#### ARTICLES

## GEOGRAPHICAL ASPECTS OF CONTEMPORARY AVIATION IN BOSNIA AND HERZEGOVINA

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UDK: 911.3:338.47(497.6)

#### ABSTRACT

Geographical aspects of contemporary aviation in Bosnia and Herzegovina The paper analyzes the contemporary development of air transport in Bosnia and Herzegovina. Hence, the article will thoroughly analyze the air traffic in Bosnia and Herzegovina, and a number of other aspects will be more or less just indicated. In geographical approach to the analysis of development of air transport in Bosnia and Herzegovina, we start from the present situation in which to consider the appropriate indicators development through geographically relevant factors and then give an explication of geographical factors on the forms, levels and directions of development of air transport.

The last five years created a new situation in the development of aviation in general, primarily caused by the economic crisis in Bosnia and Herzegovina. Air transportation network in Bosnia and Herzegovina should help the integration of the Bosnian-Herzegovinian national territory and its integration with the countries in the world. Size of the territory of Bosnia and Herzegovina with its geographical conditions is very important underlying factor in the organization of air traffic. Bosna and Herzegovina is a small country. The concentration of the economy in the immediate areas is still less pronounced for the purposes of air traffic.

#### KEY WORDS

air transportation, economic development, airports, Bosnia and Herzegovina

## 1. Introduction

Air transport in Bosnia and Herzegovina had a very dynamic development and became an important branch of the mass transport of passengers and goods. In the last 10 years it has increased at an average growth rate of about 3-4% per year, regardless of short crisis periods which occasionally repeated, approximately every 10 years (as a result of the economic and energy crises, armed conflicts and terrorist campaigns). Thanks to these developments, in the entire period after the independence of Bosnia and Herzegovina, air traffic has taken a significant role in the transport of passengers. Air transport as one of the branches of transport is of great importance in the modern tourism of Bosnia and Herzegovina. According to the World Tourism Organization 2010, 51% of international tourists used the plane as a means to arrive at a destination. (UNWTO, 2011) In the "Strategy of development of tourism in Bosnia and Herzegovina", Bosnia and Herzegovina is focused as a tourist oriented country in which tourism is one of the leading economic activities. (Ministry of Tourism and Environment of Bosnia and Herzegovina, 2014)

The aim of this paper is to analyze and determine the impact of air traffic on the development of economic activities in Bosnia and Herzegovina, mostly using data from airports and flight schedules. On that occasion, data have been analyzed on the number of passengers at airports and airfields in recent years and the correlation has been made between the number of arrivals and the number of overnight stays. (Gašparović, 2011) There have been observed the interdependence of the number of passengers and the number of tourist arrivals, i.e. the number of tourist nights during the year. Data for the years 2011, 2012, and 2013, 2014 and 2015 are analysed in more detail when the number of passengers in the airports of Sarajevo, Mostar, Banja Luka and Tuzla is divided according to the years into four categories: passengers transported by conventional airlines, low-cost airlines, charters and general aviation.

Besides, on the basis of data on actual connections between European and Bosnia and Herzegovina airports, there are defined regional economic centers. This paper puts the special emphasis on determining the meaning of low cost airlines in economic activities. The reason is that in recent years low-cost airlines have become an increasingly important segment of the entire air traffic in Bosnia and Herzegovina. (Nezirović, 2007) Results of research on air traffic and its overburden create the underlying assumption of the signing of the multilateral agreement on the European Common Aviation Area - ECAA that will ensure better air traffic in Bosnia and Herzegovina. Air transport network in Bosnia and Herzegovina ought to help the integration of Bosnia and Herzegovina national territory and its integration with the countries in the world. The size of the territory of Bosnia and Herzegovina with its geographical position is a very important underlying factor in the organization of air traffic in Southeast Europe. These data were used as motivation for further research of the issue of air transport impact on passenger traffic in Bosnia and Herzegovina. The aim of this work will be to analyze and determine the impact of air traffic on the development of tourism using of geographic and statistical methods. The first part of this paper will explore the theoretical framework of the development of air transport in Bosnia and Herzegovina as well as the importance of transport links between regional airports of Sarajevo, Mostar, Banja Luka and Tuzla, air traffic in the context of economic activities, with a general indication of the intensity of passenger traffic after 2010.

The second part of the paper deals with the connection of air traffic and tourism throughout the territory of Bosnia and Herzegovina, using statistical methods. A more detailed interpretation is given for the years 2011, 2012, 2013 and 2014, where the data is divided according to air traffic categories. At the end, the importance of low-cost airlines at the airports of Bosnia and Herzegovina is shown in more detail. It should be noted that the analysis included only airports for the reception of aircraft engaged in domestic and international air traffic according to the criteria of the Agency for Civil Aviation and the Ministry of Transport and Infrastructure of Bosnia and Herzegovina.

### 2. Data and methodology

The methodological approach of empirical analysis is adapted to the purpose of work of air traffic in 4 airports in Bosnia and Herzegovina. Studies of air traffic at the airports of Sarajevo, Mostar, Banja Luka and Tuzla are covered through local and regional areas. When researching and formulating the research results in an appropriate combination, there were used the following scientific methods: the method of analysis and synthesis, induction and deduction methods, and methods of description.

The empirical results of the model used to assess the applicability of perfect competition in the international aviation markets are presented in Table 1 and 2. As the table shows, the parameter estimates the variables that influence the costs and are significant and have the expected sign. Distance has the expected negative impact on the tariffs due to the fact that several flight costs do not vary proportionally with the distance. Similarly, the load factor has a strong negative impact on the tariffs due to airline costs that are proportionally less than the number of passengers. Flights in larger planes are to achieve lower tariffs because of the economy associated with the size of planes. Hence, the variable that impacts demand for the service also has the expected sign. (Borel, 2010)

The assessment of parameter for service frequency that is statistically significant and has a positive sign indicates that travelers are willing to pay more to have the convenience associated with more frequent flights. (Černe, 1991) Data needed for the paper are based on the research of the secondary publication of former research on this topic and the previous studies of traffic geography authors, as well as statistical documentation of the Agency for Statistics of Bosnia and Herzegovina. Rating of the direct contribution of air transport to regional development is a good basis for defining and application of the model. Certainly, it is necessary to point out that we were, while writing this paper, warned by the experts on political and economic situation in Bosnia and Herzegovina of the problems that may arise due to non-compliance of statistical data of various state agencies. Namely, on the basis of statistical data there can quite clearly be ascertained the orientation of certain international geopolitical entities towards exponents of their interests in Bosnia and Herzegovina. Similarly, we created a series of parallel graphic drawings using different geographic printing methods.

### 3. Development of air traffic in Bosnia and Herzegovina

Air transport plays an important role in the development of the total international traffic of goods and passengers in Bosnia and Herzegovina. The first flight from Sarajevo to Belgrade was carried out in 1929 which means that Bosnia and Herzegovina is a country with a long tradition of air traffic. Today in Bosnia and Herzegovina there is a network of modern equipped airports of Sarajevo, Tuzla, Banja Luka and Mostar, which are equipped to accept the most modern aircraft in civil air traffic (Figure 1). Air transport in Bosnia and Herzegovina has evolved quite rapidly following the development of this industry in the world. (Nurković, 2007)

The modernization of airports, particularly the airport in the "Butmir" settlement in Sarajevo, influenced the rapid development of air transport of passengers and goods in Bosnia and Herzegovina. The airport in Sarajevo has had the modern technical equipment since 1992 with a navigation system for air traffic in Europe. The development and modernization of this airport was greatly affected by international winter olympic games which were organized in Sarajevo in 1984 when a few dozen aircraft were landing each day.

In 1984 at the Sarajevo airport, 3.975 airplanes took off, 130.494 thousands of passengers departed and 134.804 passengers arrived. Thanks to its favorable geographical position, the airport in Sarajevo had a significant role in the historical development between East and West. In its air transport, Bosnia and Herzegovina become a crossroads of air traffic very early in this part of Europe.

Transport between Sarajevo, Belgrade and Zagreb rapidly progressed, so that the proportion of filled seats was more than 80%. The airports have been managed by civilian authorities of Bosnia and Herzegovina since 1996. From that moment on begins the struggle to restore the Sarajevo airport, its proper functions, civil aviation.



Figure 1: Airports of Bosnia and Herzegovina, 2014 Author: Nurković R.

Reconstruction of the airport terminal building in Sarajevo, with a complete line of superior equipment and technology of top quality, was successfully ended at the beginning of 2001. Airport completed all the contents in terms of the needs and comfort of passengers, which officially began a new era of highquality work and excellent results. As the capital and headquarters of many embassies, Sarajevo became an interesting destination for many reputable airlines like Lufthansa, Austrian Airlines, Turkish Airlines, Adria Airways, Croatia Airlines, German Wings, etc.

All of them recognized our professional attitude and continued to fly on mutual satisfaction for years. Today with approx. 400 employees, traffic of more than 600.000 passengers a year, over 7.000 flights, over 2 million kg of cargo, we can proudly say that the old myth of Phoenix repeats because we have made a long step from the war ashes to today's technological-operative maximum in aviation to which we all aspire.

## 4. Analysis of transport of airports in Bosnia and Herzegovina for the period 2009 - 2014

In the past decade, Bosnia and Herzegovina recorded the most progressive growth of 3-4% air traffic at the airports in Sarajevo, Tuzla, Banja Luka and Mostar, however, the total turnover is relatively low compared to neighboring European countries. (State Agency for Statistics of Bosnia and Herzegovina, 2014)

In some countries in the recent period there have been recorded a growth in traffic at the airports of more than 10%. It is logical that in this relatively short statement, it is not possible to explain in more detail the complex geographical interest for the development of a very important traffic route for Bosnia and Herzegovina. At geographical approach to the analysis of development of air traffic, we are starting from the present situation in which we should consider the appropriate indicators of development through geographically relevant factors and then give explication of geographic factors on forms, levels and directions of development of air traffic of Bosnia and Herzegovina. By analyzing statistical data from this period, there can be observed that the largest increase in turnover at the airports was achieved in the period from 2009 to 2013 while the growth continued in the period from 2014, but with a faster pace. (SEETO Comprehensive Network Multi-Annual Plan (MAP) 2012)

### 5. Airlines in Bosnia and Herzegovina

In Luxembourg in 2006, there was signed the Multilateral Agreement on the Establishment of the European Common Aviation Area (ECAA) with the European Commission. The Agreement was signed by the transport ministers of Albania, Bosnia and Herzegovina, Bulgaria, Croatian, European Union, Iceland, Macedonia, the Kingdom of Norway, Serbia and Montenegro, Romania and Kosovo. The aim of the Agreement has been to create a European Common Aviation Area. (Steiner et al., 2010)

The ECAA Agreement for the contracting parties has implied free access to the air transport market, freedom of establishment in the field of air services, equal conditions of competition on the basis of common rules including the ones in the areas of flight safety and aviation security, air traffic management and environmental protection. With this Agreement, Bosnia and Herzegovina has accepted the obligation to harmonize its national legislation with European legislation and to apply all airline regulations. Ten years of the movement of the transport operation of air traffic is a very indicative starting point in the geographical analysis. There is a visible, in addition to already mentioned

characteristics of development, and ever-present fact of international air traffic of larger scale than domestic. The excellence of the geographical position of Bosnia and Herzegovina provides a natural inclusion of our country in the European system of air traffic. A number of European airlines, particularly those towards the zone of countries of Western Europe, then the East, South Asia and a part of Oceania, have a natural route through the territory of Bosnia and Herzegovina. Using our territory for a transit territory, in which we are just among the leaders in Europe and the world, diverted part of air routes towards Italy. Most of the territory of Bosnia and Herzegovina with its geographical position is a very important underlying factor in the organization of air traffic (Table 1).

Air Companies	Destinations	Number of flights per week
ALITALIA	Milano-Sarajevo-Milano	14
AUSTRIAN AIRLINES	Beč-Sarajevo-Beč	14
CROATIA AIRLINES	Zagreb-Sarajevo-Zagreb	12
ČSA AEROLINIE	Prag-Sarajevo-Prag	8
GHADAMES AIR TRANS	Tripoli-Sarajevo-Tripoli	1
JAT AIRWAYS	Beograd-Sarajevo-Beograd	7
LUFTHANSA	Minhen-Sarajevo-Minhen	12
MALEV	Budimpešta-Sarajevo-	7
	Budimpešta	
TURKISH AIRLINES	Istanbul-Sarajevo-Istanbul	4

Table 1: Airlines, which operate in Bosnia and Herzegovina on the following destinations, 2006.

Source: Ministry of Transport and Environment of Bosnia and Herzegovina, 2006.

Bosnia and Herzegovina is a small country. Air traffic is seeking broad geographic expanses that we do not have. Therefore, it should not be surprising that our international air traffic is more developed than domestic air traffic. (Gašparević, S. 2011) However, the size of the territory is not the only cause of this state. What particularly stand out are the forms and intensity of economic and other social connections as well as offered forms of transport aircraft. The majority of aircraft of our air traffic controllers are of medium-range, 500-300 km. Out of natural factors, relief and weather characteristics have a significant impact. The relief is a concrete factor in the organization of transport by air, in our situation, especially in the phase of taking off and landing. With most of our airports there were problems with their location because of the relief conditions. Many airports are way too far due to the search for a suitable site, like at the Sarajevo, Mostar, Tuzla and Banja Luka airports. Fog is common at continental airports (Sarajevo and Banja Luka) and

gusty strong bora is a significant problem at coastal airports (Mostar). (http://www.mostar-airport.ba/o nama.php, 2015)

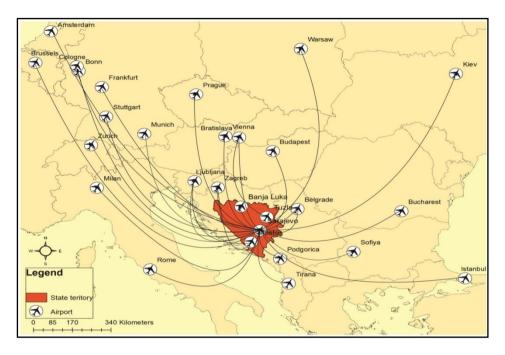


Figure 2: Relationship of Bosnia and Herzegovina with conventional and low-cost air carriers with European and non-European countries in 2014 Author: Nurković R.

Social and economic factors are more suitable for the development of international air transport of Bosnia and Herzegovina. Besides the above mentioned economic connections, an outstanding factor is the strong development of tertiary secondary activities. The main part of air traffic in Bosnia and Herzegovina is done at the four airports (charter flights). The specifics of the spatial concentration of economic and demographic potentials of the country are very important factors in the organization of our internal air traffic. The concentration of the economy in the immediate areas is still less pronounced with some exceptions in the Posavina area. Low-cost carriers, as well as full-service ones, operate on a predefined flight schedule, but only in short distances so e.g. there are no intercontinental flights considering the fact that they do not serve drinks, food, and the level of comfort is quite low (Gillen, D., Lall, A. 2004) It is similar with the deployment of the demographic population. Urbanization here is still modest. The concentration of capital in certain narrow areas exists, but it is insufficient for the high cost of regular and frequent internal air traffic.

The main part of our airports, including in particular the most recent ones, has not been built as a reflection of the transport needs and economic demands but has been more a reflection of the socio-political aspirations of certain areas. (Borel, 2010)

In the perspective of the further development of our air traffic, there should expect deepening of certain tendencies, especially those that occur as a result of tightening economic conditions, despite the specificities and the particular social interest in aviation. In view of the existing elements in the current state of air traffic and the advantages of the geographical position, it is expected to strengthen further in the framework of the overall development of the Mediterranean-European transport components. Intercontinental orientation in air traffic in a larger scale will not be possible. Internal air traffic of Bosnia and Herzegovina is in my opinion far the biggest unknowns in the future.

Bluntly put, this form of transport functions as appendage of international air traffic of Bosnia and Herzegovina. The reasons for this have already been partly mentioned. But, they must not be eternal and always correct. With the existing means of transport of medium range we cannot develop air traffic within Bosnia and Herzegovina. We should also mention the problems with size of the airports compared to other airports which combined with unfavorable relief conditions alienate air transport from the cities. If we add relatively weak links of the airports with the cities and problematic organization of air transport, it is easy to come to a conclusion on a very small advantage of air traffic in terms of speed factors in relation to inland transport at the majority of our internal transport routes. Creating our own system of internal air traffic, with no doubt, becomes more and more actual. Solutions will have to go towards the creation of air fleet with smaller and inexpensive aircraft and smaller and cheaper airports. (Malić, 1998)

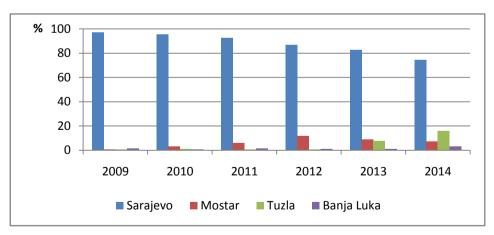
## 6. Trends in passenger, cargo and mail traffic at the airports in Bosnia and Herzegovina

If we look at the trends in passengers traffic in the period from 2009 to 2014 at the airports of Bosnia and Herzegovina, we can notice the constant growth in passenger numbers by 2014. In the year that follws, there was a decline in the number of passengers by 5.7% compared to 2009 as a result of the global economic and financial crisis. The impact of the crisis was reflected primarily in the transport of passengers and cargo at the airports of Bosnia and Herzegovina. The year 2010 brought a recovery of the most important European and world economic powers and an increase in the number of passengers to 5.54% that stabilizes the total number of passengers to the size of

the turnover in 2008 (South East Europe Transport Observatory SEETO database, www.seetoint.org) If we look at passenger traffic from 2009 at the airports of Bosnia and Herzegovina, we find that the Sarajevo Airport individually leads in the observed period with the average growth in passenger number of 533,915 passengers or 97.2%. The Tuzla Airport in the same period in 2009 transported 3,928 passengers or 0.7% of total number of passengers of airports. The Mostar Airport transported 4,027 passengers or 0.7%, and the Banja Luka Airport transported 7,300 passengers or 1.3%. The Sarajevo Airport in the total number of passengers in 2014 transported 709,901 passengers or 74.2%, followed by the Tuzla Airport on the second place with 151,353 passengers or 15.8%, the Mostar Airport with 67,974 passengers or 7.1% and the Banja Luka Airport with 27,636 passengers, or 2.9%. The total number of passengers at all airports in Bosnia and Herzegovina was constantly growing from 2009 (549,170 passengers) to 2014 (956,364 passengers). (Table 2 and Figure 3) (State Agency for Statistics of Bosnia and Herzegovina, 2014).

Table 2: Transport of passengers at airports in Bosnia and Herzegovina 2009-2014.

Airport	2009	%	2011	%	2013	%	2014	%
Sarajevo	533.915	97,2	599.978	92,3	665.638	82,7	709.901	74,2
Mostar	4.027	0,7	36.812	5,7	68.939	8,6	67.974	7,1
Tuzla	3.928	0,7	4.527	0,7	61.564	7,6	151.353	15,8
Banja Luka	7.300	1,3	8.367	1,3	8.837	1,1	27.636	2,9
Total	549.170	100,0	649.684	100,0	804.978	100,0	956.364	100,0



Source: Agency for Statistics of Bosnia and Herzegovina, 2014.

Figure 3: Transport of passengers at airports in Bosnia and Herzegovina 2011-2014.

Unlike the trends in the number of passengers, the trends in the cargo and mail traffic is much more irregular and has significantly lower growth. In 2011, there were 1.518 tons of cargo and mail and in 2014 there was an increase of 2,607 tons of cargo and mail.

Moreover, cargo and mail traffic is almost negligible in relation to the transport of passengers. In Bosnia and Herzegovina 1,609 tons of cargo and mail have been transported in the last ten years. It can be assumed that the average passenger weighs 80 kg and has at least 20 kg of luggage which means that cargo and mail traffic accounts for only 2.12% of the air transport of Bosnia and Herzegovina. (State Agency for Statistics of Bosnia and Herzegovina, 2014).

The Sarajevo International Airport had the largest cargo and mail transport of 2,060 tons of cargo and mail or 79.0% on average in 2014, and the lowest was 1,366 or 90.0% of the total of cargo and mail transport in 2011. However, when we compare cargo transport in 2011 and 2014, there is an evident increase in traffic around 12, 7%. The share of other airports in the transport of cargo and mail halved in the period from 2011 to 2014. The exception is only the Banja Luka Airport which transported 436 tons of cargo and mail or 16.7% in 2014. The Tuzla Airport transported 109 tons of cargo and mail or 4.2% and the Mostar Airport transported 2 tons of cargo and mail, or 01%. (Table 3 and Figure 4) (State Agency for Statistics of Bosnia and Herzegovina, 2014).

Table 3: Transport of goods at the airports in Bosnia and Herzegovina, in tons, 2011-2014.

Aeroports	2011	%	2012	%	2013	%	2014	%
Sarajevo	1.366	90,0	1.526	94,0	1.603	99,6	2.060	79,0
Mostar	0	0,0	29	1,8	0	0,0	2	0,1
Tuzla	152	10,0	67	4,1	6	0,4	109	4,2
Banja Luka	0	0,0	0	0,0	0	0,0	436	16,7
Total	1.518	100,0	1.624	100,0	1.609	100,0	2.607	100,0

Source: Agency for Statistics of Bosnia and Herzegovina, 2014.

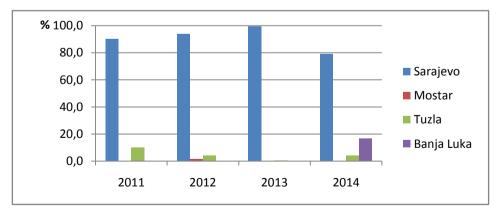


Figure 4: Transport of goods at the airports in Bosnia and Herzegovina, in tons, 2011-2014.

# 7. Comparison of traffic indicators of the airports of Bosnia and Herzegovina and the region

When we compare traffic of the airports of Bosnia and Herzegovina with other airports in the region in the period from 2001 to 2010, the dominance of airports in the Republic of Croatia is apparent.(Paljetak et al. 2012) This is due to the three airports in the area of this state (Zagreb, Split and Dubrovnik) with the annual passenger traffic of more than one million passengers (5,552,896 in 2010). (Ex-yu aviation news– www.exyuaviation.blogspot.com)

Table 4: Passenger traffic and indices of passenger growth of Southeast Europe, 2001	-
2010.	

Countries	2001	2005	2010	Index 05/01	Index 10/05	Index 10/01
Bosnia and Herzegovina	323.454	433.222	591.335	134	137	183
Croatia	2.434.941	4.021.630	5.552.896	165	138	228
Serbia	1.497.519	2.059.144	2.722.384	138	132	182
Montenegro	354.666	696.678	1.193.444	196	171	336
Macedonia	549.158	526.732	626.862	96	119	114
Kosovo	403.408	930.346	1.305.532	231	140	324
Albania	460.020	784.640	1.536.822	171	196	334
Total	5.563.146	8.667.752	11.634.006	156	134	209

Source: East Europe Transport Observatory (SEETO) database, www.seetoint.org.2010.

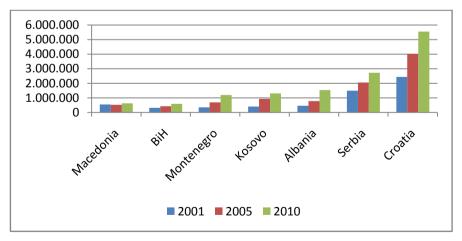


Figure 5: Passenger traffic and indices of passenger growth of Southeast Europe, 2001-2010.

South: East Europe Transport Observatory (SEETO) database, www.seetoint.org

Among other countries that recorded a significant growth, thare are the Republic of Serbia (2.722.384), Kosovo (1,305,532), Montenegro (1,193,444) and Bosnia and Herzegovina (517,819). However, their share in the total traffic of the region is roughly stable with a declining trend. Indices of growth in passenger numbers are also very high in all countries but the biggest index is recorded in Montenegro and Kosovo. Macedonia is the only one that recorded a significant drop in passenger traffic in the first half of the period including a relatively small growth index. (South East Europe Transport Observatory (SEETO) database, www.seetoint.org) (Table 4 and Figure 5)

### 8. Conclusion

In the past decade, Bosnia and Herzegovina has recorded the most progressive growth of 3-4% air traffic at the airports in Sarajevo, Tuzla, Banja Luka and Mostar but the total traffic is relatively low compared to neighboring European countries. The paper is mainly focused on the part that belongs to the topic of transport policy in the strategic planning of air traffic. Most of the territory of Bosnia and Herzegovina with its geographical position is a very important underlying factor in the organization of air traffic. It certainly refers to air traffic and airspace as well as the Multilateral Agreement on European Common Aviation Area and its objectives and principles, and the status of Bosnia and Herzegovina in the context of European integration leading to the accession of Bosnia and Herzegovina in the Single Sky in 2014.

The increase in traffic of all airlines, mostly low-tariff ones, causes the need for greater infrastructure. The important first step has been made, the Agency for Civil Aviation has been established, which will be responsible for the establishment of functional airspace blocks and certification of providers of air traffic control. In Luxembourg in 2006,there was signed the Multilateral Agreement on the Establishment of the European Common Aviation Area (ECAA) with the European Commission.

Bosnia and Herzegovina is in the process of change and adjustment to the EU legislation. The European Common Aviation Area Agreement consists of articles that define it, and Bosnia and Herzegovina must implement them into their legislation. By signing this agreement, Bosnia and Herzegovina made its legislation fully equal to the other signatories' legislation in the process of harmonization with regulations of the EU. In the perspective of the further development of our air traffic should expect deepening of certain tendencies, especially those that occur as a result of tightening economic conditions, despite the specificities and the particular social interest in aviation. Given the existing elements in the current state of air traffic and the advantages of the geographical position, we can expect further strengthening within the overall

development of the Mediterranean-European transport components. Intercontinental orientation in air traffic in larger scale will not be possible.

Internal air traffic of Bosnia and Herzegovina is in my opinion the biggest unknowns in the future. When Bosnia and Herzegovina joins the EU, the free transport of cargo, people, goods and capital will be achieved and Bosnia and Herzegovina can become one of the larger regional centers for exchange of these. Then, the airports in Sarajevo, Mostar, Banja Luka and Tuzla will require a new and much larger passenger terminal and air bridges which are inevitable these days. Undoubtedly, in this area there is the enormous potential for growth of air traffic, and governments, airlines and airports should work

together to find the best model for the promotion of tourism and travel. Undeveloped network of air connectivity within the region is a fact and it should be a challenge for everyone.

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