ECONOMICS ASPECTS OF OPERATION OF AVIATION ELECTRONIC SUPPORT SYSTEMS

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Summary. Aviation electronic security technology helps to conserve and maintain air traffic safety by determining aircraft position, using communication technology provides the link between the aircraft and ATC and the aircraft and the ground, using radar technology to manage the aircraft from the ground. The main aim of this thesis are the economic aspects of the operation of aviation security technology and its use in air traffic management. Effective use of existing aviation security systems attain greater flexibility of air traffic control and thus increases the capacity of runways, efficient use of airspace, which will have the greatest impact on safety in air transport. Of course a new generation of climbing to be flying at any flight level, where this system also allows coverage and early warning of the crew before the occurrence of precipitation.Air Traffic Services of the Slovak Republic and Air Navigation Services of the Czech Republic are the only companies that manage and own air security technology. Air navigation services represent high standards for safety, quality and maturity of the technology . The main divisions of LPS SR is the infrastructure services divisionn and division aerodrome and approach services. When analyzing cost items at LPS SR in 2012 and 2013 was one of the greatest expense material consumption, energy, services received, labor costs, taxes and fees, maintenance costs, depreciation and travel costs. Revenues from air traffic services and other revenues accounted for the largest revenue items. Total costs for the period of 2013, amounted 63,281,896 Euros and total revenues were 65,632,994 Euros.ŘLPČR major divisions dealing with traffic climb division operation is a division of development planning. The analysis of cost items showed that most funds were spent on salaries, consumption of materials, energy, repair and maintenance, software support systems, telecommunications and other services. The main source of revenue for the company during the period were air navigation services, which represented 92.4% of total revenues, of which the greatest possible extent contributed revenues of entry en route navigation services and revenues from airport services skidding. Total costs for the period of 2013 amounted to 2,994,866,000 CZK (at the rate 27,365Eur represents 109,441,476 euros), total revenues were $ 3,503,672,000 CZK (at the rate 27,365Eur represents 128,034,789 EUR).

Keywords: Aviation electronic safety technology, revenues, costs, efficiency, LPS SR, ŘLP ČR

1. AIRCRAFT ELECTRONIC SECURITY SYSTEMS

Airforce development is characterized by constantly increasing the requirements for speed, range, ensuring flight efficiency and reduce dependence on the weather. The rapid development of aviation are increasing the speed and also the density of air traffic. The biggest challenge now is to ensure a high level of safety. As the number of flights is increasing and also the number of the accidents, resulting ultimately increasing the number of victims of these airplane disasters.

In the past, staff air traffic control relied mostly on machines located mainly in the aircraft or on their own judgment. In the past, the equipment used, which are located in the aircraft were not very accurate, so could not even be compared with the current-using technology.

Nowadays we can include aviation the safest form of transport in the world Aviation security technology significantly contributes to Aviation security especially by allowing aircraft instrument approach where the pilot can perform a safe landing or a decision on suspension of the landing. It

sends signals which are useful for the auto pilot to avert the impending catastrophe. It locates deteriorating weather conditions that could endanger the safety of aircraft. Based on this information flight path can be adjusted the and thereby avoid various complications. Aviation security technology also allows their direct impact monitoring air traffic thereby ensuring speed and orderliness flows which have a direct impact on the safety and economic efficiency of air transport.[1]
Among the requirements for enhancing security through aviation security technologies include:
- Enhancing the safety and security of AViation electronic safety technology
- summarizing solutions for improving navigation and its accuracy especially for increased performance and correction of ground facilities and also in its sensitivity.

The main benefits of air electronic security technology lie in:
- Reducing the strian of the crew
- safety and its improvement in air traffic
- the precise navigation control of the aircraft
- economical aircraft operations is more effective.

To ensure and maintain the safety of flight operations serve aviation electronic security technology as a set of technical systems and measures.
Aviation electronic security technology can be divided into:

1. technique that determines aircraft position and leads it over routes
2. communication technology that provides the link between the aircraft and SRLP and the aircraft
3. radar technology operating aircrafts from the ground
4. computing and automation aviation technology[2]

1.1. Current security systems

Aviation electronic security systems, which are used for air traffic control at the initial point put the safety and the regularit. This technology is manufactured for aviation purposes and for facilitating the flight crew work to improve the quality of services to passengers.
Without this safety technology we could not imagine today managing of the flights. International Civil Aviation Organization ICAO issues technical specifications for this technology, which tries to harmonize with the ground equipment and with equipment on board aircraft.
The current aviation security system include:

- omnidirectional beacon VOR
- distance meter DME
- precision approach system ILS
- microwave landing systems MLS

Omnidirectional beacon VOR: The basic instruments used by the instrument navigators determining the direction of the plane is omnidirectional beacon VOR. Use the broadcast signal is detected magnetic pointer on board aircraft to the beacon. This technique is characterized by their precision, since the deviation from the selected pointer is only 1 degree.

Distance meter DME: DME is a device consisting of two parts of the responder as a ground station and a transmitter that is placed on board the aircraft. It works like a secondary radar responder. It provides us with continuous information on speed, time and distance to ground facilities. As well as other navigational systems and DME also has its limitations, which is the possibility to accept up to 200 aircraft at the same time.[3]

The precision approach ILS: The precision approach landing consists of the mechanism downlink and the proximity precise radio beacon transmitting signal at a given angle and reach. A pair of two lobes portrayed mentioned signals modulated by different frequencies, which aims to distinguish the polarity deviation lobes. Lobes representing the signals are shown glide plane and exchange level, which may be crossed in a part of the intersection is line of approach.

Microwave Landing System MLS: Some shortcomings ILS which included the availability of a limited number of channels as well as broadcast signals that are sensitive to the surrounding terrain has given rise to compensation. The possibility of the installation in limited landing space (eg. Heliports, roofs of buildings, airfields in rough terrain, etc.), the availability of 200 channels, covering 37 km in one of the advantages of the microwave landing system. The MLS is replenished by ground equipment that transmit information to guide aircraft, which processes the onboard receiver.
Services that provide microwave landing systems include:
- measuring the distance
- specifing angle for guidance and landing
- determining the angle of azimuth for guidance and landing
- Setting the wrong angle and azimuth.

NDB Non-directional beacon: NDB broadcast in long wave band (200 - 525kHz). The 1-3 of Morse codes is a modulated wave, which can be tuned to the acoustically to check if the correct beacon is tuned. NDB navigation accuracy is stated about about 5-7 angular degrees, it means that at a distance of 50 km from the beacon is the accuracy 4-6 km. [1]

1.2. A new generation of Aviation electronic safety technology

The main task of the Implementation Plan Next Generation program that was created by the FAA is maintaining a safe and efficient air traffic for airlines 24 hours a day. On the basis of harmonized legislation annually prepare a strategic plan, which focuses primarily on investments aimed at meeting the strategic objectives and also includes safety, environmental protection, training of staff as well as increased airspace capacity.

By implementing the new system for Performance Based Navigation PBN is FAA trying to achieve their goals, which is composed of the required performance of RNP and RNAV area navigation. Using RNAV, where this system will allow us to in any flying altitudes and also allows early warning of the crew before the occurrence of precipitation. PBN Manual was created in 2007, which involves both operational and technical capabilities of the system.

The main areas of the new generation of Aviation electronic safety technology are:
- SBAS (WAAS, EGNOS, SDCAM, MSAS, SACCSA, GAGAN, MSAS)
- ABAS,
- GBAS
- ADS-B.[4]

1.2.1. SBAS

Of all the SBAS systems are already in operation three (WAAS, MSAS, EGNOS), three in the realization (GAGAN, with DCM, SNAS), while others are in the feasibility study, as is the case SACCSA. Although according to the development of GAGAN can be route and navigation approach used for aircrafts, because it is certified to the level RNPO.1 services. According to the Working Group (IAG) expects SBAS system in the next couple of years evolution.
- GNSS Dual Frequency Operations,
- reference network expansion EGNOS and MSAS,
- Put DCM and GAGAN into operation.[4][5]

WAAS

In early 1994, the WAAS was developed by US Department of Transportation (DOT) and the Federal Aviation Authority FAA who performs performance comparable to Category I precision approach system (ILS), which have been duly certified for all aircraft.[6]

MSAS

Multifunctional satellite system magnification (MSAS) is a Japanese SBAS. NEC manufactures and supplies MSAS under contract with the Office for Civil Aviation, Ministry of Environment, Infrastructure, Transport and travel industry.

GAGAN

GAGAN is a project of the Indian Space research organization ISRO (Indian Space Research Organization) and the Indian airport administration AAI (Airport Authority of India). The eight reference stations INRESs (Indian Reference Stations) are formed by terrestrial segment located on eight Indian airports connected with a control center MCC (Master Control Center), which is near the city of Bangalore. In the future, this system of 8 reference stations should rise up to 18 stations.

SDCM

TheSystem for correction of differences and surveillance (with DCM) is being developed in the Russian Federation. In the coming years it is expected to certify SDCM, what should be the first step in a strategy SDCM, which monitors and other broadcasting means - polar potential with goal to provide a service to the northern part of Russia. SDCM is designed as a system SBAS for increasing GPS and GLONASS signals, while the rest of the current initiatives SBAS provides correction and integrity

SNAS

The People's Republic of China is developing its own SBAS satellite navigation system called Zoom (SNAS). Novatel company was awarded the contract for the provision of 12 receivers for the second phase of development in 2002. This station would be complemented by the 11 already installed around Beijing Phase 1. There is little public information available on this subject.

SACCSA

SACCSA is a project of ICAO founded by Subscribers / Member States of the SACCSA project: Argentina, Bolivia, Colombia, Costa Rica, Guatemala, Panama, Spain, Venezuela and COCESNA (Corporación de Servicios de Centroamérica Navegación Aérea). The aim is to improve air navigation environment in the Caribbean and South America. The program started in 2003, it is currently in its third phase, which will determine whether it is possible in the implementation of its own SBAS system in the car / SAM regions.

GBAS

The system is primarily used to support operations with precise requirements for the approach from category I to thecategory III. Comparedto ILS its advantage is that the system GBAS provides easy approach and the nearby airports and not only for all the tracks at the airport at which it is installed and under any weather conditions. The system consists of a differential GPS correction signal and extreme precision[7]

1.2.2. ABAS

Integrity monitoring of GNSS is the main task of extending ABAS. ABAS to provide integrity monitoring uses two methods: RAIM with the help of internal on-board algorithms and simultaneously using the on-board satellite tracking and AAIM for assistive devices on board the aircraft. Both of these methods will not only monitor the integrity of GNSS, but also offer a precise and reliable determination of theposition. A significant advantage which differs from GBAS is the possibility of precision approach, without the necessary installations at the airport.[8]

1.2.3. Automatic Dependent Aurveillance ADS-B

It represents a completely new technology that defines communication in air traffic management system. It is tested and certified by replacing of radars which allows control of the aircraft with greater precision at which it was previously possible. ADS-B works on principle of reflection of radio waves from Target acquisition. Technologies that this global navigation system is using for us is now broadcasting through a communication link. The accuracy of this system is not affected by atmospheric conditions, height above sea level or its distance. [9]

2. FINANCIAL ANALYSIS OF THE OPERATION OF ATS SR AND ANS CR

2.1.Air Traffic Services SR

As the only company in Slovakia are Air Traffic Services, which manages and owns aviation security technology. Air navigation services are high demands on safety, quality staff and technology maturity.

The tasks set out in the financial plan for 2013 assumed continuation in the trend of improving the effectiveness of the company and secure the necessary volume of revenues to achieve positive economical income.

The goals stated in the financial plan for the year 2013 were assuming continuing in the trend of increasing the effectiveness of the company activities and ensure required volume of revenues for reaching possitive economic outcome. The financial plan in cost field in 2013 yearset the drawing of costs in the amount of € 64,507,544. Actual costs were drawn in the amount of € 63,281,896, representing according to the plan savings 1,225,648 EUR. When you compare this with 2012, it is more than 3,390,296 EUR. Total revenues of the company reached to 31.12.2013 the value of 65632994 EUR, which is total 101.49% of the annual plan, which was set at 64 670 173 EUR. Compared to 2012 revenues represent an increase of 3 447 000 EUR.

2.2 Air Navigation Services of the Czech Republic (ANS CZ)

The mission of ANS CR is to participate in ensuring safe, cost efficient and sustainable air navigation services in the area of creating functional block of airspace, which meets the expectations of all users.

Volume drawing of the costs in 2013 amounted to 2 994 866 000 CZK at the rate (27.368 EUR), which corresponds to year growth of 2.8%. In the area of consumed purchases and services amounted drawing costs 504 383 000 CZK. In the annual comparison, the cost of this group reported an increase of 4.8%, consumed purchases were spent 77 761 000 CZK, which represents an annual decline of -3.2%. The services were drawn 426 622 000 CZK, which corresponds to year growth of 6.4%. In the group of personnel costs amounted cost drawing 1766518000 CZK, which represents an annual increase of 3.4%. In the group of depreciation of assets and provisions meant pumping costs 454 353 000 CZK, representing an increase of this item by 5.2%.

Total revenues of the company amounted to 3 503 672 000 CZK. The main source of income for the company was providing air navigation services (LNS), which represented 92.4% of total revenues in 2013. On the revenue gained the biggest share revenues from en-route navigation services in the amount of 2 742 772 000 CZK i.e. 78.3% of total revenues. The second most important revenue item were revenues from airport services totaling 493 822 000 CZK i.e. 14.1% of total revenues. Return on training flights amounted to 1 840 000 CZK, which is less than 0.1% of total revenues .

4. LITERATURE LIST

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