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**КАФЕДРА ПІДТРИМАННЯ ЛЬОТНОЇ ПРИДАТНОСТІ ПОВІТРЯНИХ**  
**СУДЕН**

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**КВАЛІФІКАЦІЙНА РОБОТА**  
**(ПОЯСНЮВАЛЬНА ЗАПИСКА)**  
**ЗДОБУВАЧА ОСВІТНЬОГО СТУПЕНЯ**  
**«МАГІСТР»**  
**ЗА ОСВІТНЬО-ПРОФЕСІЙНОЮ ПРОГРАМОЮ**  
**«ТЕХНІЧНЕ ОБСЛУГОВУВАННЯ ТА РЕМОНТ ПОВІТРЯНИХ СУДЕН І**  
**АВІАДВИГУНІВ»**

**Тема: «Методи та засоби підтримки належного рівня якості в системі авіаційної безпеки експлуатаційного підприємства»**

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AIRCRAFT CONTINUING AIRWORTHINESS DEPARTMENT**

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« \_\_\_\_ » \_\_\_\_\_ 2021

**MASTER DEGREE THESIS  
(EXPLANATORY NOTE)  
GRADUATE OF EDUCATIONAL DEGREE  
"MASTER"  
FOR EDUCATIONAL-PROFESSIONAL PROGRAM  
"MAINTENANCE AND REPAIR OF AIRCRAFT AND AVIATION ENGINES"**

**Theme: «Methods and means of maintaining the appropriate level of quality in the aviation security system of the operating enterprise»**

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## NATIONAL AVIATION UNIVERSITY

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### Graduate Student's Degree Work Assignment

SHESHENIA PAVLO SERHIYOVYCH

1. The thesis theme: «**Methods and means of maintaining the appropriate level of quality in the aviation security system of the operating enterprise**» approved by the Rector's order of October 11, 2021 № 2196/CT.
2. Period of accomplishing of the Graduation Project: since October 25, 2021 until December 31, 2021.
3. Initial data for the project (thesis): literature data on aviation security systems of aviation enterprise and their control methods.
4. The content of the explanatory note: introduction about principal activities and present condition of aviation security systems implemented in different aviation enterprise and ways of improving quality control of aviation security in the sphere of passenger and cargo handling.
5. The list of mandatory graphic materials: shows the statistics of aviation security system condition through the number of accidents and incidents and passenger demand for aviation services.

## 6. Time and Work Schedule

#	Stages of Graduation Project Completion	Stage Completion Dates	Remarks
1	Task receiving, selection of material	25.10.21– 31.10.21	Done
2	Analytical part, detailed analysis of factors influencing on aviation security system of the aviation enterprise	02.11.21-09.11.21	Done
3	Project part	12.11.21-18.11.21	Done
4	Operational part	19.11.21-24.11.21	Done
5	Labor precautions	25.11.21-26.11.21	Done
6	Ecology	27.11.21-28.11.21	Done
7	Arrangement of explanatory note	29.11.21-06.12.21	Done
8	Preparing for project defend	13.12.21-20.12.21	Done

## 7. Advisers on individual sections

Section	Adviser	Date, Signature	
		Assignment Delivered	Assignment Accepted
<i>Labour precaution</i>	Ph. D., Assoc. Prof. V. V. Kovalenko		
<i>Environmental protection</i>	Ed. D., Professor T.V. Sayenko		

8. Assignment issue date « \_\_\_\_\_ » \_\_\_\_\_ 2021.

Thesis Supervisor: \_\_\_\_\_ O.V. Rugain  
(signature)

Assignment is accepted for performing: \_\_\_\_\_ P. S. Sheshenia  
(signature)

## **ABSTRACT**

The explanatory note to master's degree work «Methods and means of maintaining the appropriate level of quality in the aviation security system of the operating enterprise»

97 pages, 11 figures, 2 tables, 63 literature sources

Object of the study – aviation security system of the operating enterprise and its control management.

Subject of the study – aviation security management system.

The purpose of this work is to improve the quality and efficiency of the aviation security management system and develop recommendations to be implemented for aviation operating enterprise.

The method of the Research is described by the aviation security operational efficiency and analysis of ensuring the appropriate level of flight safety

Qualification work materials are recommended to be used in airlines, aircraft operators and airports aviation security departments.

**Keywords: AVIATION SECURITY SYSTEM, EFFICIENCY, RELIABILITY, VIOLATIONS, CORRECTIVE ACTIONS, ANTI-THEFT, OPERATOR, X-RAY SCANNERS, DANGEROUS GOODS**

## CONTENT

LIST OF ACRONYMS AND TERMS.....	8
INTRODUCTION.....	9
PART 1. THEORETICAL AND METHODOLOGICAL ANALYSIS OF THE EXPERIENCE OF AVIATION SAFETY OF THE OPERATING COMPANY....	13
1.1. The main directions of development of civil aviation.....	13
1.2. Measures to improve flight safety.....	23
Conclusions to Part 1	26
PART 2. ANALYSIS OF MEANS OF MAINTENANCE OF QUALITY OF AVIATION SAFETY.....	27
2.1 Aviation security management system.....	27
2.2. Flight safety management system.....	36
2.3. Analysis of ensuring the appropriate level of safety in passenger service.....	41
2.4. Analysis of ensuring the appropriate level of security in the service of luggage, cargo, mail.....	46
Conclusions to Part 2	52
PART 3. WAYS TO IMPROVE QUALITY CONTROL OF AVIATION SAFETY.....	53
3.1. Control of elimination of the revealed violations of requirements of aviation safety.....	53
3.2. Reassess aviation security measures and develop further corrective actions to improve aviation security.....	60
Conclusions to Part 3.....	71
PART 4. LABOUR PROTECTION.....	72
4.1. Analysis of working conditions.....	72
4.2. Engineering, technical and organizational solutions to prevent harmful consequences on human.....	77
4.3. Fire safety of working area.....	78
Conclusion to Part 4.....	79
PART 5. ENVIRONMENTAL PROTECTION.....	80
5.1. Summary of paper usage.....	80
5.2. Recommended actions.....	85

5.3. Profit.....	86
5.4. Calculations on paper consumption.....	87
Conclusion to Part 5.....	88
CONCLUSIONS.....	89
REFERENCES.....	92

## **LIST OF ACRONYMS AND TERMS**

ICAO – International Civil Aviation Organization

EU – European Union

EASP – European Aviation Security Plan

NBAAI – National Bureau of Air Accidents Investigation of Ukraine

TRACECA – Transport Corridor Europe Caucasus Asia

UKSATSE – The State Air Transport Company of Ukraine

SARPS – Standards and Recommended Practices

EASA – European Union Aviation Safety Agency

IATA – International Air Transport Association

KRA – Key Risk Area



## INTRODUCTION

One of the national problems of each state is to ensure air safety. It is its level that affects the image of the state, economic development, tourism and air transport. The problem becomes especially relevant against the background of the development of Ukraine's integration into the European transport space, which strictly monitors the state's obligations to citizens to move safely inside the country and abroad, where their standards apply to delays, accidents and disasters. Ukraine's accession to the Single European Sky program provides for cooperation in such key areas as access to the aviation market, industrial cooperation in aviation, air traffic management and flight safety.

The activities of the State Aviation Service are annually aimed at improving the level of flight safety through the implementation of standards of the International Civil Aviation Organization (hereinafter – ICAO), as well as bringing Ukrainian legislation in line with EU law.

In 2020, the COVID-19 pandemic affected every country in the world and industry, and Ukraine's aviation industry is no exception.

As the pandemic slowly comes under control, the State Aviation Service is making every effort to help it return to normal operation and is taking steps to protect people who interact with airport staff and flight crew. The Civil Aviation Service supports the process of connecting people and services by identifying and coordinating efforts to protect health and safety. The information contained in the 2020 Security Report is an integral part of the security information used to set security priorities in Ukraine with reference to the European Aviation Security Plan (EASP) and the European Regional Aviation Security Plan (EUR RASP).

It is important to identify security issues in order to focus on effective measures to address the identified issues. In 2020, the State Aviation Service took a step to identify key risk areas and security issues.

Taking into account the recommendations of the National Bureau of Air Accidents Investigation (hereinafter – NBAAI), general measures are established to prevent future aviation accidents and serious incidents.

Civil aviation is an integral part of Ukraine's transport system. Its role in the general transport complex is characterized by the ability to offer a much higher speed of transportation of passengers, goods and mail compared to other modes of transport, which is especially evident in the implementation of long-distance transportation. Guaranteeing reliable transport connections between settlements, airports, cargo terminals, etc. requires clear coordination of civil aviation with related modes of transport. Given the extensive network of airports and airfields, as well as the lack of road and land transport, Ukrainian civil aviation can be quite competitive in the passenger market.

One aspect of the legal regulation of the use of aircraft is the safety of aircraft operation and service infrastructure. Definitions of aviation safety and aviation security can be found in Article 1 of the Law of Ukraine on Aviation. "Aviation security is the protection of civil aviation from unlawful interference, which is guaranteed by a number of measures with human and material resources." (paragraph 2, part 1 of Article 1 of this Code). And flight safety as an integral part of flight safety is "a condition in which the risk of injury or injury is limited to an acceptable level" [1].

Ukraine, as well as a member of the International Civil Aviation Organization (ICAO) and the State of Registration of Civil Aircraft, a state developer and manufacturer of aircraft, the state operator is committed to ensuring the safety of civil aviation. The safety of civil aviation is ensured by a comprehensive process: flight safety, protection of civil aviation from acts of unlawful interference and protection of the environment from the adverse effects of aviation (environmental protection).

Improving the level of aviation safety will be achieved by creating an aviation safety management system in all areas of aviation and progressive modernization of aviation infrastructure with an effective state policy to ensure a high level of aviation

safety. One of the projects that helps Ukraine move closer to the Common Aviation Region (CAR), which has common safety standards for the EU and third countries (currently CAR includes 36 countries), is the TRACECA project on civil aviation, security and the environment [1].

In such circumstances, the issue of air safety requires a full study of all factors that adversely affect the level of air safety. Your detailed research and consideration in the development of regulatory documents and practical recommendations, planning and operation of airlines, airports, and flight crew management is a key component of improving air safety. The task of creating an organizational and economic mechanism that contributes to a high level of flight safety and efficiency is especially relevant today.

At the international level, there are new standards for payment of flight delays for the families of passengers who died in the crash. Pollution quotas are constantly increasing. Aviation incidents are widely covered in the media, which negatively affects both the image of airlines and the image of the aviation state in general. All this increases the requirements for flight safety and aviation equipment, and therefore requires technical re-equipment of aviation companies. Transport efficiency is also very important, and it also depends on the technical level of fixed assets used. In addition, there is an EU ban on flights of obsolete aircraft, which obliges airlines to give priority to technical re-equipment, replacement of old equipment with new ones, and thus increase the level of safety and efficiency of air traffic.

Analysis of recent research and publications that have initiated the solution of this problem, the selection of unresolved parts of the general problem of maintaining the appropriate level of quality of the aviation security system of the operating enterprise. The writing of the work was based on the theoretical achievements of leading domestic scientists, among which a significant contribution to the development of scientific views and practical approaches to flight safety should highlight such authors as V.I. Tokarev, G.Y. Kasperovich, M.V. Karpenko [2]. General theoretical approaches to determining the place and role of aviation in

modern globalization processes and market relations were proposed by G.M. Franchuk, V.M. Isaenko [3]. At the monographic level is the dissertation of L.M. Zelenskaya [4]. However, today it is necessary to scientifically and theoretically comprehend a number of problematic aspects of improving the national aviation safety policy, including the procedure for investigating plane crashes, flight safety at airports and determining the best ways to improve the medical flight support system.

The problems of development of world and Ukrainian civil aviation are devoted to scientific works of such foreign and domestic scientists as: Yu.F. Kulaev [2], O.V. Kostromina [4], V.M. Zagorulko [3], M.M. Brutyan [5] and others. Most of these authors note in their works that passenger air transport is one of the first to respond to changes in the macroeconomic climate.

Problems of flight safety were developed by domestic and foreign scientists: V. Asanin, V. Babak, R. Sakach, B. Zubkov, V. Kofman, E. Bazylovych, A. Betskov, O. Orlov, I. Sergienko, V. Finkel. , V. Kharchenko, V. Shestakov. The impact of aviation and its safety on the environment is considered in their works: K. Atoev, O. Zaporozhets, V. Tokarev. The dependence of flight safety on the so-called human factor was studied by: G. Aralov, V. Bobrov, M. Vladimirov, V. Lapa, R. Makarov, M. Neymark, V. Nozdrin, V. Poltavets, V. Ponomarenko, M. Frolov, R. Hearst. Weather conditions and other factors were analyzed by: M. Makhutov, V. Nozdrin, A. Obrubov, Y. Tikhomirov, O. Trunov, M. Forman, K. Shpilev. The dependence of flight safety on the condition of the aircraft was studied: B. Andreev, O. Ovsyankin, A. Komarov, A. Kucher, O. Mikenelov, Y. Skarednov, S. Prokhorov, M. Smirnov and others.

However, it should be noted that the theoretical development of current trends in the world market of civil aviation, including the problems and prospects for their development in the context of global transformations is insufficient.

*The purpose of the study* is to analyze the patterns and trends of maintaining the appropriate level of quality in the aviation safety system of the operating enterprise.

## **PART 1. THEORETICAL AND METHODOLOGICAL ANALYSIS OF THE EXPERIENCE OF AVIATION SAFETY OF THE OPERATING COMPANY**

### **1.1. The main directions of development of civil aviation**

Civil aviation, which has complex relationships with other industries, contributes to the economic development of states. The growth of revenues and the level of production leads to an increase in demand for air transport services. At the same time, aviation is becoming an important tool for economic development, promoting tourism, trade and employment. In addition, air transport promotes international contacts and mutual understanding.

To measure the growth of air traffic in civil aviation, the indicator RPK ( *revenue-passenger-kilometers* ) is used - the number of traveled passenger-kilometers. According to air traffic statistics collected by IATA, in 2018 the total volume of passenger-kilometers traveled by international flights increased by approximately 7.4% compared to 2017. However, in 2019, the growth of air traffic slowed down compared to the active growth trend from 2017 to 2018, the increase in RPK was only 4.2%. The inhibitory factor was the reduction of measures to stimulate demand for air transportation through tariff reductions, trade wars and other geopolitical problems.

**Table 1**

**The main indicators of the global aviation industry (2014-2020)**

Indicator	Year						
	2014	2015	2016	2017	2018	2019	2020
Total income, USD billions	767	721	709	755	812	838	872
Operational Costs, USD billions	731	659	648	698	766	796	823
Income growth, %	5,3	-10,0	-1,5	7,6	9,7	3,8	3,5

Net profit, USD billions	13,8	36,0	34,2	37,6	27,3	25,9	29,3
Average net profit per passenger, USD	4,1	10,1	9,0	9,2	6,2	5,7	6,2
World pax flow, billion people	3,328	3,569	3,817	4,095	4,378	4,540	4,723
Rates of pax flow growth, %	5,7	7,2	6,9	7,3	6,9	3,7	4,0
Load factor of pax seats, %	80,0	80,5	80,4	81,5	81,9	82,4	82,0
RPK, %	6,0	7,4	7,4	8,1	7,4	4,2	4,1
Baggage tons, million tons	54,0	54,8	57,0	61,5	63,3	61,2	62,4

Source: based on data [17].

The largest increase in RPK in the international market in 2019 compared to the previous year showed airlines from the Asia-Pacific region - 4.7%. This was facilitated by generally favorable economic conditions in the region and increased air traffic. The decline in RPK growth in 2019 for European airlines (4.5% vs. 7.5% in 2018) was due to a slowdown in economic activity. The decline in business confidence was compounded by industrial strikes, uncertainty following Britain's exit from the EU and financial difficulties for a number of airlines.

Aviation plays an important role not only in transporting people but also cargo. It helps countries contribute to the world economy by improving access to international markets and globalizing production. In 2017, 61.5 million tons of cargo were transported by air, the total value of which amounted to 6 trillion dollars. Their real value was 35% of the price of all goods in world trade, while their share was only half a percent of total goods. Thus, aviation carries especially valuable and expensive cargo. However, in 2019 the volume of transported goods decreased for the first time since 2012 to 61.2 million tons and decreased compared to the previous year by 3.3% [7]. This is the lowest value in the last three years. Experts characterize the negative dynamics with the consequences of the US trade war with China, as a result of which, according to IATA, sales in world trade increased by only 0.9% in 2019. Compared to 2017 and 2018, their number was 4.6 and 3% and [8], respectively. Although tensions between the United States and China eased in early

2020, air travel is now threatened by the spread of a new coronavirus (COVID-19). The largest decrease in 2019 was recorded in Latin America (an increase of 5.3%) and the Asia-Pacific region (a decrease of 3.5%), as well as in North America and the Middle East - by 3.4%.

Aviation directly affects the world economy and its individual industries not only directly but also indirectly. Thus, air transport plays a crucial role in the development of international tourism, thanks to it more than 58% of trips (Fig. 1) [9; 10]. The overall level of chair occupancy in 2019 reached a record level of 82.4%.

ICAO's forecast for the next 15 years was based on the fact that more than half of the tourists who crossed international borders in 2018 were transported by air. ICAO predicts that the number of flights and the number of passengers will double.

Civil aviation is one of the most expensive modes of transport, so a large amount of air traffic is inherent in countries with high economic development (Figure 1.1). For example, in 2017, 37% of the total volume of passengers on international and domestic scheduled flights accounted for Asia-Pacific airlines, European airlines - 26%, Latin American and Caribbean airlines - 8%, North America - 23%. Middle East, East - 4%, and African airlines account for almost 2% [9; 11].

Global and regional forecasts for passenger and freight traffic, air traffic and related parameters are needed to plan the activities of airlines, airports, air traffic control systems, etc.

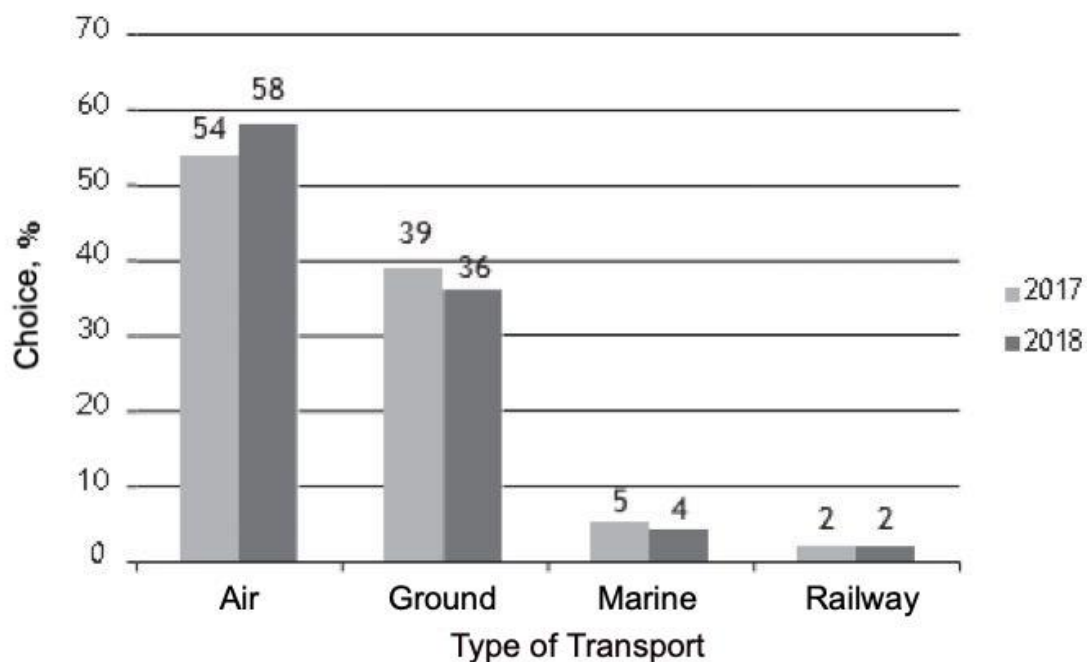


Figure 1.1 – Type of transport used by tourists on international routes (2017–2018)

Source: based on data [9; 10].

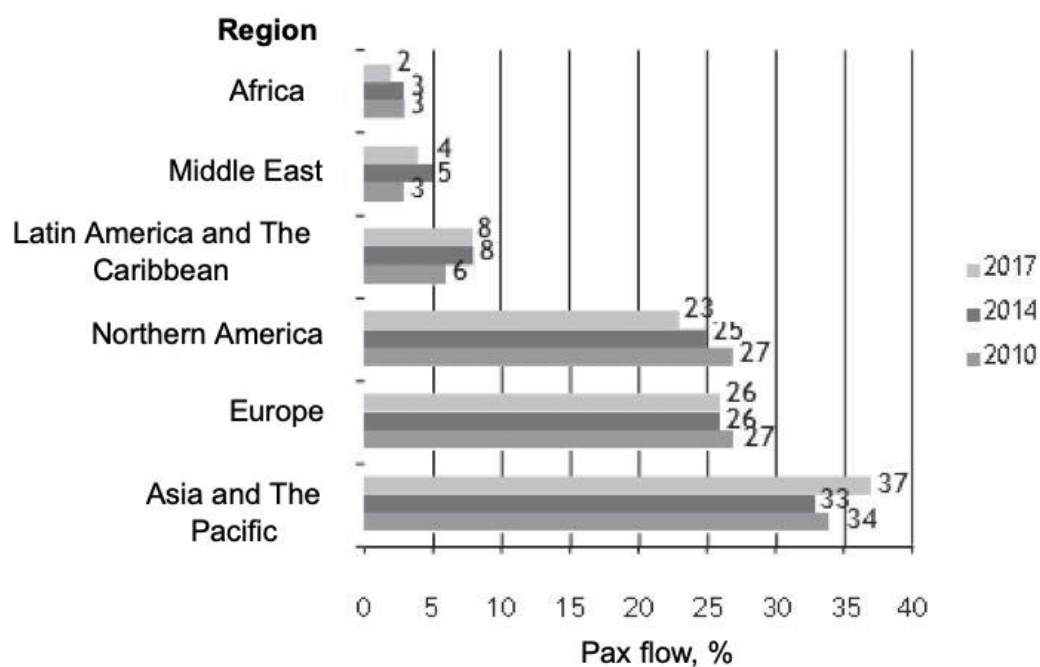


Figure 1.2. Distribution of regional passenger traffic (2010–2017),%

Source: based on data [9; 11].



The importance of aviation in the world economy is constantly growing, which contributes to both technological development and the latest developments in the aviation industry, as well as globalization and ever closer business and cultural ties between different countries.

Air transport has a positive impact on the development of tourism business and international trade, increases the country's investment attractiveness and opportunities for international companies in its territory, provides extremely fast delivery of valuable and perishable goods to destination, extensive use of air transportation by leading international logistics companies.

Today the following world tendencies are inherent in air transport:

- Improving air safety, including strengthening measures to protect civil aviation from unlawful interference;
- Ensuring the development of multimodal transport technologies and infrastructure for various modes of transport;
- Globalization of transcontinental air traffic in the framework of powerful space alliances;
- Increasing the availability of air transport for the population, strengthening the role of cheap air transportation according to the low-cost model of air transport for direct interregional communication.

Today, the aviation market of Ukraine is gaining momentum after a period of declining activity in recent years.

Currently, there are 66 intergovernmental agreements between Ukraine and the world, which regulate scheduled air services. Among them are agreements that do not provide for any restrictions on the frequency of scheduled flights, the number of airlines and directions in both directions, and account for 34.8% (agreements with the US, UAE, Spain, Italy, Greece, Poland, etc.) of the total. Agreements that remove restrictions on the number of airlines that can be allocated routes - 77.3 percent.

About 34 domestic airlines operate in the market of passenger and cargo air transportation of Ukraine, of which 21 airlines carry out passenger transportation. The five largest airlines account for 93 percent of total passenger traffic.

Regular flights between Ukraine and the world are operated by 10 domestic airlines in 46 countries and 38 foreign airlines in 37 countries. Regular domestic passenger traffic between 10 cities of Ukraine is successfully provided by four domestic airlines.

Cargo and mail are transported by 22 domestic airlines, most of which operate charter flights to other countries as part of the United Nations humanitarian and peacekeeping programs. At the same time, such companies as ATP SE "Antonov", "Ukraine International Airlines", carried out charter flights carry more than 78 percent of total traffic.

Currently, commercial flights in Ukraine are operated and serviced by domestic and foreign airlines from 20 airports and airfields, including passenger traffic through the airports of Ukraine exceeds 20 million, cargo traffic - more than 56 thousand tons.

Seven leading airports (Boryspil, Kyiv (Zhulyany), Odessa, Lviv, Kharkiv, Dnipropetrovsk and Zaporizhia) serve about 98 percent of total passenger and cargo flows.

The State Air Transport Company of Ukraine (hereinafter UkSATSE) operates more than 300,000 flights a year.

The main principles and directions of implementation of the strategy of air transport development as a part of the unified transport system of Ukraine, its further integration into the world air transport network, creation of modern air transport infrastructure, realization of aviation potential of Ukraine:

- Improving the accessibility of air transport for the general population, including people with disabilities;
- Ensuring the integration of Ukrainian civil aviation into the European and world transport system, compliance with priorities and requirements for the implementation of the EU-Ukraine Common Aviation Region Agreement, as well as

the implementation of the Single European Sky in Ukraine within the European air traffic plan;

- Ensuring the integration of Ukrainian national civil aviation into European and world transport systems, compliance with priorities and requirements for the implementation of the Agreement between Ukraine and the EU on the Common Aviation Area, the introduction of Local Single Sky in Ukraine (Local Single Sky Implementation) within the European Union plan on air traffic control (European ATM Master Plan);

- Improving environmental safety and energy saving;

- Deregulation of air carriers, liberalization of the air transportation market;

- Promoting free competition in aviation markets and the provision of airport services, non-discrimination of individual participants in such markets;

- Providing state support to domestic airlines and airlines regardless of ownership;

- Promoting the use of domestic aircraft, equipment and other goods and services by air carriers in the development of air transport and airports, non-aviation activities and activities in related markets.

In general, the forecast for 2021 and the coming decades is positive. But the overall picture is that the growth of the aerospace industry is slowing.

Against the background of the spread of coronavirus infection COVID-19 in 2020 for the first time in 12 years after the financial crisis of 2008-2009, according to IATA due to air traffic restrictions, global RPK traffic in passenger-kilometers will decrease. by 4.7% compared to the previously forecast growth rate. According to preliminary estimates by IATA, published in February 2020, such a scenario should lead to a loss of airline profits of \$ 29.3 billion. And, first of all, the passenger traffic of airlines operating in the Asia-Pacific region is planned to be reduced by 13% [14]. This forecast was based on the assumption that the economic impact of COVID-19 would be similar to that of SARS pneumonia, which broke out in 2002-2003. The impact of the virus then led to a sharp decline (for example, in the Asia-

Pacific region lost 5.1% of passenger traffic ) and then to their rapid growth when the outbreak stopped. But in March 2020, IATA will adjust its forecast for the worse.

In January 2020, the growth of international demand for passengers slowed to 2.5% from 3.7% in December 2019 (Fig. 3). This is the lowest monthly increase since April 2010, which was observed during the crisis in Iceland due to volcanic dust, which led to a massive closure of airspace and cancellation of flights [15].

The slowdown in demand for passengers is observed in all regions of the world except Africa. Revenue from passenger traffic of African airlines increased by 5.3% in January 2020 compared to 5.1% in December 2019.

The volume of air traffic of Asia-Pacific airlines increased by only 2.5% in January 2020 compared to 3.9% in December 2019.

This is the lowest result since the beginning of 2013. This was made possible by weak GDP growth in several major economies in the region and the initial impact of COVID-19 on China's international aviation market. Domestic traffic by Chinese airlines fell 6.8% in January due to flight cancellations and travel restrictions.

Demand for European transport increased by only 1.6% in January 2020 compared to 2.7% in December 2019. The results were affected by the slowdown in GDP growth in the leading countries in the fourth quarter of 2019, as well as the beginning of the difference in flights due to COVID-19 at the end of January 2020.

The Middle East was minimally affected by the COVID-19 outbreak in January 2020. Airline traffic increased by 5.4%. For the fourth month in a row, there has been a steady increase in demand in the Europe-Middle East and Middle East-Asia regions, which were not significantly affected by the cancellation of COVID-19-related routes during the reporting period.

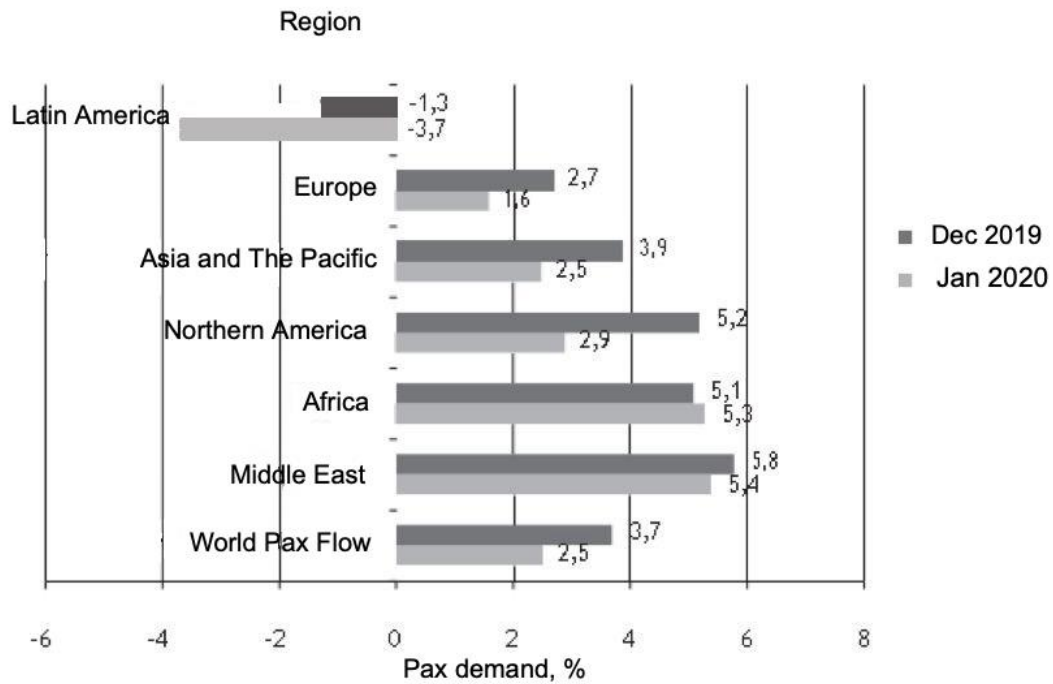


Figure 1.3 Comparison of the dynamics of international passenger demand (RPK) for the period November 2019 - January 2020,%

Source: based on data [15].

International demand for North American airlines increased by only 2.9% from 5.2% in December last year, although there were no significant differences in flights to Asia in January 2020.

In January 2020, Latin American airlines had to agree to a drop in demand by 3.7% compared to the same month last year. This was a further deterioration compared to a 1.3% drop in demand in December 2019. The traffic of Latin American airlines has been declining for four months in a row, reflecting the ongoing social unrest and economic hardship in a number of countries in the region that have not yet done so in connection with COVID-19 [15].

From February 2020, the situation on the world aviation market will begin to deteriorate. On February 13, the International Civil Aviation Organization (ICAO) released preliminary data on the impact of the COVID-19 outbreak on passenger traffic. About 70 airlines have already canceled their international flights to and from China, and about 50 have cut flights. This has led to an 80% reduction in Chinese-related passenger traffic and a 40% reduction in the number of flights operated by Chinese airlines.

Ukrainian airlines have played ahead and, following the example of European airlines, have been restricting flights to countries affected by the virus since the beginning of March. In particular, the largest Ukrainian airline Ukraine International Airlines (UIA) announced in the spring the cancellation of about 2,000 flights to 16 countries. Moreover, UIA was forced to adjust its domestic flight program. Another Ukrainian airline, SkyUp Airlines, was also forced to cut its flight schedule due to increased security measures due to the spread of coronavirus. The airline also postponed the launch of a flight program to some areas in early summer, including flights to Tel-Aviv from Kharkiv and flights to several Italian cities from the capital and Lviv.

As of March 17, Ukraine has completely suspended flights with other countries. According to the IATA forecast, the reduction in the number of passengers at Ukrainian airports in 2020 may be 7%. If the virus continues to spread, the prognosis may worsen to minus 10% [19].

But there is also good news for airlines. Unlike previous crises, they continue to avoid lower ticket prices and can save costs by reducing the route network to compensate for some of the losses due to falling revenues. In addition, a significant reduction in world prices for oil and, consequently, for gas from the beginning of the year will reduce the negative economic consequences of reduced traffic. However, some airlines hedge purchases - they actually pay the bills for kerosene for the next year, so some may not have time to take advantage of low fuel prices if the crisis continues [17].

If the virus continues to spread across the planet, aviation will face a large-scale crisis. Airlines around the world are suffering losses due to reduced passenger numbers, flight cancellations and airport controls. According to IATA, in 2020, airlines around the world lost from the coronavirus from 63 to 113 billion dollars. [20]. It is noteworthy that this is much higher than the association's previous estimate of February 20, 2020, when the world's leading industry association estimated that the pandemic would cost airlines \$ 29.3 billion loss of income [14].

The COVID-19 outbreak and its impact on aviation underscore the need for effective coordination and a proportionate response by States.

In addition to exploring opportunities and finding tools to minimize losses, airlines need to develop effective strategies to counter the redistribution of passenger traffic. The health and well-being of passengers, staff and the public, as well as limiting the spread of infectious diseases, are priorities for the aviation industry. However, in the near future we will not be able to definitively assess the effects of the coronavirus, which affects the whole world.

## **1.2. Measures to improve flight safety**

In the realities of the modern world, the use of various modes of transport for social, individual and general needs is relevant. The share of public air traffic is increasing. Air transportation is used to transport passengers, cargo, military needs, medical needs of society, etc.

Given the growing role of air transport, it is necessary to explore some aspects of ensuring the safety of this mode of transport. The main areas of security are: technical, industry and legal. From a legal point of view, the main purpose is to assess the legal risks of negative consequences from the use of this mode of transport. The parties involved in the aviation incident and the injured third parties are subject to legal risks.

The main direction of ensuring air safety from a legal point of view is the fight against terrorism in air traffic and ensuring the maximum level of protection of pilots, passengers and cargo.

The main anti-terrorist mechanism of aviation security is the Aviation Security Management Mechanism [1].

The practical aspect of implementing the aviation security mechanism is:

- a) ensuring the safety of air transport terminals;
- b) strengthening the role of law enforcement agencies in monitoring and forecasting terrorist threats;
- c) monitoring of the situation in the area of the air traffic terminal;

e) constant monitoring of suspects and their preventive investigation;

g) analysis of risky and suspicious situations around the terminal, in the terminal, on the runway, etc.

The use of air transport for public purposes suggests the existence of the category "aviation security management system".

This system consists of two levels: theoretical (ensuring public safety in aviation) and practical (implementation of international and national anti-terrorist legislation in aviation).

Aviation content of public safety is defined as the activities of law enforcement agencies, local governments, law enforcement agencies and other public safety entities to avoid threats and dangers to society and citizens when using air transport, which is regulated by the administrative provisions of the Law.

One of the elements of flight safety is management. From the point of view of management research, it is the impact of aviation security on the object in order to achieve a state of freedom from threats [2].

The status of aviation security is regulated by administrative mechanisms. These administrative mechanisms are mandatory. From the point of view of aviation security, coercion is a tool to achieve a state of freedom from threats.

The specificity of aviation public safety is that the activities and influence of law enforcement agencies and local governments, together with other public security actors are aimed at monitoring, forecasting and neutralizing internal and external threats. These activities can be carried out by separate parts of the mechanism of public administration and local authorities without direct or indirect (related) interference in the economic, organizational and individual functioning of public safety. In the case of a dangerous or risky situation, such an intervention may occur, then this intervention is direct (immediate).

In accordance with the outlined features of interference in the work of security devices, we propose to distinguish two components of the content of public safety: the first - the general safety of air traffic; the second is the immediate safety of aircraft use.



General security is provided by all subjects of public safety. General public safety is constant in time and space.

Direct public safety is provided by executive authorities and local governments, which are empowered to adopt regulations and take legal action to ensure public safety, which involves interference in the economic, organizational and individual functional of public safety. These actions can change the order and system of relations in the subject of intervention in order to ensure the safety of all air traffic objects (passengers and property) in dangerous situations and dangers of any origin or to prevent such situations.

The peculiarity of the content of measures to ensure public safety in air traffic is the measures of those executive authorities and local governments that are directly authorized to ensure traffic safety. This is due to the fact that such a provision is largely subject to the rules of administrative law and are the rules of direct action.

Thus, we can conclude that the activities of the executive and regional authorities. They are regulated by the norms and provisions of administrative law on public safety in air traffic by directly interfering in the economic, organizational and individual functioning of public safety, which are not organizational for them, are administrative regulations for air traffic safety.

In addition, it is also necessary to highlight the border aspects of public safety related to the rules of civil, commercial, financial, criminal and other areas of law.

From a scientific point of view, the definition of safety can be defined by forms of aviation security in the following format: Forms of administrative and public aviation security are direct actions of law enforcement agencies and other aviation security entities to avoid the threat to air traffic, terminals and airports [3].

When ensuring public safety in aviation, these forms are given special characteristics: expediency, purpose and objectives of such activities.

The aviation security management system is a set of administrative measures aimed at the effective use of management and coordination mechanisms to ensure the protection of all participants in the use of aircraft from external interference in order to cause harm.

### **Conclusion to Part 1**

The content of administrative assistance to public safety in aviation allows to define the essence of this category and to reveal its main purpose and tasks in the administrative law of Ukraine.

The essence of the category of public safety is defined as a set of goals and principles of activity of authorized institutions of public safety of Ukraine.

The purpose of ensuring public safety in aviation is to achieve a state of freedom from threats and dangers of various origins for all social actors through the application of administrative law.

From this we conclude that the aviation security management system is part of general aviation security.

## **PART 2. ANALYSIS OF MEANS OF MAINTENANCE OF QUALITY OF AVIATION SAFETY**

### **2.1. Aviation security management system**

Aviation has long been at the heart of the economic success of many countries around the world, and from the beginning, flights have helped to establish international trade relations and create important domestic ties that "connect" the country together.

Both in aviation and in other industries that are not in the spotlight of senior officials, many problems have accumulated over the years.

Long-term strategic planning is crucial for the sustainable and cost-effective development of air traffic.

Therefore, the industry needs a long-term plan for sustainable growth of air traffic, which will ensure the projected development of air traffic until 2030.

This should be the starting point for a national aviation development strategy, which includes a clear plan and a number of key priorities.

Airport managers, together with the heads of airlines that carry them out in the controlled area of the airport, determine the areas where important work is carried out to ensure the safe operation of civil aircraft at the airport. These zones are defined as controlled, sterile and restricted zones. Critical parts of restricted areas are also identified. Critical parts may coincide with sterile areas. The location of controlled, sterile and restricted security areas and critical parts is indicated on the airport map attached to the airport aviation security program.

Based on these rules, air carriers prepare appropriate instructions, which are approved by the head of this organization, and for airports - by an approved body of civil aviation.

Each airport (at the aerodrome) has a single access system, which is approved by the head of the airport. The management of such a system, organization of production and decision-making on the issuance of ID-cards is carried out by the Deputy Chief of Aviation Security of the airport.

Air traffic controllers operating permanently in a controlled area of an airport or aerodrome shall provide the airport or aerodrome manager with an appropriate list of persons who need unaccompanied clearance for that area of the airport or aerodrome.

Legal entities that have access to controlled, sterile and restricted restricted areas, as well as critical parts of restricted areas, must have an identity document identifying the areas in which they may be located and carry identity cards in a conspicuous place.

Aviation security personnel, including unaccompanied personnel of legal entities in the performance of their duties at the control areas of the airport or aerodrome, must undergo special control, including law enforcement, to identify and access these areas. An on-site inspection is conducted by law enforcement agencies operating in the airport control area, which is notified in writing to the airport management.

After that, the holder of the identification card is regularly checked every two years when changing the identification card. In particular, given the importance of preventing unlawful interference, one of the reasons for refusing or issuing a permit may be a person's involvement in a crime, a criminal record (extinguished or outstanding), mental illness, drug addiction or non-compliance with the airport, customs or border control area.

The decision to refuse to issue a permit is made by the head of the airport or aerodrome after consultation with law enforcement officers - members of the airport aviation security committee.

At airports where checkpoints (checkpoints) are open across the national border or where international flights are authorized, the rules of entry and internal rules shall be agreed with the state border guard authority responsible for the checkpoint and the competent customs authority. .

A person who enters or attempts to gain unauthorized access to a controlled, sterile or restricted area of access to air traffic outside airports to which access is controlled and restricted shall be liable in accordance with the provisions of the law.

Information on areas outside the airport (if any) and defined as controlled or restricted areas is contained in the airport safety program (air traffic control service provider).

These areas may include:

- places for communication, navigation and surveillance;
- antenna fields;
- compositions of fuels and lubricants;
- other areas critical to the safe operation of civil aviation.

The responsibility for access control, as well as compliance with the rules of residence in these areas rests with legal entities that own these areas.

The protection of controlled, sterile and restricted access areas is provided by paramilitary security units of aviation security services with the use of firearms or devices of domestic production for firing rubber or similar non-lethal shells (electrical protection systems and technical means).

Security, especially in the uncontrolled zone, is achieved through:

1. At the stage of planning and construction:

- avoidance of planning and construction of direct access roads to airports;
- installation of artificial obstacles and curbs of increased height on these roads;

- location of parking lots and parking places for vehicles at a distance of at least 50 meters from the airport building;

- installation of shockproof showcases at airports;

- use of rubbish bins, which reduce their capacity in case of explosion;

- installation of a sufficient number of video surveillance devices;

2. For daily activities:

- definition of uncontrolled zones;

- development by the main unit of the national system of combating terrorist activities and implementation, taking into account risk assessments of illegal interference in uncontrolled areas of the airport, for all legal entities and individuals mandatory measures to reduce risk and prevent illegal interference in the airport;

- constant presence of patrols of internal affairs bodies;

- involvement of law enforcement officers carrying out operational monitoring;

- control of parking lots near airports;

- use of service dogs (depending on the level of threat);

- control of the adjacent territory from the outside of the aerodrome perimeter to prevent unauthorized entry into the controlled area of the airport.

If necessary, the airport operator instructs the police to strengthen the security of the airport on a contractual basis.

The procedure for access to the border and customs control zone at international airports (at aerodromes) is carried out by the state border guard body responsible for the located checkpoint and the competent customs authority in accordance with the procedure established by law.

When conducting international flights to / from Ukraine or transit flights through Ukrainian airports, the air carrier is obliged to provide information on passengers of such international flights to the State Border Guard Service, customs authorities and the main department of the national counter-terrorism system, including the passenger's name, gender, citizenship, date of birth, series, ID number.

The information must be provided by the airline 72 hours before the scheduled time of the international flight, and in case of change of such information the airline is obliged to provide updated information, but not later than 30 minutes before landing at the airport of Ukraine by international flight.

Tickets are issued only after entering the name of the passenger, his gender, nationality, date of birth, series, ID number in the reservation system.

The personnel of air carriers operating in the field of booking and sale of passenger transport shall inform the customer of the transport service about the requirements of the fifth paragraph of this paragraph.

People who have checked in for the flight and have the status of a passenger are sent to a sterile area and critical parts of protected areas of limited access (for example, security control of a valid identity card and boarding pass issued in the prescribed manner). After passing the control, passengers are transported to the aircraft only accompanied by an authorized person from the airport or ground handling center under the control of the aviation security service.

Crew members who do not have a permanent identity card of the airport in which their aircraft is located undergo a mandatory security check and are accompanied by an authorized person of the airport or ground handling center.

The natural person - the operator of the aircraft must present a certificate of registration of the aircraft instead of being assigned to the flight.

Air carriers are developing a system of measures to regulate access, manufacture, issue, bill and control the use of badges for vehicles to pass to controlled, sterile areas, restricted areas and their critical parts.

Access to vehicles that are not involved in the direct service of aircraft, passengers, crew, airport units and operators is restricted.

In order to protect civil aviation from unlawful interference, the airport manager and his deputy aviation security officer, together with the responsible internal affairs bodies, shall organize evacuation to special areas or places of temporary storage of vehicles that may cause danger in uncontrolled areas of the airport.

The evacuation is carried out by the decision of the responsible employee of the internal affairs body in agreement with the airport management.

The natural person - operator is responsible for ensuring the safety of the aircraft specified in the operator's certificate or operated by him under the contract.

Air carriers shall take the necessary measures to protect aircraft from unlawful interference in accordance with the organizational rules for the protection of aircraft and aviation activities, which are developed by an approved body of civil aviation and approved in the manner prescribed by law.

Aircraft in the restricted area must be under the constant supervision of the responsible person:

- a shooter from the paramilitary guard and the dispatcher of the video surveillance unit of the aviation security service of the airport when placing the aircraft under protection;

- responsible employee of the operator (engineer of the flight equipment unit, commander of the aircraft, next shift of the aviation security service) when working on the aircraft.

When the aircraft is not in use or serviced, its doors and hatches must be closed and access equipment removed. The aircraft is transferred under protection only in an airtight state.



Aircraft located in the technical zones of control zones for scheduled work or sludge must be under the control of the operations manager, unless the aircraft is transferred under the protection of the aviation security service.

Such an aircraft may enter the security restricted area and operate only after it has been serviced for security reasons and appropriate measures.

An aircraft, with the exception of general aviation aircraft, with a take-off mass of up to 5700 kg, must have:

- design of doors and partitions to the cabin, which minimizes the likelihood of penetration of firearms and fragments, as well as the possibility of forced penetration;

- internal communication system between the cabin (cargo space) and the cabin, in addition, the passenger aircraft - installed alarm "danger";

- a lock on the door on the inside of the cockpit, which opens and closes from each pilot's workplace, a system for access control to the cockpit and video surveillance;

- regular anti-theft devices;

- devices for special maintenance of the aircraft: rotating mirrors, markers for marking controlled points, lights, etc.

Operators must take measures to ensure that passengers do not leave objects and belongings on board the aircraft, especially during transit.

In the event of notification of a threatening illegal action, the personnel who received such information are obliged to notify all interested persons in accordance with the notification scheme developed for such cases in each airline.

The operator conducts an inspection (maintenance, inspection, special care) of the aircraft with the participation of trained specialists. To carry out these checks, the operator shall create appropriate instructions and diagrams, which shall be approved by the operator's operations manager and transmitted to the airport security services. The appropriateness of the inspection, maintenance and special maintenance of the

aircraft is determined by the results of the threat and risk assessment approved by the civil aviation authority.

To ensure safety, the civil aviation authority has the right to instruct the airport managing body to organize security checks on passengers, hand luggage, luggage, cargo, couriers and mail arriving from airports in high-risk areas or where security checks are not carried out properly.

If dangerous objects and substances are found on board the aircraft before departure, these aircraft must be unloaded (including luggage) and passengers and crew members disembarked with hand luggage.

To prevent unauthorized access to and use of aircraft, general aviation and air transport operators, as well as individuals, aircraft operators should take practical and technical measures, including, but not limited to, the following measures:

- physical means of restricting access to aircraft: physical security, security lighting, video surveillance, etc.;
- warning signs restricting access to the controlled runway area, aerochemical works sites;
- anti-theft devices of aircraft, if provided by their design, on fuel, electrical, as well as other systems or removable parts of the structure;
- the presence of locking devices in the cockpit or on the aircraft itself, if provided by its design.

Protection of objects of radio navigation support of means, and also services is carried out:

- installation of a fence on the perimeter of objects;
- introduction of access and exit regime at facilities;
- use of technical means of protection;
- prevention of intentional and unintentional radio interference;

- protection of facilities located outside the controlled area of the airport;
- monitoring of the situation at the facilities by the airline's staff;
- use of service dogs.

Object of aviation activity operating terrestrial radio stations:

- determines the list of radio navigation systems to be protected and duplicates of radio navigation systems in case of failure of the most important ones, which is agreed with the authorized body of civil aviation;

- is responsible for the condition of the roads leading to the radio navigation systems they serve, in order to ensure the timely arrival of the emergency crew in case of signs of attempted burglary.

Emergency rescuers and equipment involved in emergency rescue operations to eliminate fires, accidents, natural disasters, emergency landings of aircraft and rescuers (ambulances) in case of accidents are allowed to enter the controlled area of the aircraft without hindrance. The movement of such vehicles in the control area is accompanied by an aviation security officer. The head of the next shift of the aviation security service informs the dispatchers of the airport management about the call of emergency rescue vehicles, rescue services and fire departments.

Maintaining an appropriate level of aviation security is in the following main areas:

- No aircraft registered in the State Register of Civil Aircraft of Ukraine, as well as foreign aircraft are allowed to take off or land at the airports of Ukraine without the relevant rules for issuing permits for departure and arrival at airports in Ukraine;

- People and vehicles are prohibited from entering or passing through the controlled area, as well as in sterile and restricted areas without permission and properly conducted safety checks for a long period of time;

- No person is allowed on board the aircraft without the appropriate permission of the authorized person of the airline;
- Items and equipment, including hand luggage, luggage, cargo, courier and postal items, on-board accessories, on-board food may not be transported on board the aircraft without a security check;
- The organization of flight safety is entrusted to the head of the air carrier and the commander of the aircraft to perform aviation work at airfields or locations of aeronautical chemical enterprises;
- The general aviation organization and the individual operator of the aircraft must ensure the safety of flights at bases, in the parking lot of the aircraft and during flights;
- Aviation personnel and persons working in the aviation industry and whose work is related to aviation security may carry out this activity only in the presence of relevant documents on aviation security issued by the central executive body for the implementation of state policy in the field of civil security, aviation security, or educational institutions that have been inspected and certified by such a body.

## **2.2. Flight safety management system**

Civil aviation is an integral part of the economy and society, integrated into the transport system of Ukraine. Ensuring aviation security is a national security priority.

As a party to the Convention on International Civil Aviation (hereinafter - the Convention), Ukraine is responsible for fulfilling its international obligations under the Convention, including the implementation of the state aviation security program, which is an integral part of effective security management.

Security management is based on a systematic approach to identifying and eliminating hazards and controlling risks in order to ensure security and minimize human losses, material, financial, environmental, and social damage.

The gradual implementation of the program will ensure an appropriate level of flight safety for each air carrier.

*Goals and policy of the state in the field of flight safety*

The system of state regulation of flight safety is based on the interaction of government agencies and air carriers.

Implementation of an effective safety management system at the national level by implementing the provisions of the European Regional Aviation Safety Plan and in accordance with the provisions of ICAO Doc 10131 on the development of regional and national safety plans allows:

- ensuring the introduction of innovative technologies;
- establish national policies as well as rules in accordance with ICAO SARPS and EU legislation;
- ensure the promotion of aviation safety on the basis of an assessment of the level of risk associated with the conduct of aviation work;
- increase the efficiency of investigation of incidents and accidents in aviation;
- encourage air carriers to collect, analyze, protect and exchange information;
- control of the effectiveness of the flight safety system;
- to introduce the practice of constantly raising the level of culture in the field of civil aviation.

*Security risk management at the national level*

Ukraine has a high level of flight safety and aviation security. A systematic and comprehensive approach to security risk management is needed to increase security.

System safety management is based on risk and predictability, which combines elements of quality and risk management into an integrated system and helps airlines:

- identify threats and associated risks that affect the entire organization;
- control, track, report and review such risks;
- ensure the quality of products and services in accordance with standards;
- constantly improve products and services.

Establishing, maintaining and improving a safety management system is a must for most airlines.

The transition to a security management system shifts the focus from compliance policy to security management policy.

*Commitments to the security management system*

The implementation of a safety management system is mandatory for the following air carriers:

- training organizations which, in the provision of their services within the meaning of Annex 1 to the Convention, are exposed to safety risks associated with the operation of aircraft;
- operators of aircraft or helicopters approved in accordance with Part 1 of Annex 6 or Part 2 of Part 3 of the Convention on International Commercial Air Transport;
- approved maintenance organizations providing services to operators of aircraft or helicopters engaged in international commercial air services in accordance with Part 1 of Annex 6 or Part 2 of Part 3 of the Convention;
- development and manufacturer's organizations responsible for the standard design, construction of aircraft, engines or propellers in accordance with Annex 8 to the Convention;

- air traffic service providers in accordance with Annex 11 to the Convention;
- managers of approved aerodromes in accordance with Annex 14 to the Convention.

In the safety management system, air carriers should identify threat detection and risk management processes, safety objectives and reporting, audit procedures, investigations, corrective actions and safety training.

#### *Investigation of aviation incidents and accidents*

Ukraine establishes rules for the investigation of aviation accidents and incidents in accordance with ICAO-SARPS and / or EU rules.

The sole purpose of investigating security incidents is to prevent future accidents and incidents in aviation, not to find and punish those responsible.

Plane crashes and serious incidents with civilian aircraft are being investigated by the NBRCA.

Detailed procedures and procedures for the investigation of plane crashes and serious incidents are set out in the Rules for Technical Investigation of Air Crashes and Serious Incidents.

#### *Risk management for flight safety*

The civil aviation industry will achieve acceptable levels of ALoSP safety performance if all airlines take responsibility for flight safety, voluntarily adhere to flight safety standards and take a systematic approach to safety management.

The State Aviation Service may restrict or prohibit airlines from taking certain measures or taking certain measures in accordance with the aviation rules of Ukraine to maintain an acceptable level of flight safety.

#### *Ensuring flight safety at the national level*

To achieve the required level of aviation safety in civil aviation, a number of measures are taken to prevent aviation accidents:

- definition of flight safety criteria;
- establishing the required level of flight safety;
- analysis and determination of the existing level of flight safety;
- implementation of state supervision over objects and subjects of aviation activity;
- setting deadlines and monitoring the elimination of violations by airlines;
- prohibition, cancellation, temporary suspension or replacement of all types of flights and aviation activities in case of detection of a threat to flight safety or its non-compliance with the established standards and aviation rules of Ukraine;
- cancellation, temporary suspension of certificates, certificates, licenses, approvals, restriction of the rights granted by these documents, cancellation of approval of candidates for the positions of airline managers;
- imposition of fines and other measures to ensure flight safety.

#### *Obligations to supervise*

A key element of effective safety management is a monitoring system that provides continuous monitoring of relevant aspects of the air carrier's activities.

The Ukrainian aviation safety control system focuses not only on avoiding incidents and events in aviation, but also on developing, implementing and monitoring proactive safety practices and maintaining public confidence in the civil aviation industry.

Regular evaluation of the effectiveness of the safety management system is an integral part of the overall safety oversight system in Ukraine.

The effectiveness of the safety management system is assessed using safety performance indicators. The State Aviation Service coordinates with individual airlines the safety indicators provided by their safety management system. Agreed safety performance indicators of the safety management system are regularly



reviewed to ensure that they remain relevant and in line with the nature of the activity.

### *Promotion of flight safety at the state level*

For the purpose of professional advice, safety issues are agreed on the basis of risk and threat assessment according to ICAO and EASA standards, analysis of recommendations based on the results of investigations and identification of measures to prevent incidents in civil aviation of Ukraine in accordance with Part Two of Article 121 permanent or temporary advisory bodies that develop recommendations for the implementation of elements of the security management system.

### **2.3. Analysis of ensuring the appropriate level of safety in passenger service**

Technical developments for use in human surveillance systems are not yet very close to the practical stage of implementation. In recent years, significant efforts have been made in the field of various innovative technologies with little success in the form of ready-made devices. The only exception is face recognition technology, also known as digital biometric face recognition, which is already used at many airports around the world.

Sophisticated cameras use sophisticated digital cameras with software to identify criminals and terrorists using algorithms that compare faces to existing recordings. This technique very quickly found its way from theory to practice. ICAO has identified face recognition as a biometric technique that is likely to be used to spread around the world, although this technology is of concern for violations of civil and human rights.

The U.S. Immigration and Naturalization Service is interested in using video cameras and computer databases to identify known illegal immigrants and criminals, terrorists, drug couriers, and others at airports, checkpoints, and other points of entry.

One of the problems to be overcome is that the database of terrorists and criminals consists of flat 2D images, and the cameras have to compare faces in 3D.

Some face recognition methods are based on measuring facial features at different angles, digitizing this information, and comparing it to images in a database. Other systems use facial thermography to measure the properties of thermal models that each face emits. However, a serious disadvantage of this method is that alcohol radically distorts the thermograms.

If you imagine a person in these circumstances, any hidden object is a dark image against the background of a light image of a person. This difference in brightness in the images is due to different intensities of radiation. Monitoring can be performed remotely with the necessary care. Although passive infrared devices see through clothing, the images on the display do not show any intimate anatomical details. Customs and SAB agents believe that they make more sense because they eliminate the need to touch passengers and allow for more thorough controls.

One area of research is the development of a comprehensive system that uses MMR millimeter radar and long-wave infrared receivers, individually or together, to measure the temperature difference between concealed weapons and the human body. It is expected that the probability of detection of hidden weapons will increase significantly after the integration of signals from these sensors and joint work on a computer visualizer. Alternatively, a hybrid between MMR and ultrasound is proposed.

Another monitoring system is more like seismic sensors that allow you to remotely record the heartbeat. These systems, which use acoustic or seismic methods, detect people through the walls of houses, containers and cars. They can be expected in the AVSEC units in the next 5 ... 10 years. Usually, simpler systems for detecting people hidden in cars are ready for delivery. To work with them, it is enough to put geophones on the outside of a large machine. Algorithms are used in high-speed systems to check cars for the absence of illegal passengers, to detect the special shape of seismic waves from the human heartbeat and to distinguish them from other vibrations.

Other experimental systems include a system that works on the following principle: a person is irradiated with an electromagnetic pulse (Heaviside pulse - a

voltage jump), and only then measure the delay of reflection of existing metal objects. The intensity and time lag of the reflection allow you to determine its type and identify the object as a weapon or a dangerous metal object. Some research is needed to determine if this system has sufficient resolution for security services to use it in their physical search for concealed weapons. It is expected that the modified system will have a low probability of false positives. There is also the problem of getting passengers used to receiving directed electromagnetic radiation and convincing them of its safety.

To implement the considered technologies of covert surveillance of weapons, you can use existing equipment used in the exploration of natural resources that determine the parameters of the environment, military navigation. These technologies are based on passive sounding of the Earth's magnetic field.

Due to the slight change in the magnetic field caused by ferromagnetic objects such as pistols and knives, it can be detected using supersensitive magnetometers. The sensors in this system must collect data simultaneously and thus provide a human magnetic profile from top to bottom. The justification for the suspicion depends on the location and size of the registered magnetic anomaly. An electronic catalog of magnetic unmasking features is created by collecting magnetic profiles of different types of weapons in different places, as well as a number of common items for personal use. These unmasking features are then used in analysis schemes to determine the presence, location and, in the long run, the type of concealed weapon. However, only ferromagnetic materials can be detected with this technology.

Another method is to use extremely small doses of scattered X-rays in combination with an advanced computer image format to detect weapons, explosives, illicit chemicals and smuggling hidden under human clothing. The person to be checked stands in front of the system for about 3 seconds. A computer-enhanced image appears on the monitor, showing the outlines of the person and all hidden objects. To get several species, such as front, back and side, a person needs to return.

According to this method, only a fraction of the radiation power previously considered necessary is required to detect hidden objects. To scan 3c, a person receives 3 mcber (beer - the biological equivalent of X-rays) radiation. This value is comparable to 10 ... 20 mcber / g, which a person receives from the natural radiation background, 500 mcber / g, which is obtained during a flight on a passenger airline at an altitude of 10 km above sea level, and 30 .. 300 mber, obtained during treatment by X-ray examination.

Terahertz technology is an example of a new technology, but it is not yet clear whether it will have security programs. It is used by means of electromagnetic radiation with a very high frequency - about 1000 GHz. This allows you to store data and images with a variety of protective materials, including metals.

The special services faced the problem of neutralizing the detected ammunition and bombs. Ammunition disposal equipment can include some detection and monitoring tools to help the operator identify the bomb, locate it and components from a safe distance.

However, the main demand in the market for remote-controlled munitions disposal devices will remain the simplest models. Since the beginning of 2001, more than 30 terrorist munitions operations have been carried out around the world, injuring about the same number of people. About 75% of the losses were incurred by recycling crews, which were equipped with only the simplest tools and not the simplest remote control devices.

Every technique has big problems. For example, its high cost. This is not necessarily a problem for developed countries, but it is a real problem for developing countries. And where do terrorists most often come from?

Too often, technical systems lose value if they are poorly integrated into a comprehensive action plan. This plan should provide for the connection of additional systems with detailed detailed operating logs, managed by well-trained and regularly certified personnel. All technologies in the world are useless without proper management and understanding of their strengths and weaknesses. Six months after the events of September 11, 2001, the security services of some American airports

calmed down and missed up to 70% (!) Of the test samples when checking the checkpoints.

Thus, the technique allows to partially solve the problem. As terrorism spreads its tentacles, acceptable solutions must be found. This means that there will be a real market for inexpensive and not very complex devices. The detectors, although it does not have excellent but acceptable properties, easy to use and maintain, will always surpass the complex, but poorly operated, perfectly executed system performance.

The number or features of the equipment of care facilities depend on several factors, namely the number of people who will be cared for; Premises that can be allocated for equipment placement; on the number of employees who know how to use the devices. For example, it is clear that a large airport with a complex infrastructure, which regularly serves a large number of passengers, needs more devices to provide efficient coverage than a small airport with a smaller capacity.

Therefore, the number of passengers is the best criterion for estimating the amount of equipment needed to ensure the efficient operation of care facilities, for which formalities at this airport do not lead to complaints from passengers. The calculation of the required amount of equipment is based on the results of analysis and forecast of passenger traffic statistics.

X-ray machines must be safe to operate. It is necessary to provide some protection of the operator and technical staff from electric shock and X-rays. The design of the device must prevent accidental access to the X-ray chamber during normal operation and maintenance.

X-ray machines must have reliable radiation protection. The level of external radiation should not exceed 0.5 mR / g at a distance of 50 mm from any point on the surface of the X-ray machine. With regard to occupational safety measures, X-ray devices must comply with the requirements of the International Commission on Radiation Protection (ICR) and / or other internationally recognized standards.

*Requirements for stationary metal detectors*

The metal detector must ensure the detection of metal objects of different sizes, regardless of shape, position and orientation, which are in the field created by the device. The metal detector must emit a light signal proportional to the size and density of the metal object in the generated field, including the sound signal, if the size or density of the metal object exceeds a certain value. Light and sound signals must be programmable and adjustable. The duration of these signals should be 1... 10 s, the shutdown is automatic. The field created by the metal detector to detect metal objects must be evenly distributed over the entire height and width of the device.

The system must be able to adjust the sensitivity to detect specific objects within the size and density of metal objects. The supplier must indicate the sensitivity range in the technical documentation. The system must visually indicate the performance of the metal detector. All handles and controls must be placed in a protected and closed place. The dimensions of the free passage are 2000 mm in height and 800 mm in width. The frequency of false positives should be low. No moving external metal objects can operate the metal detector.

The metal detector must not interfere with pacemakers and other medical devices, quartz watches and magnetic media. The system provides 600 facilities per hour. The system is located directly next to the X-ray machine with a conveyor belt and two meters from another such system with an X-ray machine. Therefore, the system should not create obstacles and obstacles to the operation of neighboring systems.

#### **2.4. Analysis of ensuring the appropriate level of security in the service of luggage, cargo, mail**

In recent years, the world has made several industrial developments in airport baggage control systems, which have significantly improved the ability to control and detect explosives and weapons. This is in line with ICAO safety recommendations. The full solution of the problem will require the joint efforts of the international community.

However, the increase in cases of illegal interference in the functioning of the air transport system indicates the possibility of an increase in cases of terrorism in those countries where active international policy is beginning to be pursued.

Flight safety is now seen by some states as a commercial factor, which means that strict control of passengers' luggage is increasingly affecting the overall efficiency of airlines. It is clear that there is no simple and unique way to ensure strict control of passenger baggage at different airports around the world, in addition, this control will be different for airports around the world and will depend on the number and type of air traffic, shape, size and probability of strict control system.

Some control systems use sophisticated technologies (for example, the EDS system, which is constantly being improved), and in other cases manual control is used. In some countries, baggage screening is carried out before passport control, in others - after it. The advantages and disadvantages of each of the existing technologies are known and taken into account and depend on the complexity, characteristics and cost of a particular system.

The paper features the features of modern baggage control technologies:

- control with the placement of luggage in the equipment (control system) or for it may have advantages, but is accompanied by a conversation with the owner of the luggage;
- baggage screening in front of control devices requires a significant and expensive space, which the airport operator often prefers to use for commercial purposes (for concession);
- control with the storage chamber in the equipment can continue the control procedure;
- baggage control with the help of control devices requires that the conversation with the passenger was short;
- the usual X-ray control system is easy to obtain, but requires more operators than simpler and less complex automatic control systems;
- any technology can generate faulty signals that need to be resolved with the passenger in these disputes;

- technically complex control systems, such as radiographic, must be able to switch to manual control;

- Some automated screening systems optimized for use in high-speed baggage inspection are best used with a conveyor belt.

Automation makes handling large flows of luggage easier and simpler.

ICAO, the International Airport Council (ASI) and the International Air Transport Association (IATA) can inspect airlines, their airports and professionals.

When choosing baggage screening technology at airports, it is important to clearly understand the limitations of the screening system chosen. The changing economic situation in recent years has led to the emergence and use of new technologies. This means that the process of implementing the program of transition to 100% control of passengers and luggage is delayed. The main requirement for both large and small airports, as well as for all airlines operating international, domestic scheduled or charter flights, is the maximum versatility, reliability and minimum possible cost of transportation of one piece of luggage.

The system for detecting explosives and weapons can be divided into the following categories:

- technical means without obtaining an image - gamma-ray reflection, radioactivity detectors, metal detectors, dogs;

- technical means with obtaining images - X-rays, gamma rays, ultrasound, neutron radiation, etc.;

- chemical identification - detectors of traces of substances, nuclear quadrupole resonance of NQR, X-ray diffraction, pulsed analysis by fast neutrons PFNA

As early as 1980, several countries began using so-called neutron analyzers (TNAs) to check passengers and luggage. However, their use is hampered by the difficulty of taking into account the conditions at a particular airport (for example, dust in the baggage sorting department, etc.), as well as insufficient time for baggage control.



Radioscopic control systems began to be used in 1990. During this check, the luggage is placed in front of or in the control unit. The system cannot be used at all airports and only in the following cases:

- if the airport is restricted by international traffic;
- when there is a relatively cheap labor (which is not typical for European countries);
- at airports that are involved in air traffic during certain crises (for example, the Gulf War, Afghanistan).

In the early 1990s, several promising management systems began to be developed. One of them is also an X-ray system, but its operation is simplified compared to previous systems. Reducing the cost of computer equipment has led to the creation of more convenient, reliable and universal (intelligent) X-ray control systems. New generation control systems (CDS) are able to automatically determine the probability of an explosion with sufficient accuracy. Computed tomography can also be used to determine the probability of an explosion. European countries, the United States and ICAO are developing standards for such systems. The reason for this is the "Convention on the marking of plastic materials to determine the probability of explosion", adopted in Montreal in March 1991 [17].

Promising passenger and baggage control systems should operate on a one-off check-in basis and not require screening at transfer airports. This is the reason for establishing common criteria for all airports (which European airports have almost achieved with the launch of the ECAC program). The joint efforts of all ICAO member countries and the ECAC program in Europe will lead to the introduction of 100% control of passengers and luggage over the next decade.

Despite the fact that a large number of different technical means are already used, experts continue to work on tools that are designed to increase the attention, concentration and skills of interpretation of the operator. The interpretation is decisive because terrorists know that the operator is looking for devices with a typical design and, above all, with important unmasking components. It is

impossible to predict in advance what the contents of a passenger suitcase and well-thought-out terrorism will look like.

Many care device operators talk about unusual items in their luggage and even weirder ways to pack them. It is clear that staff training also plays an important role, as does the need for the operator to know and feel the importance of the work.

X-ray machines are not new in their technology, but software improvements can help the operator artificially paint objects hidden among dense materials between organic materials, light and heavy metals. The mechanism for detecting a simple X-ray system is to detect different shapes and densities. Such gamma-ray systems are used in some situations to illuminate large objects, such as bulk materials and machines.

SAIC, an international applied research company, has developed gamma-ray detection systems such as the VACIS machine and the cargo inspection system. Sources of gamma rays are isotopes contained in a strong container with appropriate biological protection. Therefore, they require much less maintenance than X-ray generators. SAIC manufactures stationary and mobile gamma ray systems. Mobile systems can offer efficiency and effectiveness by creating high quality images. Mobile systems can be delivered to the port and installed by three people in 15 minutes.

The advantage of imaging systems is that they can provide high bandwidth if the operator can stay focused. Some X-ray systems contain signal transmitters to draw the operator's attention to objects of a certain density and size. The CTX series, manufactured by Ins Vision Technologies, uses cross-sectional computed tomography to detect everything that looks like a bomb for passengers and luggage at airports. CT (or tomography) is a medical technology that allows you to view the contents of luggage. It is increasingly used at airports and border crossings.

Other systems are used in slightly different ways to obtain an image of the object under study. The functional principle of fast neutron pulse analysis of PFNA is that the object is irradiated by a pulsed stream of fast neutrons. These neutrons come either from a radioactive source or from a neutron generator. Irradiation of

luggage with them leads to the appearance of gamma rays, which re-emit carbon  $^{12}\text{C}$ , oxygen  $^{16}\text{O}$  and nitrogen  $^{14}\text{N}$  with special unmasking properties.

These systems can be programmed to send an alarm after the detection of certain unmasking factors and, accordingly, certain explosives. A key advantage of such systems is that the operator does not need to interpret the results, so the system can be left alone to check a significant amount of luggage. Although PFNA analysis is not technically a system based on obtaining an image of the internal structure of the object of control, some of its variants may provide pseudoimages to facilitate finding the location of a particular substance in luggage. It is clear that this type of equipment is not suitable for testing by humans. PFNA analysis is usually under development, and such systems are rarely used.

Chemical trace detectors use a variety of principles, including ion mobility detection, chemical testing, and gas chromatography. A sample detector is required. This factor of the detector system usually means that the sample must be taken manually and not by an automated system. Chemical trace detectors have the added advantage of examining people and are especially useful for identifying certain materials. However, they often take a long time, either because of the sampling process or because of the duration of the test itself. The probability of erroneous results depends on the technology used, but is usually in the range of 0.1 ... 0.15.

At the forefront of explosive detection methods are so-called biotechnological detection systems, which use, for example, antibodies with a genetically inherent ability to react with certain explosives. The specificity of reactions with biological antibodies gives these systems a high level of accuracy with a low probability of false alarms. However, these systems must be selected manually.

The developed advanced detection systems will use data integration, i.e. a combination of two or more technologies in a hybrid system. Of course, quadrupole QRA resonance analysis will be part of these hybrid systems, but imaging systems will retain their place for at least a few years.

## **Conclusion to Part 2**

Nowadays, all aviation-related personnel has to be provided with the ID-card in order to enter the controlled area of the airport. The issuance of such document can take up to 2-3 month due to the necessity to agree it with the Security Services. Such complicated process is performed in order to mitigate the risk of unlawful interference at the airport or onboard the aircraft.

Also modern technologies allow to detect dangerous items that are tried to be carried in the baggage or as a carryon. The most advanced of them give the possibility to inform if any suspicious baggage has been detected even if the operator misses it that in its turn decrease the level of human factor error.

## **PART 3. WAYS TO IMPROVE QUALITY CONTROL OF AVIATION SAFETY**

### **3.1. Control of elimination of the revealed violations of requirements of aviation safety**

In today's globalized and high-tech world, the success of an individual country largely depends on its integration into international institutions that determine the policy of effective development of a particular industry and develop standards for its operation. The basis of safe and regular international air traffic are international standards of the aviation industry, requirements for physical properties and configuration of aircraft, functional responsibilities of personnel, basic rules of aircraft operation. They are mandatory for all member states of ICAO, the International Civil Aviation Organization. It was founded in 1944 and today unites more than 180 countries. The priority areas of the organization are technical, economic and legal support for cooperation in the field of civil aviation. ICAO initiates the adoption of legal acts that standardize flight rules, personnel requirements and standards of airworthiness of aircraft. These documents are systematized in such areas as "Standards", "Recommended Practice", "Procedures".

An important step towards the creation of a judicial space for civil aviation in Ukraine was the adoption in 2003 of the State Program for Civil Aviation Security (Law of Ukraine of 20.02.2003 № 545-IV) [31]. It is designed in accordance with the Conventions on International Civil Aviation to combat the illegal seizure of aircraft and illegal acts contrary to the safety of civil aviation. The purpose of the program was to create organizational and legal conditions to ensure flight safety and efficiency of civil aviation. Its main functions are the implementation of measures for the protection and safety of passengers, crew, flight crew, aircraft, airport facilities, etc. An important feature of the program was that its main provisions were generally based on international standards. In particular, the program stipulated that international air transport agreements concluded by Ukraine with other countries should contain air traffic safety requirements in accordance with the standards and recommendations of the International Civil Aviation Organization. One of the

priorities of the Department of Civil Aviation Security is to work with international civil aviation organizations in such areas as participating in the development of international and multilateral aviation security agreements and making proposals to improve international aviation security standards, developing proposals to improve aviation security, permanent or temporary participation in the work of bodies of international civil aviation organizations, the tasks of which include aviation security, cooperation with international civil aviation organizations.

The aim of strengthening cooperation with international organizations in the field of civil aviation, led by ICAO, was to adapt domestic legislation on aviation safety to international standards. Following the implementation of the program, important steps were taken regarding the legal provision of aviation security. Regulations on the procedure for using airfields of Ukraine (2003), Resolution of the Cabinet of Ministers of Ukraine "On approval of the List of dangerous objects and substances prohibited for carriage by air" (2007) and the Law of Ukraine "On Aviation" (2011). At the same time, the process of implementing ICAO flight safety standards has been quite lengthy and complex. In 2015-2016, about 15,000 GOSTs of the USSR were repealed and more than 4,000 modern technical standards that meet international and European requirements were adopted. In January 2015, a law was adopted to adapt Ukrainian legislation to European Union standards in the field of technical regulations and conformity assessment.

A logical step was the adoption by the Verkhovna Rada of Ukraine on January 17, 2017 of a new law "On the State Program for Civil Aviation Safety". Its feature is the maximum consideration of ICAO norms. Agreements on mutual recognition of standardization certificates between Ukraine and the European Union will allow, like the planes of domestic companies, to obtain their certification, which in turn integrates domestic aviation into the European and international transport space.

*Improving the level of safety in aviation*

Problem to be solved: issues of coordination and interdepartmental control of the ornithological situation around airports in accordance with ICAO document 9137, part 3 "Risk from birds and methods to reduce them", in particular the

development of commercial or other activities within 15 km radius not regulated by law airports (from the aerodrome control point, ARP).

*Decision:*

1) updating the aviation security policy taking into account the national civil aviation security program at the national level and monitoring the status of its implementation by air carriers in accordance with Annex 17 to the Convention on International Civil Aviation;

2) the establishment of a single center for the collection and analysis of civil aviation incidents in order to make the best decision in the event of an incident or illegal interference;

3) development and implementation of an action plan for the implementation of the State Program for Civil Aviation Security, in particular the creation of a civil aviation cybersecurity system taking into account ICAO requirements, guidelines of the national cybersecurity regulator and existing European recommendations;

4) implementation of the state aviation security program to create an effective ground management system at the ground and air levels in accordance with Annex 19 of the Convention on International Civil Aviation and the Global Security Plan for 2013-2027;

5) implementation of European rules for certification of civil aerodromes and requirements for their infrastructure;

6) the legal introduction of systematic state control over the ornithological situation within 15 km of airports as an important part of ensuring safety requirements, including the involvement of certain commercial activities that may restrict birds (and other wildlife) and increase the risk of collision with aircraft ;

7) reduction of the negative impact on the environment of aviation activities in the airspace of Ukraine by introducing new technologies and taking into account the priorities set by ICAO standards and recommended practices, as well as the requirements of Eurocontrol;

8) ensuring the active participation of Ukraine in the work of ICAO, in particular the representation of Ukraine in the ICAO Council and full support for the

functioning and development of the ICAO European Regional Aviation Safety Training Center at the National Aviation University;

9) ensuring Ukraine's membership in the European Aviation Safety Agency (EASA).

An expert aviation investigation body is working with the Civil Aviation Authority to establish a mandatory incident reporting system to facilitate the collection of information on actual or potential aviation security deficiencies.

The accredited civil aviation authority shall establish a list of incidents and the amount of information on civil aviation safety to be reported by air carriers, analysis and / or investigation, and establish a procedure for reporting, verifying, analyzing and taking appropriate action.

Information on flight incidents and events provided under the mandatory alert system is entered into a database of voluntary and mandatory alerts. Names or addresses of persons are not included in the database of voluntary and mandatory reports. This database is used by the authorized persons of the Authorized Body of Civil Aviation and the Bureau for Investigation of Aviation Accidents within their powers to systematically analyze the information in the database in order to identify alarming trends in aviation safety and take precautionary measures.

The information collected in the database of voluntary and mandatory reports is protected by law.

To ensure the confidentiality of the information specified in part 3 of this Article, the information shall be disclosed to interested persons in accordance with part two of Article 122 of this Code.

In order to facilitate the collection of information on actual or potential safety deficiencies that are irregularly recorded within the reporting obligation, a system of voluntary reporting of civil aviation safety incidents is established and maintained.

The system of voluntary reports makes it possible for every citizen to inform the body responsible for civil aviation about negative events that have been recorded by him or in which the applicant participated. This system will be established in



accordance with the principles and procedures established by the Civil Aviation Authority.

A citizen who reports dangerous events or circumstances of civil aviation that may endanger the life and health of passengers, crew and operational services, as well as other threats, may not be subject to discrimination, persecution or restriction of rights and freedoms if these reports are confirmed.

APU 1817 clearly defines the reporting procedure, reporting deadlines and periods for the analysis of the event, the amount of information provided in the initial report, the list of events that are reported.

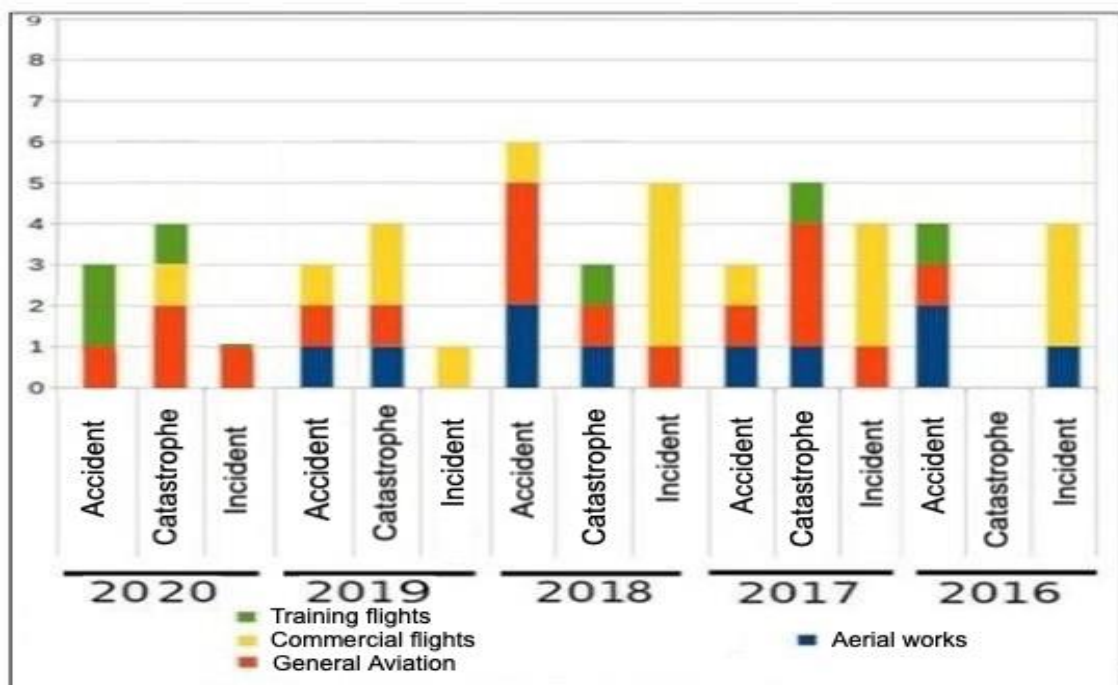


Figure 3.1. Distribution of accidents, catastrophes and serious incidents by type of flight for the period 2016-2020.

To facilitate incident reporting and information analysis, the Risk Management Department has developed an electronic web portal [rmd.avia.gov.ua](http://rmd.avia.gov.ua), through which air carriers can submit electronic reports, which are currently available to representatives:

During 2019-2020, the State Aviation Service received 2,024 reports of events through the web portal [rmd.avia.gov.ua](http://rmd.avia.gov.ua): 1052 - mandatory, 972 - voluntary.

Below is a comparative histogram of notifications received for activities for the period 2019-2020.

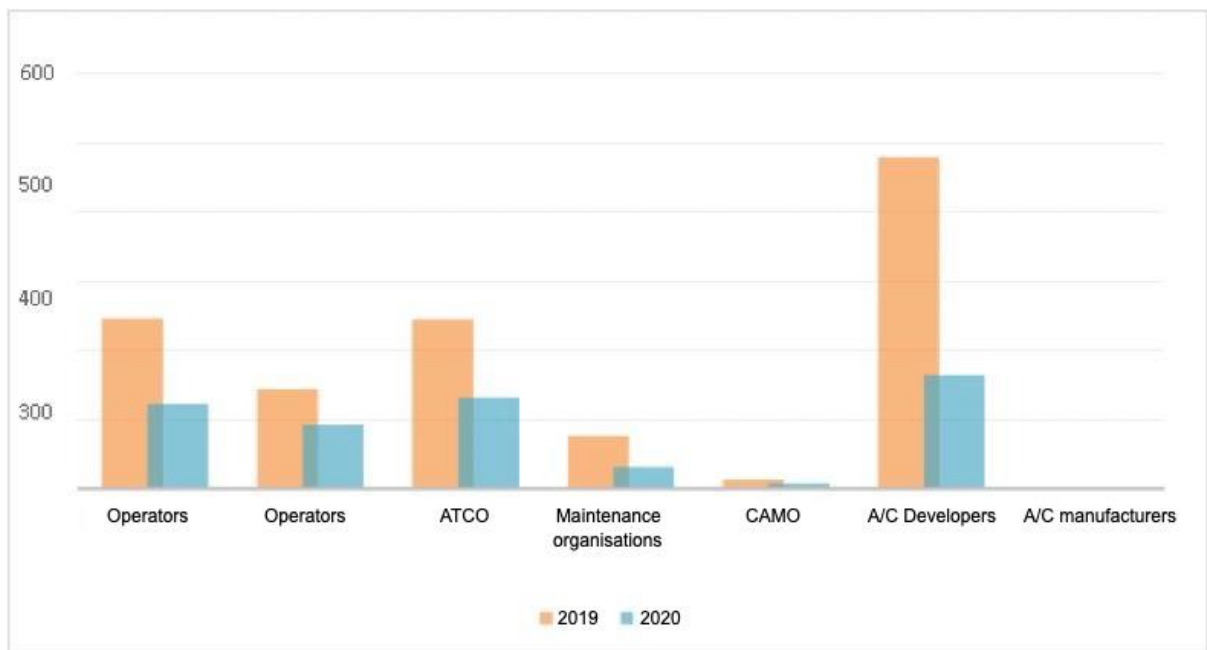


Figure 3.2. Number of notifications received for activities for the period 2019-2020

From the analysis of the number of reports by areas of activity, we can conclude that the reporting system is improving, and the reporting culture in most sectors of aviation is relatively low.

Priorities												
Number of events		3	15	26	4	16	1	5	8	1	3	0
Flight safety issues	Priorities	Key Risk Areas										
		Aviation Security	Collision with the ground	Upset condition	Collision with ground vehicles	Runway Excursion	Collision on the runway	Injuries	Environment	Ground collision	Mid-air collision	Taxiway Excursion
Decision making and planning			*	*	o	*	o		o		o	
Problems in civil-military coordination and cooperation		o										
Flight preparation and planning			*	o	*	o						
Experience and personal competence			*	*	o	*	o					
Perception and situational awareness			*	*	*	*		o	o	o		
Management system efficiency			o	o	o	o			o			
Aircraft maintenance			*	*		*		*	*		o	
CRM& Communication			o	o	o	o	o					
Heart disease			o									
Braking and steering						*						
Flight Safety Culture					o			o		o		
Knowledge of aircraft systems and procedures			o									
Providing crew with information						*						
Glideslope management			o			o						

Based on the results of statistical and analytical processing of flight safety data on the web portal <https://rmd.avia.gov.ua/>, a list of flight risks (hereinafter - SRP) for the period from 2016 to 2020 has been determined.

SRP has two dimensions:

The first dimension is the Key Risk Area (hereinafter KRA), which represents the most probable circumstances of potential aviation incidents in aviation areas and is aggregated according to the level of their risk determined by the ERCS methodology.

The second dimension is aviation safety issues (hereinafter: SI), which are causal and concomitant factors that lead to KRA (causing aviation accidents).

The points in the grid create a link between safety aspects and central risk areas - they show which safety aspects contribute to the corresponding (potentially) dangerous consequences. The source of points is data about events.

Aviation safety KRA reduces the level of risk of the aviation security system of the State Aviation Service by:

- implementation of a unified state policy in the field of aviation security, protection of civil aviation from illegal interference and cyber threats;

- development of draft laws and regulations for the implementation of state policy and planning in the field of aviation security;
- state supervision of aviation safety by air carriers, their protection against unlawful interference in accordance with the State program of quality control of aviation safety in civil aviation;
  - analysis and assessment of threats and risks in civil aviation;
  - ensuring a rapid response to any growing security threat;
  - planning and implementation of preventive measures to combat illegal interference and cyber threats in the activities of Central Asia.

As Ukraine has identified priority operational risks at the state level, airlines are encouraged to consider such risks in their own safety management processes by assessing operational risk, setting targets, identifying necessary measures to reduce the level and implementing these actions. The State Aviation Service monitors the number and level of risk of incidents, determines the necessary measures in the framework of risk management for aviation safety and monitors how airlines have taken into account and implemented measures on operational risks at the national level.

### **3.2. Reassess aviation security measures and develop further corrective actions to improve aviation security**

The annual inspection plan to ensure the safety of flights of airports, air carriers, operators and other legal entities operating in the field of civil aviation is developed and approved by the state executive body, which is authorized to conduct inspections in accordance with Ukrainian legislation.

The following factors are taken into account when drawing up the annual inspection plan:

- assessment of the degree of threat of illegal interference in the activities of civil aviation and risk management;
- performance indicators of airports, air carriers, operators and other legal entities operating in the field of civil aviation;

- availability of high-risk flights;
- results of aviation safety quality control inspections for the previous year;
- new threats to aviation security;

Information on attempts or acts of illegal interference in the activities of civil aviation.

Based on the results of the inspection of the airport, air carrier, operator and other legal entity operating in the field of civil aviation, an inspection report must be drawn up indicating the deficiencies and deadlines for their elimination.

A copy of the inspection report is sent to the head or proxy of the legal entity.

In order to effectively implement measures to implement a set of measures of the national aviation security system and take corrective measures, state executive bodies shall organize in the prescribed manner the collection and evaluation of information based on the results of inspections. An annual final report is prepared.

The annual final report contains the following information:

- number and type of events held in the reporting year;
- review of identified deficiencies based on the results of inspections;
- proposals for adaptation of aviation security measures.

When conducting a quality assessment in the field of safety during the inspection (audit) deviations are divided into the following categories:

Category 1 - meets the requirements of the aviation security system;

Category 2 - does not meet the requirements of the aviation security system.

There are some non-critical shortcomings that do not directly affect flight safety;

Category 3 - does not meet the requirements of the national aviation security system. There are serious violations that directly affect flight safety;

If during the inspection violations of flight safety rules are revealed, the officials of the state control body will act within the powers of the legislation of Ukraine:

- issue to legal entities, civil servants and individuals in the specified field of activity, mandatory for the implementation of instructions on the elimination of identified violations, indicating the timing of their elimination;

- exercise control over the elimination of identified violations and take measures to bring to justice those who committed violations;

If during the inspection it is established that as a result of violation of aviation security measures there is an imminent threat of illegal interference in the activities of civil aviation, it is necessary to take immediate measures to prevent harm, including a temporary ban on the legal entity, its branch, representative office, structural unit. established by the legislation of Ukraine.

Depending on the categories of identified discrepancies and the severity of their impact on the level of aviation safety, immediately develop corrective actions that must be taken immediately upon detection of any deficiencies by the inspection team.

In case of violation of the provisions of the legislation of Ukraine in the field of aviation safety to legal entities operating in the field of civil aviation, the following measures may be taken:

- suspension or revocation of the license for aviation security activities;
- suspension or termination of the certificate of conformity in aviation security.

Legal entities, civil servants and individuals guilty of violating flight safety rules may be prosecuted in the manner prescribed by law.

The state system of regulation of civil aviation in Ukraine in general, and air transport in particular, is based on international aviation law. The main normative legal act of the civil aviation legislation of Ukraine is the Aviation Code, the purpose of which is to create a legal basis for the safe operation of all subjects of the aviation industry of Ukraine.

Economic security should also be taken into account, as an inefficient airline will not be able to comply with the above rules. Economic security is also affected by the condition of the aircraft.

According to a study by Saber Airline Solutions, there are three main issues that affect economic security: rising fuel costs, government regulation, and customer loyalty. Although concerns about the fuel problem have grown in the North

American region, more and more attention has been paid to the environment in Europe recently. The same problems remain unresolved in Ukraine. The impact of the above problems on the activities of airlines can be reduced by improving their technical level by eliminating obsolete equipment. The problem of old planes is not new, it exists all over the world, but in Ukraine it has become sinister. Today, the level of safety in air travel depends on its solution. Only the consolidation of the efforts of aircraft designers, operators and manufacturers with proper funding will help solve the problem.

The new generation of aircraft will provide Ukrainian airlines with a number of advantages. Flight safety consists of the following components: economic, technical and environmental.

With increasing competition, the main criterion for the profitability of the airline is to reduce its costs. IATA chief economist Bran Pierce said the aviation industry was performing even better than expected, but remained satisfactory despite the "oil shock" that raised transport prices and caused significant financial losses to airlines. See Appendix 1

Thus, cost is another factor influencing the introduction of new high-tech systems. The need for technical re-equipment is evidenced by the increase in the cost of maintaining airworthiness and certification of obsolete equipment, as well as possible errors in maintenance. To avoid such mistakes and increase flight safety, it is necessary to systematically prevent them, assess the possible consequences and use a mechanism to involve staff in such activities. At the same time, employees must have a firm guarantee that they will not be punished for reporting their own shortcomings and mistakes. In justifying the need for technical upgrades, special attention should be paid to the different levels of fuel efficiency of old and new devices.

For reasons of economy on international routes, so far mainly used aircraft of foreign companies and are in demand with little wear. Regional transportation requires a complete set of An-140 and An-148 aircraft, the ratio (price - quality - efficiency) which allows airlines to receive a stable profit. However, problems with

their manufacture, maintenance and delivery open the way for regional aircraft of foreign manufacturers, such as Bombardier and Embraer, to enter the Ukrainian market. They are not so effective, but, unlike their domestic counterparts, are available, and their purchase and operation allows you to use convenient leasing models through foreign financial institutions.

However, we must not forget about flight safety. For any airline, transportation safety and profitability are paramount, but these factors sometimes contradict each other. Under these conditions, it is necessary to combine regulatory tools (eg noise, pollutant emissions, etc.) and changes in the structure of payments and taxation based on accounting for operating costs to reduce the costs of socially unforeseen emergencies and costs related to plane crashes, accidents, damage to the environment, etc. to a minimum.

The airline's image and technology also depend on its national and global image. Today, the world community is closely monitoring the work of airlines. For example, a plane crash affects a number of airlines, and every incident (whether a jet engine failure or a flight delay) reported by the press in a highly competitive environment leads to a reduction in commercial air travel. Airline associations constantly create and publish reviews of the safest and most dangerous airlines, on time or not, there are even reviews of airlines that often lose the luggage of their passengers. In these conditions, the work of airlines requires special vigilance and equipment - a high level of serviceability and competitiveness.

The fuel problem also affects aviation safety. Sometimes, in order to save fuel, airlines do not allow their planes to make an emergency landing or replace an airfield, which leads to air emergencies. Therefore, there is a need to create regulatory and economic conditions under which airlines that rely on safety should not carry out air transportation.

However, given the significant increase in fuel prices for domestic aircraft, it is almost impossible to ensure the efficiency of flights. Fuel consumption Tu 154-M is 4.8 tons per hour, its foreign counterpart (Airbus A-320) 2.2 tons [6]. There is a lack of a commercial fleet, and the existing one is morally and physically obsolete.



In addition, there is an opportunity to purchase abroad so-called second-hand, which are actively used by Ukrainian airlines. This, of course, for a number of reasons, one of which is perhaps the most important, even foreign ones that have been in operation, consume 30-60% less fuel than old domestic equipment. At the same time, the world's air giants are already actively developing a new generation of commercial aircraft, which will save 20% of fuel compared to motor. The only way out of this situation may be to impose such a fee on aircraft that are more than ten years old, which will make it impossible to buy them and make them unprofitable to operate.

The situation is complicated by the fact that on domestic aircraft, equipment that calculates the required amount of fuel per flight, gives an error of plus 1 ton, which directly affects the payload and, consequently, transport costs. For comparison: foreign aircraft with equipment have an error of plus 100 kilograms. The ship's crew is responsible for refueling. There is even a way to pay pilot bonuses for kerosene savings and overspending fines. In Europe and the United States, by contrast, airline managers do not determine the dependence of pilots' salaries on fuel consumption, as this may affect road safety. IATA has now developed a special aviation fuel saving strategy that includes not one service but several services within the airlines themselves. These are the air traffic controller, the structures responsible for route correction and operational efficiency, as well as the units that coordinate their work with IATA expert groups. To avoid the impact of profitability on transportation safety, fuel risk protection mechanisms similar to IATA member airlines are used.

The issue of saving and consumption of aviation fuel also depends on the regulation of prices for it at airports, insufficient resolution of legal and economic issues of monopoly filling stations (PZK) at airports. The exclusion of competition between aviation gas stations is the reason for the uncontrolled rise in fuel prices and after-sales service. In these conditions, one of the priority tasks is to develop its own pricing mechanisms for aviation fuel. The largest share of fuel costs in civil aviation - more than 27%. For comparison: in maritime transport the share of fuel costs is

about 13%, in road transport 25%. "It is necessary to create conditions for PZK, so that its profit is not due to the sale of aviation fuel, but through the provision of services for the reception, storage, preparation, quality control, delivery and refueling of air in the air. "Ship" –says the director of the trading house TOAP Eugene Ostrovsky [6]. The high cost of fuel may affect the process of Ukraine's integration into the world air transport market and the creation of hub airports on its territory.

It is necessary to create a mechanism to balance the interests of airlines, their employees, airports and PZK, with a way to reduce fuel costs and air travel costs.

Therefore, when carrying out technical modernization, it is also necessary to analyze its economic benefits, the cost of purchasing or renting new equipment with profitability, the cost of the airline to improve fuel efficiency, safety, environmental friendliness and, accordingly, and payments. The problem of economic efficiency in air transport requires constant control, improvement and management related to: changes in current state legislation, development of the airline and the definition of its new priority goals, the emergence of new competitors, changes in the behavior of existing ones due to changes in political and economic situation. state and criminogenic situation.

The use of new technologies makes it possible to ensure both economic security and flight safety. During the operation of the latter, the cost of kerosene will be reduced by almost half. One of the decisive factors in choosing a new generation of aircraft is the noise and emissions of pollutants into the atmosphere, another factor - the serviced routes. Therefore, aircraft operating international air services must meet generally accepted international safety standards. On 1 January 2005, European aviation authorities imposed a ban on flights in the airspace of aircraft that are not equipped with early warning systems for approaching the ground, as well as the function of assessing the terrain in the direction of flight. This problem can be solved with the help of the technical component of aviation security, which eliminates the dangerous manifestations of terrorism. Airport technical re-equipment also aims to protect aircraft from unlawful interference. Improvements to pre-flight check-in

equipment, new capabilities for baggage, hand luggage and personal baggage control will increase flight safety in the industry. It is necessary to reduce the risk of dangerous approach and dangerous collision of aircraft on the runway, to develop a collision warning system that transmits information directly to the ship's crew and does not use the mechanism of ground surveillance system - dispatcher - pilot.

As the number of aircraft is expected to double, the trend of increasing emissions of pollutants from global air traffic is particularly threatening. Emissions of carbon monoxide, water vapor, air smog and indirect air pollution with nitric oxide are constantly increasing and reaching catastrophic proportions.

All of the above factors are interrelated and can affect each other. For example, improving the environmental situation can reduce the airline's cost of paying emission allowances, which has a positive effect on the economic safety factor, and optimizing the fleet with new, improved aircraft models will directly improve the safety of the safety component.

Technical re-equipment of airlines will also have a positive impact on flight safety. They can be divided into those that depend on airlines and those that do not depend on airlines. The latter include: weather conditions and other obstacles. Human and technical factors depend on the airlines. Consider the direct impact of a technical update on the latter.

The technical and technological factor of flight safety includes from the airline: selection of the appropriate type of aircraft (aircraft), maintenance of airworthiness, compliance with ground handling technology, control of own production and repair of parts and components, certification and standardization of devices. The airport must pay attention to the quality of the runway, prevent illegal interference in its own activities and the activities of airlines - aircraft operators, to ensure proper air traffic control. In order to better prevent weather emergencies, it is also necessary to modernize the activities of meteorological services with which airports cooperate. They provide information about wind gradients, landing schemes, etc. Today, only a few have their own meteorological service, the equipment of which usually does not meet modern requirements of pilots. Unlike local companies

in China, for example, the Asian Aviation Meteorological Service is being implemented in collaboration with the World Meteorological Organization, which disseminates data on the Internet.

It is also necessary to include data on the presence of birds in the pre-flight information to avoid collisions with them. At the global level, this problem can be solved with a single bird information system. The Royal Netherlands Air Force already uses a bird alert system that includes flock density, location and time of stay, and a similar system (US-BAM) exists in the United States. The creation of an appropriate international model for monitoring and informing airlines about the meteorological situation, the presence of birds and other factors beyond their control can help solve these problems. However, this is not possible at the appropriate level without the use of state-of-the-art equipment and technologies, the development of which is entrusted to design organizations and institutions.

There are significant problems with the human factor. Over the last 5 years, more than 70% of aviation accidents have been related to this [2]. This is the main cause of 80 percent of tragedies in aviation. The concept of "human factor" should include: optimization of equipment savings, improvement of training, the ratio of personal factors. The human factor in an emergency can play both a positive and a negative role, localizing it or worsening it. During a normal flight, in the event of a dangerous situation, the pilot must make such a decision at no additional cost to the airline. This requires developing an adequate and rapid response to unexpected emergencies and localizing the impact of administrative and management staff on crew members by creating conditions for airlines where traffic safety is a priority and non-compliance can lead to significant economic losses.

System failures require special training to work in a variety of situations. There is no need to create an adequate picture of the situation, which includes lack of time, equipment failure, personnel changes, solving several tasks simultaneously, and so on. It is necessary to take into account the process of constant complication of all aircraft, which requires appropriate automation, otherwise the "biological" intelligence of the airline staff will not be able to cope with all the tasks. The

introduction of a central video surveillance system at airports and the improvement of the functional responsibilities of the relevant services will help to solve this problem.

With the increase in the number of passengers on Western aircraft, there are threatening trends that can only affect flight safety. There is a very noticeable lack of interaction between the crew, violations of work techniques, lack of awareness of the flight crew. Problems with certification can also occur if there is a change in the standard design of the aircraft or a change in the operational and technical documentation that affects the airworthiness.

With regard to flight safety, it should be noted that the level of so-called small aircraft is still particularly low. In search of profit, small airlines forget about the rules of safety and operation of air transport. Therefore, it is necessary to introduce and apply uniform requirements for the operational condition of equipment for both large and small airlines, as well as to strengthen control over compliance with safety rules for small aircraft.

The general processes of globalization and integration, the rapid growth of transportation and competition in world markets, the need for mass renewal of the fleet, the change of the generation of aviation specialists are the problem of improving flight safety for Ukrainian airlines.

Studies of air safety and efficiency indicate deterioration in these indicators. One of the main reasons for this situation is also the unsatisfactory condition of aircraft. To improve it, it is proposed:

- creation of a system of effective public administration, regulation and supervision in the field of civil aviation;
- increase the status of aviation, strengthen the structure and personnel, develop the accumulated potential;
- to achieve systematization in the prevention of flight accidents;
- provide the necessary organizational, logistical requirements for quality training of flight crew in educational institutions of civil aviation;

- to restore and consolidate the practice of medical examination of crews before departure, to oblige medical control of pilots of small aircraft, to create a system of supervision over the work of medical units;

- to develop a comprehensive program of modernization of meteorological equipment throughout the country;

- review and improve the regulatory framework for civil aviation in accordance with international standards and requirements;

- give the development of civil aviation and the aviation industry the status of a national priority project and make aviation safety an integral part of national security;

- ensure compliance of the operated fleet with ICAO requirements for noise, emissions, navigation accuracy, avoidance of collisions between aircraft and obstacles, life support systems with gradual decommissioning of non-compliant aircraft requirements;

- introduce into national law measures establishing liability for the delivery of counterfeit and substandard aircraft, as well as for forgery of numbered documents relating to this property;

- to develop a system of measures that ensures the author's supervision and responsibility of the aircraft developer for the installation of technical means during operation and repair, for compliance of technical documentation with established standards and preservation of airworthiness during operation;

- Introduce voluntary self-regulation of airlines, airports and companies of the Air Traffic Management System (ATMS) based on the results of each advertising season on the main issues affecting flight safety. Based on the results of monitoring, ensure that the necessary measures are taken;

- develop and actively maintain information exchange mechanisms that ensure the smooth exchange of safety information between all parties involved in aviation;

- provide for an increase in the number of ICAO Category III aerodromes suitable for normal base traffic in accordance with the European Air Traffic Management Plan;

- implement quality management systems in the field of civil aviation management;
- to ensure effective control over the safety of flights of aircraft of foreign operators on the territory of Ukraine under the SAFA program;
- to establish strict control over observance of provisions and the Instruction on the account by operators of materials of aviation offenses;
- to create a mechanism for reconciling the interests of the state, manufacturers and operators of aircraft with airports, PZK, which allows:
  - a) create a system that encourages flight crews and air traffic control to save aviation fuel, taking into account the safety of flights and reducing the moral pressure on pilots to consume fuel;
  - b) introduce a corporate policy of airlines to save aviation fuel;
  - c) stimulate for domestic batteries to improve aircraft engines and avionics, which automatically calculates fuel costs;
  - d) to create systems of state control over the antitrust of the aviation fuel market and the transfer of competition from resale to the quality of service and development of airport infrastructure.

### **Conclusion to Part 3**

An appropriate integrated approach will have a positive impact on both the efficiency and safety of air transport, as well as provide an opportunity to strengthen the image of Ukraine as a transit country with a developed infrastructure and high-quality air transport services.

## **PART 4. LABOUR PROTECTION**

### **Introduction**

This graduation project is based on the investigation of information and practical experiments. The subject of this work is a study of present aviation security systems and control of its violation. In this work, we will consider working conditions, loads, and harmful sources in the workplace of an employee.

### **4.1. Analysis of working condition**

Harmful factors that consequence the human body during the functioning process can lead to injury, affliction or other irrevocable changes in employees health. The bad aftereffect is also conditional on on the amount of negative factors, how unchangeable consequences this condition can cause, direct or allusive contact, as well as the length of the contact of this factor with the subject.

Depending on the continuance and degree such factors can create harm to humans life. The preceding can lead to sickness or to increasing of existing already, and in the worst occasion scenarios could lead to lethal outcome.

#### **4.1.1. Workplace organization**

Aviation security officer workplace is designed to be a 3 persons working space. Total area for 1 person is:

$$A = (a \times b)/3 \text{ [sq. m.]}$$

Where a-length, and b-width (Fig. 4.1)



$$A = (16 \times 8) / 3 = 42 \text{ sq. m.}$$

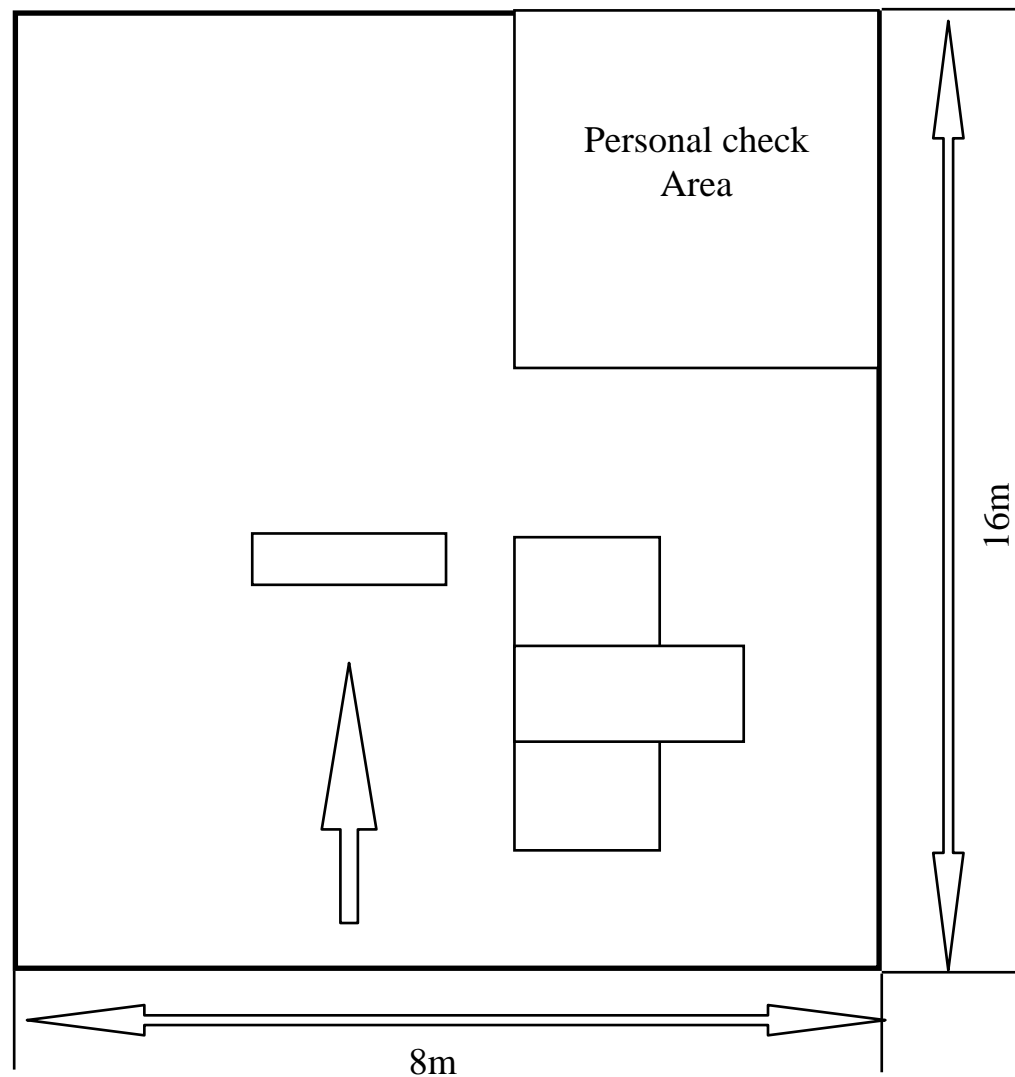


Figure 4.1 AVSEC workplace

The working area of one person is equal to 42 sq. m.

The volume of the working area is to be determined as:

$V = A \times h$  [c. m.] Where  $h$  – is the height of the room.

$$V = 128 \times 2.8 = 358.4 \text{ c. m.}$$

The perimeter is equal to:

$$P = 2a + 2b \text{ [m.]}$$

$$P = 2 \times 16 + 2 \times 8 = 48 \text{ m.}$$

All dimension of working space are within the limits of ДБНВ.2.2-28:2010.

The space is furnished with 10 ceiling lights, baggage scanner, metal detector, 2 first-aid kits, and 2 fire extinguishers, but there are no windows. In addition to, the working place is equipped with 2 types of outlets (for 220 V and 360 V)

The most preferable conditions of working are:

- temperature between 20 and 24C<sup>0</sup>
- relative humidity should be 40-60%
- air velocity must be 0.2-0.3 m/s

In order to maintain the preferable working state in terms of climate, ACsand heaters are used.

#### **4.1.2. The list of harmful and hazardous factors**

From a pack of normative documentation called ГН від 08.04.2014 №248 “Гігієнічна класифікація праці за показниками шкідливості та небезпечності факторів виробничого середовища” we can define the list of harmful factors in our project case. All of them belong to:

- microclimate (temperature, air velocity, humidity)
- illumination: natural (insufficient/lack), artificial (insufficient illumination; direct an reflected dazzling glare)

- electrostatic fields, permanent magnetic fields (including geomagnetic), electric and magnetic fields of industrial frequency (50 Hz), electro- magnetic source radio frequency range, electromagnetism of optical range (including laser and ultraviolet);

#### 4.1.3. Analysis of harmful and dangerous production factors

Depending on the destination the following classes are distinguished:

- means of normalization of air conditions in the working area (ventilation, air conditioning, cooling, etc.)
- protection against electromagnetic radiation
- means of normalization of illumination in working area (light sources, lightning devices, sufficiency of light, etc.)

Analysis of these harmful and dangerous factors are shown in chapters below.

##### 4.1.3.1. Microclimate of the working place

After comparing actual data of environmental conditions of working area with favourable, we get such a table:

	Optimal	Actual
Temperature $C^0$	20-24 $C^0$	26 $C^0$
Humidity %	40-60%	54%
Air velocity m/sec	0.2-0.3 m/sec	0.2 m/sec

Table 3.1 Comparison of environmental conditions

From Table 3.1 we can see that all parameters are beyond the preferable limits except temperature that is higher than the upper boundary. There is the necessity to increase the number of ACs or change their settings in order to cool the air.

#### **4.1.3.2. Electromagnetic fields and radiation**

According to the “Державних санітарних правил і норм роботи з візуальними дисплейними терміналами електронно-обчислювальних машин” ДСанПІН 3.3.2.007-98, , rules which are written in there are designed to forestall unfavourable consequences on staff member of harmful factors that go along with work with VDT, related to visual and emotional accentuation that performed in a strained working position at local voltage upper extremities on the background of limited overall muscle activity under the influence of a complex of physical factors of electrostatic field, non-ionizing and ionizing electromagnetic radiation.

These Rules incorporate hygienic and ergonomic requirements for establishment of workplaces, and workplace parameters working environment, compliance with which will avert disorders in the health condition of computers and PCs users.

Primary preventive measures that ought to be satisfied, according to the document mentioned above, to arrange safe and harmless working conditions for an operator:

- the area per workplace should be at least 6 sq. m. and a volume of not less than 20 cubic metres;
- The space for work with VDT must have natural and artificial source of light;
- The area is to be equipped with heating, air conditioning, or supply and exhaust ventilation;
- working area must be equipped with first aid kits;
- levels of positive and negative ions in the air VDT premises must comply with sanitary and hygienic standards N 2152-80;
- the value of the electrostatic field strength mustn't exceed the maximum value allowed by the book;

## **4.2. Engineering, technical and organizational solutions to prevent harmful consequences on human**

Preventative measures are divided into corporate and personal, which principal objective is to keep away from injuries and accidents during working action.

Corporate measures are designed to preclude or decrease the influence of dangerous working factors.

Personal measures are also designed to use of employee to forestall or shorten the negative aftermath of working conditions on its health. These category of measures is used in case when the structure of equipment and the organisation of production mechanism cannot guarantee the safeness of the worker.

Means of preventing harm and injuries for a worker:

- to preserve the health of workers, prevention of occupational disease and maintenance internally regulated breaks for rest should be provided;
- when corporate circumstances do not permit to apply regulated breaks, continuance of nonstop work with VDT should not overstep 4 hours;
- to decrease nervous and emotional stress, fatigue visual analyzer, augment cerebral circulation, it is desired to use some breaks to carry out a set of exercises;
- ionizing electromagnetic radiation at a distance 0.05 m from the screen to the housing of the video terminal at any the positions of the adjusting devices must not exceed 0.1 mber / h;
- the master criteria for assessing the suitability for activity with PCs should be pointers of the state of the visual organs: visual acuity, indicators of refraction, accommodation;
- the work chair must be lift-and-turn, adjustable in height, with the angle and inclination of the seat and back, the height of the seat surface must be adjustable within 400 - 500 mm, the surface of the seat and back of the chair should be semi-soft with a non-slip, hermetic covering that is easy-cleaned and not

electrified;

Overall, the greater part of these recommendations and requirements are satisfied in our case of avsec inspector workplace, apart from the natural source of light. It could be replaced in conformity with the regulatory document with adequate quantity of the light, with time breaks away from the working area.

### **4.3. Fire safety of working area**

Fires in avsec working space are to a certain extent rare but also occur. Basically, the source of fire appearance can be a short circuit, an overload in the network or all the more a damaged cable that wasn't patterned in time. According to "НАПБ А. 001-2014 Правила пожежної безпеки в Україні" the working space mentioned above can be classified as category D with electronics. Due to the probability of fire appearing in the working space, it is equipped with fire alarm system, and two different fire extinguishers.

The length of the primary escape path is roughly 20 meters. In case of fire appearing, the staff must leave the working area as it is shown in Figure 4.2, which is leaving the room through the door with the sign "EXIT", go straight forward approximately 10-12 meters take one more left turn and after 10 more meters leave the space via the escape door. There also is an alternative escape route that is to exit the room and go about 15 meters, turn right, go another 15 meters, then turn left and exit the building. The same picture of evacuation that is shown below must be put on the visible place on the wall inside the working space.

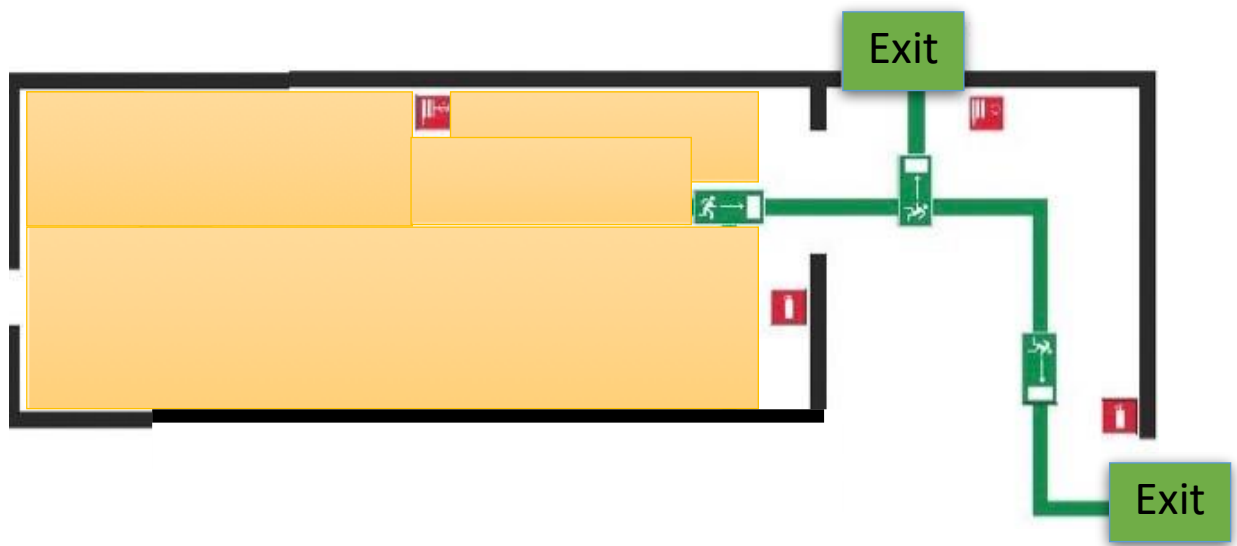


Figure 4.2 Emergency evacuation scheme

#### **Conclusion to Part 4**

During this project, we were able to assure that the employee is in good working conditions at his workplace and that most of technical, organisational and engineering measures are taken in accordance with regulations and laws and is strictly controlled by administration.

To make a conclusion on this chapter, provided that the employee follows all regulations, instructions, and company policies, there will be no negative effect for his/her physical or mental health.

## **PART 5. ENVIRONMENTAL PROTECTION**

### **Introduction**

Nowadays environmental as well as business concerns point towards paperless documentation. IATA is calling for paperless shift while assuring aviation safety, security, and environmental sustainability. Managing substitutions to the enormous paper handbooks can be complex because it embraces both airline operations, which owns and improves it, and maintenance, which also uses it. Every modification has to be printed and distributed to maintenance, as well as signed for by that department, so their record is not found to be out of date when the CAA pays a call.

There are several inefficiencies associated with the use of paper. Time wasted on data input, erroneous re-keying of data from paper into the maintenance information system, and ineffective search and retrieval are just a few examples.

Any business, no matter how big or little, can help solve the world's environmental concerns. All that's required is for competent and responsible business judgments to be made! Getting rid of paper is a terrific way to save money while also helping to protect the environment.

Discarded paper and paperboard account for around 26 percent (or 67 million tons) of the 258 million tons of solid municipal garbage created in 2014, and more than 14 percent of the 136 million tons of solid municipal waste that ended up in landfills in 2014. Paper trash, like other wastes, poses the extra risk of hazardous inks, dyes, and polymers that might be carcinogenic when burnt or commingled with groundwater via traditional burial techniques such as current landfills. Paper recycling reduces this impact, but not the environmental and economic impact of the energy spent in making, transporting, burying, and/or reprocessing paper goods.

#### **5.1. Summary of paper usage**

Savings are an excellent illustration of how you may help to solve the world's environmental challenges. According to the 2011 Manufacturing Condition



Report, "improvements in the usage and recycling of paper have a significant influence on the world's environmental situation." Progress in this business can aid in the resolution of a variety of urgent environmental issues, such:

- deforestation;
- climate change;
- the vanishing of natural habitats of animals;
- air and water pollution with poisonous chemicals (mercury and dioxins, methane emissions from decomposition of paper waste)

Awareness of reduction of paper consumption will help preserve forests, shorten water and energy consumption, and scour our planet of pollutants. One of the easiest ways to tighten paper consumption is to digitate paper information. Digital records are environmentally beneficial and more suitable to collect and use. Paperless business processes are a fighting chance to save capital rush up your business and satisfy regulatory requirements.

An airline's manuals is also a favourable candidate for conversion. These handbooks — which spell out a carrier's standard operating procedures — can be even longer than 2-3 thousands of pages so that their transformation into a digital version will play the good role in environmental protection.

### **5.1.1 Consumption information**

Paper has always played a significant role in our day-to-day life. It is not surprising that business, until recently, could not help itself without it. Archive documentation filing bureau legal and regulatory records - all these documents were traditionally kept in hard form. Various fundamental business processes are "triggered" by paper documents and result in the creation of more and more dozens of paper. For many companies, the conception of a paperless business is all the more on paper.

Tiny statistics on paper consumption all over the Earth:

- Each office worker uses an average of 10,000 sheets of paper per

year;

- 42% of paper documentation is garbaged within a day after being printed;
- The main consumers of paper are the United States and Western Europe;
- The highest outgrowth in paper consumption is ascertained in China; all other regions are challenging to decrease the level of paper consumption;
- More than 60% of organizations are still increasing paper consumption by creating more and more records in the hard copies;

In order to greater understanding of importance of avoiding paper records, it is imperative to understand the level of paper expense in companies. And the numbers, regularly are as following:

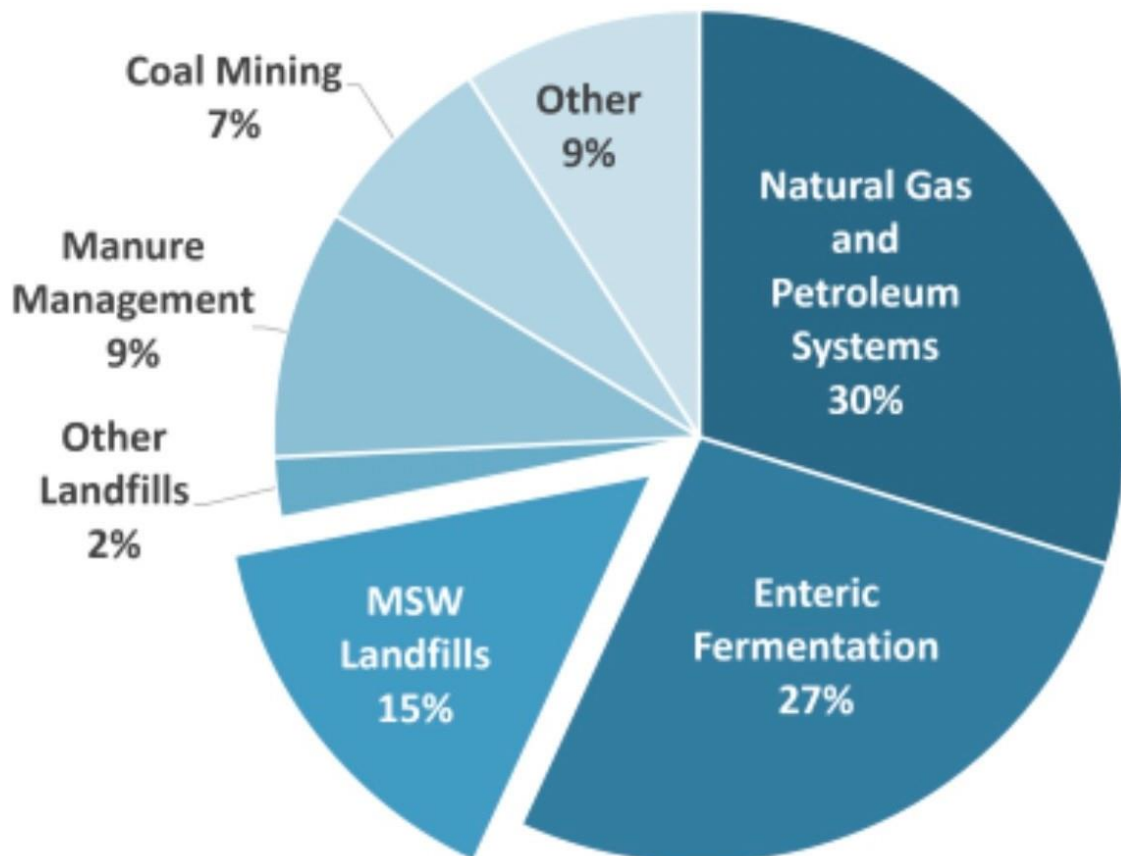
- On average, one document is copied 15 to 20 times;
- It takes approximately 20,000 € to fit a standard record storage with foursome compartments; archive upkeep charge is around 1600 € per year;
- The price for sending a paper document is 16 €;
- The price for finding an incorrectly sent document is 98 €;
- The price for re-creating a lost document is 204 €;
- Up to 20% of documents in companies are printed incorrectly;

The price for photocopying, faxing, shipping, storing and disposing of paper demand to be considered in order to visualise the real cost assets from eliminating paper media

### **5.1.2. Landfill pollution**

Not only is paper stuffing up landfills when consumers first get rid of it, but many human beings do not catch on that it can take five to 15 years for paper to

downfall in a landfill. When paper does partitioning in a landfill, it is normally due to an anaerobic rather than aerobic process of decomposition. Anaerobic is a deficiency of air and is caused by the compression systems in landfills that shorten the amount



of space the rubbish takes up. While this course of compression retains the volume down, in taking away the air pockets between items, the natural aerobic decomposition is prevented. In the case of paper, anaerobic disintegration is deleterious since it develops methane gas. Methane is combustible and extremely dangerous, creating landfills a greater environmental hazard.

Fig. 5.1 Methane emissions by source on 2019

Civil solid waste (CSW) landfills are the third-largest source of human-related methane emissions in the world, accounting for roughly 15.1 percent of these emissions in 2019. The methane emissions from CSW landfills in 2019 were approximately equivalent to the greenhouse gas (GHG) emissions from more than 21.6 million passenger vehicles driven for one year or the CO<sub>2</sub> emissions from almost 12.0 million homes' energy use for one year. At the same time, methane emissions from CSW landfills correspond to a lost opportunity to seize and use a substantial energy resource.

The undermentioned diagram demonstrates the changes in general LFG composition after waste placement. Bacteria decompose landfill waste in four phases. Gas composition changes with each phase and waste in a landfill may be undergoing many phases of disintegration at once. The duration after positioning scale (total time and stage duration) varies with landfill conditions.

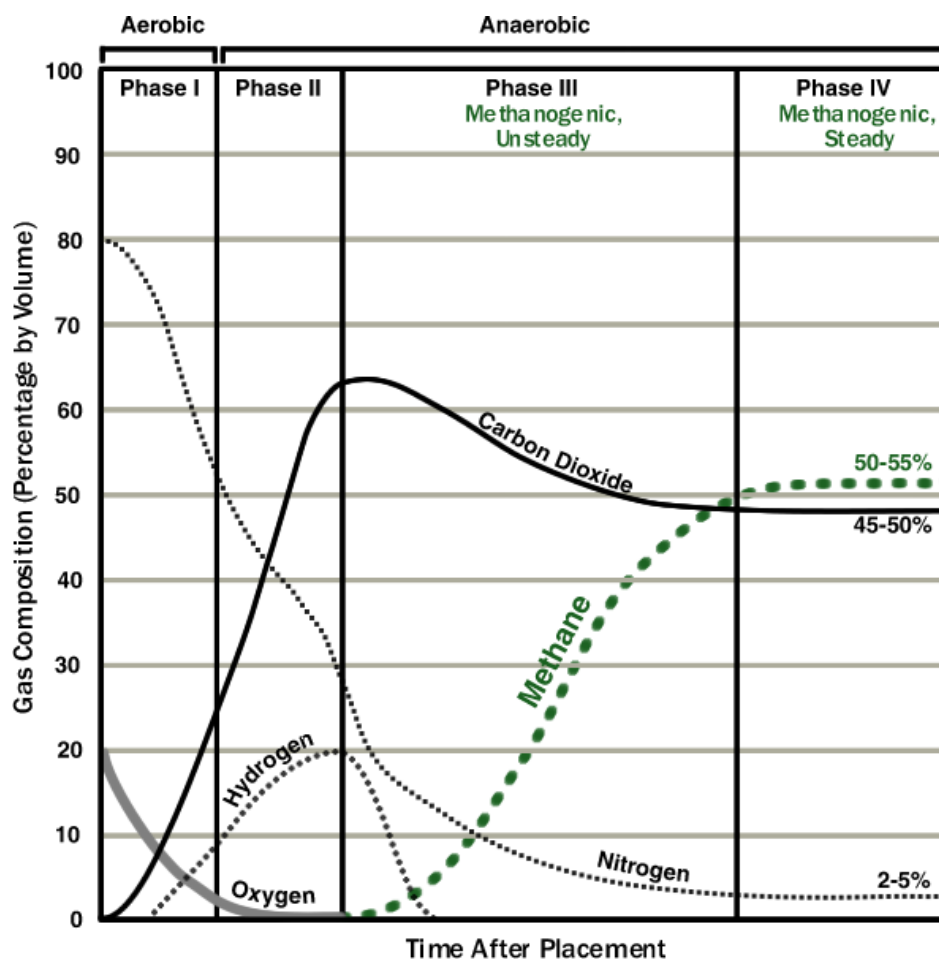


Fig. 5.2 LFG decomposition phases

Instead of escaping into the air, LFG can be captured, converted, and used as a renewable energy resource. Exploitation of LFG helps to reduce odours and other danger related to LFG emissions, and anticipates methane from migrating into the atmosphere and contributing to local smog and worldwide climate change. In addition, LFG energy projects build gross income and compose jobs in the community and beyond.

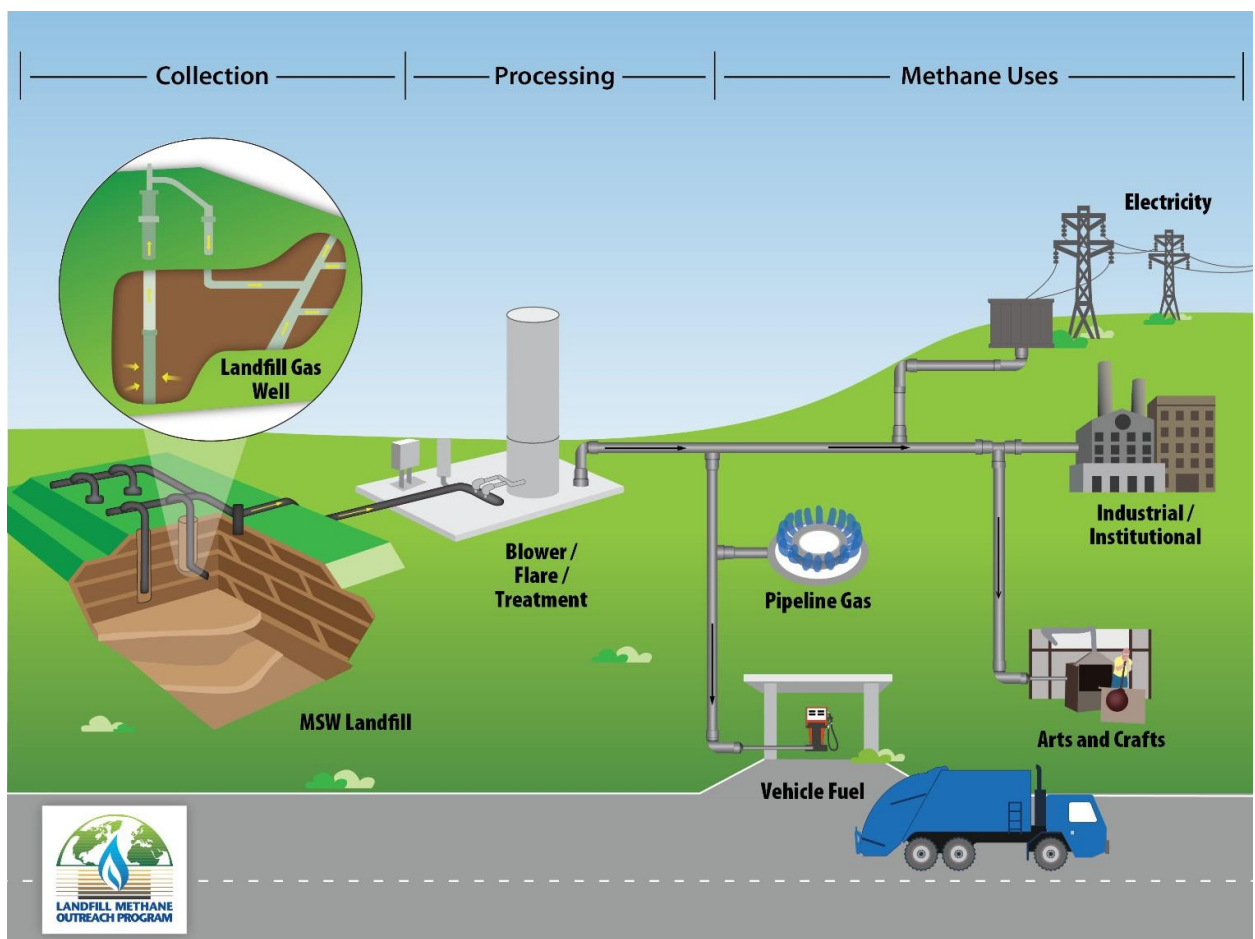


Fig. 5.3 LFG collection and processing scheme

## 5.2. Recommended actions

While a complete transformation to a paperless workflow may be an evasive ambition for many companies, any organization can take two simple steps in that direction:

- Keep off printing data that was originally created digitally, including web

content, emails, and documents.

According to Cap Venture, 80% of the information is still on paper, although 80% of the documents we work with are already on our computers.

- Reduce the amount of paper used in electronic processes.

Document Imaging, a key component of Enterprise Content Management (ECM), transform paper documents to digital, ensuring that only one duplicate is stored, managed and distributed without printing, copying or physical transportation to the recipient. Document Imaging is an accumulation of hardware and software instruments that convert paper documents into ready-to-use content.

Scan-to-image and scan-to-process technologies help support business operations that require reliable documentation. They offer a host of environmental and economic benefits. These measures - reducing over-printing and saving paper in business processes - can help companies compete.

Any MRO or airline that transforms paper processes to digital processes will completely eliminate paper in such processes. But until the industry as a whole goes paperless, 100 percent elimination of paper is probably not a realistic expectation.

### **5.3. Profit**

Reduction of the need for paper can benefit both business and the environment. Organizations take in significant economic benefits from lessen costs, increased productivity, streamlined business processes, and improved collaboration and communication.

The introduction of digitalization technologies provides cost savings in the medium and long term. According to AIIM analysts, a 10-employee company will recoup the investment in just 4 months after installing the scanner, and a small change in processes will save an additional 940 € in 12 months. These calculations take into account the costs of printing, photocopying and distributing documents. However, there are several other factors to consider:

- Printing costs - hardware, technical support and supplies (approx 14 € for 1000 sheets);
- Photocopying costs - equipment, technical support, supplies and staff time;
- Fax costs - equipment, technical support, supplies, telephone line and staff time;
- Distribution - envelopes, postage and courier services (Note: Document Imaging solutions often pay for themselves by reducing courier costs and helping to reduce shipping CO2 emissions).

#### **5.4. Calculations of paper consumption**

We are going to carry out calculations of the approximate consumption of paper on average statistical data in Europe.

The current purchase price of paper according to the latest tenders is 230,000 UAH for 2600 boxes. Each box contains 500 sheets from which we can get that it is 1,300,000 sheets for 230,000 UAH:

$$230\ 000 / 1\ 300\ 000 = 0.18\ \text{UAH/sheet}$$

Averagely each office employee makes use of an average of 10,000 sheets of paper p.a.:

$$0.18 \times 10\ 000 = 1800\ \text{UAH / year}$$

Considering the aforementioned, we see that one office worker spends around 1800 UAH for paper annually.

Printing costs - hardware, technical support and supplies approximately 200-300 UAH for 1000 sheets, so we are taking a sum of 250 that is a middle-point price:

$$250 \times 10 + 1800 = 3300\ \text{UAH}$$

This is the amount that the enterprise spends on the purchase and expenses for a paper per employee per annum.

Let's imagine that the enterprise employs 11 000 office staff members.

Provided that we have 11 000 people who deal with paper, we can make the following calculation:

$$11000 \times 3300 = 36\,300\,000 \text{ UAH}$$

This result shows that the company expense for paper usage is more than 36 million UAH per year.

From the general statistics, we can find out that, on average, from one industrial tree - you can get 8500 sheets. That, in its turn is:

$$(11000 \times 10000)/8500 = 12941$$

The amount of trees that could be saved in case of leading all documents in the digital version.

### **Conclusion to Part 5**

To sum up, during exploration of the damage and hazards of using paper documentation, we found out that in case of transforming all processes to digital ones the environment will get rid of a list of problems, from the problem of deforestation to decrease of air pollution by methane.

So, each aviation enterprise should make efforts to step into the digitalisation revolution in order to protect the environment from hazardous conditions and also increase the gross profit of the enterprise.



## CONCLUSIONS

According to the Aviation Code of Ukraine, aviation security is a set of measures with human and material resources aimed at protecting civil aviation from unlawful interference. In other words, aviation security is a state of protection of civil aviation from illegal interference in its activities, ie the absence of unacceptable risk associated with the possibility of harm from illegal interference in the activities of civil aviation.

The paper presents theoretical generalizations and new results in the form of scientific conclusions on economic and legal mechanisms of aviation infrastructure development in Ukraine, identifies problems in the process of their application (implementation) and develops scientifically sound approaches to solving.

In the course of the research a number of new theoretical provisions were concretized, practical recommendations and proposals on the covered issues were formulated, the author's view on construction of the effective mechanism of development of air transport on the basis of modern public transport

Ukraine has a huge, but not yet fully used potential for the development of air transport.

Based on the study, the term airport is formulated in a dualistic way: on the one hand as a subject of economic relations, on the other - as the object of such relations.

It is clear that a clear legal definition, enshrined in regulations in a single standard, is needed to define all the technical characteristics and requirements for air transport infrastructure that ensure the proper functioning of the airport and air traffic control facilities.

The design and development of aviation infrastructure (to minimize human, material, financial, environmental and social damage) also requires the development and approval of a national aviation safety program based on ICAO standards and best practices.

Ukraine regularly recognizes progress in implementing ICAO standards and best practices in establishing a national security oversight system.

The development and approval of a government security program will ensure compliance with international aviation security requirements and practices. It will also ensure the development of an efficient, safe, reliable, accessible and sustainable air transport system to improve the quality of life, safety and opportunities for all Ukrainians.

Strategic state-owned airlines, such as UkSATSE and Lviv Airport, need effective and professional boards of directors, ownership recommendations and performance indicators.

Ukraine has extensive international legal obligations in the field of civil aviation, as it is a member not only of the International Civil Aviation Organization (ICAO), but also of other international organizations - the European Civil Aviation Conference (ECAC), the European Organization for the Safety of Air Navigation (Eurocontrol), Interstate Council on Aviation and Airspace Use, Interstate Aviation Committee (IAC).

The result of close cooperation with the international community in the field of civil aviation security, especially aviation, was the adoption of the Law of Ukraine "On the State Program of Civil Aviation Security" of March 21, 2017 № 1965-VIII. from illegal interference.

This Law defines the principles of aviation safety, regularity and efficiency of air traffic by introducing rules, practices and procedures to protect against unlawful interference.

The main task of the program is the division of responsibilities between management bodies and services whose activities are aimed at ensuring flight safety; establishing rules for the implementation and implementation of measures to ensure the safety of passengers; aviation personnel and personnel involved in aviation activities; property transported by air; airline facilities or structures, regardless of ownership and subordination.

In conclusion, the introduction of new standards and rules of flight safety in civil aviation will significantly increase the level of flight safety through the introduction of a

proactive approach to state regulation of civil aviation by constantly identifying and eliminating risks in aviation.

Thanks to data and information from airlines and RAM (which, unfortunately, do not provide much information), the central issues of civil aviation security are partially known. Incident analysis is an important part of the aviation security risk assessment conducted by the National Aviation Service in relation to its activities and the activities of the entire civil aviation industry. In addition, management decisions are increasingly based on risk and effectiveness assessment and prioritization according to pre-defined criteria (main risk areas). Event data, along with other risk factors, can be used as a basis for decision making.

Given the European risk portfolio and its conclusions, the areas of security risks in Ukraine have a similar priority.

The Aviation Security Report invites industry partners to review reports and events related to Ukrainian civil aviation from 2016 to 2020. This safety report describes system, operational, and new issues.

Priorities in key areas of risk will help Ukraine make better use of its oversight resources and identify measures to continuously improve security. Analysis of event data is an important starting point for further discussion and work. In the future, we will need to gather even more data on UAS, cybersecurity and RAM to be able to draw conclusions from this information and any events that may occur.

In addition to warning about possible risks in Ukrainian civil aviation, the State Aviation Service continues to review other sources of information, including the results of audits, inspections and reports of aviation incidents and serious incidents abroad, which develop additional security measures. By analyzing event data and obtaining the maximum amount of information, you can draw the right conclusions and be prepared for changes in the aviation system.

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