

SESAME CBA AND GOVERNANCE

**Assessment of options, benefits and
associated costs of the SESAME
Programme for the definition of the future
air traffic management system**

Final Report

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- A A DESCRIPTION OF OUR KEY STEPS IN THE ATM DEVELOPMENT PROGRAMME**
- B EXAMPLE ANALYSIS: UN-MET DEMAND COSTS, AIRBORNE COSTS AND SAFETY DISCUSSION**
- C COMPARATOR GOVERNANCE MODELS**

**D RECORD OF ICB AND SESC WORKING GROUP MEETING ON DRAFT
FINAL REPORT ON 15 JUNE 2005**

1. EXECUTIVE SUMMARY

Introduction

- 1.1 The European Commission (the Commission) has made the reform of air traffic management (ATM) in Europe one of its priority actions. The legislation to establish a Single European Sky (SES) became effective in April 2004, but for the objectives of the SES to be fully met, significant investment in new technology and changes to ANSPs' operating concepts and procedures will be necessary. All major stakeholders recognise the need for committed collaborative working at the European level, and within the SES framework, to develop and implement a Master Plan for the future development of the EATMN.
- 1.2 In response to this need, a number of European manufacturers have proposed the SESAME programme to achieve interoperability convergence by 2012 and full interoperability by 2022. It is to be organised in two phases:
- A two-year **definition phase**, beginning in 2005; and
 - A fifteen to twenty five year **development and implementation phase**, beginning in 2007.
- 1.3 The Commission has appointed Steer Davies Gleave and its associates, the Solar Alliance and Grant Thornton, to examine the development and implementation phase and undertake, ahead of the results of the definition phase:
- A crude **cost benefit analysis** of the programme; and
 - An assessment of the appropriate **governance structure** for the development and implementation phase to ensure successful achievement of the programme goals.
- 1.4 This Final Report sets out the conclusions of the work in both areas.

Working methods

- 1.5 The Air Traffic Management industry is under continual pressure for change, and the impact of the Single European Sky in the short term has been to increase the demand on stakeholders to allocate resources and time to consultation. In this context, our working method has been to minimise the burden of the study on stakeholders in the industry by making the maximum possible use of existing material, but nevertheless to consult with as wide a range of stakeholders as possible through working groups and bilateral discussions.
- 1.6 The stakeholders consulted included CANSO, IATA, the AEA and Air Traffic Alliance, together with a range of parties represented on the Industry Consultation Body established under SES legislation. We undertook formal stakeholder meetings with the Industry Consultation Body (ICB) sub-group on 10 March 2005 and 29 April 2005.
- 1.7 The Draft Final Report formed the basis of a presentation to a stakeholder workshop comprising the ICB and Single European Sky Committee on 15 June 2005 in Brussels.

Comments made during that meeting have been incorporated into this final report (and are recorded as Appendix D).

Our understanding of SESAME

- 1.8 We have based our understanding of the goals and objectives of SESAME on the SES legislation and relevant documentation prepared by the Commission and EUROCONTROL. We have also discussed the scope of SESAME with the Commission and other stakeholders.
- 1.9 Based on our review of the documentation, we understand that SESAME covers the design and implementation of a single Air Traffic Management Master Plan (including technology and operational aspects), enabled by the SES legislation (and in particular the Interoperability Regulation). SESAME is also expected to provide institutional arrangements that facilitate greater harmonisation and cooperation across the industry leading to improved decision-making. The programme will help facilitate a safe and efficient air transport system for the benefit of the Member States of the Single European Sky.
- 1.10 The SESAME programme does not include the implementation of the whole of the SES. However, the SESAME institutional arrangements, cooperation, systems and interoperability will facilitate the operation of new and existing technology to improve ATM efficiency. Hence, while our Cost Benefit Analysis (CBA) of SESAME presented in Chapters 5 to 7 does not include the implementation of Functional Airspace Blocks (FABs), as this is an existing legal requirement of the SES, it is recognised that the cooperation and decision making, as well as technology developments forged by SESAME, will help facilitate the creation of FABs.

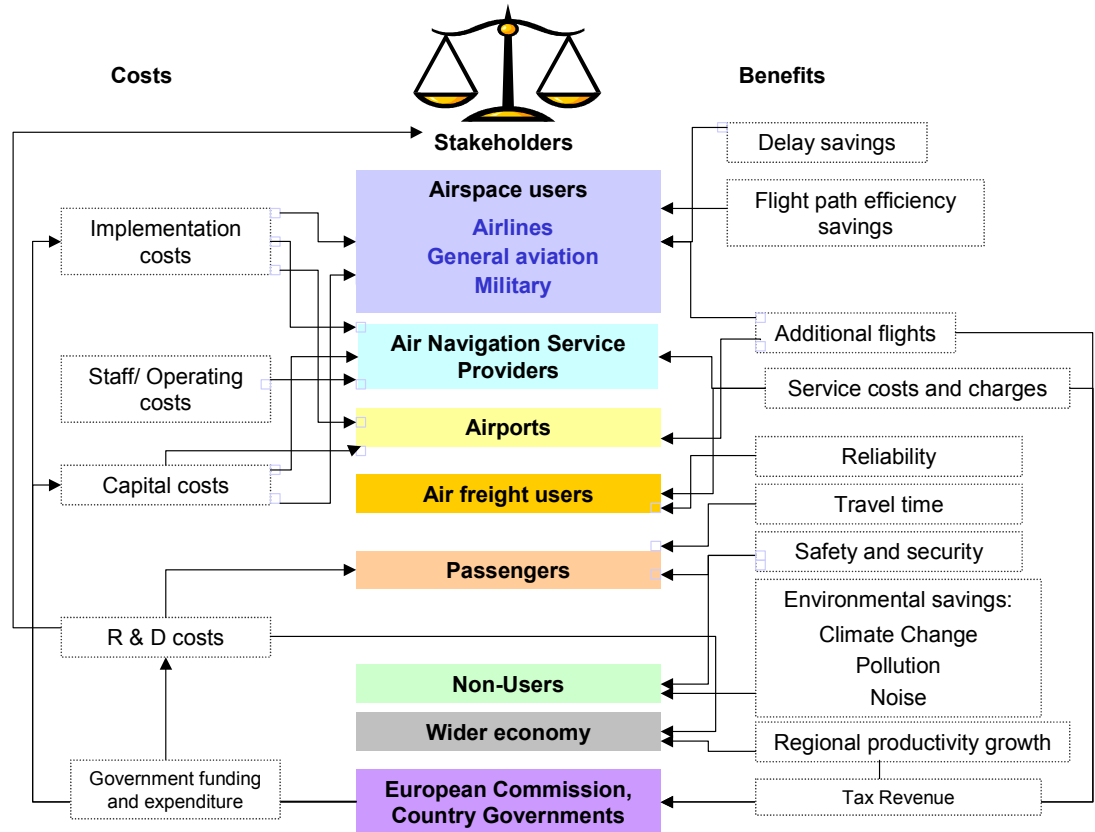
Cost benefit analysis

Framework

- 1.11 Our cost benefit framework explores how the **incremental costs of SESAME may be justified by the programme's corresponding incremental benefits**. SESAME is expected to bring increased programme management discipline to the definition and development of future ATM concepts and technologies, leading to a number of potential benefits such as:
- Earlier implementation, and consequential benefits of new concepts and technologies;
 - Potentially, a better phasing of projects, taking advantage of reduced implementation times and greater focus on high-priority projects;
 - Lower expenditure on conventional system upgrades of legacy systems;
 - Lower development costs – or “better value-added” development – due to a reduced number of parallel developments;
 - Lower equipage costs for aircraft operators; and
 - Competitive advantage for the European air transport industry.
- 1.12 The framework takes account of both the financial and economic consequences of

these benefits, as well as of the potential costs. It also distinguishes between key industry stakeholders, as shown in Figure 1.1.

FIGURE 1.1 COST BENEFIT ANALYSIS FRAMEWORK



SESAME Base Case and scenarios

1.13 The cost-benefit analysis compares three different SESAME scenarios with a Base Case. The Base Case is designed as the “most-likely” evolution path for ATM in the absence of SESAME. It has therefore been built by consolidating existing strategies and plans from the EUROCONTROL ATM 2000+ Strategy and Operational Concept Description, EUROCONTROL Convergence and Implementation Plan (ECIP), and the IATA roadmap (as developed by a group of industry stakeholders). The Base Case is inclusive of the availability of airborne and ground investment to achieve the objectives of these plans.

1.14 The scenarios are defined as follows:

- **SESAME scenario 1** assumes that our Base Case work programme is implemented to the planned timescales, without any delays and the full capacity benefits. This is a potentially conservative view of the impact of SESAME as it does not include potential savings from reduced development costs.
- **SESAME scenario 2** assumes the same timescales as SESAME scenario 1, but less duplication of programmes and additional cost savings through collaborative approaches. Research & development and implementation

costs are assumed to be lower than the Base Case as speculative developments are stopped and effort is refocused on more beneficial initiatives.

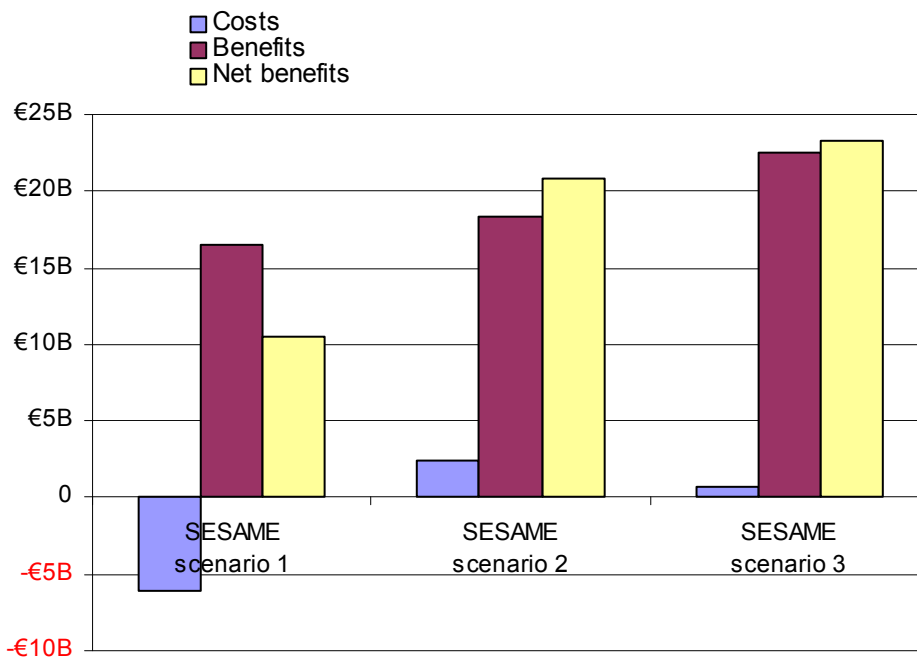
- **SESAME scenario 3 incorporates the same reduced development costs and steps as SESAME scenario 2, but also assumes shorter implementation timescales.** It reflects a more accelerated implementation programme benefiting from more focussed and timely decision-making.

Results

1.15 The CBA results are presented for SESAME scenarios compared to the Base Case. The Base Case would require considerable investment to fulfil the objectives of existing strategies and plans, and the estimated SESAME costs and benefits are **relative** to this investment. The CBA therefore provides an indication of the relative benefits of consolidating such investments or accelerating developments compared to the assumed Base Case.

1.16 Figure 1.2 shows the Net Present Values (NPVs) of the **incremental** financial costs and benefits of the SESAME scenarios relative to the Base Case; all scenarios are expected to provide a net financial benefit. The assumed lower implementation cost of SESAME scenarios 2 and 3 make its costs in aggregate lower than the Base Case, although it costs more in the early years as implementation is brought forward.

FIGURE 1.2 INCREMENTAL NPV OF SESAME SCENARIOS (€BN)



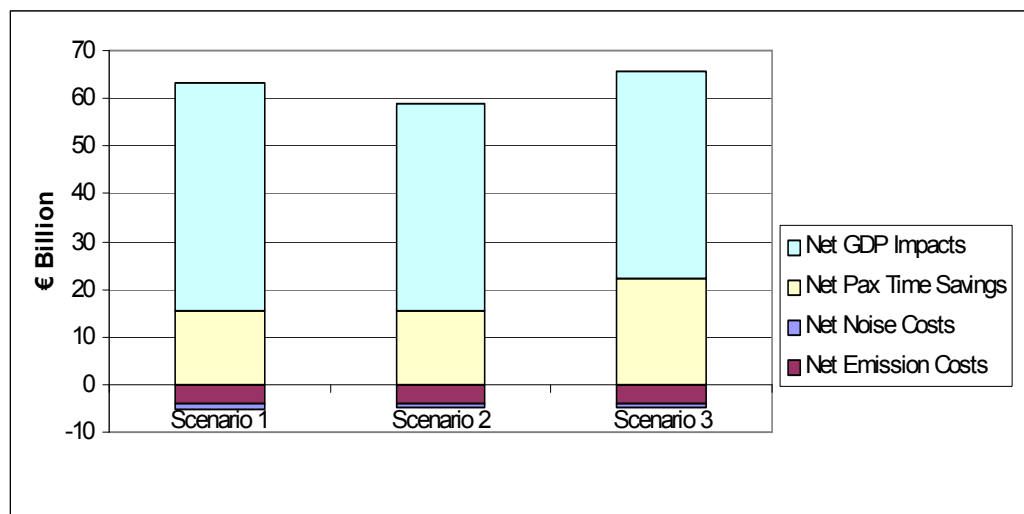
1.17 The potential for SESAME to cost less than the Base Case is dependent on minimum waste in expenditure at all levels and will therefore require a high level of commitment across Europe. The costs shown in the figure are either increases (SESAME scenario 1) or cost savings (SESAME scenarios 2 and 3) compared to the

Base Case expenditure.

1.18 These results are highly sensitive to the assumed discount rate and to the timing of the receipt of benefits, as discussed in Chapter 7.

1.19 As shown in Figure 1.3 our cost benefits analysis finds that SESAME scenarios 1 and 2 yield similar economic benefits. This is largely because SESAME scenario 2 assumes the same implementation timescales (and efficiency improvement timescales) as Scenario 1, with the only difference being the reduced duplication programs and cost savings through collaborative approaches. Scenario 3 yields the highest economic benefits.

FIGURE 1.3 BREAKDOWN OF INCREMENTAL ECONOMIC BENEFITS AND COSTS (€BN)



Governance arrangements

Framework

1.20 Before developing governance arrangements for SESAME, we discussed a number of criteria for evaluating different possible structures with the Commission and stakeholders. We concluded that the governance arrangements must:

- provide for **clear lines of reporting** and **efficient decision making**;
- draw together all **potential sources of funding**;
- be based on “buy-in” from a **wide range of stakeholders**;
- allow for a **smooth transition** through the different programme phases;
- allow sharing of resources from across participating organisations and **avoid duplication of effort**;
- facilitate effective **direction of research, development and validation effort** as well as efficient procurement of systems and services;
- ensure **coordinated implementation of standards and systems**;
- involve the **minimum possible level** of administrative resources; and

- help to ensure that SESAME leads developments in air traffic management outside Europe.

1.21 We also reviewed governance arrangements for other, European-level programmes, including the development of technical standards for interoperability in the rail sector and the Galileo Joint Undertaking.

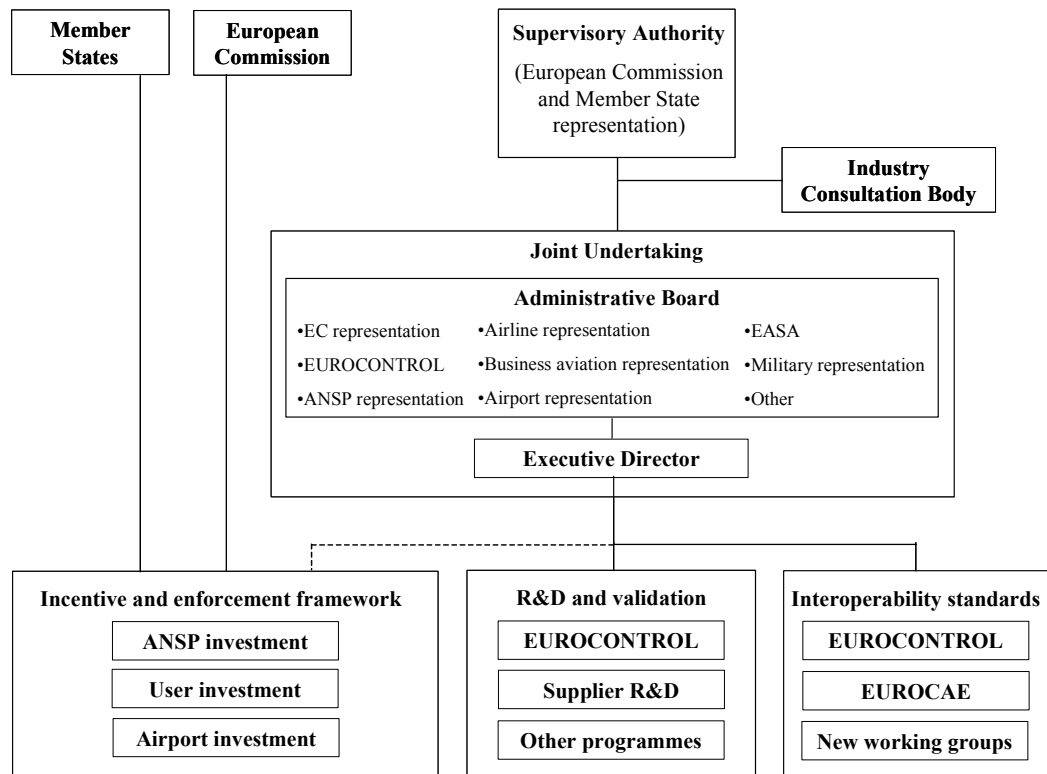
Proposed governance arrangements

1.22 From our review of precedents and stakeholder consultation, we have concluded that the governance arrangements should consist of:

- **A Supervisory Authority** to carry out the oversight responsibilities. As discussed below, we suggest that this is a newly created body with a specific remit to oversee the development and implementation of SESAME.
- **A Joint Undertaking (JU)** created under Article 171 of the EC Treaty and charged with the management of the programme at the European level. The JU should be constituted with an Administrative Board, comprising stakeholder representatives, and an Executive Director with delegated authority to undertake the various day-to-day management activities.
- **Full participation by existing bodies**, in particular EUROCONTROL and EUROCAE, whose ongoing work on relevant research and development initiatives and the formulation of standards would need to be geared towards the delivery of SESAME.
- **Additional working groups** organised, as appropriate, by the JU to undertake necessary workstreams not already covered by established bodies.
- **Programme managers** appointed by individual stakeholders to implement specific initiatives within the framework provided by the broader SESAME programme.

Under these arrangements, manufacturers would continue to respond competitively to tenders for systems issued by the JU, individual ANSPs, aircraft operators and airports, but according to a broad, European programme of development and implementation, developed by the JU. As part of this process, the JU might administer some incentive and enforcement mechanisms, again overseen by the Supervisory Authority. This structure of governance is summarised in Figure 1.4.

FIGURE 1.4 PROPOSED OUTLINE GOVERNANCE ARRANGEMENTS



1.23 Some of the constitutional issues surrounding this structure are discussed in more detail in Chapter 10.

Procurement

1.24 The governance arrangements described above were developed with a view to facilitating some central procurement activity. While there is no clear consensus between stakeholders on the appropriate level of activity, all recognise the need to determine a proper balance between reducing fragmentation and duplication, in line with the vision of the SES, and allowing individual ANSPs and airspace users to procure systems implementation in a competitive market.

1.25 There are many possible combinations of procurement approaches that could be adopted. In order to examine principles at this stage, we identified three key options, together with their advantages and disadvantages:

- **Option 1: Centralised procurement**, in which the JU would be responsible for the bulk of SESAME system procurement;
- **Option 2: Centralised research and development procurement with local implementation procurement**; and
- **Option 3: Local competitive procurement**, with SESAME delivering only interoperability standards and generic functional requirements.

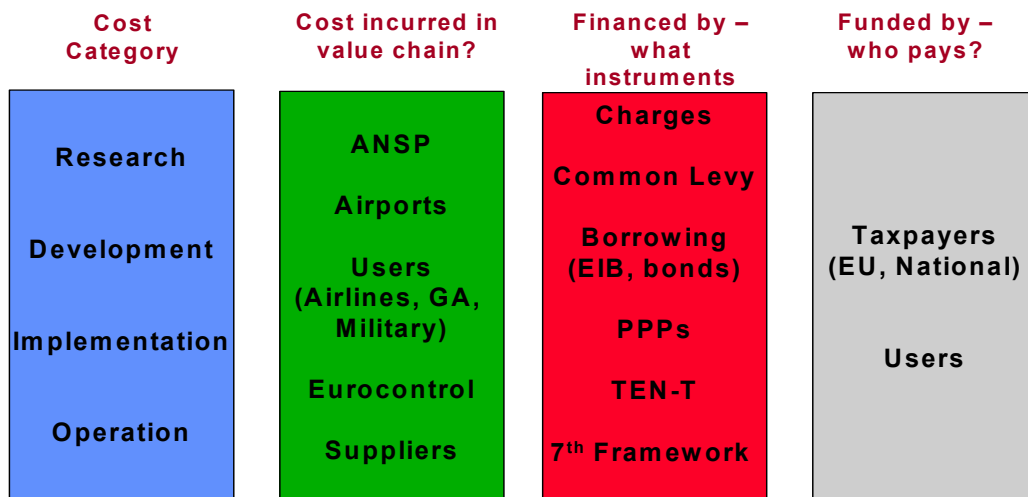
1.26 We consider that Option 2 offers the best balance in terms of meeting the SESAME

requirements while recognising the need for commercial judgement on the part of service providers. Prior to project definition, Option 2 should be considered a flexible approach that avoids the extremes of Options 1 and 3 but can be tailored to suit the findings of project definition and individual circumstances. The central management of basic system applications software ensures a high level of configuration control in terms of interoperability and common functionality, while the responsibility for buildings, services, local software adaptation and system hardware rests in the areas with the primary knowledge and experience. These principles provide a COTS software product to service providers.

Funding

- 1.27 Taking a long term perspective on investment and funding has proven difficult for the air transport industry, as short term cost pressures tend to drive behaviour. Therefore, the industry is encouraged to take a longer-term strategic view to achieve the full benefits of SESAME. European Union funding will both accelerate the realisation of the benefits of a Community-wide, interoperable network and also increase the benefits by providing an incentive to maximise the geographic coverage of the implementation. Network benefits will be increased and brought forwards in time if implementation is coordinated in a planned implementation (rather than member state ad-hoc implementation).
- 1.28 The distinction between **the categories of costs** that are incurred in the value chain, and **how they are financed and funded** is outlined in Figure 1.5. The distinction between how the incremental costs of SESAME are financed through appropriate instruments, and ultimately **who is responsible for paying / funding** these costs is critical to the discussion in Chapter 12.

FIGURE 1.5 LINK BETWEEN COST, FINANCING AND FUNDING



- 1.29 Chapter 12 discusses the sources of funding and financial instruments potentially available. Our review and analysis of their suitability for funding SESAME suggests that the Commission’s funding should be directed to areas of significant risk. In particular, we suggest that such funding should:

- Cover the costs of the new Joint Undertaking proposed in Chapter 10;
- Support the research, development and validation costs associated with the Road Map and determining the ATM Master Plan; and
- Allow for a contribution to the implementation costs of the programme, though incentives and perhaps compensation for bringing forwards costs for more timely investment to provide investment network benefits.

1.30 In Table 1.1 we set out indicative levels of the Commission’s contribution to the main elements of SESAME. These are based on the CBA, the total costs of the ATM research and development programme, and an expectation of the implementation costs brought forwards by the acceleration of timescales. However, at this stage these numbers are illustrative and intended to show the broad order of magnitude of the Commission’s funding. The level of contribution will be subject to finalisation during the definition phase of the programme.

TABLE 1.1 INDICATIVE CONTRIBUTION TO THE FUNDING OF SESAME (€ M)

Source of funding requirement	Duration	Annual (indicative) € m	Total (Indicative) € m
Joint Undertaking costs	Enduring (30 years)	10	300
Research, development and validation	Seven years of framework	50	350
Implementation Costs	First 10 years of programme	150 - 250	1,500 - 2,500

2. BACKGROUND

The Single European Sky legislation

2.1 The European Commission (the Commission) has made the reform of air traffic management (ATM) in Europe one of its priority actions. The legislation to establish a Single European Sky (SES), which became effective in April 2004, comprises four linked Regulations:

- Reg (EC) No 549/2004 laying down the **framework** for the creation of the SES. This establishes a harmonised institutional and regulatory framework for the creation of the SES. It requires Member States to nominate “National Supervisory Authorities” (NSAs), separate from service providers. It creates a “Single Sky Committee” and defines how implementing rules are to be developed through mandates to EUROCONTROL.
- Reg (EC) No 550/2004 on the **provision of air navigation services** which establishes requirements for the safe and efficient provision of these services in the Community that address, among other things, safety, quality, security and accounting systems. It sets out the NSAs’ tasks and mandates the adoption of Eurocontrol Safety Regulatory Requirements (ESARRs). It introduces a certification mechanism for Air Navigation Services Providers (ANSPs) and the means of monitoring compliance, together with requirements for greater transparency and a new charging scheme for air navigation services.
- Reg (EC) No 551/2004 on the **organisation and use of airspace**, which creates the conditions and requirements for creating functional airspace blocks (FABs), which can be transnational where this is the most efficient approach to airspace organisation. It also encourages the “progressive harmonisation” of airspace classification, based on the simplified approach defined in the Eurocontrol airspace strategy.
- Reg (EC) No 552/2004 on **interoperability**, aimed at achieving the interoperability of the European Air Traffic Management network (EATMN), by defining essential requirements for it, and by expediting the introduction of new operational concepts and technology. The regulation will be supported by implementing rules, standards and Community specifications. Compliance with the regulation will be assured by manufacturers’ “declarations of conformity”, monitored by notified bodies.

2.2 Implementation of the SES regulations has recently begun. For example the Commission has already issued mandates to EUROCONTROL to develop:

- Regulatory measures and recommended practices for the Flexible Use of Airspace concept (FUA);
- Rules on airspace design;
- Regulatory measures on a common air navigation charging scheme; and
- Concepts for the development of FABs.

2.3 However, while the new legal framework is an important enabling requirement, for the objectives of the SES to be fully met, significant investment in new technology and changes to ANSPs’ operating concepts and procedures will also be necessary. Indeed,

such changes would be necessary to support the cost-effective growth of the industry in any event. For example the High Level Group (formed to develop the SES proposals) identified the urgent need to modernise the European Air Traffic Management Network (EATMN) and introduce new operational concepts and technologies in order to meet growing traffic demand in 2000. The SES initiative now provides the essential institutional and legal framework within which these changes can be coordinated.

The genesis of SESAME

- 2.4 All major stakeholders (the Commission, EUROCONTROL, ANSPs, airports, users, manufactures, member state governments and National Supervisory Authorities (NSAs)) recognise the need for committed collaborative working at the European level, and within the SES framework, to develop and implement a Master Plan for the future development of the EATMN.
- 2.5 The original impetus for SESAME came from a consortium of European manufacturers EADS, Airbus and Thales working as the Air Traffic Alliance (ATA). The ATA developed proposals for a Single European Sky implementation programme, which gained support from key stakeholders in the Commission and EUROCONTROL.
- 2.6 The Commission recognised that to receive the full benefits of the Single European Sky legislation, a coordinated programme for implementing interoperability should be encouraged.

SESAME definition and development/implementation phases

- 2.7 The SESAME programme is to be organised in two phases:
- A two-year **definition phase**, beginning in 2005; and
 - A fifteen to twenty five year **development and implementation phase**, beginning in 2007.
- 2.8 While the details of the implementation programme have yet to be defined, it anticipates completion of interoperability convergence by 2012 and full implementation by 2022.

SESAME definition phase

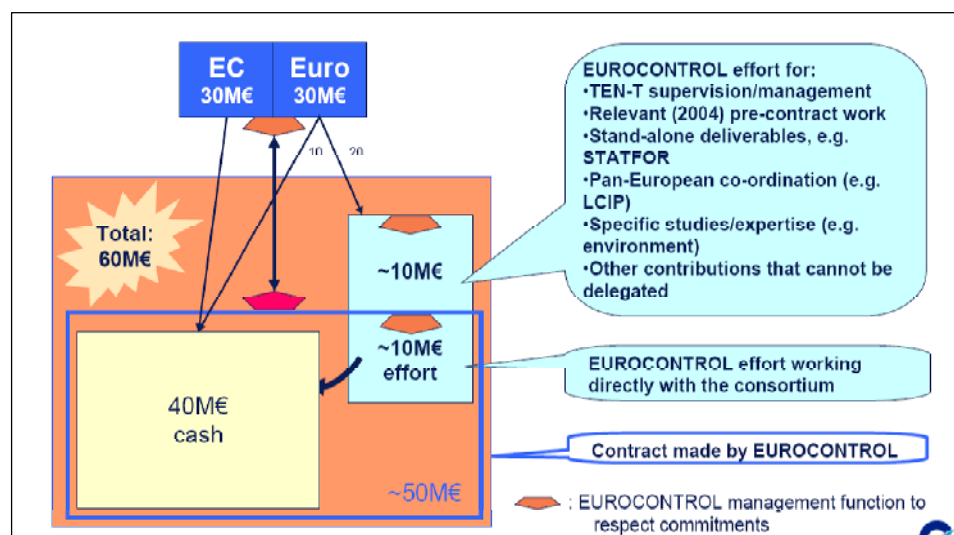
- 2.9 The definition phase of SESAME will be part funded through TEN-T funding from the European Union and part from EUROCONTROL. The majority of the work will be contracted out by EUROCONTROL, following the approach described in the EC funding decision 91601.
- 2.10 The total budget of approximately €60 million will be funded by a €30 million contribution from TEN-T, €10 million cash, €10 million diverted working effort and €10 million existing effort from EUROCONTROL, as illustrated in Figure 2.1.
- 2.11 The invitation to tender was finalised on 25 January 2005, and EUROCONTROL

received submissions from bidders in early April. The preferred bidder was announced at the 2005 Paris air show as an Industry Consortium comprising airspace users, airports, ANSPs, and the supplier industry. It is headed by the Air Traffic Alliance and the definition phase is expected to begin by the late summer of 2005.

2.12 The work programme comprises the following high level activities:

- Regulatory and Business Framework;
- Performance Requirements and Assessment;
- Operational changes in ATM;
- Enabling systems;
- Validation needs;
- ATM Master Plan;
- Work Programme for 2007-2012, & management structures; and
- Communication.

FIGURE 2.1 EUROCONTROL DESCRIPTION OF FUNDING OF DEFINITION PHASE



Source: EUROCONTROL

2.13 The definition phase is expected to last for a maximum of two years. Consortia responding to the tender were encouraged to represent all ATM stakeholders, as well as the required technical expertise, in their teams. The winning consortium provides a wide industry backing for this phase of work.

SESAME development and implementation phase

2.14 After 2007, the SESAME development and implementation phase, lasting until at least 2025, is expected to require significant efforts from the Commission and the EU Member States, as well as the relevant industry stakeholders, including EUROCONTROL, ANSPs, airports, airlines and other airspace users, and the manufacturing industry. This phase will be a complex and challenging international programme, and its effective execution will require the prior establishment of appropriate institutional and organisational structures, and the associated efficient

financing and risk allocation mechanisms.

This study and organisation of this report

2.15 The Commission launched this study to examine the development and implementation phase of SESAME, to undertake ahead of the results of the definition phase:

- A crude **cost benefit analysis** of SESAME; and
- An assessment of the appropriate **governance structure** for the development and implementation phase to ensure successful achievement of SESAME's goals.

2.16 The Commission appointed Steer Davies Gleave and its associates, the Solar Alliance and Grant Thornton, to undertake the study, and work began in January 2005. This document is the Final Report. It covers, in addition to this introductory Chapter on the background:

- Chapter 3, describing our methods of working;
- Chapter 4 setting out our understanding of the definition and objectives of SESAME;
- Three Chapters covering the **cost benefit analysis**:
 - ◆ Chapter 5, describing our framework for the CBA analysis;
 - ◆ Chapter 6, defining our Base Case and SESAME scenarios; and
 - ◆ Chapter 7, giving our assessment of the results of the CBA analysis;
- Five Chapters covering the **governance arrangements** for the SESAME development and implementation phase:
 - ◆ Chapter 8, describing our framework for assessment of governance options;
 - ◆ Chapter 9, providing a review of different comparator governance models and their applicability to SESAME;
 - ◆ Chapter 10, highlighting our proposed governance framework for the implementation phase;
 - ◆ Chapter 11, describing procurement issues arising from SESAME;
 - ◆ Chapter 12, outlining funding and financing issues arising from SESAME;

We also provide the following appendices:

- Appendix A: providing a description of the ten key steps in our programme;
- Appendix B: detailing our analysis of un-met demand costs, airborne equipment timescales and the estimation of safety benefits;
- Appendix C: detailing our comparator investigation of existing governance arrangements; and
- Appendix D: a record of the meeting of the ICB and SESC working group on 16 June 2005.

3. OUR WORKING METHOD

Introduction

- 3.1 The Air Traffic Management Industry is under continual pressure for change, and the impact of the Single European Sky in the short term has been to increase the demand on stakeholders to allocate resources and time to consultation. Significant work to develop the implementation rules of the SES is ongoing, involving participation in the Industry Consultation Body (ICB) and Single European Sky Committee (SESC). The responses to the EUROCONTROL invitation to tender for the definition phase of SESAME provided an additional call on industry resources. Moreover, a parallel study of the impact of fragmentation on the European ATM / CNS Industry for EUROCONTROL's Performance Review Unit has involved extensive consultation with industry.
- 3.2 In this context, our working method has been to minimise the burden of the study on stakeholders in the industry by making the maximum possible use of existing material, but nevertheless to consult with as wide a range of stakeholders as possible.
- 3.3 The techniques that we used comprised working groups and bilateral discussions with stakeholders, and the preparation of short briefing presentations sent ahead with structured questions regarding both the CBA and governance issues.

The ICB SESAME Working Group

- 3.4 The ICB has been a key counter-party to the study team in developing its work. It has established a SESAME Working Group to oversee and review our work. This Final Report has benefited from extensive comments from the ICB sub-group and representations from its members though written and verbal comments on our approach and emerging results of the study. We undertook formal stakeholder meetings with the ICB sub-group on 10 March 2005 and 29 April 2005.

Stakeholder working groups

- 3.5 We undertook additional consultation with key stakeholders through working groups of:
- The Coordination Committee of CANSO (on 25 February 2005);
 - Representatives of the airline associations (on 24 February 2005);
 - Representatives of the Supplier Industries (on 24 February 2005); and
 - Key managers at EUROCONTROL (on 25 February 2005 and 18 April 2005).

Bilateral meetings

- 3.6 We have undertaken a number of bilateral discussions with stakeholders to develop our understanding of their position and perspectives in relation to the study, including representatives of the General Aviation and Commercial civil aircraft users of the ATM system. We have worked closely with EUROCONTROL and the departments responsible for managing the SESAME definition phase and undertaking CBA for the

industry. In addition, we have met with individual representatives and associations of the ANSP, airline and manufacturing industries.

Working papers

- 3.7 We developed a number of working papers and presentation material to share and circulate with stakeholders. This material formed the basis of discussion, enabling us to set out key questions in advance of our meetings. This enabled us to develop an active debate on the key issues, which is reported throughout the remainder of the report.

Stakeholder workshop

- 3.8 The Draft Final Report formed the basis of a presentation to a stakeholder workshop, comprising the full membership of the ICB and the SESC on 15 June 2005 in Brussels. There was a constructive discussion of the draft results of the study on both the CBA and governance arrangements. Comments made during that meeting have been taken into consideration in finalising this report. Moreover, the Commission set out its intention to work up its own proposal for the governance arrangements for SESAME and share them with the ICB and SESC. A record of the meeting is attached as Appendix D.

4. THE DEFINITION AND OBJECTIVES OF SESAME

Introduction

- 4.1 This Chapter provides an overview of the definition and objectives of SESAME. It concentrates on the development and implementation phase, although it also comments on the definition phase as an integral part of the overall programme.
- 4.2 Before setting out the programme objectives, we have described our understanding of the scope and coverage of SESAME. Given the apparent differences of view about the scope of SESAME within the industry, which were perhaps inevitable in advance of the conclusion of the definition phase, it was important to clarify these scoping issues before commencing detailed CBA and work on governance arrangements.
- 4.3 The definition and objectives presented in this Chapter have been developed through discussion with the Commission and stakeholders.

What is SESAME?

- 4.4 SESAME covers the design and implementation of a single Air Traffic Management (ATM) Master Plan (including technology and operational aspects), enabled by the SES legislation (and in particular the Interoperability Regulation). SESAME is also expected to provide institutional arrangements that facilitate greater harmonisation and cooperation across the industry leading to improved decision-making. The programme will help facilitate a safe and efficient air transport system for the benefit of the members of the Single European Sky.
- 4.5 The scope of SESAME does not include the implementation of the whole of the SES. However, the SESAME institutional arrangements, cooperation, systems and interoperability will facilitate the operation of new and existing technology to improve ATM efficiency.
- 4.6 While our CBA of SESAME presented in Chapters 5 to 7 does not include the implementation of Functional Airspace Blocks (FABs) (as this is an existing legal requirement of the SES), it is recognised that the cooperation and decision making, as well as technology developments forged by SESAME will help facilitate the creation of FABs.
- 4.7 The development of the ATM Master Plan will involve all relevant stakeholders and be based, as far as possible, on a consensus approach. However, it was accepted throughout consultation that there were limitations over what consensus decision-making could achieve.
- 4.8 Within the implementation phase, there are three key milestones:
- early deployment of existing solutions starting in 2007/8;
 - interoperability / convergence and initial upgrade of system capability by 2012/13; and
 - collaboration on the basis of a high performance system functionality

beginning in 2017/18.

Stakeholder consultation

- 4.9 During our stakeholder consultation exercise, different stakeholders placed emphasis on different aspects of SESAME and what it offers compared to the current situation:
- Some emphasised its **decision making** advantages;
 - Some highlighted its promotion of **programme management**;
 - Some emphasised that it should help **overcome fragmentation** in service provision and infrastructure;
 - Some noted its benefits as a **facilitation and consensus building** exercise; and
 - Some described it as the **Master Plan for the future of ATM industry**.
- 4.10 These apparent differences in emphasis should be clarified during the definition phase. However, we anticipate that all of these aspects will be reflected to some degree in the overall objectives for the programme.

Key goals and objectives of SESAME

Source information

- 4.11 We have based our understanding of the goals and objectives of SESAME on the following documents:
- Single European Sky Legislation;
 - EUROCONTROL document: “Definition Phase for a Single European Sky Implementation Programme – preliminary requirement specification for core activity (version 2.0, 25 January 2005);
 - European Commission’s TEN-T funding decision on the ATM Master Plan (Annex I) Project No – 2004-EU-91601-S;
 - European Commission: High Level Group Meeting notes (13 July 2004);
 - Air Traffic Alliance documents: “An alliance for seamless Air Transport”, and further information from the website on SESAME and the implementation framework;
 - Discussions at meetings with the Commission; and
 - Stakeholder consultation.

SESAME’s goals and objectives

- 4.12 We have split our understanding of the goals and objectives of the programme between:
- High level goals;
 - Objectives of the definition phase;
 - Key working objectives; and
 - Output objectives.

High Level Goals

- 4.13 The high level goals of the SEAME programme are to:
- i. Enable the implementation of the Single European Sky
 - ii. Establish the future vision for the industry
 - iii. Facilitate an integrated programme of activities
 - iv. Improve decision making
 - v. Provide capacity in the system as and when required by demand
 - vi. Improve the cost efficiency of the ATM system
 - vii. Achieve mutual benefits for passengers, airlines, ANSPs and airports
 - viii. Improve the safety, security and environmental quality of the system
 - ix. Coordinate the agreed implementation programme through common development

Definition Phase

- 4.14 The objectives of the definition phase are described on page 6 of the EUROCONTROL draft terms of reference. These are to:
- *“Define European air transport system performance requirements up to 2020 and beyond.*
 - *Identify globally interoperable and harmonised ATM solutions to meet performance requirements.*
 - *Produce the detailed Research and Technology and validation work programme, including planning costs and priorities, as required to meet the performance requirements.*
 - *Establish a detailed and phased implementation and deployment plan, including costs and priorities.*
 - *Propose the legislative, financial and regulatory framework required for successful deployment, including possible incentive schemes and funding models.”*

Key Working Objectives

- 4.15 Working objectives that both reflect the high level goals and establish a workable SESAME programme include:
- i. Establishing an ATM Master plan owned by ATM stakeholders.
 - ii. Ensuring the programme is based on a sound business case.
 - iii. Ensuring EUROCONTROL budgets are not increased and user charges remain within efficiency targets.
 - iv. Focusing industry research and activity on the ATM Master Plan.
 - v. Establishing a clear supply chain with agreed links between research and development, validation and implementation.
 - vi. Establishing and validating common development standards.

- vii. Accelerating the deployment of validated, interoperable technology and operational concepts through the use of coordination and consensus building.
- viii. Improving coordination of air and ground air traffic management infrastructure development.
- ix. Facilitating the transfer of air traffic management activity to areas surrounding and outside the Single European Sky.

Output objectives

- 4.16 The aim of SESAME will be to produce outputs that are measurable, recognisable and understood to bring benefits to the ATM industry, airspace users and their customers. The programme will therefore have the following output objectives:
- i. Achieving cost efficiency (through economies of scale in development and avoidance of fragmentation in system implementation and infrastructure).
 - ii. Providing lower costs of system procurement and maintenance (through agreed common system standards and certification).
 - iii. Achieving industry cooperation at a Community level.
 - iv. Achieving Community (rather than national) level standards.
 - v. Achieving an increase in the speed of the introduction of agreed ATM interoperable products.
- 4.17 We have used these objectives as the basis for our assessment of the CBA and to develop the appropriate governance arrangements for SESAME.

5. OUR COST BENEFIT ANALYSIS FRAMEWORK

Introduction

- 5.1 This Chapter describes the key sources of the potential benefits of SESAME before going on to describe the framework for organising and reporting on our CBA of the SESAME programme. A draft framework was discussed with the Commission and stakeholders in the first month of the study, to ensure that it would assist in meeting all the reporting objectives for the study.
- 5.2 The Commission asked us to undertake a high-level, initial CBA of SESAME within a four-month study programme. The expectation is that a detailed CBA will be undertaken during the definition phase of SESAME. It should be noted that, while we have endeavoured to express all elements of the analysis in monetary values, this has not been feasible for all parameters used in the study. In some cases, therefore, it has been necessary to express elements in qualitative descriptive terms.
- 5.3 As has been commented on by some stakeholders, we expect that the CBA undertaken in this report will assist the definition phase work programme in identifying the key parameters driving whether SESAME is a success, and areas for further investigation.
- 5.4 Our SESAME CBA analysis is concentrated on a subset of the SES implementation programme, and in particular the interoperability regulation and enabling the introduction of timely new and existing technology. We have been asked by the Commission not to include the costs and benefits of the introduction of Functional Airspace Blocks (as this is a legislative requirement of the SES). However, it is anticipated that cooperation and technological advances will contribute to the creation of FABs. A financial CBA of the total SES programme was undertaken for the Commission: “Financing of ATM to achieve the Single European Sky”, August 2004. In that study, an indication of the support that might be provided through the Commission for TEN-T funding to support the creation of FABs was provided.

Potential benefits of SESAME

- 5.5 The cost-benefit framework explores how the **incremental costs of SESAME may be justified by the programme’s corresponding incremental benefits**. SESAME is expected to bring increased programme management discipline to the definition and development of future ATM concepts and technologies. This will potentially lead to changes to the approach:
- Providing a better **ordering and prioritisation of developments**. It may, for example, focus resources on a smaller number of more promising concepts and technologies, which may in the interim increase costs.
 - Ensuring that there is no **unnecessary duplication of new concepts** and technologies, leading to better informed development and investment decisions.
 - Leading to Pan-European developments being **agreed and implemented sooner, through greater harmonisation and standardisation**.
 - **Coordinated implementation of air and ground systems** leading to faster achievement of operational benefits.

- Improving **coordination of developments** to reduce the impact on aircraft operators in equipping with new technologies.
- Improving coordination of developments of ATM systems that **support step-wise implementation of new functions** and optimal phasing in of benefits. In particular, increases in capacity must be carefully matched to increases in demand where capacity is constrained.
- **Defining a “uniform” ATM system** or, as a minimum, a consolidation of designs. This should deliver economies of scale in procurement and reduce maintenance and operation costs.
- Enabling **decisions to be taken earlier**, bringing forward implementation dates. Enforcement of decisions will be stronger which will enable more rapid payback on early investments such as industrial research and development. A more rapid introduction of new technologies would also be possible.
- Enabling coordination of developments across the industry, **synchronising the resources of ANSPs and other industry partners**. This will reduce duplication and reduce efforts in reaching agreements on concepts and standards etc. It will also, in conjunction with other measures listed here, increase the competitiveness of European industry and ensure that Europe maintains a critical role in global decision-making.
- **Promoting planning certainty** to ANSPs and aircraft operators, enabling them to time new investment decisions with some confidence. This may lead to stakeholders delaying system upgrades to take advantage of the next generation of technologies.

The benefits that may flow from these changes include:

- Earlier implementation, and consequential benefits of new concepts and technologies (safety, capacity, flight efficiency, environment etc).
- Potentially, a better phasing of projects, taking advantage of reduced implementation times and greater focus on high-priority projects.
- Less need for and therefore lower expenditure on conventional system upgrades of legacy systems (because of more rapid system replacement programme).
- Lower development costs – or “better value-added” development – due to a reduced number of parallel developments.
- Lower equipage costs for aircraft operators.
- Competitive advantage for the European air transport industry, including the equipment manufacturers and the research and development sector should similar programmes be duplicated in other parts of the world, e.g. the United States, China, etc.

5.6 However, it is anticipated that some disbenefits may also arise as compared to the status quo and these are also considered, as follows:

- A more rapid replacement or modification of legacy systems, e.g. due to earlier implementation dates, which may increase costs.
- A potential lack of competition if there are too few supplier offers. This will be considered in the governance stage of the study.

- An individual stakeholder may be forced to upgrade systems, even though it does not have a business case itself, as achieving European system wide benefits may exceed individual country or ANSP interests.

The CBA Framework

5.7 In developing the CBA framework for the study, we have considered the:

- Standard approaches to project and programme appraisal used in the development of transport infrastructure;
- Specific instances of cost-benefit analysis undertaken for other investments in the development of transport infrastructure and related areas on behalf of the Commission (e.g. GALILEO); and
- Standard approaches to analyses supporting investment decisions required by other funding organisations, notably the European Investment Bank.

5.8 On this basis, we are confident that the approach used is consistent with all the likely requirements of the CBA for SESAME, as set out in the specification of this project.

5.9 Our framework incorporates a **financial** as well as an **economic** CBA, and distinguishes the key industry stakeholders:

- Airspace users (airlines, general aviation and military);
- Air Navigation Service Providers;
- Airports;
- Passengers;
- Air freight users;

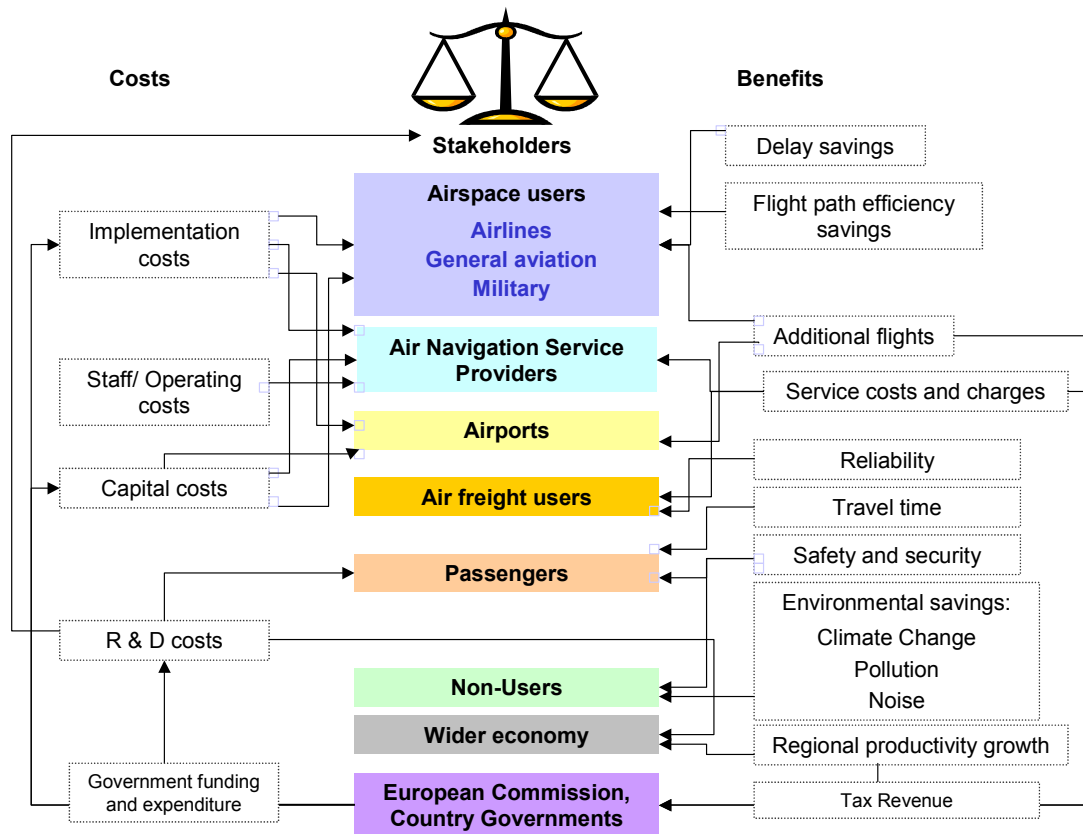
and the wider economic impacts on:

- Government (including the Commission and member state governments); and
- Non-air transport users.

5.10 Our financial CBA has concentrated on the inputs and outputs at each end of the supply chain. For example, we assume that the benefits of cost efficiency improvements by ANSPs are passed on to their users by reduced charges (through the cost recovery charging mechanisms). This follows the convention that the valuation of benefits and costs reflects preferences that will be revealed by market choices through the CBA. We have not modelled all the intermediate stages of the supply chain, as this introduces the danger of double-counting costs and benefits. We have measured the impact on the wider aviation community through the multiplier effects measure in our economic CBA. However, some stakeholders, in particular the manufacturing industry, have highlighted that they would expect to receive some share of the benefits created by the SESAME programme. We have not taken this into account in our CBA calculations. Such refinement will be appropriate for the definition phase but it goes beyond the high level, indicative CBA requested of this study. Nevertheless, the current annual value of the civil ATM systems market is over \$10 billion in Europe which gives an indication of the size of the industry.

5.11 Figure 5.1 provides a summary of the contents of the framework that we describe in detail over the remainder of this Chapter.

FIGURE 5.1 OUR COST BENEFIT ANALYSIS FRAMEWORK



Financial Cost Benefit Analysis

5.12 The financial CBA focuses on the costs and benefits to different stakeholders of the new systems and concepts provided through SESAME. The costs and benefits to each stakeholder group have been calculated, as well as the total Community costs and benefits. Within the CBA framework, the following benefits have been financially quantified:

- More rapid implementation of new programs and an optimal phasing of increases in capacity to anticipate demand requirements.
- Reduced duplication of programs, particularly by removing programs that deliver the same output benefits, or their achievement is of higher risk.
- Reduced development effort, by focussing resources into a smaller number of product implementations.
- Reduced costs of maintaining legacy systems.
- Reduction in costs, and the associated benefits to other users (i.e. passengers and freight users).
- Increased flight efficiency.
- Increased capacity. This includes an analysis of when increased capacity is required to alleviate constrained demand and where otherwise a “capacity wall” would occur.

- Reduced research and development costs.
- Reduced ANSP operating costs.

5.13 A breakdown of the costs and benefit allocation to stakeholders is provided in Appendix A.

5.14 Increased predictability of flight paths and timing for airlines has also been considered and quantified where possible. The potential reduced risk of accidents is also discussed qualitatively. Some stakeholders have highlighted that the ATM research and development industry is likely to produce spin-offs for other industries. While we accept this potential has been realised in the past, we have not attempted to financially quantify this potential in this high level CBA. The impact of SESAME on the quantification of benefits to airspace and air transport users are illustrated in Figure 5.2 and Figure 5.3.

FIGURE 5.2 ILLUSTRATIVE DIAGRAM OF BENEFITS IN THE AIRSPACE MARKET

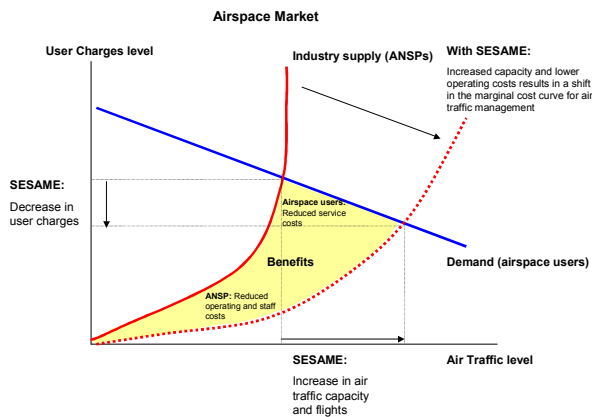
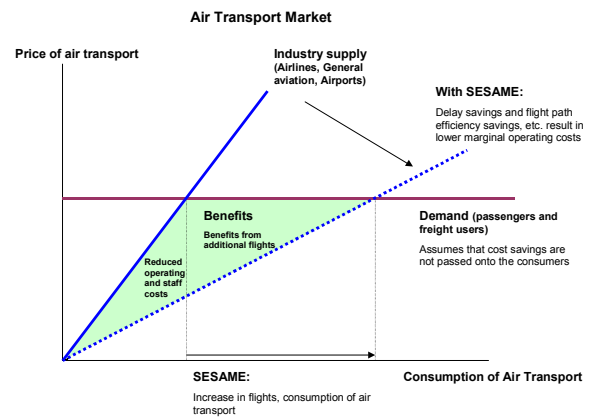


FIGURE 5.3 ILLUSTRATIVE DIAGRAM OF BENEFITS IN THE AIR TRANSPORT MARKET



Other Economic Costs and Benefits

5.15 Using the standard CBA framework for supporting investment decisions, economic costs and benefits to non-users have also been considered, including the:

- Social/community and indirect business benefits of more efficient air travel;
- Environmental benefits of increased flight efficiency; and
- Safety.

Social/community and indirect business benefits of more efficient air travel

5.16 The aviation industry has significant impacts on the level of regional employment and economic activity. Directly, the aviation industry is a consumer of fuel, research and development, equipment, and generates employment in these sectors. The

- implementation of SESAME will have direct impacts on the research and development and manufacturing industries. More efficient air travel therefore improves the productivity (added value) of labour in the transport sector, which should positively affect wages. The quantification of these benefits, however, are not included in this study.
- 5.17 The roll-out of SESAME has direct effects on the aviation industry. Components of the industry, such as research and development and manufacturers of aviation equipment, will experience increases in demand. However, this is paid for by the government (through grants from the Commission or national Governments) or eventually passed on to the consumer of air transport (represented by research and development and implementation costs in the CBA), and represents a mere redistribution of welfare as opposed to a net gain in the economy. The impact of any increase in jobs from SESAME in the manufacturing industry is picked up in our overall economic multiplier effect (and we provide an illustrative transformation between GDP multiplier effects and the number of jobs in Chapter 7).
- 5.18 It is estimated that the aviation sector (excluding the Manufacturing sector) accounts for about 0.9% of GDP in Europe¹. In addition, with its indirect and induced impacts, it contributes to 1.5% of total value added in the European economy. As SESAME increases aviation output through improved flight capacity, the direct, indirect and induced effects of aviation on the wider economy will also grow.
- 5.19 The aviation sector (excluding Manufacturing) directly employs 0.32% of the workforce in Europe. Through other supported activities and aviation-led economic growth, the sector contributes 1.15% of total employment in Europe (1.9 million jobs in EU-15 in 2000). SESAME would have two opposing direct effects on employment. On one hand, the increase in aviation output (flights) compared to the Base Case would increase demand for workers. On the other hand, capacity improvements introduced by SESAME and the subsequent enhancement in productivity suggests that fewer workers and factor inputs might be required to produce the same levels of output (or to put it another way incremental growth would not require additional direct employment). Indirect and induced employment from aviation would increase because SESAME introduces net increases in aviation, and overall economic output.
- 5.20 The cost of air transport to passengers and air freight users is regarded as a transaction cost. As such, transport costs add to the input prices of goods and services. More efficient air transport within Europe facilitates the creation of a single market and generates economies of scale in resource allocation. This in turn increases the competitiveness of European industries and consumers through lower prices of imports and exports (including tourism). This will not only lead to higher levels of intra- and extra- European trade, inward investments and economic activities, but will also directly benefit consumers, who can enjoy more choices at lower prices.
- 5.21 More efficient, cheaper, and higher levels of air travel have multiplier effects on the

¹ Source: ACARE, 2003. "The Economic Impact of the Air Transport Industry in the EU" presentation.

regional economy. For example, more efficient air travel will facilitate intra-European travel by both European and non-European travellers. This will in turn increase demand for services such as hotels, restaurants, and surface transport. More economic activity lead to higher GDP levels. More efficient transport links at the European level can also boost inward foreign investments from countries outside of Europe.

- 5.22 In the CBA, we have used potential **additional increases in GDP due to growth in aviation as a proxy for the wider economic benefits** that may be gained due to more efficient air travel.
- 5.23 Different European studies provide different estimates on what proportion of the total value-added in the economy is attributable to the aviation sector. In our CBA framework, the direct impacts of SESAME-related aviation productivity gains are those realised by the identified stakeholders, namely the ANSPs, airports and airspace users. Indirect impacts include the effects on the intermediary input markets, such as the manufacturing and research and development industries. Induced impacts associated with productivity improvements in aviation would benefit a wider range of sectors of the economy that are dependent on air transport, such as the tourist industry.
- 5.24 Estimates on the value of the direct, indirect and induced effect aviation has on the overall European economy also vary widely. This is to a large extent due to the different definitions of the “aviation industry”. For the purpose of our analysis, the aviation industry consists of the stakeholders we have identified. Defined as such, we estimate that the aviation sector represents about 0.8% of the total GDP in Europe². According to the ACARE report, "The economic impact and strategic importance of air transport in Europe", the aviation sector, comprising airlines, airports and manufacturers, directly contribute to 0.9% of the European GDP. It should be noted that during the consultations with stakeholders undertaken for this study, IATA expressed the view that the study should specifically identify the wider impacts on the economy due to the benefits accruing to manufacturing industry as a direct result of SESAME. However, the time and resources available for the study, and the lack of research and data in this area means that it has not been possible to do this.
- 5.25 To estimate the multiplier effect of the indirect and induced effects of the aviation sector on the general economy in this study, we draw on a number of different studies. These include:
- OEF (Oxford Economic Forecasting): “The Contribution of the Aviation Industry to the UK Economy”, November 1999;
 - ACARE “Strategy Research Agenda”;
 - CERMAS (European Centre for Aerospace and Air Transport Research – Toulouse Business School): “The Economic Impact of Air Transport on the EU Economy”, September 2003; and

² This estimate is based on the OEF (Oxford Economic Forecasting) report, “The Contribution of the Aviation Industry to the UK Economy”, November 1999, which suggests that the airlines and air transport supporting activities amounts to 1.4% of the total value-added in the UK.

- ATAG (Air Transport Action Group funded by ACI. IATA etc.): “The Economic Benefits of Air Transport”, January 2000.
- 5.26 According to the OEF study (1999), the average multiplier effect of all transport sectors on private output (total factor productivity) is estimated to be 0.135. That is, a 1% increase in total transport output would lead to an overall economic growth, at the margin, of 0.135%. Due to the volatility of the data, researchers have been unable to identify a separate effect for aviation that is statistically sound, but other studies suggest that a transport multiplier of 0.135 is unlikely to be a realistic estimate for the aviation sector. This is because the air transport sector represents a smaller proportion of the economy than transport as a whole. We have therefore made further adjustments to the multiplier that has been used in the present study for this purpose.
- 5.27 The literature agrees that aviation is a fast-growing sector within transport, and that much of the productivity growth in transport is led by efficiency gains in aviation. All things being equal, productivity gains would lead to output increases. Because aviation is only a small component of the transport sector in terms of output, aviation output would have to grow at a much higher rate in order to generate a 1% increase in overall transport output. Assuming that aviation constitutes 15% of the total transport output, and aviation alone is responsible for all of the output growth in transport, an aviation growth rate of 6.75% would be necessary in order to generate a 1% growth in transport. According to the 0.135 multiplier discussed above, 1% growth in transport, or 6.75% growth in aviation output, would yield 0.135% growth in GDP, which is a proxy for total economic output. We then extrapolate that the aviation multiplier for indirect and induced impacts in the wider economy is 0.02. This suggests that a 1% marginal increase in output level in the aviation sector would yield a 0.02% increase in GDP. This multiplier is likely to be a conservative estimate, because it is unlikely that aviation is responsible for all of the output growth in the transport sector.
- 5.28 One of the key aims of SESAME is to increase capacities to satisfy a growing demand for air transport. While the number of flights would increase in the Base Case along with a gradual expansion of capacities, SESAME can accommodate the additional flights at an accelerated rate. The aviation multiplier of 0.02 is applied to the year-on-year growth in aviation output in the SESAME and Base Scenarios to measure the year-on-year increase in European GDP. The Base Case growth is then subtracted from the SESAME-led growth to gauge the net indirect and induced economic impacts of SESAME. Research and development activities would likely generate further productivity and output growth in the wider economy because of technology spillovers, etc. However, the lack of published research evidence available for quantifying these effects means we have not included these potential benefits in our CBA.
- 5.29 SESAME would have two opposing direct effects on employment. On one hand, the increase in aviation output (flights) compared to the Base Case would increase demand for workers. On the other hand, capacity improvements introduced by SESAME and the subsequent enhancement in productivity suggests that fewer workers and factor inputs might be required to produce the same levels of output. The aviation sector (excluding Manufacturing) directly employs 0.32% of the workforce in

Europe³.

- 5.30 Through other supported activities and aviation-led economic growth, the sector contributes 1.15% of total employment in Europe (1.9 million jobs in EU-15 in 2000)⁴. Indirect and induced employment from aviation would increase because SESAME introduces net increases in aviation, and overall economic output.
- 5.31 Air passengers can benefit from SESAME in two ways: through reduced total travel time (as a result of reduction in delays), and lower costs of air transport. In the CBA, air transport providers are assumed to reap all of the benefits associated with higher efficiencies and lower charges. In reality, some of these benefits may be passed on to the passengers in terms of lower fares. Benefits from reduced travel times are valued at €45.70 per passenger hour⁵.
- 5.32 Direct, indirect and induced effects associated with improved efficiency in aviation may not be uniformly distributed within Europe. Due to the lack of data, we consider these impacts in aggregate for all SESAME countries. We have assumed that the efficiency benefits described in the SESAME scenarios can be realised by all of the ANSPs, airspace users and airports throughout Europe.
- 5.33 Air freight users may also benefit from improved reliability in air transport. Whereas valuations of passengers' time are readily available, there is little research on how demand for air freight is affected by reliability. The CBA therefore does not take into account the potential benefits of SESAME in the air freight market, this is an area for further investigation during the definition stage of SESAME.

Environmental effects of aircraft operations at the community level

Exhaust Emissions

- 5.34 Aircraft operations have atmospheric effects that may affect climate through emission of various exhaust gases and other materials (carbon dioxide (CO₂), oxides of nitrogen (NO_x), oxides of sulphur (SO_x) and soot) from the combustion of jet kerosene and aviation gasoline. These effects can be direct or indirect. As an example of the later, NO_x emissions also cause changes in concentrations of methane (CH₄) and ozone (O₃) in the atmosphere. Some direct and indirect effects may also combine to have further additional cumulative effects. The geographical spread of emissions and the altitude at which they occur also influence the magnitude of their environmental impact.
- 5.35 It is estimated that more than 300,000 tonnes of CO₂, the primary greenhouse gas, is generated per day from aircraft operations in Europe. Aviation is also the fastest growing source of global emissions of greenhouse gases from human activity.

³ Source: ACARE, 2003. "The Economic Impact of the Air Transport Industry in the EU" presentation.

⁴ Source: ACARE, 2003. "The Economic Impact of the Air Transport Industry in the EU" presentation.

⁵ The value of time at €45.7 (in 2005 prices) per passenger hour has been taken from the Performance Review Report PRR5. "Cost of Air Transport Delay in Europe", ITA, November 2000, which recommends a passenger valuation of time at €36-46 (in 1999 prices).

Overall, aviation contributes to over 3% of total CO₂ emissions in the EU (2002 figures). However, it is not just the absolute level of emissions of greenhouse gases from aviation that is important in terms of climate change. The “radiative forcing” effects of these gases also needs to be taken into account, which actually means the effective contribution from aviation could be higher.

- 5.36 On the basis of current trends, greenhouse gas emissions will continue to increase, both in absolute terms and as a share of total man-made emissions. This is caused by growth in demand for air travel resulting in the development of new and expanded airports and new airline routes. These factors mean that the growth in aircraft operations, and the consequent greenhouse gas emissions are expected to continue to outpace improvements in emissions-abatement technologies for the foreseeable future.
- 5.37 The changes to CO₂ and other emissions from aircraft to the implementation of the operational instruments proposed under SESAME have been estimated on the basis of factors derived from the EUROCONTROL Advanced Emission Model (AEM). These emission indices are derived from the emission rates for CO₂, NO_x and SO_x from a variety of fuel types used in aviation. The AEM was specifically developed (inter alia) for the prediction of emissions under different scenarios for the implementation of ATM 2000+, and so the factors are considered to be appropriate for use in the present study. These are set out in Table 5.1.

TABLE 5.1 EMISSION FACTORS USED IN THE STUDY

Pollutant	Emission Factor
CO ₂	3,149 kg per kg fuel
H ₂ O	1,230 kg per kg fuel
SO ₂	0.84 g per kg fuel

Source:

Forecasting Civil Aviation Fuel Burn and Emissions in Europe. Interim Report, EEC Note No. 8/2001”, EUROCONTROL Experimental Centre, May 2001.

- 5.38 The economic cost of emissions, in terms of damage to the environment, has been estimated in a number of studies. We have based our analysis on the standard values utilized in the EUROCONTROL EMOSIA model, which are in turn based on an international overview of shadow prices for the Intergovernmental Panel on Climate Change (IPCC) estimates on aircraft emissions effects (1992 estimates). These are set out in Table 5.2 below. The medium estimates are used in the CBA. Stakeholders have noted that a large number of studies have been undertaken on the environmental impact of aviation, with a wide variety of outcomes. While accepting this, we believe the values used in the study are appropriate.

TABLE 5.2 ECONOMIC COST OF EMISSIONS FROM AIRCRAFT (2005 PRICES)

	Low	Medium	High
CO ₂ (per tonne)	€11.2	€33.7	€56.1
H ₂ O (per tonne)	€3.1	€9.4	€15.7
NO _x (per kg)	€1.4	€4.1	€6.7

Source:

"Economic incentives to control the global environmental impact of European aviation/ Level of the incentive", CE, Solutions for environment, economy and technology, Delft, The Netherlands. Draft preliminary study, 2 May 2001.

Noise

- 5.39 Aircraft generate noise pollution. The cost of noise can be estimated by the hedonic prices of housing and other property around airports, or through the adverse health impacts experienced by households exposed to the noise. The UK Department for Transport published a set of marginal damage costs by aircraft type (per flight), based on a hedonic price estimation of property prices in the UK. We weight these cost estimates using country specific purchasing power parity based price indices and their respective country population to generate average marginal costs of noise by aircraft type in Europe. We then weight the costs by the proportion of trips made by aircraft types on 9/12/2004. The resulting average marginal damage cost of noise per flight used in the CBA is €78.9. This figure may overstate the marginal cost per flight over time, as newer aircraft and future aircraft types will, through use of improved technology, produce less noise pollution per flight.
- 5.40 SESAME scenarios affect noise pollution in two ways. First, the increase in air traffic leads to an increase in noise pollution. The noise cost associated with each flight, however, is mitigated by the flight efficiency factor. In each of the SESAME scenarios, flight efficiency improvements allow flights to fly more directly and thus reduces the amount of noise pollution generated.

TABLE 5.3 MARGINAL DAMAGE COSTS OF NOISE BY AIRCRAFT TYPE PER FLIGHT (2005 PRICES)

Aircraft Type	Cost Estimate	% of All Trips
A310	€61.1	40%
A340	€139.7	1%
B737-400	€61.1	41%
B747-400	€304.4	6%
B757	€79.6	3%
B767-300	€98.2	3%
B777	€60.0	4%
MD82	€88.4	1%

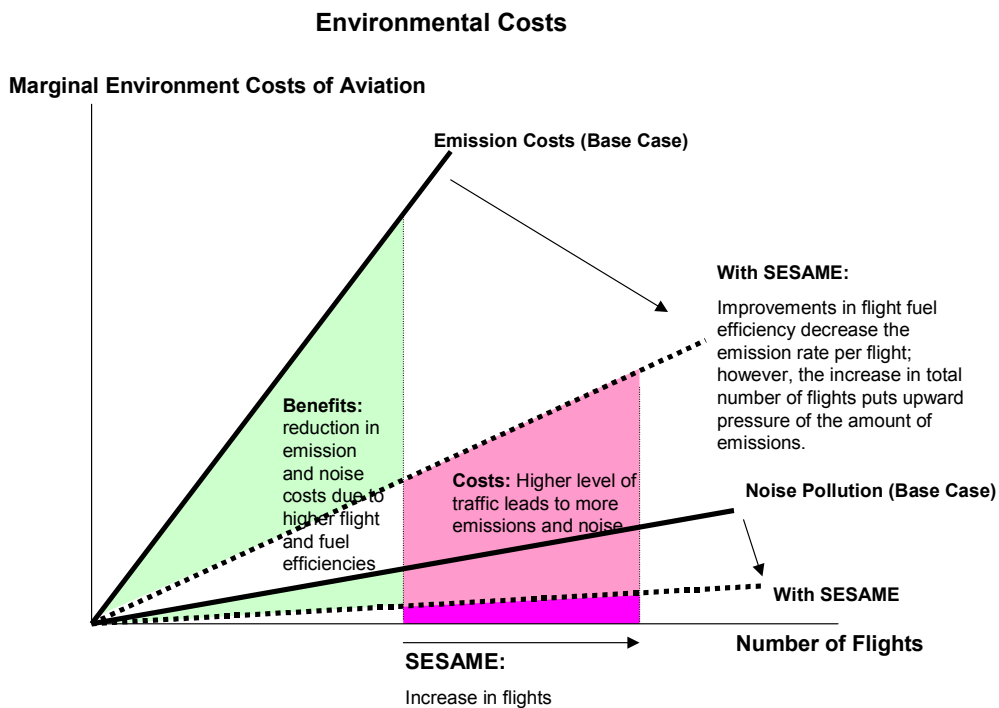
Source:

DfT, 2000. *Valuing the External Cost of Aviation* and Solar Alliance

Presenting the Environmental Effects of Aviation

5.41 SESAME has both negative and positive effects on the environment. On one hand, the improvement in flight path efficiencies reduces the amount of fuel and emissions per flight, while the increased capacity reduces air and ground delays. However, SESAME may also enable unaccommodated demand to be met, which will result in more flights and more emissions as compared to the Base Case. The CBA quantifies the net impact of SESAME on the environment in terms of the costs of greenhouse gas emissions and noise pollution compared with those generated in the Base Case. Figure 5.4 illustrates the factors that go into the calculation:

FIGURE 5.4 ILLUSTRATIVE DIAGRAM OF NET ENVIRONMENTAL IMPACTS OF SESAME



5.42 Our analyses are likely to overestimate the environmental costs associated with aviation in the long run, as newer aircraft will be quieter and even more fuel efficient. In addition, we have only accounted for horizontal improvements in flight efficiency, when SESAME will have positive impacts on the vertical efficiency of flights, and subsequent environmental implications.

Safety

5.43 Safety to those living within the vicinity of airports may improve as a result of SESAME, for example through the impact of the renewal of older systems, and through modernisation improving their reliability. Quantified risks to third parties during take-off and landing events (those within Public Safety Zones) are conventionally used as an indicator of risk and safety. SESAME can potentially alter the areas covered by the Public Safety Zone, thereby changing the level of risks

associated with aviation. However, given the scope of this CBA we have not financially quantified these changes to the Public Safety Zones. Moreover, SESAME has the potential to improve the performance of safety parameters measured by the Safety Regulation Commission (SRC), such as the number of collisions and near misses. We have not financially quantified these effects. Stakeholders have suggested that any impact of SESAME on safety should be investigated in relation to the serious incident data and how it would restrict capacity development. This is beyond the scope of our high level analysis and could be investigated during the definition phase.

Key parameters used in the Cost Benefit Analysis

Geographical coverage

- 5.44 The CBA covers all the existing SES States plus Romania, Bulgaria and Turkey. We assume all flights using European airspace receive the benefits of the improvement from SESAME.

Time Horizon

- 5.45 The costs and benefits have been appraised over a period of 30 years from 2005 to 2035. This is considered to be sufficiently long to allow for the inclusion of development, implementation and operational phases, so that all relevant costs and benefits in the value chain can be taken into account. The time period also allows us to take account of regular renewals costs as these arise.

Discount Rates

- 5.46 The time value of money and cost of capital is different across the key providers of funds and finance in the industry. For example, it is much lower for the Commission, national governments and ANSPs than for the airline industry. We therefore, in our CBA analysis, apply different discount rates to the costs and benefits of each stakeholder. This will also allow us in the second phase of the study to assess the impact of different funding arrangements.
- 5.47 In Table 5.4 we differentiate the discount rate used by key stakeholders and providers of funds in the study. These values reflect the different levels of risks and opportunity cost of capital for each stakeholder.
- 5.48 We estimate the discount rate for national government and the Commission investments to be 4.5%. Cost and benefits incurred by the military are also based on the 4.5% discount rate. The relatively low rate for governments and the military reflects the stability associated with government borrowing, and therefore a lower risk premium on borrowing. The 4.5% rate was used in the EATCHIP Overall Cost-Benefit Scoping Study.
- 5.49 The cost of capital to ANSPs and the commercial sector is more variable. However, under the current cost recovery charging arrangements and governance regime, the cost of capital is relatively low for the ANSPs. Therefore, we apply a 6% average cost of capital to the ANSP and commercial sector, which is slightly higher than that of government borrowing, but lower than that of wholly private companies, such as

airlines.

- 5.50 Commercial discount rates are higher because of the companies’ ownership structure and business nature. As such, we have adopted the conventional commercial discount rate of 10% for airlines and general aviation. The 10% rate was used in the EATCHIP Overall Cost-Benefit Scoping Study.
- 5.51 The social discount rate is applied to monetised costs and benefits by passengers and those outside of the aviation market. The official UK guidance on the social discount rate is 6%, but the CBA for GALILEO used a 5% social discount rate for Europe. We have adopted a 5% social discount rate for the CBA because of its applicability in a wider European context.

TABLE 5.4 DISCOUNT RATES BY STAKEHOLDER

Stakeholder	Discount Rate
European Commission and National Governments, Military	4.5%
Commercial discount rate (Airlines, General aviation)	10.0%
ANSPs	6.0%
Airports, Commercial sector	8.0%
Passengers, Environment, Wider economic impacts	5.0%

Context to ATM capital and operating cost expenditure

- 5.52 The figures presented in Chapter 7 needs to be placed in the wider context of the European ANSP industry expenditure. In the Performance Review Unit’s ATM Cost Effectiveness report for the year 2002, it found that across the 32 ANSPs covered by the report some €6.3 billion of costs are incurred per annum (of which €5.5 billion was on ATM/CNS costs). Depreciation and cost of capital charges amounted to some €1.2 billion of these costs in 2002. A study into the financing of ATM to achieve the Single European Sky found that cash expenditure (taken from ANSP accounts) was at a similar level to these capital charges in the period 2000-2002. The 32 ANSPs had a net book value asset base of €8.6 billion of which some €7.5 billion was used for ATM/CNS.
- 5.53 As an indication of the magnitude of ATM research and development spending across Europe, about 2.5% of the TEN-T budget was dedicated to ATM between 2000 and 2002 (€14.3 million in 2002). TEN-T funding has been used to support a variety of programmes, including over the period 2001-2003:
- European ATM Reference Validation Platform EVR;
 - EUROCONTROL ADS Programme stage 1 and 2;
 - NUP Phase II;
 - CNS/ ATM integrated Programme “Mediterranean Free Flight (MFF);
 - Study on ADS Mediterranean Upgrade Programme (ADS MEDUP) EU/IT;
 - ITEC – FDP interoperability through European collaboration – FDP;
 - European ATM reference validation platform EVF;

- North European ADS broadcast network update programme, NUPII, Phase II; and
- COMOS common Mode S.

5.54 In addition, EUROCONTROL spends about €150-200 million a year on research and development (although some of this cost covers the planning and coordination of implementation) in the ATM sector; the Commission funding for ATM under the Fifth Framework Programme amounted to €20.8 million between 1998 and 2002, and is planned to support ATM by around €100 million over the 2002-2006 period; and the European Investment Bank also contributed €390 million to support ATM in Europe between 1999 and 2003.

6. OUR BASE CASE AND SESAME SCENARIOS

Introduction

- 6.1 The CBA framework described in Chapter 5 is used in this Chapter to describe our Base Case and three distinct SESAME scenarios. Chapter 7 then goes on to describe the results of applying our framework to the Base Case and three scenarios.
- 6.2 The Base Case is defined as the ATM industry, under existing research & development plans, implementation plans and institutional arrangements, without the influence of SESAME. The three SESAME scenarios, which are defined below, show different estimates of the potential impact of the programme.
- 6.3 The Base Case and SESAME scenarios reflect research and development and planned implementation projects published in existing plans. We have estimated the impact of SESAME on the existing plans as potentially:
- **Earlier implementation** of existing (developmental) and new concepts and technologies.
 - **A smaller number of parallel developments** and therefore reduced research and development and implementation costs.
 - **A higher probability of delivering** the planned improvements.
- 6.4 SESAME is expected to bring the benefits of strong programme management discipline to ATM development, and provide a framework for more focused inputs from all key stakeholders. These factors will potentially lead to earlier implementation of new concepts and technologies. We are able to illustrate the effects of this by modelling the impact of accelerated timescales on programme costs and benefits. The focused involvement of stakeholders will potentially also lead to better and earlier decision making, meaning that development costs should fall. We illustrate this as SESAME making a choice between what are competing solutions to a single problem.
- 6.5 Better planning of the phasing of projects is a potential benefit of SESAME. However, we believe this is too speculative to model and include in our CBA. We have, however, assumed that SESAME will reduce the risks associated with currently planned programmes and that therefore it is more likely to deliver **all** of the planned benefits of those programmes.
- 6.6 SESAME is expected to implement existing and new technologies and concepts. However, at this stage, any modelling of new technologies or concepts would be hypothetical and we have not speculated on this (rather it is something which should be clarified in the SESAME definition phase). We have instead focused on the successful and timely delivery of known technologies and concepts, some of which are at the “cutting edge” of research and development.
- 6.7 Our Base Case and SESAME scenarios assume that air traffic demand continues to grow between now and 2035. A reduction in growth rates, for example through constraints from a lack of airport runway capacity, would affect all of the scenarios.

Base Case

- 6.8 Our Base Case is designed as the “most-likely” evolution path for ATM in the absence of SESAME. It has therefore been built by consolidating existing strategies and plans from the:
- EUROCONTROL ATM 2000+ Strategy and Operational Concept Description (OCD);
 - EUROCONTROL Convergence and Implementation Plan (ECIP), as reflected in EUROCONTROL’s EMOSIA tool; and
 - The IATA roadmap (as developed by a group of industry stakeholders).
- 6.9 These plans contain some commonality as they have been formed through emerging consensus about the different solutions available to solving ATM industry problems. There is also some consensus of view over the likely timescales for their implementation. The Base Case is inclusive of the availability of airborne and ground investment to achieve the objectives of these plans. Nevertheless, the SESAME definition phase will re-visit these strategies, concepts and timescales and may emerge with a different view. In the absence of the results of the definition phase, we have assumed that the **Base Case consists of a consolidation of these plans**.
- 6.10 We have also reflected stakeholders’ views on the likely outcome of these plans under existing institutional and planning arrangements. At the ICB subgroup, a number of stakeholders expressed concern that with no changes to the existing arrangements there were real risks of significant delays being introduced and benefits forecast by the plans not materialising, leading to the potential for capacity constraints in the system and the requirement for crisis management.
- 6.11 As there are a large number of projects in the existing work programmes, we have grouped them into **ten key steps**, (these are summarised in Table 6.1 and a detailed description is provided in Appendix A).

TABLE 6.1 KEY ATM DEVELOPMENT STEPS

	Step	Description
1	Advanced airspace optimisation and structure	This includes developments such as more advanced civil / military airspace sharing and improved route structures. It is planned to deliver flight efficiency benefits.
2	Optimised collaboration	This aims to increase planning and coordination between airports, aircraft operators and ANSPs. It also plans to maximise airport efficiency.
3	Early ATM datalink applications	This is based on near-term datalink such as strategic CPDLC (Controller-pilot data link communications) and D-ATIS (Digital - Automatic Terminal Information Service). It encompasses and extends the Link2000+ programme.
4	Applications using down-linked aircraft data	This is built on applications supported by Mode S Enhanced surveillance (or "ADS-B out"; Automatic Dependent Surveillance - Broadcast) to downlink avionics data that can be displayed on the controller screen and used in advanced controller tools.
5	Aircraft spacing applications (ASAS)	This is the implementation of aircraft spacing applications for both en-route and terminal airspace. It includes applications such as airborne spacing, crossing and passing manoeuvres and final approach spacing.
6	Advanced datalink applications	This is an evolution of step 3 involving real-time datalink applications. For example, this step supports downlink of aircraft intent that is sufficient for advanced conflict detection and multi-sector planning.
7	Advanced 3D RNAV navigation	This is based on the ongoing implementation of P-RNAV (Precision - Area Navigation) followed by a mandate for RNP (Required Navigation Performance) RNAV.
8	Airborne separation/self-separation	This is based on an advanced use of ADS-B/ASAS (Airborne separation assistance systems) to allow aircraft to separate themselves from one another.
9	4-D trajectory negotiation	This is the implementation of a 4-D trajectory negotiation concept with advanced 4-D navigation systems, real-time air-to-ground datalinks and trajectory planning/de-confliction systems on the ground.
10	Airport low visibility enhancement	This includes techniques to maintain airport capacity in low visibility conditions. It includes new landing systems and advanced ground guidance, routing and alerting systems.

6.12 Our approach to the Base Case and SESAME scenarios is based on the ten steps of the ATM development programme. These larger steps incorporate a number of smaller projects, providing distinct enabling actions for each step. Other activities are likely to be small in comparison to these steps and we have not estimated the costs and benefits of these.

6.13 Based on the past experience of the time lag between research and development and implementation of European ATM services, **we assumed in our Base Case a delay to**

the planned achievement of the programme. Our Base Case applies a delay factor, of typically between two and seven years, depending on our estimate of risk of the particular project. This “risk” has been determined by our assessment of recent European ATM programmes⁶. Low-risk projects are less likely to incur significant delay compared to high-risk projects. High-risk projects are any that include complex technology developments and application of new, unproven, operational concepts.

6.14 **High-risk projects are also assumed to be less likely to deliver all of the planned capacity benefits.** We describe the key assumptions as to the level of capacity benefit likely to be achieved in our Base Case in Table 6.2. We have applied our risk categorisation to each step and the consequent assumed success in the capacity delivery of the Base Case. This is based on a judgement formed through reviewing experience of past achievement and stakeholders’ views of the likelihood of achievement of the forecasts benefits under the existing arrangements.

TABLE 6.2 ASSUMED RISK IN BASE CASE

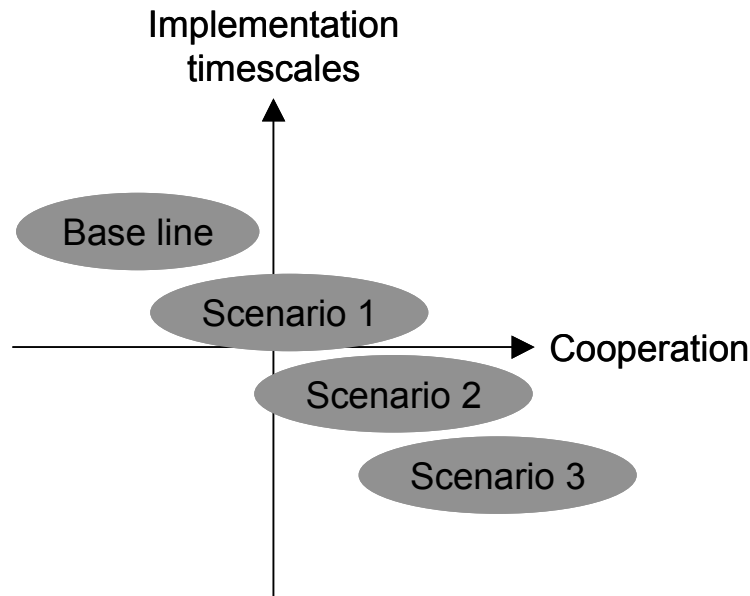
	Step	Risk categorisation	Success in capacity delivery of the Base Case
1	Advanced airspace optimisation and structure	Low	80%
2	Optimised collaboration	Low	80%
3	Early ATM datalink applications	Low	80%
4	Applications using down-linked aircraft data	Low	80%
5	Aircraft spacing applications (ASAS)	Medium	60%
6	Advanced datalink applications	Medium	60%
7	Advanced 3D RNAV navigation	Medium	60%
8	Airborne separation/self-separation	High	40%
9	4-D trajectory negotiation	High	40%
10	Airport low visibility enhancement	High	40%

SESAME scenarios

6.15 Figure 6.1 illustrates our Base Case and SESAME scenarios using the dimensions of timescale and industry cooperation. In this section we describe the basis of our three SESAME scenarios.

⁶ We have not included any long research and development lead times, which defines our programme delay as the approximate difference between planned and achieved operations. As an example, although Mode S was developed in the 1970’s, we have not assumed it should have been implemented in the early 1980’s as there are many other factors to consider.

FIGURE 6.1 DIMENSION OF OUR BASE LINE AND SCENARIOS



6.16 After consultation with stakeholders, we do not assume for any of the SESAME scenarios that incremental costs and benefits will accrue during 2005 and 2006 (apart from the SESAME definition phase). Moreover, there has been significant debate between stakeholders as to how early in the development and implementation phase significant incremental costs and benefits can be expected.

6.17 The SESAME definition phase is planned to start in Autumn 2005 and last for 2 years. It will be followed by a development and implementation phase lasting for 15-25 years. Within the development and implementation phase, there are three key phases of the programme:

- Early deployment of existing solutions starting in 2007/8;
- Interoperability/ convergence starting in 2012/13; and
- Collaboration at high performance levels beginning in 2017/18.

6.18 The CBA has reflected these timings by:

- Projecting that the most difficult, highest-benefit changes start delivering operational benefits from 2019 in this scenario.
- Other benefits are delivered from smaller steps in the meantime. Benefits from changes in the programme start accruing in 2007 and are delivered by steps up until 2015.

SESAME scenario 1 - reduced delay

6.19 **SESAME scenario 1 assumes our Base Case work programme is implemented to the planned timescales, without any delays and the full capacity benefits.** This is a potentially conservative view of the impact of SESAME as it does not include

potential savings from reduced development costs. However, it does depend on the success of SESAME in improved decision-making and programme management.

SESAME scenario 2- reduced duplication

- 6.20 **SESAME scenario 2 assumes the same timescales as SESAME scenario 1, but with reduced duplication of programmes and cost savings through collaborative approaches.** Research & Development and implementation costs are assumed to be reduced as speculative developments are stopped, resulting in effort focusing on steps that are perceived to be the most likely to achieve significant and measurable benefits to the industry.
- 6.21 The benefits of SESAME scenario 2 are demonstrated by a **removal of some of the proposed steps and a reduction in the research and development and implementation costs of other steps.** In particular, steps five and eight are assumed to be not required. These steps are related to various forms of ASAS and aircrew delegation. It is assumed that the benefits from these programmes would be delivered by RNAV and 4-D trajectory negotiation in the other steps. (The reverse could be true in which case RNAV and 4-D trajectory negotiation would not be required. The net result would be similar.)

SESAME scenario 3 – accelerated timescales

- 6.22 **SESAME scenario 3 incorporates the same reduced development costs and steps as SESAME scenario 2, but also assumes faster implementation.** It reflects a more accelerated implementation programme benefiting from more focussed and timely decision-making.

Summary of key timescale and risk assumptions

- 6.23 This section summarises the key assumptions on delays. These should be combined with the capacity assumptions outlined in Table 6.2 to determine the Base Case. They have been introduced to reflect the views of stakeholders, particularly the ICB subgroup, that the Base Case should reflect that there are capacity and delay risks under the existing fragmented approach.
- 6.24 Table 6.3 shows the assumed delays in the Base Case. Note that the SESAME scenarios bring forward some of the operational dates.
- 6.25 The ICB SESAME sub-group indicated that benefits would not be expected before 2007 and that SESAME would not be able to accelerate programme operational dates to be before 2009. Their reasoning was that since the SESAME definition phase does not finish until mid-2007, the earliest implementation start would be 2007. These assumptions are included in the assumed operational dates.

TABLE 6.3 ASSUMED DELAY TO OPERATIONAL DATES

	Step	Base Case	SESAME 1	SESAME 2	SESAME 3
1	Advanced airspace optimisation and structure	2 years	2 years	2 years	2 years
2	Optimised collaboration	2 years	2 years	2 years	2 years
3	Early ATM datalink applications	2 years	2 years	2 years	2 years
4	Applications using down-linked aircraft data	3 years	2 years	2 years	2 years
5	Aircraft spacing applications (ASAS)	4 years	No delay	No delay*	No delay*
6	Advanced datalink applications	4 years	No delay	No delay	No delay
7	Advanced 3D RNAV navigation	4 years	No delay	No delay*	No delay*
8	Airborne separation/self-separation	7 years	No delay	No delay*	Early 2 years*
9	4-D trajectory negotiation	7 years	No delay	No delay*	Early 2 years*
10	Airport low visibility enhancement	7 years	No delay	No delay	Early 4 years

* As discussed above, scenarios 2 and 3 allow for two of these steps to be omitted, to illustrate the benefits of focusing resources into the most likely steps. We make no judgement of which of these steps will be removed though.

Stakeholders' opinions

- 6.26 We shared the preliminary basis of our Base Case and SESAME scenarios with stakeholders during consultation. **Stakeholders have emphasised that our study is not intended to, and cannot, predetermine the outcome of the definition phase.**
- 6.27 In relation to the Base Case, stakeholders stated that the likelihood of achieving the benefits forecast by the existing programme of activities would be affected by whether the existing institutional and planning structure is maintained, or amended under SESAME. Many stakeholders expressed their fear that under existing arrangements significant delays would arise, benefits would not materialise and capacity constraints would emerge around 2012. These comments have been reflected in the risk assessment used to produce the “most likely” Base Case.
- 6.28 In terms of the SESAME scenarios, a stakeholder viewed the scope of SESAME included in the CBA to be too narrow, and should include Functional Airspace Blocks as well as the implementation of the service provision and framework regulations. A stakeholder also viewed the basis of the new concepts included in the CBA to be too limited, and should include concepts not yet discovered or developed.
- 6.29 Other stakeholders believed the SESAME scenarios presented represent reasonable views of the potential impact of SESAME. In particular we found support for the different views used in the Base Case and SESAME scenarios over the likely speed of

achieving implementation. Stakeholders also supported the view that SESAME may make choices between competing development programmes. However, this may result in prioritisation, rather than abandonment of a project.

6.30 Some stakeholders suggested a “negative” SESAME scenario should be explored – which resulted in lower benefits than the Base Case. However, it was agreed that this scenario would be little insight into the governance arrangements. Nevertheless, the potential for SESAME, if not properly managed and implemented, to provide a worse outcome than using current arrangements for the ATM project implementation was a risk that was raised by many stakeholders. In the CBA framework, we have sought to identify the key critical success drivers of SESAME.

6.31 Stakeholders raised a number of issues that highlighted risks to the achievement of the potential benefits of SESAME. These are described in Table 6.4. The Governance arrangements as discussed in Chapters 8 to 12 address as many of the risks raised as possible.

TABLE 6.4 RISKS TO SESAME

Risk	Description
1 Risk of Decision making inertia	There has been criticism of the inertia in the existing institutional arrangement in making decisions. SESAME is seen as addressing this, however there is a risk that the benefits of SESAME will not be delivered without a radical attitude change.
2 Slow equipage by key industry stakeholders	There is a significant danger of the ANSP, airports and airline stakeholders not equipping to the timescales required to ensure the network benefits are achieved. The speed and coordination of implementation will be key in achieving the benefits of SESAME.
3 SESAME driven by manufacturer interests	Manufacturers use SESAME as a means to maximise the benefits from their existing products without full account of ATC operational requirements.
4 Failure to gain agreement on the Master Plan	The critical success factor will be acceptance of the Master Plan by aircraft operators and air navigation service providers.
5 Immature technology / concept solutions	SESAME may underestimate, how much development and validation is required for immature technology (however other stakeholders also point out that there may be an equal number of instances of overestimation).
6 Focus on high cost solutions	Manufacturers may be influenced by the high-end of the user community and generate solutions which are too costly for low-end users. They may equally budget solutions to the scale of benefits, reducing the cost effectiveness to users.
7 Lack of competition drives high costs	Competition is driven out of the European market raising costs.
8 Lack of competition leads to single options	Focus on a single solution that fails.
9 High degree of IPR in standards and specifications.	Purchasers have reduced choice in system supplier and competition is harder for manufacturers outside of the SESAME programme which drives up costs.

Risk	Description
10 Failure to achieve global interoperability	A European solution is produced that is incompatible on a global scale. This reduces the potential market size for manufacturers and increases airline costs (duplication of equipment).
11 ATM supplier industry unable to deliver SESAME	Complexity of new systems is beyond the software capabilities of the existing supplier base.
12 Slow progress in research and development	SESAME suppliers are not focused on step by step delivery of outputs and project timescales slip.

7. COST BENEFIT ANALYSIS RESULTS

Introduction

- 7.1 In this Chapter we present the results of our cost benefit analysis (CBA). The scope of the CBA has been necessarily high-level and a number of issues have been raised which require effort beyond this study, and are appropriate to address during the definition phase of SESAME. .
- 7.2 The CBA has been performed against an assumed migration of the European system and not the system as it is today. Following standard CBA analysis, the introduction of the SESAME programme is assessed against a Base Case of what would happen without the SESAME programme. This under present plans would include substantive developments of the system. The Base Case assumes substantial airborne and ground investments (totalling about € 22 billion, more than half on airborne) that are necessary in order to fulfil the objectives of existing ATM 2000+, OCD strategies. The CBA therefore provides an indication of the potential benefits introduced by SESAME of consolidating such investments or accelerating developments relative to the Base Case.
- 7.3 As outlined in Chapter 6, the CBA only considers the costs and benefits of the ten technical and operational steps identified, and described in detail in Appendix A. Additional ATM developments may be undertaken or other benefits might arise. For example, SESAME could provide the technical foundation for the creation of FABs, but this is outside the scope of this study. During review with the ICB sub-group, some members emphasised additional synergies with, among other things, SES regulation and harmonisation of standards. We acknowledge these but have not been able to address them within the scope of this study. **We highlight that the ten steps must be considered as illustrative since we do not know exactly what developments the SESAME Master plan emerging after the definition phase will recommend.** However, our approach seeks to identify the key drivers and source of flows of costs and benefits whichever SESAEM programme is agreed as a part of the definition phase.
- 7.4 An issue that has been a subject of discussion with the Commission and stakeholders is an appropriate assumption as to when, and if, the “capacity wall” will be reached⁷. There is general agreement in the industry that a capacity wall exists and that re-sectorisation has its limits. Unfortunately, there is no consensus on when or where it will occur. As a part of this study, we did not determine the time and geographical local of a potential capacity wall. However, for illustrative purposes, we have made an estimate of when it might become significant and what the cost implications of it would be.
- 7.5 We aim to provide the reader with an order of magnitude estimate of the incremental

⁷ Our understanding of the capacity wall is the point at which capacity falls so far below demand that flights are not operated i.e. the severity of delays makes increased growth commercially unviable.

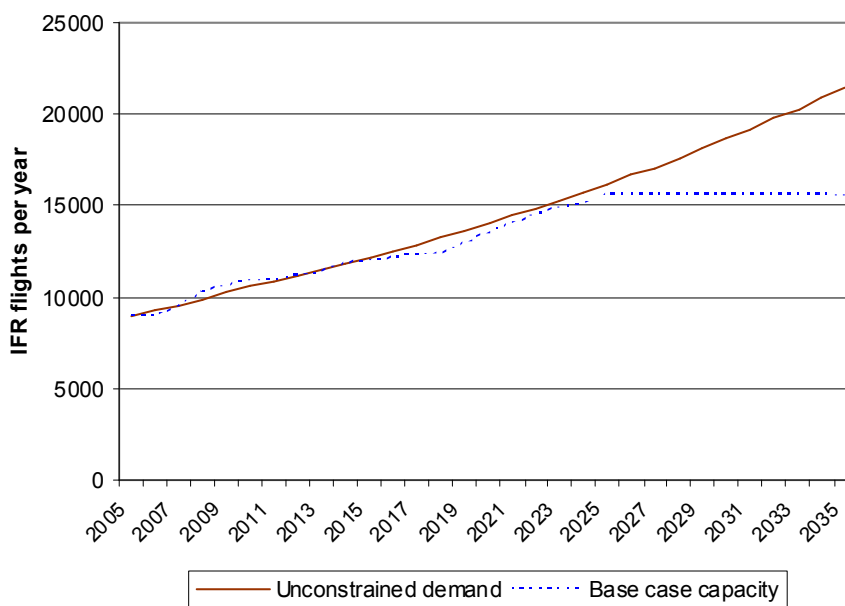
costs and benefits of SESAME using the assumptions set out in Chapter 6. However, we expect these to be refined during the definition phase of the SESAME programme.

- 7.6 The costs contained in this analysis are for the research and development, implementation and operation of the ten steps described in Chapter 6. We have not estimated the stranded costs impact of assets being decommissioned before the end of their useful life, although this may occur for some assets in some States depending on the implementation timetable of the SESAME master plan. (The costs will of course vary between States depending on the ages of their different assets.) However, in a CBA it would not be appropriate to take sunk costs into consideration, as they are a non-cash item. In any event, it is expected that some of the funding provided from the Commission to SESAME will need to be directed towards minimising the impact of these stranded costs (and is discussed further in Chapter 12).
- 7.7 After presenting an illustration of the costs of un-met demand, we first present the results of our incremental **financial cost benefit analysis** and then describe the incremental **economic costs benefit analysis**. All figures are presented in constant € million 2005 money terms using the stakeholder discount rates.

Key results – Capacity compared to unconstrained demand

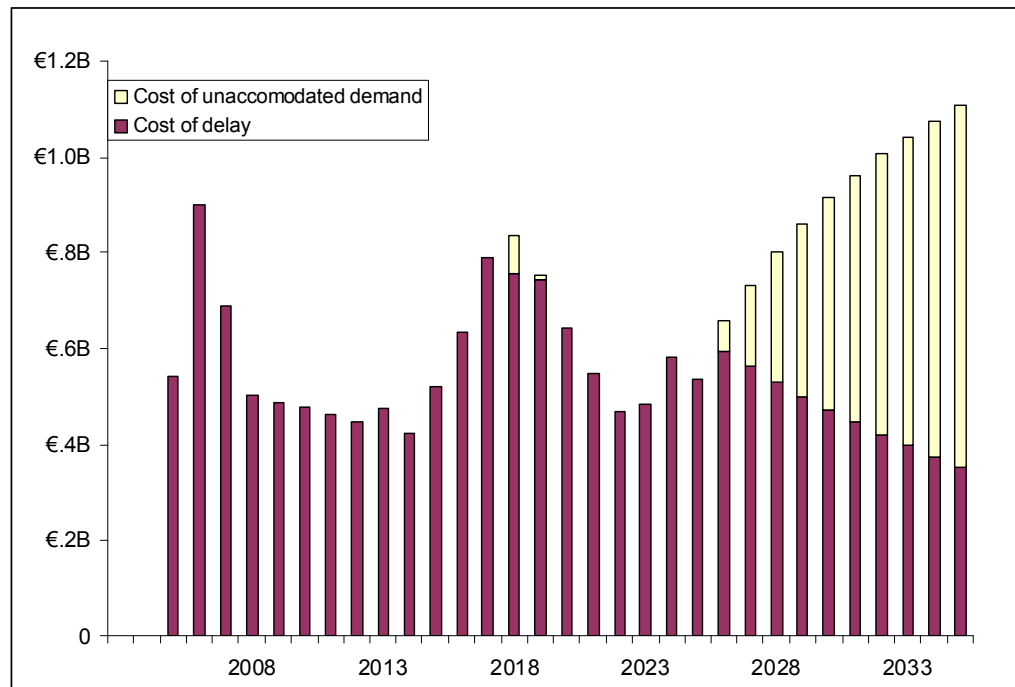
- 7.8 Figure 7.1 shows the capacity delivered by the Base Case as compared to the unconstrained demand for flights. Under our assumptions, the capacity delivered by the Base Case falls below unconstrained demand from about 2015 and then significantly below from about 2019. This would be our estimate for when the capacity wall might start to become significant. This is based on the risk assessment of the delivery of the programme set out in Chapter 6 and informed by past experience and stakeholders’ views of the risks of the programme.

FIGURE 7.1 CAPACITY DELIVERED BY BASE CASE



- 7.9 The present value of direct costs associated with managing unmet demand in the Base Case are estimated at around €3.4 billion (assuming a discount rate of 6%). This calculation is the cost of growing the present ATM service in proportion to the demand that is not accommodated by the Base Case. During a review by the ICB subgroup it was commented that this figure appeared to be high. It can be compared to the annual spend on ATM service provision, which is estimated at €5.5 billion per annum (2002 figure, from ATM Cost Effectiveness Benchmarking report), equivalent to about €141 billion over the 2005 to 2035 (PV using a discount rate of 6%).
- 7.10 This figure would be much higher if the capacity wall was reached and no increase in the supply of capacity was possible. As noted above, however, there is no common European understanding on when or where the capacity wall will be reached and what would be the predicted date of this. We suggest that this should be addressed in the SESAME definition phase since it is critical for future decision-making and estimating the benefits from addressing such capacity constraints.
- 7.11 As an **illustration**, as shown in Figure 7.2, we have calculated the potential costs of unmet demand taking into account the costs of increasing delays and the impact of excessive delays on restricting air traffic growth. The analysis is presented in greater detail in Appendix B and the total estimated illustrative costs of unmet demand are estimated at €21 billion (not including the wider social costs). All of the SESAME scenarios, as illustrated, would avoid this cost but it is **not** included in any of the key CBA financial or economic cost benefit analysis results.

FIGURE 7.2 ESTIMATED COSTS OF UNMET DEMAND (€ BN) IN BASE CASE



- 7.12 All the SESAME scenarios avoid this cost because they are predicted to deliver sufficient capacity to meet the unconstrained demand. They also offer the opportunity

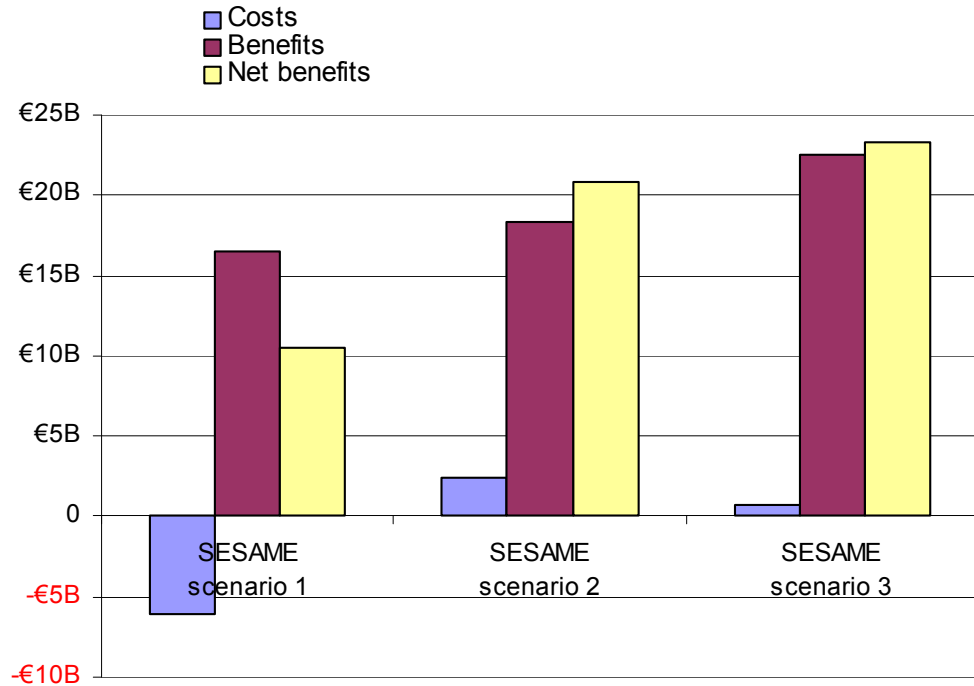
for productivity gains once the required capacity is met, which we assume would be realised by reducing sector numbers.

- 7.13 The analysis suggests that there would be sufficient capacity if all of the planned programmes could be implemented successfully and on time. Note that the SESAME scenarios are assumed to deliver all of the capacity planned by European initiatives, while the Base Case only delivers a proportion of it due to the risks that are assumed to be inherent in the current structure.
- 7.14 An illustrative analysis of the financial value of safety benefits of SESAME is provided in Appendix B. The analysis concludes that the value is relatively small because of the high level of safety already present in the system. Nevertheless, SESAME will need to increase the relative level of safety to ensure that the Target Level of Safety (TLS) continues to be met and to deliver the benefits described in Appendix B.

Key results – Financial Cost Benefit Analysis

- 7.15 This section presents the results of the financial CBA. The illustrative costs of unmet demand presented above are **not** included in any of the financial values presented.
- 7.16 Figure 7.3 shows the Net Present Values (NPVs) of the **incremental** financial costs and benefits of the SESAME scenarios compared to the outputs of the Base Case; all scenarios are expected to provide a net financial benefit. The “costs” are the additional costs of SESAME in present value terms, as well as a small additional management charge of a new SESAME governance organisation. This is primarily because SESAME brings expenditure forward, and in present value terms it is more costly.
- 7.17 The assumed lower implementation cost of SESAME scenarios 2 and 3 make its costs in aggregate lower than the Base Case, although it costs more in the early years as implementation is brought forward. The potential for SESAME to cost less than the Base Case is dependent on minimum waste in expenditure at all levels and will therefore require a high level of commitment across Europe. The costs shown in the figure are either increases (scenario 1) or cost savings (scenario 2 & 3) as compared to the Base Case expenditure.

FIGURE 7.3 INCREMENTAL NPV OF SESAME SCENARIOS (€ BN)



7.18 The benefits shown Figure 7.3 are a result of:

- **Increased capacity and productivity:** this has been quantified by assuming that once capacity supply exceeds demand, the excess capacity can be used to improve productivity supply, for example, by reducing the required number of controller working positions. This will result in a reduction of ATM costs.
- **Increased flight efficiency:** this reflects the benefits of more direct routes that aircraft will fly and therefore reduced fuel usage. It is based on PRU estimates of the benefits of increased flight efficiency. (The PRU only examines horizontal flight efficiency improvements and not vertical efficiency improvements so these are excluded from the report).
- **Increased schedule predictability:** providing reduced buffers between flights. This uses a cost per minute of buffer delays as estimated in a recent PRU study⁸. However, as this benefit depends on complex network effects there is some uncertainty of the extent to which predictability could be improved.

7.19 Additional benefits, such as reduced emissions, are discussed in the economic cost benefit analysis presented later in this Chapter.

7.20 For all SESAME scenarios, the total benefits are provided by approximately 88%

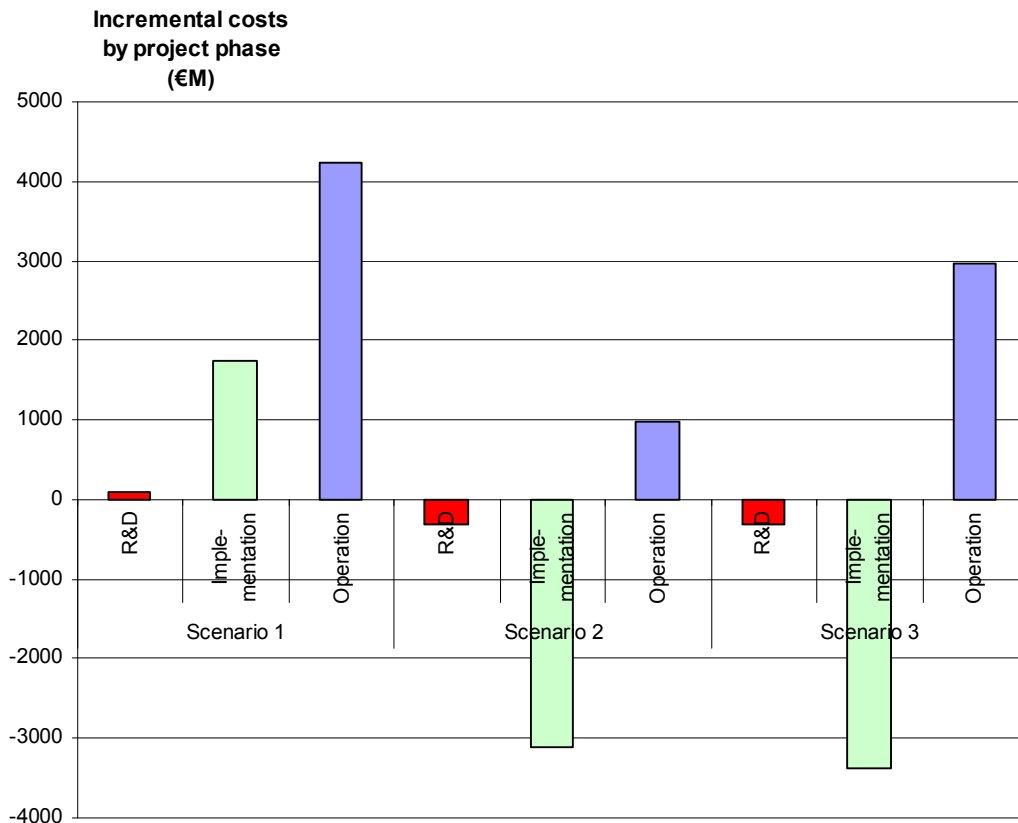
⁸ University of Westminster for the EUROCONTROL PRC, "Evaluating the true cost to airlines of one minute of airborne or ground delay", May 2004.

from increased capacity and productivity, 7% from increased flight efficiency and less than 4% from reduced buffers. The results vary by a range of plus and minus 1% by scenario.

- 7.21 As a result of the delay or postponement of some projects in SESAME scenarios 2 and 3, less total capacity headroom is delivered than in SESAME scenario 1.
- 7.22 SESAME scenario 1 shows the benefits of advancing project timescales at approximately €10 billion, while SESAME scenario 2 shows the additional benefits of programme rationalisation is approximately €11 billion. It is apparent that the benefits of each factor (reduced timescales and programme rationalisation) are significant and that the SESAME project should place emphasis on both issues.
- 7.23 During review by the ICB sub-group, it was suggested by some members that the benefits of SESAME were overestimated. There are, inevitably, risks associated with the assumptions lying behind the CBA projections. We address the issue of overestimation through sensitivity analysis presented later in this Chapter.

Key results – Categories of expenditure

FIGURE 7.4 INCREMENTAL NOMINAL TERMS EXPENDITURE IN DIFFERENT COST CATEGORIES (€ M)



- 7.24 Figure 7.4 shows the different categories of incremental expenditure in each of the SESAME scenarios, split between research and development, implementation and

operating costs as compared to the Base Case. It is apparent that the research and development costs are dwarfed by implementation and operation costs. This suggests that the research and development expenditure can deliver significant payback if it can significantly change costs downstream in the product lifecycle. In the absence of SESAME, the Base Case research and development budget is estimated at about €1 billion over the 30 year analysis period (based on current spend levels).

- 7.25 As compared to the Base Case, earlier implementation leads to higher costs – particularly of implementation and operation for SESAME scenario 1. In both SESAME scenarios 2 and 3, this is offset by a smaller programme with prioritisation and avoidance of duplication of programmes.

Stakeholder analysis

- 7.26 In the timescales available to this study, it has not been possible to precisely quantify the costs and benefits to each stakeholder. Instead, the costs and benefits of each step have been apportioned to different stakeholders according to expert opinion. The assumed split between the five stakeholders (ANSPs, Aircraft operators, airports, military and GA) is given in Appendix A.
- 7.27 To calculate benefit to cost (B/C) ratios, we have assumed that any financial benefits to ANSPs are reflected in user charge reductions to the aircraft operators. This means ANSPs are expected, under cost recovery arrangements, to pass on improvements in cost effectiveness to end users. As a result, SESAME scenario 1 has a Benefit/Cost (B/C) ratio of 2.3 to aircraft operators. The B/C ratio for Scenarios 2 and 3 are not calculated since they have lower total costs than the Base Case (in other words it represents a saving, not an investment, relative to the Base Case).
- 7.28 Note that aircraft operators are estimated to incur about one-half of the incremental costs of SESAME in the scenarios that have an investment cost (SESAME scenarios 1 and 3). The remaining costs are shared between the other stakeholders.
- 7.29 In SESAME scenario 1, airborne costs total about € 4.1 billion, compared to total costs of about € 6.1 billion. This implies that airborne costs are just under 70% of the total (a result that is consistent with estimates made in the Commission's Datalink Roadmap study).
- 7.30 For airports, a significantly positive B/C ratio (greater than 7) is seen in all scenarios. This is because their investment is not large as compared to the benefits they are predicted to receive.
- 7.31 For military, we have found there are no significant financial benefits of SESAME. The civilian capacity and delay problems largely leave the military unaffected. Their B/C ratios are therefore close to zero for all SESAME scenarios. Whilst we have not found the case for financial benefits to military users, it is noted that there will be qualitative benefits such as better civil-military coordination and longer horizons for CNS equipment requirements. There may also be some technology synergies to improve the Military ATM service.
- 7.32 General Aviation users also see a B/C ratio less than one in all scenarios. This is

because they may be required to invest in new technology but do not receive significant financial benefits (and this is consistent with the view of representatives of GA users). Most of the financial benefits of ATM advances go to the other stakeholders, leaving little motivation for military and GA to invest in them. Again, GA users may see qualitative benefits, such as continued access to high-density airspace from SESAME.

7.33 A challenge for SESAME will be to propose a strategy to ensure support from military and GA communities.

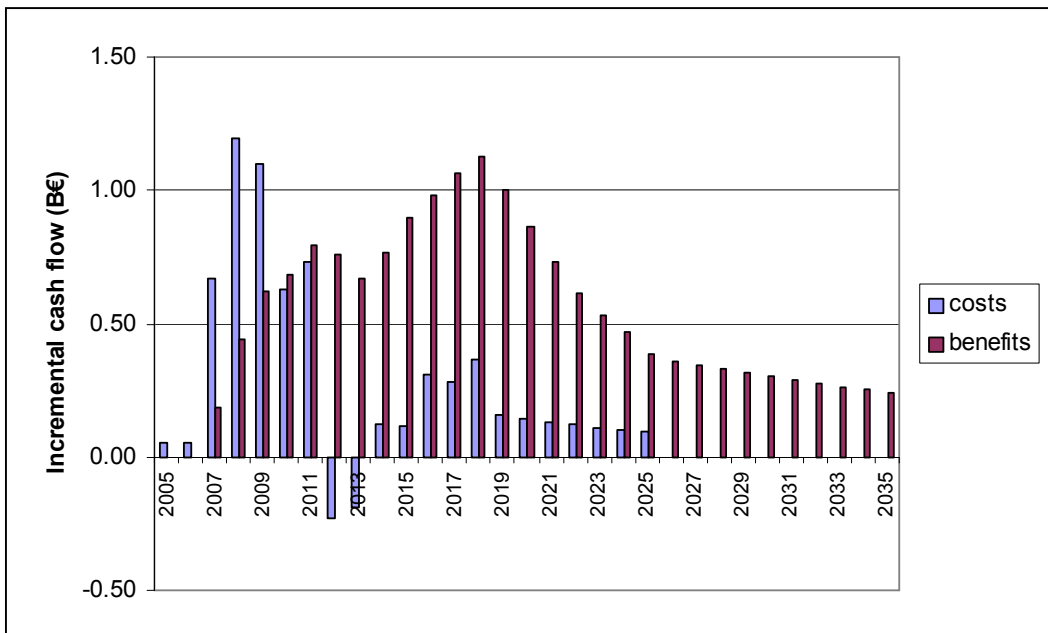
Cashflow and payback analysis

7.34 The graphics in this section showing the annual incremental cash flows are:

- Where costs are increased as compared to the Base Case they are positive;
- Where benefits are increased as compared to the Base Case they are positive; and
- Where costs are decreased as compared to the Base Case they are negative.

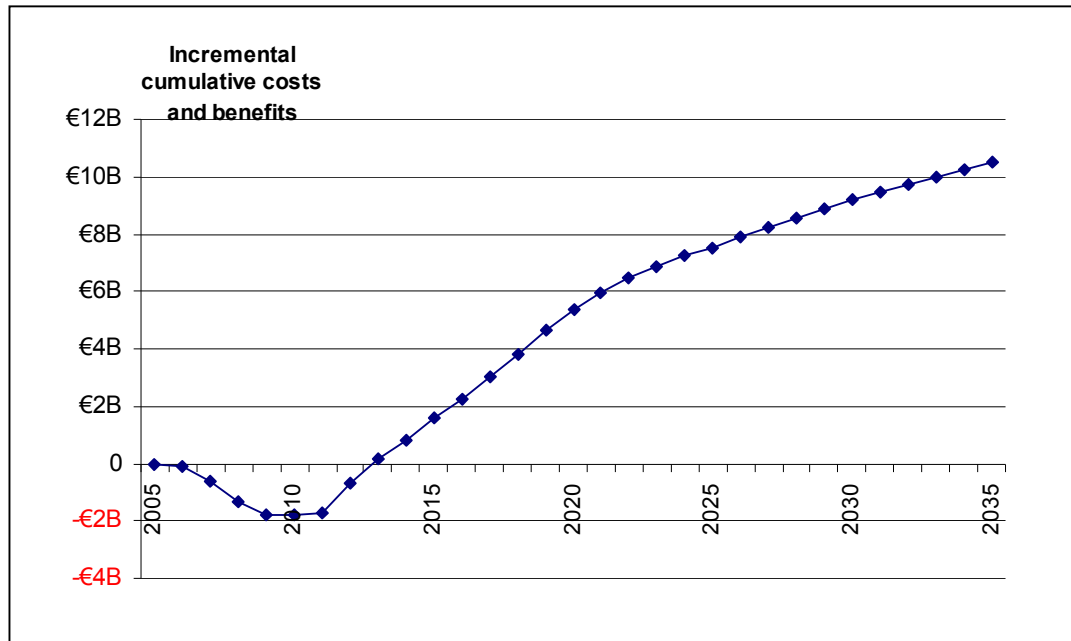
7.35 Figure 7.5 shows the incremental cash flow for SESAME scenario 1 (relative to the Base Case). As compared to the Base Case costs are brought forward and increased, with commensurate benefits throughout the period.

FIGURE 7.5 SESAME SCENARIO 1 INCREMENTAL CASHFLOW (€ BN)



7.36 Figure 7.6 shows the cumulative costs and benefits of SESAME scenario 1. The cumulative benefits outweigh the cumulative costs after 2013, which is the earliest date at which the investments can consider to have paid back the costs.

FIGURE 7.6 SESAME SCENARIO 1 INCREMENTAL CUMULATIVE COSTS AND BENEFITS (€ BN)



7.37 Figure 7.7 shows the incremental annual cashflows of SESAME scenario 2 and Figure 7.8 shows the cumulative incremental costs and benefits. As a result of significant costs being cut and benefits brought forwards the benefits are expected to outweigh the costs by 2009.

FIGURE 7.7 SESAME SCENARIO 2 INCREMENTAL CASHFLOW (€ BN)

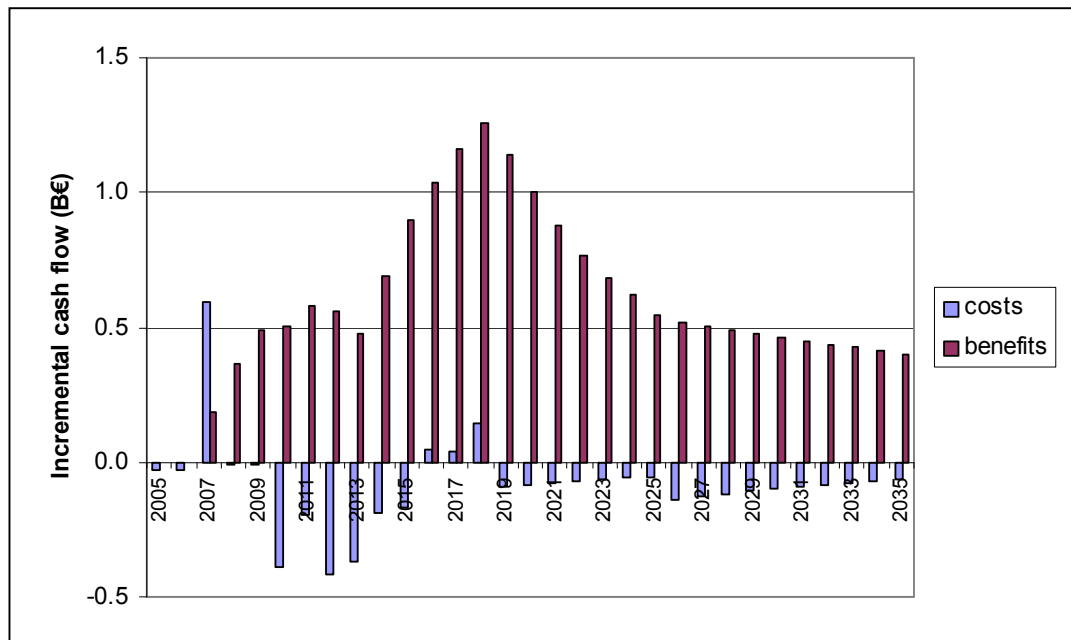
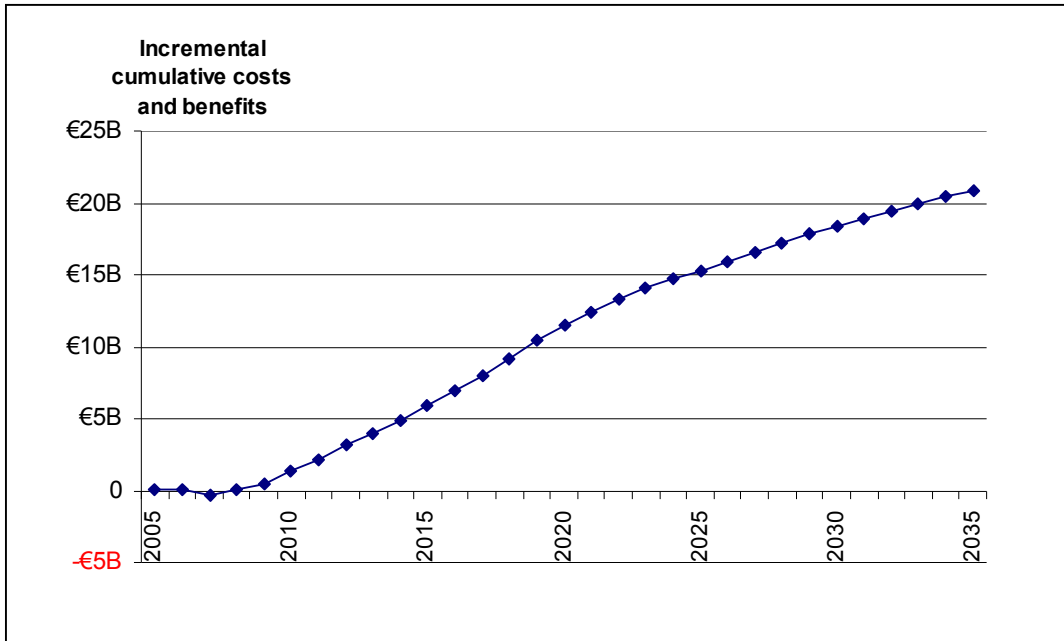
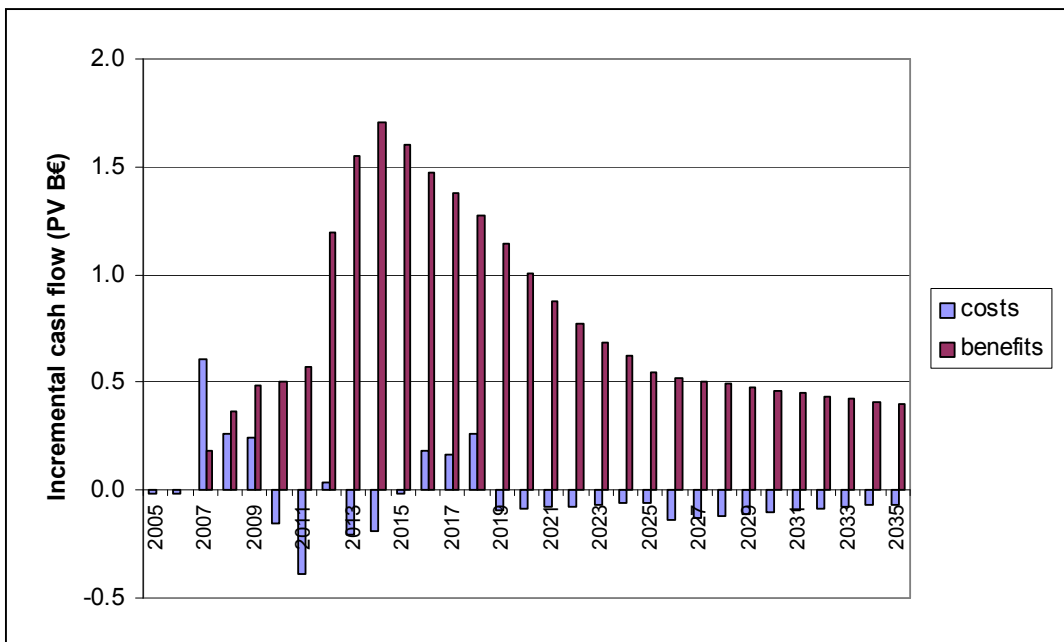


FIGURE 7.8 SESAME SCENARIO 2 CUMULATIVE INCREMENTAL COSTS AND BENEFITS (€ BN)



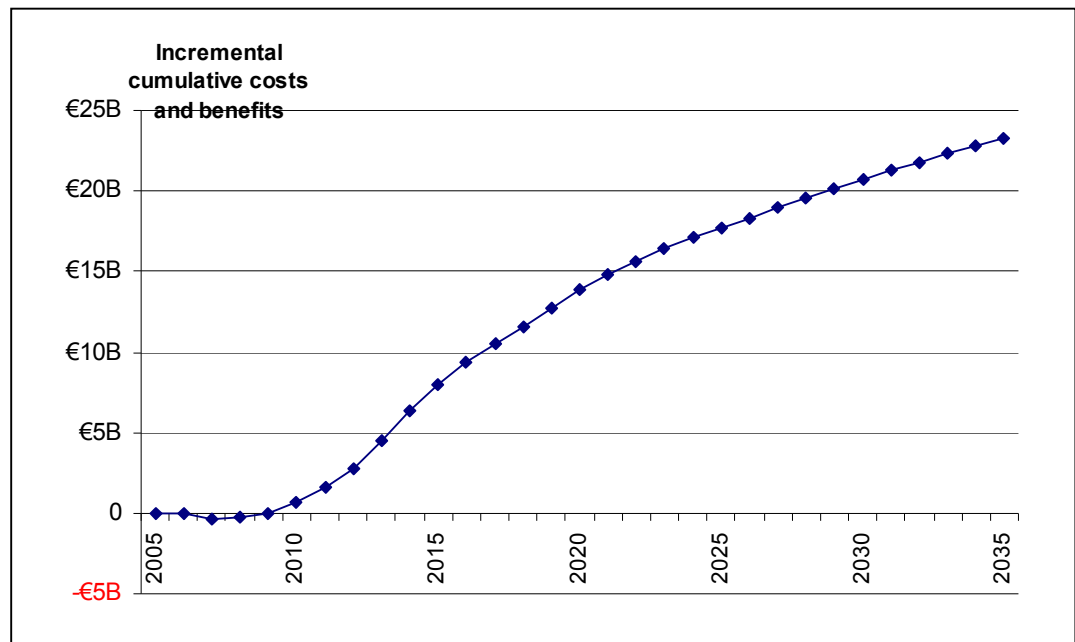
7.38 Figure 7.9 shows the incremental annual cashflow of SESAME scenario 3. The early large investment in costs is apparent with another peak around 2015-2016. Note that the costs become more constant after 2017 which is because all of the steps have been implemented by this date in SESAME scenario 3.

FIGURE 7.9 SESAME SCENARIO 3 INCREMENTAL CASHFLOW (€ BN)



7.39 Figure 7.10 shows the cumulative costs and benefits of SESAME scenario 3.

FIGURE 7.10 SESAME SCENARIO 3 CUMULATIVE INCREMENTAL COSTS AND BENEFITS (€ BN)



Sensitivity analysis

7.40 We have undertaken sensitivity analysis of some of the key assumptions in the financial CBA:

- the **discount rate** used;
- the **timing** of the receipt of benefits;
- the **level of benefits** provided by SESAME;
- the **level of costs** of SESAME; and
- the level of **demand growth**.

7.41 This analysis aims to examine the implications of some of the key risks determining the success of SESAME:

Sensitivity to the discount rate

7.42 As discussed in Chapter 5, different stakeholders are likely to have a range of discount rates. The ICB sub-group also asked us to examine the impact of different discount rates on the results. Therefore, we have chosen to examine the impact of two sensitivities. One representing high risk funding (15%), the other low risk funding (5%). The results could be interpreted as if all funding was provided through high risk user charges (high), or through taxation receipts (low). Our base assumptions assume a mix of both.

7.43 The results provided in Figure 7.11 and Figure 7.12 demonstrate that changing the

discount rate has a significant impact on net benefits. For example, in SESAME scenario 1 benefits vary between €3 billion and €17 billion for the high and low discount rate cases. Our results provided in Figure 7.3 use a mix of stakeholder discount rates that lie between the two extremes on the continuum.

FIGURE 7.11 KEY RESULTS WITH HIGH DISCOUNT RATES (€ BN)

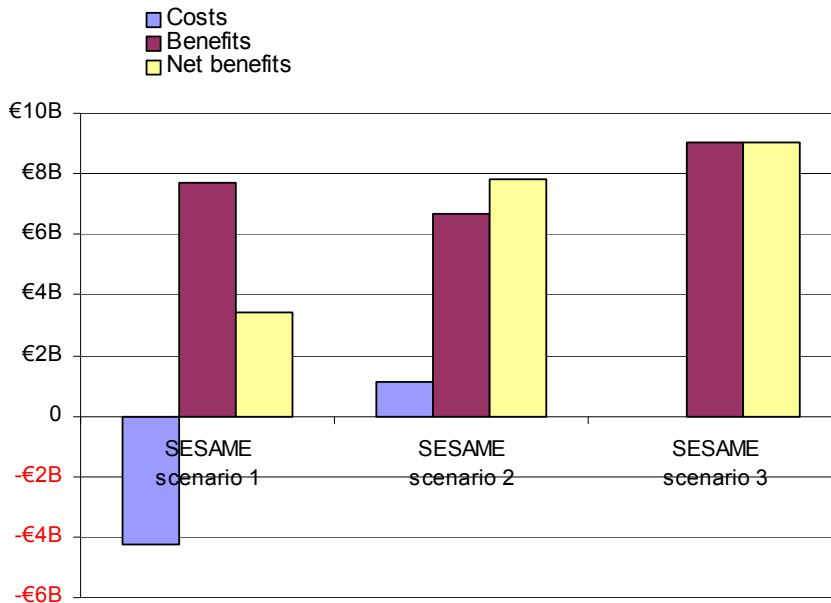
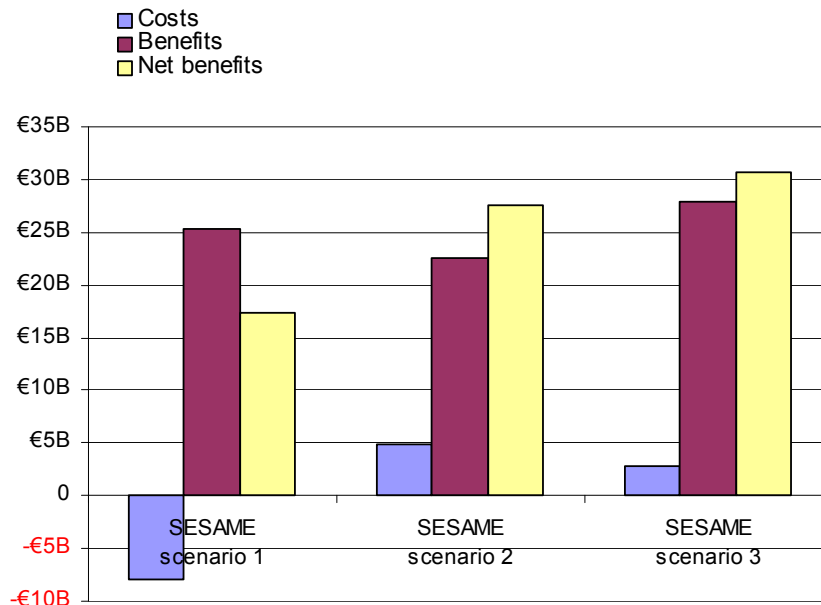


FIGURE 7.12 KEY RESULTS WITH LOW DISCOUNT RATES (€ BN)



Sensitivity to the timing of receipt of benefits

7.44 Our sensitivity test examines the impact of delaying the benefits of SESAME. In this case, we have delayed the delivery of each scenario’s benefits by one year, but with no impact on costs. This reflects a situation where SESAME programmes incur costs as planned but are late in delivering their benefits. The impact of this is shown in the following figures. For SESAME scenario 1 the impact is a reduction in net benefits of €7 billion, for scenarios 2 and 3 the net benefits reduce by approximately €3 billion. The lower net benefits demonstrate the importance of SESAME in avoiding delays in implementation.

FIGURE 7.13 KEY RESULTS FOR SCENARIO 1 WITH AND WITHOUT 1 YEAR DELAY TO BENEFITS (€ BN)

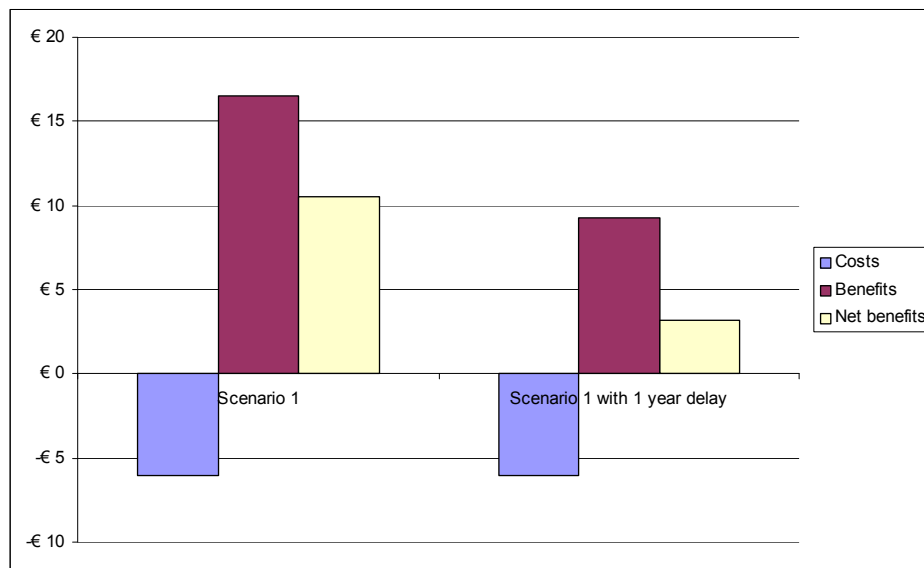


FIGURE 7.14 KEY RESULTS FOR SCENARIO 2 WITH AND WITHOUT 1 YEAR DELAY TO BENEFITS (€ BN)

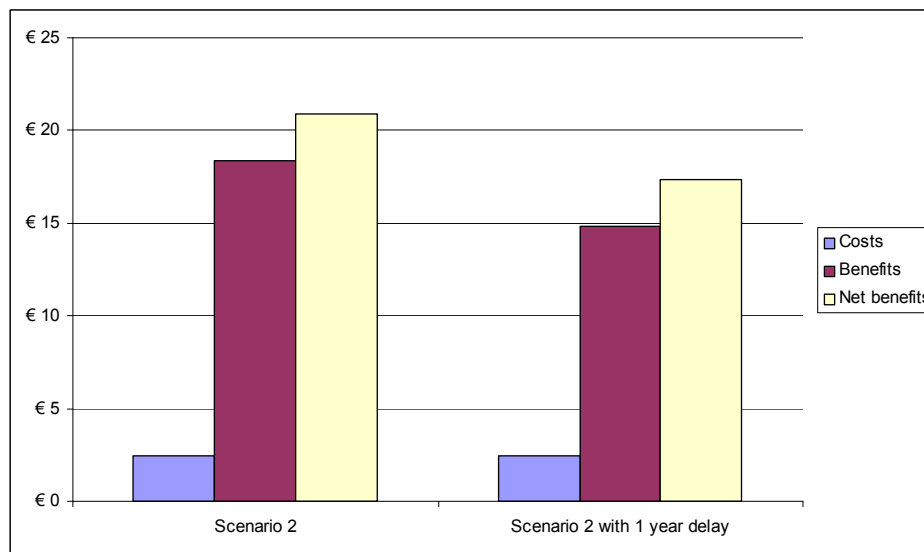
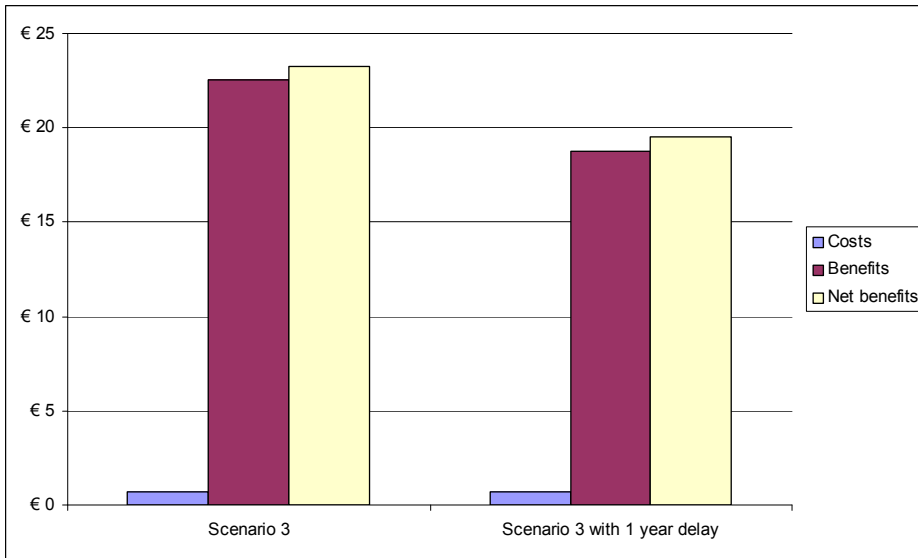


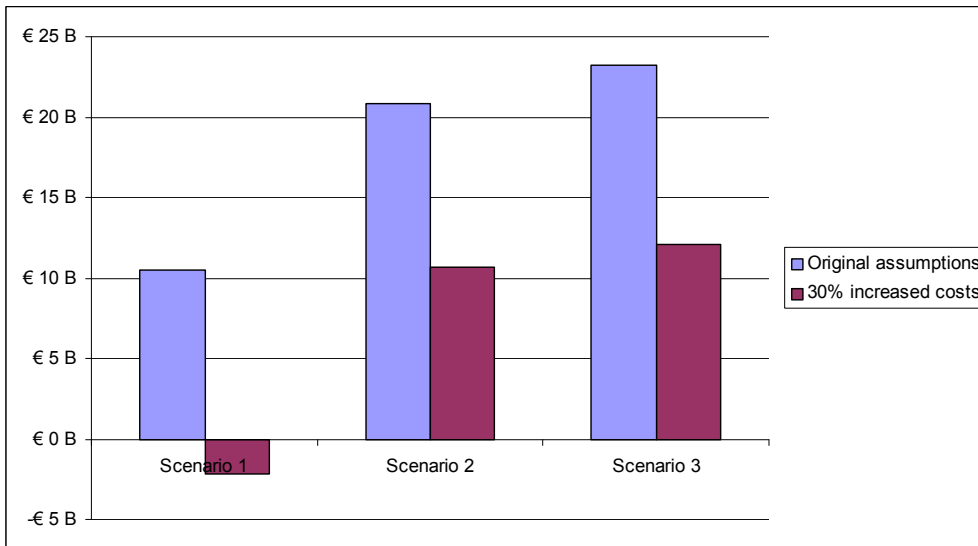
FIGURE 7.15 KEY RESULTS FOR SCENARIO 3 WITH AND WITHOUT 1 YEAR DELAY TO BENEFITS (€ BN)



Sensitivity to greater costs

7.45 Our third sensitivity examines the impact of increased SESAME costs. The following figure shows the result of a 30% increase in SESAME costs above those originally assumed. It can be seen that the net benefit reduces, particularly for SESAME scenario 1 which has the highest costs. Here the net benefit reduces from €10.2 billion to -€2.2 billion PV.

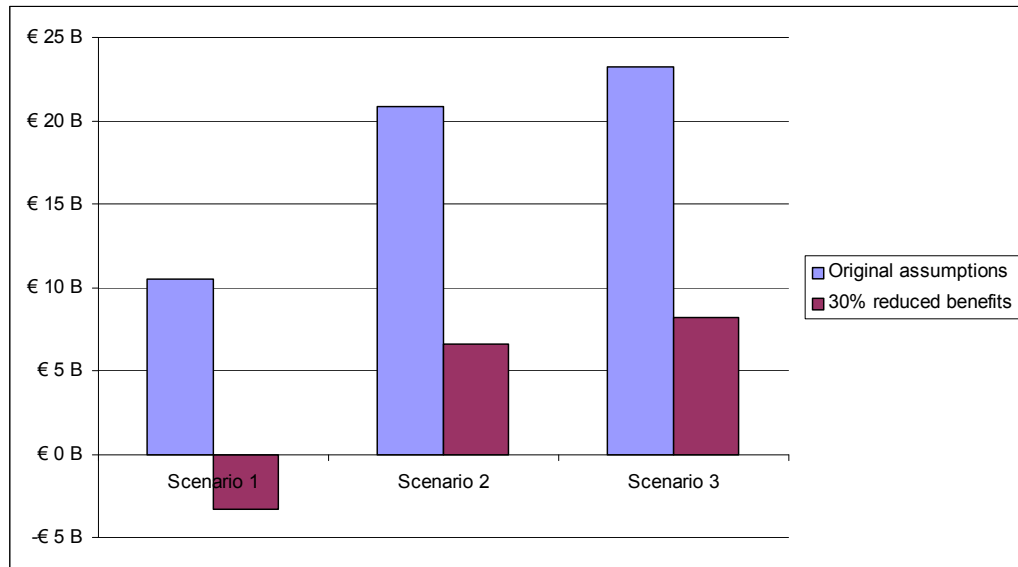
FIGURE 7.16 SENSITIVITY OF 30% INCREASED COSTS (NET BENEFITS) (€ BN)



Sensitivity to reduced benefits

7.46 Our fourth sensitivity examines the impact of reduced benefits from SESAME (i.e. if our assumed benefits are too optimistic). The following figure shows the result of a 30% reduction in delivered benefits from SESAME. Again the net benefit reduces, in SESAME scenario 1 it reduces from €10.2 Billion to -€3.3 Billion PV. Significant reductions in net benefits also result in scenarios 2 and 3.

FIGURE 7.17 SENSITIVITY OF 30% REDUCED BENEFITS (€ BN)



Sensitivity to reduced traffic growth

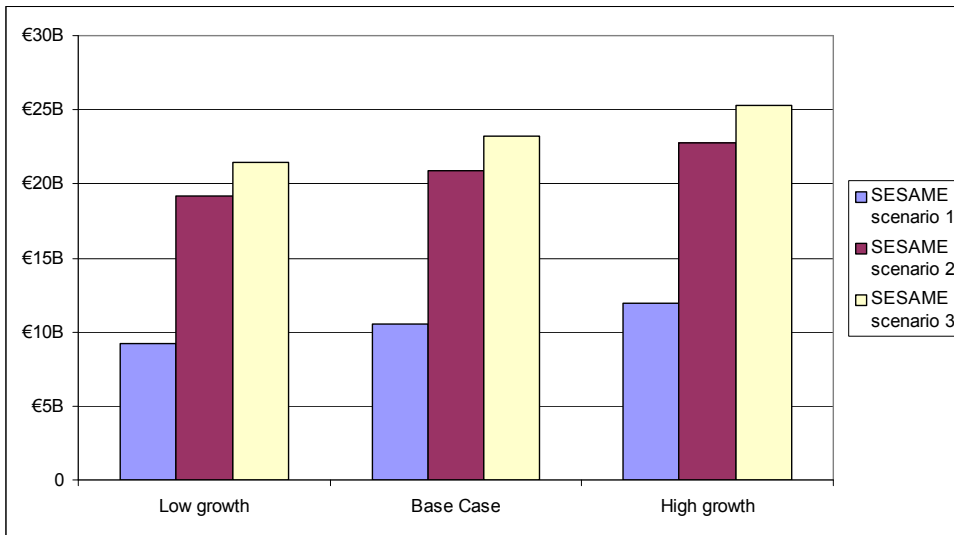
7.47 Our final sensitivity examines the implication of a reduction in the level of traffic growth assumed in the cost benefit analysis. This sensitivity was suggested by members of the ICB and SESC working group at our meeting in the middle of June 2005.

7.48 The unconstrained traffic growth projections used in this study are based on the EUROCONTROL long-term traffic forecasts (2.9% per annum to 2025), extrapolated using our assumption of the same annual growth rate out to 2035. The long-term forecast takes into account a number of factors, such as macro-economic growth airport runway constraints and transport modal choice for passengers. However, there is a risk that this long-term growth rate could be over or under estimated. For example, through an international crisis or slower / higher growth in the European economy than used in the core traffic projection, leading to slower or faster traffic growth.

7.49 We have investigated the impact on the SESAME financial cost benefit analysis results of reducing and increasing traffic growth to 1.9% and 3.9% respectively per annum from 2010 to 2035.

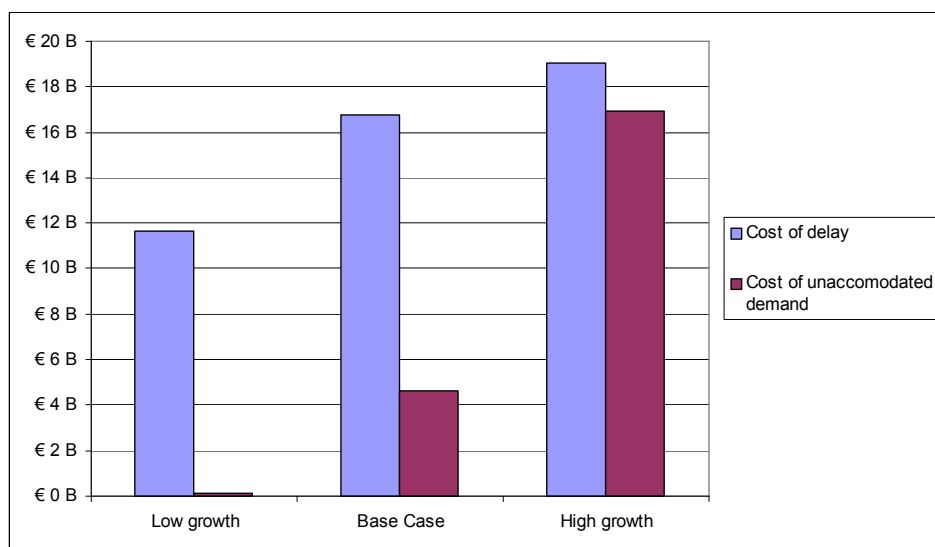
7.50 The impact of these changes to the key results is shown in Figure 7.18 below. Changes to traffic demand have a limited impact on the financial CBA analysis because the CBA measures the benefits of SESAME compared to the Base Case. The changes in traffic demand affect **both** the Base Case and the SESAME scenarios. Therefore, the incremental impacts are more limited.

FIGURE 7.18 FINANCIAL CBA RESULTS - SENSITIVITY TO CHANGED DEMAND GROWTH (€ BN)



7.51 Figure 7.19 shows the impact on changed demand on un-met costs. Here the effect is more dramatic. It can be seen that costs of unaccommodated demand, ie flights that are cancelled because of insufficient capacity, rise very quickly with the high growth rate. This means that the capacity wall would become a more critical issue than before. The benefits of SESAME, if it can avoid a capacity wall that would otherwise occur, would therefore increase considerably.

FIGURE 7.19 SENSITIVITY TO CHANGED DEMAND GROWTH – ILLUSTRATION OF IMPACT OF UNMET DEMAND (€ BN)



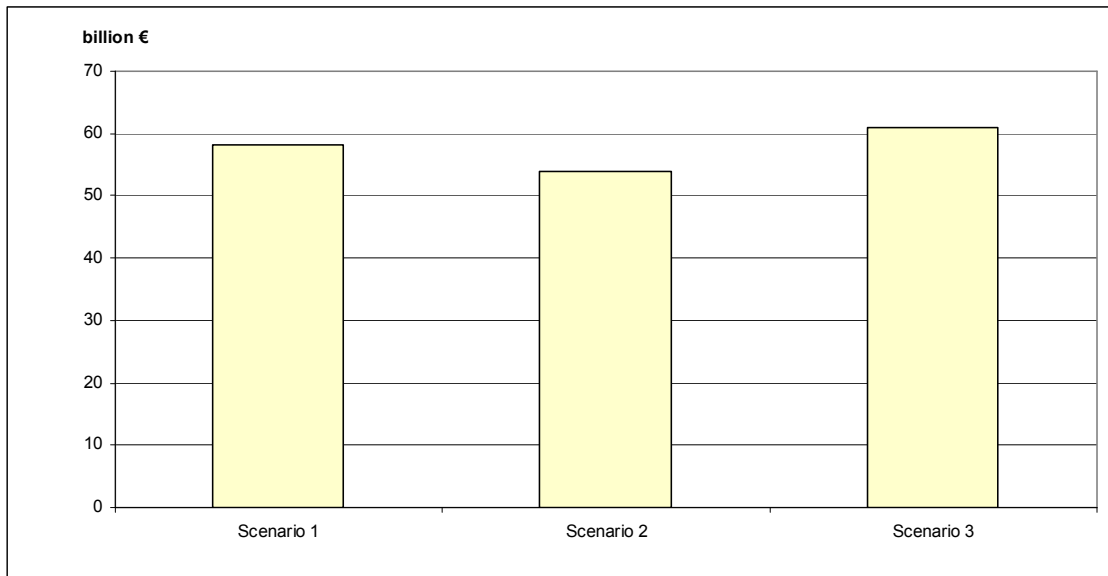
Overview of sensitivity analysis

- 7.52 The sensitivity analysis serves to highlight the importance of the key assumptions in assessing the incremental impact of SESAME namely:
- The discount rate used (and implicitly whether it is predominantly user or part tax payer funded);
 - The timing of implementation – delays have a major impact on the apparent returns of the programme
 - The assumed level of costs – required to secure benefits; and
 - The assumed level of benefits associated with the cost;
 - The predicted level of traffic growth.
- 7.53 The sensitivity analysis shows the wide range of outcomes from different assumptions used to produce our SESAME scenarios. These represent the key risks of the programme and it will be for the SESAME definition phase to secure more certainty in the achievement of such benefits.

Key results –Social and Economic Costs and Benefits

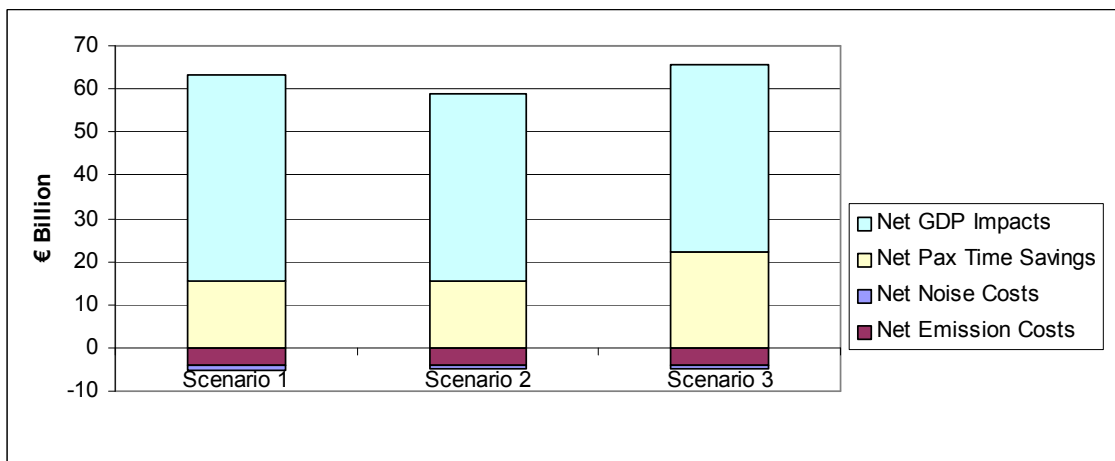
- 7.54 Figure 7.20 shows the Net Present Values (NPVs) of the net economic impacts of each of the SESAME scenarios compared to the Base Case. Net economic impacts **do not include** the financial costs and benefits described above, but take into account the wider impacts on the economy including:
- GDP effects as a result of year-on-year increases in output of air transport (a measure of the indirect and induced impacts on the economy);
 - Changes in emission costs;
 - Changes in noise costs; and
 - Passengers' time savings.
- 7.55 All SESAME scenarios are expected to provide incremental GDP growth and passenger time-savings benefits as compared to the Base Case. The net environmental impacts are negative, however, as noise and greenhouse gas emissions would increase as a result of greater output in the SESAME scenarios as compared to the Base Case.
- 7.56 The magnitude of the net economic benefits exceeds the SESAME financial benefits by between three and five times. Figure 7.20 and Figure 7.21 provide a profile of the economic benefits of the three SESAME scenarios incremental to the Base Case. It can be seen that the majority of the benefits come from GDP and passenger time-savings.

FIGURE 7.20 COMPARISON OF INCREMENTAL ECONOMIC BENEFITS AND COSTS (€ BN)



7.57 Figure 7.21 shows both the positive net impacts (from GDP and passenger time savings, and the negative impacts from noise and emission costs. The sum of these add to the total economic impact presented in Figure 7.20.

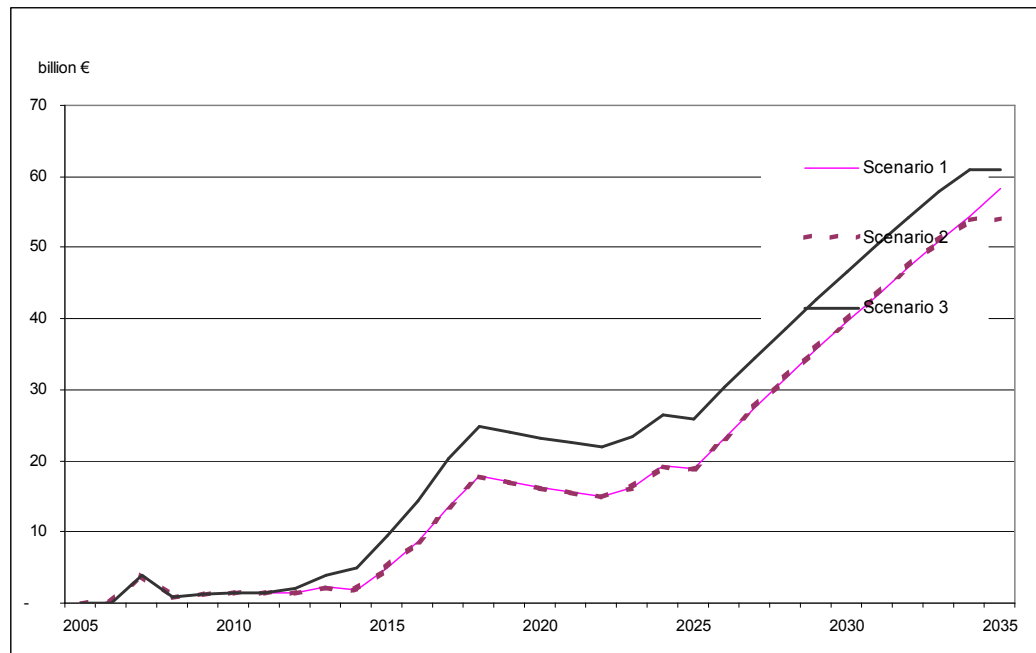
FIGURE 7.21 BREAKDOWN OF INCREMENTAL ECONOMIC BENEFITS AND COSTS (€ BN)



7.58 Our economic CBA finds that SESAME scenarios 1 and 2 yield similar economic benefits. This is largely because SESAME scenario 2 assumes the same implementation timescales (and efficiency improvement timescales) as scenario 1, with the only difference being the reduced duplication programs and cost savings through collaborative approaches. Hence, the benefits of SESAME scenario 2 compared to scenario 1 are financial (as outlined earlier in this chapter) rather than economic. SESAME scenario 3 yields the highest economic benefits of the three scenarios.

7.59 Figure 7.22 juxtaposes the cumulative net economic benefits of the three SESAME scenarios (with the net benefits at 2035 the same as presented in Figure 7.20). Financial costs and benefits to the stakeholders are not included in the estimates of the economic benefits. The key driver of the economic benefits in the SESAME scenarios is bringing forwards the implementation and timescales as compared to the Base Case.

FIGURE 7.22 COMPARISON OF THE NET ECONOMIC NPVS (INCREMENTAL TO THE BASE CASE) OF THE 3 SESAME SCENARIOS (€ BN)



- 7.60 The estimated GDP impacts of SESAME are very sensitive to the assumed aviation multiplier. This is because a small effect resulting from SESAME on the overall productivity in the European economy can yield high absolute levels of benefits because of the large size of the total European economy.
- 7.61 The marginal impact of increased aviation output on other sectors of the economy (above and beyond the direct impact in the aviation sector) is estimated to be 0.02. This multiplier suggests that a 1% year-on-year growth in the number of flights would lead to an increase in the overall growth in output across Europe of 0.02%, resulting in a 0.02% increase in GDP from the previous year. A comparison of the year-on-year GDP growth in each of the scenarios to that in the Base Case generates an estimate of economic benefits.
- 7.62 The Base Case assumes a gradual increase in aviation output (flights), with each of the SESAME scenarios releasing capacity at different rates. Unrestricted demand is assumed to remain unchanged in all scenarios and where capacity in excess of demand it is assumed to generate productivity growth. Because the Base Case capacity is either higher than or at a similar level to demand until the maximum capacity is reached in 2025, the total flight outputs differ little between the SESAME scenarios and Base Case. As a result the net GDP impacts by SESAME are relatively small in the early phases of implementation, and then increase significantly after 2025 as capacity constraints impact.

- 7.63 On average, underlying growth in the aviation sector accounts for 1.3% of the annual GDP growth (assumed to be 3% per annum) in indirect and induced impacts during the 30-year evaluation period (Base Case). SESAME would introduce an additional growth of 0.67 to 0.75% each year, on average. Most of these incremental increases, however, take place in the latter years.
- 7.64 It is difficult to estimate the direct impact SESAME has on employment. This is because SESAME introduces both increases in output and cost savings through provision of higher capacity. Indirect and induced employment from aviation are likely to increase as a result of incremental GDP growth. For **illustrative** purposes, if each job created relates to a person with total annual employment costs of €100,000, the GDP growth in SESAME scenario 3 would result in 13,630 full time employees created over the 35 years.
- 7.65 Increased schedule predictability and the subsequent reduction in buffer delays leads to passenger time savings. Gains in passenger time are a significant driver of economic benefits.
- 7.66 Noise pollution will increase over time. Two major components influence the levels of noise pollution. Improvements in flight efficiencies and more direct routing would reduce the amount of noise pollution generated; at the same time, the increase in flight capacity and the subsequent increase the number of flights would lead to more noise pollution. Our CBA indicates that the additional flights in the SESAME scenarios will generate noise pollution that outweighs the reduction in noise pollution due to efficiency improvements. This is plausible as the percentage increase in air traffic is greater than the percentage increase in flight efficiency as a result of SESAME.
- 7.67 Similarly, despite a net increase in flight efficiency and higher fuel efficiency, increased traffic will lead to higher air pollution and greenhouse gas emissions in the SESAME scenarios as compared to the Base Case.
- 7.68 In the long run, the cumulative net benefits of the SESAME scenarios are positive compared to the Base Case.

Summary

Financial Cost Benefit Analysis

- 7.69 The financial cost-benefit analyses finds that using the assumptions outlined in Chapter 6, SESAME scenario 1 costs more than the Base Case, but the extra expenditure of SESAME is justified by greater increased benefits. Therefore, under our assumptions SESAME scenario 1 achieves more net benefits than the Base Case.
- 7.70 SESAME scenario 2 follows the same timescales as SESAME scenario 1, but the reduced duplication of programmes and collaborative approaches lead to cost savings and benefit gains compared to the Base Case. Scenario 3 assumes shorter implementation timescales. As such, it costs more than scenario 2, but also delivers more benefits.
- 7.71 Scenarios 2 and 3 are estimated to achieve greater net financial benefits than the Base

Case and scenario 1. Scenario 3 achieves improved net benefit as compared to scenario 2, but it has much higher costs.

- 7.72 The analysis suggests that bring forwards the timescale for programme implementation and the rationalisation of some steps in the programme will bring similar sized benefits and SESAME should pay similar attention to both.

Economic Cost Benefit Analysis

- 7.73 Because of their similar implementation timescales, SESAME scenarios 1 and 2 yield very similar economic benefit profiles and levels. SESAME scenario 3 is assumed to achieve higher benefits than the other scenarios, because the accelerated implementation timescale allows benefits to be realised sooner.

8. OUR GOVERNANCE ARRANGEMENT FRAMEWORK

Overview

8.1 This Chapter sets out the evaluation criteria used to assess the different governance models reviewed in Chapter 9. The criteria have been discussed with the Commission and other stakeholders, and in our view they reflect all parties' expectations for the governance of SESAME.

8.2 In broad terms, the governance arrangements must enable the full benefits of SESAME to be realised within the timescales envisaged, while providing for effective control of programme costs (including research and development, validation, deployment and programme administration costs). In order to meet this high level objective, they must:

- Provide for **clear lines of reporting** and allow **efficient decision-making** at the strategic, programme management and working levels;
- Draw together all **potential sources of funding** and ensure that funds are properly and efficiently used;
- Be based on “buy-in” from a **wide range of stakeholders** and encourage their full commitment to the programme;
- Be consistent with a **smooth transition** from the governance arrangements put in place for the definition phase and through subsequent development and implementation phases;
- Allow sharing of resources from across participating organisations and **avoid duplication of effort** (for example between EUROCONTROL ATM and SESAME), while at the same time minimising the scope for conflicts of interest;
- Facilitate effective **direction of research, development and validation effort** as well as efficient procurement of systems and services;
- Ensure **coordinated implementation of standards and systems** by ANSPs, airlines and other airspace users and other parties; and
- Involve the **minimum possible level** of administrative resources consistent with the effective management of the programme.

8.3 In addition, a number of stakeholders have emphasised the importance of SESAME to the development of global air traffic management. Indeed, they see it as essential that SESAME leads, or at least remains in step with, interoperability initiatives outside Europe, notably in the US and China (both of which have control over substantial regions of airspace). It is therefore important that the governance arrangements enable the benefits of global interoperability to be realised.

8.4 We discuss each criterion in more detail below.

Reporting and decision making

8.5 The SESAME implementation phase is an ambitious, complex and long-lived programme, and in these circumstances it is particularly important that decisions can be made efficiently and that roles and responsibilities are clear. The governance

framework must therefore identify responsibility for:

- Exercising political control over key strategic and funding decisions;
- Providing strategic direction for the programme;
- Effective management of the overall programme;
- Undertaking the necessary research and development and validation work;
- The design and approval of technical and operational standards; and
- The implementation of specific investment programmes by ANSPs, airlines and others.

8.6 At each level, participating organisations and individuals must have appropriate authority to make decisions and be accountable for them. Roles must be clearly defined and separated, while approval processes involving the escalation of decisions should be kept to the minimum necessary to provide proper checks and balances on the overall management of the programme.

Financing and Funding

8.7 There are a number of possible sources of financing and funding for SESAME. These include:

- Further TEN-T funding and other public funds sourced at the European level such as from the Research Framework;
- Debt finance raised at the European level, for example from the EIB;
- Funding of research and development by air navigation system suppliers and air frame manufacturers;
- Funding of specific investment undertaken by ANSPs, airlines and other stakeholders from their own resources;
- Air navigation user charges, used either as a source of initial funding or to remunerate debt obtained at an earlier stage in the programme; and
- Funding from EUROCONTROL (although under the current arrangements for funding EUROCONTROL their budget is usually paid by Member States from user charges).

8.8 In each case, the availability of funds will be subject to specific tests and constraints designed to mitigate the risks perceived by the provider and to ensure that prospective returns, financial and non-financial, are commensurate with those risks. It is important that the governance arrangements take full account of the risks taken by parties providing funding, affording them the appropriate degree of control over the deployment of funds, while allowing different sources of funds to be combined and dispersed in the most effective way.

8.9 Funding issues and illustrative funding arrangements are discussed in more detail in Chapter 12.

Stakeholder commitment

8.10 Given the complexity of SESAME and the wide range of industry participants, we anticipate that it will not be possible to ensure full agreement on every issue across all

stakeholders at every stage. However, the governance arrangements for the programme, if properly designed, can help to build a broad consensus on the overall strategic direction, as well as creating confidence in decisions at the working level.

8.11 We have undertaken extensive consultation with stakeholders during our study in order to develop and refine our views on how best to involve them in the development and implementation of SESAME. From our discussions and the comments received, we note that they expect the following:

- **Mechanisms for ensuring that stakeholders providing substantial financial or other support have appropriate influence over strategic direction and management**, and that financial and other risks can be identified and mitigated effectively;
- **A clear definition of roles and responsibilities** within the overall governance structure, as discussed above;
- **Individual stakeholders retaining substantial decision making powers**, with central decision making limited to those areas where it is essential to secure the benefits of a common approach;
- **Effective dissemination of information**, allowing parties to understand the planned programme and assess progress against the plan at regular intervals;
- **Participation in consultation exercises** at key points in the programme, for example, before key changes to the programme are finalised;
- **Evidence that those accountable for the programme have considered the stakeholders' views** carefully, especially where these are subordinated in order to secure wider benefits; and
- **Effective integration of the work of existing bodies**, for example in relation to research and development and the specification of interoperability standards.

8.12 Full stakeholder commitment to the programme will therefore require considerably more than a well-defined process of consultation on strategic decisions. Stakeholders must believe that they have sufficient influence on decisions to be able to keep identified risks within acceptable bounds. The governance framework described in Chapter 10 is intended to meet these requirements.

Transition arrangements

8.13 Stakeholders are in general agreement that the governance arrangements for the definition phase of SESAME will need to change for subsequent phases of the programme. Moreover, development and implementation are likely to cover a number of separately defined phases, each with its own objectives, milestones and balance of funding sources. The governance model will therefore need to adapt to reflect a changing balance of stakeholder participation and risk exposure.

8.14 The recent change in the governance of the Galileo Programme, together with the associated legislative framework, provides a precedent for transition arrangements. In particular, much of Council Regulation 1321/2004, including the provisions concerning the transfer of assets from the Galileo Joint Undertaking to the new Supervisory Authority, could have relevance to SESAME. Similarly, some of the

provisions of Regulation 881/2004, setting up the European Rail Agency, which is to take over responsibility for the development of technical standards for interoperability from an industry representative body, might also be adapted for the SESAME governance framework.

- 8.15 At the same time, it is possible that the SESAME definition stage could raise new issues, for example in relation to intellectual property, unexpected liabilities, or newly emerging risks, that require bespoke, or at least modified transitional arrangements. Therefore, in considering the implications of different governance models and comparators, we have identified a number of transitional issues relevant to SESAME. These are discussed further in Chapter 10.

Resource allocation and conflicts of interest

- 8.16 The governance arrangements will need to ensure that the programme can draw on relevant expertise and capabilities within the various stakeholders. At the same time, it will need to allow for review and challenge of key proposals, and for the accommodation of changing resource needs as the programme moves through development to implementation.

- 8.17 At each stage, the allocation of roles and responsibilities will need to reflect:

- Political and financial interests in the programme, with relevant stakeholders able to take strategic decisions in order to align the overall direction of the programme with its main objectives;
- Relative technical competencies, with programme managers able to draw on specific expertise in different organisations at different times, for example in order to specify requirements or evaluate tenders; and
- The geographical scope of different elements of the programme, some of which will involve a pan-European perspective (for example, the definition of Europe-wide interoperability standards), while others will involve action at the national level (such as approval of proposed investment by a specific ANSP).

- 8.18 In some cases, a possible role for a party at one stage in the programme might conflict with another at a later stage. For example, a system supplier's particular expertise might make it well placed to undertake specific research, providing it with intellectual property or another competitive advantage in a later procurement. In these circumstances, it might be necessary to ensure that the results of research work were fully available to all parties tendering for a contract. The implications of such an approach would need to be considered, and the rules governing the use of research results set out at an early stage. This issue is also discussed further in Chapter 10.

Efficient direction of procurement

- 8.19 Given the history of large, coordinated procurement and investment initiatives, it is clear that guarding against unplanned changes of scope and specification will be critical in containing overall programme costs. The ability of a particular governance structure to manage changes in scope, and their associated costs, effectively will be linked to its ability to provide for efficient procurement of research, development and

validation activity as well as of systems required for deployment. In particular, the arrangements must facilitate the development of well-defined research or work specifications and non-discriminatory access to relevant intellectual property and other information for potential bidders, thereby ensuring the discipline of a competitive tendering process.

- 8.20 In view of the complexity of SESAME, and the significant, unquantifiable risks that could be inherited or identified during the development and implementation phases, it will be important to give careful consideration to the procurement strategy. On the one hand, a broad definition of critical development and implementation work might ensure that specific interface risks are internalised and economies realised within a single procurement exercise. On the other, separation of specific elements might allow a well-defined programme of work to be let earlier, with more effective competition, than with a wider programme with substantial risks that can only be taken by a limited number of bidders. Such an approach would also facilitate adaptation of systems to meet specific regional and local requirements, while running the risk of inefficiency through fragmentation.
- 8.21 The appropriate balance between centralised and more dispersed procurement is discussed in Chapter 12. Here, we note that the governance arrangements must ensure that those making procurement decisions can draw on the expertise required to make informed choices on these issues, based on a clear trade-off of identified risks.

Coordinated implementation

- 8.22 The programme must also enable individual ANSPs and airlines undertaking investment to prepare detailed system or service requirements, consistent with the broader requirements of interoperability. It must also allow for efficient administration of the procurement process at the national and stakeholder levels, in terms of the dissemination of information to bidders, bid evaluation, negotiation and final contract award. Coordination of such investment activity across Europe will call for considerable flexibility and recognition of specific constraints, while also ensuring that key programme milestones are met.
- 8.23 Given the wide range of legacy air traffic management systems in use, there will be a need to **incentivise** some investment, particularly where this involves replacing assets that have not yet reached the end of their economic lives. There is also general recognition among stakeholders that such incentive arrangements will need to be complemented by appropriate **enforcement mechanisms** to ensure that the overall programme is not compromised. Stakeholders will require assurance that both incentive and enforcement mechanisms are administered fairly through the governance structure put in place.

Administrative resources

- 8.24 The governance structure will need to include some form of legal entity capable of owning assets and obtaining funding on its own account. For example, it will need discretion to fund research and development work and the capability to own intellectual property arising from such work. In addition, while air traffic

management systems would continue to be owned and operated by individual ANSPs, the entity might need to award a contract for the development of a common specification for some system elements.

- 8.25 The Commission has already identified a “**Joint Undertaking**”, broadly similar to that responsible for the development of Galileo, as the appropriate vehicle for ensuring control of the programme. While such an entity will require some resources, these must be kept to the minimum necessary to enable the arrangements to function effectively. Given industry-wide concerns about duplication of effort and escalating costs among different regulatory and sponsoring organisations, keeping resources to a minimum will also be important in securing stakeholder support.

9. OUR REVIEW OF GOVERNANCE COMPARATORS

Selection of comparators

9.1 In order to assess the strengths and weaknesses of different governance models, we reviewed a number of possible comparators, drawn from a range of European programmes. In order to focus our analysis, we selected a limited number of comparators according to criteria designed to ensure that each was relevant for the development of governance arrangements for SESAME. These criteria were

- **Sector coverage:** we selected most of the programmes from within the aviation and aerospace sectors, broadly defined, to ensure that these involved most, if not all, of the SESAME stakeholders. We also included a number of specific examples from the air traffic management industry. At the same time, in order to broaden the selection and allow for the possibility that key issues had already been addressed in other sectors, we also considered rail transport, which has also been subject to major European legislative initiatives.
- **Use of diverse funding sources:** this is a key aspect of SESAME, and we therefore selected programmes involving a combination of funding sources, including the public and private sectors as well as European and national bodies.
- **Coordination across national boundaries and diverse stakeholders:** we sought to identify programmes involving coordination of investment and other activities across countries and stakeholders as well as those involving sponsorship and/or procurement at the European level.
- **Significant research and development activity:** while some research and development work will be undertaken during the definition phase of SESAME, this will continue throughout the implementation phase. All the programmes chosen therefore have a significant research and development dimension.
- **Interoperability:** the development and application of interoperability standards will be a critical element of SESAME, and we therefore identified programmes requiring similar, cross-industry initiatives to develop appropriate technical standards and specifications.
- **Significant procurement:** all the examples chosen involved significant procurement exercises, undertaken either by pan-European organisations or national and corporate entities.
- **Political profile:** SESAME clearly has a high political profile since it is a key element in the realisation of the Single European Sky. We have therefore selected a number of programmes with a similar pan-European political dimension.

9.2 A number of the examples selected also involved different phases, typically reflecting key distinctions between defining a programme, undertaking research and development work, and implementation or deployment. These enabled us to investigate how different transition arrangements have allowed governance structures to change with the evolution of an overall programme.

9.3 A summary description of the comparator programmes, and a brief justification for their inclusion in the study is provided in Table 9.1 below. A description of the

governance arrangements for each is set out in Appendix C.

TABLE 9.1 GOVERNANCE COMPARATORS

Programme	Description	Reasons for inclusion
Galileo planning phase	European Satellite Navigation Programme, jointly funded by the European Union and European Space Agency. This phase covers research and development, testing and demonstration of satellites and negotiation of a contract with a private sector service provider.	<ul style="list-style-type: none"> • An example of a “Joint Undertaking” arrangement involving European level sponsors • Development of a pan-European programme • Significant research and development
Galileo deployment phase	Deployment of the satellite system and ongoing management and regulation of the service.	<ul style="list-style-type: none"> • Example of change in governance • Significant procurement element
Rail interoperability (pre European Rail Agency)	Development of European technical standards for interoperability, covering high-speed and conventional rail infrastructure, undertaken within the framework of EC Directives 1996/48 and 2001/16.	<ul style="list-style-type: none"> • Development of common technical standards involving a range of stakeholders • Undertaken within an evolving EU legislative framework • Coordination across boundaries and stakeholders
Rail interoperability (post European Rail Agency)	Continuing development of technical standards for interoperability under the direction of the European Rail Agency established under Regulation 881/2004.	<ul style="list-style-type: none"> • Example of change in governance
European Rail Traffic Management System (ERTMS)	Pan-European programme to establish standardisation of train control systems within the broader framework of EU interoperability legislation	<ul style="list-style-type: none"> • A specific example of an interoperability initiative, involving both harmonisation of standards and investment at the national level • As for interoperability generally, a wide range of stakeholders
European Flight Data Processing (EFDP)	Pan-European programme to replace legacy flight data processing systems with a common system	<ul style="list-style-type: none"> • An air navigation programme • A wide range of stakeholders, including airlines and ANSPs • Substantial investment required
Link 2000+	Programme to coordinate the implementation of air-ground data link services in the core European area	<ul style="list-style-type: none"> • An air navigation programme • A wide range of stakeholders, including airlines and ANSPs • Substantial investment required
Reduced Vertical Separation Minima (RVSM)	Creation of six new flight levels available to commercial aviation, based on the equipage of aircraft with more accurate altimetry	<ul style="list-style-type: none"> • An air navigation programme • A wide range of stakeholders, including airlines and ANSPs • Substantial investment required

9.4 For each comparator, we reviewed relevant documentation on the origin, status and success of the programme, including any legislative provisions relating to governance. We also discussed the programme with individuals involved in its development or management, including, where appropriate, officials at the Commission and EUROCONTROL. We also sought the views of SESAME stakeholders as some had direct experience of at least one of these comparator programmes.

9.5 In the remainder of this Chapter we discuss the implications of these examples for SESAME. Each of the programmes discussed shares a number of features with SESAME, although none of them is comparable in every respect. It is particularly important to recognise key differences in the nature and objectives of the programmes before drawing conclusions about the relevance of their associated governance arrangements for SESAME.

The Joint Undertaking approach

9.6 As noted above, the Commission has identified the Joint Undertaking model put in place for the planning phase of Galileo as an appropriate framework for the implementation phase of SESAME. Indeed, if SESAME is to be centrally managed by a body capable of combining both public funding from the Commission and private sector funds, the only vehicle available in European law is the Joint Undertaking provided for under Article 171 of the EC Treaty.

9.7 There are a number of aspects of the Galileo Joint Undertaking that might inform the governance arrangements for SESAME, specifically:

- The **partnership approach** enabling key public and private sector stakeholders to secure funding and oversee strategic, management and technical aspects of the programme;
- **Management of the programme**, including research and development activity as well as planning for effective deployment, at the pan-European level and according to overall timescales defined in legislation; and
- Mechanisms for drawing on **key technical capabilities and expertise**, in this case located within the ESA, in order to ensure the success of the planning phase.

9.8 Some SESAME stakeholders have pointed out that Galileo differs from SESAME in a number of important respects. The Galileo Programme centres on a single procurement of a European satellite system to be provided by a single concession holder on a commercial basis. It will be for the concessionaire to secure a substantial proportion of the funding, although European funding will also be provided. In addition, we note that the detailed governance arrangements for the Galileo Joint Undertaking were designed to provide for combined **initial** funding of development work by a relatively limited number of equity stakeholders.

9.9 By contrast, SESAME will involve a large number of ANSPs, airlines and other parties procuring new systems from different suppliers, albeit in accordance with a programme and interoperability standards agreed at the European level. It will therefore centre on the coordination of procurement activities across Europe, rather than on the specification and acquisition of a single system for subsequent operation by a single service provider. Moreover, funding will also need to come from a wide range of sources, and underpin national as well as pan-European implementation activity at different points over the life of the programme. Hence, aspects of the design of the Galileo Joint Undertaking, such as the direct proportionality between the voting rights of the key stakeholders and their initial funding contributions, are not applicable to the SESAME governance arrangements.

9.10 However, it is important to recognise that **Article 171 of the EC Treaty is sufficiently general to allow a Joint Undertaking to take various forms**. A Joint Undertaking for SESAME need not be constituted in the same way as the Galileo precedent, and could have very different supervision and management arrangements, as discussed in Chapter 10.

Interoperability standards

9.11 The framework for establishing European rail interoperability provides useful insights into the process for developing common technical standards, a key part of SESAME. This framework has already met with some success, having produced Technical Standards for Interoperability (TSIs) covering six high-speed rail subsystems although, as noted in Appendix C, the process has arguably been protracted and the timescales for implementation remain uncertain. The ERTMS Programme has produced extensive technical specifications for train control systems, and a number of systems have been piloted in different European countries.

9.12 The governance arrangements for rail interoperability explicitly recognise the need to involve a number of rail industry stakeholders in the development of TSIs. The AEIF, the Joint Representative Body formerly responsible for drawing up TSIs under Directive 96/48, included bodies representing rail service operators, infrastructure managers and systems manufacturers in its membership. Going forward, the Administrative Board of the European Railway Agency will include representatives of these same stakeholder groups, as well as of worker unions, passengers and freight customers, albeit without voting rights. In addition, the Agency has a duty to ensure that the working parties organised to draw up TSIs “include adequate representation of those sectors of the industry and of those users which will be affected by measures which might be proposed by the Commission”.

9.13 The ERTMS Programme has also drawn extensively on stakeholder participation, as distinct from consultation, from its inception. At the same time, the programme has defined separate roles for rail operators and infrastructure managers (represented by EEIG) on the one hand, and signalling suppliers (represented by UNISIG) on the other. While EEIG focused on the development of functional specifications, ensuring that these were user rather than product-led, UNISIG developed detailed technical specifications for the signalling systems. Some studies of this approach have suggested that it is likely to lead to greater competition among suppliers to meet common functional requirements and a move away from national markets based on product specifications⁹.

9.14 However, while this experience may help in defining particular aspects of the governance arrangements for SESAME, it is important to recognise that SESAME covers considerably more than the development of interoperability standards. Indeed, the progress of rail interoperability demonstrates that, in the absence of a European-

⁹ See, for example, *A decade of change in the European rail market; influence on innovation and R&D: Toward a new equilibrium in the railway sector*, Guillaume de Tilière and Staffan Hultén, First conference on railroad industry structure, competition and investment, November 2003.

level managed programme, with associated incentive and enforcement mechanisms, a framework for setting common standards is unlikely to lead to timely investment in new systems. In these circumstances, investment will be driven by business cases and cost-benefit analysis undertaken at the national or route level, with little regard for wider network benefits from facilitating cross-border services.

- 9.15 Arguably this is less of a concern for the rail sector, since most rail travel is domestic rather than international, and the substantial investment required by programmes such as ERTMS can only be justified on the grounds that it results in substantial benefits for domestic passengers. This is clearly not the case with air travel, which is predominantly international and relies on efficient operation across airspace boundaries. In addition, the success of SESAME is critically dependent on the delivery of network benefits, and few if any benefits will be realised if investment is limited to a few stakeholders.

Co-ordination of investment

- 9.16 The EFDP Programme to develop two interoperable data processing systems demonstrates some of the potential difficulties in achieving consensus across the air traffic management industry and driving investment forward in a coordinated way. While the programme was originally intended to include three phases- preparation of the call for tender; project definition; and development and implementation of systems. It was terminated before the end of the first of these, suffering from budget overrun and delays. This was despite active participation by a number of ANSPs and central funding and coordination provided by EUROCONTROL.
- 9.17 A report prepared for the Commission by Sofréavia identified a number of problems with the programme, largely resulting from varying objectives between stakeholders¹⁰. In particular, the report noted that:
- Some stakeholders were satisfied with a relatively high-level requirement specification while others sought a more detailed specification and greater management control of specification development;
 - EUROCONTROL and stakeholders differed over whether the programme should build on earlier work under EATCHIP or embark on an entirely new specification; and
 - Some ANSPs sought to have specific requirements reflected in the general specification, resulting in the development of variants within a broader definition.
- 9.18 These different objectives appear to have contributed to the extension of the process for capturing system requirements and protracted discussions over the Base Case definition. Sofréavia also noted that EUROCONTROL eventually sought financial participation from stakeholders but that there was a general reluctance to invest in common solutions that did not reflect perceived national circumstances and constraints. This experience illustrates the importance of defining a clear financing

¹⁰ FDP *Institutional Issues Study*, a report prepared for the European Commission by Sofréavia, July 2002.

plan, capable of accommodating contingencies, from the outset.

- 9.19 The Link 2000+ Programme is similarly dependent on coordination of investment between stakeholders, specifically the synchronised implementation of controller-pilot data link communication for air traffic management. Again, the programme appears to be relatively protracted, with detailed planning and design and securing stakeholder commitment taking two years, implementation among pioneer airlines and service providers taking place between 2003 and 2005, and full implementation subject to even longer timescales.
- 9.20 It is worth noting that EUROCONTROL has explicitly recognised the risks to the implementation timetable for Link 2000+. Notwithstanding the definition of transparent management arrangements, including a Programme Steering Group to advise the Programme Manager, and specific focus groups advising on operational and safety matters, EUROCONTROL has nevertheless proposed financial incentives for encouraging timely aircraft equipage, together with an obligation to equip by a given date. The incentive mechanisms initially considered were grants to cover equipment costs and lower user charges for equipped aircraft, although we understand that user charge-based incentives have been rejected because of resistance from airlines and concerns over the practicalities of calculating charges.
- 9.21 These proposals recognise the problems of some aircraft equipage programmes experienced in the past, specifically the tendency of airlines to delay investment in circumstances where the programme benefits, in terms of delay reductions and other cost savings, are collective rather than individual and require coordinated action. They also recognise that programmes based solely on mandatory implementation by a certain date have tended to result in “a hesitant implementation approach, whereby each party waits for the other, and where in the end – near to the mandate deadline – actions for equipage are undertaken in a rush”¹¹.
- 9.22 The RVSM Programme provides a more positive example of cross-industry cooperation, and demonstrates the circumstances in which the training and investment activities of stakeholders can be coordinated to deliver substantial increases in airspace capacity within defined timescales. We note that EUROCONTROL, which managed the overall programme, was able to complete it by the agreed date of January 2002, although it did not have recourse to either substantial central funding or strong incentive and enforcement mechanisms.
- 9.23 The success of the SESAME programme appears to have been based on a number of contributory factors, including:
- Full involvement of stakeholders in the development of the programme, resulting in wide agreement on the completion date;
 - A recognition on the part of programme managers of practical constraints on

¹¹ *Link 2000+ Programme – Incentives*, Action Paper prepared by EUROCONTROL for the ATM/CNS Consultancy Group, September 2004.

delivery (for example the need to allow adequate time for training and provide for aircraft equipage over the winter season), coupled with appropriate technical support from EUROCONTROL to help overcome specific problems; and

- A clear demonstration of substantial and immediate cost savings for airlines (consistent with a six month payback period for investment in aircraft equipage).

9.24 SESAME will also need to take full account of practical constraints on stakeholders' ability to invest and change their operating practices, and the governance arrangements must enable such constraints, and their implications for programme timescales, to be debated and agreed. However, while SESAME can and should draw lessons from the successful implementation of RVSM, a simple application of the same approach is unlikely to result in similar success. SESAME is considerably more ambitious, in terms of both its scale and complexity, and, as with the EFDP and Link 2000+ Programmes, it will not always be possible to demonstrate clear and immediate benefits for individual stakeholders. This will inevitably make it more difficult to establish consensus on the nature and extent of the investment required, as well as on programme timescales.

9.25 We therefore suggest that stakeholder participation in programme development will need to take place within a formal framework of incentivisation and enforcement, as envisaged for Link 2000+. In addition, the governance arrangements will need to take full account of the difficulties of building consensus over the replacement of legacy systems, a key obstacle to success in the case of EFDP, and provide for a stronger management framework capable of delivering the necessary implementation within agreed timescales. In Chapter 10, we discuss the administration of incentive and enforcement mechanisms, taking account of legal and institutional constraints as well as stakeholder views.

Transition arrangements

9.26 Experience of both the Galileo and rail interoperability programmes highlights a number of the issues surrounding the transition from one set of governance arrangements to another. In each case, the legislation providing for the establishment of a new governance structure has made explicit reference to aspects of transition, in particular:

- In the case of Galileo, the need to arrange for the transfer of assets to the new Supervisory Authority; and
- In the case of rail interoperability, the importance of ensuring continuity in the work on standards by building on the expertise gained by the AEIF.

9.27 However, while these examples provide helpful precedents in terms of necessary legislation, their usefulness in terms of addressing practical transition issues is not yet demonstrated. The Galileo Joint Undertaking will only be wound up in May 2006, almost a year after the setting up of the new Supervisory Authority, and the mechanisms for full handover of expertise, assets and other resources have yet to be fully tested. In addition, the Galileo legislation alone does not address issues concerning intellectual property created, and expertise gained, by contractors during

the development phase¹². We understand that in practice, such issues have not arisen under the Galileo programme, since ESA undertook much of the research and the core activity to be undertaken by the contractor is anyway somewhat remote from this. However, as discussed in Chapter 10, they could arise during the development and implementation of SESAME.

Conclusions

- 9.28 It is evident from this review of comparator governance models that there is no established structure that can be readily applied to SESAME. The challenge will be to define a set of arrangements that combine clear funding arrangements, strong political control and overall programme management, direct stakeholder participation in programme development and implementation and effective incentive and enforcement arrangements.

¹² The *Galileo Phase II Executive Summary*, prepared by PricewaterhouseCoopers in January 2003, noted that the consortium undertaking the development work could have an advantage in bidding for the concession, and suggested a number of possible ways of addressing this.

10. CORE GOVERNANCE ARRANGEMENTS

Introduction

10.1 In developing our proposals for the governance of SESAME, we have drawn extensively on stakeholder views and lessons from comparable programmes discussed in Chapter 9. Final definition of the core governance arrangements is critically dependent on:

- The scope of the programme, in particular the extent to which it encompasses common procurement of research and development work and system specifications;
- The funding arrangements at each stage of the programme; and
- The resulting distribution of costs and benefits across SESAME stakeholders.

10.2 We recognise that, as some stakeholders have pointed out, we cannot provide definitive conclusions on these issues in advance of the completion of the definition phase of SESAME. However, our study must nevertheless demonstrate that a governance structure satisfying the criteria set out in Chapter 8, and representing a practical way forward in the view of stakeholders, can be constructed. We have therefore made a number of working assumptions about the scope and funding of the programme, consistent with the broad definition of SESAME expressed by some, although not all, stakeholders.

10.3 Our key assumptions are:

- That the programme will encompass more than simply the development of an agreed master plan and supporting research and development work, potentially extending to procurement of a common specification for some systems;
- That the development of interoperability standards will be an important element of the programme;
- That ANSPs and airspace users will continue to be responsible for their own procurement of ground and airborne systems, albeit within a framework of enforcement and incentives designed to ensure that the overall objectives of SESAME are met within agreed timescales; and
- That funding will come from a wide variety of sources, as indicated in Chapter 8, although the costs of the programme will ultimately be covered by the Commission funding (and hence European Union taxpayers) and airspace users and their customers.

10.4 We have also assumed, as a minimum, that scenario 1 in our cost-benefit analysis is realised. As noted in Chapter 7, this scenario would probably be the most testing in terms of its demands on the governance arrangements, not least because the additional call on funding that it implies. However, where appropriate, we have also considered the implications of SESAME scenarios 2 and 3, which require particularly effective coordination in order to improve collaboration between stakeholders and reduce duplication. In practice, other scenarios combining elements of the three we have defined are possible, and the chosen governance structure must be able to accommodate these.

- 10.5 We suggest that if the scope of SESAME were significantly reduced below that implied by these assumptions, it would run the risk of failing to translate planning, research and development work into real benefits for airspace users and their customers. Moreover, the assumptions provide a basis for designing a robust set of governance arrangements, able to accommodate the demands placed on them by stakeholders while ensuring that the programme can progress effectively through development to deployment and operation. In our view, the resulting proposals will help to inform the definition phase work without in any way constraining it, although they will need to be revisited as the results of this work emerge.
- 10.6 In the remainder of this Chapter, we summarise the stakeholder views on governance obtained through consultation, before setting out our proposed governance structure.

Stakeholder views

- 10.7 Throughout the study, we have sought the views of a number of stakeholders on the criteria that any future governance arrangements should meet, and on the issues that such arrangements are likely to raise in the context of SESAME.
- 10.8 We have consulted with:
- **ANSPs**, through CANSO at a meeting on 27 January and through ANSP representatives at a European CANSO meeting on 25 February 2005;
 - **A subset of civil airspace users**, as represented by AEA, IATA and IOPA, through discussions with these organisations on 26 January, 24 February and 18 March 2005;
 - **Systems suppliers and manufacturers**, through discussions with the Air Traffic Alliance and Aerospace and Defence Industries Association of Europe (ASD) on 26 January and 24 February 2005;
 - **Representatives of Trade Unions**, through members of the Industry Consultation Group;
 - **Officials of the Commission and EUROCONTROL** at meetings on 26 January and 25 February 2005 respectively;
 - **The Industry Consultation Body Sub-group** with a specific remit to examine SESAME, at meetings held on 10 March and 29 April 2005; and
 - **A meeting with members of the ICB and SESC** held on 15 June 2005.
- 10.9 A record of the meeting with ICB and SESC members held on 15 June appears in Appendix D.

Nature and scope of SESAME

- 10.10 Stakeholders are generally supportive of the principle of a centralised SESAME Programme to design, develop and implement coordinated and interoperable development in European air traffic management. There is a general acceptance that existing mechanisms for coordinating operational change and investment are unlikely to be sufficient to secure the benefits of the Single European Sky within reasonable timescales, and that a new approach should be adopted. Such an approach would need to reassign roles between the different parties involved to focus more on programme

delivery.

- 10.11 There is a wide consensus that the success of the project will require strong and clear management and reporting arrangements. Programme managers will need to build consensus among diverse participants with potentially conflicting objectives. Some stakeholders see this role as requiring different skills from those required for management of a conventional engineering project, however complex.
- 10.12 It is also widely agreed that the governance structures appropriate for the definition phase will need to be changed when the development and implementation phases commence. A number of stakeholders emphasised the need to exclude manufacturing industry from governance beyond the definition phase in order to ensure fair competition in procurement. Some, however, suggested that SESAME itself should not include any major procurement activity, in which case there would be no apparent obstacle to continued participation of manufacturers. This difference of view demonstrates how the definition of the scope of SESAME might affect the optimum governance structure. However, as noted above, it is our understanding that, at a minimum, the programme will set standards and encourage procurement through incentives and enforcement legislation.

Joint Undertaking

- 10.13 SESAME is generally regarded as a more complex programme than Galileo, requiring more active participation from a greater diversity of parties. However, there is recognition that a Joint Undertaking for SESAME would not need to follow the Galileo precedent in detail. There is also a widespread view that the SESAME definition phase arrangements are not appropriate for the development and implementation phase and that the roles of the Commission and EUROCONTROL will need to be differentiated more clearly.
- 10.14 All parties agree that, in principle, airspace users need to be represented in the governance structure, since SESAME is ultimately for their benefit and the benefit of their customers, and because they will ultimately finance investment in aircraft equipment and (through user charges) ground equipment. However, the perceived short time horizons of airline management and shortage of appropriately skilled resources within airlines are seen by some stakeholders as possible constraints. Equally, there is consensus that ANSPs need to be represented, because they will operate the new systems, bring important skills to the programme and, with the airspace users, will be required to make the necessary investments and bear the transition costs.
- 10.15 There was no consensus of view as to the role of EUROCONTROL in the governance arrangements for the deployment / implementation phase of SESAME. Some stakeholders believed that their role should be confined to technical assistance in setting standards and implementation, while others recognised their potential to be involved in the programme management. Stakeholders also recognised that EUROCONTROL has a pool of skilled resource (from their EATM and EEC directorates) in the ATM industry that should be used to further the achievement of SESAME.

Funding

- 10.16 There is stakeholder agreement on the reasonableness of the sources of funding discussed, although the airlines in particular are resistant to the use of a proportion of user charges and would prefer to see other sources used. They are also opposed to any pre-funding of activities under SESAME. Among those who expressed an opinion, there was clear agreement that the administration of SESAME should be undertaken by a streamlined organisation, subcontracting as appropriate for additional resources competitively supplied.

Global dimension

- 10.17 Airlines, ANSPs and manufacturers stressed that SESAME should have a strong focus on global coordination and harmonisation. Different stakeholders suggested that IATA and CANSO (as non-regional trade associations) and EUROCONTROL (as an international body with recognised links to organisations outside Europe) would have key roles to play in ensuring such a global focus.

Proposed governance arrangements

Outline governance structure

- 10.18 Based on consideration of these views and the review of comparators in Chapter 9, we have identified a number of levels of governance representing a broadly accepted framework for application to SESAME. In generic terms, these levels can be defined as follows:

- **Political and strategic oversight** to ensure that the programme moves forward in accordance with the vision set down in the Single European Sky legislation, making use, where appropriate, of the regulatory instruments defined in the legislation;
- **European-level management** of the programme to coordinate and, in some cases undertake, the necessary research, development, validation, procurement and implementation activity across Europe;
- **Established bodies and newly created working groups** to commission and take forward research and development as well as validation initiatives and define interoperability standards and specifications; and
- **Procurement and implementation** undertaken centrally and by ANSPs and airspace users.

- 10.19 Table 10.1 describes the responsibilities and activities at each level in more detail. The governance structure will be defined by the organisations undertaking these different levels of activity, their constitutions and the relationships between them.

TABLE 10.1 SESAME LEVELS OF GOVERNANCE

Governance levels	Responsibilities/activities
Oversight	<ul style="list-style-type: none"> Approval of budget for European funding and support Approval of high-level programme for development and implementation Approval of specific incentive and enforcement actions Advice to the Commission on new proposals for legislation and implementing rules
Programme management	<ul style="list-style-type: none"> Development of European-level programme for implementation (for submission to the oversight body) and approval of detailed sub-programmes Management of the programme, including monitoring of activities, identifying the need for support and reporting progress to the oversight body Coordination of procurement and implementation activity undertaken at the regional, national and stakeholder levels Administration of pooled funding Procurement and coordination of centrally funded research, development, validation and system specification activity Integration of work of established bodies on research and development and the formulation of standards Organisation and coordination of newly created working groups charged with the development of technical standards for interoperability Making recommendations on the need for incentive/compensation payments or enforcement action, for approval by the oversight body Ensuring harmonisation with global interoperability initiatives
Established bodies and new working groups	<ul style="list-style-type: none"> Research and development initiatives Development of technical standards for interoperability for approval by the oversight body Development of detailed technical specifications Preparation of tenders for specific work packages
Regional, national and stakeholder	<ul style="list-style-type: none"> Management of national and local interoperability programmes Competitive procurement of systems Preparation of responses to programme incentive mechanisms (e.g. for early replacement of assets)

10.20 Given these roles and the diverse range of political, commercial and financial interests in SESAME, we suggest that the governance arrangements are organised as follows:

- **A Supervisory Authority** to carry out the oversight responsibilities. As discussed below, we suggest that this is a newly created body with a specific remit to oversee the development and implementation of SESAME.
- **A Joint Undertaking (JU)** created under Article 171 of the EC Treaty and charged with the management of the programme at the European level. The JU should be constituted with an Administrative Board, comprising stakeholder representatives, and an Executive Director with delegated authority to undertake the various day-to-day management activities identified in Table 9.1.
- **Full participation by existing bodies**, in particular EUROCONTROL and EUROCAE, whose ongoing work on relevant research and development initiatives and the formulation of standards would need to be geared towards the delivery of SESAME.
- **Additional working groups** organised, as appropriate, by the JU to undertake

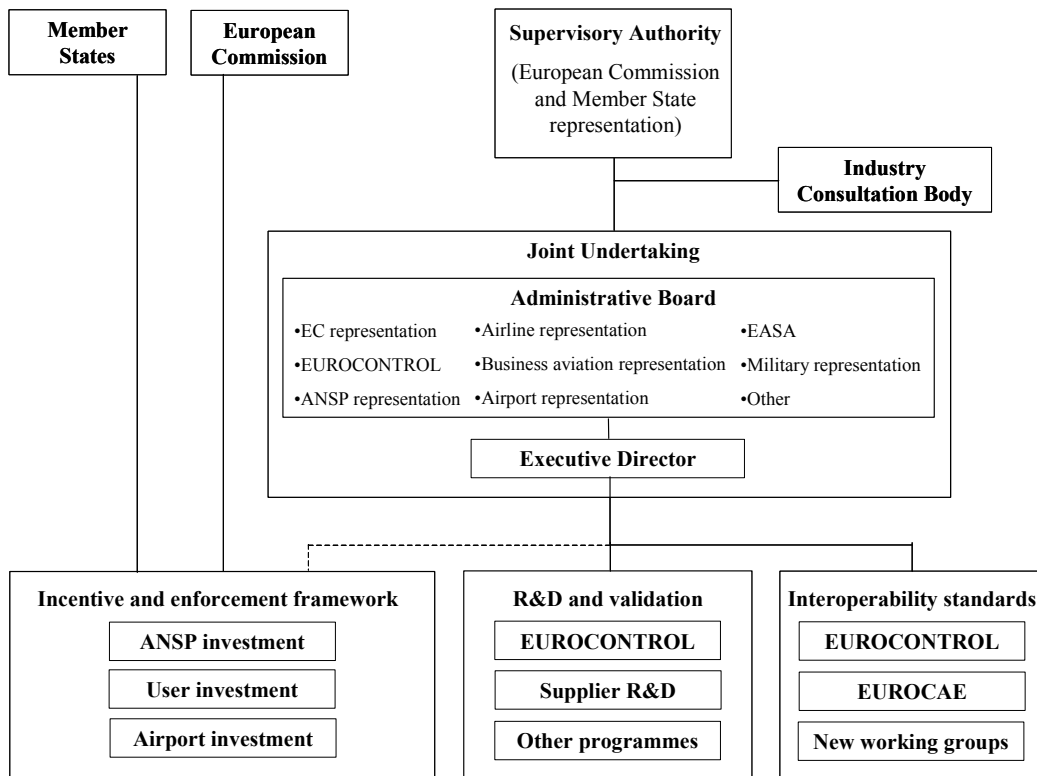
necessary workstreams not already covered by established bodies.

- **Programme managers** appointed by individual stakeholders to implement specific initiatives within the framework provided by the broader SESAME programme.

10.21 Under these arrangements, manufacturers would continue to respond competitively to tenders for systems issued by the JU, individual ANSPs, aircraft operators and airports. However, these tenders would be issued according to a broad, European programme of development and implementation, developed by the JU (with direct stakeholder participation) and approved by the Supervisory Authority. As part of this process, the JU might administer some incentive and enforcement mechanisms, again overseen by the Supervisory Authority.

10.22 This structure of governance is summarised in Figure 10.1. In the remainder of this Chapter, we discuss the various elements of the structure in more detail.

FIGURE 10.1 PROPOSED OUTLINE GOVERNANCE ARRANGEMENTS



Supervisory Authority

10.23 The Single Sky Committee, which includes both Member State and European Commission representation, has already been put in place under Regulation 549/2004, and in principle could carry out the responsibilities of the Supervisory Authority described above. In addition, the Committee includes representatives of countries that have formally agreed to the Single European Sky framework, as well as EU Member States, and is therefore able to take account of their interests.

- 10.24 However, a number of stakeholders have pointed out that the Committee has a specific role within the framework of the Single European Sky legislation, and that its members do not necessarily have the required technical knowledge to make informed funding and other decisions concerning SESAME. Member States might therefore probably wish to nominate other individuals for the Supervisory Authority. At the same time, they would need to have regard to the wider political and economic context for the programme. This argues for a new Supervisory Authority, created through legislation and drawing its membership from individuals nominated by the Member States (including Member States outside the EU but subscribing to the Single European Sky framework).
- 10.25 At the same time, the meeting of ICB and SESC members held on 15 June, while it did not express a clear consensus, highlighted the disadvantages of unnecessary duplication of institutional arrangements at the political level. We suggest, therefore, that the Committee should consider further whether it wishes to undertake the role of Supervisory Authority for the SESAME JU and provide advice to the Commission in advance of the development of new legislation.
- 10.26 Regardless of the identity of the Authority, its role in relation to SESAME, and its relationship with the JU, must be clearly defined in legislation. Given its high level role, we suggest that the Authority would normally meet twice a year, with additional meetings called if necessary.

Joint Undertaking

Objectives

- 10.27 The JU would also be created through legislation, defining both its objectives and its constitution. The formulation of specific objectives would need to draw on the objectives for SESAME set out in Chapter 4, but the JU could also be required to operate in accordance with some of the key governance criteria discussed in Chapter 8. For example, it could have a duty to:
- Secure the benefits of SESAME as quickly as possible within funding and other practical constraints;
 - Control programme costs for which it was directly responsible efficiently;
 - Ensure that SESAME was in line with relevant global developments and initiatives; and
 - Where possible, preserve or encourage competition in the market for air traffic management and related systems.
- 10.28 The scope and wording of specific objectives and duties would need to be considered further in the light of legal precedent and the political, economic and financial environment in which the JU was likely to operate.

Membership of the Administrative Board

- 10.29 The suggested organisational structure for the JU, consisting of an Administrative Board and an Executive Director, follows EU precedent and provides a framework for striking a balance between stakeholder participation and efficient day-to-day

management. We have discussed the membership of the Administrative Board with stakeholders and there is broad consensus that it should include:

- European Commission representation to ensure that the programme is fully in line with progress and timescales envisaged under the Single European Sky framework;
- EUROCONTROL, to provide technical and programme management expertise and assist in the direction of research and development, as well as to help ensure that SESAME is implemented with proper regard to parallel developments in global air traffic management;
- Representatives of ANSPs, airlines and other aircraft operators (general aviation and military) and airports, in view of their role as investors in systems, training and new operational procedures;
- Military representation, determined by Member States acting in cooperation and in accordance with the Statement on Military Issues Related to the Single European Sky issued in 2004; and
- Union representatives, following the European Rail Agency precedent, to ensure that the interests of those working within the air transport and air navigation industries are properly represented.

10.30 We propose, **that system manufacturing and supplier interests are not represented on the Board** in order to ensure that the procurement of systems continues at arms-length and on a full competitive basis during the implementation phase. Some stakeholders have pointed out that it is not always possible to draw a sharp distinction between manufacturing and supplier interests on the one hand, and system user interests on the other, for example because ANSPs and airlines sometimes participate in supplier-led consortia bidding for systems and other contracts (as with the Air Traffic Alliance Consortium awarded the SEAME definition phase work). However, we suggest that any concerns over potential conflicts of interest could be overcome by requiring members of the Board to affirm, as appropriate, that they would comply with defined confidentiality requirements and represent users', rather than suppliers' interests.

10.31 In principle, membership could be:

- Organised through existing representative bodies such as CANSO, the AEA, European Low Fares Airline Association (ELFAA) and IATA;
- Selected by the Commission or the Supervisory Authority from a shortlist of names submitted by each stakeholder group (following the European Rail Agency model); or
- Chosen directly by agreement between stakeholders within each group.

10.32 We suggest that the third approach would be most likely to ensure effective representation and encourage buy-in from stakeholders. The membership of existing industry organisations, while typically covering the broad range of stakeholders in SESAME, does not coincide precisely with the groupings most affected by the programme. Moreover, in our view, members of the Board should be free to put forward views in the interests of those they represent, unconstrained by the specific objectives and policy positions of organisations formed well before the introduction of

SESAME. We also suggest that the approach adopted for the ERA, which is fully funded by the Commission, is not appropriate for a JU.

Voting rights

10.33 The broad Administrative Board membership suggested in paragraph 10.29 would need to be maintained throughout the programme, as all the stakeholders identified would retain an interest at each stage. However, there is a consensus among stakeholders that the level of representation (i.e. the number of Board places) for each grouping and the associated voting rights would need to change over time. This raises the question of how initial representation and rights should be determined and how and when these should be changed.

10.34 We noted in Chapter 9 that the simple relationship between initial equity funding and voting rights applied in the case of the Galileo JU is not appropriate for SESAME, and more generally there is no readily available formula for determining the allocation of voting rights at a particular stage in the programme. As a broad principle, we suggest that rights should instead be related to the risks to which different stakeholder groups were exposed, and/or the risks that they would be expected to manage during separately defined phases. Note that according to this principle, representatives would enjoy voting rights:

- If they were exposed to risk but had only a limited role in managing it (as in the case of the Commission, which would make substantial contributions to funding but not be expected, given available human resources and expertise, to actively manage specific work programmes and procurement activity).
- If they managed risk but were nevertheless partly protected from it (arguably the case for most ANSPs, which would manage the deployment of ground systems and carry operational and implementation risks, but whose financial risk exposure would probably continue to be limited by user charges based on cost pass through mechanisms).
- Where they were expected to manage their own significant risk exposure, at least to some degree (as in the case of airspace users, who would be responsible for aircraft equipage, the cost of which would be covered partly by commercial revenues).

10.35 We suggest that at this stage, given the level of uncertainty surrounding the cost, benefit and funding profiles in our cost-benefit analysis, it would be premature to propose a specific allocation of voting rights for the different phases of the SESAME programme. However, given the principle described above, we propose that the following guidance is taken into account in the development of legislation for the creation of the JU.

- We would expect the Commission to have a significant share of the voting rights through the development and implementation stages, both because of its role in representing Member States and given the substantial European-level public sector funding envisaged. The Commission representation would need to be confident that this funding was ultimately translated into tangible benefits for airspace users and their passengers through the timely deployment of ground and airborne systems. Its role could also continue beyond

implementation through the operational phase, particularly if ongoing research and development effort during this phase required a measure of public sector funding.

- EUROCONTROL would not be exposed to significant economic and financial risk, since any contribution that it made to JU funds would itself be funded through airspace user charges. Nevertheless, it would have a critical role in managing research and development effort, as well as the development of standards and functional specifications, and would need to exercise voting rights commensurate with its management responsibilities. These would be significantly greater under Scenarios 2 and 3, which envisage cost reductions through more efficient organisation of research and development work and, possibly, acceleration of programme timescales. In our view, EUROCONTROL's broad view of air traffic management programmes across Europe and depth of technical expertise would be essential in rationalising and accelerating key research and development work.
- Similarly, while most ANSPs are arguably protected from substantial risk exposure, they would bring critical implementation and operational expertise that would inform initial planning and development work. They would also have a key role in procuring and deploying ground systems during the implementation phase. We would therefore expect ANSP representation to exercise significant voting rights throughout the programme, albeit more limited than those enjoyed by the Commission and airspace users during the development and implementation phases.
- Commercial airspace users would incur significant financial risk during the implementation phase, depending on the level of incentive and/or compensation payments available for deployment of airborne systems, and would anyway account for a substantial proportion of overall funding through their payment of user charges. They would also face major operational and commercial risks associated with the deployment of new technology and systems across Europe. At the same time, they would need to be confident that timescales and milestones set by the JU were achievable, given the practical constraints on aircraft equipage and crew training. We therefore suggest that, as a group, they should enjoy a broadly comparable level of voting rights to the Commission.
- The voting rights of other stakeholder groups represented on the Board, including the military, unions, general aviation and airports, would require further consideration in the light of their expected role in SESAME. In some cases, it might be sufficient for them to be allocated observer status. For example, we anticipate that systems and procedures ultimately delivered through SESAME would need to be fully compliant with the body of safety and security regulations applying to air traffic management at the time. Therefore, while we would expect EASA to make important contributions to discussion within the Board, it should not be necessary for it to ensure compliance with safety regulations through the exercise of voting rights.

10.36 As already noted, the constitution of the JU would need to provide the flexibility for the level of representation and associated voting rights to change over time. However, we suggest that as far as possible, such changes should be defined in advance, and explicitly linked to the achievement of key milestones in the programme, signalling a change in risk exposure and management responsibilities as well as the profile of funding contributions.

- 10.37 We consider the definition of representation and voting rights further in the context of the discussion of transitional issues later in this Chapter.

Balance of Administrative Board and Executive Director responsibilities

- 10.38 The constitution of the Joint Undertaking would also need to define the relationship between the Administrative Board and the Executive Director. While the latter would need clearly defined authority in the interests of efficient management and decision making, the appropriate balance of responsibility must be considered in the light of the need for active participation by stakeholder representatives on the Board.
- 10.39 In our view, the balance of responsibilities established for the Galileo JU and for the European Rail Agency is not appropriate in this case. In the case of the Galileo JU, the organisational arrangements are more complex than those that we have proposed for SESAME, involving a separate Administrative Board, Executive Committee and Advisory Committee as well as a Director role. Hence, the allocation of responsibilities within the organisational structure is not directly comparable.
- 10.40 The responsibilities of the Administrative Board of the European Rail Agency are mainly limited to approval of the work programme and budget and appointment of the Executive Director. However, the Agency is entirely funded by the Commission and its role is focused on the development of interoperability and safety standards, and is therefore less dependent on stakeholder support through funding and buy-in to the governance arrangements. In these circumstances, it is appropriate that the role of stakeholders is limited to discussion of high level budget and programme issues, and that they have no direct influence on decision making through the exercise of voting rights.
- 10.41 By contrast, the SESAME JU will have more of a programme focus, and will be making decisions that affect investment undertaken and risks borne by stakeholders. We therefore propose that the Administrative Board, on which such stakeholders will be represented, should participate more actively in working level programme decisions, at least in the early stages of the development work and while systems are being implemented. Again, it is difficult to offer a definitive view of the precise allocation of responsibilities in advance of the definition phase work. One possibility would be to task the Administrative Board with defining this allocation on its formation. It could be required to formulate proposals on this and other aspects of the administration, including frequency of meetings and rules of procedure, within a specified timescale.

The role of the Industry Consultation Body

- 10.42 Against this background, the future role of the Industry Consultation Body (ICB) in the SESAME programme will need to be clarified. It could be argued that if key stakeholders have a decision-making role through direct participation in the JU, the need for frequent and extensive participation is reduced. However, if the Administrative Board were to operate efficiently, representation would need to be focused, running the risk that specific stakeholder views were ignored or unreasonably discounted. This suggests that the ICB would need to continue to play an important

role in ensuring the widest possible buy-in to SESAME.

- 10.43 There is strong and wide support for the ICB continuing to advise the Commission on matters related to SESAME. Indeed, at the meeting of ICB and SESC members held on 15 June, the ICB itself indicated that it should take a more direct role on the Administrative Board, exercising voting rights as appropriate as part of the Board's decision making process. In our view, this suggestion raises a number of constitutional issues that would need to be resolved before the ICB could effectively fulfil such a role.
- 10.44 In particular, it would be important to establish whether the ICB, when speaking and voting on the Board, was doing so as the ICB (having first established a co-ordinated view among its members) or as a channel for the different views of its members. If the former, it would be important to ensure that the ICB's own constitution was capable of supporting efficient decision making, such that a co-ordinated position could be established prior to Administrative Board meetings. As it was originally introduced, by definition, as a consultation rather than a programme management body, we question whether its constitution and organisation are appropriate.
- 10.45 If, on the other hand, it is anticipated that the ICB acts as a ready made channel for expressing different views, potentially casting votes in proportion to individual positions taken by its various members, we see no major advantages over the arrangements for direct stakeholder participation that we have proposed. We therefore suggest that the ICB should be given an explicit and ongoing advisory, as distinct from decision-making, role in relation to SESAME under the legislation creating the JU. This would enable stakeholders to continue to express their views based on a broad industry perspective, unconstrained by the constitutional and procedural framework governing the Administrative Board of the JU.

Work programmes and working groups

- 10.46 A number of stakeholders have emphasised that the JU would need to coordinate and draw on the work of established bodies sponsoring, or undertaking, research, development and validation work and developing standards relevant to SESAME. These include:
- EUROCONTROL, in its role as sponsor and funder of specific programmes, for example Link 2000+;
 - EUROCONTROL as the body responsible for defining implementing rules, where mandated to do so in accordance with Regulation 549/2004, and for coordinating the development of functional specifications for systems;
 - The European Civil Aviation Equipment Standards Organisation (EUROCAE) as the body responsible for setting standards for ground and airborne systems;
 - EASA, to ensure that SESAME complies fully with the broad framework of safety regulations applying to air traffic management.
 - Other European standards bodies, as appropriate (e.g. the European Committee for Electrotechnical Standardisation and the European Telecommunications Standards Institute); and

- Bodies with a global remit concerning air traffic management standards and systems, such as ICAO and RTCA.
- 10.47 We would expect these organisations to become increasingly familiar with SESAME and its key objectives and milestones and to reflect these in their own work programmes. In order to facilitate this, we suggest that the JU should have explicit responsibility, under legislation, to liaise with them and help coordinate their activities in support of SESAME, while recognising that in many cases they will have a wider agenda.
- 10.48 The JU would also need to have discretion to form additional working groups to sponsor and undertake work programmes not already covered. Again, it could be required to ensure that such groups built on relevant expertise within EUROCONTROL and elsewhere (analogous the requirement under regulation 881/2004 for the European Rail Agency to draw on the work of the AEIF when forming working parties on rail standards).
- 10.49 In view of the concerns over competitive procurement expressed by some stakeholders, the JU might also be required to organise new working groups in a way calculated to preserve competition in manufacture and supply. This could involve making a clear distinction between the development of user-led, functional specifications, on the one hand, and development of technical specifications, in partnership with suppliers, on the other. Such a distinction has been made in the rail sector ERTMS programme discussed in Chapter 9, and also underpins the division of standards-related work undertaken by EUROCONTROL and EUROCAE. At the same time, we recognise that there would be some overlap between functional and technical specifications in many cases, and that working groups might therefore need to draw on both users' and suppliers' expertise to resolve some issues efficiently.

Incentives and enforcement

- 10.50 There are a number of issues concerning the relationship between the JU, responsible for managing of the programme at the European level, and individual ANSPs, aircraft operators and airports undertaking specific initiatives in the implementation of SESAME. The effective coordination of these activities, together with recognition of the financial, operational and other constraints that some stakeholders will face goes to the heart of the successful delivery of SESAME. As indicated above, the design and implementation of incentive and enforcement mechanisms in accordance with the regulatory provisions of the Single European Sky legislation, and their effective application will be critical to the success of the process.
- 10.51 At the same time, based on discussions with various stakeholders including the Commission, we anticipate that the JU would have a limited, although important role in the administration of such mechanisms. This is because:
- While the programme and associated funding would be supported by clearly defined enforcement measures, these would need to be administered by the Commission itself within a clearly defined legislative framework;
 - Although draft legislation relating to charges for air navigation services

provides for the introduction of transparent and non-discriminatory incentives through charging mechanisms, these would be implemented and administered by Member States; and

- There are practical difficulties in implementing a system of incentives through differential charging, since monitoring arrangements would need to be enhanced to identify which aircraft had been equipped with new systems and which had not, and the JU would not be well placed to coordinate such an enhancement (assuming it was desirable).

10.52 Nevertheless, we suggest that the JU, as the body responsible for managing SESAME, should be able to make recommendations on the role and structure of incentive mechanisms. These might extend to suggestions on the appropriate application of charge-related incentives, proposals for the structure and level of grants to promote early aircraft equipage (similar to those applied under the Link 2000+ pioneer programme), and recommendations on the appropriate level of compensation for early replacement of legacy ground systems.

10.53 In the latter case, we envisage that the compensation required could vary significantly, depending on when legacy systems were first deployed and the length of their remaining economic lives. Against this background, it would be for an individual ANSP seeking compensation to submit a business case, demonstrating the economic and financial penalty arising from early replacement in accordance with SESAME's requirements. The JU could then assess this case and, if appropriate, either release its own funds or make recommendations to other bodies responsible for administering compensation arrangements. In either case, it would need to have the necessary technical and financial expertise to submit the business case to rigorous examination.

Resourcing

10.54 The JU's resourcing requirements would need to be established as the scope of the programme and its management role were more precisely identified through the definition phase work. At this stage, we suggest that it would be likely to require sufficient staff and other resources to undertake the following:

- Overall programme management;
- Coordination and sponsorship of research and development, validation and interoperability standards work;
- Procurement of common system specifications;
- Provision of advice on, and possible administration of, incentives;
- Financial management; and
- External liaison with other European and international bodies.

10.55 We anticipate that staffing requirements would be met, in part, through transfers and secondments from other organisations.

10.56 We note the consensus among stakeholders that the JU should be allocated the minimum administrative resources necessary to carry out its functions effectively. Given that much of its role would involve coordination and integration of work undertaken by existing bodies, we envisage that it would not need the level of

resources committed to the Galileo JU. As a further spur to efficiency, it could be required to minimise administrative resource needs, subject to performing its role effectively and meeting its other objectives.

Transition issues

10.57 The JU would have an important role in maintaining the momentum of the overall programme during the transition from the definition to the development and implementation phases and beyond. It would therefore need to be established before the conclusion of the definition work, and be sufficiently well prepared to review and develop work programmes and other deliverables prepared by the definition phase consortium. The timing of the transition period and the necessary preparatory activity would need to be defined, taking into account:

- The need for further legislation to establish new governance arrangements (as with Galileo and the European Rail Agency);
- The necessary transfer of assets, including any intellectual property created during the definition work, and resources to the JU;
- The need, as discussed below, to form working groups, probably drawing heavily on constituent members of the definition phase consortium, while re-establishing a clear distinction between system procurers and users, on the one hand, and manufacturers and suppliers on the other; and
- The fact that the JU, once established, would immediately require some funding, staff and other resources.

10.58 While it will be for the definition stage work to cover transition arrangements in detail, we have identified the broad timescales required for establishing the JU and associated governance arrangements. In our view, the JU would need to be in place at least six months to a year before the conclusion of the definition phase in order to ensure an effective transfer of management responsibility, work programmes, assets and expertise. Given the lead times for putting in place the necessary legislation, this would mean defining the key constitutional and procedural requirements during the second half of 2005.

10.59 This suggests that an initial view on these requirements, including voting rights, would need to be taken before the end of 2005. These rights could be modified to some degree before the final legislation was adopted, possibly drawing on the initial definition phase work, and the Administrative Board could also be given discretion to change them, subject to approval of the Supervisory Authority, at a later stage. Nevertheless, stakeholders would need to be confident that the voting arrangements provided an appropriate platform for discussion and agreement during the initial months of the JU.

10.60 In view of these timing issues, the Commission will need to develop proposals, for discussion with stakeholders, well before formulating further legislation. This would help to ensure the necessary stakeholder buy-in to the basic decision making process to be employed by the Administrative Board.

10.61 Going forward, the JU would need to be charged, through legislation, with ensuring

effective transition through later stages of the programme. In promoting competitive procurement, it will be particularly important to prevent particular consortia from gaining an unfair advantage through, for example, better access to key intellectual property. This could have important implications for the funding of research and development and specification work.

- 10.62 In particular, the JU would need to ensure that the funding of key programmes was consistent with non-discriminatory dissemination of results where these were needed by bidders for future contracts. It would therefore need to give careful consideration to the appropriate application of TEN-T and Framework Programme funding, taking full account of the implications of partial private sector funding for the allocation of intellectual property. In some cases, it might be appropriate to draw partly on private sector funding for research and development to be undertaken by a consortium, thereby ensuring that all parties to the consortium, as well as the JU, had a share of the intellectual property rights.

Assessment of proposed governance arrangements

- 10.63 In our view, the governance arrangements described above represent a practical way forward for the future management of SESAME. They have been developed with a view to meeting all the criteria set out in Chapter 8, and draw, where appropriate, on the precedents set by other European transport-related programmes of similar complexity and with the same political profile. They also reflect stakeholder views as far as possible, recognising that stakeholders have not yet reached full agreement on the scope and implementation of SESAME. They also seek to address some of the risks identified with SESAME in our CBA approach outlined in Chapter 7.

- 10.64 In the table below, we provide a summary assessment of our proposals against the criteria identified earlier. For each criterion, we identify the specific elements of our proposals that are intended to meet it.

TABLE 10.2 ASSESSMENT OF GOVERNANCE ARRANGEMENTS

Criteria	Specific proposals
Clear lines of reporting, efficient decision making	<ul style="list-style-type: none"> • Clear distinction between oversight, programme management and working levels • Distinction between Administrative Board and Executive Director allows for effective stakeholder participation and efficient day-to-day management • JU explicitly required, under legislation, to recognise, liaise with, and draw on work of established bodies
Able to combine wide variety of funding sources	<ul style="list-style-type: none"> • JU framework enables public and private sector funding contributions • Direct stakeholder participation through Administrative Board provides for effective risk management and encourages stakeholder funding contributions
Achieves stakeholder buy-in	<ul style="list-style-type: none"> • Direct stakeholder participation through Administrative Board encourages buy-in to broad framework and decision making process • Ongoing role for ICB, providing a channel for stakeholder views unconstrained by JU remit and constitution

Criteria	Specific proposals
Allows for smooth transition between phases	<ul style="list-style-type: none"> • Anticipation of end of definition phase through early formation of JU • Flexibility to change stakeholder representation and voting rights through the different phases of the programme • JU explicitly charged, through legislation, with ensuring smooth transition
Enables sharing of resources, avoids duplication of effort	<ul style="list-style-type: none"> • Allows for common research, development, validation and procurement effort where appropriate, while allowing airspace users and ANSPs to procure equipment and systems meeting their specific requirements • JU explicitly required to recognise, liaise with, and draw on work of established bodies
Provides for efficient direction of research, development, validation and procurement activity	<ul style="list-style-type: none"> • Allows for common research, development, validation and procurement effort where appropriate, while allowing airspace users and ANSPs to procure equipment and systems meeting their specific requirements • Delegated authority to Executive Director enables more efficient decision making • JU explicitly required, under legislation, to preserve and encourage competition between suppliers
Effective coordination of implementation activities	<ul style="list-style-type: none"> • JU has overall responsibility for programme management at the European level • JU has a role in advising on, and administering, incentives to promote coordinated implementation • JU explicitly required, under legislation, to recognise, liaise with and draw on work of established bodies
Uses minimum level of resources	<ul style="list-style-type: none"> • JU explicitly required, under legislation, to minimise use of resources, subject to meeting its other objectives • JU's role is primarily one of coordination, reducing the need for substantial in-house research and development capability (and thereby avoiding duplication)
Recognises parallel global developments in air traffic management	<ul style="list-style-type: none"> • JU explicitly required, under legislation, to ensure that SESAME proceeds in a way that is consistent with global developments in air traffic management • EUROCONTROL, EASA and other stakeholders with understanding of global developments participate directly in management of JU • JU required to recognise and liaise with appropriate international standards bodies

11. SESAME PROCUREMENT

Introduction

- 11.1 The governance arrangements described in the previous Chapter were developed with a view to facilitating some central procurement activity. While there is no clear consensus between stakeholders on the appropriate level of activity, all recognise the need to determine a proper balance between reducing fragmentation and duplication, in line with the vision of the SES, and allowing individual ANSPs and airspace users to procure systems implementation in a competitive market.
- 11.2 Against this background, this Chapter reviews procurement options and makes recommendations for further development in the light of SESAME's objectives and the procurement environment. The recommendations are compatible with the proposed governance and funding arrangements outlined in Chapters 10 and 12. At this stage, it is appropriate to consider only high-level, strategic principles and outline proposals will need to be refined as the project definition work progresses.
- 11.3 SESAME has been defined as having the following output objectives:
- Achieving cost efficiency (through economies of scale in development and avoidance of fragmentation in system implementation);
 - Providing lower costs of system procurement and maintenance (through agreed common system standards and certification);
 - Achieving industry cooperation at a Community level;
 - Achieving Community (rather than national) level standards; and
 - Achieving an increase in the speed of the introduction of agreed ATM interoperable products.
- 11.4 These key objectives provide guiding principles for the procurement strategy discussed below.

Procurement environment

- 11.5 Systems used for the provision of Air Navigation Services (ANS) include airborne systems and ground systems. Airborne systems are usually provided by airlines in accordance with international standardisation requirements and fleet fit policy. Ground ANS systems are generally provided by ANSPs, in accordance with a limited number of basic standards and local service requirements. Airport systems are also interfaced to ground ANS systems.
- 11.6 Due to the increasing level of integration between these three main system areas, there is a requirement to coordinate the introduction of new functionality and interoperability requirements. The management and funding of SESAME will therefore need to take account of procurement of all three, and this imperative has been reflected in both our CBA and our proposed governance framework. However, in view of the particular lack of standardisation in ANS systems and the scope for rationalising research and development and system specification in air traffic management, our discussion of procurement strategy focuses largely on this area.

- 11.7 Ground ANS systems are conventionally divided into communications, navigation, surveillance and air traffic management systems (CNS/ATM). The CNS subset refers mainly to the remote infrastructure (radars, communications stations and navigational aids etc) that supports the Area Control Centres (ACCs), although the communications element covers a broader range of equipment and systems. The ATM system subset refers mainly to the systems at the ACC and airports, although other systems such as flow management systems are included in this category.
- 11.8 ATM systems are currently characterised by high software content and a relatively high level of bespoke application software. The CNS infrastructure is characterised by a higher hardware content and software that operates in a more prescriptive (i.e. standardised) environment.
- 11.9 The development and implementation of large ATM systems has a poor track record in terms of delays and cost overruns. This is because such systems are characterised by:
- High software content;
 - A high level of bespoke software to meet the requirements of individual customers;
 - Demanding functional requirements, particularly in the area of data integrity and safety; and
 - A lack of standards.
- 11.10 In addition, there is a tendency to carry out research and development work within implementation contracts.
- 11.11 The need to coordinate airborne, airport and ground ANS system provision and the high level of bespoke application software in ATM systems are particular factors that need to be considered in the context of a recommended procurement strategy.
- 11.12 There are only a small number of companies with the relevant expertise to provide ANS systems in Europe. Even on a global scale, the options are restricted. Procurement strategy must therefore foster the existing competitive environment.
- 11.13 ANS systems have a long life expectancy. This is due to the high implementation costs and the extended processes involved in approving systems for operational use - particularly in the area of validating compliance with safety requirements. These issues make it cost effective for service providers to implement mid life upgrades and other progressive improvements to system functionality. As a consequence, the procurement strategy must take into account supplier in-service support. Such support can involve a wide range of activities, including day-to-day system management, fault repair (hardware and software), functionality upgrades and hardware replacement.
- 11.14 The service provider is usually the owner or operator of the systems under consideration. However, there is a trend to outsource specific services to a third party (for example communication networks). To date, this has not had a major impact on core ANS systems, but it remains a possibility in the timescales under consideration. Potentially, the governing body will need to work with outsourced suppliers.

- 11.15 SESAME foresees three main stages - project definition, development and implementation. In terms of procurement, the development stage can be considered the most critical, since it is at this stage that the detailed system architecture and design will be formulated (possibly drawing on a high level architecture designed in the definition phase), leading to a product that should be capable of implementation with relatively low risk. The proposed governance arrangements recognise these stages and they are also inherent in the procurement options considered. However, it should be noted that elements of the implementation and development stages might run concurrently in view of the need for implementation of more advanced functions.

Procurement issues

Integration and standards

- 11.16 The need to develop common operating procedures is an essential first stage prior to system development and implementation. Many projects have failed or been delayed by a lack of a full understanding of operational procedures before system design work has commenced.
- 11.17 One of the risks associated with the delivery of common systems is that the commercial advantages of competitive tender can be reduced. Essentially, there is a trade off between the benefits of commonality and the benefits of competitive tender. It is therefore important to maintain competition as far as possible, and this is recognised to varying degrees under the procurement options discussed.
- 11.18 As noted above, to date there has been a lack of common functional specifications and standards in the area of ground ANS systems. Work is underway in EUROCONTROL (Implementing Rules, functional specifications and standards) and EUROCAE (Community Specifications and technical standards) to produce a number of key standards to support the SES. The European standardisation organisations are also involved in generating aviation related standards and raising aviation standards to EN status where appropriate.
- 11.19 In the area of airborne systems, the need to adopt global standards is an essential part of the process. Aircraft must offer full interoperability at this level and this involves standardisation bodies such as ICAO and RTCA. EUROCONTROL and EUROCAE have strong links with such bodies to ensure the interoperability of airborne and ground systems is achieved. As discussed in Chapter 10, the work of all these bodies will need to be integrated with SESAME, and the proposed JU would have a key role in ensuring that their efforts are channelled effectively.
- 11.20 The work on standards is an essential prerequisite to the objectives of the SES and, in particular, interoperability objectives. However, it should be noted that the delivery of the appropriate standards is the only first step in ensuring full interoperability. The development stage is also a key process and, common development is considered to be an essential part of mitigating risks in achieving interoperability.
- 11.21 Many of the parties involved in the provision of ANS systems are already working on programmes that are intended to achieve objectives shared with the SESAME programme. For example, and of particular relevance, are the iTEC-eFDP and

COFLIGHT programmes, which involve the joint procurement of interoperable FDP systems. SESAME procurement must build on these initiatives to achieve consensus on fully interoperable systems. Specific transition arrangements will need to be determined at the project definition stage.

- 11.22 Given the need to achieve interoperability of ground, airport and airborne systems, it is envisaged that SESAME development and implementation may be required to deliver common specifications or software components for inclusion in airborne and airport systems. This is likely to be necessary in closely coupled systems such as Controller Pilot Data Link Communications (CPDLC).
- 11.23 Suppliers providing services under the development contracts would be in an advantageous position with regard to selling systems outside Europe. It is proposed under the procurement strategy that the contract conditions for development contracts should include a royalty clause and that the JU should have a significant share of the IPR rights (the allocation depending on contributions to funding, as noted in paragraph 10.62).
- 11.24 In order to achieve the benefits of an integrated air traffic control system, it is important to coordinate and possibly synchronise implementation of some systems in more than one country. This aspect has been covered in the proposed outline governance arrangements. It is an important aspect of the procurement, that the suppliers have adequate resources to meet this demand.

Separation of system elements

- 11.25 For modern systems, the provision of application software can be divorced from the provision of hardware and operating systems. Also, the basic application software design could be considered to be part of the development phase, awarded as result of competitive tender. The implementation phase has a hardware, installation and commissioning bias and does not need to be provided by the same supplier. Hence, it is possible to utilise a different supplier for hardware and software and also permit further competition for the implementation aspects.
- 11.26 The ACC ATM systems represent the biggest area of work for SES. Subject to project definition and specifically the system architecture, it is possible to break the ATM system down into key blocks (i.e. system blocks as opposed to functional airspace blocks). For example, such separation could involve separate servers for flight data processing, radar data processing, support information processing and controller workstations. This partitioning would allow development processing to be carried out by different suppliers, thereby sharing the work between suppliers and reducing overall risks. In essence, it could provide a modular approach. However, such an approach would require a systems integration authority/contract. Details of possible system partitioning are dependant on the systems architecture studies inherent in the project definition stage.

Procurement rules

- 11.27 The procurement processes for the development and implementation phases will inevitably be complex and are likely to require contractual commitments over

extended periods. To the extent that the governing body could be deemed to be a public body, the Commission's procurement rules could apply, depending on the procurement option adopted. It is also noted that where procurement is carried out at national level, national procurement legislation may apply (although for public bodies the Commission's Rules will apply). Therefore, the procurement strategy will need to be examined during the project definition stage, against the requirements of the Commission's and national procurement framework.

11.28 Where appropriate, the outline procurement options described are designed to meet the objectives of the Commission's rules by:

- Utilising the open procedure for contract award, although the restricted procedure may be appropriate in some cases;
- Ensuring that competitive tender is applied for each of the research and development and implementation stages; and
- Recognising that all options involve a mix of supplies and services (bespoke software is defined as "services").

11.29 The research and development phase may have elements that are defined under the Commission's Rules as a design contest. This procedure permits the evaluation of competing designs and a negotiated contract awarded to the winner.

11.30 Although not explicitly required by the Commission's Rules, the splitting of system provision into hardware and software or by functional area has the potential to provide sharing of the work between suppliers in the field.

Procurement options

11.31 There are many possible combinations of procurement approaches that could be adopted. In order to examine principles at this stage, three key options are described, together with their advantages and disadvantages. These three options represent a range of approaches, from fully centralised procurement to a largely decentralised option. There is a clear requirement for in-service support to be specified as part of the development and implementation phases. All three options assume that, where appropriate, building structures and services are specified and contracted locally on a competitive basis.

Option 1: Centralised procurement

11.32 In this scenario, the JU would be responsible for the bulk of SESAME system procurement. Specifically, it would take responsibility for the research and development contracts and for the provision of systems for implementation. Essentially, the governing body would be responsible for providing systems hardware and software to individual service providers under call off contracts. Service providers would negotiate with the supplier to incorporate local requirements, and for arranging for the installation and commissioning activities. They would also be responsible for the provision of buildings and services where appropriate. Arrangements for through life support would also be the responsibility of the JU.

Option 2: Centralised research and development procurement/Local implementation procurement

- 11.33 In this scenario, the JU would procure centrally funded research and development. This research and development activity would be aimed at minimising risk for the implementation stage, and for ensuring interoperability under terms of the SES legislation. It is recommended that this activity should extend to the delivery of the basic application software, which could be provided free or at reduced cost to service providers as an incentive to adopt the preferred standard, this may need to be backed-up by legislation. Procurement of system hardware, local software adaptation and integration, installation and commissioning, as well as long term support, would all be negotiated by the individual service providers under a competitive process.

Option 3: Local competitive procurement

- 11.34 In this scenario, SESAME would deliver interoperability standards and generic functional requirements. SESAME would also instigate research and development activity in selected areas to ensure that the supplier industry was well placed to respond to procurement specifications incorporating SESAME requirements. Individual service providers would incorporate the interoperability standards and generic functional requirements into a local procurement specification. This specification would be used to initiate the normal competitive tender process for systems and for through life support.

Advantages and disadvantages of options

11.35 In the table below we summarise the advantages and disadvantages of each of the procurements options.

TABLE 11.1 ADVANTAGES AND DISADVANTAGES OF PROCUREMENT OPTIONS

Option 1: centralised	Option 2: centralised research and development / local implementation	Option 3: local competitive
ADVANTAGES		
1). It provides firm configuration control to ensure compliance with SES standards; 2). It would provide the highest level of system commonality and potentially lowest costs (assuming cost reductions from reduced duplication were not outweighed by additional administration and bureaucracy); and 3). It would provide the governing body with the best means to coordinate installations.	1). It ensures that commonality of the basic design is achieved and enables economies of scale to be exploited; 2). It develops what is essentially a COTS software product for delivery to service providers; 3). It can provide an incentive to adopt the standard basic software; and 4). It provides the service providers with the opportunity to tender for, and negotiate, the implementation contracts.	1). The service providers will be free to pursue their own commercial judgement in all aspects of the procurement.
DISADVANTAGES		
1). It would be seen by service providers as bureaucratic and remote; 2). The governing body would require access to more resources than the other options; 3). Service providers would feel that they were no longer in a position to manage their businesses effectively; and 4). There might be reduced competition, depending on the number of specifications and systems developed.	1). It places a larger workload on the governance arrangements, particularly in the area of development; and 2). Service providers may prefer to specify and negotiate their own applications software provision (Option 3).	1). This would be a high risk strategy in terms of achieving the objectives of the Single European Sky; 2). The overall costs will be higher than under the second option; and 3). The use of functional specifications and standards alone are considered a higher risk approach to achieving full interoperability.

Procurement – suggested approach and stakeholder views

11.36 We consider that the principles described under Option 2 offer the best balance in terms of meeting the SESAME requirements while recognising the need for commercial judgement on the part of service providers. Prior to project definition, Option 2 should be considered a flexible approach that avoids the extremes of Options 1 and 3 but can be tailored to suit the findings of project definition and individual circumstances. The central management of basic system applications software ensures

a high level of configuration control in terms of interoperability and common functionality, while the responsibility for buildings, services, local software adaptation and system hardware rests in the areas with the primary knowledge and experience. These principles provide a COTS software product to service providers.

- 11.37 The possibility that the provision of application software on a free or reduced cost basis could be a strong incentive to the service providers to adopt the standard software under Option 2. It is important that the governance arrangements are adequately resourced, with the appropriate level of expertise to manage the procurement programme.
- 11.38 The provision of common specifications or software modules for inclusion in airborne and airport systems should be considered as part of SESAME. This would reduce the risk to the programme where systems were tightly coupled.
- 11.39 Where existing procurement initiatives designed to meet SES objectives have been initiated, SESAME procurement strategy must build on these initiatives to achieve consensus on fully interoperable systems. Specific provisions for the transition arrangements for these initiatives will need to be determined during the project definition stage.
- 11.40 Given the limited number of suppliers of ANS systems within Europe, the possibility of suppliers from outside Europe should not be excluded from the procurement strategy. This may be necessary to efficiently provide expertise and to ensure a competitive environment.
- 11.41 We suggest that the requirement for in-service support should be specified and evaluated when development and implementation contracts are tendered and evaluated. Again, the treatment of intellectual property rights within the development contract would depend on funding contributions, but the JU should have a share in these.

Stakeholder views

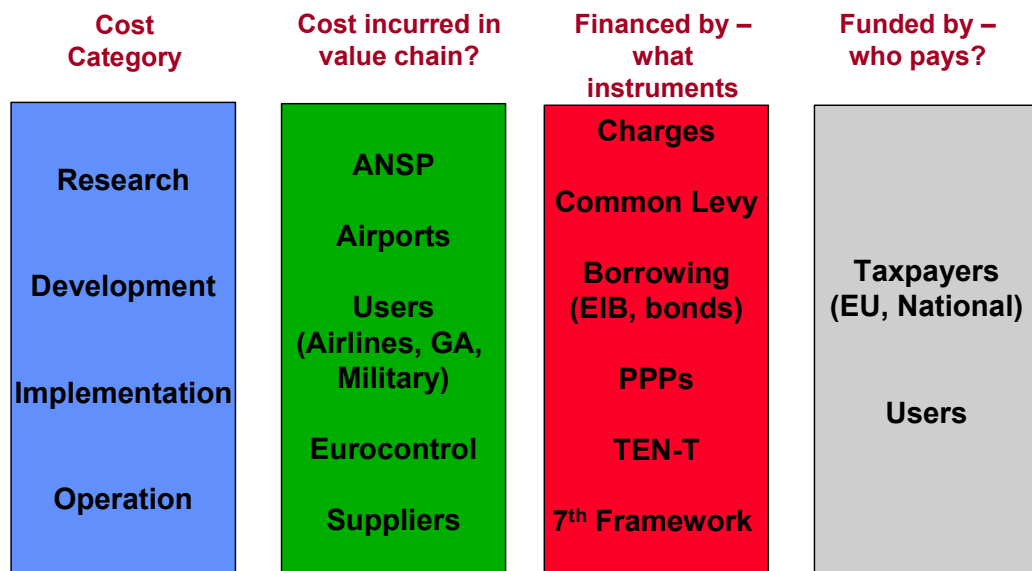
- 11.42 In discussion of these options at the ICB sub-group, members thought that there would be cases for using all three options for aspects of SESAME. However, that options 2 and 3 were likely to be used most often. There was a feeling that a blended approach using aspects of options 2 and 3 might be most attractive to the ANSP community. The Commission saw most merit in following the approach outlined in option 2.

12. SESAME FINANCING AND FUNDING

Introduction

- 12.1 This Chapter presents a range of options for the financing and funding of the incremental costs of the SESAME definition and implementation programme. The values used in the Chapter are drawn from the results of the costs benefit analysis, and as such are illustrative and subject to refinement during the definition stage of the programme.
- 12.2 Our financing and funding analysis examines the incremental costs (and the timing of them) in developing the SESAME programme. However, it also examines the cases where existing research programmes will be redirected from existing uses to the aims of SESAME and where implementation of programmes needs to be kick-started.
- 12.3 Costs are likely to be incurred by a wide range of stakeholders including Air Navigation Service Providers (ANSPs), airports, aircraft operators, military and general aviation operators, as well as key parts of the supply chain including system manufacturers and research organisations such as EUROCONTROL.
- 12.4 The distinction between **the categories of costs** that are incurred in the value chain, and **how they are financed and funded** is outlined in Figure 12.1. The distinction between how the incremental costs of SESAME are financed through appropriate instruments, and ultimately **who is responsible for paying / funding** these costs is critical to the remaining discussion in this Chapter.

FIGURE 12.1 LINK BETWEEN COST, FINANCING AND FUNDING



- 12.5 The impact of SESAME in terms of changing the level and timing of costs is addressed in the remainder of this Chapter, together with the following:

- The **rationale** for the Commission **funding support** to SESAME and **risks** associated with the programme;
- Lessons from **funding arrangements for similar programmes**;
- Possible **financing instruments** available to stakeholders;
- **Sources of funding** for SESAME;
- The **level of funding** that may be appropriate for the Commission;
- The **role of the Joint Undertaking**.

The rationale for the Commission's funding support for, and risks of, the SESAME programme

- 12.6 All stakeholders recognise that introducing the SESAME programme will have an impact on the costs of the industry. In the short to medium term, incremental costs will be incurred through a new institutional structure, a focussed research and development programme and the timescales of implementation programmes being brought forward. The financial benefits of the programme are likely to materialise in the medium to long term. There may also be a re-focusing of existing research, development and implementation programmes to the road map set out by the SESAME definition phase.
- 12.7 Taking a long term perspective on investment and funding has proven difficult for the air transport industry, as short term cost pressures tend to drive behaviour. Therefore, the industry needs to be encouraged to take a longer-term strategic view to achieve the full benefits of SESAME. European Union funding will both accelerate the realisation of the benefits of a Community-wide, inter-operable network and also increase the benefits by providing an incentive to maximise the geographic coverage of the implementation. Network benefits will be increased and brought forwards in time if implementation is coordinated in a planned implementation (rather than member state ad-hoc implementation). There are also significant economic benefits available from implementation of SESAME.

The risks of SESAME

- 12.8 To be most effective, the funding strategy for SESAME will need to reflect and contribute to the management of the risks in the programme. Risks that are expected to have a particular impact on the funding of SESAME, some of which have already been highlighted, include the following:
- SESAME will be safety critical for large numbers of people and hence the monetary and reputational costs of system failure could be very high;
 - delays and costs resulting from failure to fully coordinate a large and diverse group of stakeholders including a large number of national governments;
 - major IT projects have a significant technology risk and a tendency to be subject to cost and time overruns; and
 - the lengthy development period may require that the system adjusts during development to as yet unknown changes in supporting technologies, including information technology generally and telecommunications.
- 12.9 The risk profile of the project can be expected to decline during the development

period as implementation gets closer and the development issues are resolved. Hence funding costs and the barriers to the private sector fully engaging should decline over time. This is reflected in the profile of likely European Commission contribution during the lifecycle of the project.

Lessons from funding arrangements for similar programmes

- 12.10 In order to assess the strengths and weaknesses of different funding models, we have reviewed a number of comparators, drawn from a range of European aerospace programmes. The majority of these comparators are reviewed in greater detail at Appendix C.

Galileo

- 12.11 Two consortia of leading European aerospace companies are competing for the contract to build and finance Galileo as part of a tender process launched in October 2003. Private funding will cover two-thirds of the deployment cost of Galileo, while EU governments will fund the remaining third and have already agreed to pay for the €1.1bn development cost. The Commission is hoping to get a dozen countries to join the list of Galileo partners, following a landmark cooperation agreement with China, which has committed €200m to Galileo.

EFDP

- 12.12 The eFDP flight data processing programme had the overall objective of improving interoperability, developing a common platform and establishing new operational concepts.
- 12.13 The initial development of the programme was estimated to cost €73 million for the common element and €27 million per ANSP for specific elements. EUROCONTROL originally intended to fund the common development itself, but as the estimated cost increased by 2-3 times in the course of the programme it sought support from the ANSPs. The ANSPs were not prepared to support the common development work and the programme was terminated.
- 12.14 There are now two systems in development, i-TEC (supported by Germany, Spain and probably the UK), which is “bottom up” and based on a development of existing systems, and Coflight (supported by France and Italy), which is a new “top down” system. In each case, initial versions are expected to be in place by 2008, with full versions of i-TEC from 2012 and of Coflight from 2014.

Link 2000+

- 12.15 The research and development programme supporting Link 2000+ was fully funded by EUROCONTROL from user charges, although airlines and ANSPs provided expertise. Implementation, in the sense of aircraft equipage and ground system procurement, was to be funded by the airlines and ANSPs.
- 12.16 EUROCONTROL is proposing incentives for the airlines as well as setting mandates for forward and retrofit equipage. It originally proposed two possible approaches –

direct subsidies for early equipage and differential route charges. The latter approach was rejected as unfair competition by the airspace users.

- 12.17 The final mandates and system of incentives are not yet finally approved, although a pioneer incentive scheme has been running for some time. 100 aircraft have been equipped, giving far less than the necessary 25% of flights needed to realise real benefits. Incentives have been set at £20k per aircraft, below the estimated £30k needed to provide and install the software, although the actual cost may be significantly below this estimate. Without a decision on mandatory equipage, the programme is unlikely to succeed.
- 12.18 EUROCONTROL will now seek TEN-T funding for the full programme.
- 12.19 So far, ANSPs have resisted equivalent incentive arrangements on the grounds that the use of funds from route charges to provide incentives would amount to using industry money to cross-subsidise certain ANSPs.

New Scottish Air Traffic Control Centre PPP

- 12.20 In 1993, the UK Government announced that the New Scottish Air Traffic Control Centre to be built at Prestwick would be designed, built, maintained for 25 years and funded via the Private Finance Initiative (PFI) and operated by the UK's National Air Traffic Services (NATS). NATS had reservations about losing control of major technical assets, contending that systems needed to be continually updated, and that if NATS did not own the assets its ability to carry out upgrades would be limited. Commercial negotiations with PFI providers proceeded slowly and were eventually overtaken by the Public Private Partnership (PPP) for NATS itself, which resulted in the planned date for opening the centre being delayed till 2009.
- 12.21 The PFI procurement process was slow. It was not until March 1997 that a consortium comprising Lockheed Martin (systems) and Bovis (construction) was declared the preferred bidder. In December 1998, NATS submitted a draft PFI agreement for approval by the government. Following further discussions between government and NATS, it was decided in early 1999 that it was no longer appropriate to pursue the contract under PFI.
- 12.22 Following this step, there was a review of the contracting strategy for the entire New Scottish Centre project, which concluded there would be significant advantages to contracting directly with Lockheed Martin for the systems, and retendering the building contract. In February 2000 an agreement was signed with Lockheed Martin, and separate contracts let for construction of the building. In 2000, the UK Government expected the revised contracting strategy to save up to £100 million when compared with the original post-PFI estimates. However, after a number of contractual difficulties and following the impact of September 11, NATS suspended work tendered under a contract on a conventional basis with Lockheed Martin.

Implications for funding SESAME

- 12.23 These comparators suggest implications for the funding of SESAME which include:

- The cost to the public sector of investment in development to kick-start a high technology project like Galileo or SESAME can be shared with other countries outside of the European Union;
- Realistic budgeting and tight cost control if a multi-year technology project is to be successful;
- In order to access funds from a wide range of sources, a wide range of partners must “buy-in” to the project;
- Using a PPP to develop and implement a major, cutting edge technology project is difficult. PPPs are more suitable for implementing well-established technology through a single project;
- Providing committed funding to a project provides greater certainty to stakeholders in planning and implementation;
- Establishing consensus across stakeholders as to the form of incentives for implementation of a technology programme may prove difficult; and
- Without strong central control, “competing” systems can develop with implications for procurement costs and interoperability.

Possible financing instruments available to stakeholders

- 12.24 In our study for the Commission on Financing of the Single European Sky¹³ we examined a number of financing instruments for the implementation costs of the Single European Sky legislation programme.
- 12.25 In this section we outline the options that would be applicable to the financing of SESAME.
- 12.26 While the funding for the incremental costs of SESAME will ultimately come from either contributions from taxes (through the Commission or national governments) or from various fees and charges paid by the users of air navigation and airport services, these funds will be channelled through a variety of different institutions. A number of different instruments for financing these mechanisms are discussed below. In practice, a number of these instruments will be used simultaneously.
- 12.27 All stakeholders will draw upon a variety of financing instruments in order to smooth financing costs.

EIB

- 12.28 The EIB sees SESAME being consistent with its objectives and has a mandate to fund product development costs where this is likely to lead to other lending (implementation) opportunities. However, under the rules of the EIB, SESAME development and equipment procurement contracts are usually required to be subject to open tender.

Private finance

¹³ Financing of the Single European Sky, 2004, Steer Davies Gleave and the Solar Alliance

12.29 Without clear support from public sector bodies, financial institutions will be concerned regarding repayment of any loans. In the particularly risky development stage, public sector guarantees would result in low cost commercial loans, which would be more expensive without this support.

12.30 Once equipment sales are being made, the financial institutions are likely to be attracted to funding purchases by ANSP, airports and airlines (in the latter case, the resale value of the equipment may be important). Financial institutions can be expected to both provide loans to fund equipment purchases and to lease equipment.

Securitisation

12.31 Securitisation is a widely used financing technique which converts a future stable cash flow into a lump sum cash advance from the sale of bonds. While securitisations can raise large amounts of low cost finance, they involve complex legal structures designed to limit the risk taken by investors in the bond. This complexity increases the set-up costs of a securitisation and may also limit future operational flexibility. Securitisation has been used by the Canadian ANSP, NAV CANADA, to raise over C\$2 billion of debt to finance, among other things, modernisation of its hardware and software.

PPP

12.32 A PPP involves the public and private sectors working in cooperation and partnership to provide infrastructure and services. It is one of a range of alternative structures that fall between conventional procurement through state ownership at one end of the continuum and full privatisation at the other.

12.33 Instead of the public sector procuring a capital asset by paying for it in full at the implementation stage, the effect of a typical PPP structure is to create a single standalone business, financed and operated by the private sector. The purpose is to create the asset and then deliver a service to the public sector client, in return for payment commensurate with the service levels provided.

12.34 Key features of a PPP therefore include:

- Buying specified outputs. The private sector should determine the inputs required, including infrastructure and skills, to achieve that specified output.
- Creating a process that delivers the service required to the necessary standard throughout the lifetime of the project.
- Aligning the interests of the user, the service provider and the major funders. It is in the funders' interests that the output is supplied to the agreed standard.
- Establishing a relationship between public and private sectors, that is based on partnership rather than confrontation.
- Providing the appropriate training, motivation and reward for staff to ensure that quality services are provided on a consistent basis.

12.35 The most obvious application of a PPP in the context of SESAME is for a private sector consortium to implement and then maintain SESAME compliant hardware and

software for ANSPs. The private consortium would implement a system which satisfies parameters laid down by the ANSP and then to maintain it to agreed standards for a further 30 years. The maintenance could include periodic refreshments to the technology to keep it up to date. The Unitary Payment paid to the consortium over the operating period would incentivise the consortium to maintain the system to agreed standards of reliability and functionality.

- 12.36 As SESAME is likely to be concentrated on non-capital infrastructure but more systems infrastructure any PPP would need to be tailored to these circumstances.

Conclusion of possible uses of financing instruments

- 12.37 The choice of financing instruments to be used by stakeholders will be determined by its financial position and own governance arrangements (for example some ANSPs cannot draw upon private financing arrangements). Moreover, the charges that stakeholders levy to recover the costs of financing are determined by legislation and regulatory constraints. We would expect a wide range of these instruments to be used during the SESAME development and implementation programme.
- 12.38 We would expect that EIB and private finance or debt instruments to be more popular than the more innovative forms of financing discussed: securitisation and PPP.

Funding mechanisms

Contributions from general taxation at a member state or community level

Member States

- 12.39 Some Member States may want to support local manufacturers with development or production subsidies in order to generate jobs and hence positive external benefits. In the aerospace sector there is a tradition of Member States using “Launch investment” to achieve these objectives. There are also Member States that make direct contributions to research and development programmes.
- 12.40 Launch investment is used by a number of Member States including France, Germany, Spain, the Netherlands, Italy and the UK to support the design and development of civil aerospace projects. In the UK, this investment is repayable at a real rate of return, usually via levies on sales of the product. The government shares in the risk, as the company may not achieve sales at the level or price forecast. The investment is repayable once a specified return has been produced.
- 12.41 In the UK, launch investment is available for projects which satisfy the following criteria:
- the project is technically and commercially viable;
 - public investment is essential for the project to proceed on the scale and in the time-scale intended;
 - the project will generate considerable positive externalities; and
 - government will recoup the investment at a real rate of return.

- 12.42 If it is decided to support an application, the government will provide the minimum support required for the project to go ahead. The government closely monitors the progress of a supported programme. Payments are linked to actual expenditure by the company and to the achievement of specific technical milestones.
- 12.43 Under international agreements between the European Union and the United States there are limits on launch investment for aerospace projects. The main limits are:
- direct support limited to 33% of total development cost of a project;
 - direct support to be repaid within 17 years at a rate of return at least marginally above the cost of Government borrowing;
 - indirect support (for example research and development funded by government) are limited to 3% of the annual commercial turnover of the local civil aircraft industry; and
 - transparency on both direct and indirect supports.

TEN-T Programme

- 12.44 Within the Commission's budget there are a number of instruments which could be used, perhaps in combination, to fund SESAME. In order to speed implementation and to encourage the timely implementation of SESAME, the Commission may decide to provide a combination of financing or outright funding through a number of mechanisms.
- 12.45 Trans-European transport network (TEN-T) funding of €30 million is planned for the SESAME definition stage, between 2005 and 2007. TEN-T has provided a limited contribution to the funding of the ATM industry over the last eight years.
- 12.46 TEN-T was established in July 1996 when the European Parliament and Council adopted guidelines for the development of the TEN-T. These guidelines focus on support for traffic management systems and other transport infrastructure that serve the entire continent, carry the bulk of the long distance traffic and bring the geographical and economic areas of the Union closer together.
- 12.47 Under the terms of Chapter XV of the EC Treaty, the European Union must aim to promote the development of trans-European networks as a key element for the creation of the Internal Market and the reinforcement of Economic and Social Cohesion. This development includes the interconnection and interoperability of national networks, as well as access to such networks.
- 12.48 In the transport sector, proposed regulation focuses aid on a limited number of projects and authorises aid of up to 50% of the costs of cross-border projects as an incentive in exceptional cases. The aid will be subject to compliance with the objectives of modal shift and interoperability. The aims of TEN-T are to promote regional cooperation, ensure technical and administrative interoperability, and encourage implementation of new technologies like traffic management systems and measures to improve safety and security. In the absence of such measures, bottlenecks would occur especially at border crossings even if infrastructure works were completed.

- 12.49 The Commission is proposing more than €22 billion in funding over the period 2007 to 2013 for the trans-European transport and energy networks including the Galileo programme. The aim is to give the European Union sufficient budgetary resources to encourage public and private investment in major infrastructure and key technologies in the energy and transport sectors in the interests of a true internal market and greater competitiveness
- 12.50 This budget, which represents a significant increase over the previous period, will make it possible to co-finance the work on 30 TEN priority projects (costing a total of €225 billion) and programmes to deploy the European air traffic and rail management systems.

Framework programme for research

- 12.51 The Sixth Framework Programme (FP6) is the European Community Framework Programme for Research, Technological Development and Demonstration. It is a collection of actions at EU level to fund and promote research. SESAME would be funded under the Seventh Framework Programme (FP7) and subsequent programmes.
- 12.52 Following the principle of subsidiarity, projects have to be transnational. In other words: only consortia of partners from different member and associated countries can apply.
- 12.53 The Framework Programme must serve two main strategic objectives: strengthening the scientific and technological bases of industry; and encouraging its international competitiveness while promoting research activities in support of other EU policies.
- 12.54 In general, the EU contributes only a certain percentage of the total costs of a project. Participants have to mobilise their own resources accordingly. The percentage of the EU's financial contribution depends on the type of activity. There would be the potential for this and future research programmes making substantive contributions to the research and development cost of SESAME through the FP7.

EUROCONTROL

- 12.55 EUROCONTROL is providing €30 million for the funding of the SESAME definition stage, through cash and in-kind contributions. Its budget is paid out of member state contributions, which are usually passed directly onto users through the cost recovery mechanism basis of ANSP charges.
- 12.56 EUROCONTROL is presently spending an average of €150-200 million per annum on air traffic control research and development and co-ordination of implementation.
- 12.57 Encouraging the development of SESAME is consistent with EUROCONTROL's primary objective: *“the development of a seamless, pan-European Air Traffic Management system”*. Therefore, we would expect EUROCONTROL to make a contribution to the costs of SESAME through the redirection of some of its existing budget and expert human resource pool.

Other stakeholder contributions

- 12.58 **ATM system suppliers** could be incentivised to participate in funding development costs by the prospect of being well positioned to supply equipment. Granting some Intellectual Property rights for sales outside of the EU to ATM system providers would incentivise them to participate in funding some of the SESAME research and development programme.
- 12.59 Most European **ANSPs** can be expected to add the incremental costs of SESAME compliant equipment to their cost base, which they recover via air navigation charges. In the case of NATS, they would seek to get their regulator, the CAA, to add their investment in SESAME compliant equipment to their Regulatory Asset Value which is remunerated in their charges.
- 12.60 If the SESAME programme is announced well in advance and is seen as credible by the ANSPs, they will be able to manage their investment programme to minimise the need to scrap relatively new non-SESAME compliant hardware and software and the significant transitional arrangements
- 12.61 The Commission is currently developing a regulation laying down a common charging scheme for air navigation services which cover the costs of ANSPs. The current draft of the regulation provides in the preamble that *“Specific common projects, which would benefit from funding on the basis of air navigation charges with a view to improving collective infrastructures, and the associated financing modalities should be identified under separate instruments.”* SESAME is designed to improve the collective infrastructures and hence this regulation as drafted could provide a legal basis for the costs relating to SESAME to be funded from the air navigation charges.
- 12.62 The draft regulation also provides for **Member States** to implement incentives schemes to, among other things, encourage ANSPs and airlines to improve the provision of air navigation services. However, it is important to note that the Commission cannot levy differential air navigation charges. However, as SESAME is designed to improve the provision of air navigation services, the draft regulation provides a clear legal basis for Member States to:
- increase the charge received by ANSPs for a period of up to five years to cover the costs of developing and implementing SESAME; and
 - reduce the charge paid by airspace users to reflect efforts made to optimise the use of air navigation services, e.g. implementing and operating SESAME compliant equipment.
- 12.63 The draft legislation would allow the introduction by **Member States** of a higher charge for aircraft which are not SESAME compliant and so provide an incentive for airlines to implement the new equipment. However, given the LINK 2000+ precedent, differential route charges might be rejected as unfair competition by the airlines. An alternative approach would be to increase the levy for all aircraft and use the additional revenue to subsidise the capital cost of equipment and for other uses relating to SESAME. This is the approach included in the illustrative funding model presented below.

- 12.64 The draft Charging Rules legislation, Article 14 allows for the costs of common projects to be financed through specific unit rates that are added to the unit rates for the relevant charging zones.
- 12.65 **Airports** are expected to incur significant costs associated with SESAME, and we would expect that these costs would in a large part be passed on to users through charges, and financed through a variety of commercial instruments. However, some airports operate in a price controlled / regulated environment, and therefore any incremental investment and costs from the SESAME programme would need to be fully justified through commensurate output / benefits.
- 12.66 **Airlines** are likely to incur some incremental direct costs (for airborne equipment) and indirect costs from the user charges levied from ANSP and airport user charges. As an industry, airlines have a poor profitability record. Severe cost pressures and an aggressive competitive environment mean they have a natural reluctance to invest unless they see a short and secure payback period or are required to do so by legislation. Hence, subsidies to airlines to cover part of the cost of investing in SESAME compliant equipment may be required to ensure rapid and comprehensive implementation by airlines. Financial institutions can also be expected to help fund capital costs subject to expectations of an adequate financial return, particularly for new aircraft, given that many aircraft are leased.

What is the appropriate level of the Commission's contribution to the SESAME programme?

- 12.67 The incremental costs of SESAME will in part determine the required contribution from the Commission. However, in addition to that, the Commission may want to direct and influence the direction of the programme through further appropriate funding and incentive arrangements.
- 12.68 Examining the CBA results outlined in Chapter 7, there are three areas where the Commission could be expected to contribute to the costs of SESAME. These are areas where significant risks are associated with the funding of the programme:
- The costs of the new institution – suggested as a Joint Undertaking in Chapter 10;
 - A contribution to the research, development and validation costs associated with the Road Map and determining the ATM Master Plan; and
 - A contribution to the implementation costs of the programme, though incentives and perhaps compensation for bringing forwards costs for more timely investment to provide investment network benefits.
- 12.69 In Table 12.1 we set out indicative levels of Commission's contribution to the main element of the SESAME programme. These are based on the CBA, the total costs of the ATM research and development programme, and an expectation of the implementation costs brought forwards by the acceleration of timescales. However, at this stage these numbers are illustrative and intended to show the broad order of magnitude of the Commission's funding. The level of contribution will be subject to finalisation during the definition phase of the programme.

TABLE 12.1 INDICATIVE COMMISSION CONTRIBUTION TO THE FUNDING OF SESAME (€ M)

Source of funding requirement	Duration	Annual (indicative) € m	Total (Indicative) € m
Joint Undertaking costs	Enduring (30 years)	10	300
Research, development and validation	Seven years of framework	50	350
Implementation Costs	First 10 years of programme	150 - 250	1,500 -2,500

The role of the Joint Undertaking

- 12.70 We would expect there to be appropriate management and overview of the Commission’s and other funding support provided to SESAME. Key milestones and monitoring processes will be required. The JU could be expected to play a significant role in this process, and would ultimately have the powers to withdraw funding support from programmes if they failed to meet key objectives or expectations of the support.
- 12.71 The JU would be responsible for combining and coordinating different sources of funding from the Commission, and other stakeholders. Moreover, it would coordinate further applications for TEN-T and FP7 funding as appropriate for centrally funded activities.

APPENDIX A
**A DESCRIPTION OF OUR KEY STEPS IN THE ATM DEVELOPMENT
PROGRAMME**

A1. INTRODUCTION

- A1.1 To undertake our cost-benefit analysis (CBA), we have grouped the future ATM development programme into ten steps. Each step delivers new concepts, technologies and the benefits of improvements in capacity, flight efficiency and safety. Each step will contain several of the EUROCONTROL Operational Improvements (OIs) defined in the ATM 2003+ strategy, although not all OIs are covered by our steps.
- A1.2 Each step is described along with its main costs and benefits in this Appendix. The quantified benefits are usually taken from previous studies or derived from reports such as the Performance Review Reports (PRRs) published by EUROCONTROL. Where the study team has estimated the benefits of a step, our approach is described.
- A1.3 In the financial analysis, the benefits of each step are assumed to build up during the implementation period leading to the full benefit being achieved from the network operational date.
- A1.4 The quantified benefits must be treated as approximate and requiring additional validation in all areas during the development phase. In many cases, the operational concept for the steps is not known. Our approach does not consider the benefits of improved vertical flight profiles. In the timescales of the study, the study team was not able to make a reliable estimate of this benefit.

A2. STEP 1: ADVANCED AIRSPACE OPTIMISATION AND STRUCTURE

- A2.1 This step promotes the continued optimisation in use of airspace, including the improved collaboration between civil-military users, harmonisation of airspace structure and classifications and more direct routes structures. Some of the benefits of this step include the creation of Functional Airspace Blocks (FABs), but detailed consideration of this is outside the scope of this CBA.

A3. STEP 2: OPTIMISED COLLABORATION

- A3.1 This step is the increased planning and co-operation between stakeholders in an airport environment. It provides optimum use of the airport resources, including slots and stands.
- A3.2 The concept of Collaborative Decision Making (CDM) (presently being developed in Europe) is included. Early versions of ground automation tools such as Arrivals Manager (AMAN) and Departure Manager (DMAN) are required for this step to be implemented.

A4. STEP 3: EARLY ATM DATALINK APPLICATIONS

- A4.1 This step is based on the near-term datalink such as strategic CPDLC and D-ATIS. It broadly encompasses the Link2000+ programme.
- A4.2 This step includes:

- Aircraft and ground datalink equipment installation.
- Adaptation of controller working positions (CWPs), including the interface and tools.
- Implementation of a suitable ground network and development of automation tools for uplinking of data.

A4.3 It is assumed to deliver capacity benefits of 11% (source: The Commission's datalink roadmap). Other benefits, e.g. improved safety through reduced communications errors) are not quantified.

A5. STEP 4: APPLICATIONS USING DOWNLINKED AIRCRAFT DATA

A5.1 This step is built on applications supported by Mode S Enhanced surveillance or possibly by "ADS-B out". It includes the use of downlinked data to support:

- Controller access parameters (CAPs), i.e. downlinked data that is presented on the CWP.
- Downlink parameters for increased efficiency of tactical separations and ground automation tools.

A5.2 This step includes the use of downlinked data to support advanced automatic tools such as Arrivals Manager (AMAN), Departure Manager (DMAN), MTCDD (Medium Term Conflict Detection), and Surface Management.

A5.3 This step requires the implementation of:

- A Mode S enhanced surveillance infrastructure.
- Adaptation to CWPs and related ground systems, including user interface, new controller support tools, greater integration with RDP and FDP.

A5.4 This step delivers a 27% capacity increase (source: datalink roadmap).

A5.5 This step is based on the Commission's datalink roadmap Step 2 ("Applications relating to downlinked aircraft data") (source: datalink roadmap).

A6. STEP 5: AIRCRAFT SPACING APPLICATIONS (ASAS)

A6.1 This step is the implementation of aircraft spacing applications based on ASAS for both en-route and terminal airspace. It includes applications such as airborne spacing, crossing and passing manoeuvres and final approach spacing.

A6.2 This step is based on the Commission's datalink roadmap Step 3 ("Introduction of spacing") (source: datalink roadmap).

A7. STEP 6: ADVANCED DATALINK APPLICATIONS

A7.1 This step extends the datalink applications defined in step 3. It specifically aims to provide more support for increased automation such as flight plan consistency checks and dynamic route availability. This step includes the downlinking of aircraft intent data for medium-term conflict detection, downstream conflict checks and advanced

multi-sector planning. Uplink of real-time route availability is also provided by this step.

A7.2 This step is assumed to include development of new, advanced FDP systems, including the “Flight data object” concept presently under development in EUROCONTROL. Developments to ground automation tools may also be required.

A7.3 Accurate quantitative data was not available to estimate the benefits of this step. An increase of 30% was assumed by the study team.

A7.4 This step is based on the Commission’s datalink roadmap Step 4 (“Extension of a/g ATM applications”) (source: datalink roadmap).

A8. STEP 7: ADVANCED 3-D RNAV NAVIGATION

A8.1 This step is based on the ongoing implementation of P-RNAV followed by a mandate for RNP RNAV.

A8.2 This step requires the implementation of:

- P-RNAV and RNP RNAV avionics.
- New controller tools to support RNAV operations in high-density airspace, for example route conformance monitoring of closely spaced parallel RNAV routes.
- Advanced data management systems to ensure higher integrity of aeronautical data.

A9. STEP 8: AIRBORNE SEPARATION/SELF-SEPARATION

A9.1 This step is based on an advanced use of ADS-B/ASAS to allow aircraft to separate themselves from one another. This step therefore allows a considerable reduction in the complexity of ground systems, but at the expense of increased avionics.

A9.2 Airborne separation delivers a capacity increase of 39% and self-separation adds an additional 50% (resulting in a total of 89%) (source: datalink roadmap).

A9.3 This step is also assumed to deliver a flight efficiency benefit of 3%.

A10. STEP 9: 4-D TRAJECTORY NEGOTIATION

A10.1 This step is the implementation of a 4-D trajectory negotiation concept with advanced 4-D navigation systems, real-time air-to-ground datalinks and trajectory planning/de-confliction systems on the ground.

A10.2 This step is an implementation of a similar concept to the PHARE project.

A10.3 This step requires the implementation of:

- 4-D navigation/flight management avionics.
- Real-time air-to-ground datalinks.

- Trajectory planning/de-confliction systems.

A10.4 This step is considered to deliver highly optimised aircraft routes in a similar way to Step 8. However, the steps together deliver broadly the same efficiency and capacity benefits as each other. Therefore the benefits of each step are not additive.

A10.5 This step is assumed to deliver the same capacity increase as airborne self separation (89%), although both steps together will only deliver a maximum benefit of 89% (not twice that).

A10.6 This step is also assumed to deliver a flight efficiency benefit of 3%. Again, this is the maximum flight efficiency benefit of both Steps 8 and 9, even if they are both implemented.

A11. STEP 10: AIRPORT LOW VISIBILITY ENHANCEMENT

A11.1 This step is the implementation of measures to maintain airport capacity in low visibility conditions. Specifically these include new landing systems (MLS or GLS) that may help to allow higher landing rates than ILS and advanced A-SMGCS systems that support guidance, routing and conflict detection on the airport surface (these would broadly relate to Level 3 and 4 A-SMGCS systems).

A11.2 PRR6 (source: Performance Review Unit of EUROCONTROL) identified that terminal and en-route airspace and airports all contribute to capacity restrictions. That is capacity increases in all these areas are required to meet future demand. Therefore we have assumed it is required to achieve the benefits of Step 8 or 9, but on its own would not deliver a significant benefit.

A12. SUMMARY OF EACH STEP

A12.1 This section lists the main benefits from each step. This part of the analysis focuses on:

- The benefit of increased capacity. This is the benefit of increasing the capacity of the ATM system, resulting in reduced delays, increased flights and reduced operating costs.
- The benefit of increased flight efficiency. This is the benefit of allowing more direct flight paths.
- The benefit of reduced buffers. This is the benefit of increased predictability in flight times that allows some of the buffers that are built into airline schedules to be removed.

APPENDIX: TABLE A12.1 THE MAIN BENEFITS OF THE KEY STEPS

Step		Capacity increase	Efficiency increase	Reduced buffers ⁶
1	Advanced airspace optimisation and structure	2% ¹	40% ⁴	-
2	Optimised collaboration	2% ¹	-	1 min/flight
3	Early ATM datalink applications	11% ²	-	-
4	Applications using downlinked aircraft data	10% ⁸	-	1 min/flight
5	Aircraft spacing applications (ASAS)	9% ²	-	-
6	Advanced datalink applications	8% ²	-	-
7	Advanced 3D RNAV navigation	13% ³	20% ⁴	-
8	Airborne separation/self-separation ⁵	89% ²	40% ⁴	1 min/flight
9	4-D trajectory negotiation ⁵	89% ²	40% ⁴	1 min/flight
10	Airport low visibility enhancement	89% ⁷	-	1 min/flight

Comments/Sources:

1: Expert opinion by comparison with step 3 (expected to deliver similar level of benefit).

2: Taken from Commission's Data Link Roadmap (Roadmap for the implementation of data link services in European ATM, Datalink roadmap, Helios Technology, P167D2010v3.0).

3: Expert opinion by comparison to step 4 (expected to deliver similar benefit)

4: Total possible efficiency increase (100%) is split between the steps that can deliver it.

5: These two steps deliver broadly the same benefits. For example, either of them can deliver 89% capacity gain, but both together do not deliver 178% capacity gain. Therefore we consider them as substitutive, not additive..

6: Expert opinion. Lack of quantitative data for buffer reductions has mean that an equal, nominal, benefit has been assigned to each step that can deliver a predictability benefit.

7: Expert opinion. It is assumed to deliver a matching capacity benefit to that offered by steps 8 and 9.

8: Results from Escapade Real Time Simulation.

A12.2 A comment was received from the ICB sub-group that the expected capacity improvements appear optimistic.

A12.3 The table below lists the costs of each step. These are the total combined costs of research and development, implementation and operation summed over the lifetime of the step.

APPENDIX: TABLE A12.2 COSTS OF EACH STEP (€ M)

Step	Assumed total cost (€ m) (sum over lifetime)	Notes/comments
1 Advanced airspace optimisation and structure	86	From FRAP Business Case
2 Optimised collaboration	86	From FRAP Business Case
3 Early ATM datalink applications	10,145	From EC datalink roadmap
4 Applications using downlinked aircraft data	6,340	From EC datalink roadmap
5 Aircraft spacing applications (ASAS)	11,786	From EC datalink roadmap
6 Advanced datalink applications	8,818	From EC datalink roadmap
7 Advanced 3D RNAV navigation	2,875	From RNAV Business Case
8 Airborne separation/self-separation⁵	8,678	From EC datalink roadmap
9 4-D trajectory negotiation⁵	8,678	From EC datalink roadmap
10 Airport low visibility enhancement	8,678	Assumed same as steps 8 and 9

A12.4 Each project has been allocated a risk category that affects its implementation delay and the amount of the capacity benefit that it is assumed to deliver:

- Low risk: Base Case delay of 2 years of operational date. Capacity benefit delivered is 80% of the target.
- Medium risk: Base Case delay of 4 years of operational date. Capacity benefit delivered is 60% of target.
- High risk: Base Case delay of 7 years of operational date. Capacity benefit delivered is 40% of target.

APPENDIX: TABLE A12.3 RISK CATEGORIES OF EACH STEP

	Step	Risk category
1	Advanced airspace optimisation and structure	Low
2	Optimised collaboration	Low
3	Early ATM datalink applications	Low
4	Applications using downlinked aircraft data	Low
5	Aircraft spacing applications (ASAS)	Medium
6	Advanced datalink applications	Medium
7	Advanced 3D RNAV navigation	Medium
8	Airborne separation/self-separation	High
9	4-D trajectory negotiation	High
10	Airport low visibility enhancement	High

A13. APPROACH TO COST/BENEFIT QUANTIFICATION

A13.1 This section describes the approaches and assumptions to the cost/benefit calculations.

A13.2 The costs have been estimated assuming that each program has 3 phases of investment; research & development, implementation and operation. Each phase follows the other and the operation phase continues to the end of the analysis period (2035).

A13.3 The following benefits are estimated;

- Benefits of capacity/productivity increases. This is based on the delivered capacity increase from each step. Where capacity can be delivered that would be in excess of the required demand, we have assumed that it can instead be used to deliver a productivity increase (and reduce the cost of operation of the ATM system).
- Benefits of reduced buffer times, which are quantified using data from a PRU study.
- Benefits of increased (horizontal) flight efficiency. Again, quantified using data from the PRU.

A13.4 In the base case, we have assumed that all of the benefits promised by each step are not necessarily delivered. We have therefore scaled down benefits in the base case in proportion to the risk categorisation of the step. (See Table 6.2)

A13.5 Cost and benefit data has been taken from published sources where possible. The Commission's datalink roadmap¹⁴ has provided cost data and estimates of increases in capacity resulting from most of the steps. Other sources of data that we have used

¹⁴ "Roadmap for the implementation of data link services in European ATM, Datalink roadmap", Helios Technology, P167D2010v3.0.

include: EUROCONTROL Performance Review Reports (PRRs), the RNAV Business Case and the Free Route Airspace Business Case.

A13.6 Despite the use of external source data, we have nevertheless had to use the study team’s judgement as the only source of data in several places. In addition, the operational concept for some steps is not known so accurate quantification is not possible. Finally, the study uses a long analysis period (30 years) and the evolution of ATM over this period is not accurately known. Therefore, the CBA incorporates a number of assumptions and judgements based on the best data and knowledge available to the team at creation.

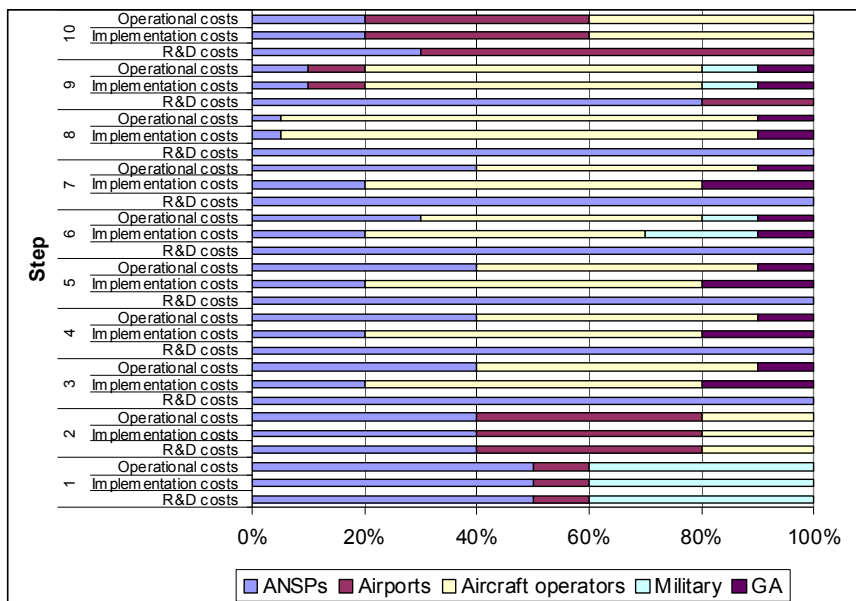
A13.7 The ATM work programme has been grouped into the 10 steps as described. Costs for each step have been separated into research and development costs, investment costs and operational costs. Three types of benefit have been analysed: increased capacity, increased flight efficiency and improved predictability. Benefits are assumed to increase over the investment period and reach 100% when the operational period starts.

A13.8 Where data from previous sources was used for projects, the annual operational costs and benefits have been extended for the duration of the analysis period (up to 2035). This means that once improvements are introduced they are assumed to be maintained throughout the period of the analysis.

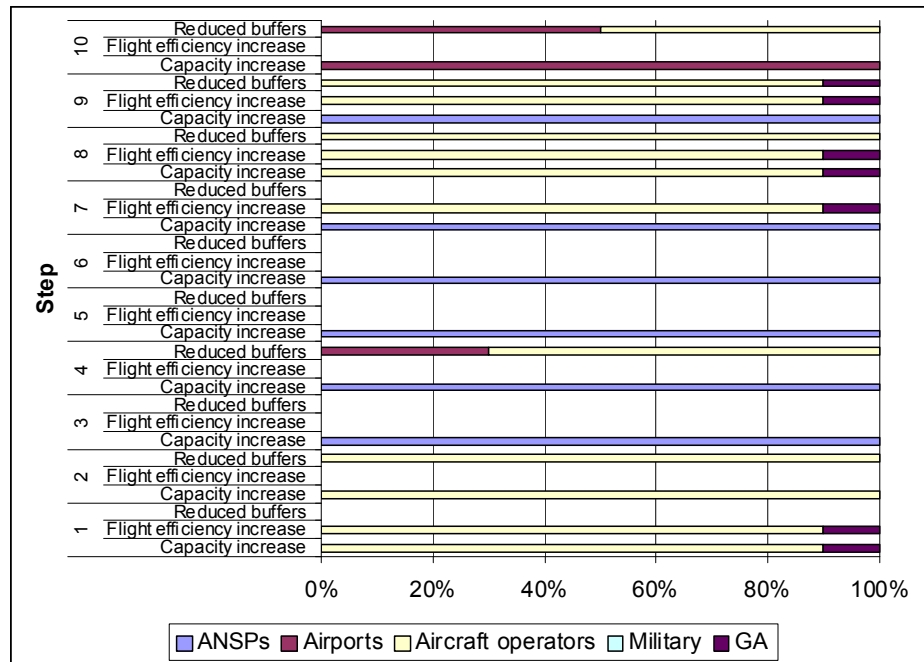
Our costs and benefits split by step and by stakeholder

A13.9 One area of assumptions that is key to driving the results of the study is the split of costs and benefits between stakeholders. The following graphs show the assumptions made to split the costs and benefits between stakeholders.

APPENDIX: FIGURE A13.1 COST SPLIT BY STAKEHOLDER (%)



APPENDIX: FIGURE A13.2 BENEFIT SPLIT BY STAKEHOLDER (%)



A13.10 The flight efficiency benefits are based on a total possible flight efficiency benefit estimated by the PRR6. This estimates the maximum horizontal efficiency benefit to be between 2 and 5% of €800 million. We have used the mid-point of this range as the maximum efficiency benefit. The PRR analysis does not include the benefits of improved vertical flight profiles. In the timescales of the study, the study team was not able to make reliable estimates of this benefit.

A13.11 Capacity benefits are quantified using the approach derived in the Commission’s datalink roadmap.¹⁵ This assumes that capacity increases can be used to increase system productivity. Therefore the same ATM system (controllers, CWPs, etc) can support more aircraft or a smaller ATM system may even be sufficient. Without the productivity increase, the ATM system will have to increase to support more aircraft. This approach does not include the effect of a “capacity wall”. The ATM system costs are taken from PRR6¹⁶.

A13.12 Predictability benefits are quantified by assuming that airlines could reduce the buffers that they currently put into their schedules. This is quantified using an assumed

¹⁵ There is no European consensus approach on quantifying capacity increases and it is recommended that this should be addressed.

¹⁶ “Performance review report 6, An Assessment of Air Traffic Management in Europe during the Calendar Year 2002”, EUROCONTROL, July 2003.

reduction in buffer and the cost per minute of the buffer. The cost per minute is taken from the University of Westminster report on delay costs for EUROCONTROL¹⁷.

¹⁷ University of Westminster, "Evaluating the true Costs to Airlines of one minute of airborne or ground delay" (2003).

APPENDIX B

EXAMPLE ANALYSIS: UN-MET DEMAND COSTS, AIRBORNE COSTS AND SAFETY DISCUSSION

B1. INTRODUCTION

B1.1 This section gives three example analyses:

- an examination of the costs of increasing delays if demand is not met;
- an examination of the impact of changing airborne equipage timescales and,
- a discussion of safety benefits.

B2. ANALYSIS OF THE COSTS OF UN-MET DEMAND

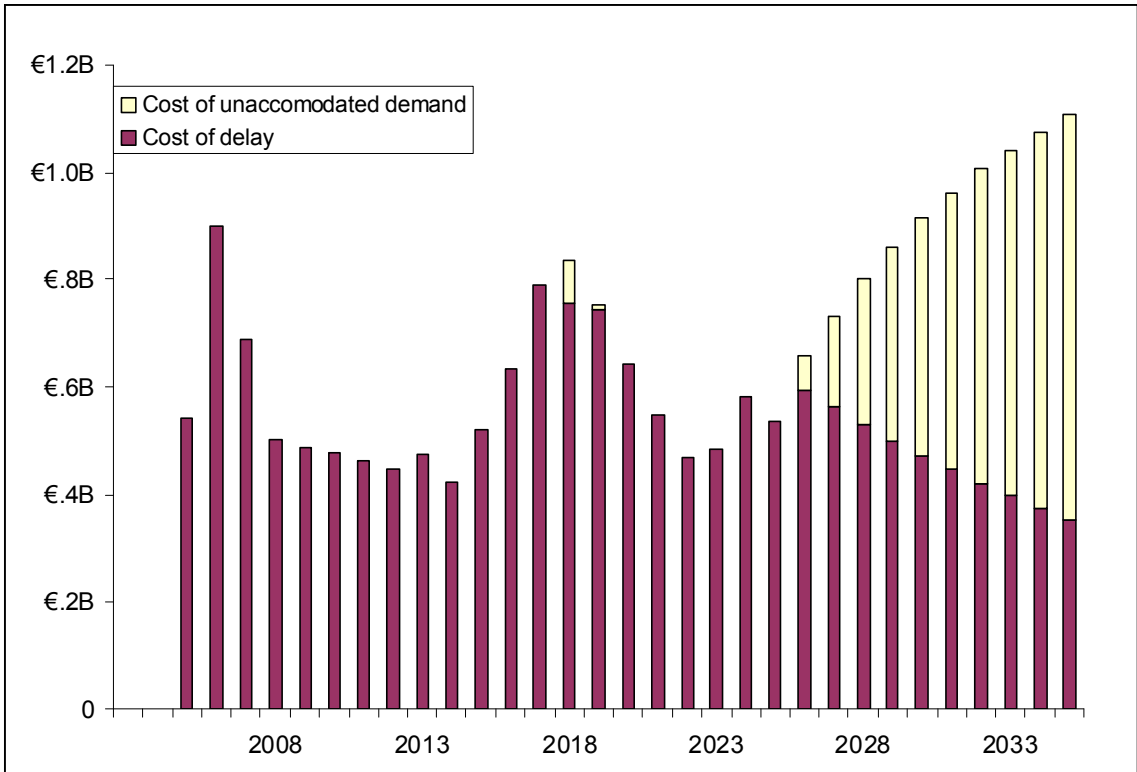
B2.1 If/when the “capacity wall” is reached, demand will start to significantly exceed available capacity. The impact of this will firstly be increased delays to flights. At some point, the delays will become so large that they impact on the continued growth of the industry. After this, fewer additional flights will be scheduled.

B2.2 We have made an illustrative calculation of the costs of reaching the capacity wall by comparing unconstrained demand to the Base Case capacity. We have used the following assumptions:

- When the ratio of unconstrained demand to delivered capacity is less than 105%, the consequence is delays. The amount of delay is estimated from PRU formulas (“elasticity” assumed to be 7). The cost of delay to airlines is assumed to be €72 per minute (2004 PRU / Westminster study).
- When the ratio of demand to capacity exceeds 105%, the consequence is that traffic growth stops. The cost of this un-accommodated demand is assumed to be €1000 per flight that does not occur. (This is increased from €700 estimated by the IATA Cost Benefit Task Force in September 1999.) In reality, some of the costs would be incurred by aircraft that are kept idle on the ground. In other cases, airlines would not buy additional aircraft and therefore would simply lose the profit that they otherwise would have gained from operating the new aircraft.

B2.3 This calculation is clearly illustrative based on the assumptions shown. The results of this calculation are shown in the following figure. (Costs are discounted at 6%.) The total cost over the analysis period is € 21 billion PV.

FIGURE B1: COST OF UN-MET DEMAND (PV € BN)



B3. ANALYSIS OF CHANGING AIRBORNE EQUIPAGE TIMESCALES

- B3.1 One of the proposed benefits of SESAME is better project phasing. One aspect of this is optimising the timing of adding equipment to aircraft. The costs of new equipment on an aircraft can dwarf other projects costs and they are very sensitive to the timescale of implementation.
- B3.2 To illustrate this, the following data are taken from the EUROCONTROL RNAV Business Case (Source: RNAV cost report). It shows the cost for a mandate of RNP RNAV on all aircraft flying IFR in ECAC (it is the “high cost” option assuming dual avionics equipage).

APPENDIX: TABLE B3.1 COST OF RNP RNAV MANDATE TO AIRCRAFT OPERATORS (€ M)

Year of Mandate	Cost (PV, 2002 value)	
	Single	Dual
2007	€ 1,021 M	€ 2510 M
2008	€ 890 M	€ 2,199 M
2009	€ 783 M	€ 1,942 M
2010	€ 688 M	€ 1,708 M
2011	€ 605 M	€ 1,500 M
2012	€ 528 M	€ 1,306 M
2013	€ 454 M	€ 1,122 M
2014	€ 388 M	€ 951 M
2015	€ 328 M	€ 799 M

B3.3 It can be seen that delaying the mandate for the RNP RNAV equipment considerably reduces the costs to aircraft operators. This is because:

- New aircraft are deployed every year to replace retiring ones and because the total fleet of aircraft is growing. Most new Air Transport aircraft come with RNP RNAV equipment as standard.
- The study assumed that a significant number of aircraft will install RNP RNAV during one of their major upgrades. These occur quite infrequently – many aircraft will have only one (at most) significant avionics upgrade during their lifetimes.

B3.4 However, the study assumed that operators would make use of early mandate announcements to start the equipage process. This has not always happened in the past, for example some operators left 8.33kHz radio equipage to the last minute. SESAME therefore has a role to ensure early announcements of future aircraft equipment requirements and to encourage operators to upgrade early.

B4. SAFETY BENEFITS

B4.1 The safety objective for ECAC is to ensure that the numbers of accidents attributed to ATM do not increase. This is a demanding objective since, as traffic increases, the accident rate must correspondingly decrease to meet this target. The current target level of safety, to be reached by 2015, is 1.55×10^{-8} aircraft accidents, with direct ATM contribution, per flight hour. Future ATM developments must therefore deliver increased capacity at higher levels of safety.

B4.2 The study has considered whether there are any arguments for SESAME to yield incremental safety benefits compared to the Base Case. If new systems are indeed capable of delivering increased capacity and safety, bringing their implementation forward should show a safety benefit of SESAME.

B4.3 Quantitative assessments of safety benefits are difficult to substantiate given that accidents are rare and unpredictable. Nevertheless we have undertaken some calculations to **illustrate** this benefit. The following table converts forecast flight hours into forecast average accidents per year based on the 2015 target level of safety. These are then converted into an average cost of accidents accident per year.

APPENDIX: TABLE B4.1 ESTIMATE OF SAFETY BENEFITS OF SESAME (€ M)

Description	2015	2035
Flight hours ¹⁸	16M	25M
Achieved level of safety	1.55 ⁻⁸	1.55 ⁻⁸
Fatal accidents per year	0.3	0.4
Cost of accidents ¹⁹		
Airframe	€11m	€11m
Passenger VOSL	€35m	€35m
Total	€46m	€46m
Average annual cost of accidents	€12m	€18m
Benefit of advancing safety improvement	€0.6m	€0.9m

B4.4 For every year that SESAME advances a new system implementation, the safety benefit is equivalent to the reduction of risk by a year's growth in traffic, around 5%. Hence the safety benefit of SESAME may be around €1M per year of advancement. This may appear small, but does not account for the impact on an aircraft operator's business in potential lost revenues or share value. These factors would multiply the costs of an accident by an order of magnitude²⁰.

B4.5 We have also considered whether there are specific issues for safety under the SESAME programme. Most of the current safety activity concerns a levelling up of safety standards and best practice. SESAME is therefore unlikely to offer any benefits above those of the Single Sky requirement to adopt EUROCONTROL Safety Regulatory Requirements. However, future safety improvements may be given more prominence through the Master Plan and the increased involvement of stakeholders through SESAME may also have a positive effect on safety.

¹⁸ Estimated from Eurocontrol PRU and STATFOR data converting forecast flights into flight hours using a factor of 1.4 flight hours per flight on average.

¹⁹ NEI Transport, Airclaims and NLR for the European Commission DG Transport and Energy, "The Cost of Unsafety", ASTER WP3, March 2001.

²⁰ The Flight Safety Foundation reported in 1998 that the impact on an airline of two fatal accidents within 90 days resulted in a loss of revenue of \$150M. Also, a helicopter service company had calculated that the ratio of safety benefits to investments in safety was 8:1. The same article reported that 50% of airline user preference was based on an airlines safety record. Flight Safety Foundation, "Aviation safety - US efforts to implement flight operational quality assurance programs", p 53, September 1998.

APPENDIX C
COMPARATOR GOVERNANCE MODELS

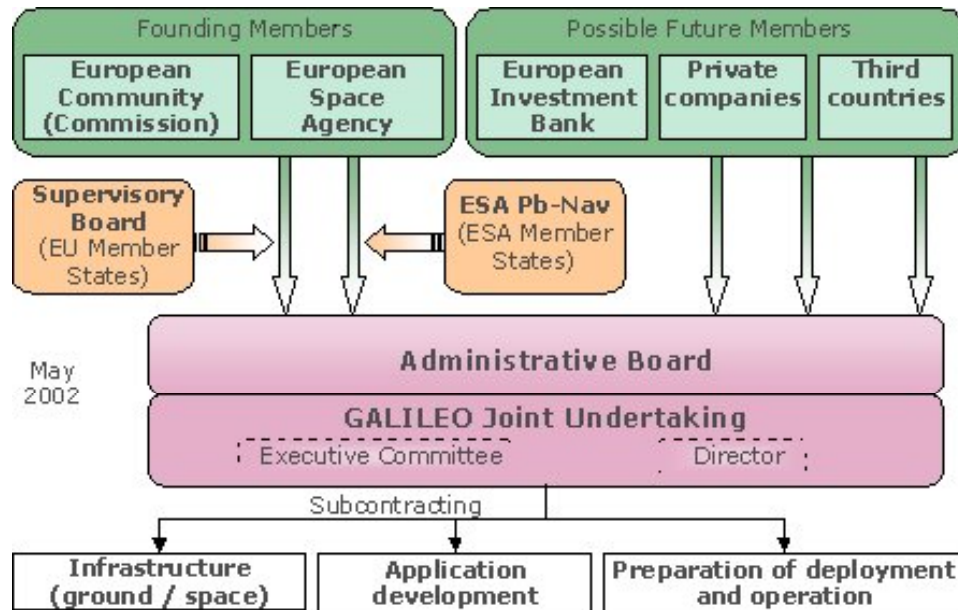
C1. GALILEO – DEVELOPMENT PHASE

Overview

- C1.1 The Galileo Programme exists to develop and put into operation a satellite navigation system both as an alternative and complementary to the United States Global Positioning System. The programme is projected to have a high positive benefit to cost ratio, and contains significant, clearly defined revenue generating schemes.
- C1.2 The programme is divided into distinct phases: definition; development; deployment; and commercial operation.
- C1.3 The initial definition phase produced a High Level Definition document. This document was produced through a consultation process including Member States, users and potential private investors, and provides a picture of the main characteristics of the Galileo Mission. The subsequent development and validation phase was managed by the Galileo Joint Undertaking (GJU), the structure of which is described below. Its main tasks are:
- **Defining concession arrangements** through the establishment of a public-private partnership, and competitive tendering to select the private consortium for the deployment and operation phase of the programme;
 - **Validation of In Orbit satellites** following the launch by GJU, through ESA, of a first series of satellites;
 - **Galileo-related research activities under the 6th Framework Programme** for the technical management of Galileo-related projects; and
 - **Managing the integration** of European Geostationary Navigation Overlay Service (EGNOS) with Galileo.
- C1.4 The development phase is largely financed by the Commission and the European Space Agency (ESA). The Commission provided €550 million, with the ESA contributing a similar amount, and a further €100 million was made available under the 6th Framework Programme. Provision was made in the original Regulation setting up the Joint Undertaking for other investors to take stakes in the Joint Undertaking, to include potentially the European Investment Bank, third countries and the private sector. China has since become an investor, contributing €200 million.

Institutional structure

APPENDIX FIGURE D1.1: GALILEO DEVELOPMENT PHASE GOVERNANCE



Source: European Commission DGTREN website

C1.5 The governance arrangements for the Joint Undertaking comprise the following:

- **An Administrative Board:** composed of members of the Joint Undertakings, with votes in proportion to capital invested. Its principal task is to “take the decisions necessary for implementing the programme and exercise overall supervision of the execution of the programme”²¹. Its main tasks are to appoint the Director and to approve budgets and accounts;
- **An Executive Committee:** composed of “a representative of the Commission, a representative of the European Space Agency and, as soon as undertakings are involved, a representative of industries designated by the Administrative Board”²². Its main role is to assist the Administrative Board, including in particular reporting to the Board on progress of the programme.
- **A Director:** the Chief Executive responsible for day-to-day running of the Joint Undertaking. The Director is appointed by the Administrative Board, and reports to it.

C1.6 A Supervisory Board has also been established, composed of a representative of each Member State and the Commission representative from the Administrative Board. The Supervisory Board, whose function is to ensure the flow of information and political control by the Member States, meets before each meeting of the Administrative Board, and decides, by Qualified Majority Voting, a position on each item. The Commission representative then does everything possible to ensure that the

²¹ Council Regulation (EC) No 876/2002 – Annex 1, Article 8, paragraph 2a

²² ibid – Annex 1, Article 9 paragraph 1a

decisions of the Administrative Board reflect the decisions and views of the Supervisory Board.

Relevant characteristics

- C1.7 The Galileo development phase does contain some common features with the future SESAME programme that render it a useful comparator. These include the experience of facilitating common working between European institutions, and of these institutions jointly funding and participating in researching, developing and contracting for a large, technologically-driven project.

C2. GALILEO – DEPLOYMENT AND OPERATION PHASE

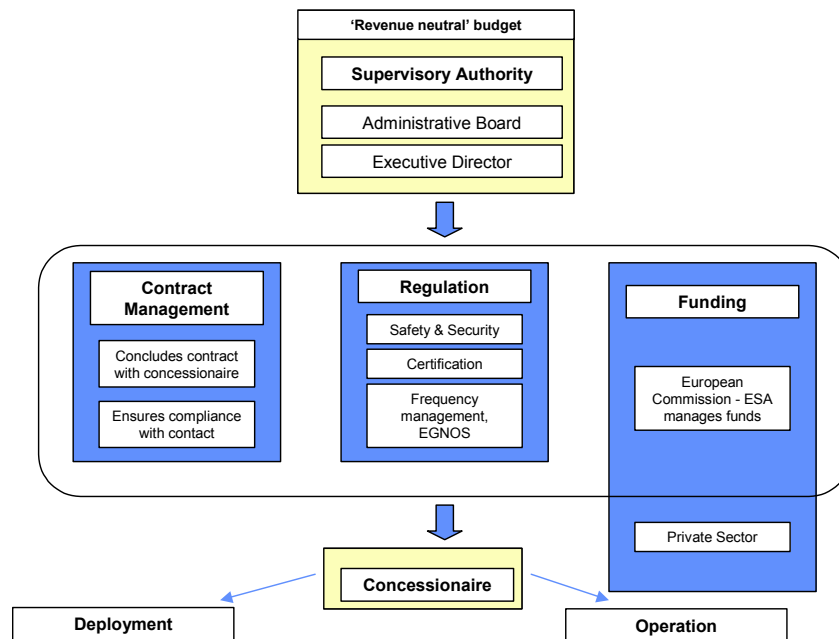
Overview

- C2.1 One of the key parts of the development phase outlined above is the definition and letting of the contract, by the Joint Undertaking, for the deployment and operation phases. Three consortia submitted bids, with two being taken forward for full consideration. The deployment phase consists of the construction and launch of the satellites as well as establishing the terrestrial infrastructure network.
- C2.2 The funding for the deployment phase amounts to €2.1 billion, with one third coming from the Community budget, and the remaining two thirds from the private sector. The private sector contribution is made on the basis that the concessionaire has rights over certain revenue streams generated by the project. The financing of the commercial operating phase will be covered by the private sector.

Institutional structure

- C2.3 Upon completion of the Definition Phase, the Joint Undertaking is to be wound up and its assets passed to a new agency, the European GNSS Supervisory Authority.
- C2.4 The Authority has an Administrative Board made up of a representative from the Commission and one from each Member State. The Administrative Board appoints the Executive Director and adopts the work programme of the Authority. The Executive Director is responsible for implementing the work programme. The Administrative Board is also responsible for setting up a Scientific and Technical Committee and a System Safety and Security Committee.
- C2.5 The Authority has a wide range of tasks. These include:
- Acting as the licensing authority with respect to the private concession holder, including concluding the contract and ensuring compliance with it;
 - Management of public funds for European GNSS programmes;
 - Responsibility for modernisation and development of new generations of the system;
 - Certifications of system components; and
 - Management of safety and security aspects of the system.

APPENDIX FIGURE D2.1: GOVERNANCE FOR GALILEO DEPLOYMENT AND OPERATION



C2.6 This new structure does present a number of advantages as compared with the administrative organisation of the Joint Undertaking. The proposed structure is significantly simpler, and the lines of communication and decision-making are clearer, with less duplication of roles.

Relevant characteristics

C2.7 The Galileo deployment and operation phases provide interesting comparisons with respect to SESAME in terms of the movement from a specification phase to a deployment phase, and the institutional evolution accompanying this shift. Of note in this context is the changing role of ESA, from a significant provider of funds and key steering member in the development phase, to a more technical role in the new Authority.

C2.8 We also note, however, that the Galileo deployment and operations phase, and the role of the private sector within it, is strongly shaped by the revenue-generating possibilities in the programme, and it is therefore significantly different in nature to SESAME.

C3. RAIL INTEROPERABILITY – EARLY STAGES

Overview

C3.1 Rail interoperability is an important part of the ongoing process of increasing integration of the European rail network. Directive 96/48 instigated the harmonisation process for the High-speed network, and Directive 2001/16 addressed the conventional network. The key mechanism for introduction of interoperability was the creation of technical specifications for interoperability (TSIs). These are agreed

standards to which all **new** (and upgraded) components of the rail system must conform.

- C3.2 The legislation did not propose a specific timetable for making diverse national systems interoperable, but instead focused on ensuring that new (and upgraded and replacement) elements of the system were interoperable. However, there exist a number of obstacles to this process. The key problem was a lack of a clear, enforceable programme introducing interoperability. The high-speed directive did not contain an enforceable programme. The subsequent conventional interoperability directive did contain a sequence of priorities for the adoption of TSIs, and mandated that TSIs should contain a strategy for implementing the TSI. However, this did not extend to structured European plans for adoption.
- C3.3 Furthermore, in both directives there are also a large number of possible derogations which can be applied. These include derogations for projects that are already substantially developed when a TSI is published, geographically isolated projects or where application of a TSI would damage the economic viability of a project.
- C3.4 There is also little additional funding available for rail interoperability. While European funding has been available for the process of drawing up TSIs, and some testing and validation work, implementation remains a national responsibility. Thus, there are no mechanisms at the European level to either encourage or enforce adoption of interoperable systems.

Institutional structure

- C3.5 The interoperability legislation creates a Joint Representative Body (JRB) to draw up TSIs - the European Association for Railway Interoperability (AEIF). The AEIF represents infrastructure managers, railway companies and the manufacturing industry. The AEIF sets up working parties for drafting TSIs, and aims to establish consensus across stakeholders. The AEIF first draws up the basic parameters of the TSI and identifies viable alternative solutions, and then goes on to draw up the draft of the TSI. In addition, the AEIF consults users of the system, and social partners, during the drafting process.
- C3.6 TSIs are adopted by the Commission following approval by a Committee, made up of representatives of the Commission and from each Member State. The Committee may request that alternative solutions to technical problems are examined. It also draws up the list of users to be consulted in the TSI drafting process, and analyses measures suggested by Member States who apply for derogations. Its work programme also includes high-level definition (following a draft report by the JRB) of the overall “architecture” of all TSIs as a system, adoption of cost-benefit methodologies for assessing TSIs and adoption of the basic parameters for each TSI. This Committee therefore acts to provide high-level control on the system.

Relevant characteristics

- C3.7 The development of interoperability on the European rail network provides a number of interesting lessons for SESAME. The process of drawing up TSIs at a European

level, with close stakeholder consultation and participation, is one which is likely to have to be undertaken in some form for SESAME. However, lack of clear programming for the process of national implementation of interoperability, from the derogations available in the legislation and the lack of an overall framework, has meant that the programme has remained fairly loose.

- C3.8 It is also important to note that the process for establishing TSIs has been relatively protracted, and this has led to a revision in the institutional arrangements supporting TSIs, as discussed below.

C4. RAIL INTEROPERABILITY – LATER DEVELOPMENTS

Overview

- C4.1 The European Union adopted, as part of the Second Railways Package, a Regulation on setting up the European Rail Agency, and a Directive amending the two original interoperability Directives. The Second Package has a strong emphasis on safety regulation, with the European Rail Agency taking an important role in this area.
- C4.2 The amending directive focused on two main areas: transfer of the role of the AEIF to the ERA; and extension of interoperability to the whole of the conventional network. It also clarified the scope of the earlier directives with respect to renewals, and made clear the distinction between European specifications for the high-speed sector, which are developed in the spirit of harmonisation and enable conformity with the essential requirements of the legislation, but which are not mandatory, and the TSIs that must be complied with.

Institutional structure

- C4.3 The Agency will have an Administrative Board made up of representatives from the 25 Member States, four Commission representatives and six industry representatives, who have no voting powers, covering railway undertakings, infrastructure managers, the rail supply industry, trades unions, passengers and rail freight customers. The Board has the power to establish a budget and financial rules and approve the work programme, and to appoint the Executive Director.
- C4.4 The role of the Executive Director is to manage the organisation, including preparation of the work programme, with consultation of the Commission, for approval by the Board. The term of office is five years, renewable once. The Agency itself will have a relatively small staff, but it will be supported by groups of experts, as well as undertaking consultations with social partners, freight customers and users as required by legislation. The Agency will also be responsible for monitoring and reporting on progress on interoperability.
- C4.5 The change to the new organisational structure does not represent a radical departure from the original interoperability agenda. Indeed, continuity with respect to the work done and processes set in place by the AEIF is seen as very important for the success of European Rail Agency. The significant changes introduced by the new structure are that safety and interoperability are now handled together, and by a single body with arguably a higher profile, and that industry representatives are now represented

on the Administrative Board. However, these changes are incremental rather than revolutionary.

Relevant characteristics

- C4.6 The European Rail Agency is interesting as an example of institutional evolution, and of changing participation structures. While its role in relation to interoperability is not significantly different from that undertaken by the AEIF, its creation enables clearer institutional ownership of the process of developing TSIs, and may allow for closer integration of technical development with a political interface to support achievable implementation plans.

C5. ERTMS

Overview

- C5.1 The European Rail Traffic Management System (ERTMS) is an advanced train control system that enables trains to operate on compatible signalling systems across European borders, can increase network capacity and performance, and provides Automatic Train Protection (ATP) safety systems. ERTMS has a number of possible “levels” of operation, corresponding to different technical signalling systems.
- C5.2 The European Union provided some funding for research into the system, and for the development and validation procedure. However, implementation must be done by individual countries, subject to a cost-benefit analysis foreseen in the interoperability directives.
- C5.3 ERTMS carries benefits beyond the integration benefits of being part of an international system, including safety benefits and capacity benefits. However, as an expensive system, some countries have found it difficult to make a positive business case for ERTMS, in particular as national development and implementation issues carry additional risk. In the case of the United Kingdom, for example, viability is highly dependent on the discount rate used and the exact choice of implementation programme.

Institutional structure

- C5.4 Specifications for the system were developed jointly by the ERTMS Users Group, representing infrastructure managers, and UNISIG, a grouping of manufacturing industry. The Users Group was responsible for defining functional requirements, and the manufacturers then turned these requirements into technical specifications. These specifications were then incorporated into TSIs under the 96/48 interoperability directive. Individual countries have been willing to participate as they will eventually be subject to TSIs and wish to have their requirements taken into account.
- C5.5 The development of these TSIs was largely funded at the European level. There are also EU level development and validation programmes, and continual updating of TSIs occurs at the European level. However, the TSIs are only functional and do not cover economic and performance specifications, and integration to national infrastructure, rolling stock and operational procedures. Therefore, European actions

are complemented by national programmes covering development and implementation, funded nationally and subject to national decisions with regard to cost-benefit analysis.

- C5.6 There is a recognition that, for technological, operational and financial reasons, there is a risk of a “patchwork” of isolated ERTMS systems surrounded by parts of the European network still using existing train control systems. A working group established at the request of the European Commission has investigated the implementation of ERTMS, with each Member State requested to provide their implementation plan for comparison and coordination purposes. One suggestion has been to focus implementation efforts on completing key international rail corridors.

Relevant characteristics

- C5.7 ERTMS highlights some of the most important issues in achieving rail interoperability. Progress has been made in developing common standards at the European level, and the structure of having users defining requirements and the supply industry designing technical specifications makes for a clear distinction between roles and provides for competition in procurement. It is interesting to note however that the costs of the system remain high, in part due to the necessity to develop implementation measures for each country’s industry. One proposed solution for cutting costs has been to open the supply market to non-European suppliers.
- C5.8 It is also important to note that while TSIs underpinning the ERTMS Programme have been successfully developed at the European level, significant obstacles to actual implementation remain. The underlying reason for this is that the costs of both national development and of implementation are very high, and individual countries may struggle to find the schemes viable. Furthermore, there are significant challenges in capturing network effects while implementation is not uniform across Europe.

C6. EFDP

Overview

- C6.1 The European Flight Data Processing (EFDP) Programme developed out of the need to replace a number of legacy system and recognition that there would be benefits from developing a common European system. The process began with a bilateral agreement between DNA and NATS, but development into a programme to develop two interoperable systems, supported by EUROCONTROL funding. In addition to DNA and NATS, Maastricht UAC AENA, ENAV and DFS also participated with a view to deriving benefits from a common specification for interoperability.
- C6.2 The programme originally had three phases covering the call for tender, project definition and development and implementation at the national level. However, it was terminated before the completion of the first phase after budget overruns and calls from EUROCONTROL for financial participation from stakeholders. It did produce a partial functional specification, and has fostered the development of alliances leading to the development of the iTEC-eFDP and Coflight systems.

Institutional structure

- C6.3 The governance arrangements for the programme comprised:
- A Steering Committee chaired by EUROCONTROL;
 - A Programme Management body supported by EUROCONTROL; and
 - Programme teams within each participating ANSP.
- C6.4 Although the programme was supported by a number of ANSPs, EUROCONTROL provided the funding for the development of the core system, and individual stakeholders appear to have been reluctant to provide additional funds given the delivery risks of a pan-European exercise that they could not fully manage.
- C6.5 A report by Sofréavia for the Commission noted that these arrangements did not support efficient decision-making, and that meetings held in Brussels, Toulouse and London absorbed considerable time and resource²³.

Relevant characteristics

- C6.6 The EFD Programme demonstrates the difficulties of replacing legacy national air traffic management systems with a core system through a collaborative exercise. The Sofréavia report highlighted a number of difficulties, centring on differences between stakeholders over the level of detail required for the core specification and the extent to which specific national requirements should be included in a common system. SESAME will be similarly challenging in terms of the need to build a consensus on system requirements in circumstances where substantial programme benefits are secured at the network, rather than the individual stakeholder, level.

C7. LINK 2000+

Overview

- C7.1 The Link 2000+ Programme aims to coordinate the implementation of operational air-ground data link services for air traffic management in Europe over the period 2000 – 2007. This will make an important contribution to the increase in capacity required to meet traffic growth, as well as improving service quality, safety and cost effectiveness. It will involve the same groups of stakeholders as SESAME, including ANSPs, airspace users, airframe manufacturers, communications service providers and pan-European and national regulatory authorities.
- C7.2 The programme has been organised in three stages:
- Detailed planning and design between 2000 and 2002;
 - Initial deployment with pioneer airlines and service providers between 2003 and 2005; and

²³ See note 10 in Chapter 9.

- Large-scale deployment from 2005.

C7.3 Full implementation is planned for completion by December 2007.

Institutional structure

C7.4 The programme is under the overall direction of EUROCONTROL. A Programme Steering Group, including key stakeholders such as ANSPs, airlines and airframe manufacturers, monitors progress against a plan and advises the Programme Manager. Detailed work is managed by work package leaders within EUROCONTROL's Internal Link 2000+ Team and by programme managers provided by individual stakeholders. A separate Integration Team, which also draws on a wide range of organisations for its membership, is charged with resolving specific technical and operational issues, with Operational and Safety Focus Groups providing additional support. An Institutional Issues Focus Group has been set up to address financial and liability issues.

C7.5 Based on experience of previous aircraft equipage programmes, EUROCONTROL has proposed a system of financial incentives to encourage airlines to equip earlier than might otherwise be the case. In an Action Paper submitted to the ATM/CNS Consultancy Group in September 2004²⁴, it suggested two possible approaches to incentivisation, both of which are consistent with Regulation 550/2004 on Service Provision:

- Equipment grants for eligible aircraft, possibly amounting to €20k per airframe, targeted towards those aircraft contributing most to the benefits of the programme; and/or
- Differential route charges, with equipped aircraft attracting lower charges reflecting the associated cost savings and other benefits.

C7.6 EUROCONTROL has noted that further work, including stakeholder consultation, is required to determine a final proposal.

Relevant characteristics

C7.7 The development of air-ground communications will be a core element of SESAME, and the programme will therefore be similarly dependent on full participation of airspace user stakeholders and timely aircraft equipage. The Link 2000+ Programme therefore offers potentially helpful insights into how stakeholder participation can be secured through representation at appropriate levels, from Steering Group through to specific technical and operational input. In addition, the incentive mechanisms proposed by EUROCONTROL may be applicable to SESAME, at least in principle, possibly to encourage earlier equipage and asset replacement among both airlines and ANSPs.

²⁴ See note 11 in Chapter 9.

C8. RVSM

Overview

- C8.1 Europe undertook a significant reorganisation of its airspace with the implementation of Reduced Vertical Separation Minima (RVSM) in 2002. RVSM, which has also been applied in the North Atlantic Region, introduced 6 new flight levels in European upper airspace. The introduction of the extra levels resulted in a large increase in capacity and allowed for better optimisation of routing. It was implemented on time despite requiring coordination of a large number of parties, and is regarded as a successful programme delivering tangible benefits.
- C8.2 The programme required action from ANSPs, airlines and EUROCONTROL, including operational changes and some technological changes. The programme proceeded in a number of distinct phases:
- Initial planning;
 - Advanced planning and preparation (preparation of aircraft, ATS environment and monitoring environment for RVSM);
 - Verification; and
 - Introduction of the system.
- C8.3 It was completed in January 2002, a deadline set after consideration of practical issues such as training timescales and the need to equip aircraft over the winter season.
- C8.4 The initial planning phases of the programme were supported by ICAO research over a period of many years. However, individual airlines and ANSPs had to fund their own implementation of the programme, without any central funding sources. The level of technological development was relatively modest, in particular for the aircraft technology, as it was built largely on existing technology. EUROCONTROL also spent around €40 million on programme management, support and implementation of safety monitoring systems.

Institutional structure

- C8.5 Following initial planning, a detailed implementation Master Plan was drawn up, with participation from all parties. A pragmatic approach was used to develop buy-in, and support was given to overcome technical obstacles. The programme consisted of a central timescale to synchronise coordination of national level implementation strategies. EUROCONTROL coordinated the programme, and provided technical support, including, for example, providing training to ANSPs. Preparation of the plan took two years, and involved extensive discussion at the Member State level (for service providers) and with airlines. The latter presented a more diverse group, but were in general motivated to participate in the programme, as the benefits to them were clear and significant.
- C8.6 The implementation of this plan then proceeded, including development of new operational procedures and systems by providers, fitting of aircraft with new technologies and approving these and monitoring development by EUROCONTROL.

The Master Plan was a useful tool in ensuring all parties had clear timescales to follow, and allowed for a certain amount of influence to be brought to bear by other stakeholders within the programme in the case of delays. Airlines were strongly motivated to follow the timescales as failure to implement would have meant being excluded from using a large proportion of upper airspace.

Relevant characteristics

- C8.7 The RVSM Programme managed complex institutional and technological change, and the co-ordination of many diverse actors, factors highly relevant to SESAME. It is interesting to note that despite the lack of a firm institutional structure, the programme was successfully delivered. Clearly, a significant contributing factor to this process is the positive perception of the programme by stakeholders owing to the clear benefits that almost all would receive from it. However, the governance of the programme also seems to have been effective, through involvement of the key stakeholders in drawing up the Master Plan, and in having nationally owned plans integrated into a European framework, with central coordination and technical support.
- C8.8 However, it must be borne in mind that RVSM as a programme was much smaller in scope than SESAME, and consisted of one tightly defined programme with clearly identifiable costs and benefits. It also had much less significant procurement and research and development components, both of which are highly important to SESAME.

APPENDIX D

RECORD OF ICB AND SESC WORKING GROUP MEETING ON DRAFT FINAL REPORT ON 15 JUNE 2005

D1. RECORD OF MEETING OF WORKING GROUP 15 JUNE 2005

- D1.1 Ben Van Houtte welcomed everyone to the meeting and invited the consultants to make their presentation
- D1.2 Stephen Wainwright introduced the agenda for the day and gave a short presentation on the background to the study.

Cost benefit analysis

- D1.3 Nick McFarlane gave a presentation of the draft report results of the cost benefit analysis to the working group.
- D1.4 An open discussion, chaired by John Raftery followed.
- D1.5 Ben Van Houtte: Asked if the environmental costs included in the analysis were net of any savings. Stephen Wainwright confirmed that savings in environmental costs had been taken into account, and that the results were therefore net of these.
- D1.6 Harmat Uhf (ETSI / Infosys-ATM): Encouraged the consultants to think again about their description of the lack of benefits for GA and military users. He stated that they would benefit from co-operation and synergy in development of systems. He also commented that if a policy was to provide the level of benefits outlined in the study it should appear attractive to CEOs.
- D1.7 Rob Peters (NL – MOD): Asked what benefits there could be for Military? Nick McFarlane outlined that many of them might be qualitative rather than financial. However there might be synergies with civil development and SESAME should encourage more strategic cooperation between civil and military users.
- D1.8 Luca Falessi (ENAC Italy): Expressed some doubt as to how easy it would be to bring forward programmes in time. In particular the aircraft equipage timescales. He asked how rapid an implementation had been assumed in the study. Nick McFarlane responded that the assumption was that it would be more rapid than the standard seven-year lifecycle assumed presently and would be a considerable challenge for the SESAME programme. Ben Van Houtte also outlined that there would be both mandate and incentive options available to the Commission to enable more rapid timescales to be fulfilled. Luca Falessi recommended that mandatory requirements should not be introduced, as they did not have a good track record.
- D1.9 Gunther Martis (AEA): Highlighted that the airlines must have clear benefits to tie into the implementation lifecycles.
- D1.10 Laurence King (ETF): Highlighted the importance of ATM workers in providing an enduring SESAME programme. He stated that ATM workers were cautious about the initial presentation and conscious that the benefits of the programme should not be “talked up”. The working group should also not underestimate the operational improvements over the last few years and that money has not been wasted on these improvements. Stephen Wainwright clarified that colleagues in the ETF had been involved in the ICB sub-group on SESAME.

- D1.11 Bernard Miaillier (Eurocontrol): Asked for clarification on how long the implementation stage of the programme was assumed to last in the CBA and whether the cost of unmet demand was included in the projections. Moreover, he highlighted that airport runway infrastructure is likely to provide the most immediate capacity constraint on the system. Also Eurocontrol only produced traffic forecasts for a period of 20 years into the future (not 30 as was implied by the presentation). Nick McFarlane clarified that due to uncertainties about the programme the implementation was concentrated on the first 15 years (but that the cash flow implications of this work programme over 300 years were considered). The costs of unmet demand were not included in the base projections – they were an additional illustration. The STATFOR projections had been grown forwards from the 2025 to 2035 using the annual growth projection. It was accepted that Runway capacity was the potentially binding constraint.
- D1.12 Colin Chisholm (Vice Chairman ICB): From a service provider perspective he did not think there would be a capacity wall in the period 2010 to 2020. The closest the industry had got was in 1987 and the early 1990s. He also stated that runway constraints were a major problem and some way of including this in the scope of SESAME should be found.
- D1.13 Harmat Uhf (ETSI / Infosys-ATM): Stated that he thought that FABs were a prerequisite to SESAME. Nick McFarlane responded that the study team did not agree with this.
- D1.14 Hemant Mistry (IATA): Asked for clarification on the cost implications of SESAME and on the extent to which sunk costs had been taken into consideration in the cost benefit analysis. He also noted the significant economic benefits (as distinct from financial benefits) from SESAME and asked if that would be reflected in the funding arrangements for the programme. John Raftery commented that sunk costs should not and did not form part of the CBA. However, they were envisaged in the incentive framework to be discussed in the Governance arrangements. Stephen Wainwright clarified that the ATM cost implications of the programme were set out in slide 21 of the presentation and that the funding arrangements would be discussed as a part of the governance arrangements.
- D1.15 Marie Dessaux (CANSO): Highlighted the difficulties and challenges with accelerating the programme. SESAME would need industry commitment to be successful. Therefore real industry involvement needed to be provided through the chosen governance structure. However, the CBA did not appear to be clearly linked to the governance structure.
- D1.16 Frederic Huslaing (IFATSEA): Human resources who operate the systems need to be taken into consideration in determining the success of the programme. Moreover, one of the key benefits of SESAME would be the improvement in the accident rate from a more reliable system. He also stressed the importance of long-term research and development in the industry.
- D1.17 Fritz Feitl (ICB Chairman): Stressed that safety was a vital part of the SESAME Programme. Moreover, airspace users were the end of the value chain – they were

already restructuring and could not afford additional infrastructure costs. Moreover he highlighted that SESAME should cover not only technology but also operational capability.

- D1.18 Dirk Nitschke (German Federal Ministry of Transport): Acceleration of decision-making seemed to be the key to the benefits of the programme. However, the main driver would come from the SES regulations through technical and political enforcement. He also encouraged the involvement of military users in SESAME and, where possible, the military equipage industry. He highlighted that one of the key benefits of the programme was to provide European Industry with European products. There was, however, a risk of too many “chiefs” and not enough “Indians”. He also asked whether the study traffic projections had taken into consideration the possibility of other modes of transport fulfilling the demand. Stephen Wainwright noted that the study team had not taken explicit account of other modes, but implicitly the STATFOR forecasts would be based on an assumption about air transport’s modal share.
- D1.19 Werner Langhans (Austria CAA): Asked if a demand growth-sensitivity had been undertaken. The study team agreed that such a sensitivity should be performed.
- D1.20 Theo Zandstar (Dutch Ministry of Transport): Asked what would happen to the costs and benefits if there were another crisis in the airline industry. The study team responded that an appropriate sensitivity test would be needed to assess the impact.
- D1.21 Joel Cariou (ATCEUC): The level of safety should be a key criterion for the success of SESAME. The study was too focussed on cost and capacity issues. He highlighted that ICB should be major stakeholders in the process and recommended that safety impacts be taken into consideration in the final report. Nick McFarlane highlighted that they had been analysed and were contained in the appendix. However, because of the high level of safety standards provided by the current system, the financial benefits derived from improved safety were expected to be minimal.
- D1.22 Bruce Coombes (UK Department of Transport): In order for SESAME not to degrade safety, safety considerations would need to be taken into account in the Definition phase of the programme.
- D1.23 Colin Chisholm (Vice Chairman ICB): Emphasised that SESAME should and must deliver improvements in safety. He saw the main risks to the programme being the level of benefits and also the key area of transition from the existing situation to a fully functioning SESAME programme. Moreover, the typical delays in the industry in implementing were three to five years – this would necessarily have a significant impact on the level of benefits.
- D1.24 Gunther Martis (AEA): Asked whether it was assumed that airborne systems would be developed, and that the approach to SESAME would take account of the need for global harmonisation. The study team highlighted that the global dimension had been a key consideration in framing the Governance arrangements.

- D1.25 Geir Ingerbrethsen (CAA Norway): Welcomed the discussion of the environmental risks in the analysis, and highlighted that the political emphasis on environmental issues might have an impact on growth projections. There might be significant legislative constraints in the future.
- D1.26 Lionnel Wonneberger (Air Traffic Alliance): There would be significant benefits from SESAME for the success of the supply industry in Europe. One of the main benefits would be to encourage the development of a European supply industry capable of competing with US industry.

Governance framework

- D1.27 Simon Ellis presented on the proposed Governance framework.
- D1.28 Ben Van Houtte outlined the Commission's views on the consultant's work on the governance arrangements. They had four main comments:
- They would prefer a simpler structure
 - They were open-minded about whether to include the manufacturing industry in the governance arrangements
 - There needed to be greater clarity about the level of responsibility between the Supervisory Authority and the Administrative Board.
 - The Commission would need to frame its own proposals for legislation
- D1.29 Gerry O'Connell (IATA) asked the Commission to set out their plans for the communication, legislation and SESAME work definition stages of the programme. Ben van Houtte noted that the Definition Phase was expected to start soon, and that it would include a work package for the structure of the implementation phase. This meant that there was inevitably some overlap in the programme. The Joint Undertaking would need a new Council Regulation to take effect – this would need the approval of Parliament and be expected to take between one and one and half years to proceed through the legislative process. The Commission would be preparing a communication for publication in late summer / early autumn. This would mean that Council and Parliament would give guidance on a work package by the beginning of 2007.
- D1.30 Luca Falessi (ENAC): Stated that he did not believe there was enough clarity as to the balance of power between the Supervisory Authority and the Joint Undertaking. The study team stated that the power would to a large extent depend on the voting rights in the Joint Undertaking.
- D1.31 Rudiger Schwenk (CANSO): Stated that the customer – supplier relationship needed to be the key driver of the governance framework.
- D1.32 Fritz Feitl (Chairman ICB): Believed that the ICB should play a more central role in the governance arrangements than the one set out in the proposal. The ICB's TOR remained unchanged. The study team noted that, in discussions with stakeholders, it was felt that the ICB should have an important advisory role but probably did not have

the skills and the decision-making processes enabling it to participate directly in the Administrative Board.

- D1.33 Luigi Iodice (Air Traffic Alliance): Put forward two recommendations. First, representatives of the suppliers are on the Administrative Board. Although he agreed with need to maintain competition, he noted that the suppliers also needed to be involved with standardisation and R&D. Second, the current draft of the 7th Framework did not explicitly include large projects for the SESAME programme. This should be addressed by the Commission.
- D1.34 Laurence King (ETF): Industry workers needed to be involved in the Administrative Board. He was glad that this had been recognised in the proposals.
- D1.35 A representative from (Eurocontrol): Eurocontrol accepted that past programme implementation had suffered from a lack of industry conformity and agreement on a course of action. There would need to be independent decision making, although it was important that the JU was as lean as possible.
- D1.36 Dominique Stammler (DGAC France): Highlighted that the Eurocontrol ATMN budget would need to be transferred to SESAME. The JU would need to be sized depending on its role in procurement - under option 2 it would have a much larger role than under option 3, requiring more resources.
- D1.37 Werner Langhans (Austrian CAA): The Commission needed to ensure that there was no duplication between the SESAME JU and Eurocontrol. The key link between the CBA and governance arrangements was the appropriate level of public and private funding.
- D1.38 Luca Falessi (ENAC): Noted the need to avoid too many entities being involved in standardisation (EASA, EU and Eurocontrol). Safety needed to be a central objective of the Joint Undertaking.
- D1.39 Fiona McFadden (European Cockpit association): Asked under what legislative arrangements the JU would be established and where it would be located. Ben Van Houtte noted that the location of the SESAME entity had not yet been decided and it would be established under Belgian law.
- D1.40 Bruce Coombes (Department of Transport UK): There needed to be a clear line of authority between the Supervisory Authority and the Administrative Board. A careful balance between Member State and industry involvement was required in to provide a governance mechanism that delivered.
- D1.41 Colin Chisholm (Vice Chair ICB): Believed that the JU was too complex. The supervisory authority could be the Single Sky Committee. Both manufacturers and Eurocontrol should be inside the governance framework. There was a funding challenge to get the balance between public and private providers in proportion. Thought that EASA should not participate directly in the Supervisory Authority or the JU, although both would need to operate in full compliance with the established framework of safety requirements and set improvements in safety as a key objective. Simon Ellis responded to the points about complexity on behalf of the study team. He

noted that any suggestions about how the proposed structure could be simplified would be welcome, but stakeholders needed to make specific proposals as to which bodies or organisations should be removed.

- D1.42 Jean-Jacques Savage (Eurocontrol): Wanted to ensure the success of the ATM Master Plan and use the expertise of Eurocontrol in enabling this through SESAME.
- D1.43 Hermant Mistry (IATA): To gain the potential benefits of SESAME, there needed to be significant public money put into the programme to ensure proper financing, particularly given the significance of wider economic (as opposed to stakeholder financial) benefits. The voting rights of the JU needed to be related to funding or risks taken on by the organisations. The JU should not develop into a body that competed with EUROCONTROL. There was a need for a balanced procurement market with a middle layer between software and hardware requirements.
- D1.44 Fritz Feitl (Chairman ICB): Emphasised the need to avoid duplication. The JU should integrate existing bodies and ensure their contribution to the SESAME programme.
- D1.45 Bernard Maartens (CANSO): Did not believe that the JU should be promoting common procurement as this would undermine competition. There was insufficient clarity on what it would procure.
- D1.46 Andries Verbugt (CANSO): ANSPs were taking on significant risk exposure through the impact of the system on safety. The study downplayed the risk to ANSPs too much.
- D1.47 Gerry O'Connell (IATA): The airline industry expects to contribute €80 billion over the life of the programme and the Commission's contribution of €2-3 billion therefore represented only 2-3% of total research and development. The ICB needed to do more work in the area and further impact studies needed to be undertaken during the transition period.

Closing the meeting

- D1.48 The meeting was closed with summaries of the meeting from Daniel Calleja of the European Commission. He summarised the importance of SESAME and stated that the Commission would come back with firm proposals for discussion with the SESC and ICB soon.

CONTROL SHEET

Project/Proposal Name: SESAME CBA AND GOVERNANCE

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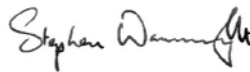
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