

Advanced Airspace Management Process

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Abstract: In order to increase efficiency and reduce delays, an improved airspace management process must be implemented leading to optimal route planning, better utilization of available airspace and increased performance targets in service delivery - through the establishment functional blocks of airspace (FABs). The Single European Sky (SES) project supports the establishment of the FAB through greater optimization and better performance, strengthening the ATM network through the introduction of the main objectives of the regulatory package, redesigning the European airspace in order to establish new air traffic flows; creating an increase in additional capacity, all with the aim of increasing the efficiency of the ATM system.

Keywords: air traffic, air traffic control, ATM, FAB.

INTRODUCTION - COMPLEXITY OF AIR TRAFFIC

The development of air transport in Europe is recording constant growth, and the forecasts show the expected growth of up to 6 percent on an annual level. Growth depends on the unstable phases that are the causes of terrorist attacks, as well as the development of the global economic crisis, which is still ongoing. Aircraft manufacturers Boeing and Airbus, according to the ordered aircraft, give a forecast of an increase in air traffic of up to 5% by 2023. [1] According to EUROCONTROL's forecast, the expected traffic growth rate is from 3.5 to 4.5% per year. The rapid development of low cost airlines in 2015 had approximately 45% coverage of the European market. According to statistical analyses, today over 4.5% of the world's gross product is brought by the aviation industry, 45% of passengers belong to the category of tourists. As a result, there is an increasing increase in air traffic at airports, which has increased five times in the last 30 years. [2] There are over 450 registered airports in European airspace; 130 companies and 60 air traffic control service providers. The operational implementation of "Enroute" air traffic, as well as in the terminal and airport zones, serves around 16,700 air traffic controllers in the European area. The daily number of flights in the complex structure of the ATM under the jurisdiction of EUROCONTROL airspace is conducted from 26,000 to 38,000 flights per day.

Complexity can be defined as a situation that is difficult to analyze and resolve, as the state of difficulty of an operation or task. The current European airspace is divided according to national borders into the provision of air transport services that can represent a limited space for the development of the European space through the design and implementation of optimal and satisfying user needs. The current airspace is divided into areas:

- In-flight information areas Flight Information Regions (FIRs),
- Upper Flight Information Regions (UIRs). [3]

Each airspace has its own specifics in the provision of air transport services as well as limitations for the design and implementation of European airspace in order to improve cooperation between service providers regardless of national borders.

The goal of the introduction of the Functional Airspace Block (FAB) is to increase the efficiency of air traffic through the improvement of the air traffic integration process as well as the goal of streamlining the airspace organization which will result in increased performance goals in service provision.

Factors of airspace complexity have a significant impact on the elements of air traffic control services. EUROCONTROL's model of complexity considers internal and external factors that affect the workload of air traffic controllers, and thus the efficiency of air traffic in the area of competence.

By internal factors we mean:

1. organization of airspace,
2. route structure,
3. airspace sectorization. [4]

In the factors of complexity as internal factors we take into consideration: Operational and technological concepts, which are used. Under external factors we consider:

- characteristics of traffic in the area of jurisdiction
- external constraints that affect operation

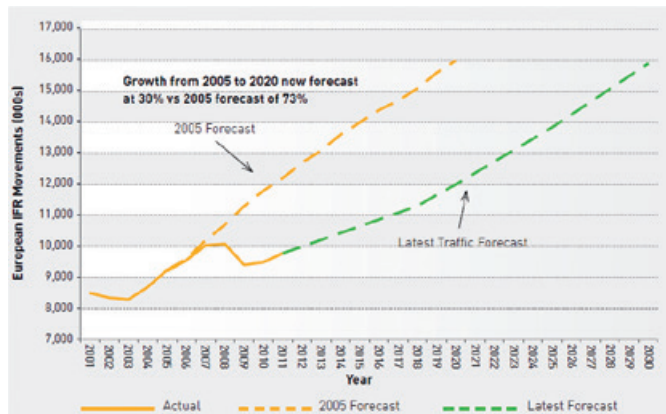


Figure 1. Overview of the increase in air traffic in the period from 2005 to 2020 [11]

Considering internal and external factors, we can conclude that the workload can be flexible, more or less depending on the applied above characteristics and limitations that affect the work as well as the layout of airways, their complexity, traffic schedule in time and space - sectoral configurations of operational procedures and concepts in order to separate aircraft.

The characteristics or factors may be affected by various restrictions on the use of airspace of jurisdiction, such as: military zones or restrictions on the use of certain parts of the day, month or year. All this affects the workload of the area of competence, work sectors, as well as air traffic controllers. A larger number of aircraft contributes to the reduction of unit labor costs. [7]

Considerations of indicators for assessing the complexity of traffic - complexity we can consider the requirements for altitude change during the summer, the number of airports nearby, as well as the number of conflicts. Factors for estimating the level of traffic flow are influenced by: unplanned aircraft, planned aircraft at certain time intervals, spatial and temporal number of aircraft, time required to fly through the sector and as a recorded number of conflicts. [5]

Unplanned aircraft are all those aircraft that have not completed the flight plan to fly through certain FIRs (sectors). These include aircraft that must be on their route due to weather conditions, cumulonimbus,

meteorological fronts, strong altitude wind, turbulence zones, emergency restricted zones on the route; to use unplanned neighboring FIRs to fly to the destination.

Planned aircraft are all those aircraft that have completed and received approval for the planned-requested flight plan. [4]

STRATEGY FOR REFORMING AIR TRAFFIC CONTROL IN EUROPE

Reforming traffic control is absolutely crucial. The Association of Airlines of the European Region (ERA) agrees with this, but they point out that the changes are taking place at a very slow pace. The problem is reflected in the fact that the authorities of the EU member states are slowing down the improvement of the unified air traffic management system. In 2004, the European Commission presented a plan for more efficient flight management in Europe through the Single European Sky initiative. [9] This implies that air traffic control is not divided by countries, but by regions, the so-called functional air traffic blocks. In addition, the exchange of research and technology through the European program SESAR for research and development of European airspace is planned. A new generation of air traffic control technology has also been developed, which began to be applied in 2014. The EU initiative also envisions coordination with the US next-generation air traffic management system, in order to better manage overseas routes.

CREATING A SINGLE EUROPEAN SKY (SES)

In order to rationalize the organization of airspace to achieve and increase performance goals in the provision of services to airspace users and their expectations, the idea of creating a single European sky - Single European Sky (SES), through the establishment of FABs, all in order to improve safety, efficiency of capacity increase, lower costs of services, as well as reduction of environmental pollution in the area of competence. The fragmentation of airspace (a large number of national air traffic control providers) also affects the safety of air traffic in the area of jurisdiction, reduces airspace capacity, increases costs (employed licensed personnel in the provider, technical equipment in air traffic control, equipment maintenance), affects the whole process of work. In accordance with the above, appears the idea of uniting certain countries-providers in air traffic control in blocks from several countries in the European Union. [8]

The SES program includes national air traffic control service providers in Europe and plans to establish a common and unified airspace. In order for the program to be acceptable, consent at the level of national requirements of the provider is required, as well as the implementation of national, regional and global operations. Europe's airspace is seen as a common good that should

be jointly managed in order to have a single airspace with maximum optimization of systems and processes in order to satisfy all users.

Regardless of the fact that in the European Union airspace is considered as a common resource, in most cases it coincides with state borders and as such it is managed through the function of airspace management (Airspace Management - ASM). This way of airspace management reduces capacities, and thus increases the costs of airspace users.

With the establishment of FABs, there has been an improvement and increase in safety, an increase in the capacity and efficiency of the system as well as lower costs of service providers - improving the overall efficiency of air traffic management and air navigation services in Europe. Due to the reduction of capacity, security and increase in the costs of airspace users, the integration of upper airspace within Europe has started. With the main goal: reconstruction of the airspace in the function of air traffic flows, creation of additional capacities, as well as increasing the efficiency of the ATM system - creation of FAB. FAB is defined as an air traffic block based on operational requirements that are established regardless of national borders, in which the provision of air navigation services and related functions are optimized or integrated. The introduction of FABs enables optimal use of airspace, as well as air traffic flows. This is conditioned by the ECAA agreement. This is a multilateral agreement on the establishment of a common European airspace, which provides for the harmonization of domestic regulations with European Union regulations in the fields of aviation security, safety, air traffic management, airport management, protection of passengers and other users of air traffic services, air markets liberalization, the prohibition of state aid and environmental protection. [10]

Given that the aim of the FABs is to enlarge the airspace to operational requirements that is established regardless of national borders, in which the provision of air navigation services and related functions are performance-driven and optimized in order to, in each functional block introduced improved cooperation between air navigation service providers or, where appropriate, an integrated (joint) service provider. FABs are, among other things:

- supported by a security study,
- enable optimal use of airspace, taking into account the flow of air traffic,
- ensure compliance with the European route network established in accordance with Article 6 of the Airspace Regulation,
- justified by total added value, including optimal use of technical and human resources, based on cost-benefit analyzes;
- ensure the smooth and flexible transfer of responsibilities in the field of air traffic control between air traffic service units,

- ensure coherence between different airspace configurations by optimizing, inter alia, current flight information regions,
- compliant with the conditions arising from regional agreements concluded within ICAO;
- in accordance with the regional agreements in force on the date of entry into force of this Regulation, in particular those signed by a third European country,
- aligned with performance targets at Community level. [12]

Formation of functional airspace blocks

The SES regulation requires the formation of FABs at least in the upper airspace of Europe and the ICAO AFI region above FL 285. There are currently nine FABs:

- AB FAB Baltic - Poland, Lithuania,
- FAB Blue Med - Italy, Greece, Cyprus, Malta (Tunisia, Egypt and Albania as associates and Jordan as an observer),
- AB FAB Danube - Bulgaria, Romania,
- FAB Central Europe - Austria, Czech Republic, Croatia, Hungary, Slovakia, Slovenia, BiH,
- FAB Europe Central - France, Germany, Switzerland, Belgium, the Netherlands, Luxembourg and the UK as associates,
- FAB NUAC - Denmark, Sweden,
- AB FAB NEFAB - Norway, Finland, Estonia, Iceland, Denmark, Sweden,
- AB FAB SW Spain, Portugal
- FAB UK-Ireland - UK, Ireland. [6]

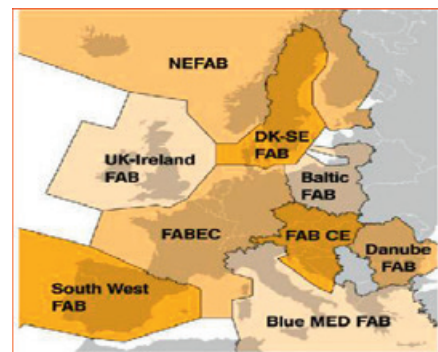


Figure 2. Schedule of FABs according to SES regulations [5]

Several countries are not members of any FAB initiative, Serbia, Montenegro and Macedonia. Serbia, Montenegro and Macedonia are signatories to the ISIS project, which aims to implement the SES program in Southeast Europe.

4. CONCLUSION

The expected airspace, as well as the pressure of airlines for shorter routes and reduction of delays in air traffic, has developed the need for a new organization of airspace, and thus the provider. It was concluded that the establishment of SES regulations in European airspace is needed in order to improve ANS performance. FAB is defined as an airspace block based on operational requirements for the provision of air navigation services and performance management and optimization functions, through improved cooperation in a functional airspace block among air navigation service providers and integrated service delivery regardless of national borders. The above requires the interoperability of functional, technical and operational characteristics of the constituent elements of the technical systems used in the provision of air navigation as well as their operational procedures for the purpose of safe, continuous and operational work within the FAB. IT integration of all systems used during operation is a prerequisite for achieving all set goals of increasing the efficiency of ATM systems.

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