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## SELECTED ASPECTS OF CIVIL AVIATION SECURITY

**Summary.** This article discusses civil aviation security, which is understood as a combination of human and material activities and resources to safeguard international civil aviation against acts of unlawful interference. This article presents protection measures applied in the security system of civil airports. Parts of the article focuses on both theoretical and practical solutions concerning the airport security system. The systemic approach observes aviation security as a set of elements and relationships that occur between them in accordance with established principles, through the prism of the aim. The aim of aviation security is to prevent acts of unlawful interference (people, objects, hazardous materials threatening the safety of aviation and the aviation infrastructure). The authors of the article have identified the concept of airport security system and characterised the civil airport as a specific object. This article presents the procedural and technical aspects of the functioning of the civil security airport system.

**Keywords:** security, civil aviation, civil airport, civilian airport security system, act of unlawful interference.

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## 1. INTRODUCTION

Civil aviation is considered as the most secure means of transport in the contemporary world. Statistics support the above proposition despite the fact that, from time to time, the public opinion is informed by the mass media about air accidents or acts of terrorism on board an aircraft or on the grounds of a civil airport. However, in such a situation it is assumed that aviation security has been affected. For a great number of people, this seems to be a laconic statement, however, in point of fact such events result in significant casualties among people and are a cause of enormous material and prestigious losses.

Safety in aviation is perceived as a condition, in which the possibility of injury to persons or damage to property is minimised and it is maintained in a continuous process of threat identification and safety risk management on an acceptable level or below the acceptable level [14,7,8,9].

A coherent part of aviation security is the protection of civil aviation, including the security of civil airports. Security - in accordance with Annex 17 to the Chicago Convention is interpreted as a combination of measures and human and material resources intended to protect international civil aviation against acts of unlawful interference [3].

The issues related to the protection of civil aviation are particularly visible at an airport. The Aviation Law Act specifies that the airport is a public aerodrome used for commercial flights [6], whereas a commercial flight is a flight, which lands in order to collect or leave passengers, baggage, cargo or mail, carried for profit. [4].

In civil protection airport systems, it is essential to consider, for example, potential risks to the airport, the vast terrain to be guarded by Aviation Security Service and other services, a specific airport infrastructure, passenger and freight traffic.

Airports are included in the state's critical infrastructure, which classifies them as important installations, requiring widely-understood protection. The importance of such objects results from their functions in a country, which encompass economic, social, political, defence and communication [13].

Airport security ensures the safety of passengers, crews and employees as well as aircraft in aprons and airport facilities. The workers of Aviation Security Service, Police, Border Guard and operational services are responsible for airport security. The staff airport security system uses a variety of technical equipment for assistance. There are two notable aspects of the airport security system; a technical subsystem (technical devices used for protection) and a subsystem made up of personnel who are responsible for flawless operations of the entire system of airport security. Therefore, it is crucial for the personnel to be properly trained, experienced with full knowledge of threat awareness that security staff may encounter.

In the traditional approach, the security of civil aviation against acts of unlawful interference is to prevent the sneaking of objects and dangerous materials onboard, which pose a threat to the safety of passengers and aviation infrastructure. The question arises whether such a traditional perception of civil aviation, including airports, is presently sufficient. The authors of this article are of the opinion that it is inadequate. The infiltration of people and hazardous materials into the airport grounds results from gaps in the protection system. This is unlikely, especially in the Member States of the European Union, where high common standards for the protection of airports are established. They are related to the applied procedures, training and technical devices used by services of the airport.

The aim of this article is to characterise the system of security for the protection of a civil airport in terms of the functioning of this type of an object. The problem dealt with by the authors of this article has been expressed in a question: What is meant by airport security system?

## 2. AIRPORT - GENERAL CHARACTERISTICS

In accordance with the earlier mentioned Aviation Law Act, the airport is an aerodrome intended for public and commercial flights. The aerodrome is an area of takeoffs, landings and taxiing of aircraft (helicopters, aeroplanes). Thus, an airport is an aerodrome with all its grounds, equipment and ground services (Fig. 1). The equipment of such an installation is, among others, dependent on the number of passengers served and the characteristics of the loaded goods.

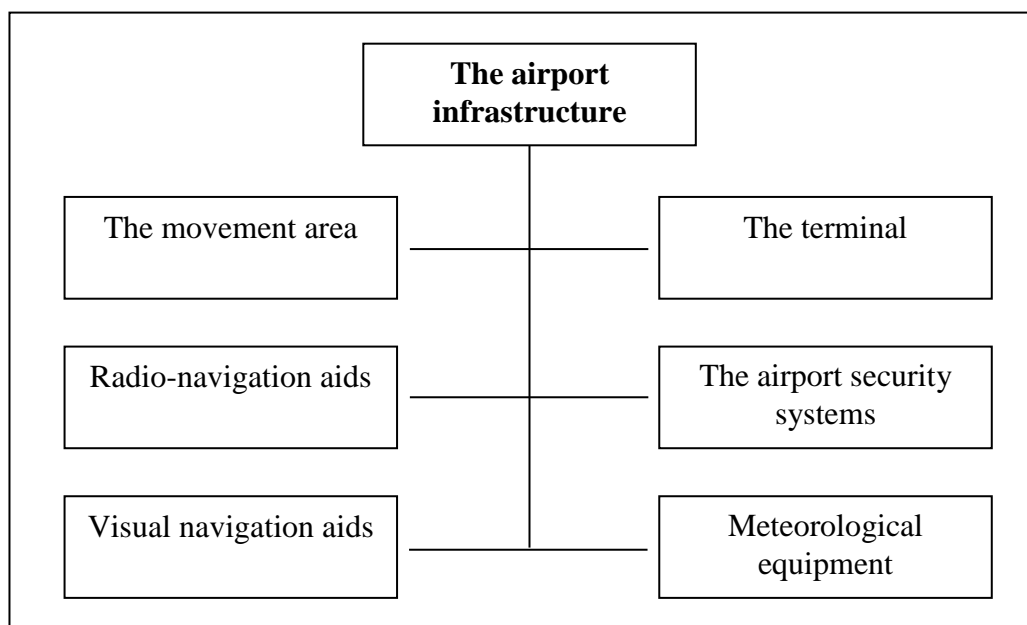


Fig. 1. The airport infrastructure

The airport is divided into sections where different tasks are performed. The technical part is used by the services responsible for aircraft takeoffs, stopovers and landings. This section includes hangars, tower control, taxiways, aprons, exits, runways and navigational aids.

The airport passenger terminal provides passenger services [4]. It should have a lounge, baggage services, check-in area, duty-free zone and technical facilities. In large airports, there are cargo terminals, designed to handle cargo and mail. Within each airport, there is also an administrative building [1]. The technical and organisational airport solutions must ensure the safety of passengers, crews and personnel and airport operations executed at the airport.

A civil airport is not only a place of handling passengers. On its premises, especially in the passenger terminal, numerous retail and customer service facilities are located. In the vicinity of airports, there are open conference centres, hotels, coffee shops for the convenience of passengers.

At international passenger terminals, apart from passport control and check-in areas, there are specially assigned transit areas. Duty-free shops, relaxation lounges (for example, children care), restaurants, chapels, etc., can be found here. Large airports have more than one terminal. An excellent example would be the Heathrow airport in London, which has as much as five terminals. These are not only terminals operating scheduled flights and charter flights, but also those operating private tourist and business aeroplanes and cargo terminals in which cargo is cleared [5,10,12,15].

A significant part of the airports are radio-navigation aids. It is possible to determine the position of the receiver onboard the aircraft in the airspace through these aids. This enables pilots and air traffic services to bring the flying machine on the ground safely. These systems are characterised by the following parameters: operating range, parameter accuracy, operating principle, economy, capacity and reliability [6]. The basic one is Very-High Frequency Omnidirectional Radio Range – VOR. It determines the position of the aircraft based on the phase comparison of the signals sent from the earth station. The next system is called Distance Measuring Equipment – DME. It is an impulse system designed to measure the distance of an aircraft from a ground beacon. Analysis of distance changes estimates the speed and expected arrival time to beacon. Important is the Instrument Landing System - ILS, which enhances the precision approach procedure. In addition, safe operations like landing, taking off, taxiing and others at airports would not be possible without visual navigational aids. Among others, these aids provide the proper use of such objects. They are quite numerous. The most common classification consists of five categories [4]: indicators and signalling devices, markings, lights, signs, markers. Due to the number of visual navigational aids, any negligence or damage can cause serious problems in airport operations.

A civil airport is an area of several hundred hectares of grounds which needs protection. For example, the surface area of the London Heathrow Airport equals 1,227 hectares and the largest Polish national airport Okęcie is an area of approximately 830 hectares.

### **3. CIVIL AIRPORT SECURITY SYSTEM**

The goal of the airport security system is to ensure a high level of security. The very word "system" is an expression commonly used colloquially. A system is a deliberately defined set of elements and a set of linkages among them, which together determine the characteristics as a whole. Defining the system consists in extracting the elements of the system environment, significant couplings between system components and relevant system feedbacks with all its surroundings [16]. Airport security system (Fig. 2) can be treated as a typical anthropo-technical system. It is a human complex, binding men with technical means, created by a deliberate human impact on the technical means. A provision of security at an airport rests on the Aviation Security Service, the Border Guard, the Police, the Customs Services and the airport operational services. The protection system is an integral part of the airport security system, which is designed to prevent any act of unlawful interference in its area.

The organisation and functioning of the security system of individual airports in Poland result from the implementation of the rules of international aviation law, including the EU to national documents such as the Aviation Law Act, the National Civil Aviation Security Programme and other documents affecting solutions in the field of civil aviation security around Poland. It should be borne in mind that the indicated documents are updated from time to time. The Aviation Law Act, while shaping the area for protection, is of vital importance, since the discussed system should function in accordance with the legislation. In the authors'

opinion, the National Civil Aviation Security Programme should be noted among a collection of important documents relating to the security of civil aviation, because its contents are practically realised in Polish airports.

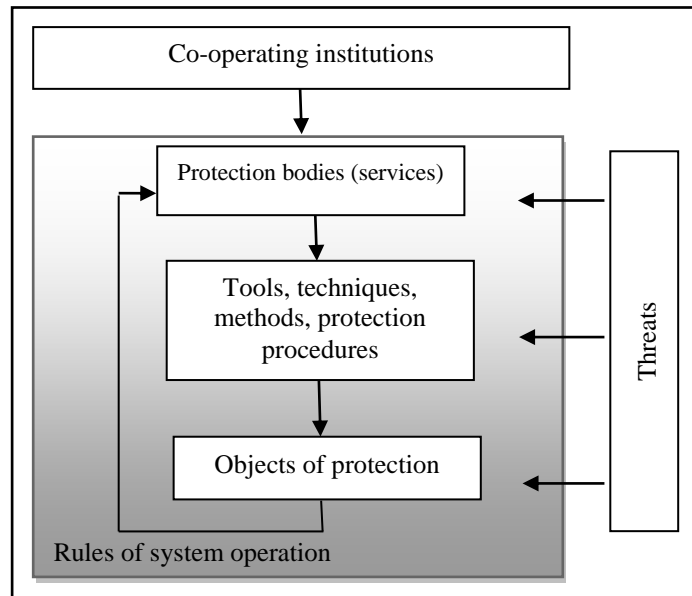


Fig. 2. Schematic diagram of the system of airport security

In addition to the services, an important component of the airport security system is the Aviation Security Team, which consists of the following airport representatives: airport manager (team leader), the Aviation Security Service, the Police, the Border Guard - at airports with air border crossings, the Internal Security Agency, the Customs Service, air carriers operating at the airport [11].

Moreover, representatives of other bodies conducting business activity at a given aerodrome, medical rescue units and a relevant province governor may also be invited to work in the Team.

In accordance with the content of the National Civil Aviation Security Programme, the Aviation Security Team carries out tasks related to the assessment of airport security. These are key tasks that shape the area of protection at the airport and they include [11]:

- expressing opinions and making proposals of projects, orders and instructions in order to protect the airport as prepared by the airport manager
- expressing opinions and making proposals to the programme draft of airport security
- assessment of the degree of airport risks or acts of unlawful interference
- expressing opinions on solutions concerning the mechanisms of the functioning of terminals
- the initialisation of the introduction of new practices and procedures relating to control measures in terms of security
- evaluation of the cooperation between air carriers, operating at the airport and other entities, security services

An important part of the security are protection devices, or even technical systems supporting human work. An important group among them is the Access Control Systems. Access Control (AC) denotes the application of means to prevent the incursion of unauthorised persons or vehicles, or both at the same time.

The AC system, above all, effectively controls access to individual rooms and zones. Only authorised personnel can move around a given facility, using personal identity cards. The readers of proximity cards, mounted in designated areas, can effectively limit access to certain areas and/or zones. Owing to the access control system software, the administrator and other authorised persons have an opportunity not only to give or restrict access rights for individuals or groups, but also to control the situation during threats or emergencies. The most important advantage of using the modern Access Control Systems, apart from tangible financial benefits, is to increase the level of security and to protect the property on the premises of the facility. The introduction of access control reduces the risk of losses due to theft, as well as enabling immediate data acquisition for people staying and moving around the premises. This is particularly valuable information in case of a sudden emergency evacuation. The AC system is based on a cooperation of ID devices, which as a rule, are proximity cards. The system users are granted permission to move around in designated zones or by the entrance to the building. In the access control system, no data are stored on the card, which is of particular importance in the case of its loss or theft. The working of the system is controlled by a central processing unit, and its communication with the proximity cards readers is provided by drivers. The user permissions are given individually, which allows customising the system to the structure of the company or of the functions fulfilled by its employees.

Another group is devices used in security checkups of passengers and baggage. Security controls mean the application of technical or other means to identify or detect prohibited items. The equipment used is the X-ray scanner, intended to scan all items for the presence of concealed weapons, explosives or drugs. X-ray scanners can be used in prisons, at police stations, in courts, military units, embassies, museums, banks, airports, border crossings, and sports facilities. During the security control of liquids, aerosols and gels, airports use an x-ray device, Explosive Trace Detection (ETD) devices, test strips to test chemical reactions, scanners of liquids in bottles.

There are also Explosive Detection Systems (EDS) used. Consequently, at civil airports, there is the need to extend the Baggage Handling System (BHS) by the EDS system, which is used to control the hold baggage. It consists of procedures and equipment needed to maintain a steady level of security. The control process is conducted as follows: the BHS system provides baggage to the control zone; the device, which x-rays the baggage, visualises its contents; the operator verifies the contents (unusual shapes) of the screened baggage; the second operator, if necessary, performs a manual checkup; in case of a detection of a high-risk material, it is neutralised.

One of the sensitive, although not always appreciated, elements of the aviation security system is the electromagnetic spectrum, which operates a number of radio navigation systems, communications and other systems, essential for the proper execution of a safe flight. Modern devices are capable of detecting, with a certain likelihood, any signal emitted into space, bind the signal to the global axis of time, to recognise it as well as locating the position of the emitter with a certain accuracy. The monitoring systems operate passively, hence, their use is secretive in nature. They can operate in a narrow band, dedicated, in an extreme case, to a single frequency, or make observations of a very broad range of frequencies. Apart from numerous optical observation systems or thermal imaging, passive sensors can also be a great

source of information. They complement the operation of other sensors by detecting persons or devices that are equipped with emission sources of radio signals, and whose existence may be linked to the concept of threat. In some areas, the emergence of sources of radio emission (not necessarily the emission itself) may indicate a threat status. There are already technical solutions that enable monitoring this area.

At airports around the world, unattended baggage and suspicious items are a major source of security threats. Each of them can be a source of a potential bomb threat, requiring an immediate response from the bomb disposal experts, who often risk their own health and life. In such a situation, portable x-ray devices, bomb suits and controlled detonation barrels are used. More and more frequently, the security services are equipped with special robots or mechanical devices, which automatically perform some particularly dangerous tasks, for example, screening suspicious packages. The robot can be controlled by a preinstalled programme or by a set of general rules which translate into the robot's operation by means of artificial intelligence techniques.

It is also necessary to stress the progress that has been made in properly constructed fences of key installations, that is, airports. In this case, it is not the classic fence (for example, made of metal), but a system of external protection. These systems are equipped with a variety of electronic sensors that give a reliable picture of a situation - that is, what is happening in a given place and time, regardless of the time of day or night and weather conditions. The external protection systems, due to heavy working conditions, are very complex systems, often difficult to install and quite expensive.

#### **4. HUMAN FACTOR IN A CIVIL AIRPORT SECURITY SYSTEM**

The basic elements, which create aviation safety, are the human factor, the technical factor, the environmental factor and the organisational factor. However, the human factor generates most of the aviation events or threats to civilian airports. The human factor can be defined as something related to human activity, caused by specific individuals and groups of people filling organisational structures and implementing duties and tasks resulting from their roles as well as their own private goals and aspirations in an organisation. Since the beginning of aviation, man has always played a leading role in the process of shaping aviation security. Unfortunately, people make mistakes. It is related to the specificity of the human body, which can even fail in a healthy person, not to mention cases of neglecting his elementary needs. The term human factor in aviation is widely understood as air personnel, including pilots, air traffic controllers, technical and maintenance personnel, crews of aircraft and other persons responsible for the organisation and security of aviation activities. Therefore, the human factor in aviation can be described as inadequate to the situation, the operation of pilots and other persons who caused the situation of an accident or did not remove it when it was caused by independent factors and there were real possibilities to remove or reduce the threat. Turning to considerations concerning the airport security system, this is inadequate to the existing situation, the actions of persons - employees of airport security services and other services or persons who caused the threat by unlawful interference and there was a real possibility of its removal or reduction of the threat. In the case of airport personnel, the most important elements taken into consideration are the psychophysical state, specialised competencies and situational awareness, motivation and discipline. The human factor at the airport, inter alia, offers officers airport security service and the Border Guard.

The airport security service is the basic formation which performs tasks of civil aviation security at airports. Main tasks are [11]:

- control access to restricted areas
- control of passes issued by the airport manager
- carry out security checks, protection of the restricted area at the airport and other zones within the jurisdiction of Regulation 300/2008 / EC
- recognition and transfer to the Police or Border Guard, offender of safety conditions at the airport or passenger violating the conditions of carriage and the person who, without obtained authorisation or tried to obtain access to the restricted area or person who has committed or attempted to commit an act of unlawful interference and person who violates the public order as well.

Officers of the Border Guard are required to check if a transported weapon is unloaded and properly secured. Moreover, they are also to verify if ammunition was packed in a suitable manner to prevent any danger, for example, hitting percussion cap [11]. Furthermore, officers perform such actions as [11]:

- observation and recording operation of security control points
- immediate response to the infringement of airport security service
- immediate response to the signals of disruption of public order at the security point and the area adjacent to it
- immediate notification to the airport manager proposals for the removal of identified serious deficiencies
- immediate request to the airport manager for the removal of identified serious deficiencies and to inform the President of the CAA about these deficiencies

The airport is a specific object. As an element of the transport system, it belongs to the critical infrastructure and will be a target of acts of terrorist groups, and during the war, the armed forces of a potential enemy (including its special forces). This is due to the vast area and specific infrastructure (Fig. 3).

The services and other entities should treat airports as special objects of security and conduct diagnoses to understand the behaviour of criminal groups. To do that, it is necessary to answer the following questions:

- What kind of civil aviation elements may be of interest to criminal groups?
- What elements will terrorists reach easily?
- What elements attacked will have the most impact and publicity?
- What type of organisation can carry out the attack?

Answering the above questions will prompt adequate knowledge of the object. This will prevent a successful coup by having the element of surprise and preparation for a possible attack. In addition, the services and entities have specific procedures. They are described in the National Civil Aviation Security Program. The third chapter characterises rules of transporting weapons and ammunition, chapter 4 defines the degree of threat and the prevention of crises in civil aviation. The part of the document, which strictly deals with airport security, is Chapter 8. Chapter 10 contains information pertaining to the protection of the aircraft, and the next one applies to passengers and cabin baggage. Chapter 12 deals with the topic of checked baggage. Moreover, the discussed document describes methods and means of protection of cargo and mail transport, training in the field of civil aviation security



and the possibility of using dogs to detect explosives as well. The discussed issues concerning the human factor do not fully cover this subject. The above material is only a brief outline showing the essence of human activity at the civil airport, which prompts further analysis and exploration of the human factor in civil aviation.

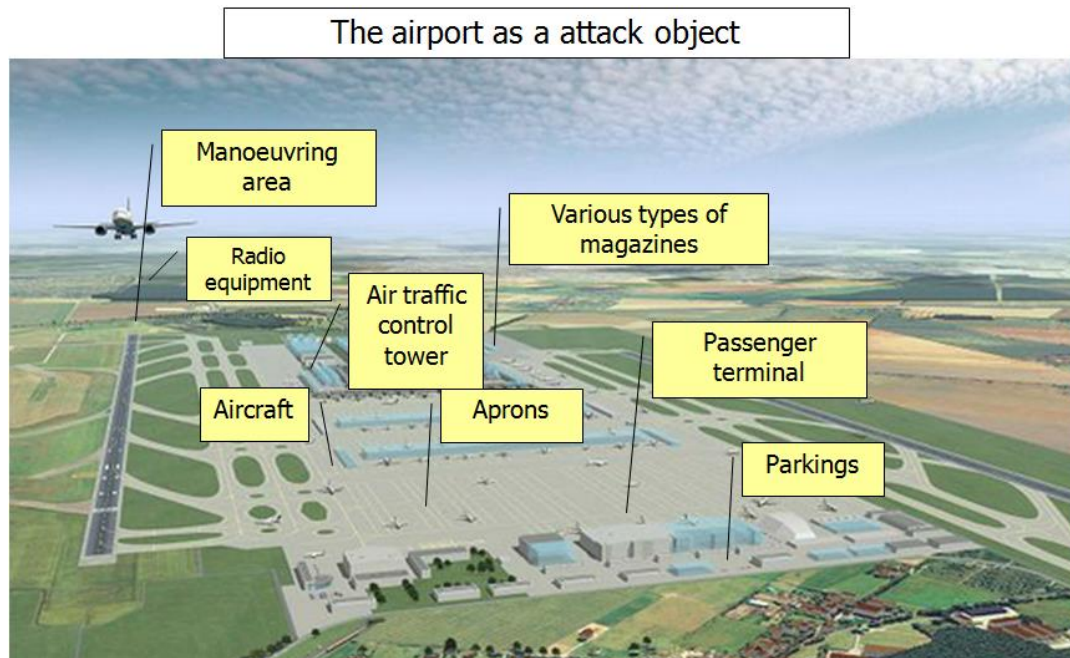


Fig. 3. The airport as a attack object

#### 4. CONCLUSION

This article deals with the subject "Selected aspects of civil aviation security" and its objective is to characterise the system of civil airport security in terms of the operation of this type of object. The problem dealt therein this article was expressed in a question: How can airport security system be understood? There is no straightforward answer to this question. In conditions of the following strict standards for the protection of airports, it appears that infiltration to the restricted area of the airport (that is, part of the operational airport zone, where except the limited access, there are also other aviation security standards in force), of people and hazardous materials, security controls appears to be extremely difficult. Experience and technical equipment of proper services responsible for conducting security checks of persons and baggage impede the action even further. The organisation of airport security also plays a beneficial role. Every person who seeks access to the restricted zone of the airport will undergo security controls.

The issue of security of the airport operational zone looks quite different. This is basically an area in which the action of people with hostile intentions is very real. One should expect that such actions may be performed by means of unmanned aerial aircraft, carrying dangerous explosives, and also creating a possibility of an intentional collision with an aircraft. A major threat is also posed by portable flying anti-aircraft mines. The greatest challenge for civil aviation is its protection in the cyberspace. The availability and universality of networking

solutions intensifies this challenge even more. The deliberations of the above-mentioned risks made by the authors can be found in the paper entitled: “ Selected threats for civil aviation”.

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