TERRORISM AND NATIONAL INSTABILITY AS THE CURRENT THREATS OF AIR TRANSPORTATION

Abstract
The present transport and logistics are global, therefore there is a need to maintain transportation in every continent of the world. This article presents the main threats of the international air transport connected with the necessity of flying over danger and instable countries which actually constitutes almost a half of the world.

Keywords: air transportation, aviation security, global logistics.

Introduction

Nowadays, aviation is one of the main types of transport. Modern logistics is functioning on a global scale. It requires the need to provide transportation between each of the continents. Every year, thousands of tons of cargo and millions of passengers are carried on intercontinental routes. This applies particularly to maritime transport (mainly cargo), but also to land and air.

At the same time, about half of the countries in the world is currently instable - a major threat there is the risk of an outbreak of social unrest or even a civil war and collapse of the state. Many of these countries are already considered as to be fallen. Crime, corruption and often terrorism, and piracy spread on their territory [9]. The list of the stable countries in the world can be found on the organization „Fund for peace” website (http://fsi.fund-forpeace.org/).

One hundred and seventy-eight countries of the world were taken into account. The most instable state recognized is South Sudan (114.5 instability points, the category of "a very high alert"), and the most stable is Finland (17.8 points - which is the only country in the world that received the category of "very sustainable"). Poland was on 153rd place (39.8 points, category "more stable"). In the same category, were the USA with 158th place (35.3 points). These are the findings of the Fragile States Index 2015 report [9]. While comparing the map of instability with the map of the world's major transport routes, it can be easily seen how many of them are located in dangerous areas.

Threat to civil aviation over dangerous areas of the world

Currently, aviation is one of the main modes of transport in the world and is considered as the safest mean of transport. Its safety depends on many factors including the possibility of destruction of aircraft by armament both air and ground. It is a very specific factor which depends largely on the political situation in the area. In fact, airlines should immediately suspend flights over politically dangerous regions,
however sometimes economic benefits and political factors cause that in such regions civil air connections are maintained. There are also the cases of accidental firing or shooting down communication aircraft in the areas not covered by any armed conflict. Since the beginning of aviation there have been many incidents of opening fire to civil aircraft. In this paper, only the selected examples from the recent history were put under consideration [4].

On September 1, 1983, the most tragic event in the history of aviation concerning the shooting to communication aircraft by the fighter, took place. That day, the Korean Boeing 747-230B of the KAL airline performed a scheduled flight from New York to Seoul with stopover in Alaska (flight KAL007). The planned flight route led over the beacon Bethel and by R-20 airway (marked on the maps in red), only 28 km away from the Soviet Kamchatka. However, for unknown reasons shortly after
the take-off, the Boeing began to veer off course, passing Bethel in more than 20 km and came on to the area of the Soviet military bases between Kamchatka and Sakhalin. At the same time, on the east of Kamchatka, the American RC-135 airplane of the USAF performed a reconnaissance mission and monitored the Soviet missile tests. The RC-135 was, however, about 1500 km from the Boeing KAL. The Soviets assumed, however, that the two planes are the military RC-135. The KAL007 for the first time has been flown over the airspace over Kamchatka and left the sea of Okhotsk. The Soviet fighters then did not manage to catch it. Later, the Korean plane again crossed the border with the Soviet Union and followed in the direction of Sakhalin. This time, the B747 has been intercepted by a pair of the Soviet Su-15 fighters commanded by Maj. Gennady Osipovich whose fighter had a side number 805. The Russians argue that a warning was given as a series of gunfire, but if Sukhoi had no contrail ammunition, the Korean crew were not able see it. In addition, the Su-15 remained behind the Boeing, and not next to it, thus the crew could not see it.

There has been a confluence of the events that proved to be tragic for the KAL. Firstly, the Boeing in a few minutes could leave the space of the USSR which would prevent the Soviets. Secondly, Osipovich’s Su-15 started running out of fuel and the pilot did not inform the Soviet ground station that they are aiming at the civil aircraft (did not do so because nobody asked about it…). After receiving the command from the ground, Osipovich fired two R-98 (the NATO code AA-3 Anab) rockets into the Boeing. First missile guided by infrared passed the goal, but the second guided by radar exploded at the Boeing causing decompression and destroyed 3 of 4 hydraulic systems. After 12 minutes, the burning Boeing crashed into the sea about 37 km west of Sakhalin, killing all 269 people being on-board. At the time of hitting, the Boeing was already a few kilometers outside the USSR [7].

The reasons why KAL007 went off the planned course of the flight are still not known. The investigation has officially eliminated the participation of the aircraft in the espionage mission. Officially, there was a mistake into setting of the autopilot, even though the Russian side and part of the Western experts do not agree with such an opinion. The tragedy of KAL007 flight had other consequences. In 1986, the USA, Japan and the Soviet Union established joint air traffic control over the North Pacific Ocean where the Soviet inspectors gained full access to all civil flight plans. The most important change, however, was the decision of the President Reagan to share the world GNSS satellite navigation system to a wide civilian use, now known as GPS [7].

Many transport aircraft have been also shoot down by a ground-based antiaircraft artillery. For example, in 1978 and 1979, the ZIPRA (Zimbabwe People's Revolutionary Army) terrorists revolutionary organization downed by Striela shoulder-firing missiles (MANPAD -Man Portable Air Defense system) shoot down two Vickers Viscount aircraft belonging to the Air Rhodesia (flight No. 825 and 827). In the first case, some passengers survived the crash, but were murdered by the terrorists on the ground. This took place at the territory of Rhodesia today belonging to Zimbabwe.

On June 27, 1980, the Douglas DC-9 of Aerolinee Itavia airline (flight no. 870) crashed into the Tyrrhenian Sea about 40 minutes after the take-off from Bologna, Italy. Apparently, there was seen an object approaching the plane just before the crash. All 81 people on-board have been killed. This incident is still not clearly explained, however there are indications that it could be mistakenly shot down by the NATO forces.

On February 24, 1985, the research-transport plane Dornier 228 Polar 3 belonging to the Alfred Wegener Institute was shot down by guerrillas of the Polisario Front over the Western Sahara. All three crew members were killed. Polar 3 was on its
way back from Antarctica and took off from Dakar, Senegal to reach Arrecife in the Canary Islands.

On November 6, 1987, the Shorts Skyvan with registration 7Q-YNB of Air Malawi was shot down during a domestic flight from Blantyre to Lilongwe. The plane was shot near the city of Ulongwe in Mozambique. Eight passengers and two crew members were killed.

However, the most well-known case of shooting down communication aircraft by the ground (or water) armament is shooting down the Airbus A300B2-203 with registration EP-IBU of Iran Air (flight IR655) on Sunday, July 3, 1988 [7, 2]. The plane took off at 10.17 a.m. from Bandar Abbas in the southern Iran, heading to Dubai. There were sixteen crew members and two hundred seventy-four passengers on board. The Airbus took off with 27 minutes delay. The flight took place at the altitude of 4300 meters above the Strait of Hormuz in international airway Amber 59 (A 59) with a width of 35 km, leading almost a straight line from the take-off point to the destination airport. The entire flight was to last about 30 minutes. Strait of Hormuz was patrolled at that time by the American cruiser USS Vincennes (Ticonderoga type) equipped with the AEGIS air defense system. The ship was commanded by a Captain William C. Rogers III. The unit patrol took place as a part of the Operation Earnest Will designed to protect Kuwaiti oil tankers from the attack of Iraqi or Iranian forces. As it is known, these two countries have been in state of an absolute war for years. In the morning, on July 3, the USS Vincennes influenced Iranian territorial waters in order to pursue Iranian boats. The action was performed in accordance with the international maritime law. These units fired earlier in the American helicopter in the Iranian airspace. At about 10.47 a.m. a radar of the USS Vincennes detected an approaching object that was mistakenly identified as an Iranian fighter F-14 Tomcat. The mistake was supported by the fact that the airport which the Airbus took off, was also used as a base for the F-14, and as mentioned, the Airbus took off with almost half an hour delay (so it was not in accordance with the filled flight plan). The Americans maintain that before opening fire as many as 11 times, they tried to establish communication with the approaching plane. The report of the International Civil Aviation Organization (ICAO) says that Americans invoked its crew on the military frequency seven times and three times on civilian frequency, calling an unidentified aircraft flying at a speed of 350 knots.

The recorder (black box) of the A300 has confirmed that the Iranian crew took the last three messages, but admitted that they are directed to the Iranian maritime reconnaissance aircraft P-3 Orion which previously operated in the area. A few seconds before opening fire, A300 crew exchanged the correspondence in English with the traffic control in Bandar Abbas. Americans do not hear it because they did not have that frequency set on the receivers. The American cruiser had also difficulties in contacting with the Iranian air traffic control, which was due to not only a tense situation between Iran and the US, but also the lack of adequate training in this regard. Americans had in mind the attack of Iraqi Mirage F1 fighter, which a year earlier was hit by Exocet missile American frigate USS Stark, where 37 sailors were killed and 21 were injured. Soaring of the Airbus was interpreted by Americans as preparation for firing an air-sea missile. At about 10.54 a.m., the commander of the USS Vincennes ordered to fire two SM-2MR missiles. Both hit the Airbus flying at the altitude of 4100 meters at a distance of 14 km from the cruiser, killing all people on board.

The incident caused a serious conflict between the US and Iran, and the Soviet Union, which requested the UN resolution condemning the US actions in the Persian Gulf. On October 24, 1988, the USS Vincennes returned to the United States, where the
crew of the cruiser was greeted as heroes and awarded (including the officer responsible for coordination of fire). In 1996, the US government made a decision to pay compensation to the government of Iran in the amount of 61.8 million dollars for the death of 248 citizens of this country.

Nevertheless, the Americans refused to pay compensation for the destroyed aircraft ($30 millions). The US government also announced that the payment of compensation for the victims of the incident is an act of goodwill, not an admission of guilt. This payment has completed its investigation of the International Court of Justice, where Iran accused the US of the incident. Until now, the issue remains controversial. For example, in 2003, the NGO ISSA (International Association of Strategic Studies) decided that placing the ship with AEGIS system in the area of operating communication aircraft is irresponsible and the behavior of the American captain as being aggressive.

Ninety cases of intentional downing of civilian communication aircraft occurred in local conflicts. For example, on September 21, 1993, Tu-134A of Transair Georgia airline flew from Sochi in Russia to Sukhumi in Georgia and was shot down during landing by pro-Russian Abkhazian separatists. The shoulder missile (MANPAD) was fired from a boat. Five crew members and twenty - two passengers have been killed. One day later, Abkhaz separatists downed the Tu-154B of Orbi Georgian Airways approaching for landing. The plane was burned at the runway. Eight out of twelve crew members and one - hundred out of one – hundred and twenty passengers have been killed.

Another example of this kind was the incident of October 10, 1998, when the Boeing 727 belonging to the Lignes Aeriennes Congolaises was flying from Kindu to Kinshasa in Congo. Shortly after the take-off, the Boeing was hit by Striela MANPAD. All passengers and crew have been killed.

![Fig. 2. The 9K34 Striela MANPAD (Man Portable Air Defense system) rocket launcher (USA/NATO code: SA-7 Grail)](image)

Source: [11].

A spectacular case was on November 22, 2003 and concerned the Airbus A300B4-203F (OO-DLL) belonging to the European Air Transport managed by a famous transport company DHL. A300 performed a flight from Baghdad to Bahrain. Only three crew members and cargo were on board. A few minutes after the take-off at about 9.03 a.m. of the local time, the Airbus has been hit at a height of 2,450 meters by a MANPAD missile 9K34 Striela 3. The rocket hit a trailing edge of the left wing. The attack has been performed by a small group of fedayeen who were accompanied by a French journalist, and perhaps her presence (and consequently, the ability to appear
in the media) provoked the attack. The explosion of the rocket damaged one of the fuel tanks and caused the fire. It is interesting that it did not explode, paradoxically because it was almost full (vapour is the main cause of firing and exploding of fuel, but there was no enough space to produce so much vapour in almost full tanks). There has been a leak of hydraulic fluid, resulting in a loss of hydraulic power steering systems. After 10 minutes, the crew managed to regain some control over the plane and mechanically lower the landing gear. The first landing attempt was unsuccessful because the plane was too high. The second trial was successful and the Airbus landed. During taxing after touchdown, A300 went off the runway and stopped outside the airport. The evacuation of the crew was very difficult because the plane was on a minefield, however, all were rescued.

The most famous incident is a disaster of the Boeing 777 (9M-MRD, flight MH17) of the Malasyan Airlines which took place on July 17, 2014 [3, 1] when 283 passengers and 15 crew members have been killed. The examination of the wreckage revealed that the Boeing had been hit by an anti-aircraft missile. Officially, the guilty people were not indicated, but most likely the plane was shot down by the Russian separatists set 9K37 Buk M1 (SA-11 Gadfly), which service incorrectly identified the target as the Ukrainian military An-26. One of the evidence was the post on the Twitter of a separatist leader Igor Strielkov who praised the alleged shooting down of another Antonov. This entry quickly disappeared from the network. This issue requires some explanation. It is probable that the majority of the blame lies on the separatists’ side as there are many indications that they shot down the Boeing. However, it can be also asked who let that the Boeing be there. According to the common sense (and civilized principles) airspace over the area covered by the armed conflicts should be closed immediately after the start of fights, regardless of the type of armament at a disposal of the warring factions. This space is controlled by the Ukrainian air traffic services. Why was not this done?

The Ukrainian side has explained that there was no need to stop civilian air traffic there because the separatists possessed only a light anti-aircraft equipment which has not been able to reach a high flying aircraft. Such opinions cannot be serious because advanced missile sets with bigger ranges could be delivered from Russia within a few hours every day. The problem is that Ukraine is still very dependent on Russia for a gas supply reason (and not only). Therefore, despite the intense fights, the Ukrainian government’s operations in the eastern regions still are not defined as a war, but officially as an internal stabilization operation. Closing the airspace over eastern regions would be an act of admitting to the world that Ukraine does not completely control the situation and that the real war is conducted there. The space was closed for civilian air traffic after the incident with the Malaysian B777. Even before, the flights in that area have been appealed by airlines from the European Union and the United States.

**Methods of civilian aircraft protection against missiles**

The means to mislead enemy missiles have been known in military aviation for a long time. These include mainly board or suspended pods emitting energy of the jamming systems as well as rocket flares and chaffs (aluminum strips). They are jamming the flying missiles homing infrared systems (flares) and radar systems (aluminum strips). At present, the civilian aviation is also interested in such devices.

The idea of arming civilian means of transport is not new. In the history of transport, ship were often armed for defense. Equipping civilian ship on weapons on a larger scale was abandoned only in the 20th century. The current threat of instability
in many countries of the world will, however, need to return to this concept, at least to some extent which currently also applies to aviation.

Until now, the attempts to protect communication aircraft operating in the troubled areas through have been made mainly by ad hoc methods. In the 1980’s, the Soviet communication aircraft during landing in Afghanistan were escorted by military helicopters which fired flares all the time during landing. It also establishes a very steep approach path for the landing plane, to decrease time of flight into a potential range of fire as short as possible. The shoulder missile (MANPAD) operators could be located close to the airport. Such methods are also used in the current times. However, these are not the methods appropriate as being standard for civil aviation. Designers all over the world are trying to find cheaper and more efficient solutions. Currently, several airlines are already using on-board systems of jamming (or perhaps destruction of) missiles. Their disadvantage is a high price of 1 to 3 million USD per a single set [5]. The leader in this field is Israel which has equipped the aircraft of El Al airline in such systems for years. The company Rafael started working on such systems in 2002. The Rafael Britening system has sensors for detection of incoming missiles by detecting the changes of heat in the environment. Then, the Britening system generates a powerful beam of light that interferes the guiding system of missiles [5, 6]. It can protect guided missiles against light especially during take-off and landing. The system works automatically. The Rafael Britening system has been developed on the basis of the military helicopters protection system Aero-Gem. It costs not much than 1 million USD. Another similar system is the Israeli IAI / Elta Flight Guard. It functions as the previously described Britening, except that the Flight Guard is detecting missiles using a Doppler radar. The IAI says that the Flight Guard has the efficiency of 99%, and is able to operate in any weather conditions. The system weighs 60 kg with the dimension of 306 x 361 x 207 mm and uses 500 watts of energy [8].

Fig. 3. Rafael Britening system: 1 – detection of an attack, 2 – rocket jamming

Source: [8].
Another Israeli system of this type is the C-MUSIC. Defence24.com portal reports [10]: “The company Elbit Systems announced the installation of anti-missile system C-Music on the first passenger aircraft belonging to the Israeli airline El Al. Music or Multi Spectral Infrared Countermeasures is a system that protects aircraft from guided infrared missile fired with hand-held launcher. Its action depends on detecting the firing of a missile, and blinding or the destruction of its infrared tracking head by a strong laser. Version C-Music is designed to protect large communication aircraft. The entire system is housed in a gondola installed below the fuselage. Due to the growing threat of civil aircraft by hand-held launchers held by the terrorist formations, interest in this type of systems has been growing since the beginning of the century, especially after the incidents in Kenya in 2002. The Israeli airline El Al are among the most threatened by terrorist attacks and therefore introduced a program to protect their machines under the name "Sky Shield". Under this program, we installed the first system C-Music on the Boeing 737-800 aircraft belonging to the airline".

Fig. 4. C-MUSIC system on the Boeing 737-800 of the El Al airlines

Source: [8].

Fig. 5. Northrop Grumman Guardian on MD-11 of FedEx

Source: [6].
Another country that develops on-board anti-missile systems for a civil aircraft is the USA. On December 21, 2008, the Department of Defense signed a contract with the BAE Systems for this type of systems. Under this contract, anti-missile systems were to be installed on the aircraft of the American Airlines flying between New York and California [5]. The similar Guardian system has been also developed by Northrop Grumman. It is a kind of a civil variant of the military system AN / AAQ-24 (V) Nemesis. Guardian can be placed almost anywhere on fuselage and increases fuel consumption by 3 to 4% [5].

Conclusion

As shown by the above examples, the risk of destruction of civil communication aircraft by means of combat still occurs. In the case of conflicts taking place in third world countries where the opponents are often unspecified terrorist groups, the main risk is the widespread use of lightweight MANPAD (Man Portable Air Defense system) shoulder rocket launchers, usually Striela type (SA-7). Terrorists of this kind are the only ones whose aim is to destroy an aircraft and maximizing the number of victims, to increase a media effect.

The cases of shooting to civil aircraft by heavier vehicle based rockets which took place in 21st century, can be classified rather as tragic mistakes, the effects of negligence, not as the intentional acts. However, it must remembered that the possibility of gaining such advanced systems by terrorist groups is also possible. Heavy missile systems require experienced crew but black market is full of unemployed soldiers and officers form former armies of S. Hussein, M. Kaddafi or others.

The increasing number of the world countries being in a crisis or a war can lead to the increase of the number of potential attacks on aircraft communication and tragic mistakes similar to those described in this paper. This causes that instability in many countries and terrorism connected with it may be a primarily threat of transcontinental air transport (as well as the global transport in general) in the 21st century.

Nowadays, modern means of transport (especially aircraft) are already so advanced that the risk of a technical failure is minimal (especially in air transport). However, there is still no effective solution to protect transport against acts of an unlawful interference. For this reason, it would be necessary to stabilize the political, social and economic situation in the worrying regions of the world, and it is still unfortunately a long process to go through. Currently, the only solution is the use of on board self-defense systems on communication aircraft. Undoubtedly, such systems will be developed in the 21st century.

BIBLIOGRAPHY


On-line resources: