there will be a benefit to the quality of the system design and procurement efficiencies as a result.

The combination of these factors, the benefits to Galileo outlined in section 4.4.1 above, and the potential level of macroeconomic benefits derived from the continuation of the EGNOS programme (as described in 4.3.2 above), suggests a case for public sector support for EGNOS operational costs. Based on our analysis such financial support will in fact be essential as there is no apparent stand-alone business case for EGNOS.

## 4.5 EGNOS and Galileo: options for integration

In the light of the Resolutions of The Council of the European Union that require that an action plan be presented for the optimal integration of EGNOS into the Galileo programme, we have analysed:

- The existing EGNOS procurement programme and its implications;
- The implications for the Galileo business case should EGNOS continue to be procured as currently planned; and
- The benefits to both programmes of the preferred integration solution

### 4.5.1 The current EGNOS procurement

With EGNOS hardware and ground segment procurement well under way, and lease agreements with Inmarsat for positioning transponders on two of their geostationary satellites in place, ESA have been focusing on the need to have an operator in place in time for operations to commence as planned in early 2004. Statements of work for operations and service provision have been produced, and ESA are already in discussions with potential operators with a view to appointing a preferred bidder to perform technical operations, marketing and service provision in early 2003.

A combined Galileo/EGNOS service offering would facilitate a wide range of synergies. Not taking advantage of this scenario could lead to competition between Galileo and EGNOS, if they were not controlled by the **same** authorities. This in turn could adversely impact the view that Galileo Concession bidders would be willing take on the level of market revenue risk that they would otherwise accept, to the detriment of the public sector.

It would seem appropriate to merge the two programmes such that both benefited from the positive aspects of the other and that the Galileo business case was not jeopardised by the potential disruptiveness of active market development under the EGNOS programme.

#### 4.5.2 Integration options

The two main scenarios for the EGNOS concession are:

**Scenario 1:** a concession awarded for technical operations, with an interim service provision contract under the supervision of the JU until the Galileo Concessionaire has the opportunity to take over

**Scenario 2:** a concession awarded for both technical operations and service provision

It is vital for the success of both programmes that a pragmatic approach to coordinating the two is taken, with the form of coordination taking into account the following:

- The desirability of starting EGNOS services in the short term (2004) to maximise potential for developing the market in advance of Galileo services and to avoid a hiatus in the EGNOS programme (the worst scenario would be for EGNOS Operational Readiness Review to take place and then for there to be no service provision); and
- The need to manage the offering of commercial services based on EGNOS where these could compete with Galileo services, in order to ensure they can be integrated into Galileo in the future.

Under *scenario 1* following the Galileo Concession award, the Concessionaire would *either* take over from the JU as the counterparty to the EGNOS concession contract *or* contractually take over the technical operations of EGNOS from the EGNOS Operating Company.

Under *scenario 2* following the Galileo Concession award, the JU could transfer the whole EGNOS concession to the Galileo Concessionaire, *or* the Galileo Concessionaire could buy out the EGNOS Concession from the EGNOS Operating Company, *or* the Galileo Concessionaire could take over the service provision part of the EGNOS concession only and formally contract with the EGNOS Operating Company for technical operations of EGNOS on fully commercial terms

#### 4.5.3 A recommended way forward

Our view is that *scenario 1* offers the most flexibility and benefits to the future Galileo Concessionaire and the JU, and is thus recommended as the approach to take. Separate technical operations and service provision concessions, with the Galileo Concessionaire contracting with the EGNOS technical operator whilst taking over EGNOS service provision would optimise the potential for:

- Achieving synergies through integration of EGNOS services into the Galileo programme;



- Ensuring that EGNOS is available to the Galileo Concessionaire for combined Galileo/EGNOS services on *fair* terms, so that integrated service provision can be offered;
- Priming the market for future Galileo services; and
- Permitting operational integration to achieve cost savings.

For the way forward we recommend:

- Allowing clear separation of technical operations from service provision in the current EGNOS procurement plan to facilitate future integration. This should be accompanied by careful communication of the rationale for such action to the interested parties, in order to sustain interest and goodwill of stakeholders for the recommended integration solution;
- Award of an EGNOS concession for technical operations to a private entity, with break clauses exercisable by the awarding authority (preferably the JU), and with reduced scope as a system operator only;
- Award of an interim EGNOS service provision contract. One alternative (which is assumed for the purposes of our work) would be to have this contract under the supervision of the JU with the option to integrate this service provision into the Galileo Concession when appropriate;
- Careful drafting of the EGNOS operating contract, both to ensure maximum flexibility for Galileo Concession bidders to consider how best to achieve functional integration, and to create a framework for cooperation between the EGNOS operator and Galileo bidders on an equal basis;
- The inclusion in the Galileo Invitation To Tender of a requirement for all Galileo Concession bidders to consider and make proposals for the optimal integration of EGNOS and Galileo; and
- From a marketing and public relations perspective, we would also recommend a re-branding of the EGNOS product under a new name that clearly aligns EGNOS and Galileo, such as “Galileo European Overlay”. This would have the benefit of dispelling any perception that there are two separate European satellite navigation programmes, whilst allowing the Galileo Concessionaire to begin active marketing through the EGNOS service.

The recommended integration solution would result in the procurement schedule being adjusted with three distinct phases and actions to be taken as outlined below:

*Phase 1 - 2003 to 2004*

- EGNOS operations contract preferably let by the JU
- Interim service provision and market development to be supervised by the JU

*Phase 2 - 2004 to 2008*

- EGNOS operations sub-contracted through the Galileo Concessionaire
- Service provision and market development folded into the Galileo Concession or subcontracted by the Galileo Concessionaire

*Phase 3 - 2008 onwards*

- EGNOS and Galileo operations are optimised by Galileo Concessionaire to control costs
- Services are integrated and GPS/EGNOS and Galileo operations are continued to optimise revenue generation and allow full interoperability between GPS and Galileo

#### **4.5.4 Key issues to address in implementing Integration**

We recommend that:

- Consideration should be given to the contractual rights and commercial agendas of those European Air Traffic Service Providers who have contracted with ESA to provide €100m of funds for the EGNOS programme, and who have a stake in how the procurement proceeds. In particular, the JU should look closely at the consequences of the recommended scenario on the bi-lateral contracts between ESA and each European Air Traffic Service Provider. Particular attention should be paid to clauses that deal with termination, reimbursement of funds invested, material change, future use of EGNOS by the aviation sector, and commercial returns;
- Preferably, the JU should be the body that awards the EGNOS operating contract and an interim EGNOS service provision and market development contract until the Galileo Concessionaire is in place. The JU should deal with this issue as soon as possible;
- Arrangements should be made to permit IPR generated during the EGNOS procurement to be made available for exploitation by the Galileo Concessionaire;
- The EGNOS Concession contract should explicitly state that the EGNOS Operating Company should communicate with Galileo Concession bidders in an equal fashion, with any commercial offers being comparable for each bidder; and
- Similar to the arrangements to be made for the Galileo programme, the EGNOS assets could be owned by the public sector for use by the EGNOS Concessionaire(s).