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Security Challenges at Airports Today

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Abstract

As can be seen from the title, our paper intends to be thought-provoking in the topic of airport (more widely aviation) security. We discuss the difference between the two terms of "safety" and "security" (the Hungarian language has only one expression for these two terms). In the article we overview the stakeholders of aviation, the current safety management system and the security-related approaches, research, and solutions.

Keywords: aviation safety, airport safety and security, safety management system, predictive approach

Introduction

Air transport is one of the most popular modes of transport today, and it is also a dynamically developing industry. Hundreds of thousands of passengers, thousands of tons of cargo pass through the busiest airports on a daily basis, the safe and efficient handling and processing of which is ensured not only by airport staff and air traffic services, airlines, but also by cooperating third parties, businesses, organizations and staff.

Although aviation is a heavily multi-secured form of transport, the risks and hazards, as in any system, are constantly present here as well. Yet when compared to other modes of transport, we find that the nominal value and the specific rate of serious and fatal accidents are considerably lower, aircraft disasters, seem to be more far-reaching. This is due to the fact that they receive much greater public attention, especially if the accident is caused by an external impact (e.g. terrorist attack). On the other hand, recovering wrecks, detecting the exact causes of an accident, and making the right conclusions normally takes a longer time, in some cases it is perpetually uncertain (Flight MH370, March 8, 2014).

In our brief paper, we review the terminological complexity of aviation safety, clarify misunderstandings arising from the English terms, and discuss airport security issues within these conceptual frameworks.

Elements taking part in air travel

In a release published in 2014 (Meyer–Mudra, 2014), we get a brief summary of the elements of aviation. Accordingly, these are the following:

- aircraft and its crew;
- airport and its staff;
- air traffic service and its personnel.

This is now being complemented by the travelling public, which is not involved in operating air traffic, but they are themselves the subjects of air traffic most exposed to security risks, threats and dangers, and from the point of view of airport security they may pose threats themselves. Figure 1 illustrates the relationship between the actors and the directions of external and internal threats.

Figure 1

Actors of aviation, and the graphic representation of threats against aviation security and airport security

Source: Own material

Misunderstandings arising from the English terms

The notion of security has been defined by experts from many fields of research, depending on the specifics of the subject. For the purposes of this article, we consider the following definition to be the most appropriate: "security is provided when the threat is minimal" (Ürmösi, 2013: 150.). However, in the area of aviation, this is to be approached more accurately, especially in the context of the many literary sources in English. Let's briefly look at what concepts we may encounter, and what exactly is to be understood under these terms.

In the Hungarian language both *safety* and *security* are generally understood as "security", but there is a significant difference between the two terms. *Safety* refers to a condition where air traffic risks directly linked to aircraft and the direct support of their operations are kept to a minimum acceptable level (Annex 19, 2013). The term *security* covers the protection of international civil aviation against unlawful acts. This objective is achieved through the combination of measures, a combination of human and material resources (Annex 17, 2006). Accordingly, it is worth clarifying what we mean in the following subfields.

- *Aviation safety:* safety of air transport, safe implementation of processes related to flying an aircraft, aircraft control, design, maintenance, manufacture, in terms of human factors, procedures, tools, and organizations. (Looking for internal threats for air transport as a whole, see Figure 1: Inner Threat4.)
- *Flight safety:* the human factors, tools, and procedures required for the safe execution of flight as a process.
- *Aviation security:* safeguards the security of aircraft processes, instruments, procedures, human factors, and protects against deliberate, unlawful or unintentional attacks on aircraft flight, design, maintenance and production. (Also considering the aviation as a whole, but looking for the external threats, see Figure 1: External Threat2.)
- *Airport safety:* the means, procedures, buildings and human factors necessary for the safe execution of all aviation in the aerodrome of the airport. (Similar to the first concept, it seeks to address threats that are internal to the organization, but only to one of the elements of aviation, focusing on the airport, see Figure 1: Inner Fencing3.)
- *Airport security:* the means, procedures, organizations and human factors necessary to guarantee the security of the infrastructure for the transport of goods, passengers and luggage. (It also looks for protection solutions for the airport, but can be used against external threats, see Figure 1: External Threat1.)

Against this background, the term *safety* will be used as security and the term *security* term will be used as a protection.

Peculiarities of the safety management system (SMS, SeMS)[1] in certain areas of air transport

The various dangers and threats are constantly present in all areas of air transport, including airports, air traffic services or even the operation of aircraft. In order to allow these elements, organizations and persons working within them to work together with aviation safety in mind, ICAO[2] issued Annex 19 on the operation of the safety management system in February 2013. The appendix states that safety must be understood and approached at the level of the air transport system, including all necessary organizational structures, re-

[1] *Safety Management System:* a system for managing safety; *Security Management System:* a system for managing protection.

[2] *International Civil Aviation Organization:* an organization of the United Nations dealing with aviation; it has 191 member states, including Hungary.

sponsibilities, policies and procedures (Annex 19, 2013). ICAO also requires Member States to provide for a national flight safety program and to operate a flight safety management system for licensed training organizations where aviation safety risks may arise; for aircraft operators[3] engaged in international commercial operations; for the maintenance organization with official license; for organizations designing and manufacturing aircraft and aviation equipment; for the commercial airport operator and the air traffic service.

In 2012, as a model for the safety management system (hereinafter referred to as "SMS"), the Ministry of Transport[4] of the United Kingdom submitted a proposal for the development and operation of a protection management system (hereinafter referred to as SeMS) at London airports (Goodwin–Christensen, 2013). Below we will briefly review the principles, elements and features of both systems, as well as the uniformities and differences.

Any organization that uses SMS is provided with *safety policies*. The essence of the policy is to define the person responsible for the safety, the service, the responsibilities, the areas with special security/protection factor, procedures, and perhaps the most important one: the reporting system in support of communication and information gathering. These elements can be identified in both the SMS and the SeMS. The reporting system is effective and security-enhancing, by being voluntary and stimulating. This means that any event, whether it is a runway incrusion due to a procedural error or an unidentified piece of luggage discovered late for a similar reason, is reported immediately. To ensure that all members of the organization fulfil their reporting obligations voluntarily and without delay, the system operates under the so-called *just culture* ("trust") principle. In the SeMS's reporting system, the so-called "If You See Something, Say Something", launched as a campaign by the US DHS[5], is used to record and investigate not only reports from staff, but also from passengers and other external sources.

Table 1

Safety management matrix

		Severity				
		A	**B**	**C**	**D**	**E**
	Frequency of occurrence	Catastrophic	Dangerous	Moderate	Low	Negligible
5	Frequent	5A	5B	5C	5D	5E
4	Occasional	4A	4B	4C	4D	4E
3	Slight	3A	3B	3C	3D	3E
2	Unlikely	2A	2B	2C	2D	2E
1	Extremely unlikely	1A	1B	1C	1D	1E

Source: ICAO Doc 9859, 2013: 178.

[3] Aircraft and helicopters subject to Annex 6, Part I or Part III, Section II.

[4] Ministry *for Transport.*

[5] *Department of Homeland Security:* the equivalent of the Hungarian Ministry of Interior.

The next important element is the so-called *risk management*. The first step is to identify, then analyze and reduce risks and operate a *monitoring* system that will help maintain the safety level. An airport SMS can be found in a number of places, whether it is a work area's priority traffic zone or docking procedures. For the same reason, the SeMS of the airport also prioritizes the monitoring system (Becmann–Price, 2014). Both systems conduct risk management with scientific methods. Such is the preferred SHEL or ICAO 5M model adopted by the ICAO or FAA. SHEL (Software, Hardware, Environment, Lifeware) examines and evaluates the relationships between aviation security and assesses the risk assessment matrix (Table 1). Potential risks can be assessed using the matrix, depending on their probability and severity. The advantage of the risk assessment matrix is that it can be customized, depending on the identity, probability and severity of the risks involved in the organization of the airport's organization and the aviation activities it conducts, enabling the organization's responsibilities to be clarified, developing procedures and methods for reducing the risk and reviewing the effectiveness of those procedures. Based on the matrix, the risks in the red and yellow categories fall into the less tolerable range, and it is necessary to take action to reduce these risks – to mitigate either the severity factor or the occurrence probability factor.

5M uses a somewhat different method to analyze the risks. The first M: mission, that is, the precise clarification of the task. The second M: man, that is, is equal to the human factor. The third M: machine, therefore, includes all the tools that are in the system of human-machine contexts. The fourth M: management, which means the procedures. The fifth M: media, which refers to the social environment in which the system is interpreted, in this case the airport (Figure 2).

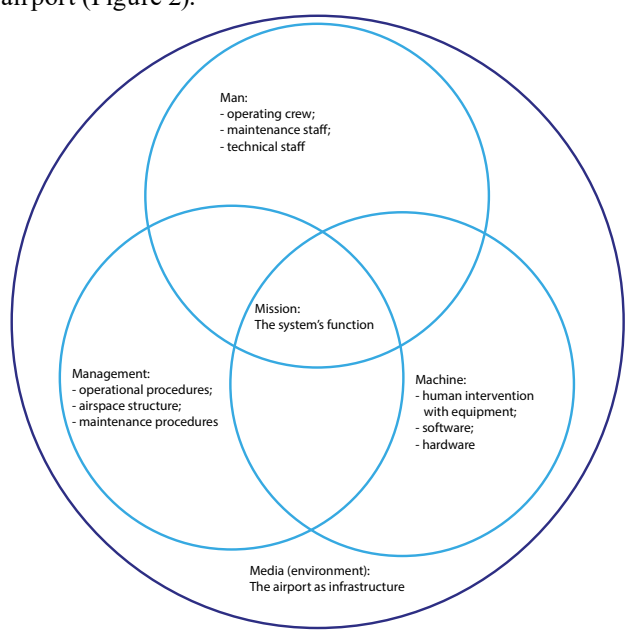

Figure 2
The 5M model

Source: FAA System Safety Handbook, 2000: 3–16.

The last element of SMS and SeMS is to *warrant and guarantee security*. In order to keep the threats and risks at the lowest possible level *(ALARP – as low as reasonably practicable),* continuous and comprehensive auditing and quality assurance are required. The audit may be conducted by the competent authority or by an authorized body designated for this purpose. The study identifies so-called safety/protection performance indicators that show how effective the system works and how well the goals set in the guidelines are met and which essentially represent a measure of the reputation and reliability of a given organization.

Approaches to airport security

Initially, a *reactive* approach to aviation safety was prevalent in the development of safety equipment (and, in general, different types of equipment). With this attitude, we only reacted to incidents and accidents, we did not have any preventive solutions. These resulted in the pursuit of research, development, or the use of procedures or equipment. Thanks to these, the state-of-the-art equipment of airplanes and aviation areas has evolved that not only allows the airplane to take off into the air but also provides safety of air transport. Just to mention a few examples: basic onboard instruments of the airplanes (altitude and airspeed indicator instruments, instruments measuring the parameters of the engines or other main components), all hardware related to air traffic control (including navigation equipment) and software, etc.

The next step to increase safety was a *proactive* approach that, based on the experience gained, has developed equipment or procedures that avoid potential risks and hazards. Here, we must mention the ICAO Safety Management Handbook, which has been in force since January 2009, to provide guidance to stakeholders in general to address the risks that have already been identified in flight (Meyer, 2015). The preparatory, forward-thinking attitude is thus realized, which is marked as a proactive approach.

The proactive approach, however, should not be confused with the *predictive approach* that is created as a result of real-life planning and research. In this case, we are preparing for events that are considered to be potential or expected, which have not been experienced so far, or we may infer from their trends and signals that they are occurring. Research is therefore required (for purposes of this writing, primarily in the area of protection), defining the vulnerable points that offer the possibility of assault, rather than thinking ahead, as it were, in place of the attackers. We believe that this approach has an important role to play in enhancing and improving airport protection *(airport security).*

For aggressive acts involving human casualties (e.g. terrorist attacks), both proactive and predictive approaches should be applied. In aviation security, the complex approach must dominate. However, experience has shown that we must also be responsive to attacks, so keeping reactive procedures up to date is also an important task. We are thinking here primarily of securing the airport, preventing further casualties or accidents, and care for the wounded, and restoring the normal conditions.

Security-enhancing research and solutions to protect airports

Two of the most desirable ways of addressing the challenges and threats are the predictive (prevention that averts even the possibility of threats emerging) and the proactive (also preventive in nature but it averts an already emerging threat) approach. Among reactive solutions, we can bear in mind the arrest of the perpetrators of bomb attacks (Lukács, 2009) or the plans for dealing with attacks perpetrated with the use of weapons of mass destruction (AEP, ASP, ACP) (Rankin, 2014). Furthermore, the bombings at the airport (such as the March 1966 bombings in Brussels and the bombings in Istanbul a few months later), then restoring the original conditions and managing hostage situations (Horváth, 2008), can also be listed here.

During the passenger security screening at the airports, explosives, weapons, and other illicit materials (e.g. drugs, valuable objects, excessive volumes of liquids, etc.) are detected with the use of current technology. To detect these items/materials X-ray beam detectors, metal detectors, explosives sensors and fluid analyzers are used (Szabó, 2016). In today's mechanized world, it is a curiosity, but it is possible to use service dogs to detect explosives or other prohibited objects (Daruka, 2009). These methods can be referred to as proactive methods, because if an individual carries a prohibited item and is detected when going through the passenger security screening on the airside, the threat is already in progress and will be removed immediately before the flight.

The most desirable solution, however, is having predictable procedures that also prevent the emergence of a threat. We can see more development in this direction. At airports it is not desirable to allow the formation of large groups of people, which has created a very simple solution to mitigate this: online check-in from the comfort of the passenger's home. This reduces the number of rope lines in front of the airline's counters and also reduces the waiting time at the airport before take-off. There is also an automated passenger control system among the airport security solutions, which also aims to reduce the number of large groups (Gunnebo), increasingly sophisticated surveillance systems (Proximex, SAAB, Siemens, Thales) and advanced decision support systems (Qognify). For surveillance systems, it would be important to have a function capable of measuring biological and behavioural parameters and then highlighting potentially high-risk persons. In the area of prevention, it is also important that the decision-support system of the airport solves the rapid and efficient exchange of information with the intelligence services. The task to be solved is to conduct surveillance of the hitherto less controlled peripheral areas, from which threats arrive (car park, freely accessible area of the terminal, etc.). The fences surrounding the airports also represent a very important preventive system, but not only because of their physical obstacles, but also by various procedures and solutions which multiply their obstacle and arresting function. Their lower part is dug in the ground, elements impeding passage are attached to their upper rims, and develop a motion-sensor and warning system (SightLogix) along their path. We can give an example of an Israeli airport solution where robot technology is used for controlling and patrolling perimeter fences (Olivier, 2014).

As part of the predictive approach, it is important to look into the future and to look at options that are likely to occur at airports and to develop appropriate solutions to them. The predictable approach in this case is the implementation of the SeMS system, following overseas examples, helping to identify existing or emerging *gaps* in the system, assess their risks and minimize them to their lowest acceptable level. There are a number of new chal-

lenges facing airports, both from a safety and a security point of view. This is the case, for example, with flights carried out with remotely controlled flying apparatuses (drones) which, in themselves, carry security risks, but if they are used to carry out an attack, they pose a threat to flight security in the form of a terrorist attack. There is also a kind of biological attack (similar to suicide bombings) when a person infected with a rather aggressive, virulent disease travels around the Earth in 24 hours, using airports as a kind of "virus distribution centre". These are, therefore, challenges that need to be answered and further opportunities for attacks need to be forecast, and we must manage them in theory.

Summary

In this article, we gave a review of the various aspects, characteristics and challenges of airports and security through an overview of international and national literature related to this topic. We considered it important to list the procedures and systems that analyze the security and defence strengths and weaknesses of certain areas and assets of the airport using a risk-based approach in line with today's challenges. As a further use of this short study, we would like to thematically examine the security challenges of jointly operated airports that are, for the time being, in the design phase.

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