

# THE AIRPORT AS A THREAT-PRONE FACILITY

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## 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.

The purpose of this article is the characteristics of airports in terms of possible threats. To accomplish this, the most important elements of airport infrastructure are characterized in the first part, which is followed by a presentation of selected acts of unlawful interference committed at airports. The last section of the paper contains most important results of the research regarding safety at airports in Poland from the passenger's point of view.

**Keywords:** 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 for people and goods between remote locations around the globe. Due to the proximity of road and rail transport, airports are exposed to an 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<sup>1</sup> and security<sup>2</sup> requirements. Due to the vast array of threats, safety and security procedures are a great challenge for security services. It is caused by the necessity to monitor a large area consisting of a terminal, movement area and adjacent areas.

This article has been developed to examine issues related to threats at airports. It would not be possible without a characterization of selected acts of unlawful interference committed against airports. Moreover, the results of research on terrorist threats for airports will be presented.

## CHARACTERISTIC OF AIRPORTS

Airports are objects with a complex structure. Because of that, these places should be considered and analyzed in a 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

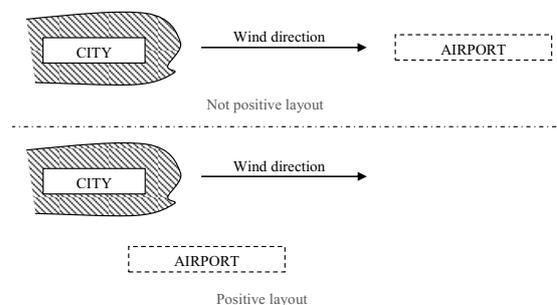
1 Safety is defined as “the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management” (Source: *Safety Management Manual (SMM)*, ICAO 2013, p. 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, pp. 1-2.).

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 a difference between the following concepts: the airport, the aerodrome, the airstrip. The airport is an aerodrome used for commercial flights<sup>3</sup>. According to the 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<sup>4</sup>. The airstrip is an area on land, water, or other surface, which can be wholly or partly used to take off or land, either on land or on water<sup>5</sup>. As we can see, the airport is a broader term, than the aerodrome.

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



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

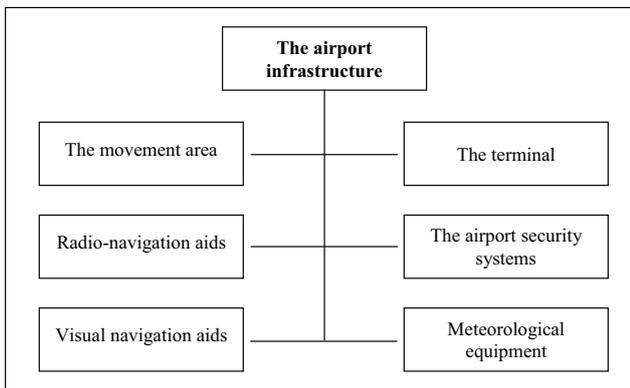
3 *The Polish Aviation Law*, article 2, point 17.

4 *The Polish Aviation Law*, article 2, point 4.

5 *The Polish Aviation Law*, article 2, point 5.

Moreover, the ground used for airports should not be of the highest quality due to high purchase costs. What is more important, it cannot be situated on wetlands, because such soil makes it difficult to maintain the movement area in proper condition and usable readiness. The 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.

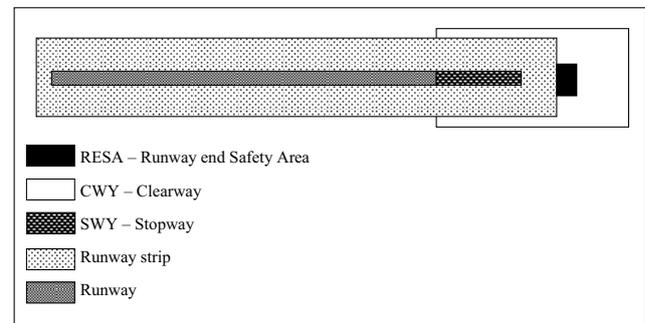


**Fig. 2** The airport infrastructure. Source: own work

The terminal is a building designed for handling and checking-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<sup>6</sup>, which is considered as the most important risk zone. Among others, there are food courts, a chapel, mother and baby room, the first aid point, and the information point in the terminal. Terminal marking is essential for safety. 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 for taking off, landing, and taxi (excluding aprons)<sup>7</sup>. It consists of the landing area (Fig. 3) and taxiways. The landing area is designed for taking off and landing<sup>8</sup>. The most important element is the runway strip<sup>9</sup> that includes the runway<sup>10</sup>. Besides the elements listed above, the landing

area is composed of such elements as: the Stopway – SWY, the Clearway – CWY, and the Runway End Safety Area – RESA. Of course, the number and location of runways, taxiways and aprons depend on the 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<sup>11</sup>. Taxiways are subject to specific requirements. The most important are the capacity and width adequate for the runways, and as many as possible straight segments to allow aircraft sufficient speed. Taxiways should be also seen from the air traffic control tower<sup>12</sup>.

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

The airport security equipment is the key to prevent unlawful acts in civil aviation. These equipment is tested and the result of test is recorded in the internal documentation<sup>14</sup>. The airport security facilities include for example<sup>15</sup>: 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. It is also acceptable to use new technologies during perform security checks. This is possible when several conditions are fulfilled<sup>16</sup>. 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<sup>17</sup>.

A significant part of the airports are radio-navigation aids. Thanks 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

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, pp. 1-3).

7 *The Annex 14 to the Convention of International Civil Aviation*, Aerodromes, ICAO 2009, p. 1-6.

8 *The Annex 14 to the Convention of International Civil Aviation*, Aerodromes, ICAO 2009, 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 of International Civil Aviation*, Aerodromes, ICAO 2009, 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 of*

*International Civil Aviation, Aerodromes*, ICAO 2009, p. 1-7).

11 *The Annex 14 to the Convention of International Civil Aviation*, Aerodromes, ICAO 2009, pp. 1-7, 1-8.

12 J. Rajchel, E. Zabłocki, *Port lotniczy*, WSOSP, Dęblin 2009, pp. 55-56.

13 *The Annex 14 to the Convention of International Civil Aviation*, Aerodromes, ICAO 2009, pp. 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 Commission Regulation (EU) 2015/1998 of 5 November 2015, Annex, point 12.8.

17 *The National Civil Aviation Security Program*, 31 of July 2012, §71.

to bring the flying machine safely on the ground. These systems are characterized by the following parameters: operating range, parameter accuracy, operating principle, economy, capacity and reliability<sup>18</sup>. Due to the purpose of the article, there is a brief description of selected radio-navigation systems below.

The basic one is the 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<sup>19</sup>. This system works in 108-117.95 MHz frequency range<sup>20</sup>. 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 of airports, there are Terminal VOR – TVOR, which operation range is between 35 and 50 kilometers. It allows to carry out a non-precision approach procedure.

The next system is called the 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, the 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<sup>21</sup>.

The mentioned above the Instrument Landing System – ILS allows to carry out a precision approach procedure<sup>22</sup>. It also is able to provide a vertical and horizontal position of the 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 the distance and height of the aircraft in relation to the runway threshold (nowadays these beacon markers are replaced by the DME system)<sup>23</sup>. 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 the phenomenon of reflection and wave interference. Because of that approach procedures based on satellite systems are implemented.

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<sup>24</sup>: 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 the above considerations it is possible to say that safety at airports can be considered in two main areas: the first one is connected to the security of operations performed at movement area, and the second one refers to handling operations and passenger traffic. Most likely, incidents and aviation accidents are caused by an error, a human or technical failure, and they belong to the first group. In case of operations carried out in the terminal, there are mostly acts of unlawful interference. Some of them are described in the next section of article.

### ACTS OF UNLAWFUL INTERFERENCE DIRECTED AGAINST SAFETY OF AIRPORTS

According to the 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<sup>25</sup>: 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 a will to perform such acts, as well as the possession of hazardous materials or equipment at the airport or the board of the aircraft. Selected acts of unlawful interference related to airports are briefly described 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. In result of the incident, one person was killed, 11 were injured, and the terrorists were arrested by police<sup>26</sup>. A similar attack was carried out on 17 December 1973 in Rome. 31 people were killed<sup>27</sup>. More tragic attacks occurred 12 years later at Vienna and Rome airports. During these attacks 16 people were killed and 117 were seriously injured<sup>28</sup>. 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<sup>29</sup>. Another example is the use of a bomb by

18 J. Ćwiklak, A. Fellner, H. Jafern timer, K. Kusek, R. Fellner, *Wykonywanie lotów według IFR*, Wydawnictwo Politechniki Śląskiej, Gliwice 2014, pp. 131-132.

19 The VOR emits two signals: one called variable phase with  $f = 30\text{Hz}$  and next one called reference signal with  $f = 9960\text{Hz}$ . 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.

21 J. Ćwiklak, A. Fellner, H. Jafern timer, K. Kusek, R. Fellner, *Wykonywanie lotów według IFR*, Wydawnictwo Politechniki Śląskiej, Gliwice 2014, p. 135.

22 More information: J. Ćwiklak, A. Fellner, H. Jafern timer, K. Kusek, R. Fellner, *Wykonywanie lotów według IFR*, Wydawnictwo Politechniki Śląskiej, Gliwice 2014, p. 136.

23 J. Ćwiklak, A. Fellner, H. Jafern timer, K. Kusek, R. Fellner, *Wykonywanie lotów według IFR*, Wydawnictwo Politechniki Śląskiej, Gliwice 2014, p. 136.

24 *The Annex 14 to the Convention of International Civil Aviation, Aerodromes*, ICAO 2009, pp. 5-1 – 5-91

25 *The Annex 14 to the Convention of International Civil Aviation, Aerodromes*, ICAO 2009, 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-Spoleczne* 7, Lublin 2013, p. 151.

28 J. Laskowski, „Terroryzm lotniczy – charakterystyka zjawiska”, *Studia Humanistyczno-Spoleczne*, Lublin 2013, p. 151.

29 J. Nowak, „Zamach na lotnisku Domodiewo”, *TVN24*, retrieved from: [http://www.tvn24.pl/0,11158,,zamach-na-lotnisku-domodiewo,raport.html,\(20.10.2017\).](http://www.tvn24.pl/0,11158,,zamach-na-lotnisku-domodiewo,raport.html,(20.10.2017).)

a partially paralyzed man who wanted to enforce compensation for beating him by public officials<sup>30</sup>. Nowadays, acts of unlawful interference occur as well. As a confirmation of that fact, one may describe the act of unlawful interference that took place on 18 March 2017 at the Orly airport near Paris. According to the information given to the public opinion, the terrorist took a soldier’s gun and then he was shot<sup>31</sup>.

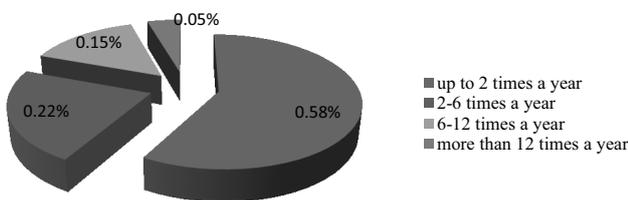
On the basis of the described acts of unlawful interference, it can be concluded that there are still acts which surprise with innovation, as well as organizational and technological advancement in spite of systematic improvement of the procedures and systems to ensure an adequate level of safety at airports. These acts are not characteristic only for the 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 the research carried out with the use of the empirical research method called questionnaire. The purpose of this examination was to gain the information related to safety at airports in Poland from the passenger’s point of view. There were 67 respondents, 41 women and 26 men. The vast majority of the respondents, i.e. 48 people (71.6%) have higher education and the rest 19 (28.4%) are high school graduates. 64 respondents (95.5%) are between ages 20 and 39, and respectively one person belongs to the following age ranges: 0-19 years, 40-59 years, 60 years and more.

The survey questionnaire contained 15 questions. The results presented below are the most relevant for this analysis.

39 respondents (58.2%) claimed they travel by plane 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 three 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 the respondents, i.e. 54 people (80.6%) claimed they feel safe at airports in Poland. Eight people (11.9%) answered negatively, four people (6%) an-

swered they feel rather safe, and one 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 eight 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 a lack of awareness among passengers about potential hazards at airports.

The vast majority of respondents, i.e. 50 respondents (74.6%) answered that the security procedures fulfilled their expectations, seven people (10.4%) responded negatively, and the remaining 10 (14.9%) could not answer at this question. The results at this level presented the correctness and effectiveness of the security procedures used at Polish airports.

Only four people (6%) responded that they had encountered 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 experience any threat situations at the airport.

It is necessary to add that 40 respondents (59.7%) claimed the airports in Poland can become a target for a terrorist attack. Their answers were motivated by the presence of Muslim migrants or a large concentration of people at airports. Quite a large number of respondents – 25 (37.3%) answered that there are not possibilities for terrorists to attack airports in Poland. The remaining two respondents (3%) could not answer this question. On the basis of these answers it is possible to claim that respondents analyze the situation in the world and are aware of the possibility of a terrorist attack to be carried out anywhere in the world.

The described results are presented below (Table 1).

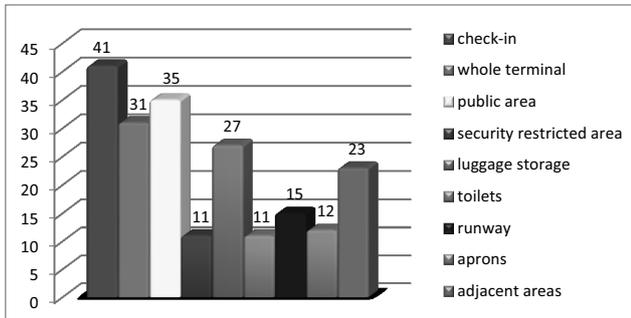
**Table 1** The most important research results.

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.

30 „Kalendarium: Ataki na lotniskach w ostatnich latach”, *Gazeta Prawna* 29.06.2016., retrieved from: <http://www.gazetaprawna.pl/artykuly/956067,ataki-na-lotniskach-w-ostatnich-latach.html>, (07.04.2017).  
 31 „Francja: Napastnik był uzbrojony. Krzyczał, że jest gotów umrzeć za Allaha”, *RMF24* 18.03.2017., retrieved from: [http://www.rmf24.pl/fakty/swiat/news-francja-napastnik-by-l-uzbrojony-krzyczal-ze-jest-gotow-umrze,nId,2370612](http://www.rmf24.pl/fakty/swiat/news-francja-napastnik-by-l-uzbrojony-krzyczal-ze-jest-gotow-umrze-nId,2370612), (22.03.2017).

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



**Fig. 5** Summary of responses related to areas which require special protection from the passenger's point of view. Source: own work.

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

The presented research results are the basis to say that according to the passengers' point of view the provided level of safety at airports in Poland is high. As it is written above, 80.6% respondents feel safe there. Unfortunately only 56.7% respondents believed that the security and alert systems used at Polish airports are sufficient to ensure safety. Because of that, necessary measures to improve the quality of control should be undertaken. Furthermore, we have to remember that 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 the described analyses, it is possible to claim that airports are complex objects. Threats can occur in any area within these objects. It is necessary to remember that this article contains an outline of issues related to threats at airports. An in-depth analysis of this subject requires extensive theoretical and empirical research. This kind of researches has to be done to precisely understand the complexity of airports, their infrastructure and a number of possible threats.

The purpose of the article has been carried out – the author characterized airports in terms of possible threats. It was done by providing a characteristics of the airport infrastructure and selected acts of unlawful interference committed at airports. The results of the research related

to the considered topic are also presented. According to the research 59.7% of respondents claimed that airports in Poland can become a target for a terrorist attack. Because of that, it is necessary to develop security systems at airports. Another reason is the fact that nowadays we face an increasing number of threats due to a quickly progressing technological development. To improve the level of safety and security, 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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