

THE POTENTIAL FOR THE DEVELOPMENT OF FREE ROUTE AIRSPACE AS AN OPPORTUNITY FOR THE REPUBLIC OF TÜRKIYE TO PARTICIPATE IN ACHIEVING THE OBJECTIVES OF THE GREEN DEAL IN EUROPE'S AIR TRANSPORT

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Abstract: The development of air transport in Europe is trending towards sustainable growth. Since 2012, nine functional airspace blocks have been operating in Europe, fulfilling the requirements of the legislative framework for the creation of the Single European Sky (SES). The idea of their creation is related to the implementation of a system of measures to ensure sufficient capacity to service the constantly increasing number of flights over Europe, to reduce delays, to improve the safety and profitability of air navigation services, which is expected to reduce the negative impact on the environment.

In view of the location of DANUBE FAB, which is located on the air route between Europe and Asia, there are real opportunities for its expansion to neighbouring countries. The Republic of Türkiye is a potential participant in the process of expanding the neighbouring functional airspace blocks bordering its territory – these are DANUBE FAB and BLUE MED FAB. In view of the direction of the main air traffic flows, the option to join DANUBE FAB is the most practical applicability.

On the other hand, the Free Route Airspace initiative opens up real opportunities for the optimal implementation of measures to reduce the distance traveled by aviation operators' aircraft when conducting flights between Europe and Asia. The logic is that the shorter distance will lead to savings in fuel consumption, resource of aviation equipment, as well as to a reduction in the negative impact on the environment. This achieves one of the objectives of the Green Deal in the field of air transport in Europe, which is related to the organization and use of airspace, through the implementation of the Free Route Airspace initiative.

The inclusion of the Republic of Türkiye in the Free Route Airspace initiative will create conditions for the real achievement of the objectives of the European Green Deal in Southeast Europe in the field of air transport, as the economic advantages of establishing a "free airspace" (the so-called "free airspace"). Free Route Airspace (FRA) can be felt after its introduction.

This article explores the development of the concept of Free Route Airspace (FRA) in Türkiye and its potential to reduce air traffic pollution in line with the objectives of the Green Deal. Through the analysis of traffic data from 2020-2023 and route simulations, the environmental benefits of FRA were assessed. The results show that its full implementation can lead to a 20 % reduction in CO₂ emissions compared to traditional systems. These findings highlight the role of the FRA as a key tool for achieving sustainable solutions in air transport.

Keywords: Functional Airspace Block, Free Route Airspace, economic efficiency, green deal, air transport.

1. INTRODUCTION

Comparative studies conducted at the end of the 1990s on air traffic management (ATM) systems in Europe and the United States determined that the European ATM system was less efficient and more costly for passengers than its American counterpart. A primary reason identified for this observation was the substantial fragmentation in the provision of air navigation services (ANS), driven by national borders across Europe. At that time, all European Union (EU) member states typically provided air traffic services within their own national boundaries, supplemented by delegated services over the open sea for relevant states. Concurrently, forecasts indicated a significant increase in air traffic, particularly in Southwestern and Southeastern Europe. One practical initiative that commenced implementation during this period was the Single European Sky (SES), predicated on the assumption that the rising air traffic could only be managed safely and efficiently through enhanced cooperation between neighboring countries and air navigation service providers.

To address the challenges posed by fragmentation in the European ATM system, an initiative was launched to establish Functional Airspace Blocks (FABs). This approach was intended to facilitate the use of airspace along the most direct air routes while preserving the sovereignty of each participating state. As an initial step, the most direct routes were successfully implemented within the established FABs. However, it became evident that the primary air traffic flows did not align with the architectural design of these FABs. Consequently, a subsequent initiative was

pursued to establish "free route airspace" (commonly referred to as Free Route Airspace - FRA). This initiative focuses on the phased development of airspaces unrestricted by national borders and available for flexible planning. Upon its completion, this is expected to yield tangible reductions in pollution from civil aviation activities by decreasing the distances traveled by aircraft.

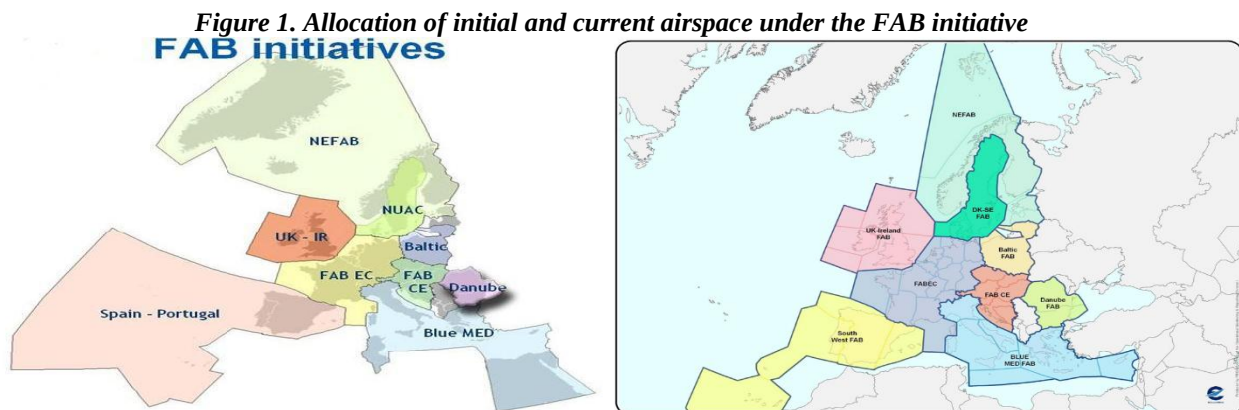
„To achieve a successful green transition through their funding policy“ (Dimitrova, R. 2025) of an industry as specialized as aviation, in alignment with the requirements of the Green Deal, necessitates addressing its environmental challenges. Ecological flights, facilitated through the so-called FlyingGreen platform, demand the adoption of new tools and resources by states, air navigation service providers (ANSPs), airports, and all other relevant stakeholders in the aviation sector. These measures aim to establish conditions for a more sustainable future. The FlyingGreen platform is structured around four strategic pillars designed to achieve the decarbonization of aviation, targeting four key priorities: "reducing emissions (NetZero), transitioning to more sustainable fuel (Fuelling Decarb), building resilience to climate change to ensure efficient and safe operations (ClimAdapt), and accelerating aviation's access to green financing (DecarbFin)."

Furthermore, when combined with the expressed commitment to reducing CO₂ emissions from large aircraft—typically responsible for the longest flights—by 2035, these two measures emerge as feasible strategies for achieving the Green Deal's objectives in the domain of air transport.

The purpose of this report is to explore and present the development of the idea of introducing "free airspace" in the Republic of Türkiye as an opportunity to achieve the objectives of the Green Deal in the field of air transport by reducing environmental pollution from air traffic.

2. EXPOSITION

Within the framework of the initiative to create functional airspace blocks, nine FABs have been established in the European Union so far. The initial initiative for the airspace volumes of the individual FABs as well as the current airspace configuration are shown in Figure 1.



Source: Eurocontrol.

Table 1 presents the countries at the start of these projects and now. The parties that initially participated and then withdrew or the initial names of the respective initiatives are placed in brackets. In italic font are the countries or organizations that have subsequently joined.

Table 1. Participants in the FAB initiative in the beginning and now

FAB INITIATIVE	MEMBER STATES	YEAR OF FRA
Baltic FAB	Lithuania and Poland	2022
Danish - Swedish FAB (DK-SE FAB)	Denmark and Sweden (first as a NUAC program)	2011
North European FAB (NEFAB)	Estonia, Finland, Latvia, Norway (Iceland, Sweden and Denmark)	2021
FAB UK-Ireland	United Kingdom and Ireland	2021
FAB Europe Central (FABEC)	Belgium, France, Germany, Luxembourg, Netherlands, Switzerland and <i>EUROCONTROL Maastricht</i>	2019

FAB INITIATIVE	MEMBER STATES	YEAR OF FRA
FAB Central Europe (FAB-CE)	Austria, Bosnia and Herzegovina, Croatia, Czech Republic, Hungary, Slovakia and Slovenia	2019
Danube FAB	Bulgaria and Romania	2022
South West FAB (SW FAB)	Portugal and Spain	2018
Blue MED FAB	Cyprus, Greece, Italy and Malta*. *Albania, Egypt and Tunisia as associated partners. Kingdom of Jordan and <i>Lebanon</i> as observers	2023

Source: Eurocontrol and authors' research.

When comparing the initial ideas and the current state of the airspace, it is easy to see the decrease in the size of the airspace NEFAB, SW FAB, and BLUE MED FAB. There are no changes for DANUBE FAB. In addition, there was a change in the name of the NUAC - it became the DK-SE FAB, with the countries participating in the DK-SE FAB actually leaving the NEFAB. The initial idea of achieving savings on more direct flights by expanding the boundaries of existing FABs did not receive sufficient support, in part because of the problems of guaranteeing air sovereignty, which led to the development of the FRA initiative.

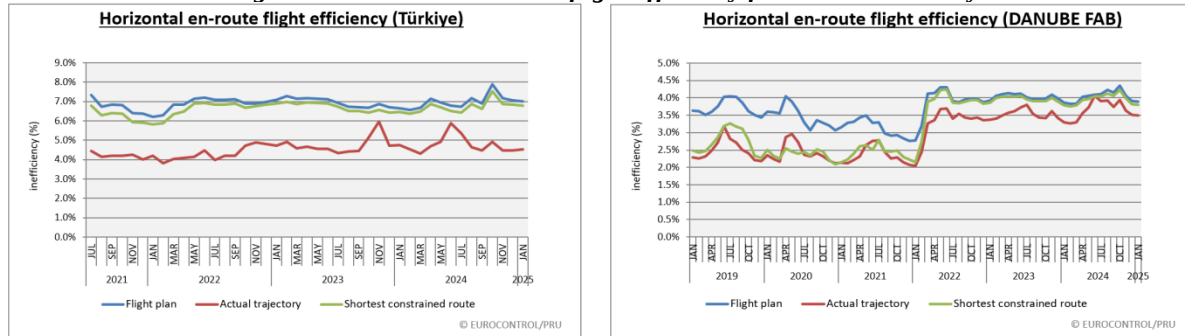
A special report of the European Court of Auditors (ECA) from 2017 found that "The lack of substantial defragmentation, combined with a slower increase in traffic, are key factors contributing to the weak quantitative results shown by the performance scheme. The currently existing functional airspace blocks (FABs) provide a forum for cooperation between stakeholders from neighbouring countries, but have proven ineffective in addressing fragmentation, whether at the level of airspace management, service provision or supply of technical equipment."

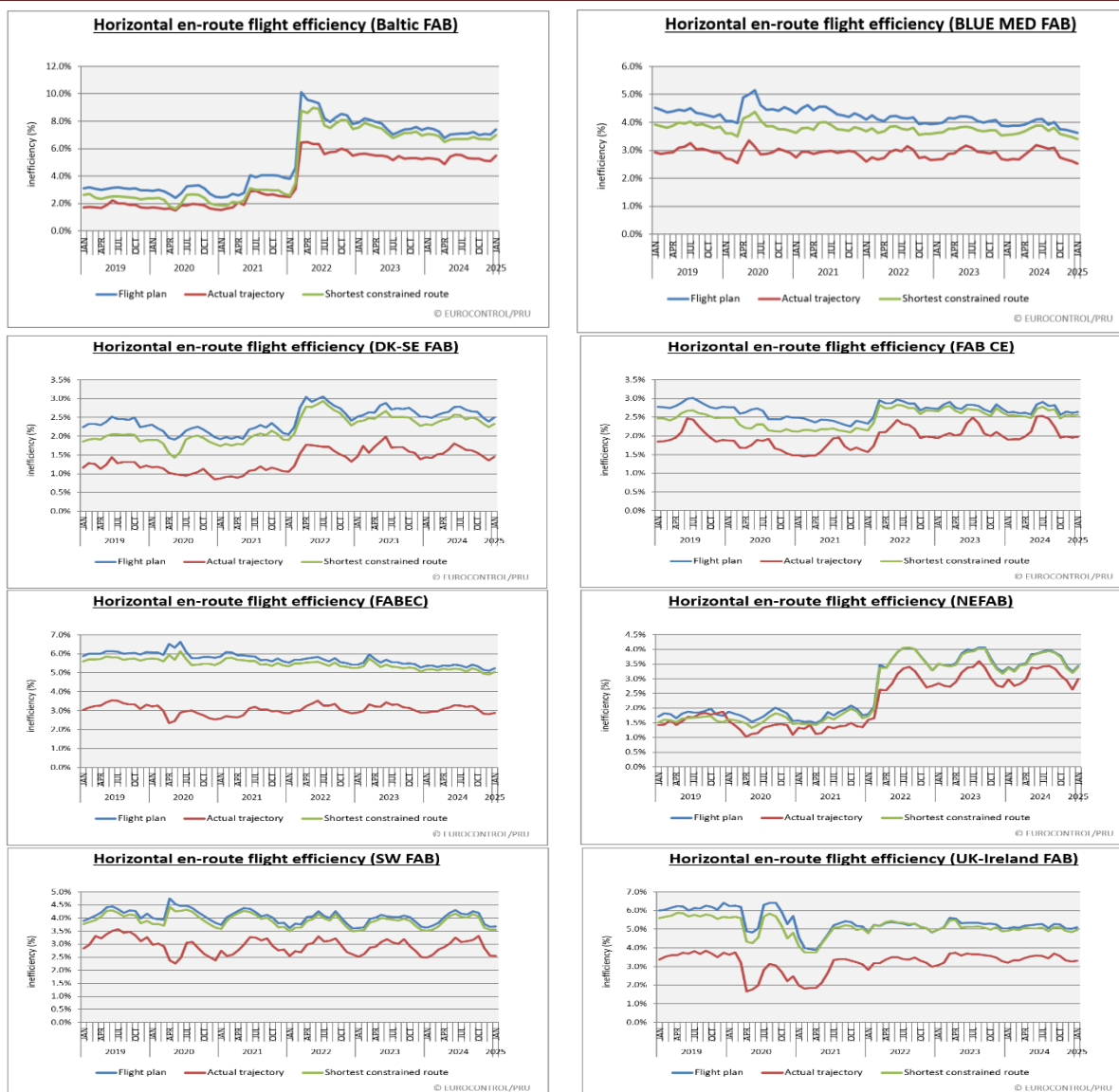
A new approach to avoid defragmentation is the idea of Free-Route Airspace (FRA), which is defined as an FRA, within which users can freely plan a route between a certain entry point and a certain exit point, with the possibility of routing through intermediate (published or unpublished) significant points, without reference to the permanent air route network, depending on the possibility of using the full capacity of the airspace. The benefits of the FRA application are an opportunity to overcome the efficiency, capacity and environmental problems of the aviation sector, while supporting the reduction of fuel consumption and emissions and improving flight efficiency. At the same time, it paves the way for activities to further improve the design of the airspace in line with ATM operational concepts.

3. RESULTS AND DISCUSSION

A comparative analysis of the horizontal performance data along the route for the different FABs and the dates of introduction of the FRA reveals a different influence, which can be seen in Figure 2.

Figure 2. Horizontal En-route flight efficiency for FABs and Türkiye



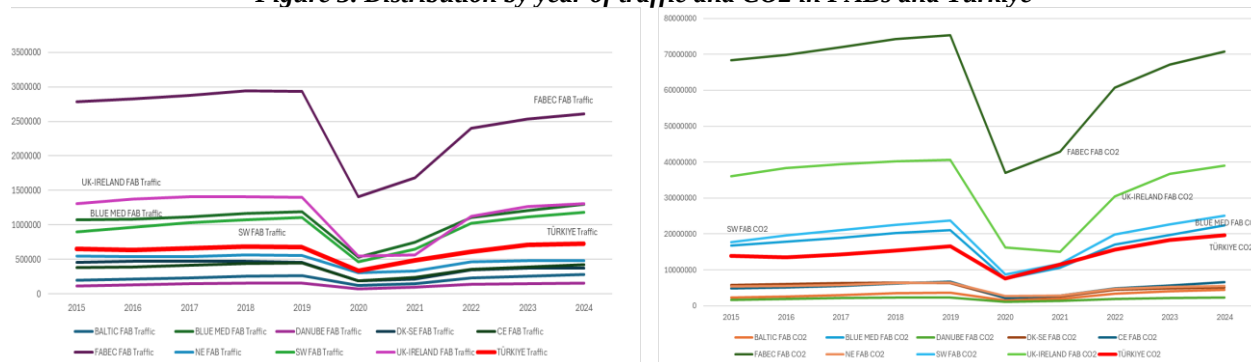


Source: Eurocontrol.

Correlations are found between the years of implementation of the FRA (in the relevant FAB or together with activities in adjacent FAB) and times of improvement in horizontal performance along the route for NEFAB, DK-SF (linked to NEFAB), BALTIC FAB and DANUBE FAB.

According to Eurocontrol data, it is easy to find the impact of the COVID pandemic on the development of the aviation market in terms of traffic and CO2 indicators, and there is definitely a relationship between scale and effect (a larger scale is associated with a greater impact effect), as can be seen in Figure 3.

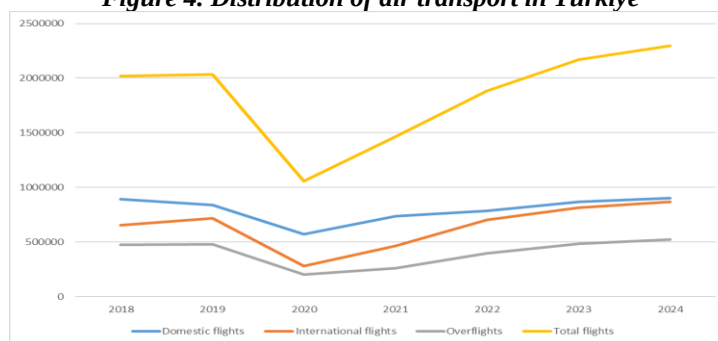
Figure 3. Distribution by year of traffic and CO2 in FABs and Türkiye



Source: Eurocontrol.

When compared with the distribution of traffic in Türkiye, it is easy to find that the analysis of Eurocontrol data is covered by the data available on the Devlet Hava Meydanları İşletmesi (DHMI) site relating to inbound traffic, as shown in Figure 4.

Figure 4. Distribution of air transport in Türkiye



Source: DHMI

According to information from the Ministry of Transport in Türkiye, from 2010 to 2020, a 20% reduction in CO2 emissions, a product of aviation, was achieved, as evidenced by the data in Table 2.

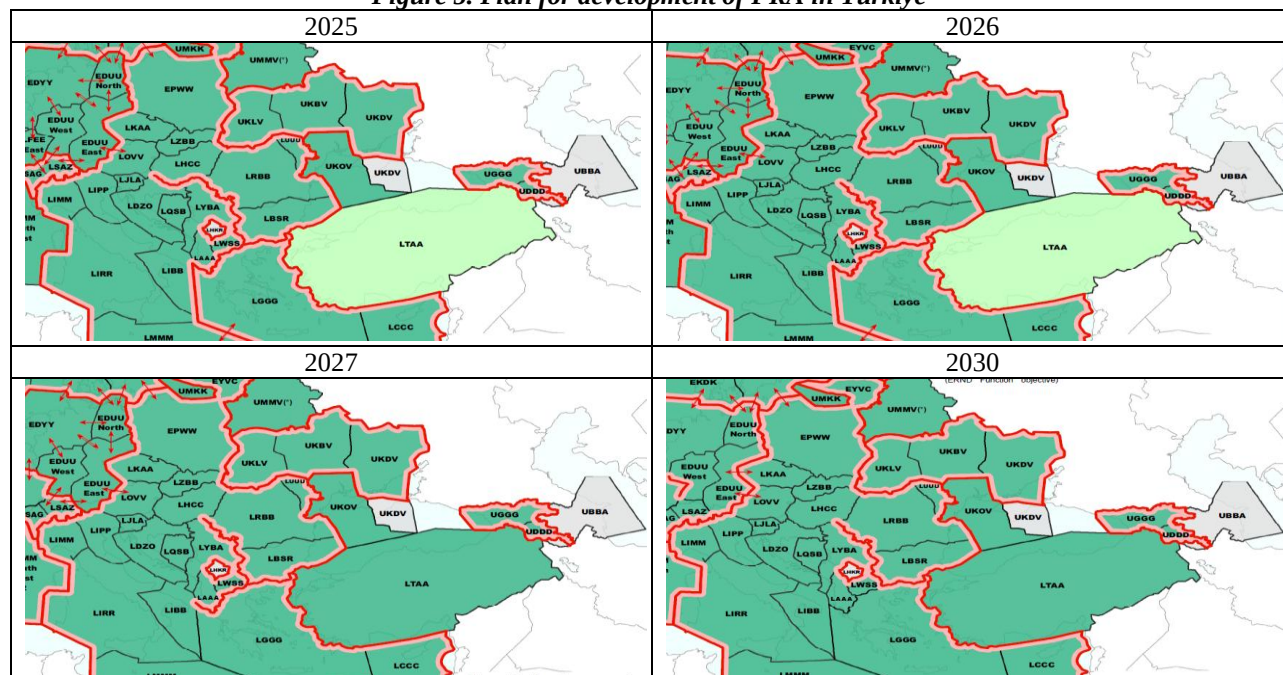
Table 2. Reducing air transport emissions in Türkiye (2010-2020)

Year	Emissions (tonne CO ₂)	Reduction (%)
2010	10000000	-
2015	9500000	5%
2020	8000000	20%

Source: Ministry of Transport of Türkiye, 2021

The data in Table 2 show that since a 20% reduction in emissions is possible in the period 2010-2020 per decade, the effectiveness of Türkiye's environmental policies in the field of air transport certainly has the potential to achieve the target results of zero emissions in 2050. As a good approach, the possibilities of implementing the FRA can also be used as an additional tool to reduce emissions from air transport. The plans for the expansion of the FRA stipulate that from 2025 to 2026, a night FRA will be introduced in Türkiye, after which a 24/7 option will be established, can also be seen from figure 5.

Figure 5. Plan for development of FRA in Türkiye



Source: Eurocontrol.

4. CONCLUSION

In conclusion, it should be noted that the implementation of the activities to increase the volume of airspace for free route planning in Southeast Europe achieves the goals set for the implementation of the European Green Deal in the field of reducing emission pollution of the environment in the use of air transport. The manuals of all FABs and Turkey provide the possibility of operating more direct routes in accordance with the planned schedule, with the aim of achieving a reduction in negative environmental impacts across Europe by the end of 2030. which is a confirmation that the achieved results of the FABs are an appropriate tool for achieving the objectives of the European Green Deal in Southeast Europe.

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