ECONOMIC ASPECT OF OPERATION SYSTEMS OF AVIATION SUPPORT

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The main purpose of this article is to highlight the economic aspects of air traffic safety systems. Currently, air security technology has a great impact on the safety of air traffic. To ensure high quality and aviation safety management systems are used for security. To maintain security, the use of security technology, this relates to its high cost of operation. This is why I will devote my attention mainly on economic aspects of air traffic safety systems, particularly their cost, yield and economic efficiency. The paper focuses on the processes ATM and CNS concept of using satellite systems.

K e y w o r d s: ATM systems, CNS Systems, Navigation, communication, costs and revenues

1 INTRODUCTION

Each mode of transport is something extraordinary, whether in comfort, speed and above all safety. That air travel is the closest to these properties. The development of air transport is characterized by being constantly put in greater demands to increase the speed and range, to reduce dependence on flight weather and increasing economics of flight. The main and most discussed issue at present is to ensure a high level of security. The fact that there is a growing number of flights consequently there are added accidents. The constant increase in air traffic necessitated a fundamental change in the management and security of air traffic. To ensure high quality and safety of air traffic, the aviation security technology is used. To maintain security, the security management system developed air traffic security technology that secures and maintains safe air traffic. The problem of growth in the number of aircraft movements addressed the concept of ATM / CNS. Due to this, it is now a top priority to create the Single European Sky, which in turn creates SJU. This should solve the main problem of crowded air corridors. Even in the United States to establish a joint project of simplifying traffic called Next Generation. All of these projects are related to the use and harmonization of aviation security technology.

2 AVIATION SECURITY SYSTEMS

Each mode of transport is something special, whether Aviation security systems ensure the safety and regularity of air traffic, so they are in the air is an important place. A security technique of electronic systems used for air traffic control, they are weak-current electrical engineering, which is produced only for aviation purposes. It also facilitates the work of crews of aircraft, thereby improving security and quality of service for passengers. Aviation security technology for existing aircraft is of utmost importance, without it, they could not perform today. The aviation security systems are particularly ILS, MLS, NDB beacon, VOR and DME. ILS is used as a landing aircraft instrument. In reduced visibility provides both horizontal and vertical guidance of aircraft. MLS system is used for landing aircraft in all weather conditions and was originally intended to replace the ILS system. MLS provides accurate information on the azimuth angle of descent and the optimal distance. It can also guide the plane in complex trajectories when approaching. NDB beacon is one of the oldest navigation systems. It is used all over the world, although with little accuracy and is morally and technically outdated. It is very popular for its simplicity and low cost. Omni-directional beacon VOR is one of the instruments used for instrument navigation. It specifies the flight direction of the aircraft. DME is distance meter, which measures the distance between the inclined plane and ground responder with the time passing by sending pulse from the deck of an aircraft until it does not respond.

3 ECONOMIC ASPECT OF OPERATION SYSTEMS OF AVIATION SUPPORT

There are various methods that provide economic efficiency. The most commonly used are investment and operating parameters and the depreciation costs of systems. The operating costs included depreciation expense and operating systems. Economic efficiency is composed of four basic elements:

1. Investment costs - necessary for the implementation of satellite systems, to construct and launch satellites. In addition to the cost of the satellite systems this also includes the cost of setting up road equipment and on-board equipment for commercial and military aircraft.
2. Operating expenses - represent expenses for the maintenance and operation of facilities in countries that provide air traffic control.
3. Cost savings - used to improve operational efficiency. Cost savings are scrapping the current system of operation since the introduction of the satellite system is useless. Retirement systems will be the basis of cost savings for the country that provide air traffic control service for its users. This reduces the cost of maintenance and investment costs for equipment of existing aircraft systems.
4. Increase the efficiency of air traffic - the main aim is more efficient use of airspace and the creation of the shortest available routes.

3.1 THE COST OF INSTALLING AND OPERATING AIR SECURITY SYSTEMS

The funds used for the operation of air security technology are used to cover the costs incurred in establishing or in the actual operation. These cost items are divided into the following groups:

- **Purchase of aviation security** and security technology to meet the requirements of quality, safety, capacity, and economy of operation. Aircrafts shall be compatible with other systems used at airports. When selecting the desired aviation security technology we must take into account the category of the airport, where it will be used and the number of aircraft movements at the airport. Purchase of new security systems, whether for their lack at the airport or aging legacy systems is affected by various factors. The main factor for the selection of a new system is its cost, which is very important.
- **Depreciation resulting** from the use of aviation security technology reflects the level of wear of aviation technology. This may be either moral, that there is a gradual obsolescence of technology and the advent of new, better equipment or physical, which is created by using of the systems. Depreciation of property shall be carried out in several periods, which reduces the cost and is projected to expenses. Depreciation is the gradual inclusion of depreciation of tangible and intangible assets in tax expenses.
- **Maintenance and repair of aviation security technology** is one of the largest cost items. Costs are broken down by type of technology that is used at the airport and flight routes. Any maintenance is performed by qualified personnel using certified parts from specialized companies. Costs that are incurred for repairs and maintenance must have an adequate contribution to the use of technology. Most funds are spent on maintaining software and hardware. Software maintenance is performed during system modification after its introduction to service. Here is performed a correction of possible errors. The second major cost item is the maintenance of the hardware, which is essential for the maintenance of navigation technology. Each airline security technology must pass before being put into use, and the verification process get approval to operate.
- **Personnel costs** also have a large share of the costs of business. Each airline security technology must be operated by trained personnel. Personnel expenses consist of personnel costs, their wages, statutory social insurance, other social security and other social costs. Labour costs include gross wages and bonuses, including the kind of performance dependent on activity of staff. Gross pay is the price of labour workers. The gross pay employee insurance pays 13.4%. The employer pays for the employee 35.2%.
- **Rents telecommunication channels** are used to ensure the reliability of aviation security equipment.
- **Other costs** are the costs that arise from the number of airports, technical requirements, traffic density and structure of the tracks.

Air traffic services are the only aviation support equipment operating in the Slovak Republic. They are responsible for the operation and maintenance of these systems. In 2011 was spent on operation and maintenance 8 230 800.40 €.

3.2 REVENUES FROM THE USE OF AVIATION SECURITY SYSTEMS

In the Slovak Republic are the owners of aviation security systems Air traffic services, state-owned enterprise. They are collecting fees for the use of security technology to carriers, representing proceeds from the operation of aviation security equipment. Fees account for around 90% of their income. Charges for air navigation services include route navigation charges and fees, which are provided in the regional flight information of the country in which they perform.

Fees are divided into:

1. Over flight fee: This fee must be paid by each aircraft operating the flight under instrument flight rules in the flight information region. These rules are set by ICAO. Over flight fee is used to cover the costs that are incurred for navigation services and air traffic control service. This fee covers the costs incurred by Eurocontrol for the operation and maintenance of systems.
2. Proximity fee: This fee is paid as a provision of air traffic in the terminal phase of flight before landing.
3. Radar signal charge: these are revenues relating to the provision of data from radar signals. These are provided for the neighbouring countries such as Austria, Czech Republic and Hungary. Data from the radar signals are mainly used to monitor the movement of aircraft in order to increase the safety and regularity of air navigation.

Air traffic services in 2011 achieved revenues in the amount of 55,033,656 €. This en-route navigation services received proceeds in the amount of 47,936,705 €.

4 THE CONCEPT OF ATM/CNS

In 1988, the concept of air systems ATM/CNS was developed. This concept was introducing completely new technologies and equipment in the air traffic. It was introduced into service in a short time and enabled to overcome the shortcomings of the current system. The main task was to overcome the problems of air transport growth through this new and modern technology.

The system of ATM / CNS consists of two parts, which are interconnected and mutually dependent. These parts are:

- ATM: (Air Traffic Management) is to manage air traffic control. Part of the ATM system is not only air traffic, but also the Organization of the air traffic flow ATFM and Airspace Organization ASM. CNS system in the future provides an opportunity to extend the benefits of ATM, especially in the field of safe air traffic. Use of this system will reduce flight delays, increase capacity and also increase the flexibility of the system.

- CNS: below this abbreviation are hidden words like communication, navigation and surveillance. CNS forms a technical basis for future systems. Its principle of operation is built on existing systems and technologies. System of the CNS is managing development and use its introduction, will improve ATM, especially structural and procedural changes [2].

4.1 BENEFITS OF ATM/CNS FOR AIE TRAFFIC CONTROL

The main aim of air traffic management is to make 16 million trips per year in the European airspace. It requires a 24-hour flight operation. Another objective is to ensure that 99% of all flights respect flight plan and timetable. Every day there is done at least 30,000 commercial flights by 5000 aircraft. This is expected to double in next 8 years. That is why the requirements for ATM systems include the flights to be able to operate in any weather conditions, to ensure a smaller but still safe separation of aircraft to create optimum air corridors. The challenge is to optimize the airports, airfields and areas intended for taxiing aircraft. That is why it is very important to create a Single European Sky, using the ATM. This deals with the SESAR project, whose main task is to improve aviation safety, optimal use of airport capacity, reduce flight delays, reduce operating costs and dynamically plan routes.

Even in the United States they are trying to maintain safe and efficient air traffic. Therefore, the FAA developed the concept of Next Generation, which aims to increase flight safety, reduce delays in arrivals and departures, save fuel and reduce the bad effect on the environment.

4.2 SINGLE EUROPEAN SKY

In 1985 were eliminated all borders between the states of Europe. The continued growth of aviation was the reason to change the organization and management of the airspace over Europe. Therefore, there was a ministerial meeting held in Lisbon in 2000. Main priorities of this meeting were that the European Commission has solved the problems arising from the use of airspace. The Commission presented a proposal for the creation of SES, which means Single European Sky. The European Commission establishes rules to maintain standards of safety and environmental protection in compliance with the Single European Sky [1].

The main objectives of the SES include:

- Ensure sufficient airport capacity and airspace
- Organize airspace by national borders
- Increase the efficiency of the air system of air traffic management.

Air Traffic Services of the Slovak Republic in May 2011 signed with Austria, Bosnia and Herzegovina, Croatia, the Czech Republic, Hungary and Slovenia formed an agreement to create these functional blocks in Central Europe. Through this is increasing the efficiency and climate change of the ATM service. This will help to improve the functioning of the European air transport network. According to the legislation of the European Communities on 4 December 2012 they had to take all measures to ensure the implementation of the implementation of functional airspace blocks. Navigation service providers are thus opening up new opportunities for cooperation, thereby facilitating the achievement of common goals binding. The European Commission has also signed an agreement with the International Civil Aviation Organization (ICAO), a memorandum of cooperation. It is an essential document to enable the achievement of greater EU involvement in matters which fall within the scope of ICAO. Europe on the basis of this document will be able to participate in the preparatory work of policy making and standard setting in ICAO fields of safety, security, environment and traffic management [3].

Currently SES brings no results. European Commissioner for Transport has submitted a proposal for new legislation to speed up the implementation of this project. Due to the fragmented European Sky there is an additional cost of 5 billion Euros a year. Flight distance is extended by 42km, which has a major impact on fuel consumption and release of aircraft emissions. It also increases airspace user's fees and prolongs the delays. The year 2012 brought the four major results, including nine functional airspace blocks. At the beginning of 2013 the European Commission will present a proposal to strengthen the existing framework of the Single European Sky to accelerate ongoing reforms. These proposals include a performance chart that includes national plans to reduce costs and increase capacity for the years 2012 to 2014.

4.3 SESAR

Program Joint Undertaking will modernize the current European ATM system. This program is involving all member states of the European aviation. SESAR (Single European Sky ATM Research) means research of management of air traffic of Single European Sky. The main objective of this project is to harmonize the way air traffic control services by combining ATM. The priority is to synchronize the flight plans of the service providers and ATM. The SESAR program is to safely handle the expected doubling of flights in 2020. The role of this company is to modernize the European ATM system, coordinate and concentrate all efforts on the research and development of air transport in the EU. The future system will ensure the safety and fluidity of air transport over the next thirty years. The team will be flying more environmentally friendly and reduce the cost of air traffic control. The SESAR Joint Undertaking is responsible for the tasks of the action plan. The action plan is a plan that is agreed by all components of the joint venture. European Action Plan shows the basic operational and technological changes that are planned to

take place. This provides and applies SJU to help put into operation a new ATM concept that supports the objectives of the Single Sky. It is a living document that is assuring stable and reliable planning, where all stakeholders can expect new functionality associated with investment cycles.

4.4 NEXT GENERATION

NextGen transportation system that produces FAA will serve to streamline traffic in the airspace. This system transforms management and air traffic. This system improves safety, reduces latency, saves fuel and reduces the negative impact on the environment. The principle of operation is the same as NextGen GPS in cars. This initiative provides benefits and integrating new and existing technologies, including satellite navigation and advanced digital communications. Airports and aircrafts in the national airspace of the United States will continuously share information in real time. NextGen is the modernization of the U.S. air transportation system that provides benefits for airports to improve the safety and availability of ATM services. It will provide closer view with WAAS (Wide Area Augmentation System) in low visibility, which increases both horizontal and vertical accuracy of GPS. Another important system that will be used is ADS-B, which will receive GPS satellite signals to give an air traffic controller more precise information on the position of the aircraft. By 2014, there should be installed 700 stations that would provide national coverage. The system will provide information on air traffic as well as the weather. Many aircraft are already equipped with these systems and can use this information, which is provided free of charge in the U.S. [4].

FAA seeks to harmonize NextGen with other partners to provide air navigation services. It seeks to harmonize systems and procedures to ensure effective use of airspace. The main objective of this cooperation is to be environmentally friendly [4].

7 CONCLUSION

There is currently great emphasis placed on safety and efficiency of air navigation. To achieve these goals were created projects such as the Single European Sky and NextGen. The main objective is to combine and align these projects in order to increase throughput flight paths, improve flight safety and reduce the impact on the environment. These projects include improving the design of ATM / CNS, which are used for such purposes. The main priority is the adoption and use of satellite systems, which have lower operating costs and do not have to install a new ground system. The main contribution of air traffic safety is airline security technology which is used at each airport. With the operation of these systems are related financing costs, which are mainly spent on the purchase, repair and maintenance of these resources. Large cost items are depreciation which is arising from the use of technology. Using aerospace technology also brings higher profits for its operators.

BIBLIOGRAPHY

[1] EUROCONTROL [online] 2013 [cit. 2013]. Available at:www.eurocontrol.int/dossiers/single-european-sky

[2] KEVICKÝ, Dušan – KULCÁK, Ludvik – PALICKA, Libor: Cobcept aviation security systems. Žilina: VŠDS in Žilina, 1995. ISBN 80-7100-209-7

[3] World Communications [online]. 2011 Available at: http://www.svet-komunikacie.sk/index.php?ID=9648

[4] FAA [online]. Available at: http://www.faa.gov

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