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THE AIRPORT AS OBJECT PRONE FOR THREATS

Abstract

There were many attacks on civil aviation facilities which occurred since the 1930s but the first recorded attack against the airport security occurred in 1970. Due to the extensive infrastructure, airports are susceptible to the occurrence of hazards especially acts of unlawful interference. Therefore, there is adopted following purpose of this article: characteristics of airports in terms of possible threats. To accomplish this, there are characterized most important elements of airport infrastructure in the first part and then author presented selected acts of unlawful interference committed at airports in the second part. In addition, the last section of the article contains most important results of the research connected to this topic which refer to safety at airports in Poland from passengers point of view.

Key words: the airport, act of unlawful interference, threat, safety, security

Introduction

Airports are multifunctional objects which create a significant problem from the point of view of safety. These objects are complex centers which provide transportation of people and goods between remote locations around the globe. Due to the proximity of road and rail transport, airports are exposed on occurrence of numerous threats. This is compounded by huge population density within the terminal which is conducive to the execution of unlawful acts. Because of that, the airport facilities have to fulfill specific safety[1] and security[2] requirements. Due to the vast array of threats, safety and security procedures are a huge

[1] Safety is *defined as the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management* (Source: *Safety Management Manual (SMM)*, ICAO 2013, p. 17.).
[2] Security means *safeguarding civil aviation against acts of unlawful interference. This objective is achieved by a combination of measures and human and material resources* (Source: Annex 17 to the Convention on International Civil Aviation – *Security*, ICAO 2011, p. 1-2.).

challenge for security services. It is caused by necessity to monitor a huge area consists of a terminal, movement area and adjacent areas.

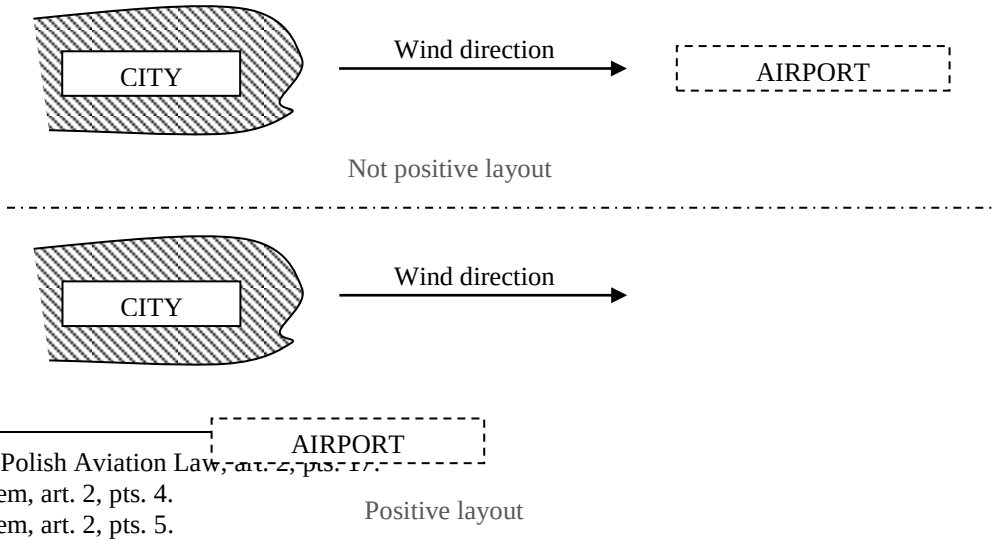
This article has been developed to consider issues related to threats at airports. It would not be possible without characterization of selected acts of unlawful interference committed against airports. In addition to discussed topic, there are contained results of the research in which there were considered terrorist threats for airports.

Characteristic of airports

Airports are objects with a complex structure. Because of that, these places should be consider in systemic way. This allows to identify critical areas for each component and whole objects. This is essential for implementation of measures to counter and prevent threats. It is required to analyze such issues as location, infrastructure, radio-navigation aids and visual aids to understand essence of existence, complexity of the structure and number of potential threats for airports.

Speaking about airports, it is necessary to explain difference between following concepts: the airport, the aerodrome, the airstrip. The airport is called as the aerodrome used for commercial flights[3]. According to Polish Aviation Law the aerodrome is a segregated area (including objects and equipment with durable nature) on land, water or other surface which is listed in the register of aerodromes[4]. The airstrip is area on land water or other surface which can be wholly or partly used to take off or land and for land or overwater motion of aircraft[5]. As we can see, the airport is the concept of wider sense which includes the aerodrome.

Taking into consideration location of the airport, it is essential to analyze atmospheric conditions, for example prevailing wind directions (Fig. 1), annual precipitation, haze or temperature distribution.



[3] The Polish Aviation Law, art. 2, pts. 17.
[4] Ibidem, art. 2, pts. 4.
[5] Ibidem, art. 2, pts. 5.

Fig. 1 The airport location according to wind direction. Source: own work based on: M. Leśko, *Porty lotnicze*, Wydawnictwo Politechniki Śląskiej, Gliwice 1991, p. 113.

In addition, ground used for airports should not be the highest quality due to high purchase costs. What is more important, it can not be wetland due to difficulty to maintain movement area in usable readiness. Considered objects have quite developed infrastructure. The basic elements are (Fig. 2):

- the terminal,
- the movement area,
- radio-navigation aids,
- visual navigation aids,
- meteorological equipment,
- the airport security systems.

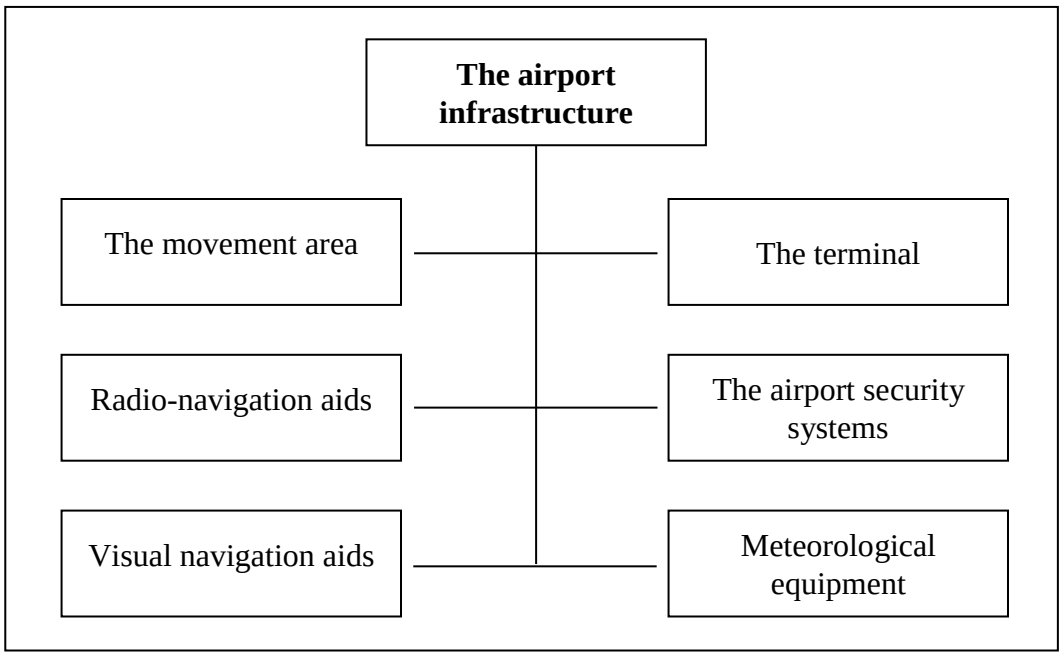


Fig. 2 The airport infrastructure. Source: own work

The terminal is a building designed for handling and check-in. It is divided into two zones: the public and the security restricted area. There are check-in places in the public zones. The security restricted area of the airport is the part of the airside[6], which is considered

[6] Airside - the movement area of an airport, adjacent terrain and buildings or portions thereof, access to which is controlled (Source: The Annex 17 to the Convention of International Civil Aviation, *Security*, ICAO 2011, p. 1-3).

as the most important risk zone. Among others, there are food court, chapel, mother and baby room, the first aid point and information point as well in the terminal. Essential for safety is the terminal marking. Information signs should be understandable and placed in easily recognizable places.

The most important element of any airport is the movement area consisted of the maneuvering area and aprons. The maneuvering area is a part of the aerodrome intended to take off, land and taxi (excluding aprons)[7]. It consists of the landing area (Fig. 3) and taxiways. The landing area is designed for taking off and landing[8]. The most important element is the runway strip[9] together with runway[10]. Besides elements listed above, the landing area includes such elements as: Stopway – SWY, Clearway – CWY and Runway end Safety Area – RESA. Of course, number and location of runways, taxiways and aprons depend on size of the airport.

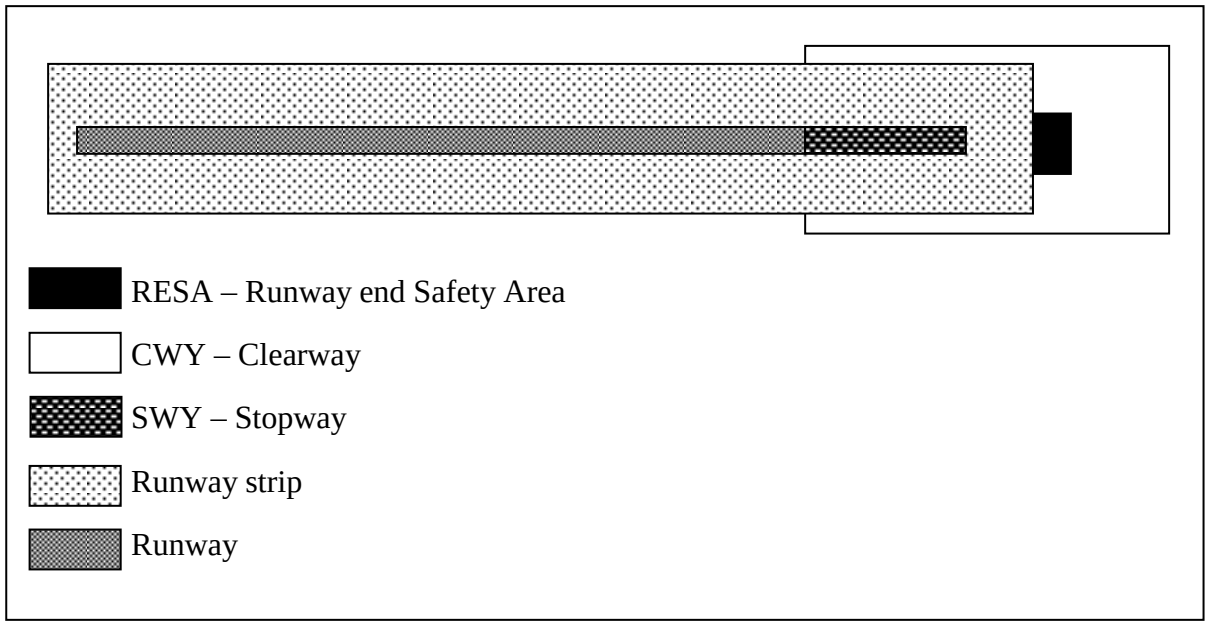


Fig. 3 The landing area. Source: own work based on J. Rajchel, E. Zabłocki, *Port lotniczy*, WSOSP, Dęblin 2009, p. 41.

In simple words, taxiways are land ways on aerodromes designed for taxiing aircraft. These areas link different parts of the aerodrome as well[11]. Taxiways are subject to specific

[7] The Annex 14 to the Convention of International Civil Aviation, Aerodromes, ICAO 2009, p. 1-6.
[8] Ibidem, p. 1-5.
[9] Runway strip - a defined area including the runway and stopway, if provided. It is intended to reduce the risk of damage to aircraft running off a runway and protect aircraft flying over it during take-off or landing operations (Source: The Annex 14 to the Convention …, p. 1-7).
[10] Runway - defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft (Source: The Annex 14 to the Convention …, p. 1-7).
[11] The Annex 14 to the Convention …, p. 1-8.

requirements. Most important are capacity and width adequate for runways and as many as possible straight segments to allow aircraft sufficient speed. Taxiways should be also seen from the air traffic control tower[12].

At last there should be described aprons as part of movement area. These are areas at the land aerodrome designed for aircraft to board passengers, load or unload goods, refuel and park[13].

The airport security equipment is the key to prevent unlawful acts in civil aviation. These equipment is tested and result of test is recorded in the internal documentation[14]. The airport security facilities include for example[15]: metal detection gateways, hand-held metal detectors, equipment for checking the safety of liquids, aerosols and gels, explosive detection systems, roentgen devices, explosives trace detectors. There is also acceptable to use new technologies during perform security checks. This is possible when there are fulfilled several conditions[16]. According to §71 of The National Civil Aviation Security Program, appropriate requirements for equipment are contained in section 12 of Annex I to Regulation 300/2008 and section 12 of Annex to Regulation 2015/1998[17].

A significant part of the airports are radio-navigation aids. Due to these aids, it is possible to determine the position of the receiver which is on board the aircraft in the airspace. This allows the pilot and the air traffic services to bring the flying machine on the ground safely. These systems are characterized by the following parameters: operating range, parameter accuracy, operating principle, economy, capacity and reliability[18]. Because of the article topic, there are a brief description of selected radio-navigation systems below.

The basic one is Very High Frequency Omnidirectional Radio Range – VOR. It allows to determine the position based on the phase comparison of the signals sent from the earth station[19]. This system works in the following frequency range: 108 - 117.95 MHz[20]. The channel separation is alternated between 50 and 150 kHz for frequencies between 108 and 112 MHz and 50 kHz for frequencies between 112 and 117.95 MHz. In the case

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[12] J. Rajchel, E. Zabłocki, *Port lotniczy*, WSOSP, Dęblin 2009, p. 55-56.
[13] The Annex 14 to the Convention …, p. 1-3.
[14] The National Civil Aviation Security Program, 31 of July 2012, § 71a.
[15] Commission Regulation (EU) 2015/1998 of 5 November 2015 laying down detailed measures for the implementation of the common basic standards on aviation security, Annex, point 12.2
[16] Ibidem, point 12.8.
[17] The National Civil …, §71.
[18] J. Ćwiklak, A. Fellner, H. Jafernik, K. Kusek, R. Fellner, *Wykonywanie lotów według IFR*, Wydawnictwo Politechniki Śląskiej, Gliwice 2014, p. 131-132.
[19] The VOR emits two signals: one called variable phase with f = 30Hz and next one called reference signal with f = 9960 Hz. The difference between signals phases is variable and proportional to the azimuth (Source: own work).
[20] I. Moir, A. Seabridge, *Civil Avionics Systems*, Professional Engineering Publishing, London 2003, p. 147.

of airports, there are Terminal VOR – TVOR which range of operation is between 35 and 50 kilometers. It allows to make non-precision approach procedure.

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 allows to calculate speed and expected arrival time to beacon. Currently, DME system is used also as a part of the ILS system which is characterized below. The DME system works in the following frequency range: 960 - 1215 MHz[21].

Mentioned above the Instrument Landing System - ILS allows to make precision approach procedure[22]. In addition, it provides vertical and horizontal position of an aircraft. The ILS consists of three elements: localizer aerial which works between frequency range 108 – 112 MHz, glideslope aerial which works between frequency range 328 – 336 MHz and three beacon markers used to provide information about distance and height of an aircraft in relation to runway threshold (these beacon markers are replaced by the DME system in present times)[23]. There are some disadvantages of the ILS system. The first is high installation costs, the second one - one approach path and the next one is phenomenon of reflection and wave interference. For this reason, there are implemented approach procedures based on satellite systems.

Safe flight operations at airports would not be possible without visual navigational aids. Among others, these aids provide the proper use of such objects. The number of them is enormous. The most common classification consists of five categories[24]: indicators and signaling devices, markings, lights, signs, markers. Due to the number of visuals navigational aids, any negligence or damage can be cause of serious problems in operations at airports.

On the basis of above considerations it is possible to said that safety at airports can be considered in two main areas: the first one is connected to secure operations performed at movement area and the second one refers to handling operations and passenger traffic. Most likely are incidents and aviation accidents caused by error and human or technical failure for the first group. In case of operations realized in the terminal, there are mostly acts of unlawful interference. Some of them are described in the next part of article.

Acts of unlawful interference directed against safety of airports

[21] J. Ćwiklak, A. Fellner, H. Jafernik, K. Kusek, R. Fellner, *Wykonywanie lotów…*, p. 135.
[22] More information: J. Ćwiklak, A. Fellner, H. Jafernik, K. Kusek, R. Fellner, *Wykonywanie lotów…*, p. 136.
[23] Ibidem, p. 136.
[24] The Annex 14 to the Convention …, p. 5-1 – 5-91

According to provisions of Annex 17 to the Chicago Convention, acts of unlawful interference mean *acts or attempted act such as to jeopardize the safety of civil aviation and air transport* by for example[25]: unlawful seizure of aircraft in flight, unlawful seizure of aircraft on the ground or forcible intrusion on board an aircraft or at an airport, communication of false information connected to safety at airports, aircraft, personnel or ground facility and many other. As we can see, it is not just the use of forceful means to achieve the intended benefits but also desire to do such an acts, as well as the possession of hazardous materials or equipment at the airport or aircraft board. There are briefly described selected acts of unlawful interference related to airports below.

The first recorded attack on the airport occurred on 10 February 1970. That attack took place in Munich. Three terrorists from the People's Liberation Front of Palestine used machine guns and grenades against El Al Air passengers. As a result of the incident, there were: 1 person killed, 11 injured and terrorists were arrested by police[26]. Similar attack was carried out on 17 December 1973 in Rome. There were killed 31 people[27]. More tragic attacks occurred 12 years later at airports in Vienna and Rome. During these attacks 16 people were killed and 117 were seriously injured[28]. The very bloody attack took place in Domodiewo on 24 January 2011. The suicide bomber used an explosive charge filled with metal objects which increased the power of destruction. There were 220 people injured and 39 killed as a result of the explosion[29]. Another example is the use of a bomb by a partially paralyzed man who wanted to enforce compensation for beating him by public officials[30]. Nowadays, there are also acts of unlawful interference. As a confirmation it is possible to describe act of unlawful interference which occurred on 18 March 2017 at the airport Orly near Paris. According to information given to the public opinion, the terrorist took the soldier's gun and then he was shot[31].

On the basis of the described acts of unlawful interference, it can be conclude that there are still acts which surprise with innovation as well as organizational and technological advancement despite of systematic improvement of procedures and systems to ensure

[25] The Annex 17 to the Convention …, p. 1-1.
[26] B. M. Rubin, J. C. Rubin, *Chronologies of Modern Terrorism*, New York 2008, p. 186.
[27] J. Laskowski, *Terroryzm lotniczy – charakterystyka* zjawiska, Studia Humanistyczno – Społeczne, Lublin 2013, p. 151.
[28] Ibidem, p. 151.
[29] http://www.tvn24.pl/0,11158,,,zamach-na-lotnisku-domodiedowo,raport.html, access: 04.11.2016.
[30] http://www.gazetaprawna.pl/artykuly/956067,ataki-na-lotniskach-w-ostatnich-latach.html, access: 07.04.2017.
[31] http://www.rmf24.pl/fakty/news-francja-napastnik-byl-uzbrojony-krzyczal-ze-jest-gotow-umrze, nId,2370612, access: 22.03.2017.

an adequate level of safety at airports. These acts are not characteristic only for chosen period of time but for almost the entire history of aviation development.

The level of safety at airports

This part of the article is based on research done by the empirical research method called questionnaire. The purpose of this research was to gain information connected to safety at airports in Poland from passengers point of view. There were 67 respondents including 41 women and 26 men. The vast majority of respondents, means 48 persons (71.6%) have higher education and the rest 19 (28.4%) are secondary. What is more, 64 respondents (95.5%) are between ages 20 and 39 and respectively one person belong to the following age ranges: 0 - 19 years, 40 - 59 years, 60 years and more.

The survey questionnaire contained 15 questions. According to considered topic, there are presented only the most important answers below.

39 respondents (58,2 %) claimed they travel by aviation transport up to twice a year, 15 people (22,4 %) do it 2 - 6 times a year, 10 people (14,9 %) travel 6 - 12 times a year and 3 people (4,5 %) declared they use aviation transport more than 12 times a year (Fig. 4).

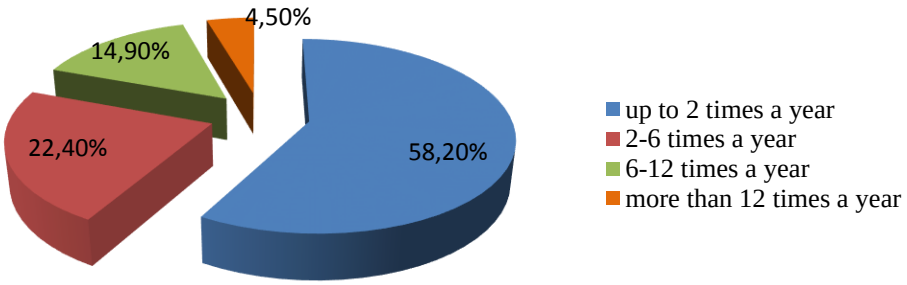

Fig. 4 The percentage of answers about the frequency of travel by aviation transport. Source: own work.

More than half of respondents, it means 54 people (80,6 %) claimed they feel safe at airports in Poland. 8 people (11,9 %) answered negatively, 4 people (6%) answered they rather feel safe and 1 person (1.5%) could not answer this question. These answers present a high level of safety at airports in Poland.

The answers to the question related to the security and alert systems used at Polish airports was not satisfactory because only 38 respondents (56.7%) believe that the security and alert systems used at Polish airports are sufficient to ensure safety. Next 8 people (11.9%) answered in opposite way and 21 respondents (31.3%) could not answer unequivocally.

As we can see, nearly one third of the respondents were unable to provide a clear answer. This may be caused by lack of awareness among passengers about potential hazards at airports.

The vast majority of respondents, it means 50 respondents (74,6 %) answered the security procedures fulfilled their expectations, 7 people (10.4%) responded negatively and the remaining 10 (14.9%) could not answer at this question. Results at this level presented the correctness and effectiveness of the security procedures used at Polish airports.

Only 4 people (6 %) responded they met threat situation at an airport in Poland caused by deliberate human activity. There were for example negative behavior of aggressive or alcoholic passengers or evacuation of Warsaw Chopin Airport as a result of a false telephone alarm. The rest 64 respondents (94 %) did not meet any threat situation at the airport.

It is necessary to add that 40 respondents (59,7 %) claimed airports in Poland can become the target for terrorist attack. Their answers were motivated by migrants of Islamic followers or huge concentration of people at airports. Quite a large number of respondents - 25 (37.3%) answered there are not possibility for terrorist attacks at airports in Poland. The remaining 2 respondents (3 %) could not answer at this question. On the basis of that answers it is possible to claim respondents analyze the situation in the world and are aware of the possibility of carry out a terrorist attack anywhere in the world.

Described results are presented below (Table 1).

Table 1 The most important research results.

Considered issue	**Percentage of positive responses**	**Percentage of negative responses**
Do you consider you feel safe at airports in Poland?	80,6 %	11,9 %
Do you consider the security and alert systems used at Polish airports are sufficient to ensure safety?	56,7 %	11,9 %
Do you consider the security procedures fulfilled your expectations?	74,6 %	10,4 %
Have you met threat situation at an airport in Poland caused by deliberate human activity?	6 %	94 %

Do you think that airports in Poland can become the target for terrorist attack?	59,7 %	37,3 %

Source: own work.

There was also a question related to areas which require special protection from passengers point of view. There were mentioned eight areas, every respondent had to choose three of them (Fig. 5).

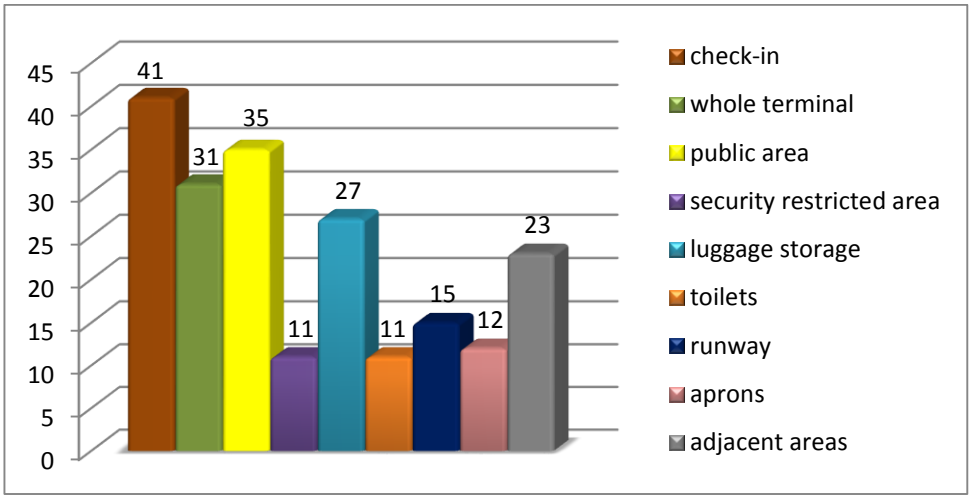

Fig. 5 Summary of responses related to areas which require special protection from passengers point of view. Source: own work.

As it is presented above at Fig. 9 most of respondents pointed check-in places (41 person), public area (35 person) and whole terminal (31 person). On the other hand, the least respondents pointed aprons (12 person), the security restricted area (11 person) and toilets (11 person).

The presented research results are the basis to said that according to passengers point of view provided level of safety at airports in Poland is high. As it is written above, 80,6 % respondents feel safe at considered places. Unfortunately only 56,7 % respondents answered the security and alert systems used at Polish airports are sufficient to ensure safety. Because of that, there should be taken necessary measures to improve the quality of control. What is more, we have to remember people who commit crimes have unlimited imagination so it is necessary to implement procedures aimed for identification and counter new threats.

Conclusion

On the basis of described considerations, it is possible to claim airports are complex objects. Threats can occur in any area associated with these objects.. It is necessary

to remember that this article contains outline of issues related to threats at airports. Depth analysis of this subject requires extensive theoretical and empirical researches. These kind of researches have to be done to precise understand complexity of airports, its infrastructure and number of possible threats.

There is realized purpose of this article, it means that author characterized airports in terms of possible threats. It was done by characterization of airport infrastructure and selected acts of unlawful interference committed at airports. There are also presented results of the research connected to consider topic. According to research 59,7 % of respondents claimed that airports in Poland can become the target for terrorist attack. Because of that, it is necessary to develop security systems at airports, as a result of technological development and increasing number of threats. To improve level of safety and security as well, it is very important to increase public awareness in the discussed matter because a conscious passenger is an excellent source of information for security services.

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