SELECTED ASPECTS OF RESEARCH REGARDING SAFETY OF HAZARDOUS MATERIALS AIR TRANSPORTATION

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ABSTRACT

Scientific research is fundamental for progress made not only in the field of technology, but also in perceiving the reality that surrounds us, or even increasing the security of our existence. Following article aims to underline the need for research in the area of safety of hazardous materials (Hazmat) air transportation. Its creation does not result from an attempt to confirm something that is commonly known, namely the necessity to conduct research in all areas of science. The authors want to draw attention to narrow but forgotten area of security, associated with rapidly growing branch of air transportation including hazardous materials and various threats related with these. As a result of undertaken analysis of existing risks, the directions in which research should be developed were indicated. Further exploration of those areas of security should lead to identification of additional risks as well as the most effective methods of counteracting them.

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KEY WORDS

Safety, air transport, hazardous materials, Hazmat, research issues.

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Introduction

Current legal regulations require a detailed analysis of their effectiveness in ensuring the safety of air transportation of hazardous materials. Based on a previous worksin the area ofhazardous materials transportationsafety carried out by the International Civil Aviation Organization (ICAO), International Air Transport Association (IATA), United States Department of Transportation (DOT) World Health Organization (WHO) and International Atomic Energy Agency (IAEA) two basic normative documents have been developed. Those include "Technical Instructions for the Safe Transport of Dangerous Goods by Air" (ICAO Technical Instructions), and "IATA Dangerous Goods Regulations" (DGR), introduced by International Air Transport

Association. Across the whole world, air transport of hazardous materials is carried out following the instructions mentioned above, which only specify the procedural provisions of the transport. Direct translation of the extensive (approximately 1,200 pages) ICAO Technical Instructions from English often makes those regulations very ambiguous, and the usage of imprecise terms even further blur the essence of the laws contained within. Nevertheless, the most important concerns regard the procedures included in the operational ICAO Technical Instructions, which in many cases have been limited to indication of the applicable rules of conduct only. On the other hand, the organizational aspects of ensuring the safety of air transport, technical requirements of aircraft and threats posed by transported dangerous materials were omitted. For this reason, it is necessary to prepare periodic research publications, covering not only the entirety of safety issues in the transport of dangerous substances and objects, but above all containing analysis of existing regulations in the aspect of ensuring safety of human health and life and natural environment. Therefore, scientific and journalistic studies of existing regulations including legal acts and other documents treatingabout transportation of hazardous materials are of the highest importance. Such approach will allow not only to indicate a broader spectrum of conditions for the creation of legislation, but will also determine the level of existing legal, organizational, technical and procedural solutions which will minimize existing threats.

Research activity objectives

The main objective of conducted research should focus on diagnosing threats occurring in air transportation of hazardous materials, which in extreme situations may destabilize the security of the state. The outcome of such research should identify factors determining the safety of air transport of hazardous materials and highlight measures to minimize them. Nevertheless, the evolution of currently existing threats and diversity of emerging onesrequire the national security system to be capable of immediate, comprehensive response to emerging threats.It should include activities carried out both local and global scale (across the whole country or even on an international scale). Therefore, existing security system should be constantly transformed in order to be able to monitor and accurately predict potential threats. As a result, in the event of their occurrence, a quick and adequate steps would be undertaken allowing to remove the effects of the incident. The scope of research investigating threats to national security should definitely include possible aircraft incidents involving hazardous materials. It should be noted that the occurrence of an aviation incidents as a result of which biological agents, radioactive substances or chemicals are released to the environment may lead to crisis situations on such a large scale that they will require action by the highest state bodies.

Another reason for undertaking a research analysis of the safety of transporting hazardous materials is the ongoing technical progress in the construction of aircraft, allowing transportation of an increasing number of passengers and payload. Unfortunately, increase in the intensity of air flights can affect the safety of transportation. By creating unlimited possibilities for flights, airspace becomes a place where aeroplane incidents can occur, resulting in a plane crash and fatalities. Considering the issues of ensuring safety in transport, special attention should be paid to the existence of aviation threats related to the transport of hazardous materials. This

is mainly due to the fact that the transport of chemical, radioactive and biological agents by air takes an increasingly important place in the entirety of global air transport [Kucharek, 2016, p. 17].

Research devoted to investigation of threats in the aviation transport of hazardous materials, should attempt to answer the question: *What factors affect the safety of air transportation of hazardous materials and are the actions undertaken sufficient in the situation of a growing threat to national security?*In order to answer mentioned research question it is necessary to achieve several closely related goals:

1. Identification of means through which air transport of hazardous materials could pose a threat for national security.
2. Determination of possibilitythatgiven hazardous materials will be used by terrorist organizations.
3. Analysis of the process of implementing legal regulations in the air transport of hazardous materials.
4. Identification of hazards posed by materials dangerous to the safety of air transport.
5. Recognition of level of security of hazardous materials during air transport.
6. Analysis of the importance of human factor in providing safety of air transportation of hazardous materials.

The comparison of the above objectives should be achieved both in an explanatory and diagnostic manner (indicating gaps being filled). During conducted research, the genesis and essence of described phenomena/processes should be presented and explained, as well as the recommendations required for implementation should be indicated. Resulting recommendations must not only identify existing threats, but should also highlight actions that must be taken to minimize the causes and effects of aviation incidents involving hazardous materials.

Scope of undertaken activities

As a result of analysis of air transportation safety, proposals for undertaking specific actions should primarily concern the introduction of amendments to the next edition of the ICAO Technical Instructions. Amendments should apply to already used instructions, and target, for example, ambiguous, and thus imprecise definition of term *"hazardous materials"* in the air transport of dangerous substances and objects. This is due to the fact that in the literature treating aboutcurrently used legal regulations and procedures significant differences in the determination of hazardous materials can be identified.ICAO Technical Instructions, is the fundamental document regulating the air transport of hazardous materials. It is also a source for scientific, legal and organizational work in Poland. The complexities in the instructions are mainly caused by imprecise translations of Technical Instructions that were previously developed by ICAO, IATA and IAEA. The lack of a clear definition of hazardous materials is a significant problem, not only from the perspective of required linguistic correctness, but most of all it hinders proper understanding of the concepts used, which then may jeopardise safety of transporting hazardous materials.

Required amendments should clarify the interpretation of terms: hazardous materials (HM), toxic industrial chemicals (TIC), mass destruction agents and weapons of mass destruction (WMD). Failure to understand the rules of use and destructive effects of hazardous substances and objects posing threats for man and natural environment, results mainly from qualifying them to separate groups of hazardous materials, which may have a significant impact on air transport safety. A proposal for an equal

treatment of hazardous materials and mass destruction factors should also be presented. In contrast, weapons of mass destruction and toxic industrial chemicals are only subsidiaries of mass destruction factors that are widely used in industrial processes and combat operations. A unique feature of WMD is its production (construction, laboratory work) with a specific purpose, i.e. in order to destroy the living force and equipment of the opponent. In addition, the use of weapons of mass destruction occurs using specialized means of transport.

An important element of research conducted in the field of aviation safety during the transportation of hazardous materials is to investigate the impact of extending the testing period of structures being introduced into civil operation and simultaneously used for air transport of chemicals, radioactive substances and biological agents. Imperfections in their structure are basic drawbacks of aircrafts having a direct impact on flight safety. The majority of design errors are removed at the early testing stage, but "young constructions" are often characterized by high number of defects, emerging even during its commercial operation. An example of the high failure rate of newly constructed aircraft, affecting the safety of passengers and transported cargo, was implementation of Boeing 787 Dreamliner. The first commercial flights of dreamliners often ended with large delays or replacements of aircrafts caused by technical defects. In the initial phase of their operation, most of the problems resulted from the failure of the power system, especially troubles with batteries. Although the planes were undergoing permanent technical production controls, they did not solve the existing problems. An important example presenting threat to passenger safety was September 2013 event when Boeing identification system failed. A Boeing 787 flying to Poland from Canada had to make an emergency landing in Glasgow, where the identified technical defects were removed. Therefore, the use of newly introduced aircrafts for the transport of hazardous materials creates a high probability of aircraft incident. As a result, when analysing incidents including aircrafts recently put into use, additional hazards must be presented in order to achieve the holistic image and properly define risks for the transport of dangerous substances and objects. The resulting risks will result from merging two issues: the very transport of hazardous materials and a large number of defects of newly introduced aircrafts [Kucharek, 2016, p. 65].

Noteworthy is also the indication of hazards associated with the use of hazardous materials by terrorist organizations. These arise from the "benefits" that terrorist organizations can achieve by using airplanes with dangerous materials to make a terrorist attack. Terrorism is currently one of the greatest threats to ensuring security, both in the national, regional and global dimensions. There are currently over 100 definitions of terrorism in current documents and subject literature. This phenomenon is a real threat, as it goes beyond the framework of traditionally understood principles of conducting armed conflicts and emerging crisis situations [Narodowy Program Antyterrorystyczny na lata 2015-2019, 2014, p. 4].The genesis of the term "terrorism", "terrorist" or "act of terror" derives from the Latin word "terror" and means "fear, terrible thing, news" [Kopaliński, 1983, p. 423]. The term "terrorism" is usually identified with events for occurrence of which the organizational structures, ideological ties, strategy or regularity in the implementation of acts of terror (terrorist offenses) are required [K. Wiak, 2014, p. 237].

Therefore, taking into account the societal fear against any contamination from hazardous materials, their use by terrorists would multiply the effect of the attack on many different levels, including: media, psychological, political, social, and even economic. It should be noted that based on past experience regarding the means of destruction used by terrorists to perform attacks, no use of hazardous materials transported by air has been recorded. This does not mean that there will be no aeroplane incidents in the future, which will result in the deliberate crash of the aircraft on board which will contain chemical or radioactive substances or biological infectious agents. The high probability that such a situation may take place in the future causes the necessity of investigating events related to the use of dangerous materials by terrorists. Thus, it is essential to introduce appropriate precautions that would minimize the possibility of terrorist attacks during air transport of dangerous substances and objects.

By analysing recent research works regarding terrorist threat in the transport of dangerous goods by air, it can be concluded that Islamic State's militants are currently one of the major threat to worldwide security. They tend to use terrorist attacks as one of the methods of achieving goals presented by organisations they represent. One of the examples could be the bombing of the Airbus A321 aircraft belonging to Russian company Metrojet, which transported tourists from Sharm el-Sheikh in Egypt to St. Petersburg [Poszukiwania materiałów wybuchowych we wraku samolotu, http://www.rp.pl].Flawed aircraft security procedures at the airport in the Middle East, caused mainly by insufficient financial resources, prevailing corruption and sympathizing of part of society with the ideology of Islamic extremists, significantly increase the possibility of attacks on planes belonging to ISIS fighting countries. One of the countries threatened by attacks is Poland. The policy pursued by Poland government, consisting of supporting actions aimed at resolving conflict situations in the Middle East, undertaken jointly with the United States, is met with great dissatisfaction in some circles of the Arab community. The information appearing in mass media regarding the participation of Polish contingent in the Middle East operation may result in retaliatory actions by terroristic organizations. They perceive Poland as hostile to them, both for political and military reasons. A great influence on the unfriendly perception of Poland is also connected with the cultural and, above all, religious differences between countries. Therefore, there is a high probability that military attacks will be happening not only in countries where our soldiers carry out the tasks entrusted to them, but also on the territory of Poland. The current terrorist threat is increasing due to the lack of state internal borders resulting from Poland's membership in the Schengen area. Within the existing zone, the transport of goods and people is undergoing a very limited control, which greatly facilitates the preparation and subsequent implementation of terrorist actions aimed at state security [Kucharek, Grzela, 2007, p. 39].

Summary

One of the main reasons that should not only encourage, but even force to undertake research into the safety of air transport of hazardous materials, is the fact that these problems are omitted in existing scientific studies. It should be noted that so far no one has tried to comprehend the issue of aviation transport of dangerous substances and objects in the context of air-related phenomena and processes such as: antiterrorist protection and de

fence of airport infrastructure, sanitary and epidemiological conditions of passenger transport and technical solutions used in construction of currently used packaging for transportation of hazardous materials. It should be noted that so far only singular studies have been created in Poland that cover the issues of air transportation of hazardous materials. Existing publications very often only boil down to the presentation of the current qualification of hazardous materials, in addition, they selectively address the problems of used packaging and documentation required for the transport of hazardous materials. Conducted research should systematically fill this gap by identifying both the most important threats at a given time and the actions required for implementation in order to increase safety in the air transport of chemicals, radioactive substances and biological agents.

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