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## DETERMINANTS OF EUROPEAN AIR TRAFFIC DEVELOPMENT

**Summary.** The paper elaborates main determinants of the strategic development as well as the key factors, which influence European air traffic dynamics. The problem of European airspace fragmentation should be solved by the comprehensive dynamic harmonization programmes, which can contribute to effective increase of airspace capacity and increase of air transport efficiency. The main objective of development strategy refers to the implementation of reformation processes of the European air traffic management system through functional ATM regionalization and adoption of Single European Sky legislation.

## ОПРЕДЕЛЯЮЩИЕ ФАКТОРЫ РАЗВИТИЯ ВОЗДУШНОГО ТРАНСПОРТА В ЕВРОПЕ

**Резюме.** В статье разработаны как основные детерминанты стратегического развития, так и ключевые факторы, которые влияют на динамику воздушного движения в Европе. Проблема фрагментации воздушного пространства в Европе должна быть решена в соответствии с всесторонними динамическими программами гармонизации, которые могут способствовать эффективному увеличению пропускной способности воздушного пространства и увеличению эффективности воздушного транспорта. Главная цель стратегии развития направлена на выполнение процессов преобразования европейской системы управления воздушным движением при помощи функциональной ATM регионализации и принятия Единого европейского законодательства в области воздушного транспорта.

### 1. INTRODUCTION

Recognizing the principles of sustainability, the projection of air traffic development needs to evaluate both the social and economic benefits of the aviation industry, and the external costs caused by air transport. The economic benefits of aviation industry are doubtless.

However, the issue of negative dimension of air traffic articulated by the costs of environmental pollution and congestion has become topical because of the traffic growth projection at a rate of 6 percent in the period from 2004 to 2008.

The main problems refer to the congestion of international air routes of the Euro-zone and the insufficiency of conventional air traffic control systems in following the future traffic increase. The operational implications are reflected in the delays of flight operations with negative connotations for

international operators (increase in exploitation costs), in airport saturation and the impossibility in increasing the airport capacities, and indirectly also in ecological and safety aspect of air traffic exploitation.

The planned system of technical, operational and economic measures in the context of the implementation of Kyoto protocol provisions and the strategic documents of the European Union should contribute on the one hand to the reduction of the growth in traffic demand and negative impact of air traffic, whereas on the other hand it should ensure further economic growth. The adopted development plans of the European air traffic are oriented to several relevant aspects:

- development and introduction of advanced communications, navigation and surveillance systems,
- harmonization of technical and technological standards,
- separation of regulatory and operational function (regulators and providers),
- implementation of unique safety regulations and supervisory mechanisms,
- optimization of air traffic management.

Reformation processes of the air traffic management system in Europe are directed to the integration of the European airspace by means of comprehensive dynamic harmonization programmes.

The strategic development programmes of the European airspace, from the safety aspect, refer to the solving of the problem of fragmented airspace by means of ATM (Air Traffic Management) regionalization with the aim of effective increase of airspace capacity, following the forecast traffic growth, and increase in the air traffic efficiency. From the economic side, the development programmes refer to the liberalization of the aviation market of the enlarged Europe.

## 2. INDICATORS OF AIR TRAFFIC DYNAMICS

European air transport has marked over the past twenty years the most dynamic growth compared to other transport branches at an annual growth rate of about 7.5 percent.

The air traffic tripled in the period from 1980 to 2000. In 2005 more than 700 million passengers were carried by air, which accounted to about 35 percent of world passenger traffic, and 11 million tonnes of goods.

Although these facts, the projection of the dynamics of further growth has to take into consideration the possible influencing factors, as well as the risks of globalization trends and reformation processes in Europe.

The traffic growth at a rate of 5.1 percent in 2007 was higher than in 2006, first of all because of the continuation of the progressive growth of low-cost carriage traffic and business transportation as well as significant increase of the traffic of conventional carriers during winter.

As consequence of the decrease in air fares, the load factor stabilization, strong economy and substantial deliveries of aircraft, a continuation of the traffic growth may be forecast.

The basic reviewed forecast of the traffic volume growth in 2008 is 4 percent. For 2009 the projection of the traffic growth is between 4 and 5 percent.

In the year 2014, in Europe, according to the medium-term forecast a traffic of almost 12.8 million IFR (*Instrumental Flight Rules*) operations will be realized, which corresponds to average annual growth rate of 3.7 percent for a seven-year period.

In Central Europe there is continuous change in the projection of traffic growth present because of rerouting of the flows towards the southerner corridors.

Substantial increase of air traffic in the European North-east has been generated by the flows towards Russia, and the indicative growth of traffic in the South of Europe is the result of the market opening of transition countries and concluding of an Agreement on the Single Airspace.

Expressed with the value of 9.9 million IFR operations, an annual air traffic growth of 5.1 percent was realized in Europe in 2007.

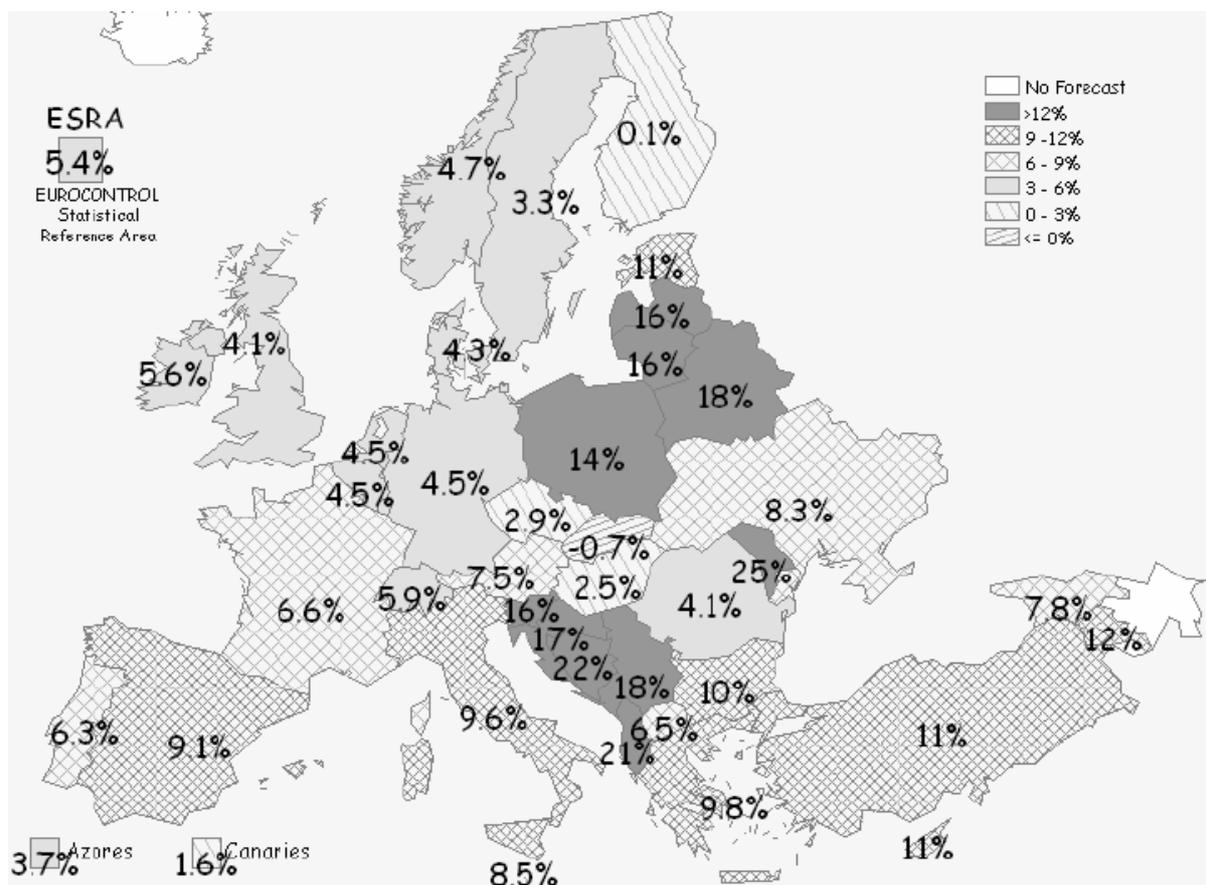


Fig. 1. Air traffic growth forecast [5]

Рис. 1. Прогноз роста воздушного движения согласно [5]

Analyzing the factors of influence on the air traffic growth the following can be highlighted:

- economic growth,
- dynamic growth of low-cost carriage traffic by 24 percent, and business aviation by 10 percent,
- continuous strengthening of transport market of new European Union members since 2004, adding anticipation of Bulgaria and Romania since 2007,
- strengthening of domestic air transport market in Turkey.

Besides the statistically evaluated demand, and limitations of saturated airport capacities and congestion of air routes of the Euro-zone, the projection of further air traffic growth in Europe has to recognize specific risks on the global and regional plan, and the main sources of uncertainties are:

- changes in route network,
- tourist trends,
- oil price,
- load factor,
- “open sky” arrangements and environmental charges,
- terrorism, wars and natural disasters,
- changes at local level.

The indicative air traffic growth, excluding the overflights, has been realized in Romania, Poland and Turkey, and substantial growth of low-cost market has been realized in Spain and Italy.

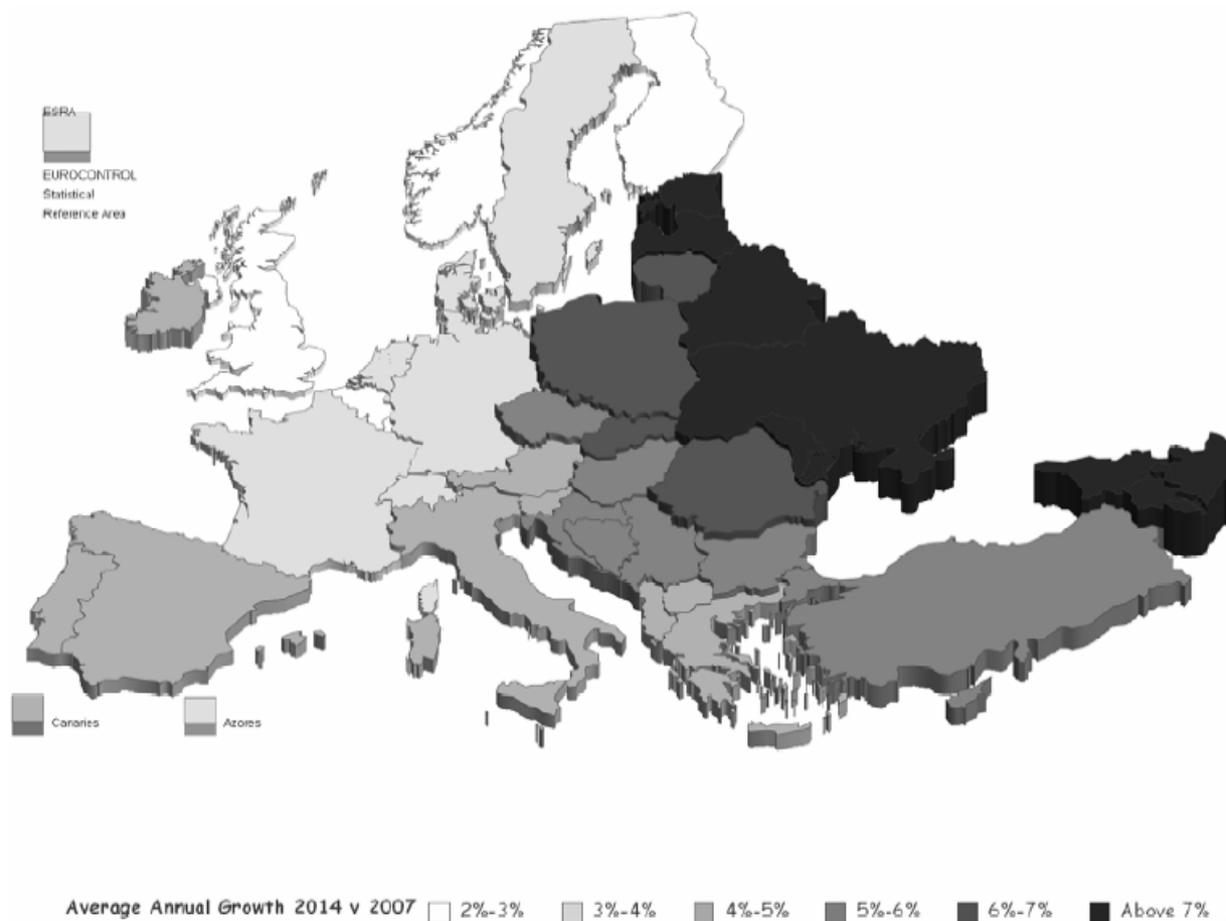


Fig. 2. Forecast of air traffic growth in Europe for the period 2008-2014 [4]

Рис. 2. Прогноз роста воздушного движения в Европе в течение периода 2008-2014 [4]

Apart from the main influencing factors, in the evaluation of the air traffic status in Europe some factors that are important can be isolated, although they have no direct influence on the growth of operations volume:

- continuous increase of the load factor contributes to an increase in the transport performance and operational profit of the companies.
- constant reduction in air transport costs after the jump in prices in 2005 caused by rapid increase in the oil price,
- the expansion of low-cost market that has a share in the structure of European traffic of about 20 percent with average realized 5100 flight operations per day in 2007,
- growth of business aviation traffic emphasised by the world football championship FIFA in Germany.

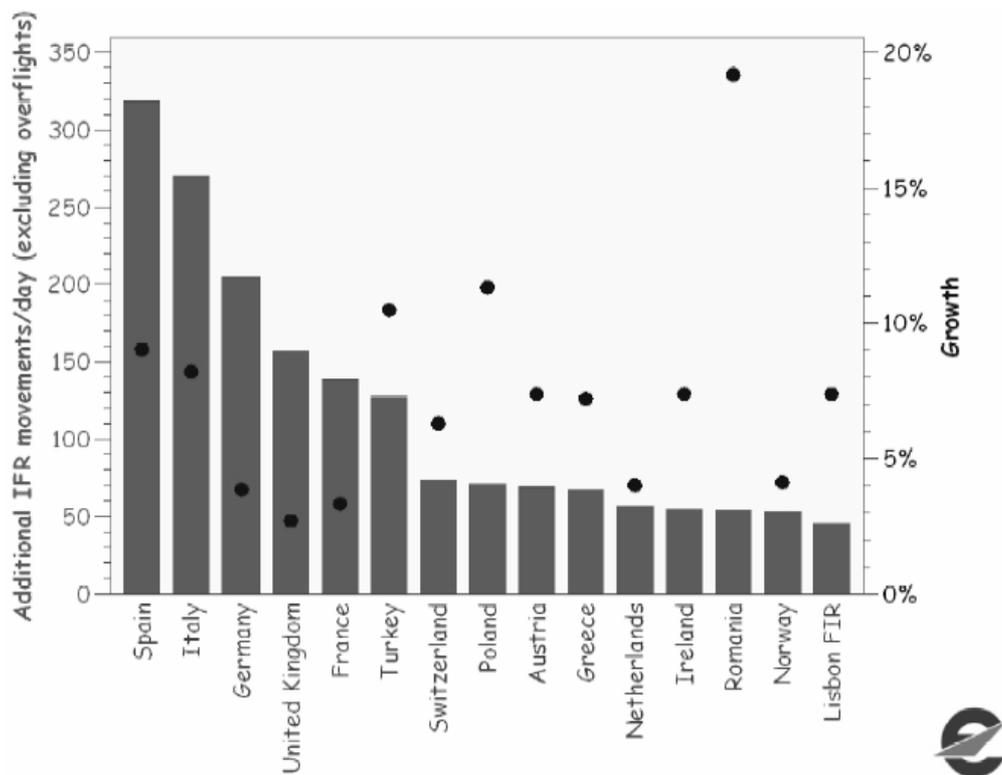


Fig. 3. Countries – main contributors of traffic growth in 2007 [4]

Рис. 3. Страны - основные участники транспортного роста в 2007 [4]

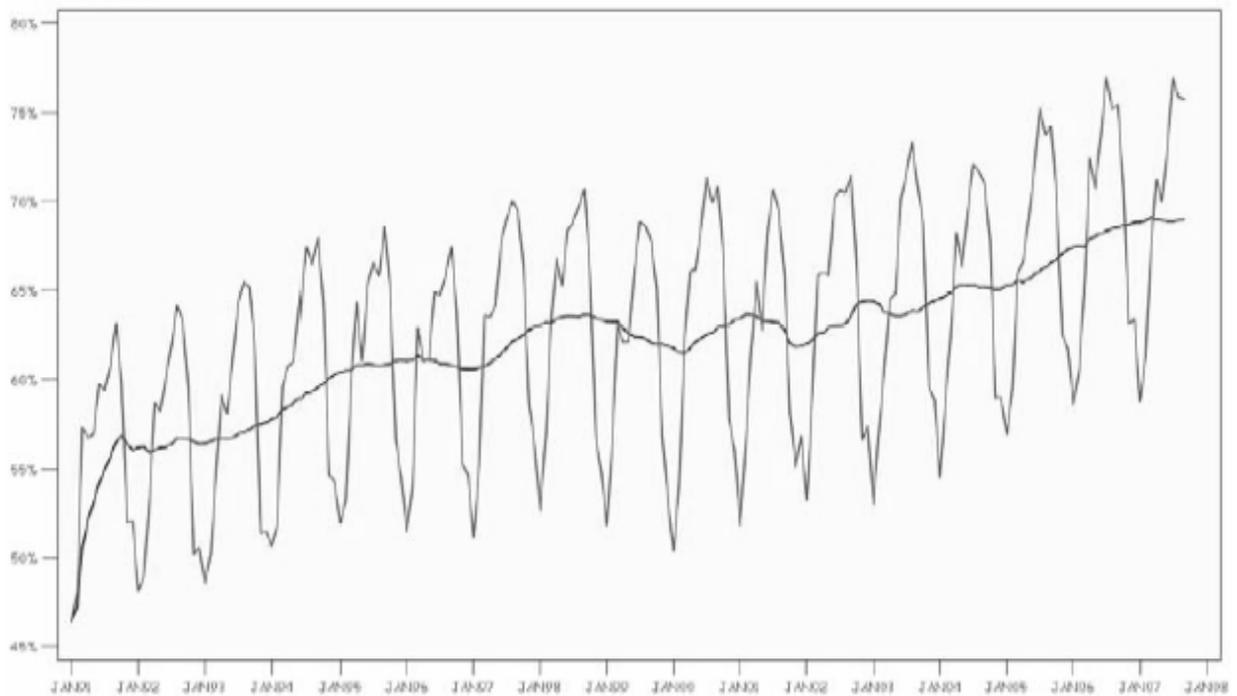


Fig. 4. Trend of the load factor in European air transport [4]

Рис. 4. Тенденция фактора загрузки на европейском воздушном транспорте [4]

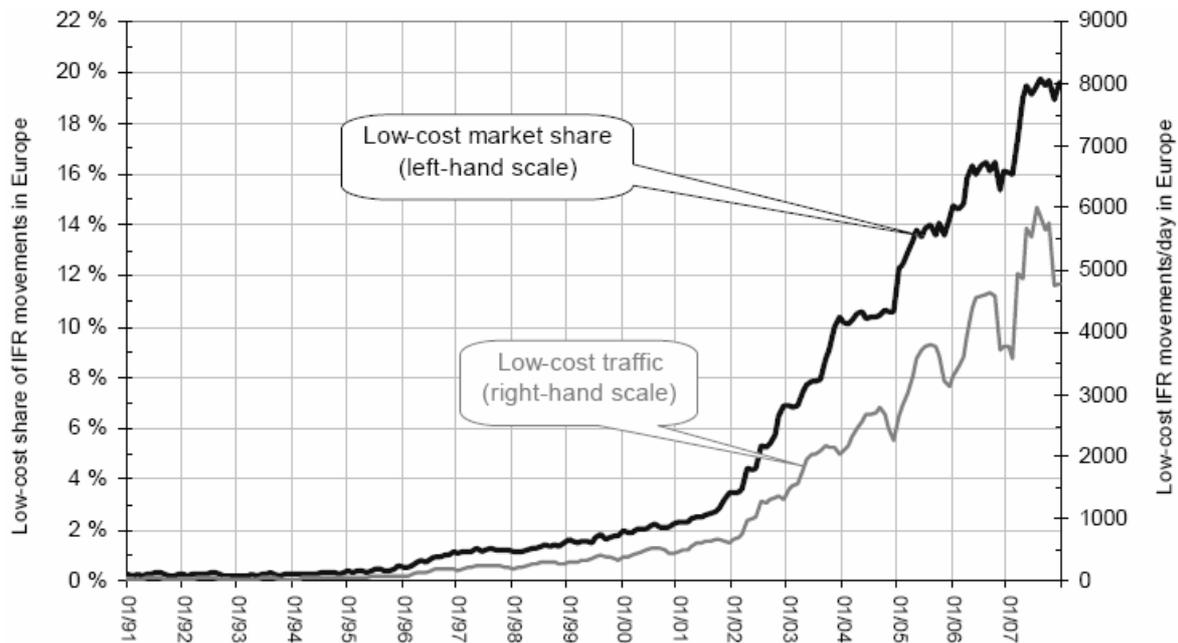


Fig. 5. Dynamics of low-cost traffic and their market share [4]

Рис. 5. Динамика низкобюджетных перевозок и их доли на рынке [4]

The main influencing factor on the dynamics of air traffic growth at the regional level is the possible change of the route network. In this sense, the most sensitive is the region of South-eastern Europe with huge development potentials.

Apart from Bulgaria and Romania – new European Union members, Croatia and Macedonia, as well as Turkey are in the process of integration, and the implementation of the third liberalization package of the aviation market and market opening of the transition countries will directly mark the result in the redistribution of air traffic flows to the southern corridors and the expansion of traffic in that region.

The third package of liberalization measures assumes: [3]

- implementation of standardized conditions for operational licence of air carrier in the EU and ECAA countries,
- the open approach to airlines with operational licence to all the routes included in the European route network, and the possibility of national governments of imposing the liability of public service on the routes that are essential for regional development,
- full freedom of the operators in the policy of pricing and fees with no obligation of their approval at the level of national authorities.

South-east Europe, on the other hand, has an extremely favourable geo-strategic position for attracting air traffic in overflights and regarding the projection of traffic growth between North-western Europe and the Mediterranean and the Near East, the operationalization of the regional ATM system will contribute to the rerouting of the flows to the southern shorter routes in the future route network, which ensure savings and substantial reduction in operational costs for the operators.

The open sky and free market are also important influencing factors in the projection of air traffic trends at the regional level. The European Union enlargement has a double effect, which is manifested in the current liberalization of the aviation market, but also in the free trade and free movement of the working population. Consequently, there is an increase in the local traffic, which e.g. for Poland has a rate of 20 percent.

The future trend will be significantly affected by the agreement on the open sky between the European Union and the United States, Morocco and Ukraine. However, these effects will not be as substantial as in the case of new EU members, because of the absence of the accompanying effect of

free trade and movement. In case of such arrangements, an increase in IFR operations in the European Union is estimated at about 5-8 percent.

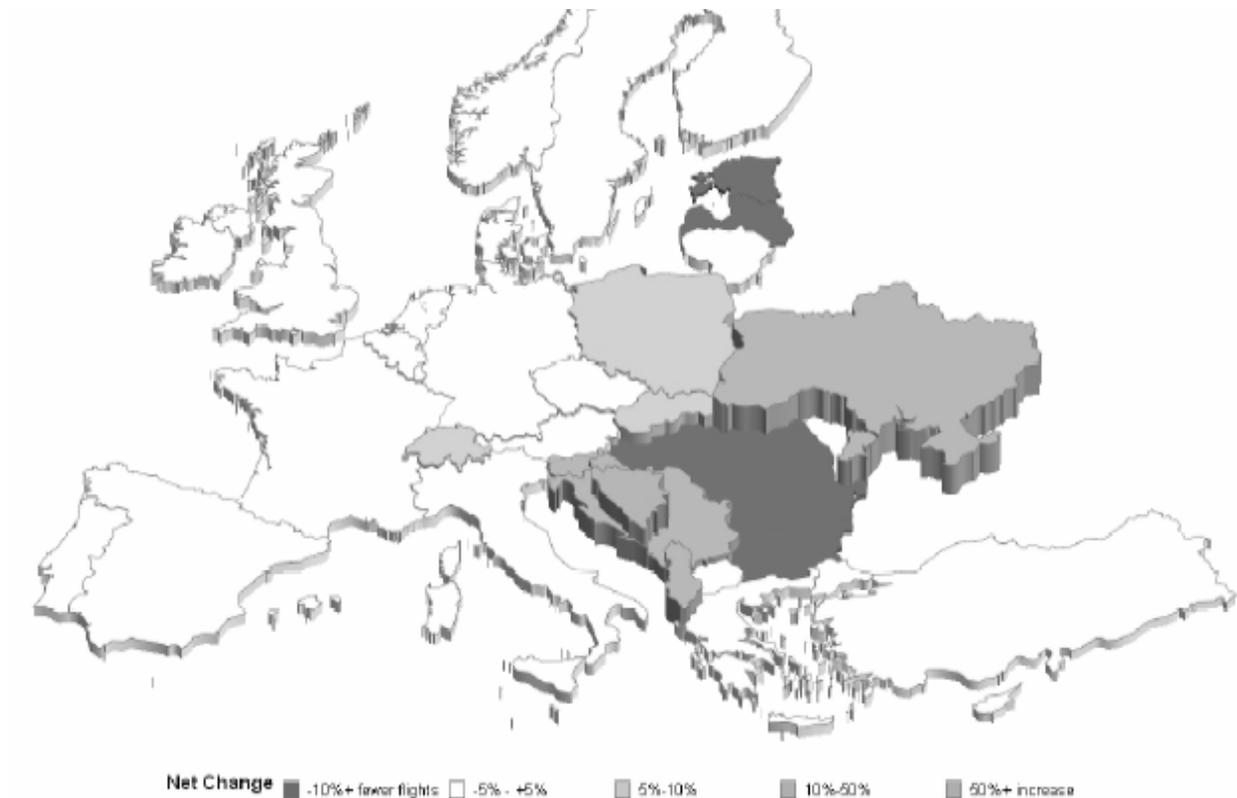


Fig. 6. Sensitivity to changes in the route network [4]

Рис. 6. Чувствительность к изменениям в маршрутной сети [4]

The dynamics of air traffic in Europe may be restrictively affected by the limitations of airport capacities. According to the mid-term forecast for the period from 2008 to 2014, almost 350 thousand non-realized operations of departures are expected, which corresponds to the reduction of the air traffic growth rate by 2.7 percent.

The development of high-speed railway network in the European Union is manifested by extreme competitiveness of this traffic mode compared to air traffic, especially on 1000-kilometre lines. According to mid-term forecast, in the period from 2008 and 2014 the high-speed railways will affect the reduction in air traffic by 71 thousand IFR operations or about 0.5 percent of total traffic. Major influence of railway traffic on the reduction in air traffic is expected in Spain and Italy by about 3 percent and 2 percent, respectively.

### 3. EUROPEAN ATM REFORMATION

With the aim of establishing a Single European Sky the European Commission founded a group (High-Level Group) to study the reforms of ATM system in Europe. In solving the problems of fragmentary character of the European airspace regarding regulation and control of air traffic the EC-group faced three essential barriers in the realization of the "Single European Sky" concept:

- the issue of commercialization / privatization of ATS providers,
- the issue of a unique regulator,
- the issue of harmonizing civil and military users.

The safety regulations regime in the European Union for ECAC members was delegated to the responsibility of the new founded European Aviation Safety Agency EASA and in principle is based on taking over the JAR system and its upgrade.

Since JAA and subsequently EASA regulation domains actually do not cover the air traffic management, the question is raised about the efficiency of the future regulator.

Apart from the activity of harmonization of CNS/ATM national systems and implementation of ATM Strategy 2000+ through the portfolio of EATM related projects, EUROCONTROL took over the task of standardizing the safety aspects of the air traffic management. The implementation of safety regulatory requirements ESARRs at national levels should insure in the future the uniqueness of the ATM safety management.

The Air Navigation Service Providers (ANSP) are obliged to adopt the ESARR regulations, standardized as a package of combined requirements for improving the reporting system, monitoring of significant changes in work operations, incorporation of standardized safety procedures into the safety manual, and evaluation of safety changes at the organizational and infrastructural level.

The expected controversial issues in realizing the "Single European Sky" concept refer to the status of EUROCONTROL with the double function of service provider and regulator, and analogue to the establishment of a single unique regulator for all the segments of the air transport system. Therefore, as part of reformation processes of the European air traffic management system, the European Commission has initiated also a process of transposing the regulatory function for the ATM sector from the responsibility of EUROCONTROL to the responsibility of EASA. [1]

The strategic foundations of the European air traffic refer to the implementation of innovative technological, operational and economic measures of the transport policy in the realization of the European Commission program entitled Single European Sky - SES. The main objectives of the program include restructuring of the European airspace for better throughput capacity of air traffic, creation of additional capacities, and increase in the total ATM efficiency.

As part of the related SESAR program, the regulatory and legislative framework of the Single European Sky initiative will be completed, in order to facilitate the implementation of the technical, operational and organizational innovations with the aim of increasing the European air transport safety. The development initiative assumes de-fragmentation of the European air traffic management system through synchronization and integration of the implementation plans and actions in two phases - from research and technical implementation to operational implementation of the program.

In the period from 2005 to 2012, the research will focus on the establishment of interoperable integration, support and upgrade of the ATM/CNS systems and components.

The interoperability in the SES system will be implemented progressively, depending on the dynamics of the SESAR "out-puts", and full operation is expected by the year 2020. The determined guidelines for the realization of the Single European Sky programme include:

- reducing the fragmentation of the European aviation market,
- reducing of unnecessary costs through system reorganization,
- increase of compatibility and interoperability of ATM systems,
- improvement and enhancement of the total safety,
- promotion of technological innovations on ground and board systems,
- increase in the airspace capacity,
- simplification of the regulatory framework.

The implementation of the development program of establishing the Single European Sky is supported by adequate European Commission regulations:

- The framework of regulatory measures establishes a harmonized institutional and regulatory model for SES requiring the member countries to create National Supervisory bodies - NSA, independent from service providers, that act in the committees of the Single European Sky,
- Service provision regulation sets the standards of safety, quality and security. The regulations enables the operation of independent supervisory bodies that require shift of ESARRs to the principle of social right, representing the navigation service providers certification mechanism,

- ANSP in the sense of following the requirements of the European Commission for transparency and clear scheme of the air traffic control system,
- Regulations related to airspace determines the development requirements of transition functional airspace blocks - FAB, that ensure optimal access to the operative restructuring of the airspace, and also give incentive to the harmonization of the airspace division methodologies,
- The interoperability regulation refers to the achievement of interoperability of the European ATM network. The regulation defines the basic conditions, new operational concepts and technologies. The document entitled Declaration on agreement contains the implementation rules, standards and specifications that are in compliance with the manufacturers.

The issue of ATM reform in Europe has not been sufficiently delegated to the responsibility of the national regulators, primarily because the complex of the standards has been brought at the level of the professional association EUROCONTROL, rather than at the level of an international regulator. The national regulators are not obliged and have no responsibility of implementation.

On the other hand, in the air transport deregulation process in Europe with the aim of commercializing the service providers, the national ATM systems have been transformed in the majority of transition countries from the government authorities to autonomous commercial companies owned by the state. As successors, these companies have taken over the infrastructural and human resources with the primary function of commercial management on the open market, whereas the regulatory function of the ATM system has remained under the jurisdiction of the national regulator. Following the non-obligatory legislation and the transfer of the qualified staff into the air traffic control operative, the national regulators cannot adequately follow the development needs of the ATM system due to the shortage of the qualified administrative staff, i. e. insufficient administrative capacities.

In the assumptions of the model of the future European air traffic management, the expanded cooperation with the national regulators in ECAC countries, EU non-members, as well as stakeholders unions is of extreme importance. The adopted model, namely, will consequently refer to the wider European area, mainly the transition countries that tend towards integration into the European Union, with the adoption of EU solutions being not only the question of the political will, but also of objective possibilities regarding legal, financial, and human resources. In this sense, from the aspect of associate transition countries, the planning of the instruments of financial and technical support in the European ATM reform is suggested.

#### **4. CONCEPT OF ATM REGIONALIZATION**

The air traffic management system in Europe ensures the infrastructure for 27 thousand flight operations per day, which are realized by about 5 thousand commercial aircraft among 100 main airports of the European community.

Liberalization of aviation industry implied a reorganization of air carriers on the global market, whereas the air traffic control remained organized and operated at the national level.

Although aviation has the essential characteristic of a cross-border activity, the existing system of air traffic management has retained the attributes of being fragmentary.

The airspace and air traffic management fragmentation influences safety, reduces the capacities and increases the costs.

Moreover, it decelerates the process of making decisions necessary for the introduction of new technologies and for the adaptation to users' requirements.

The airspace should be, therefore, divided according to operational requirements regardless of the national border into functional space blocks.

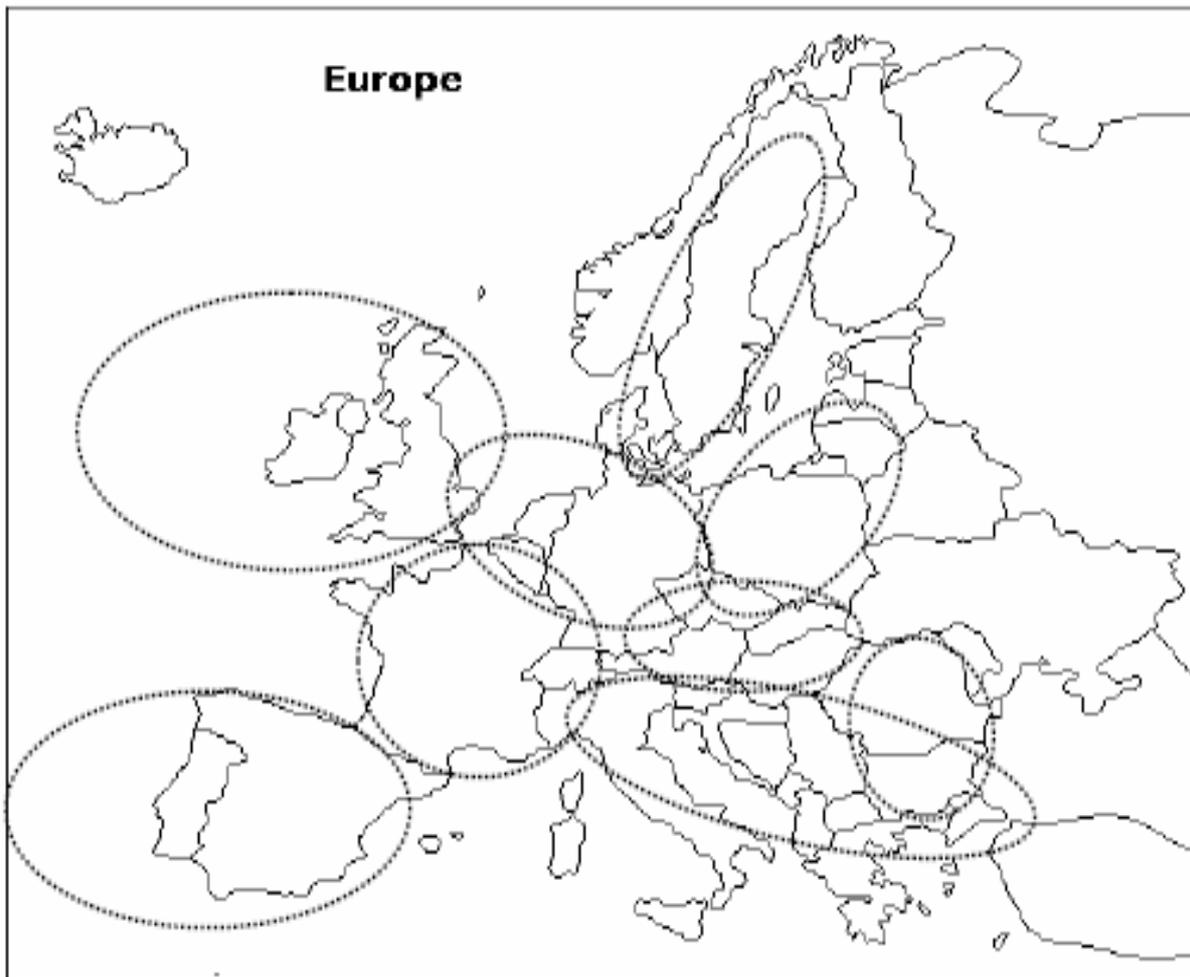


Fig. 7. ATM regionalization – overview of potential functional space blocks [6]

Рис. 7. ATM регионализация – обзор потенциальных функциональных пространственных блоков [6]

As part of SES legislation the European Union members are obliged to join such regional forms of integrated management.

Two-three years after having adopted the legislation for the establishment of a single European sky, the European Commission has to actually evaluate the progress in the establishment of the functional space blocks.

The approach to functional space block of South-eastern Europe - SEE FAB, is of special significance. It promotes the regional cooperation on the Balkan and opens up the possibilities of reactivating the Kosovo airspace. The Pact on Stability in South-eastern Europe and the European Commission have taken initiative and offered a political framework for the cooperation within integrated ATM region, which includes Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Romania, Serbia, Montenegro, Macedonia, with the United Nations mission on Kosovo (UNMIK) and support of Greece, Italy, EUROCONTROL, ICAO and NATO.

After the phase of preliminary study, the directors of air traffic authorities of participant countries decided to start the feasibility phase of studying the regional model of integrated air traffic management for the forecast annual traffic growth of 30 percent in the region of South-eastern Europe.

The Agreement on European Common Aviation Area (ECAA) expands the aviation market of the European Union to partner countries that will adopt the EU acquis in air transport, including SES legislation with the planned implementation until 2010.

Table 1

Indicators of current projects of ATM regionalization in FABs network (2004) [2]

FAB-functional space block	Countries - participants	Area of controlled space (km <sup>2</sup> )	Total flight hours	Number of controllers	Number of sectors	Number of ACC units
CEATS	AT-BH-HU-SK	241,400	505,952	624	4	4
Central FAB	BE-DE-LU-NL	740,995	1,970,480	2,138	5	8
FR-CH	FR-CH-(IT)	1,232,447	2,360,007	2,798	88	7
ES - PT	ES - PT	2,873,683	1,420,959	2,029	52	6
NUAC	DK-SE-(NO-FI)	1,917,000	1,003,812	1,294	5	9
SEE-FABA	AL-BH-BG-CR-FYROM-UNMIK-RO-SE-MO	1,371,520	1,546,980	2,516	15	11
BUL-ROM	BG-RO	399,120	353,998	775	22	3
UK-IRL	UK-IE	1,637,120	1,830,486	2,315	11	6
Total		10,014,165	10,638,675	13,715	180	51

## 5. CONCLUSIONS

Strategic modelling of air transport development is influenced by external and internal factors - from global trends of ecological standardization, dynamics of tourist development, and reformation changes within the European context to the limitation at the local level in the sense of insufficient administrative capacities for the necessary restructuring of the air transport sector.

Positive development aspects are reflected in the trend of air traffic growth. In the majority of transition countries the air traffic growth rate is greater than the European average. The medium air traffic forecast in Europe for the period 2008-2014 is at the annual rate of 3.7 percent.

Unfavourable development aspects are manifested in the evaluation of the external costs of air transport with a share of 14 percent, excluding the congestion costs, in the total external transport costs. Because of the harmful impact on the environment, at the global level and at the European Union level, strict measures of reducing fuel consumption are introduced, that will be reflected also on the deceleration of air traffic growth.

The European reform of air traffic management system is targeted to the integration of the European airspace through comprehensive dynamic harmonization programmes. From the safety aspect, strategic development programmes of the European air transport refer to solving problem of airspace fragmentation. In this context ATM regionalization has the objective of effective increase of airspace capacity, following the traffic growth forecast, and increase of air transport efficiency. From the economic aspect, the development programmes refer to liberalization of aviation market within the enlarged Europe.

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