

Special Report

Single European Sky: a changed culture but not a single sky

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This performance audit was produced by Audit Chamber II – headed by ECA Member Iliana Ivanova - which specialises in investment for cohesion, growth and inclusion spending areas. The audit was led by ECA Member George Pufan, supported by Patrick Weldon, head of private office and Mircea Radulescu, attaché; Pietro Puricella, principal manager; Afonso Malheiro, head of task; Luis de la Fuente Layos, Erki Must, Maria Dominguez, Annekatrin Langer and Judit Oroszki, auditors.



From left to right: Luis de la Fuente Layos, Annekatrin Langer, Afonso Malheiro, Erki Must, Maria Dominguez, George Pufan, Pietro Puricella, Mircea Radulescu, Patrick Weldon.

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GLOSSARY

Additional taxi-out time: An indicator that measures additional time in the taxi-out phase calculated as the difference between the actual taxi-out time of a departing aircraft and the unimpeded time based on taxi-out times in periods of low traffic.

Area Control Centre (ACC): A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

Air navigation services: They include: air traffic services (mainly air traffic control); communication, navigation and surveillance services (CNS); meteorological services (MET); and aeronautical information services (AIS).

Air Navigation Service Provider (ANSP): Any public or private entity providing air navigation services for general air traffic.

Air Traffic Control: A service provided for the purpose of ensuring a safe separation between aircraft and maintaining an orderly flow of air traffic.

Air Traffic Controller: A person authorised to provide air traffic control services.

Air Traffic Management (ATM): The aggregation of airborne and ground-based services (air traffic services, airspace management and air traffic flow management) required to ensure the safe and efficient movement of aircraft during all phases of operations.

Air Traffic Flow Management (ATFM): A function established to ensure a safe, orderly and expeditious flow of air traffic by optimal use of ATC capacity and to see that the traffic volume is compatible with the capacities declared by the appropriate air navigation service providers.

Airspace users: Operators of aircraft either civil (commercial airlines and general aviation) or military.

Central Route Charges Office: A Eurocontrol unit in charge of handling the billing and collection of aviation en-route charges from airspace users and its redistribution to the States.

Connecting Europe Facility: Since 2014, the Connecting Europe Facility (CEF) has provided financial aid to three sectors: energy, transport and information and communication technology (ICT). In these three areas, the CEF identifies investment priorities that should be implemented in the coming decade, such as electricity and gas corridors, the use of renewable energy, interconnected transport corridors and cleaner modes of transport, high-speed broadband connections and digital networks.

Determined Unit Cost: The result of dividing the pre-determined costs relating to eligible services, facilities and activities to be incurred for the provision of air navigation services by the traffic forecasted for the same period, expressed in service units. They are calculated for each en-route or terminal charging zone and included in the performance plans.

En-route ATFM delay: A capacity key performance indicator that measures the average minutes of en-route ATFM delay per flight attributable to air navigation services expressed as the difference between the estimated take-off time requested by the aircraft operator in the last submitted flight plan and the calculated take-off time allocated by the Network Manager.

En-route charging zone: A volume of airspace for which a single cost base and a single unit rate are established.

En-route services: They are eligible services related with the provision of en-route air navigation services and therefore excluding terminal services.

Eurocontrol: The European Organisation for the Safety of Air Navigation is an intergovernmental organisation founded in 1960 and aimed to promote safe, efficient and environmentally-friendly air traffic operations throughout the European region.

European Aviation Safety Agency: An EU agency having as primary objective establishing and monitoring a high uniform level of safety and environmental protection in civil aviation in Europe.

European ATM Master Plan: A document that outlines the essential operational changes required to achieve the Single European Sky performance objectives. It is the agreed basis

for the timely, coordinated and synchronised deployment of the new SESAR ATM functionalities.

Free Route Airspace: It is a specified airspace within which users can freely plan a route between a defined entry point and a defined exit point, without reference to the air traffic services route network, subject to availability. Within such airspace, flights remain subject to air traffic control.

Flight Information Region: An airspace of defined dimensions within which air navigation services are provided.

Functional Airspace Block: An airspace block based on operational requirements and established regardless of State boundaries, where the provision of air navigation services and related functions are performance-driven and optimised to introduce, enhanced cooperation among ANSPs or, where appropriate, an integrated provider.

IFR movement: Movement of an aircraft (arrival or departure) carried out under instrument flight rules as defined in Annex 2 of the Chicago Convention.

Horizon 2020: An EU instrument to finance over the 2014 to 2020 period, the research and innovation programme *Innovation Union*, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness.

Horizontal en-route flight efficiency: An environmental key performance indicator that compares the length of the en-route part of the trajectory (either planned or actual) and the corresponding portion of the great circle distance, i.e. the shortest route. The underlying assumption is that by flying the shortest route the fuel burn and the environmental impact of the flight would be minimized. En-route refers to the distance flown outside a circle of 40 nautical miles around airports.

National Supervisory Authority (NSAs): The bodies nominated to assume the supervision and monitoring tasks assigned to them in the Single European Sky legislation.

Network Manager (NM): A body nominated by the European Commission in 2011 to reinforce and improve the performance of the European ATM network. The Network

manager is in charge of the central ATFM function, as well as coordinating the use of scarce resources and contributing to the design of a European Route Network.

Performance and Charging Schemes: The performance scheme sets targets for ANSPs in the key performance areas of safety, the environment, airspace capacity and cost-efficiency. The charging scheme provides the rules for the calculation of the unit rates chargeable to airspace users for the provision of air navigation services.

Performance Review Body: A body designated to assist the Commission and, upon request, the NSAs, in the implementation of the performance scheme.

Pilot Common Project: the first common project, mandated by EU legislation, identifying a first set of ATM functionalities to be deployed in a timely, coordinated and synchronised way so as to achieve the essential operational changes stemming from the European ATM Master Plan.

Service Units: It is the unit used for the calculation of the charges to be paid by airspace users. En-route service units are calculated as the product of the distance factor and the weight factor of the aircraft concerned. Terminal service units are equal to the weight factor of the aircraft concerned.

SESAR Joint Undertaking: A public private partnership set up to manage the activities of the development phase of the SESAR project. The aim of the SESAR JU is to ensure the modernisation of the European air traffic management system by coordinating and concentrating all relevant research and development efforts in the EU. It is responsible for the execution of the European ATM Master Plan.

Single European Sky ATM Research (SESAR): A project that aims at improving ATM performance by modernising and harmonising ATM systems through the definition, development, validation and deployment of innovative technological and operational ATM solutions.

Single Sky Committee: A committee composed of representatives of the Member States established to support the European Commission in the implementation of the Single

European Sky initiative and to issue opinions on the corresponding implementing regulations and decisions.

Terminal arrival delay: A capacity key performance indicator that measures the average minutes of arrival ATFM delay per flight attributable to terminal and airport air navigation services and caused by landing restrictions at the destination airport.

Terminal charging zone: An airport or a group of airports for which a single cost base and a single unit rate are established.

Terminal services: Eligible services related to: (i) aerodrome control services, aerodrome flight information services including air traffic advisory services and alerting services; (ii) air traffic services related to the approach and departure of aircraft within a certain distance of an airport on the basis of operational requirements; and (iii) an appropriate allocation of all other air navigation services components, reflecting a proportionate distribution between en-route and terminal services.

Trans-European Transport Networks (TEN-T): A planned set of road, rail, air and water transport networks in Europe. The infrastructure development of the TEN-T is closely linked with the implementation and further advancement of EU transport policy.

ABBREVIATIONS

ACC: Area Control Centre

ANSP: Air Navigation Service Provider

ATC: Air Traffic Control

ATCO: Air Traffic Controller

ATFM: Air Traffic Flow Management

ATM: Air Traffic Management

CBA: Cost Benefit Analysis

CNS: Communication, Navigation and Surveillance services

CRCO: Central Route Charges Office

DG MOVE: Directorate-General for Mobility and Transport

DUC: Determined Unit Cost

EASA: European Aviation Safety Agency

EUIR: European Upper Flight Information Region

FAB: Functional Airspace Block

ICAO: International Civil Aviation Organization

IFR: Instrument Flight Rules

KPI: Key Performance Indicator

NSA: National Supervisory Authority

R&D: Research and Development

SES: Single European Sky

SESAR: Single European Sky ATM Research

SESAR JU: SESAR Joint Undertaking

SSC: Single Sky Committee

TEN-T: Trans-European Transport Networks

EXECUTIVE SUMMARY

About the Single European Sky

I. Air transport is an important component of the EU internal market, promoting the mobility of persons and goods while propelling economic growth. Some 920 million passengers and 15 million tonnes of freight departed or arrived at EU airports in 2015. In that year, the European skies were used by almost 10 million IFR (Instrument Flight Rules) flights. The safe and efficient flow of such traffic requires the intervention of Air Traffic Management (ATM), which comprises three essential functions: ensuring separation between aircraft; balancing supply (of air traffic control) and demand (flights); and providing aeronautical information to airspace users.

II. Although having inherently an international nature, air traffic has been traditionally managed at national level in a fragmented and monopolistic environment, features which have contributed to delays and higher ATM costs borne by airspace users. Therefore, the Single European Sky (SES) initiative aims at improving the overall performance of ATM by moving a number of competences from an earlier intergovernmental practice to the framework of the European Union.

III. The SES initiative was formally launched in 2004 and gradually established a regulatory framework, comprising a set of EU-wide common binding rules on ATM safety, on the provision of ATM services, on airspace management and on interoperability within the network. That framework is coupled with a technological modernization programme, the “SESAR project” (Single European Sky ATM Research), backed with financial incentives.

How we conducted our audit

IV. In this audit we assessed whether the EU’s SES initiative has so far resulted in a more efficient European ATM. In particular, we examined whether the SES was justified and the extent to which a selection of its components (the performance and charging schemes, the functional airspace blocks and the definition and development phases of the SESAR project), have so far contributed to a more efficient European ATM.

V. We visited the Commission (DG MOVE), Eurocontrol, EASA, the SESAR JU and a sample of its members. We also visited 5 Member States – Spain, France, Hungary, Sweden and the United Kingdom – covering in each the governmental department responsible for air transport policy, the national supervisory authority and one air navigation service provider. In addition, we reviewed a sample of activities (11 R&D projects, 4 demonstration activities and one study) executed in the framework of the SESAR project and co-financed by the EU.

What we found

VI. The SES initiative was justified because European air traffic management was hindered by national monopolies and fragmentation. The various components of the policy form a coherent set that indeed targets those shortcomings. However, changes in traffic patterns meant that the high level goals established in 2005 for the initiative became partly unachievable and partly irrelevant.

VII. The performance and charging schemes aim at mitigating the negative effects of a monopolistic service provision by establishing binding targets and establishing common rules for the charging of costs to airspace users. They have fostered a culture of efficiency and transparency at the level of air navigation service providers (ANSPs). However, the quantitative results fell below expectations: delays have generally been above the targets set in performance plans and, despite reaching a record low in 2013, have been increasing since; unit rates paid by airspace users are heavily dependent on traffic volumes and have only decreased by 4 % between 2011 and 2016, which is below the EU-wide reduction set by the Commission.

VIII. The absence of substantive defragmentation, coupled with slower traffic growth, are key contributors to the lacklustre quantitative results shown by the performance scheme. Current Functional Airspace Blocks (FABs) essentially provide a forum for cooperation between stakeholders of neighbouring States but have proved ineffective in targeting fragmentation, whether at the levels of airspace management, service provision or procurement of technical equipment.

IX. The oversight role attributed to National Supervisory Authorities (NSAs) is hampered by the fact that they are not always fully independent from ANSPs and in some cases do not

have the necessary resources to fulfil it. We also found a limitation, particularly in the area of cost-efficiency, where regular checks on costs charged to airspace users are not being conducted.

X. The process of adopting targets for the performance scheme is lengthy and complex. Reaching agreements between the Commission and Member States has proved to be difficult, particularly in the areas of capacity and cost-efficiency. In addition, some indicators used to measure ATM performance contain shortcomings as they do not capture relevant aspects of that performance.

XI. SESAR's definition and development phases promoted the commitment of key stakeholders to a common technological plan and its development phase transformed a previously fragmented R&D environment into a coordinated one. The SESAR JU has been gradually releasing technological and operational improvements, packaged under a number of "SESAR Solutions". However, the EU's role in the project has evolved from its original inception as regards scope, timeframe and financial magnitude, all of which have been significantly extended. The SESAR project now pursues an open-ended, continuously evolving R&D vision which is not aligned with the regulatory framework that governs the SESAR Joint Undertaking. This misalignment impacts negatively on the accountability of the Joint Undertaking. As of 2016, only a small part of the Master Plan in-place had actually been executed and SESAR performance ambitions were re-set for 2035, not 2020 as originally envisaged. In addition, individual R&D projects were launched without the support of a specific cost benefit analysis demonstrating their added value.

What we recommend

XII. The Commission should:

- review the SES high level goals;
- analyse other policy options targeting defragmentation;
- ensure full independence and capacity of NSAs and cover the inspection gap at the level of the charging scheme;

- streamline the performance scheme;
- review certain key performance indicators;
- review the EU's support structure to R&D in light of its objectives;
- reinforce the accountability of the SESAR JU;
- prioritize EU support to R&D solutions that promote defragmentation and a competitive environment.

INTRODUCTION

Background

1. Air transport is an important component of the EU internal market and of the competitiveness of European industries and services. It enables the mobility of persons and goods across and beyond the EU, while propelling economic growth, jobs and trade. Some 920 million passengers and 15 million tons of freight departed or arrived at EU airports in 2015. In that year, the European skies were used by almost 10 million flights conducted under Instrument Flight Rules ¹.
2. Air traffic management is needed to ensure safe and efficient air transport in a context of growing air traffic using a limited volume of airspace. It consists of three primary activities:
 - ensuring separation between aircraft;
 - balancing supply (of air traffic control) with demand (flights), aiming at a safe, efficient and expeditious flow of air traffic;
 - providing aeronautical information to airspace users (e.g. navigational aids, weather information).
3. Air traffic management has traditionally been developed and provided at a national level by air navigation service providers. This has had three important consequences: (i) the European sky was fragmented into a multitude of sectors and area control centres, drawn on the basis of national borders and managed by national air navigation service providers (see **Map 1**); (ii) each air navigation service provider operated under its own procedures and used tailor-made support tools, effectively limiting integration, interoperability and economies of scale; and (iii) air navigation service providers enjoyed a largely monopolistic situation vis-à-vis a much more competitive aviation market.

¹ Source: Eurostat, “Air Transport Statistics” and Eurocontrol “Seven-Year Forecast (ESRA08)”.

Map 1 – European Flight Information Regions



Source: Eurocontrol².

4. Users of European airspace are charged for the air traffic management services they receive on the basis of the type of aircraft and the distance flown within the area of responsibility of each air navigation service provider (ANSP), according to the planned trajectory. Each year, they pay up to 9 billion euro for these services³, an average of some 900 euro per flight.

² Disclaimer by Eurocontrol: “The use of this map is at the user’s sole risk and responsibility .”

³ ECA calculation based on reports by Eurocontrol’s CRCO and by the Performance Review Body, including both en-route and terminal charges.

What is the Single European Sky?

5. The Single European Sky (SES) initiative aimed at improving the overall performance of air traffic management (ATM), whilst meeting the requirements of all airspace users⁴.

6. The SES today is a regulatory framework (see ***paragraph 10***) coupled with a technological modernization programme (the SESAR project). It comprises a set of EU-wide rules on ATM safety, on the provision of ATM services, on airspace management and on interoperability within the network, as well as financial support to SESAR.

7. The SES area includes all 28 Member States of the European Union and extends also to Switzerland and Norway. It involves a wide range of stakeholders, both at national and European levels.

STAKEHOLDER	Main role
EUROPEAN COMMISSION	Responsible for the overall implementation of the SES initiative
EUROCONTROL	An intergovernmental organisation composed of 41 States ⁵ , active as: network manager, in charge of the central ATFM function, as well as coordinating the use of scarce resources and contributing to the design of a European Route Network; provider of technical support to the Commission, EASA and NSAs; ANSP in the Maastricht Upper Area Control Centre; Central Route Charges Office; founding member and contributor to the SESAR JU, among others.
SINGLE SKY COMMITTEE (SSC)	Comprised of representatives of the Member States and issues opinions on Commission's implementing regulations and decisions
EUROPEAN AVIATION SAFETY AGENCY (EASA)	Provides oversight and support to Member States in ATM issues as well as support to the Commission in its rulemaking activity

⁴ Article 1 of Regulation (EC) No 549/2004 of the European Parliament and the Council of 10 March 2004 laying down the framework for the creation of the Single European Sky (OJ L 96, 31.3.2004, p. 1) as amended by Regulation (EC) No 1070/2009.

⁵ All 28 EU Member States, Albania, Armenia, Bosnia-Herzegovina, the former Yugoslav Republic of Macedonia, Georgia, Kosovo, Moldova, Montenegro, Norway, Serbia, Switzerland, Ukraine and Turkey.

NATIONAL SUPERVISORY AUTHORITIES (NSAs)	Responsible for the certification and oversight of their national ANSPs as well as for the drafting and monitoring of performance plans and targets
PERFORMANCE REVIEW BODY	Assists the Commission and, upon request, the NSAs in the implementation of the performance scheme
AIR NAVIGATION SERVICE PROVIDERS (ANSPs)	Provide air traffic control, communication, navigation and surveillance services as well as meteorological and aeronautical information
AIRSPACE USERS	Recipients of en-route and ground air navigation services. Includes the commercial airlines, the military and the general aviation.
AIRPORT OPERATORS	Administer the airport facilities and coordinate and control the activities of the different actors present at the airports
SESAR JOINT UNDERTAKING (SESAR JU)	Responsible for the coordination and execution of R&D activities of the SESAR project as foreseen in the European ATM Master Plan
SESAR DEPLOYMENT MANAGER (SDM)	Responsible for the synchronised deployment of a selection of new ATM functionalities resulting from the SESAR project

The history of the SES initiative

8. As far back as 1989, an estimated 4.2 billion US dollars per year⁶ was being lost to air-traffic control – induced delays, excessive air-traffic control costs and uneconomical flight trajectories. National governments were calling for initiatives such as a Central Flow Management Unit (to manage flows through the network) and a European Air Traffic Control Harmonisation and Integration Programme for technological harmonisation⁷.

9. The European Commission began to acknowledge the technological and institutional limitations of the air-traffic control system, such as fragmentation of airspace, a multiplicity of national air traffic control centres, a lack of effective decision making mechanisms and

⁶ “Towards a Single System for Air Traffic Control in Europe”, Consultant’s Final Report to the Association of European Airlines, September 1989.

⁷ “MATSE” meetings (ECAC Transport Ministers on the Air Traffic System in Europe) in 1988 and 1990.

enforcement powers, and costly delays. Citing a catastrophic level of delays the Commission presented plans for the creation of a Single European Sky initiative in 2001⁸.

10. In 2004, the first SES legislative package was adopted⁹. The regulations were revised and extended in 2009 in the “SES II” package. This introduced a performance scheme, a revised charging scheme and the requirements for functional airspace blocks. A Network Manager was created, as well as a Performance Review Body to support the development and management of the SES performance scheme. The framework also included several other Implementing Rules and Community Specifications (“technical standards”) to ensure the interoperability of systems. A more detailed timeline of the SES initiative is included in **Annex I**.

EU financial support to the SESAR project

11. The EU’s financial support to the SES initiative, while originating from a variety of financial instruments, is essentially dedicated to the SESAR project. Support during SESAR’s definition and deployment phases was and is being awarded in the form of grants with co-financing rates of 50 % (definition phase) and ranging between 20 % and 85 % (deployment phase). As regards the development phase, a public-private partnership was created (the SESAR JU) in which funding is shared between the European Commission (cash contribution), Eurocontrol (cash and in-kind contributions) and a group of industrial partners (cash and in-kind contributions).

⁸ Key documents supporting the Commission’s diagnosis include the Communication from the Commission on Air Traffic System Capacity Problems, COM(88) 577 final, January 1989; White Paper presented by the Commission “ATM - Freeing Europe’s Airspace”, 1996; COM(1999) 614 final/2 of 6.12.1999 “The creation of a Single European Sky”; Report of the High-Level Group (composed by senior representatives of civil and military air traffic authorities from Member States but including also contributions from airspace users, ANSPs, manufacturers and staff representatives), November 2000; and COM(2001) 123 final “An action programme on the creation of a Single European Sky”.

⁹ Regulations (EC) Nos 549/2004, 550/2004, 551/2004 and 552/2004 from the European Parliament and the Council, as subsequently amended.

Table 1: EU Financial Support to the SESAR Project

SESAR Phase	Period	EU contribution (million euro)	Funding source
Definition	2004-2006	30	TEN-T
Development	2007-2013	700	TEN-T and 7 th Framework Programme
Development	2014-2020	585	Horizon 2020
Deployment	2014-2020	2 500	Connecting Europe Facility
Total		3 815	

Note: The amounts mentioned for the period 2014-2020 are indicative.

Audit scope and approach

12. In this audit the Court assessed whether the EU's SES initiative has so far resulted in a more efficient European ATM. To do this, we examined:

- whether the SES initiative was justified;
- whether the SES's regulatory components, in particular the performance and charging schemes as well as the functional airspace blocks, have effectively contributed to a more efficient European ATM;
- whether the SES's technological component (the SESAR project) has made an effective contribution to the performance of European ATM.

13. The audit work firstly sought to determine if a correct analysis of the problems within European ATM was made prior to launching the SES legislative packages (2004 and 2009) and whether those components of the SES initiative are solving the problems identified. Secondly, the audit sought to measure the actual benefits brought about by those components until 2016 and compare them with the initial expectations. The audit did not cover the deployment phase of SESAR, which only started in 2014.

14. We visited the Commission (DG MOVE), Eurocontrol, EASA, the SESAR Joint Undertaking and some of its members. We also visited 5 Member States – Spain, France, Hungary, Sweden and the United Kingdom – covering in each, the governmental department responsible for air transport policy, the National Supervisory Authority and one ANSP. Interviews were also held with representatives of airspace users and air traffic controllers. Moreover, we carried out a visit to relevant institutions in the United States dealing with ATM¹⁰ for an exchange of views on their operational and audit experience in this field.

15. In addition, the audit included a sample of activities (R&D projects, demonstration activities and one study) executed in the framework of the SESAR JU and co-financed by the EU. This review evaluated the need for launching such activities and whether their outputs and final results were in line with expectations. The analysis of activities covered is presented in **Annex II**.

OBSERVATIONS

The SES initiative was justified

16. We have reviewed the key problems affecting European ATM prior to the Single European Sky initiative and the need for EU intervention in this area, together with the expectations set for the SES.

National monopolies and fragmentation called for EU intervention

17. International airspace, when fragmented into smaller units organised along national boundary lines, has a limiting effect on integration, interoperability and economies of scale, whilst also causing flight delays. In addition, there is usually only one ANSP per country. With little or no competition, near monopoly conditions allow service providers to dictate the conditions of ATM supply. This background provided ample justification for European level intervention in this area. This was finally triggered by the high levels of delay experienced in the late 1990s - en-route delays stemming only from air traffic control restrictions were

¹⁰ The Federal Aviation Administration responsible for the provision of ATM and two audit institutions with relevant work done in this field: the Government Accountability Office and the Office of Inspector General of the Department of Transportation.

climbing rapidly, reaching almost 5 minutes per flight in 1999 and significantly contributing to overall delays in air transport.

18. The main policy instruments of the Single European Sky initiative, analysed in more detail in the following sections, form a coherent set that, in principle, would allow tackling the key problems identified in European ATM. They brought in legal enforcement power coupled with financial incentives, which should promote significant improvements in ATM.

However, the policy's High Level Goals were formulated in a period of strong traffic growth

19. The policy's overall objective of improving ATM's safety and performance was translated into a set of high level goals. Using 2005 as a base year, the goals were to triple capacity, to reduce effects on the environment by 10 % and ATM costs to airspace users by 50 %, whilst increasing safety tenfold¹¹.

20. These high level goals underpinned the decision to launch the SESAR project and commit EU funding to it. The Commission's DG MOVE adopted them as mid-term targets for its SES policy¹².

21. However, the goals were established relative to the strong air traffic growth at the time and even then lacked an in-depth analysis. When demand later slowed¹³, these goals became both irrelevant in respect of capacity, and unachievable in respect of cost-efficiency. During the course of the audit, the Commission acknowledged that the goals are to be seen as aspirations rather than targets. Slower growth also shifted the key expectations of

¹¹ Initially announced by Commissioner Jacques Barrot in 2005, these high level goals were later included as part of the European ATM Master Plan endorsed by the Council in 2009.

¹² DG MOVE Annual Activity Report 2013.

¹³ Between 2000 and 2016, traffic grew only at an average rate of 1 %, well below the forecasts included in the SES preparatory documents (5-7 %). In addition, airlines have been using aircraft with more seating capacity and/or operating them with higher load factors. As a consequence, the expected growth in air travel, measured in passengers, did not translate into a proportional increase in air traffic.

airspace users from the SES initiative: after 2008, their key concern moved from increasing the capacity of the ATM system to lowering its cost.

The SES regulatory achievements: a changed culture but not a single sky

22. We have reviewed the adequacy of selected key regulatory components of the Single European Sky initiative to address the problems hindering European ATM: the performance and charging schemes and the functional airspace blocks (as described in paragraphs 23 and 38). Furthermore, we analysed the results achieved and compared them with the expectations.

The performance and charging schemes fostered a performance-oriented culture and brought transparency to the provision of Air Navigation Services ...

23. The performance scheme seeks to mitigate the monopolistic position of the ANSPs by setting binding targets in respect of safety, flight efficiency and delays, as well as cost. The charging scheme enhances transparency by defining which costs are eligible to be charged to airspace users and by providing common rules for the calculation of unit rates. Both schemes also contain provisions for the monitoring of their implementation by the Commission and National Supervisory Authorities. A more detailed description of the functioning of these schemes, as well as the links between them is provided in **Annex III**.

24. The implementation of the performance and charging schemes has brought two main benefits which were generally acknowledged by all the stakeholders involved:

- (a) It has helped ANSPs to develop a performance-oriented culture that was not always present in the past. The definition of performance targets, the measurement of results and the incentives linked to their achievement have contributed to this culture and led ANSPs to search for efficiencies within their operations.
- (b) The availability of timely and relevant information required by the performance and charging schemes has contributed to a high level of transparency in the provision of air navigation services. This has also been fostered by regular consultation between stakeholders.

... but quantitative results are below expectations ...

25. We have analysed the quantitative results of the performance and charging schemes against the targets for the environment, capacity and cost-efficiency for reference period 1 (RP1, 2012-2014) and reference period 2 (RP2, 2015-2019)¹⁴. In addition, **Figure 1** shows a longer term evolution of actual en-route delays and average unit rates¹⁵, together with actual traffic, with which they are closely linked.

26. We highlight that:

- (a) As regards capacity, en-route Air Traffic Flow Management delays (see green line in **Figure 1**) in 2016 are better than in 2008 for a comparable volume of traffic. However, the EU-wide target of 0.5 minutes per flight has never been reached and delays have been growing since 2013, exceeding the target value in 2016 by a factor of 2. Industrial action contributed to 13.6 % of total en-route delay in 2016 and an estimated 13 000 flights were cancelled during strike days¹⁶.
- (b) As regards cost-efficiency, between 2004 and 2016 actual unit rates (see red line in **Figure 1**) experienced an accumulated decrease of 22 % at constant prices. However, most of this reduction has been achieved between 2004 and 2008, i.e., during years of strong traffic growth and before the performance scheme came into force. Between 2011 (the year prior to the implementation of the determined cost system and the performance scheme) and 2016, the total reduction was only of 4 %. This falls below what the Commission had set as EU-wide reduction objective for determined unit costs

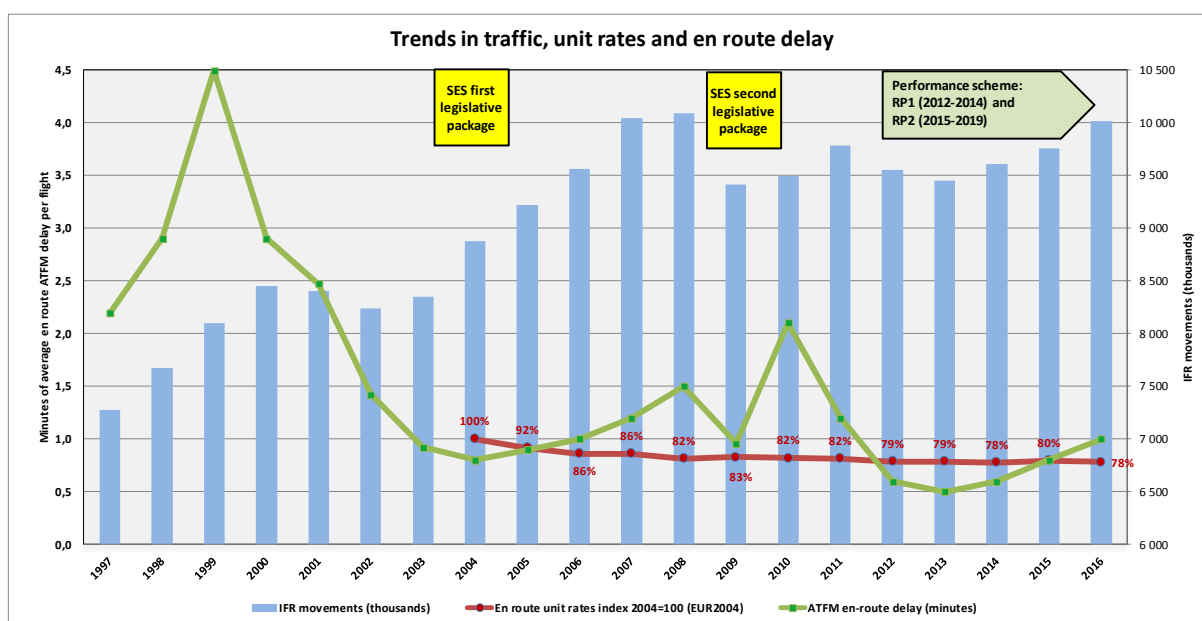
¹⁴ The EU-wide targets have been adopted in specific decisions: Commission Decision 2011/121/EU of 21 February 2011 setting the European Union-wide performance targets and alert thresholds for the provision of air navigation services for the years 2012 to 2014 (OJ L 48, 23.2.2011, p. 16) as regards RP1 and Commission Implementing Decision 2014/132/EU of 11 March 2014 setting the Union-wide performance targets for the air traffic management network and alert thresholds for the second reference period 2015-19 (OJ L 71, 12.3.2014, p. 20) as regards RP2.

¹⁵ Unit rates have been calculated as a weighted average of the en-route published rates in all SES charging zones and are presented at constant prices (base 2004=100).

¹⁶ Network Manager: Annual Network Operations Report 2016.

(3.5 % per year during RP1 and 3.3 % per year during RP2) and that underperformance is primarily the result of actual traffic being below the forecast¹⁷. As such, the benefits actually transmitted to users are far below the expectations raised by the Commission's decisions. In general, we observed that the determined unit costs and the unit rates are heavily dependent on traffic forecasts and actual traffic, respectively.

Figure 1 - Long term evolution of traffic, en-route delays and average unit rates



Source: ECA calculation based on data from Eurocontrol (reported by Network Manager and Central Route Charges Office).

- (c) Moreover, for the environmental key performance indicators (KPIs), despite a gradual improvement throughout RP1 and the first year of RP2, the 2014 target (4.67 % excess relative to the shortest route between origin and destination) was missed (4.9 %) and the latest figure available (2016) shows an interruption of the earlier positive trend (4.91 %).

¹⁷ According to the traffic risk sharing mechanism of the charging scheme, ANPSs are entitled to recover from airspace users a part of planned revenues that were not collected because the expected volume of traffic did not materialize. This was achieved through an adjustment of the unit rate of subsequent years. Further details on the functioning of the charging scheme are presented in **Annex III**.

27. The performance results at local level (Functional Airspace Blocks (FABs), charging zones) are varied and depend on local circumstances: geographical situation, legal and institutional set up, organisation of service provision, staff conditions, specific cost structure, and traffic patterns. See examples in **Box 1**.

Box 1 - Local results dependent on local circumstances

- In recent years, en-route delay has deteriorated in Spain and France. While in Spain it has been due to unforeseen higher traffic in South West Europe, in France it mainly resulted from the implementation of a new operating system in some area control centres and strikes by air traffic controllers. On the contrary, Sweden and Hungary have recorded very low en-route delay values because traditionally there are no capacity constraints in these countries.
- In Sweden and in the UK, the cost-efficiency results have been affected by certain cost items, notably defined benefit pension rights, which are considered to be outside of the control of the ANSPs¹⁸.
- In Spain, a 2010 law modified the working conditions of air traffic controllers. This has ensured a substantial reduction of staff costs, bringing them into line with the average of the five main ANSPs in Europe. Since the scheme's implementation in 2012, the unit rates have remained stable.

... and the schemes are affected by shortcomings

Lack of link between the performance scheme targets and the SES high level goals

28. The performance scheme should improve the overall efficiency of air navigation services across the four key performance areas of safety, environment, capacity and cost-efficiency, in line with the performance framework of the European ATM Master Plan¹⁹. The setting of

¹⁸ In a context of low interest rates, these defined benefit pension schemes required additional annual contributions from ANSPs to ensure that the covered employees will attain the agreed pension benefits.

¹⁹ Commission Regulation (EU) No 691/2010 of 29 July 2010 laying down a performance scheme for air navigation services and network functions (OJ L 201, 3.8.2010, p. 1) later repealed by Commission Implementing Regulation (EU) No 390/2013.

the European Union-wide performance targets should be considered part of a process aiming at achieving the goals contained in the Master Plan²⁰.

29. Despite these provisions, no measurement of the contribution of the performance scheme in RP1 to reach those high level goals has been done. In the Commission Decision setting the EU-wide performance targets for RP2 no reference is made at all to these goals.

The KPIs are not always fit for purpose

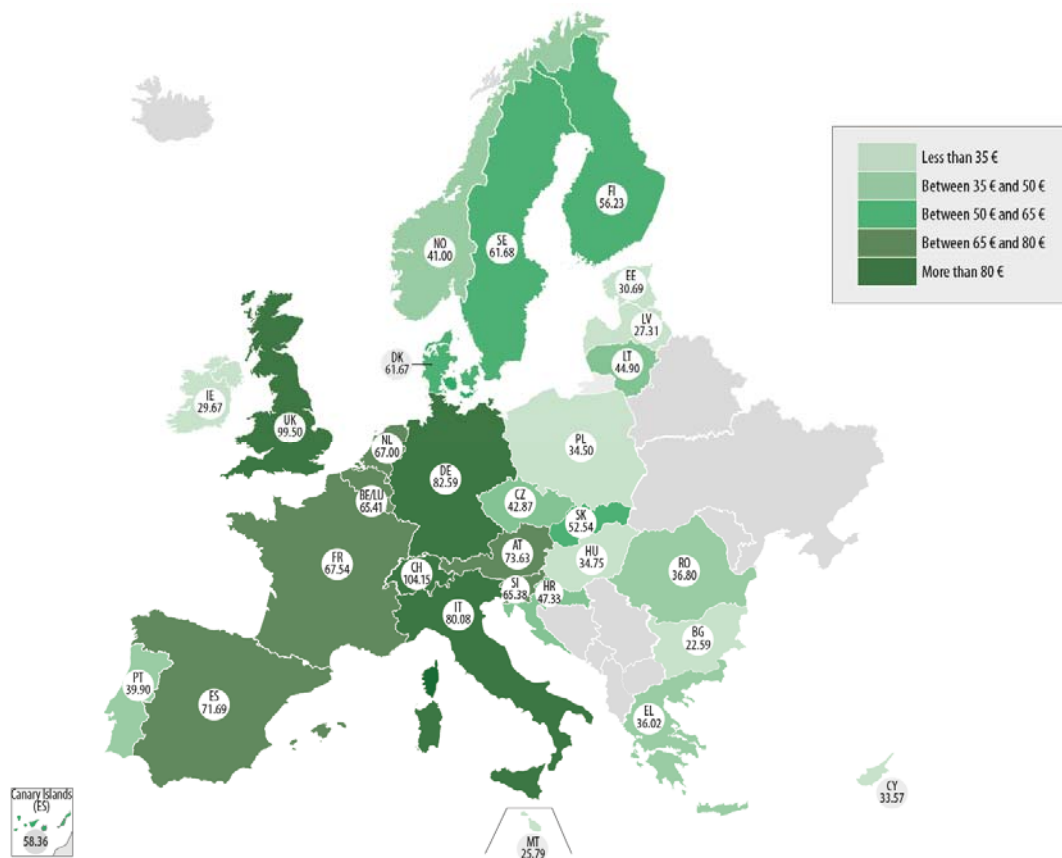
30. The set of performance indicators selected was largely based on the existing work of Eurocontrol and was determined by the pre-existing availability of information. However, we identified concerns as to the adequacy of certain key indicators to measure performance in their respective areas, as described below.

31. Environment. The key indicator in this area captures the difference between the planned or actual trajectory against the shortest route²¹. However, while the trajectory can certainly be extended by congestion or a non-optimal route design, there are also a number of other factors which result in deviations from the shortest route: weather conditions, airspace restrictions due to military operations or cost-efficiency decisions by airlines (unit rates vary significantly across countries, as shown in **Map 2**, which often leads airspace users to fly less expensive routes in terms of air navigation services instead of shorter routes). The accountability for this KPI cannot therefore be fully allocated to individual ANSPs, as these factors are outside their control. In addition, vertical flight efficiency is currently not targeted, although the altitude at which an aircraft is flown also determines the flight's environmental impact.

²⁰ Recital 8 of Commission Decision 2011/121/EU.

²¹ Horizontal en-route flight efficiency.

Map 2 - Contrasting en-route unit rates in different SES States in 2016 (expressed in euro)



Source: Eurocontrol's CRCO.

32. **Capacity:** Delays represent a very relevant performance measurement for air transport. However delays caused by air traffic management represent less than a third of the overall delay experienced by passengers²². No binding targets are set for additional components of the overall “gate-to-gate” delay, such as additional taxi-out time prior to take off or holding patterns in the vicinity of airports prior to landing. While ANSPs will only be accountable for a part of the overall gate-to-gate delay, a meaningful indicator in this area would need to

²² According to Eurocontrol's Central Office for Delay Analysis (CODA) Digest 2016, the overall delay experienced per IFR flight was 11.3 minutes, of which 6.2 minutes could be traced down to their primary causes (airlines 51 %, ATFM 28 %, airport 7 % and others causes, 14 %). The remaining 5.1 minutes are classified as reactionary, generated as a result of an aircraft's late arrival from a previous flight which in turn affects the punctuality of its next flight with the same aircraft, as well as potentially delaying connecting passengers.

include the key components that make the total delay. It is noted that these components are already being monitored, albeit without binding targets, in the area of the environment.

33. In addition, the measurement of delays is an indicator of the ability of ANSPs to respond to peaks in demand, but does not provide any insight into the efficient use of such capacity during off-peak periods, which is a challenge given the hourly, daily and seasonal variability of traffic flows.

The decision making process of performance targets is lengthy and complex

34. The adoption of performance targets requires a 3-step process including (i) the proposal, consultation and decision on targets at EU level; (ii) the preparation of FAB²³ performance plans with local and FAB targets, followed by their assessment by the Performance Review Body; (iii) the decision, by the Commission, on the consistency between local/FAB targets with those set at EU level. When deciding on targets, the Commission must seek the opinion of the Single Sky Committee²⁴, which can block or postpone that decision.

35. Such a process is inherently lengthy as the legal deadlines foresee a duration that can go up to two years. In practice, agreements on the targets for cost-efficiency have proved to be particularly difficult because of different levels of ambition displayed by the Commission and Member States on the magnitude of cost reduction. Actual negotiations with Member States and the Single Sky Committee have extended well into the reference period they were meant to cover. The whole process for reference period 2 has already taken almost four years and is not yet fully closed for all FABs²⁵. Specific cases are illustrated in Annex IV.

²³ The Functional Airspace Block concept is described in paragraphs 38-49.

²⁴ Article 5 of Regulation (EU) No 182/2011 of the European Parliament and of the Council of 16 February 2011 laying down the rules and general principles concerning mechanisms for control by Member States of the Commission's exercise of implementing powers (OJ L 55, 28.2.2011, p. 13).

²⁵ In the case of FAB BlueMed, capacity targets had not yet been adopted at the time of the audit.

Weak monitoring of performance targets and unit rates

36. Both the National Supervisory Authorities and the Commission are responsible for monitoring the implementation of the performance plans and, by regulation, can conduct inspections of ANSPs and the Network Manager, if they see fit²⁶. National Supervisory Authorities (NSAs) are also able to conduct inspections on the establishment of air navigation charges²⁷. In these activities, NSAs should be independent, at the functional level at least, from ANSPs and need the necessary resources and capabilities to carry out the tasks assigned to them²⁸. In addition, the Commission is also responsible for assessing the unit rates against the provisions of the performance and charging schemes²⁹.

37. We found a number of shortcomings limiting the effectiveness of the monitoring role:

- (a) We found cases where the lack of adequate resources (staff and/or financial) or the purely functional but not hierarchical and financial separation from the ANSPs were limiting the ability of NSAs to comply with their tasks. In Spain there was not a complete hierarchical separation between the ANSP and the NSA. In France the NSA and the ANSP report to the same Director General and share financial resources from a common budget, primarily funded by the very same navigation charges over which the NSA has regulatory oversight. In Hungary, the functional separation does not exist as the national law attributes to the ANSP the establishment of the ATM cost base, and the NSA lacks the necessary resources to carry out its oversight role. Already in 2013, the Commission proposed to reinforce the efficiency and independence of the NSAs “as a matter of priority”, however as of 2017 the situation remains unchanged in this respect.

²⁶ Article 20 of Commission Implementing Regulation (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions (OJ L 128, 9.5.2013, p. 1).

²⁷ Article 20 of Commission Implementing Regulation (EU) No 391/2013 of 3 May 2013 laying down a common charging scheme for air navigation services (OJ L 128, 9.5.2013, p. 31).

²⁸ Article 4 of Regulation No (EC) 549/2004.

²⁹ Article 17.1.(c) of Commission Implementing Regulation (EU) No 391/2013.

- (b) In the five Member States visited, no regular inspections were carried out to provide assurance that only eligible costs are included in the charging scheme nor on whether they were incurred in a cost-efficient manner and adequately allocated between en-route and terminal charging zones. As the verification work done by the Performance Review Body when assessing unit rates on behalf of the Commission also excludes the eligibility of the underlying costs, the unit rates are charged to users without sufficient checks being carried out on the costs underlying them.
- (c) Guidance in respect of the en-route / terminal cost allocation was found to be insufficient, which leads to a lack of harmonized accounting procedures across Member States and a risk of cross-subsidization between en-route and terminal services: the charging of terminal air navigation services to airspace users that are only overflying the concerned airspace and not using those terminal services.
- (d) Capital expenditure³⁰ included in performance plans is part of the determined unit cost and will be charged to airspace users even if ANSPs opt to cancel or postpone such investments. While the Performance Review Body has identified capital underspending of approximately 1 billion euro during the 2012-2015 period³¹, there is no provision for the return of these amounts to users should the related investments never materialize.

Functional Airspace Blocks eventually fostered cooperation structures, not defragmentation

38. The functional airspace block concept was created as a response to fragmentation, aiming in particular at airspace management on the basis of operational requirements and not on national borders. However, the regulatory framework in force does not prescribe FABs capable of effectively targeting fragmentation, as regards airspace management, service provision or the procurement of technical equipment.

³⁰ In the context of the charging scheme, this includes the cost of capital needed to fund investments on new assets deemed necessary for the service provision, as well as their subsequent depreciation.

³¹ PRB Annual Monitoring Reports 2014 and 2015.

A gradual conceptual change

39. From the initial vision of the Commission, focused on a configuration of airspace that would enable the operation of area control centres of an optimal size, FABs were gradually transformed into cooperation mechanisms between NSAs and ANSPs of neighbouring Member States:

- (a) The initial ambition for the FABs was expressed in a Commission communication of 2001³², which referred to the “creation of control areas across national boundaries”. It proposed the establishment of a European Upper Flight Information Region (EUIR) that would be “reconfigured into functional airspace blocks of minimum size on the basis of safety and efficiency”. The borders of such functional airspace blocks would not need to coincide with national boundaries and they would be created to support the “provision of air traffic services within area control centres responsible for an optimal size of airspace in the EUIR”.
- (b) The first SES package defined FABs as airspace blocks based on operational requirements and aimed at a more integrated management of the airspace regardless of existing boundaries³³. It envisaged the establishment of the EUIR, configured in FABs which should respect a number of conditions related to safety, efficiency and operability³⁴. Where FABs extend over the territory of more than one Member State, the Member States concerned would jointly designate the service providers³⁵. However, the reference to area control centres of an optimal size of airspace in the EUIR is no longer mentioned.

³² COM(2001) 564 final.

³³ Article 2.25 of Regulation (EC) No 549/2004 (“Framework regulation”).

³⁴ Articles 3 and 5 of Regulation (EC) No 551/2004 of the European Parliament and of the Council of 10 March 2004 on the organisation and use of the airspace in the single European sky (“Airspace regulation”) (OJ L 96, 31.3.2004, p. 20).

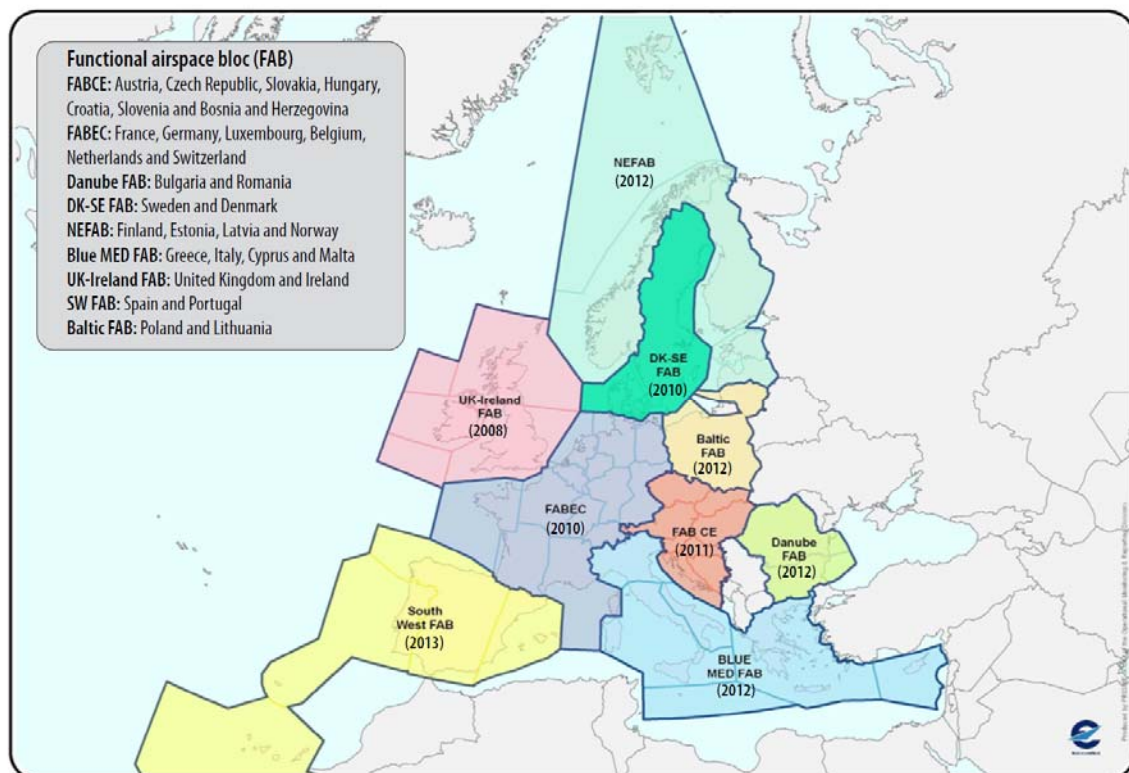
³⁵ Article 8.4 of Regulation (EC) No 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of air navigation services in the single European sky (“Service provision regulation”) (OJ L 96, 31.3.2004, p. 10).

- (c) The second SES package, adopted in 2009 and still in force today, introduces the concept of “enhanced cooperation” as an alternative to “integrated management” when defining FABs³⁶. Crucially, it also eliminates the requirement for the envisaged EUR to be configured into FABs. The prescribed requirements for FABs do not explicitly require integrated or cross-border service provision.

Actual implementation was contentious...

40. Following the adoption of the second SES package, 9 FABs were formally set-up in Europe, as shown in **Map 3**.

Map 3 - The 9 FABs established, together with creation dates



Source: Eurocontrol.

³⁶ Article 2.25 of Regulation (EC) No 549/2004, as amended in 2009.

41. The actual implementation of FABs was a matter of contention between the Commission and Member States. In 2013 the Commission generally questioned how the FABs could deliver optimisation of the airspace independently of national borders, if flight information regions have remained the same, the ANSPs are structured in the same way and the objectives of cost-efficiency and capacity set out in performance plans were in certain cases deemed not optimum by the Performance Review Body.

42. The terms “enabling optimum use of airspace” and “being justified by their added value”³⁷ give ample room for interpretation to Member States when implementing FABs. In general, they did not accept the arguments put forward by the Commission emphasizing that the creation of FAB structures and coordination mechanisms had respected the legislative requirements. This shows a general difference in perception of the regulatory requirements between the Commission and the Member States. No case has been pursued at the European Court of Justice. A consultant’s study on the implementation of FABs found that “FABs have not met the high level policy objectives set by the SES legislation, despite the substantial efforts undertaken for their implementation”³⁸.

...and led to cooperation, not defragmentation

43. In the Member States we visited, the creation of FABs had set-up cooperation structures and procedures in NSAs and ANSPs. They are active mostly in matters of regulatory and technical cooperation, such as establishing Free Route Airspace in their areas. Some FABs (e.g. FABCE, FAB UK-Ireland) are formally coordinating the implementation of the Pilot Common Project³⁹.

44. However, cooperation pre-dated the creation of FABs and ANSPs are engaged in similar activities with other partners outside their respective FABs. Technical initiatives such as

³⁷ Article 9a of Regulation (EC) No 550/2004.

³⁸ Integra, “Study on Functional Airspace Blocks – Final Report”, 2017.

³⁹ The Pilot Common Project is the first common project mandated by EU legislation. It identifies a first set of ATM functionalities to be deployed in a timely, coordinated and synchronised way so as to achieve the essential operational changes stemming from the European ATM Master Plan.

COOPANS and ITEC deliver coordinated investments and BOREALIS is implementing free route arrangements that extend beyond FAB boundaries. This shows that some benefits are also achievable through voluntary cooperation, outside any regulatory framework.

45. No Member State visited was able to provide a precise estimation of the costs of creating or running a FAB and none of the bodies visited could demonstrate that FABs had delivered tangible benefits to airspace users. There were no measurements against the key performance areas of the performance scheme and even if several KPIs were set at FAB level, they are mostly just an aggregation of national targets.

46. Defragmentation, namely through cross border service provision, merging of air traffic control centres or common charging zones, was not achieved in any of the FABs and there is a general lack of commitment to these initiatives on the part of Member States. Concerns linked with preserving sovereignty, the legacy ANSPs, their revenues and their workforce have a strong impact in the Member States preference for keeping the current status quo.

But size matters and the need for defragmentation remains

47. A study led by Eurocontrol on behalf of the Commission on European and North American ATM cost-efficiency⁴⁰ provides evidence of economies of scale and the potential benefits of defragmentation. While traffic patterns, as well as the political context, differ between the two regions, the study highlights that the ATM system in the United States, where ATM is integrated in a single organization, is able to control a larger number of flights using fewer staff and air traffic control centres (see [**Table 2**](#)).

⁴⁰ Eurocontrol, "U.S. - Europe continental comparison of ANS cost-efficiency trends (2006-2014)".

Table 2 - Selected performance data for Europe and the United States

Calendar Year 2014	Eurocontrol States	United States
Geographical area (mio km ²)	12	15
Controlled IFR flights (mio)	10	15
Controlled flight hours (mio)	15	23
Civil en-route ANSPs	37	1
Total staff	56 300	31 500
ATCO in operational duty	17 500	12 960
Support staff	38 800	18 540
En-route ATC centres	63	23
Relative density (flight/km ²)	0.85	1.03
Productivity ⁴¹ (flight hours/ATCO)	834	1 767

Source: Eurocontrol “U.S. – Europe continental comparison of ANS cost-efficiency trends 2006-2014”, November 2016.

48. Our analysis of air traffic control centre productivity⁴² based on data collected by Eurocontrol also corroborates the existence of potential economies of scale. Although several other factors may impact on productivity, the analysis shows that there is a positive correlation between air traffic control centre productivity and its size, as measured by number of Instrument Flight Rules (IFR) movements in a year. This suggests that consolidation of centres and/or enhanced forms of temporary cross-border service provision (e.g. one air traffic control centre providing air navigation services beyond national borders during off-peak periods) would allow a more efficient use of spare capacity and could result in higher productivity and cost-efficiency gains.

⁴¹ In this table, productivity is calculated on the basis of total IFR flight hours controlled in 2014 in each region, divided by the total number of air traffic controllers on operational duty who were responsible for controlling those flights.

⁴² Air Traffic Controller (ATCO) productivity measured as Total flight hours controlled per ATCO-hour on duty, aggregated by ACC, sourced from Eurocontrol, ACE 2014 benchmarking report.

49. Given the presence of economies of scale, progress towards the current high level goal of halving ATM costs would require a combination of increases in traffic and real defragmentation of service provision.

The SESAR project has fostered a common vision but has become detached from its initial schedule and is now open ended

50. The SESAR project is the technological part of the SES initiative and is made up of a public-private partnership between the European Commission, Eurocontrol and several industrial stakeholders as well as a specific regulatory framework and a range of financial instruments. It seeks to harmonise and modernise ATM systems and procedures across Europe. SESAR was from the outset divided into: a definition phase (aimed at drawing up the plan for modernisation), a development phase (the establishment of the necessary technological bases) and a deployment phase (installation of the new systems and procedures).

51. We reviewed the case for the SESAR project as well as selected aspects of its definition and development phases, in particular the set-up, functioning and extension of the SESAR JU. For a sample of R&D projects and related activities, we reviewed the needs assessment that justified their launch, what outputs were delivered and what operational use has been so far made of those deliverables.

The SESAR project targeted technological fragmentation, but benefits were overestimated and EU intervention was meant to be temporary

52. By aiming to bring together a range of stakeholders to commit to an ATM Master Plan, the SESAR project targeted the existing technological, conceptual and procedural fragmentation in service provision. In 2004 the cost of fragmentation was estimated at 880 to 1 400 million euro per year, almost half of which was related to fragmented procurement, development and operation of ATM systems⁴³.

⁴³ Eurocontrol Performance Review Commission, The impact of fragmentation in European ATM/CNS, April 2004, study commissioned to a consultant.

53. However, the benefits expected from the SESAR project, such as reduced delays and lower costs, were overestimated as they were based upon overoptimistic long term traffic forecasts that have not materialised. The 2005 Cost Benefit Analysis underpinning the project was based on a forecast of a 2.9 % per annum growth in traffic over 30 years (2005-2035). Despite this, the data shows that the average actual growth was 1.1 % during the 2005-2016 period, rather than 2.9 %. Similar optimism can be found in key milestones that later marked the SESAR's development phase: the 2009 edition of the ATM Master Plan and a 2012 study in support of an extension of the SESAR JU⁴⁴.

54. The SESAR project was launched with a specific timeframe. According to a 2005 Commission communication to the Council⁴⁵, the definition phase would run from 2005 to 2007 and would be followed by the development (2008-2013) and deployment phases (2014-2020). The scope of the EU's participation would be limited to definition and development: both the governance and the financing of the deployment phase were to be transferred in full to industrial stakeholders. The Council Regulation that later established the SESAR JU⁴⁶ included that calendar in its recital and defined a termination date for the Joint Undertaking, 31 December 2016, although foreseeing the possibility of a revision.

SESAR's definition phase ensured the involvement of key stakeholders

55. In 2004 Eurocontrol applied to the Commission for financial aid for the definition phase of SESAR. Financial support was granted by Commission decisions in 2004, 2005 and 2006. In total, 30 million euro was granted from TEN-T to Eurocontrol to co-finance a study with a total cost of 60 million euro.

⁴⁴ In a previous report related to airport infrastructures (ECA Special Report No 21/2014 "Eu-funded airport infrastructures: poor value for money"), the Court similarly noted that some investments had been made on the basis of over-optimistic traffic forecasts.

⁴⁵ COM(2005) 602 final.

⁴⁶ Council Regulation (EC) No 219/2007 (OJ L 64, 2.3.2007, p. 1).

56. The definition phase of SESAR was performed by a consortium⁴⁷, including all key stakeholders, from airspace users to airport operators, ANSPs and manufacturers. This phase lasted from 2005 to 2008 and, in addition to a number of deliverables⁴⁸, produced the first European ATM Master Plan, as a roadmap for the development and deployment phases of SESAR. The Master Plan was endorsed by the Council in March 2009 and was the basis for the development phase that followed.

The SESAR Joint Undertaking succeeded in setting up a coordinated R&D effort in European ATM ...

57. Research and development (R&D) activities in ATM can be complex and need to be managed. This is due to a high degree of interdependence between airports, airspace users, the network manager and ANSPs as well as the fact that R&D and actual operations need to be conducted in parallel.

58. The SESAR JU was established⁴⁹ to manage the R&D of the development phase. It set-up a framework to manage a highly complex R&D programme and coordinated a previously fragmented R&D environment. Stakeholders said that the SESAR project fostered: (i) an EU-wide vision of the future configuration and deployment of European ATM, with buy-in from stakeholders, including manufacturers; (ii) coordinated partnerships between stakeholders in R&D work and economies of scale; (iii) a stronger European influence on the setting of international standards and on the preparation of ICAO's Global Air Navigation Plan. In addition, the availability of EU funding led the stakeholders to commit additional resources to R&D.

⁴⁷ Eurocontrol selected the consortium through a call for tender and contributed to the SESAR definition phase in kind.

⁴⁸ An analysis of the existing situation (D1), the performance target (D2), the ATM target concept (D3), the deployment sequence (D4), the ATM Master Plan (D5) and a work programme 2008-2013 (D6).

⁴⁹ Council Regulation (EC) No 219/2007.

... but there are shortcomings concerning its mandate

59. The legal framework attributes to the SESAR JU the responsibility for the execution of the ATM Master Plan (and in particular for organising the development phase in accordance with that plan)⁵⁰. However, the mandate of the SESAR JU lacks clarity in respect of two elements:

- (a) Although the 2007 Council Regulation foresaw the wind-up of the SESAR JU by the end of 2016, the same Regulation also charged the SESAR JU with the execution of a Master Plan in which R&D activities extend beyond 2020;
- (b) The Regulation does not explicitly mandate the SESAR JU to update the Master Plan and only describes the procedure for the approval, by the EU, of significant modifications to it. The involvement of the SESAR JU in this process is referred to in non-legally binding documents⁵¹, which call for the SESAR JU to propose updates and for its Administrative Board to adopt them.

60. The above described framework raises a risk to the efficiency of the project. Firstly, the misalignment between the regulatory lifespan of the SESAR JU and the R&D work it was mandated to execute makes it unclear how much of that execution was to be completed by the termination date. Secondly, because updates ultimately impact on timescales as well as costs and benefits to be expected by different stakeholders, progress is being measured against a moving target, further reducing the accountability relative to the SESAR JU's mandate.

⁵⁰ Article 1.5 of Council Regulation (EC) No 219/2007.

⁵¹ Namely a Commission's Communication to the Council and the Parliament on the ATM Master Plan (COM(2008) 750 final) and Council's Resolution on the endorsement of the European Air Traffic Management Master Plan, from March 2009.

Master Plan updates reflect new realities but also significant delays...

61. The SESAR JU indeed committed substantial resources to the process of updating the Master Plan⁵². Up until 2017, two significant updates of the Master Plan were performed and a third is planned for 2018.

62. The main driver of the first update (2012) was the realization that not all the R&D activities planned could be completed by the end of 2016 and therefore the R&D effort focused on “a manageable set of essential operational changes”⁵³. The update followed an internal SESAR JU exercise conducted by members of its Programme Committee, to identify the strategic needs of its members and reallocate resources between projects accordingly. We note that the working group redefining the programme’s priorities did not include airspace users, who ultimately will be required to pay for the investments called for by the Master Plan. We see this as being detrimental to the necessary buy-in of SESAR solutions and to the overall effectiveness of the project. In the comparable American programme NextGen, the lack of buy-in by airlines, in particular their reluctance to equip their aircraft with compatible avionics, has been identified as a key challenge to deployment⁵⁴.

63. The impact affected almost all R&D projects initially launched, many were re-scoped and would no longer deliver their initially planned outputs within the regulatory lifespan of the SESAR JU. It became clear that the initially envisaged timeframe for the development phase (2008-2013) was no longer being targeted.

64. The main driver of the second update (2015) was the need to focus the R&D programme on the requirements of the deployment phase, in particular the requirements of the Pilot Common Project, and to incorporate new elements such as remote piloted aircraft and cybersecurity.

⁵² Workpackage C was dedicated to the Master Plan maintenance and was allocated approximately 51.4 million euro.

⁵³ ATM Master Plan edition 2012, p. 14.

⁵⁴ Office of the Inspector General of the Department of Transport, “Total Costs, Schedules, and Benefits of Federal Aviation Administration’s NextGen Transformational Programs remain uncertain”, November 2016.

65. The updates brought substantial changes to the ATM Master Plan, both in form and in content. We note the following key evolutions between the documents:

Table 3 - Evolution of selected features of the European ATM Master Plan

	MP 2009	MP 2012	MP 2015
Performance goals	<u>Baseline:</u> 2004/2005 <u>Target date:</u> 2020 <u>Goals:</u> <ul style="list-style-type: none"> ➤ 73 % increase in capacity ➤ 10 % reduction in environmental impact per flight ➤ 50 % reduction in cost per flight 	<u>Baseline:</u> 2005 <u>Target date:</u> 2030 <u>Goals:</u> <ul style="list-style-type: none"> ➤ 27 % increase in capacity ➤ 2.8 % reduction in environmental impact per flight ➤ 6 % reduction in cost per flight 	<u>Baseline:</u> 2012 <u>Target date:</u> 2035 <u>Goals:</u> <ul style="list-style-type: none"> ➤ 10-30 % reduction in en-route delay ➤ 5-10 % reduction in environmental impact per flight ➤ 30-40 % reduction in cost per flight
Investment costs	32 billion euro over 2008-2020 (of which 22 billion euro for airspace users and 7 billion for ANSPs)	20-29 billion euro (of which 13-17 billion euro for airspace users and 3-6 billion euro for ANSPs)	19-28 billion euro over 2015-2035, (of which 17-26 billion euro for ground investments)

Source: European ATM Master Plans 2009, 2012 and 2015.

66. The table above presents a gradual postponement of the achievement date of the ATM target concept from 2020 to 2035, a reduction in the expected performance benefits and marginally reduced overall investment needs. In the particular case of ANSPs the investment required is now expected to be higher than in 2009⁵⁵.

⁵⁵ According to estimates by the SESAR JU, some 55 % of the total investment required to achieve the target concept is expected to come from ANSPs, i.e. some 10-15 billion euro.

... and ultimately led to the decision to extend the SESAR JU and commit additional resources

67. The 2012 update of the Master Plan defined 3 main steps⁵⁶ to deployment of the SESAR concept by 2030. However, in 2013, the Commission acknowledged⁵⁷ that within the 2007-2013 financial perspectives, the SESAR JU work programme would only allow the covering of step 1 of the Master Plan and part of step 2 and that completing steps 2 and 3 would require an extension of the SESAR JU. In support of an extension, the Commission stated that the benefits of extending the SESAR JU would vastly exceed its costs. In 2014, the Council amended Regulation (EC) No 219/2007, extending the SESAR JU until December 2024 and granted additional EU funding of 585 million euro to the SESAR JU's budget over that period.

68. In addition to an optimistic long-term air traffic forecast, the Cost Benefit Analysis (CBA) supporting the decision to extend the SESAR JU did not estimate R&D costs beyond 2020, while it compared such costs with benefits expected until 2035. This mismatch reflects the discrepancy between the temporary nature of the SESAR JU (and of the financial framework that supports it) and the required duration of the R&D work it is mandated to execute.

69. The Master Plan updates and the extension of the SESAR JU further detached the ongoing development phase from the initial schedule and represented a change of vision rather than purely a delay. While initially limited to the 2008-2013 period, the R&D effort now effectively becomes open ended, despite being supported by a temporary structure.

⁵⁶ In addition to a "Deployment Baseline" consisting of operational changes that have been successfully validated after reaching the end of their R&D phase, the 2012 edition of the European ATM Master Plan also defines: Step 1 (Time based operations); Step 2 (Trajectory based operations); and Step 3 (Performance based operations). The performance goals in this edition have only been calculated for baseline and step 1.

⁵⁷ Commission Staff working document, SWD(2013) 262.

At the end of 2016, some technological solutions have been published but the execution of the Master Plan still far from being completed

70. The SESAR JU has been publishing documentation relative to technological and operational improvements, packaged under a number of “SESAR Solutions”⁵⁸. It also conducted demonstrations, in an actual operational environment, of the potential benefits of such improvements.

71. However, through the reallocation of resources and updates of the Master Plan, the SESAR JU re-scoped the R&D programme in the course of its execution, altering the content of projects, their timescale and the overall ATM target concept. This flexibility has been praised by the SESAR JU and its members but it also masks delays in the R&D work relative to the initial planning.

72. We would like to highlight four issues in this context:

- (a) The SESAR JU’s external reporting does not provide a full picture of the progress made towards implementation of the Master Plan. The annual activity report presents a percentage of completion relative to the latest scope of each project, and it does not refer to delays relative to the initial deadlines.
- (b) The maturity of Operational Improvements that are to be included in SESAR Solutions is however regularly monitored by the SESAR JU⁵⁹. Our analysis shows that at the end of 2016, only 19 % of the Operational Improvements had been validated by the SESAR JU at the ‘Pre-industrial development & integration level’ and 61 % were still at the concept definition stage.

⁵⁸ In June 2016, the SESAR JU released a “SESAR Solutions Catalogue” listing 63 solutions, some ready for industrialization and others requiring further research.

⁵⁹ The European Operational Concept Validation Methodology includes 8 levels of maturity applicable to the lifecycle of an ATM operational concept, as follows: V0 (ATM needs), V1 (Scope), V2 (Feasibility), V3 (Pre-industrial development and integration), V4 (Industrialisation), V5 (Deployment), V6 (Operations) and V7 (Decommissioning). The work of the SJU is related to levels V1 to V3, i.e. bringing concepts to a state where they are ready for industrialisation.

- (c) As of 2016, only a small part of the current Master Plan has been executed even though most of the EU's support initially planned for the development phase has been spent (700 million euro). As a consequence, the SESAR JU has had to be extended until 2024 and granted an additional 585 million euro of EU funding.
- (d) Although presented in each edition of the ATM Master Plan at an overall level, individual R&D projects audited were launched without a cost-benefit analysis demonstrating the size of the problem being addressed and that the investment committed would likely generate a net benefit. Some projects were affected by the re-scoping conducted in the context of the Master Plan updates and delivered only a part of the outputs initially planned (see **Annex II**).

CONCLUSIONS AND RECOMMENDATIONS

73. The safe and efficient flow of air traffic requires the intervention of Air Traffic Management (ATM), which comprises three essential functions: ensuring separation between aircraft; balancing supply (of air traffic control) and demand (flights); and providing aeronautical information to airspace users.

74. The Single European Sky (SES) initiative aims at improving the overall performance of ATM by moving a number of competences from an earlier intergovernmental practice to the framework of the European Union.

75. The SES initiative was formally launched in 2004 and gradually established a regulatory framework, comprising a set of EU-wide common binding rules on ATM safety, on the provision of ATM services, on airspace management and on interoperability within the network. That framework is coupled with a technological modernization programme (Single European Sky ATM Research - SESAR project), backed with financial incentives.

76. We reviewed selected key regulatory components of the Single European Sky initiative. These include (i) the performance and charging schemes, which establish binding targets in four performance areas: safety, the environment, capacity and cost efficiency, as well as rules costs to be charged to airspace users; (ii) the functional airspace blocks aimed at optimising service provision traditionally organised following State boundaries and (iii) the

definition and development phases of the SESAR project, the technological pillar of the Single European Sky initiative, aimed at harmonising and modernising ATM procedures and infrastructure.

77. Overall, we conclude that the initiative addressed a clear need and has led to a greater culture of efficiency in ATM. However, European airspace management remains fragmented and the Single European Sky as a concept has not yet been achieved. Navigation charges have not been substantially reduced and ATM-related delays have started to increase again. The SESAR project, while promoting coordination and gradually releasing technological improvements, has fallen behind its initial schedule and has become significantly more costly than anticipated. In substance, the EU's intervention in SESAR has evolved from one with a target deadline for achievement to a more open-ended commitment.

78. National monopolies and fragmentation called for EU intervention, which resulted in the SES initiative. The high level goals established for the initiative were originally formulated with reference to the air traffic evolution being experienced in 2005. When traffic growth subsequently diminished, high level goals became both unachievable in respect of cost-efficiency and irrelevant in respect of capacity. In addition, they are not linked with the targets set by the performance scheme (see paragraphs 16 to 21 and 28 to 29).

Recommendation 1 – Review High Level Goals

The Commission should propose a definition of the Single European Sky that includes the key dimensions of airspace architecture, service provision and infrastructure. On this basis, it should then review the SES high level goals, ensuring that they are sufficiently ambitious to foster performance and have realistic timelines for achievement. Revised high level goals should also be linked with EU-wide targets in the performance scheme to allow progress towards those goals to be measured. Given that the current reference period (RP 2) will end in 2019, targets for reference period 3 should be set with that in mind. Revised high level goals should also become the reference to evolve the current Master Plan.

Deadline: By 2019.

79. The performance and charging schemes constitute, in principle, adequate tools to mitigate the negative effects of a largely monopolistic service provision. They have fostered a culture of efficiency and transparency across Air Navigation Service Providers (ANSPs). However, the quantitative results of the schemes are below expectations: flight delays have generally been above the targets set in performance plans and, despite reaching a record low in 2013, have been increasing since; unit rates paid by airspace users are heavily dependent on traffic volumes and have only decreased by 4 % between 2011 and 2016, which is below the EU-wide reduction set by the Commission.

80. The absence of substantive defragmentation, coupled with slower traffic growth, are key contributors to the lacklustre quantitative results shown by the performance scheme. Current Functional Airspace Blocks (FABs) essentially provide a forum for cooperation between stakeholders of neighbouring States but have proved ineffective in targeting fragmentation, whether at the levels of airspace management, service provision or technical equipment. FABs did not succeed in fostering integrated or temporary cross-border service provision which could have significant potential to performance improvement (see [paragraphs 22 to 49](#)).

Recommendation 2 – Analyse other policy options targeting fragmentation

The Commission should:

- (a) assess the added value of maintaining the regulatory requirements for FABs, given their ineffectiveness in targeting defragmentation;
- (b) review policy options which, on their own or in addition to FABs, could effectively deliver defragmentation and potentially generate economies of scale, and monitor their implementation through relevant performance indicators and targets. Options could include the active promotion of integrated or cross border service provision, taking also into account possible restructuring of ANSP services.

Deadline: By 2020.

81. The monitoring roles of the National Supervisory Authorities (NSAs) and the Commission are affected by a number of limitations. NSAs are not always fully independent

nor effective. They do not regularly conduct inspections on important elements of the costs charged to users: eligibility, economy and adequate cost allocation. Nor are these aspects checked by the Commission when assessing unit rates. Moreover, the Commission's guidance on cost allocation between en-route and terminal charging zones was insufficient, leading to the risk of cross-subsidization between en-route and terminal navigation services (see **paragraphs 36 to 37**).

Recommendation 3 – Ensure full independence and capacity of NSAs

NSAs should be fully independent and have the capacity to fulfil their functions. To this end, Member States should ensure that NSAs are hierarchically, financially and functionally independent from ANSPs and have the resources necessary to oversee and monitor the performance and charging schemes. We note that the prompt adoption of the applicable provisions in the SES2+ legislative package would be beneficial in this regard.

Deadline: By 2019.

Recommendation 4 – Ensure inspection coverage of the charging scheme

The Commission and the NSAs should regularly conduct the inspections set out in the current legislation, covering in particular the eligibility of costs charged and their allocation between en-route and terminal charging zones. The Commission should provide additional guidance on cost allocation to ensure a harmonized accounting treatment.

Deadline: By 2019.

82. The process of approving performance plans is lengthy and complex. Reaching agreements between the Commission and Member States, particularly on capacity and cost-efficiency targets, has proved to be difficult. As the Commission does not have the possibility to impose targets, those contained in the performance plans tend to reflect a lower level of ambition (see **paragraphs 34 to 35**).

Recommendation 5 – Streamline the performance scheme

The Commission should streamline the process of approving performance plans. To this end, it should actively promote exemptions from the scheme in the case of services rendered under market conditions or under service level agreements between service providers and airspace users. In the absence of such conditions, the Commission should have enforcing powers to directly establish binding targets on the basis of the assessment of the Performance Review Body.

Deadline: By 2019.

83. The performance framework monitors ATM performance on the basis of key performance indicators some of which, however, contain a number of shortcomings. These limit their ability to appropriately measure ATM performance in various key areas. In particular, the indicators measuring capacity in terms of delays only capture a small part of the overall gate-to-gate experience for passengers and do not measure efficiency in off-peak periods. In the area of the environment, on the one hand en-route flight efficiency reflects elements beyond the control of ANSPs, whilst on the other, does not target the vertical aspect of flight efficiency (see [paragraphs 30 to 33](#)).

Recommendation 6 – Review certain key performance indicators

For the next reference period, the Commission should:

- (a) in respect of capacity, ensure that KPIs capture the overall gate-to-gate delay while maintaining adequate accountability of ANSPs. KPIs should also be able to measure not only the capacity to deal with peaks in demand but also whether resources are used efficiently in peak and off peak periods;
- (b) in respect of the environment, modify KPIs to measure the responsiveness of the ATM system to the desired trajectories of airspace users, both in their horizontal and vertical dimensions.

Deadline: By 2019.

84. SESAR's definition and development phases promoted the commitment of key stakeholders to a common technological plan and its development phase transformed a previously fragmented R&D environment into a coordinated one. The SESAR JU has been publishing technological and operational improvements, packaged under a number of "SESAR Solutions".

85. The EU's role in the SESAR project has evolved from its original inception as regards scope, timeframe and financial magnitude, all of which have been significantly extended: the initial expectation of a development phase to be completed by 2013, and then transferred to industrial stakeholders for deployment, has been replaced by an open ended, continuously evolving R&D vision pre-supposing long-term EU support. The 2012 and 2015 Master Plan updates brought substantial changes, both in content and form, as well as a successive postponement of the date of achievement of the target concept: SESAR performance ambitions are now set for 2035, not 2020 as originally envisaged.

86. There is a misalignment between the fixed regulatory lifespan of the SESAR Joint Undertaking (JU) and the planned duration of the R&D work expected from it. This hampers accountability at the SESAR JU relative to the execution of the Master Plan. The situation is exacerbated as the SESAR JU does not report appropriately on that degree of execution.

87. As of 2016, only a small part of the Master Plan in place has been executed even though most of the EU's support initially planned for the development phase has been spent (700 million euro). As a consequence, the SESAR JU has had to be extended until 2024 and granted an additional 585 million euro of EU funding (see **paragraphs 50 to 72**).

Recommendation 7 – Review the EU’s support structure to ATM R&D in light of its objectives

In accordance with the principles of “Better Regulation”, political decisions should be prepared in an open, transparent manner, informed by the best available evidence and backed by the comprehensive involvement of stakeholders.

Therefore, if the Commission proposes to continue funding ATM R&D efforts beyond 2024, it should:

- (a) adequately justify the EU support, in particular as to why that support should continue, to achieve what, by when and what would be the amount of public support required to maximise its value for money;
- (b) analyse whether the SESAR JU, a temporary structure, is appropriate to address that long-term R&D effort and, if not, make the necessary adaptations.

Deadline: By 2020.

Recommendation 8 – Reinforce the accountability of the SESAR JU

The Commission should reinforce the accountability of the SESAR JU by defining clear and time-bound milestones, with an associated budget, for the execution of the Master Plan. The Commission should also require that the SESAR JU regularly reports on its progress relative to the full implementation of that Plan.

Deadline: By 2018.

88. Although presented in each edition of the ATM Master Plan at an overall level, individual R&D projects audited were launched without a cost-benefit analysis demonstrating the size of the problem being addressed and that the investment committed would likely generate a net benefit. Some projects were affected by the re-scoping conducted in the context of the Master Plan updates and delivered only a part of the outputs initially planned (see **paragraph 72**).

Recommendation 9 – Prioritize EU support to R&D solutions that promote defragmentation and a competitive environment

The Commission should ensure that:

- (a) only projects with a demonstrated added value for the network are supported by EU funding. This could be achieved, for example, through the implementation of a system that evaluates the added value to the network of projects, by the establishment of such as a needs analysis or a cost-benefit analysis for projects;
- (b) within the framework of the SESAR JU, EU funding is prioritized towards ATM R&D solutions that promote defragmentation, interoperability, sharing of infrastructure and foster the conditions for a competitive environment.

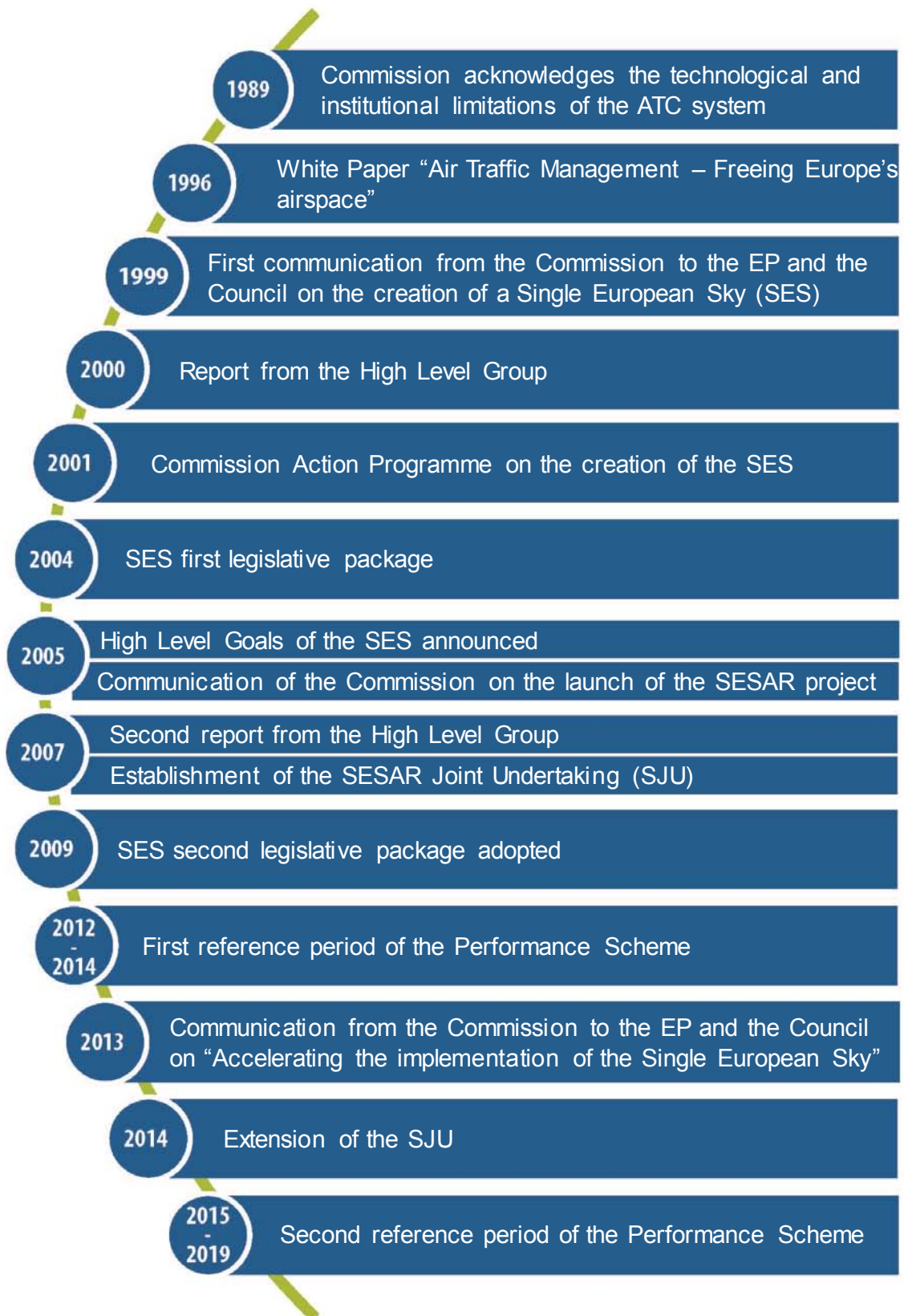
Deadline: applicable to new funded projects, as from 2018.

This Report was adopted by Chamber II, headed by Mrs Iliana IVANOVA, Member of the Court of Auditors, in Luxembourg at its meeting of 11 October 2017.

For the Court of Auditors

Klaus-Heiner LEHNE

President

The SES Timeline

ANNEX II**A summary of the analysis done on a sample of SESAR R&D projects and activities**

The audit team selected a sample of eleven R&D projects, four demonstration activities and one study, all executed within the SESAR JU framework. For each, a detailed review was conducted, focusing on the needs assessment leading to the decision to launch each project; the delivery of their outputs; the use made of them, either in an operational context or in additional R&D.

Overall, we observed that:

There was a clear rationale behind each project, and its link to the ATM Master Plan could be established. However, none of the sampled R&D projects were launched based on a cost-benefit analysis demonstrating the size of the problem being addressed and that the investment would likely generate a net benefit. While an overall SESAR CBA was produced in the context of the definition phase, such analysis did not allow a conclusion on the relative cost-benefits of individual projects.

Five of eleven R&D projects and three of the four demonstration activities did not provide the full range of deliverables initially agreed. To some extent this was due to the reallocation exercise conducted by the SESAR JU to focus on a more limited number of deliverables, but also due to inadequate planning of some demonstration activities. While the demonstration activities sampled were generally completed on time, delays of between two and 34 months were noted in seven of the eleven R&D projects sampled.

At the time of the audit, only a small number of the outputs have been integrated in solutions deployed in actual operational environments. Out of eleven R&D projects: in four the outputs delivered were partially put into real operational use; in five further research will be needed to bring actual benefits; one solution was cancelled at the end of the research activity for not having delivered the expected benefits; and one project delivered as planned and its outputs were used in the context of the Master Plan updates. Where outputs were deployed, there was no systematic measurement of the benefits they brought

to operations. None of the four activities meant to demonstrate specific functionalities to ANSPs and airspace users were deployed.

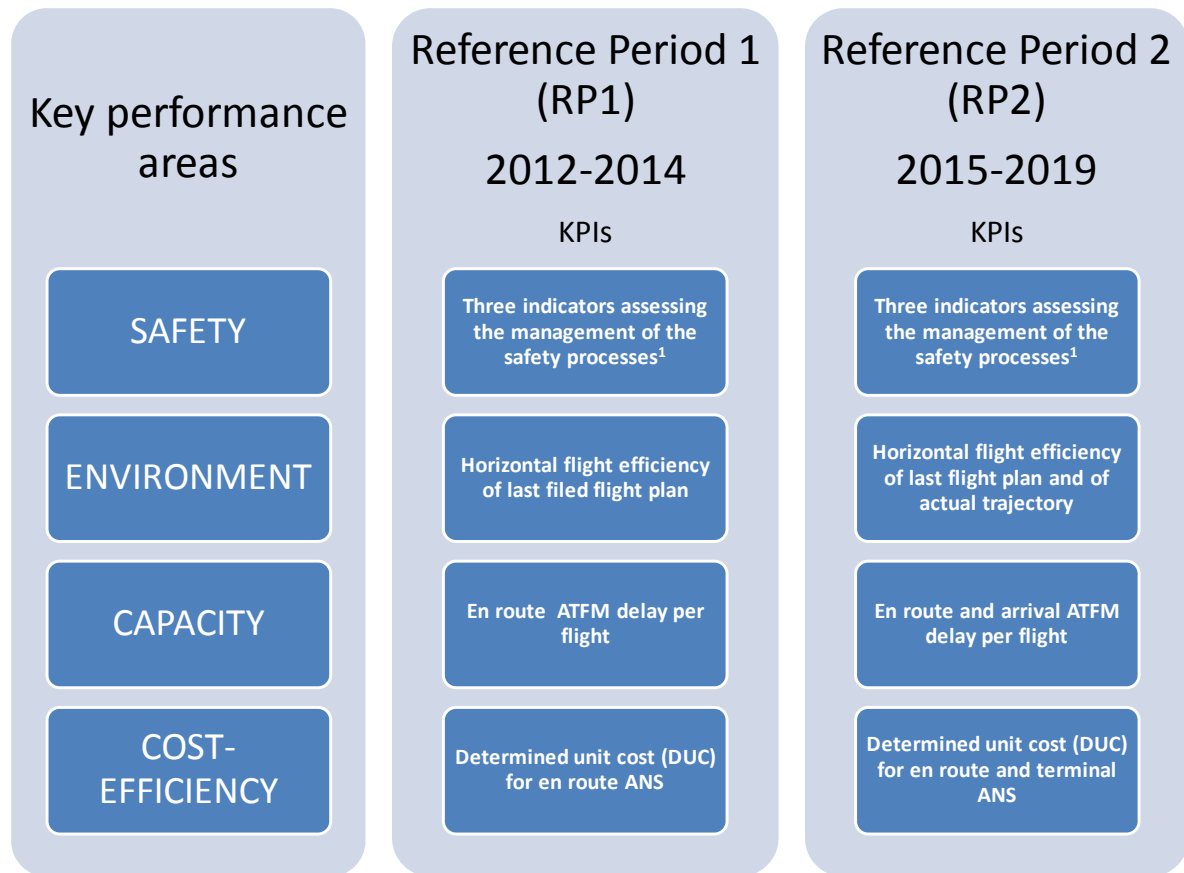
ANNEX III**The performance and charging schemes**

The performance scheme aims at improving the performance of air navigation services by setting binding targets applicable to ANSPs. The charging scheme aims at improving transparency and cost-efficiency by establishing rules on the calculation of navigation charges.

Both schemes are largely based on Eurocontrol's earlier work and processes. As regards performance measurement, metrics already used by Eurocontrol⁶⁰ were later adopted by the EU's performance scheme in 2009. The Figure below lists the key performance areas and the respective key performance indicators (KPIs) used during the two reference periods on which the scheme has so far applied.

⁶⁰ Since 1998, the Eurocontrol's Performance Review Commission provides independent advice to Eurocontrol's governing bodies using performance indicators and publishing performance review reports.

Key performance indicators (KPIs) in each reference period

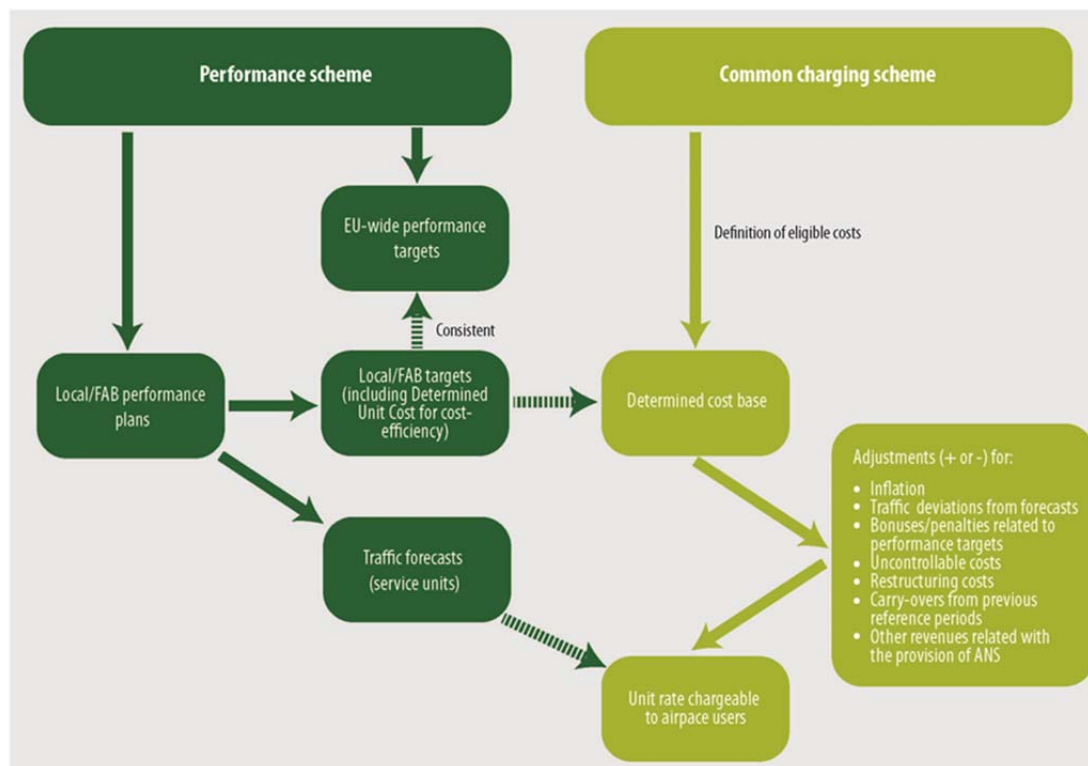


- 1 Effectiveness of the safety management, application of the severity classification scheme and application of Just Culture.

Likewise, the origin of the SES's charging system can be found in the Eurocontrol's multilateral agreement relating to the collection of route charges signed back in 1970. In 2009, the second SES package introduced a fundamental change in the charging system, namely the replacement of the full cost recovery by a system based on pre-determined costs. Instead of recovering all costs incurred in the provision of air navigation services, the system defines in advance the maximum costs to be recovered in each year of a defined reference period in relation to the traffic forecasted. The change aims primarily at cost-efficiency: having capped the air navigation services costs ex-ante, ANSPs will be rewarded if their actual costs remain below that level by keeping the respective margin; on the contrary, ANSPs will not be able to charge more than the pre-determined costs to airspace users, so they will have to bear the excessive costs. This feature of the scheme is defined as the "cost-sharing mechanism".

There is a tight link between the performance and charging schemes, as the unit rates resulting from the charging scheme must be in line with the cost-efficiency targets set by the performance plans applicable to each charging zone.

Cost-efficiency performance targets and calculation of unit rates



The calculation of the unit rates works as follows:

- (i) The starting point is the determined cost base used for the definition of the DUC targets of each charging zone in the performance plans. The local DUC targets have to be consistent with the EU-wide cost efficiency targets. This consistency is assessed by the Commission with the support of the Performance Review Body.
- (ii) The determined cost base of a charging zone consists on the sum of the estimated eligible costs of the different entities providing air navigation services. The cost eligibility is defined in the legislation. The large majority of these costs corresponds to the national ANSP, but may include costs of other entities, typically other smaller ANSPs if any, providers of meteorological services, NSAs (supervision costs) and national contributions to Eurocontrol. As regards the nature of the costs, the main

component is staff costs (about 60 % at SES area level) followed by other operating costs, depreciation and cost of capital (return on equity).

(iii) Certain adjustments, either positive or negative, can be applied to the determined costs:

- Inflation. The difference between actual and forecasted inflation.
- Traffic risk sharing. This is a compensation system for ANSPs and airspace users for traffic deviation from forecasts. Within certain traffic bands and compensation limits defined in the legislation, ANSPs have to reimburse airspace users if actual traffic increases more than forecasted and *vice versa*, ANSPs are allowed to charged additional amounts if actual traffic evolves worse than forecasted.
- Incentive schemes. This reflects the financial bonus or penalty attributed to the ANSPs for the results achieved in the performance areas of capacity and environment vis-à-vis the targets defined in the performance plans. Bonuses and penalties imply additional or reduced charges from ANSPs to airspace users respectively.
- Costs exempt from cost sharing. Certain costs borne by ANSPs are exempt from the above described “cost sharing mechanism” as they are considered outside the control of ANSPs. This includes: unforeseen changes in national pensions law, in pension costs, in national taxation law and in costs or revenues stemming from international agreements; significant changes in interest rates on loans; and unforeseen new cost items not covered in the performance plans. These exempt costs generate an adjustment to ensure they are recovered in full.
- Restructuring costs. The legislation allows the recovery of restructuring costs of ANSPs subject to a business case demonstrating a net benefit for airspace users and to the approval of the Commission. In RP1 and so far in RP2, no restructuring costs have been charged by any ANSP.

- Carry-overs from previous reporting periods. This corresponds to unrecovered costs incurred by ANSPs in the previous full cost recovery system which have been authorized for recovery in the subsequent reference periods.
- Other revenues. The revenues received by ANSP in addition to navigation charges related to the regulated provision of air navigation services have to be deducted. This includes national public funding, EU assistance programmes, commercial and other revenues.

(iv) Finally, the resulting net cost base is divided by the traffic forecast (expressed in service units) to achieve the unit rate of each year chargeable to airspace users for the provision of air navigation services in the corresponding charging zone. The traffic forecasts are those included in the performance plans.

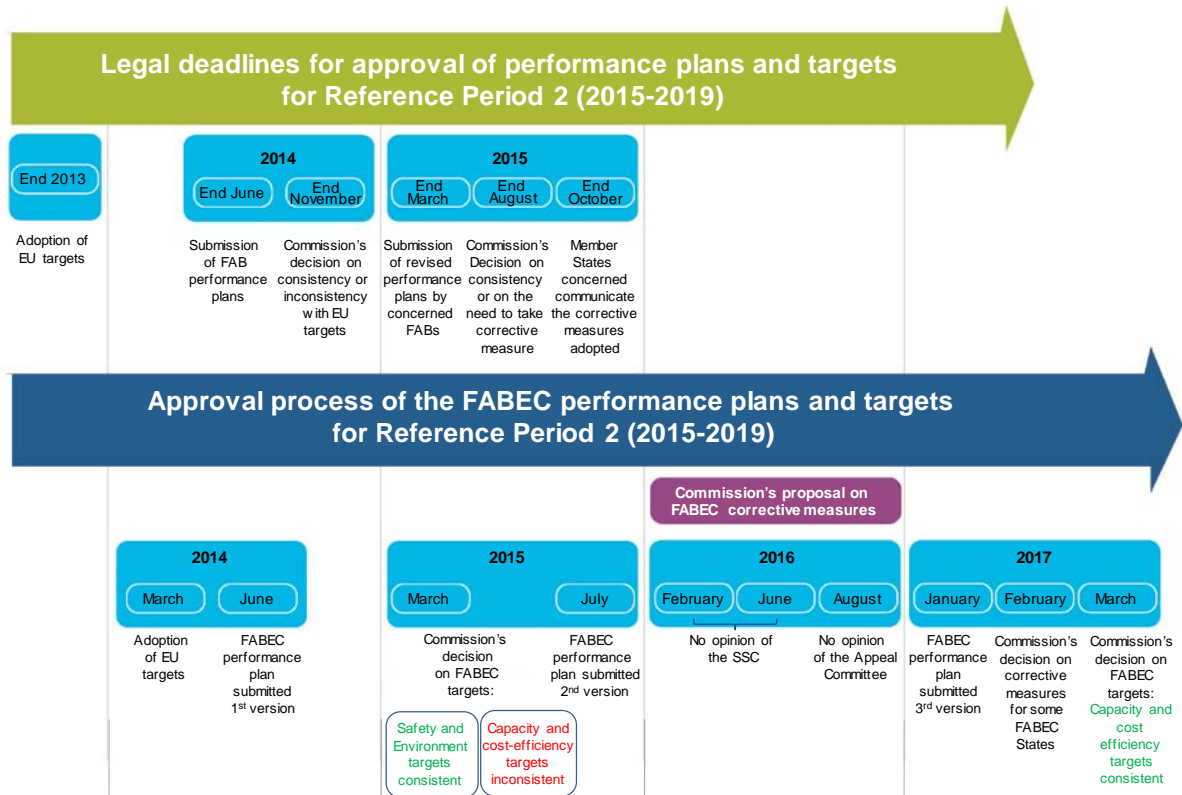
Since reference year 2014, the annual rates per charging zone are published in a Commission Decision, provided they are considered compliant with the performance and charging scheme regulations.

Finally, the information on the actual evolution of costs delivered regularly in the context of the charging scheme is used for the follow up of the cost-efficiency area of the performance plans and constitutes a fundamental input at the time of discussing and defining the cost-efficiency targets for the subsequent reference period.

Implementation of the Performance Scheme**The process of adoption of the EU-wide cost-efficiency targets for RP2**

- In September 2013, the Performance Review Body originally proposed an average en route unit cost reduction per year of 4.6 %;
- The Commission decided to propose a more ambitious target of 4.9 % in the SSC; Member States argued that additional cost reductions beyond what had been agreed during RP1 would be difficult to achieve and would impact on capacity;
- Following the lack of support of the SSC, the Commission offered two new alternatives: either an en route unit cost reduction of 4.6 % using an annual growth traffic forecast of 2.6 % or an en route unit cost reduction of 3.3 % using an annual growth traffic forecast of 1.2 %;
- Despite the Commission advocating for the alternative leading to a larger unit cost reduction, as a better balance between the interests of airspace users and ANSPs, the lack of a qualified majority to support it forced the Commission to accept the second, less ambitious, alternative;
- The EU-wide targets were formally adopted in a Commission Decision dated 11 March 2014 with a delay of two months over the deadline foreseen in the legislation (12 months before the beginning of the reference period).

FABEC performance plan and target adoption process



REPLIES OF THE COMMISSION TO THE SPECIAL REPORT OF THE EUROPEAN COURT OF AUDITORS

"SINGLE EUROPEAN SKY: A CHANGED CULTURE BUT NOT A SINGLE SKY"

EXECUTIVE SUMMARY

I. Air Traffic Management (ATM) is the dynamic, integrated management of air traffic and airspace, including air traffic services, airspace management and air traffic flow management (definition 10 of Regulation (EC) No 549/2004). Furthermore aeronautical information is provided to users as air navigation service in support to air traffic services, air traffic flow management and airspace management.

VII. The Commission and the Performance Review Body (PRB) are monitoring the performance of air navigation services on a regular basis. Regarding the failure to meet capacity targets during the past two years, the Commission is in the process of requiring Member States to propose corrective measures as required under the existing legislation. Those measures should aim to rectify the situation and improve the capacity situation in the coming years.

The Commission considers that cost-efficiency targets are set on determined unit costs. While it acknowledges that cost-efficiency should further improve and more ambitious targets could possibly have been set, the targets that were set have been reached. This is independent of the fact that the current law allows for a number of adjustments on top of the targets (including recovery of cost items that date back from before the performance scheme was introduced) and that as a result unit rates have not decreased at the same rate of the cost-efficiency targets of the performance scheme.

VIII. The Commission considers that results of the performance and charging scheme should also be evaluated in comparison to the period when those schemes were not in force. Trends in Figure 1 show that starting from 2011 the level of delays and costs have been kept stable. Before that period there was only a loose process of monitoring of performance that did not guarantee the containment of delays and costs under acceptable levels.

IX. The Commission is aware of the lack of adequate resources in some NSAs. Its proposal on SES2+ aimed at making up for this shortcoming inter alia through an improved independence of NSAs.

X. The Commission believes that the main reason for the lengthy and complex process of adopting targets lies in the comitology examination procedure that is required by the basic law for the adoption of the targets. In its proposal for the recast of the SES legislation (SES 2+) alternatives were proposed. Experience has shown that the Commission or any other regulator for air navigation services needs more autonomy in deciding on targets and that Member States do not have the full picture to be involved in decisions that directly affect other Member States.

XI. The Commission considers that SESAR project and the SESAR JU are fully aligned with the relevant regulatory frameworks, which have indeed evolved over time.

The Commission also considers that the SESAR JU is pursuing a more stable vision of the future ATM system that has been developed through its public-private partnership and formally adopted in the European ATM Master Plan and the JU's work programme. The Master Plan, the vision and the SESAR JU work have evolved since 2007 to adapt to an evolving aviation environment and the results of the development phase. The regulatory framework has also evolved accordingly.

The Commission considers that the accountability of the SESAR JU is not necessarily impacted by the above mentioned evolution, which might even have been strengthened.

The Commission understands that the ECA will conduct a separate audit on the SESAR deployment phase and welcomes it. At least from an operational perspective, the assessment of the contribution

of the SESAR "project" to the performance of European ATM should take into account the results of all the phases of the project. Actual performance gains can only be measured once the SESAR solutions have been deployed and have entered into operation throughout the European ATM network.

XII. See Commission replies to recommendations 1 to 9.

INTRODUCTION

2. ATM is the dynamic, integrated management of air traffic and airspace, including air traffic services, airspace management and air traffic flow management (definition 10 of Regulation (EC) No 549/2004). Furthermore aeronautical information is provided to users as air navigation service in support to air traffic services, air traffic flow management and airspace management.

OBSERVATIONS

19. High level goals were formulated in 2005. At that time, air traffic was forecasted to grow at an estimated 3-4% per annum.

21. The Commission considers that high level goals were aspirational and provided policy orientations to promote the need for action. They were expressed in a qualitative way and while they were not measured against any particular baseline they were associated with the 2025 year deadline. On the contrary, performance targets defined under the performance scheme are based on well-defined performance indicators and set following an in-depth analysis of underlying assumptions and rationale.

26.

(a) The Commission and the PRB are monitoring the performance of air navigation services on a regular basis. Regarding the failure to meet capacity targets during the past two years, the Commission is in the process of requiring Member States to propose corrective measures as required under the existing legislation. Those measures should aim to rectify the situation and improve the capacity situation in the coming years.

(b) The Commission considers that cost-efficiency targets are set on determined unit costs. While it acknowledges that cost-efficiency should further improve and more ambitious targets could possibly have been set, the targets that were set have been reached. This is independent of the fact that the current law allows for a number of adjustments on top of the targets (including recovery of cost items that date back from before the performance scheme was introduced) and that as a result unit rates have not decreased at the same rate of the cost-efficiency targets of the performance scheme.

(c) The Commission refers to the observations of the Court as expressed in paragraph 31 and its reply to the same paragraph.

28. The Commission considers that the performance scheme is the cornerstone of the performance approach of the Single Sky initiative.

29. The Commission considers that high level goals were aspirational and provided policy orientations to promote the need for action. They were expressed in a qualitative way and while they were not measured against any particular baseline they were associated with the 2025 year deadline. On the contrary, performance targets defined under the performance scheme are based on well-defined performance indicators and set following an in-depth analysis of underlying assumptions and rationale.

30. The Commission considers that the establishment of the performance scheme and its indicators represented a major advance in the performance approach departing from the old performance

monitoring. Indicators were established depending on data availability and stakeholders' accountability.

31. The Commission considers that vertical efficiency also depends on factors that are outside ANSPs control (flight scheduling, airport capacity, noise and terrain constraints).

32. The Commission considers that setting targets on indicators requires that sufficient historic data is available. That was not the case for some of the indicators in the terminal area when the targets were set for Reference Period 2 (RP2). The possibility to merge indicators referring to various phases of flight (gate-to-gate delay) depends on the metrics used and the need to clearly allocate the responsibility of those delays to various air traffic control units.

33. The Commission would like to clarify that although there is currently no specific indicator to measure capacity, this aspect is constantly monitored in the context of the performance of the network functions.

35. The Commission believes that the main reason for the lengthy and complex process of adopting targets lies in the comitology examination procedure that is required by the basic law for the adoption of the targets. In its proposal for the recast of the SES legislation (SES 2+) alternatives were proposed. Experience has shown that the Commission or any other regulator for air navigation services needs more autonomy in deciding on targets and that Member States do not have the full picture to be involved in decisions that directly affect other Member States.

37.

(a) The Commission is aware of the lack of adequate resources in some NSAs. Its proposal on SES2+ aimed at making up for this shortcoming inter alia through an improved independence of NSAs.

(b) The verification of the eligibility of costs is primarily in the remit of NSAs as entities responsible for the drawing up of the performance plans, the performance oversight and the monitoring of performance plans and targets.

(c) The Commission has commissioned a study regarding the cost allocation between en-route and terminal in 2015. The outcome of this study is now considered in the revision of the performance and charging Regulations ahead of Reference Period 3 (RP3). Any potential change to accounting procedures may need to be also assessed in light of the administrative burden that those changes may lead to.

(d) The Commission is aware of this problem and is working on solutions in the context of the ongoing revision of the performance and charging Regulations.

38. The Commission underlines that the existing regulatory framework define binding criteria to be met for establishing FABs. At the time of adoption of that regulatory framework, those criteria were deemed sufficient to enable the process of de-fragmentation of the European airspace. This is why the Commission initiated infringement procedures against Member States.

47. The Commission would like to clarify that this activity of comparison between US and EU is carried out under the Memorandum of Cooperation between US and EU with the support of Eurocontrol. However, that comparison does not consider the complexities and specificities of the two systems since it is based on simple indicators. Therefore the analysis of productivity levels should also be based on in-depth analyses at the level of operational units (air traffic control centres) so that economies of scale can be fully demonstrated.

48. The Commission stresses that this analysis at the level of air traffic control centres is not fully developed and conclusions on economies of scale may be premature. It is a fact that in Europe smaller air traffic control centres are in some cases less costly than bigger air traffic control centres.

59.

(a) The Commission acknowledges that the founding Regulation of the SESAR JU indicated an end date of the JU prior to the estimated duration of the ATM Master Plan R&D activities. However, the Commission considers that this is not necessarily a contradiction.

(b) The Commission considers that the role the SESAR JU's plays in the maintenance of the European ATM Master Plan is in line with the regulatory framework.

60. The Commission refers to its reply under paragraph 59 b). The Commission agrees that the current framework can be improved to achieve continuity of the work of the SESAR JU through a more seamless transition from one financial framework to another. However, it considers that the framework does not raise a risk for the efficiency of the project or for the accountability of the SESAR JU which are elements linked to the JU work programmes covering the regulatory duration of the JU that is established in Regulation (EU) 721/2014. The SESAR project has launched and connected all of its 3 phases as planned and is deploying SESAR solutions since 2014.

62. The Commission considers that the process for the approval of updates of the European ATM Master Plan sufficiently involved the airspace users. The airspace users, by Regulation, are represented on the SESAR JU Administrative Board with 10% of the voting rights, which represents the largest share of votes after the two founding members (EU and Eurocontrol).

63. The Commission considers that R&D activities are meant to prove and validate operational concepts and associated technologies whose feasibility is not known in advance. In this light their re-scoping over time is a natural and effective manner to make the best use of their results and of the funds allocated to the projects.

64. The Commission refers to its reply to paragraph 63. It also adds that the feedback from deployment activities gave the opportunity to review development activities.

Common reply to paragraphs 68, 69, 72(a) and 72(c)

The Commission refers to its replies to the Court's comments in XI and 59.

72.

(d) The Commission considers that R&D activities are meant to prove and validate operational concepts and associated technologies whose feasibility is not known in advance. In this light their re-scoping over time is a natural, inevitable and effective manner to make the best use of their results.

CONCLUSIONS AND RECOMMENDATIONS

73. ATM is the dynamic, integrated management of air traffic and airspace, including air traffic services, airspace management and air traffic flow management (definition 10 of Regulation (EC) No 549/2004). Furthermore aeronautical information is provided to users as air navigation service in support to air traffic services, air traffic flow management and airspace management.

77. The Commission stresses that the original concept of the Single European Sky was its creation *"by way of a progressively more integrated management of airspace and the development of new concepts and procedures of air traffic management"* (recital (3) of Regulation (EC) No 551/2004). That concept never materialised into an operational vision of more optimal airspace architecture in terms of number of air traffic control centres. Even the FABs initiative has not led to tangible results in this area.

78. The Commission considers that high level goals were aspirational and provided policy orientations to promote the need for action. They were expressed in a qualitative way and while they were not measured against any particular baseline they were associated with the 2025 year deadline. On the contrary, performance targets defined under the performance scheme are based on

well-defined performance indicators and set following an in-depth analysis of underlying assumptions and rationale.

Recommendation 1 – Review High Level Goals

The Commission accepts the recommendation.

The Commission nonetheless wishes to outline that, as experience has definitely shown, setting SES high level goals to be met in the long term creates a risk that they become irrelevant at a later stage even if based on an in-depth analysis. Full ownership by the ATM community is required to make these goals achievable. One of the reasons why the SES initiative has not yet produced a genuine single sky stems from the lack a shared vision/concept on the target ATM system following its modernisation process, not only from the technological perspective, but also the organisational and operational set up.

The Commission agrees that it is useful to invest efforts on the definition of that vision/concept, which could eventually translate into concrete steps to make it a reality.

80. The Commission considers that results of the performance and charging scheme should also be evaluated in comparison to the period when those schemes were not in force. Trends in Figure 1 show that starting from 2011 the level of delays and costs have been kept stable. Before that period there was just a loose process of monitoring of performance that did not guarantee the containment of delays and costs under acceptable levels.

Recommendation 2 – Analyse other policy options targeting fragmentation

The Commission accepts the recommendation and will implement it as follows.

The Commission has already made various attempts to promote the provision of air navigation services in a more integrated manner across the borders. Beyond the unsuccessful FABs initiative, the Commission has proposed in 2013 a revision of the SES legal framework (SES 2+) including the unbundling of the so-called infrastructure services.

The objective of this proposal was to favour a more competitive approach for the provision of those services or their provision as common support services. Unfortunately the SES2+ proposal is still blocked in the negotiations at the interinstitutional level. In the context of the performance scheme, it has proposed and enacted in 2013 a provision to make the recovery of restructuring costs eligible subject to a business case demonstrating a net benefit to airspace users over time.

However, Member States have not yet taken advantage of that provision. The modernisation of the ATM infrastructure based on the concepts of full digitalisation and industrial partnerships gives concrete opportunities to integrated or cross-border service provision. The Commission is today examining this opportunity in parallel to the need for consolidation and rationalisation of the ATM infrastructure in the context of the SESAR project, the need for a new airspace architecture and the revision of the performance scheme.

Recommendation 3 – Ensure full independence and capacity of NSAs

The Commission accepts the recommendation.

The issue of the full independence and capacity of the NSAs to perform their functions has been already identified by the Commission in its Communication on SES2+ (COM(2013) 408 final, pp.6-7). Proper separation between NSAs and ANSPs should be organised to ensure the autonomous and effective operation of NSAs.

The Commission underlines that the adoption of SES2+ also depends on the prompt action by the co-legislators.

The achievement of the deadline for this recommendation is subject to the removal of current standstill on SES2+.

Recommendation 4 – Ensure inspection coverage of the charging scheme

The Commission accepts the recommendation and will implement it as follows:

The verification of the eligibility of costs is primarily in the remit of NSAs as entities responsible for the drawing up of the performance plans, the performance oversight and the monitoring of performance plans and targets.

The Commission intervention could for example be focused on cases where Member States have asked the revision of their performance plans. In parallel, the Commission will review eligibility requirements during the on-going revision of the performance and charging Regulations ahead of RP3.

Recommendation 5 – Streamline the performance scheme

Insofar as it is within its remit, the Commission accepts the recommendation.

The Commission underlines that already the current rules allow for the exemption from the scheme in case terminal, CNS, AIS (Aeronautical Information Services) or MET (Meteorological) services are provided under market conditions. So far, Member States decided only in few cases for terminal services that they are to be provided under market conditions. With regard to the powers of the Commission in establishing binding targets, they can only be reinforced following a revision of the SES regulations (SES2+). They therefore depend on actions by the Council and EP (including for the deadline).

83. The Commission will consider the Court's observations during the ongoing revision of the performance and charging Regulations ahead of RP3.

Recommendation 6 – Review certain key performance indicators

The Commission accepts the recommendation and will implement it as follows:

With regard to specific indicators of the performance scheme, those indicators are currently under review ahead of the next reference period (RP3) and the Commission will consider the Court's observations in the context of this revision process. However the feasibility of new or revised indicators strongly depends on the availability of accurate and relevant data.

Common Commission reply to paragraphs 85 and 86

The Commission refers to its replies to paragraphs XI and 59.

Recommendation 7 – Review the EU's support structure to ATM R&D in light of its objectives

The Commission accepts the recommendation.

The Commission agrees that it is necessary to set up stable structures to ensure continuity within the SESAR innovation cycle and provide them with the appropriate legal and financial instruments that also support cooperation with industrial partnerships. A major strength of the SESAR project is its vocation to involve stakeholders in all its processes. In this sense, SESAR is a pioneer initiative of the Union which enjoys growing support from stakeholders in particular through the SESAR JU and the SESAR Deployment framework.

However, it considers that the results of the development phase, the maturity of the partnership and the better awareness of the future challenges of air transport have made it possible to activate an ATM innovation cycle linking all three phases of the SESAR project and its partners and contributing to the broader performance objectives of the Single European Sky. This is the result of

the work primarily led by the SESAR JU. The innovation cycle and its underlying implementing mechanisms and bodies allow, today, to better prioritize solutions that promote defragmentation enhanced ATM performance and competitiveness of European industry.

The Commission aims to enhance a framework capable of supporting and guiding these partnerships to achieve the Union's policy objectives. The Commission is assessing potential options in the context of the next multi-annual financial framework on how to connect more efficiently the full SESAR innovation cycle in the Single European Sky mechanisms and integrate the lifecycle approach in its air transport policy.

Recommendation 8 – Reinforce the accountability of the SESAR JU

The Commission accepts the recommendation.

The Commission will continue to engage with the SESAR JU to reinforce its accountability, which is largely dependent on the commitment of its members to a commonly agreed vision and an efficient framework to achieve it.

In the light of the results of the SESAR development and deployment phases, the SESAR vision (SESAR 2020), defined in the latest edition of the ATM Master Plan, is now more stable allowing better aligning priorities, investments and focusing EU funding. All members of the SESAR JU have committed to that vision. It is essential to translate the vision into binding annual and multi-annual work programmes defining the objectives and milestones for the SESAR JU's work.

Recommendation 9 – Prioritize EU support to R&D solutions that promote defragmentation and a competitive environment

The Commission accepts the recommendation.

The Commission supports the need to enhance efforts to prioritise ATM R&D solutions that promote defragmentation, interoperability, sharing of infrastructure and foster the conditions for a competitive environment. The current processes for awarding EU funding already provide for assessing the relevance of the projects in the context of the SESAR innovation cycle and the impact of EU funding in the award criteria. The Commission ensures that these criteria are carefully assessed in the calls for proposals.

The network centric approach is already embedded in the SESAR innovation cycle. In particular, the essential ATM functionalities identified in the ATM Master Plan that have demonstrated their contribution to network performance and require synchronised deployment are channelled into the deployment framework through common projects (Regulation (EU) 409/2013) and deployed under the coordination of the SESAR Deployment Manager. EU funding for SESAR deployment focuses on common projects, which are identified as a priority in the CEF Multi-annual programme and the related calls for proposals.

As indicated in the reply to recommendation 7, the Commission will seek to establish stronger links with other Single European Sky mechanisms and set up stable structures within the SESAR innovation cycle providing them with the appropriate legal and financial instruments that focus on the added value for network performance.

Event	Date
Adoption of Audit Planning Memorandum (APM) / Start of audit	11.5.2016
Official sending of draft report to Commission (or other auditee)	24.7.2017
Adoption of the final report after the adversarial procedure	11.10.2017
Commission's (or other auditee's) official replies received in all languages	23.11.2017

In this audit we reviewed selected key components of the Single European Sky (SES) initiative, which aims at improving the overall performance of Air Traffic Management (ATM).

Overall, we conclude that the initiative addressed a clear need and has led to a greater culture of efficiency in ATM. However, European airspace management remains fragmented and the SES as a concept has not yet been achieved. Navigation charges have not been substantially reduced and ATM-related delays have started to increase again. The SES's technological pillar, the SESAR project, promoted coordination and is gradually releasing technological improvements, but has fallen behind its initial schedule and has become significantly more costly than anticipated. In substance, the EU's intervention in SESAR has evolved from one with a target deadline for achievement to a more open-ended commitment.

We make a number of recommendations to the European Commission and the Member States to help improve the effectiveness of the SES.



EUROPEAN
COURT
OF AUDITORS



Publications Office

EUROPEAN COURT OF AUDITORS
12, rue Alcide De Gasperi
1615 Luxembourg
LUXEMBOURG

Tel. +352 4398-1

Enquiries: eca.europa.eu/en/Pages/ContactForm.aspx

Website: eca.europa.eu

Twitter: @EUAuditors