

## Original Paper

# Development of the Single European Sky

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### **Abstract**

*The objective of the research is to present the development of the Single European Sky initiative and to outline its importance for the European economy and the European aviation industry. The paper reviews in detail the concept of the Single European Sky, the economic factors that have led to its formation and the European regulatory framework comprised of a set of EU-wide rules on Air Traffic Management (ATM) safety, on the provision of ATM services, on airspace management and on interoperability within the network, as well as financial support to the technological modernization programme (the SESAR project). It presents the rulemaking activity of the European Commission to deal with the inefficiency of the European ATM System due to the fragmented character of international airspace, fragmented into smaller air traffic control centres divided by the national boundaries, effectively limiting integration, interoperability, and economies of scale, and leading to induced delays, excessive air-traffic control costs and uneconomical flight trajectories. The applied research methodology includes content analysis, analysis of statistical data, historical data, conclusions, and generalizations. The hypothesis is that the strategic goals of the Single European Sky initiative and its implementation are beneficial for the competitiveness of the European aviation industry, and the common rules and the introduction of a harmonized legislative framework will contribute to improving the efficiencies of ATM while accounting for the interests and singularities of all stakeholders in the European aviation value chain.*

### **Keywords**

*European Union, Single European Sky, aviation industry, European Commission; air navigation services; air traffic management*

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### **1. Introduction**

In pre-pandemic Europe aviation supports 13.5 million jobs and \$991 billion in European economic activity. This is 3.6% of total employment and 4.4% of total GDP in European countries in 2018. The

number of people employed by the aviation sector in Europe is estimated to be 2.7 million people directly in 2018. An analysis shown in the Benefits Beyond Borders global report reveals that:

- 553,000 (21% of the total) come from employment by airlines or handling agents as flight crew, check-in staff, maintenance crew, or head office staff.
- 230,000 (9%) have had jobs with airport operators in roles such as airport management, maintenance, and security.
- 1.4 million (53%) have worked on-site in airports in retail outlets, restaurants, and hotels.
- 395,000 (15%) have been employed in civil aircraft manufacturing, including systems, components, airframes, and engines.
- 69,000 (3%) have worked for air navigation service providers in jobs like air traffic control and engineering (Note 1).

Air traffic control is a vital component of the European aviation value chain. Its primary objective is to facilitate a safe, fast, and cost-effective flow of air traffic thereby reducing fuel consumption, carbon emissions and flight duration. Air traffic management (ATM) plays a crucial role in ensuring safety and efficiency of air transport amidst the growing volume of air traffic within limited airspace.

Having faced the busiest month of the year in air traffic management globally with 4,43 million flights operated in July 2023, representing a 10% increase on the number of flights since 2022 and 26 % higher than in July 2019, it's worth focusing on the key initiatives that have been in place for the last 20 years in Europe aimed at overcoming the challenges in the sector.

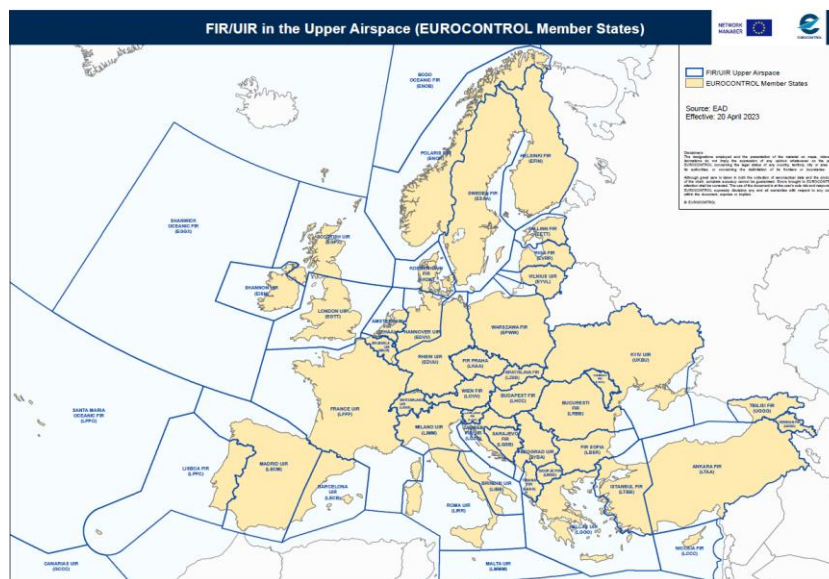
## 2. Literature Overview

In the years immediately prior to the COVID-19 crisis, air transport has gone through a period of exponential growth. It has been constantly evolving, noting a consistent increase in the level of flight traffic. In 2019, for example, the total passenger numbers have increased for almost all European airports compared with 2018, and could be established at 1,034 million, an increase of 3.8 % compared with 2018 (Note 2). In 2019 delays improved when compared to 2018, this compared to the severe delay levels both passengers and the airline industry suffered in 2018 when the airline industry reported delays reached 14.7 minutes per flight, an increase of 2.3 minutes compared to 2017 (Note 3). In terms of long-term performance, the level of delay in 2019 was the third worst in the last 10 years, ranking behind 2010 and 2018. En-route ATFM delays during the summer season have consistently posed challenges for airlines. The primary issue that persists is air space inefficiency.

Over the past two decades, several initiatives have been implemented to enhance the efficiency and interoperability of the Air Traffic Management (ATM) system in Europe. Among these initiatives, the Single European Sky stands out as the most significant one. It represents the rulemaking activity of the European Commission aimed at addressing the inefficiencies of the European ATM system caused by fragmented international airspace. The airspace is divided into smaller air traffic control centers, which are further segregated by national boundaries. This fragmentation hampers integration, interoperability,

and economies of scale, resulting in increased delays, higher air-traffic control costs, and inefficient flight trajectories.

In this respect one of the primary challenges faced by the ATM is that it can be characterized as a network industry. However, the industry is not market oriented. It comprises of hundreds of air traffic control sectors which are served by 63 air traffic control centers and more than 16,900 air traffic controllers who are responsible for managing the air traffic to and from 450 European airports, as well as to and from third countries (see attached map 1). In contrast, the US system is operated by a single ANSP, with 13,000 ATC air traffic controllers serving 23 Air Route Traffic Control Centers. The ATM system in Europe has traditionally been developed and provided at the national level by the respective ANSPs. European ANSPs are primarily organized based on state boundaries each with its own working arrangements and cost structures, whereas the US system is operated by one single ANSP. The European ANS system covers 37 air navigation service providers (ANSPs) that participate in a cost-efficiency benchmarking report. The combined business value of these ANSPs is estimated to be around EUR 8.6 bn (Note 4). The five largest ANSPs (DFS for Germany, DSNF for France, ENAIRE for Spain, ENAV for Italy and NATS for the UK) are responsible for 60% of the total European gate-to-gate service provision costs and handle 54 % of the European traffic. As a result, the other 32 smaller ANSPs are in charge of 40% of the remaining gate-to-gate costs. The system operates based on a network of air routes that are optimized at the national level, although not yet at the European level. Thus, the average flight distance is 49 km more than the direct distance between the origin and destination. Consequently, the level of fragmentation in European skies leads to the monopolistic position of the air navigation service providers in contrast with the highly competitive aviation market.



**Figure 1. European Flight Information Region (FIR) Charts -2023**

Source: EUROCONTROL (Note 5)

Air navigation service providers (ANSPs) are responsible for controlling air traffic in a manner that prioritizes safety, efficiency, and cost-effectiveness. This entails managing airspace effectively to enhance its capacity through technological advancements and infrastructure improvements. Additionally, ANSPs strive to improve service efficiency by employing skilled and productive personnel and adopting innovative and technological approaches to airspace management. The provision of effective air navigation services is vital for maintaining the highest safety standards in aviation, minimizing delays, and enhancing connectivity.

European airspace users are billed for the air traffic management services they receive, which is determined by the type of aircraft and the distance traveled within the area of responsibility of each air navigation service provider (ANSP) based on the planned trajectory. ANSPs collect terminal charges for the use of radio navigation equipment and flight services in airport areas, as well as route charges for air navigation services when flying within serviced airspace. These charges are established on a cost basis, following the Principles of the European Organisation for the Safety of Air Navigation (EUROCONTROL), which govern the establishment of cost bases and calculation of cost units for air navigation services. ANSPs generate their primary revenue from charges invoiced and collected by EUROCONTROL, in accordance with the provisions of the Multilateral Agreement relating to route charges. According to a 2016 analysis by the European Court of Auditors, airspace users have paid approximately €9 billion for these services, averaging around €900 per flight (Note 6).

This fragmentation has also led to unnecessary fuel consumption and emissions, as well as higher infrastructure charges compared to those that would have been incurred if the airspace were operated at the European level rather than at the national level. While the cost of provision of air navigation services in Europe is around €8 billion per year, the total additional costs incurred by airlines due to suboptimal profitability and fragmentation of European airspace have been estimated at around €4 billion per year (Note 7).

### **3. Legal Framework**

All these factors have led to an increasing need for the adoption at European level of common rules and development of a harmonized legislative framework known as the Single European Sky initiative. The European regulatory framework comprises of a set of EU-wide rules on Air Traffic Management (ATM) safety, on the provision of ATM services, on airspace management and on interoperability within the network, as well as financial support to the technological modernization program (the SESAR project) which is aimed at providing a framework for the creation of additional capacity and for improved efficiency and interoperability of the ATM system in Europe. The aim is to transfer regular competencies from the previous intergovernmental practice to the European union framework. The initiative is European and is open to neighboring countries.

The Single European Sky initiative has been launched as a response to the delays resulting from the inefficiency of air traffic management (ATM) in Europe, which reached their peak in the late 1990s.

Delays have had financial and economic consequences for airlines, their customers, and the community. Airlines have incurred additional costs for their aircraft fleets, as well as for their crews and ground staff, as delays prevent them from operating in optimal conditions. They must also compensate passengers for the discomfort caused by delays. According to the European Airlines Association, in 1989, approximately \$4.2 billion were lost due to delays caused by air traffic control, excessive air traffic control costs and uneconomical flight trajectories (Note 8).

The European Commission (EC) began to acknowledge the technological and institutional limitations of the air traffic control system, such as airspace fragmentation, numerous national air traffic control centers, ineffective decision-making and enforcement mechanisms, and costly delays. On 16 July 1998, the European Council authorized the Commission to negotiate with the Member States of the European Community to establish the European Aviation Safety Agency (EASA) as an international organization. In 1999, the EC issued its first communication to the EP and the Council regarding the creation of the Single European Sky. The High-Level Group on the Single European Sky published its report in November 2000. According to the report's findings, air transport demand had been growing constantly at a rate of 5-7% compared to previous years, and this growth rate was expected to continue in the coming years. This would result in at least a doubling of traffic every 12 years. The improvements made in the national air traffic management (ATM) systems that make up the European ATM system were insufficient to meet demand, because of which delays remained at unacceptably high levels. In 1999, one out of five flights were delayed by 25 minutes on average, and even in June 2000, more than 10% of all flights had delays longer than 15 minutes, with an average delay of over 20 minutes per flight. The report recognized that airspace should be designed, regulated, and strategically managed within a pan-European framework. It looked at how the European Union, with its legal framework, its decision-making process, its political oversight mechanisms, and its responsibilities, could address the need to harmonize airspace rules.

Having realized the urgent need of actions towards a harmonized legislative approach, the EC adopted in 2004 the first legislative package of the Single European Sky (SES) initiative which aimed to reduce the fragmentation of European airspace (among Member States, civil and military aviation, and different technologies), which was dominated by national monopoly service provision. This would increase the capacity and efficiency of air traffic management and air navigation services in Europe. The SES was expected to lead to shorter flight time (because of shorter routes and fewer delays) and, as a result, lower flight costs and aircraft emissions. The main policy instruments of the Single European Sky initiative are a consistent set of legislative instruments that would, in theory, address the key issues identified in the European ATM. They have resulted in enforcement powers combined with financial incentives that should stimulate significant improvements in ATM.

Two broad legislative packages have been adopted since the start of the SES initiative - SES I and SES II, which include four regulations and more than 20 implementing rules and Commission decisions. For their implementation, several implementing regulations (Implementing Rules) have been developed in

the operational, technical, and financial fields. The SES aims to achieve its overall objectives through a comprehensive approach that covers five interrelated pillars: the regulatory framework based on performance, the safety pillar, the technological contribution, the human factor, and the airport infrastructure optimization.

The Performance Scheme is one of the key elements of the SES legislation, which consists of several elements for tracking performance data in the provision of ANS. The Performance Scheme has set mandatory performance targets in key areas - such as safety, environment, capacity, cost-effectiveness, and incentives - to improve the overall efficiency of ATM and ANS. The Commission has adopted the performance targets through a committee procedure. The first reference period for the Performance Scheme was from 2012 to 2014. From 2015 onwards, each reference period was for five calendar years. The Commission has designated the "Performance Review Body" to help prepare these objectives and monitor the implementation of the Performance Scheme. EUROCONTROL has been appointed as the EC Performance Review Body. It also establishes the general principles for developing a charging scheme for air navigation services, which will help achieve more transparency in the determination, imposition, and enforcement of charges for airspace users.

Another attempt to deal with the fragmentation of the system, envisaged in the SES legislation is the concept of a "functional airspace block" (FAB), which is an airspace block that is determined by operational needs that reflect the need to ensure more integrated airspace management, regardless of existing national boundaries. Its main objectives are to provide better management of airspace, to optimize the route network and to achieve a cost efficiency through service integration.

The SES initiative also includes another important project that the EC has launched to modernize the technology of the European ATM System - SESAR Joint Undertaking (for the Study of Air Traffic Management in the Single European Sky), which was established in 2007 and manages the technical and industrial dimension of the SES, i.e., the development and deployment of the new European ATM system. The SESAR development phase (2008-2024) is estimated to cost €3.7 billion, which will be divided equally among the EU, EUROCONTROL and the industry. The deployment phase (i.e., the large-scale installation of the new system between 2015 and 2035) may need around €30 billion to be provided by the aviation sector (90%) and the EU (10%).

#### **4. Results**

Even though the two SES legislative packages have brought some improvements in the past few years, European airspace is still not fully integrated. The European Commission has acknowledged that the implementation of the initiative has been significantly delayed, and the Air Traffic Management (ATM) system has remained highly fragmented. By comparison, in contrast, in the United States, which covers a similar-sized airspace, the US single service provider manages almost 70% more flights with 38% less staff compared to Europe. The primary reasons for the difference in productivity between Europe and the United States in terms of air traffic management (ATM) are the poor implementation and enforcement of

the Performance Scheme, the weak oversight of the supervisory authorities, and the excessive number of support staff in the service providers (Note 9). The absence of a good ATM system is partly caused by these factors, which have led to extra costs of about €5 billion per year and increased the carbon emissions from aviation. In 2011, the combined direct and indirect costs of air traffic control in Europe were around €14 billion. Direct costs alone, paid by the users, made up more than 20% of the total operating costs (excluding fuel costs) of the most efficient airlines.

To overcome these challenges and speed up the implementation of SES II, in 2013 the European Commission suggested revising the SES legal framework, known as SES II + by combining the four SES regulations into one (Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the implementation of the Single European Sky (recast) / COM / 2013/0410). The proposal was structured in the following key areas: National authorities; Performance and charging schemes; Functional airspace blocks (FABs); Support services; Network Management, Involvement of airspace users. The main aim of the revision has been to enhance the efficiency of air traffic services and air traffic management capacity, as well as cost efficiency. However, the proposal has been met with great difficulties and opposition, especially because of its huge scope. Consequently, due to the political conflict between Spain and the United Kingdom over the status of Gibraltar's airport, the legislative process was stalled in the Council until the resolution of the conflict between the United Kingdom and Spain. It should be mentioned, however, that as of now, given Brexit, this issue is no longer relevant.

As a result, according to some data shown in the Eurocontrol Performance Review Report from 2016 it appeared that the challenges for the efficiency of ATM in Europe were still present. According to the analyses the level of air traffic in the Eurocontrol area kept rising for the third consecutive year in 2016 and attained the level before the economic crisis of 2008. At system level, air traffic grew by 2.4% which means an extra 681 flights per day on average (Note 10). The persistent increase in traffic in the last three years led to a deterioration of service quality. Based on the research there was a 20.9% increase in en-route ATFM in the EUROCONTROL area in 2016 compared to the previous year. This was the third consecutive year of such an increase. The proportion of arrivals that were on time within 15 minutes of scheduled time fell for the third year in a row. In 2016, 80.5% of arrivals were on time, a drop of 1.6% points from 2015.

## 5. Discussion

In the years leading up to the COVID-19 pandemic, the European Commission and the European Parliament implemented a series of strategic and operational measures to tackle capacity issues in European airspace. In 2018, flight delays amounted to over 18 million minutes. The Airspace Architecture Study conducted in 2019 and the report of the Wise Persons Group from 2019 provided key recommendations for the future of the Single European Sky. The lack of air traffic management (ATM) capacity has resulted in additional costs, delays, and CO<sub>2</sub> emissions. In 2019, delays in the EU alone cost almost €6 billion and led to 11.6 million tons (Mt) of CO<sub>2</sub> emissions. To address these issues, the EC

initiated the renewal of the Single European Sky II + legislative package known as SES II ++ in 2020. Most of the revised proposals are based on recommendations from the studies conducted in 2019.

The revised Single European Sky legislation is intentioned to deal with the issue of the limited ATM capacity and to introduce and to implement actions that will mainly boost the environmental results that are feasible under the European Green Deal, as well as new technological innovations.

The EC's updated proposal is motivated by the need to help the sector achieve its economic potential and operate more sustainably. To do this, a revision is needed to ensure a more adaptable provision of air navigation services, suitable for the current and future operating environment. The revised Single European Sky legislation aims to create a European airspace that is efficiently managed and uses cutting-edge technology. It is aimed to provide shared network management that enables airspace users to fly on the best and most eco-friendly routes. Its goal is also to provide digital services that do not depend on local infrastructure.

The following are the main differences planned in the revised proposal for a Regulation of the European Parliament and of the Council on putting into practice the Single European Sky:

- Establishment of a market-based environment (markets for various kinds of air navigation data), accreditation of economic licenses for the ANSPs, separating air traffic management services from other services in terms of organization and finance, creating a new independent body within EASA to decide on how to divide the costs between en-route and terminal services and to approve the performance plans for en-route air navigation services; and giving EUROCONTROL more authority to control airspace capacity.
- There is a proposal to introduce a common unit of charges for flights in the upper airspace of the Single European Sky. They will be based on the weighted average of the different charging units of the different air navigation service providers. The revenue from the common charging unit will be shared again to make sure that the relevant air traffic service providers do not lose or gain any money.
- A proposal to adjust the charges based on certain conditions, expecting that the charges will change (lowering the charges of the airlines that use environmental measures or lowering the charge unit of ANSP if the quality of services gets worse).

## **6. Recommendation**

There is no doubt that a sustainable and collaborative approach is recommended to achieve the strategic goals of the Single European Sky initiative since its implementation is beneficial for the competitiveness of the European aviation industry. The common rules and the harmonized legislative framework will contribute to improving the efficiencies of air traffic management. Despite this some of the ideas that the EC suggested for revising the SES II + have faced doubts from the Member States. Some of them have declared exploratory reservations. One of the main reservations that they have is that the suggested changes would make states have less power to decide how to run air navigation services in their airspace,



and instead give that power to supranational structures, which goes against Article 1 of the Convention on International Civil Aviation (Note 11) (Chicago Convention) according to which every State has complete and exclusive sovereignty over the airspace above its territory.

Currently dialogues on the text proposals in the legislative proposals between the Commission, the Parliament and the Council are under way. It is still unclear when the dialogues will end and whether common ground and acceptable compromise proposals will be found.

## 7. Conclusion

However, it is encouraging to note that European traffic is recovering fast, with a record of 32,420 average daily flights in August 2023. This represents a 7% increase compared to 2022 and is almost as high as in 2019 (94%) (Note 12). In this respect, despite the doubts and disagreements, it is important to continue efforts to achieve a consolidated approach and uniform measures to deal with the challenges for the European ATM system. To successfully implement the SES initiative and develop safe, cost-effective, and environmentally friendly ATM, close cooperation, and interaction between all stakeholders in European ATM is of great importance. It is essential to work together and consider the interests and specificities of all stakeholders in decision-making until the legislative reforms achieve the objectives of the SES.

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