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E-mails: ¹ppo@nau.edu.ua, ²ysmolnikov@nau.edu.ua**Abstract**

Formulation of the problem. The Civil Aviation of Ukraine plays a significant role in the Ukrainian society and in the international arena. It performs multifaceted functions - passenger and cargo transportation, conducting aviation works in agrarian and forestry farms, providing medical aid, performing search and rescue operations, fire fighting, construction works, cultural and sporting events, scientific research, etc. Currently, an objective study of the aviation industry is relevant, especially since there are some problems that create a negative impression of Ukrainian aviation and the perception of its decline in modern conditions. **Goal.** To analyze the activity of civil aviation of Ukraine from the beginning of the 21st century to the present and, using the problem-chronological method, to comprehensively investigate the processes of transformation in the aviation industry by its main functional directions and to identify their characteristic features, focusing on the integration of Ukrainian aviation into the European and world aviation space, air traffic trends, innovations in the development of airports and airlines, problems of aircraft construction of different types of aircraft and unmanned aerial vehicles, training aircraft specialists in modern conditions. **Results:** The new 21st century was also a new stage in the development of civil aviation in Ukraine, which, thanks to the transformations, was characterized by a positive dynamics of its growth. Basically there was a consistent process of integration of domestic aviation into international aviation organizations, the standards and recommended practices of ICAO were being more actively implemented, and air transportation was growing. Innovations in aviation and industrial infrastructure were applied, attention was focused on the problems of aviation safety and flight safety, scientific and technical developments; measures were taken to solve global problems, such as improving the level of environmental friendliness of aviation transport, the quality of training of aviation specialists and the like. However, the strong potential in all areas of the aviation industry is not sufficiently used for a variety of external and internal reasons, and solving existing problems will contribute to the sustainable development of both the aviation industry, the economy of Ukraine and international cooperation.

Keywords: civil aviation of Ukraine; transformation; integration; air transportation; airline; aircraft engineering; training of aircraft specialists

1. Analysis of recent research and publications

The issues of the civil aviation activity of Ukraine and the characteristic changes in this area were covered on the official sites of the Ministry of Infrastructure and State Aviation Service of Ukraine, in the publications of a number of authors – A. Trotsenko, O. Ryabokon, P. Rodionova, A. Maiberg, V. Grebenikov and others. Problems of adaptation of Ukrainian legislation to international standards were analyzed in the works of I. Zelinsky, P. Kravchuk, K. Kulchytska, E. V. Prushkivska. Among the studies on certain functional areas of civil aviation in Ukraine, the focus was on the specifics of air transportation and the work of airlines. These issues were investigated in the works of T. Oleshko, A. Kvitko, A. Sarkisova, A. Tokar

etc. Such well-known specialists of the Ukrainian Institute of the Future as V. Shulmeister, Ya. Pylypchuk, and K. Novikov analyzed the state of airports of Ukraine and their perspectives. The problem of international cooperation of Ukraine in the field of aviation security was considered in the works of G. Suslova, D. Buhaiko, N. Plakhotniuk, K. Savytska, T. Vysotska etc. Analytical materials on aircraft construction are presented in the publications of V. Badrak, A. Boguslaev, and A. Vovnianko. The development of unmanned aerial vehicles is highlighted in the articles by V. Kharchenko, M. Matyichko, V. Grebennikov, V. Kupriyanov, I. Matiushenko. The activities of higher aviation institutions for the training of skilled personnel are available on their official sites, in published essays, university newspapers, etc.

2. Presentation of the main material

The importance of aviation transport in the world economy, as noted in the Ukrainian Aviation Transport Strategy for the period up to 2030, is steadily increasing, thanks to both technological development and the latest developments in the aviation industry, as well as globalization, business and cultural ties between the countries of the world. According to the forecast of the International Civil Aviation Organization (ICAO), the demand for air transportation in the world by 2023 will increase annually by an average of 4-5%. It is significant that now more than half of international tourist trips are carried out by air [1].

Today, Ukraine is one of the 9 advanced countries among the 192 ICAO member countries, which have a full technological cycle of the creation and operation of aircraft technology, and it occupies key positions in the development of world aviation. Ukrainian aviation demonstrates its achievements at international air shows, congresses, exhibitions and other aerospace forums. A significant role of Ukrainian aviation in the modern world is noted by the ICAO bodies and European aviation structures. Thus, during the visit of Prime Minister of Ukraine V. Groisman to Canada in November 2017, President of the ICAO Council Olumuyiwa Benard Aliu stressed the importance of the agreement reached on strengthening technical cooperation and further development of interaction between ICAO and Ukraine, especially on air traffic safety issues [2].

The integration process of (the) Ukrainian aviation into the European space has begun since the establishment of an independent state. In 1992 Ukraine became a member of ICAO, then a member of the European Civil Aviation Conference (ECAC), the European Organization for the Safety of Air Navigation (Eurocontrol), the World Federation of Unmanned Aviation (UAV), and others. In the 21st century, European integration became a strategic priority for Ukraine. By the Decree of the President of Ukraine on September 14, 2000, the "Program of Ukraine's Integration into the European Union" was approved. In accordance with international standards, the regulatory and legal framework of civil aviation of Ukraine was improved and its legislation was harmonized. Thus, the new Air Code of Ukraine (2003, new edition 2011), the Law of Ukraine "On State Aviation Security Program for Civil Aviation" (2003, new edition 2017), the Strategic Plan of Air Transport Development of

Ukraine for the period until 2020 (2015), the Concept of the State Target Program for the Development of Airports by 2023 (2016), the National Transport Strategy of Ukraine until 2030 ("DriveUkraine 2030," 2018) were adopted. The Ukrainian Aviation Transport Strategy until 2030 (2019) defines its goal: "harmonious development of the aviation industry as an integral part of the national transport system of Ukraine, its further integration into the world air transport network, creation of modern aviation transport infrastructure, implementation of the aviation transit potential of Ukraine, increasing the availability of air transportation for the general population, promoting free competition and liberalizing the air transport market."

The adopted regulatory acts in civil aviation provide a whole range of measures to ensure the effective development of the industry. However, the problem of improving the aviation legislation of Ukraine, the implementation of relevant EU acts in domestic law remains.

The integration strategy has been consistently put into practice by the Ukrainian air transport industry. Important measures include the introduction, from 2000, of regular audits of the ability of state aviation authorities to ensure flight safety, the use of ICAO cruise trains in Ukraine since 2001, as well as the reduction of minimum vertical separation, the development of the Common Airspace Agreement with the EU (initiated 2013), the conclusion of the Open Skies Agreement between Ukraine and the USA (2015), liberalization of air services with more than 10 countries in Europe, the creation in 2018 of the International Pilot Training Center (at the National Aviation University), the International Association of Aviation and Aerospace Education (ALICANTO), etc.

Cooperation between Ukraine and ICAO is ensured through the European / North Atlantic Bureau of ICAO, located in Paris. Based on it, events of regional significance are organized, work is ongoing to improve the European Air Navigation Plan, the work of specialized working groups (EANPG, FLOE, MET, AIS, flight safety, aviation statistics, air transportation, legal issues, dangerous goods transportation) is carried out etc. [3].

Ukraine has broad international obligations under 39 international treaties within international air law (including 28 under the auspices of ICAO, 1 under the auspices of ECAC and 7 under the

auspices of Eurocontrol), 70 bilateral intergovernmental agreements on air traffic, the Agreement between Ukraine and the EU on certain aspects of air services (“horizontal agreement”), and other international treaties of Ukraine, including the GATT / WTO Annex in the field of air transport, as part of the development of regional cooperation and within the European region and the countries of the Black Sea-Caucasus region [4]. In particular, Ukraine participated in the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) program to implement the carbon reduction scheme for international aviation.

The decisive indicator of the results of activity of the aviation industry of Ukraine is the air transportation of passengers, cargo and mail, according to which in the first decades of the 21st century (with the exception of 2014 and 2015) there is a positive trend. In particular, if 1.38 million passengers were carried by air transport in 2001 (10.1% more than in 2000), then in 2010 - 6.1 million, and in 2018. - 12.4 million passengers, which is 17% more than in 2017 [5]. On freight transport, in general, there is an increase in them.

Thus, in 2010, 87.9 thousand tons of cargo and mail were transported by Ukraine's aviation, and in 2018 - 99.1 (19.7% more than in 2017). It is noteworthy that in 2018 the activation of regular transportation within Ukraine continued. Domestic passenger services were performed on a regular basis by four domestic airlines, which provided air services to ten cities of Ukraine. In 2018, 1071.4 thousand passengers were carried, which is 15.1 percent more than in the previous 2017. At the same time, the average occupancy of passenger seats on domestic scheduled flights increased from 73.5% in 2017 to 79.3 % for 2018 [6].

In fact, at the beginning of the new century, aviation emerged from the steep peak in which it found itself in the 1990s. Passenger air transportation is expected to increase even more due to visa-free travel, socialization of transport policy, and the arrival of new low-cost airlines into the Ukrainian aviation market, that is, as a result of the implementation of the National Transport Strategy of Ukraine until 2030. In 2018, according to the Minister of Infrastructure V. Omelian, Ukraine is for the first time ranked in the top 20 countries in terms of new flights, and the number of passengers using the services of Ukrainian airlines is growing by an average of a quarter annually [7]. At a meeting of the Government Strategic Committee in April 2019,

when considering the issue of long-term transport development and approving the fundamentals of Ukraine's Aviation Transport Strategy to 2030, it was emphasized that the implementation of this strategy will increase the passenger traffic to 80 million passengers a year.

It should be noted that the increased focus on aviation safety has had positive results. In 2017, according to the State Aviation Service of Ukraine, the world had the least number of plane crashes with casualties, while in Ukraine, noncommercial passenger traffic in 5 crashes killed 8 and injured 7 people [8].

The increase in air transportation is directly related to the capacity increase of Ukrainian carriers, implementation of a set of measures to improve the level of flight safety and aviation security, quality of passenger and office customer service, introduction of modern information technologies and more. In total, about 70 - 80 different airlines with the relevant certificate are engaged in aviation activity in Ukraine. In particular, in 2018, 34 domestic and 38 foreign airlines from 37 countries served air traffic [7]. Among them the leading positions were held by the Airlines of Ukraine, Airlines of the Wind, Azur Air Ukraine, YangEir and Bravo. According to the results of the year, these five largest passenger airlines carried 11620.6 thousand people, which is 20.2 percent more than in 2017, accounting for almost 93 percent of the total passenger traffic of Ukrainian airlines. More than half (54.2%) of all passenger services of domestic airlines are international scheduled services [6]. Manufacturers of passenger ships such as Boeing, Airbus and Embraer (Boeing 737-800, Airbus A320-212, Embraer 145) are most popular with Ukrainian airlines.

The flagship of Ukrainian carriers is the International Airlines of Ukraine, which is a member of the International Aviation Transport Association (IATA) and the Association of European Airlines (AEA), the first of the CIS countries in 2005 to receive the International Operational Safety Audit (IOSA) certificate. The IOSA certificate is also recognized by the United States Federal Aviation Administration (FAA). UIA also holds the JAR-145 Common Aviation Requirements Certificate, which entitles it to the full Boeing equipment maintenance cycle, including the execution of sophisticated C-Check and D-Check maintenance forms. The airline operates mainly foreign-made aircraft - Boeing, Embraer, Airbus and domestic An-158.

Ukrainian carriers have the opportunity to expand the geography of flights, including to the United States, since Ukraine obtained the first US FAA safety category as a result of the 2013 audit.

The leaders of cargo and mail transportation in 2018 were “Antonov”, “Ukraine International Airlines”, “ZetAvia”, “Maximus Airlines” (they accounted for 73% of the total volume of transportation) [6].

The world's first Antonov Airlines chartered national carrier (Antonov Airlines) has seven AN-124-100 "Ruslan" (150 t), AN-225 "Mriya" (250 t), one AN-22 "Antey" (60 t) and is one of the world's leading air carriers. Since 2006, the airline has been providing NATO SALIS (Strategic Airlift Interim Solution) services, providing strategic transportation for the benefit of the Alliance and the EU. In the United States, it received the Fifth Degree of Freedom (licensed to carry out domestic trucking under the orders of US companies) and has its representative office in Houston, Texas. Antonov Airlines continues to partner with OilSpill Response Limited (OSRL) with its UK headquarters to participate in an international oil spill response project. In 2018, it received two prestigious European awards. The first award was from the Baltic Air Charter Association (BACA) for outstanding achievements in the nomination "Cargo Charter Airline of the Year". The second award was in the nomination "Cargo Airline of the Year" by the British Freight Transport Association Logistics [9].

Low-cost airlines have occupied an important place in the aviation market of Ukraine in the 21st century, and now their number is increasing. These are companies that sell tickets at a low price and offer a minimum of service, that is, provide an opportunity for middle-income Ukrainians to use the "sky" at a completely "earthly" price. The appearance of these low-cost airlines contributed to the fact that aviation ceased to be a transport for the rich, and became a common mode of transport. Such companies are gradually expanding the geography of flights and are actively competing with each other, which contributes to the increase of air travel and the quality of services provided. The most powerful European low-cost airlines, Irish *Ryanair* and Hungarian *Wizz Air*, as well as the famous Spanish low-cost airline *Vueling*, continue to work actively on the Ukrainian market. Since 2018, the Ukrainian budget airline *Sky Up Airlines* has been operating, which also provides charter flights from different cities of Ukraine. Among other low-cost airlines, it

should be noted the activities of such airlines as the Italian *Ernest Airlines*, Turkish *Pegasus Airlines* and *Atlas Jet*, Asian *Air Arabia*, *Flydubai* (El Al), Israeli *Elal*, Latvian *Air Baltic*, Azerbaijani *AZALjet*, Greek *Aegean Airlines*, etc.

Positive changes occurred in the activities of airports in Ukraine. Now, aviation specialists divide them into 4 categories: 1 - progressive, with new infrastructure; 2 - promising, with infrastructure that needs reconstruction; 3 - conditionally perspective, in need of reconstruction; 4 - unpromising - small regional airports, the feasibility of reconstruction of which for civilian needs is doubtful [3]. This group is the largest, because under Soviet rule, airfields were needed not so much for civilian needs as for the military. Among them, the leading positions belong to the airports of Boryspil, Lviv and Kyiv. The main directions of modernization of airports are defined in the Aviation Transport Strategy of Ukraine for the period until 2030. Regional development programs for 19 airports have been created at the expense of state investments and city funds, and are being implemented in practice. This applies to airports in Odessa, Kherson, Dnieper, Ivano-Frankivsk, Nikolaev, Kherson, Chernihiv, Poltava, Vinnitsa, etc. [4].

In 2018, commercial flights of domestic and foreign airlines served 20 Ukrainian airports and airfields, while passenger traffic through Ukrainian airports exceeded the 20 million mark (24.5% increase) and post-freight traffic amounted to 56.4 thousand tones (an increase of 7.8 %). There was a significant increase in the number of passengers served at all major airports: Kyiv (Zhulhany) (by 51.9%), Lviv (by 47.9%), Boryspil (by 19.4%), Kharkiv (by 19.3%), Odessa (by 17.8%), Zaporizhzhia (by 14.9%) and Dnipro (by 8.1%) [6].

The creation of a new modern and modernization of existing high-quality aviation equipment with the use of nanomaterials and technologies remains an urgent task for Ukraine in the 21st century, and for this purpose there is a rather powerful industrial and scientific base in Ukraine. More than six dozen specialized companies have been innovating the aircraft fleet and infrastructure of the Ukrainian aviation industry. Among them: State Enterprise "Antonov", Kharkiv State Aviation and Production Enterprise (CDAVP), State Enterprise "Plant 410 of Civil Aviation", PJSC "Motor Sich", State Enterprise "Ivchenko-Progress", State Enterprise "Odessa Aviation Plant" and others. The urgency of upgrading aircraft technology is

increasing, and in line with the decision of the Ministry of Infrastructure to ban the use of passenger aircraft which is older than 20 years. This is a fundamentally sound position, since the operation of morally and physically obsolete aviation equipment not only significantly impedes the development of the aviation industry, but also remains the basis for an increased level of flight safety risks.

In the 21st century, Antonov State Enterprise continued to act as a powerful aircraft manufacturing company in Ukraine (since 2015 it has been part of the Oboronprom concern), which develops both passenger and transport aircraft, as well as special-purpose aircraft and unmanned aerial vehicles. More than 4 thousand aircraft of the Antonov brand (20 types and 100 modifications) are currently operated around the world [12]. The company continues the glorious line of ANs. Thus, on the basis of the An-24, a passenger aircraft An-140 was created for the local airlines. The serial production of this aircraft began in 2001. In 2001, on the basis of the An-74 transport aircraft, the mid-range cargo and passenger aircraft An-74TK-300 was developed, the production of which, along with the An-140-100, is carried out by the Kharkiv State Aviation Production Enterprise. In the 2000s, Antonov State Enterprise began the creation of a new regional passenger aircraft, the An-148, which first flew into the sky in 2004. It was the first East European passenger aircraft to be fully developed using digital technology. The An-148 family of aircraft (An-148-100A, An-148-100V, An-148-100E, An-148-200, An-148s, etc.) is intended for passenger, cargo-passenger and cargo transportation on short-haul airlines. In 2010, the An-158 took off - an extended version of the An-148 with improved technical and operational characteristics and increased efficiency. At the 50th anniversary of the Le Bourget international air show (2013), Antonov State Enterprise demonstrated the capabilities of the An-158 regional passenger jet aircraft, which began to be mass-produced, in the French sky, and introduced the new An-70 short-range military transport aircraft. Then work was carried out on other projects - the An-168 (An-168ABJ) from the base model An-148-100 and the transporter An-178.

The An-178 short-range turbojet aircraft was developed in 2015 in cooperation with partner companies from 15 countries on the basis of the An-158 (An-148-200) passenger aircraft and was presented in the same year at a static parking lot at

the Le Bourget and Dubai air shows. It is expected to replace the military transport aircraft of the previous generation An-12, An-26 and An-32. In 2015, the An-188 (An-70 modification) was announced at the Le Bourget air show with four turbojet engines manufactured by Motor Sich JSC - D-436-148FM or the latest AI-28 instead of the turboprop D-27.

SE "Antonov" in difficult conditions, after breaking ties with Russia, was able to create the first An-132D (2016) multi-purpose turboprop transport aircraft without Russian components. Designed by order of Saudi Arabia, it in June 2017 at the 52nd air show in Le Bourget took to the skies on the day of the opening of the air show at a temperature of more than 30 degrees. This is a transporter that is able to fly in the mountains and in the desert, and if necessary be a medical hospital, landing machine, cargo carrier.

In April 2018, at the first in Turkey's Antalya International Air Show "EURASIA AIRSHOW-2018", Antonov State Enterprise presented its planes - the An-124 Ruslan, the An-178 and the new An-77, which is a deep modernization of the mid-range, transport aircraft of short takeoff and landing An-70 with new avionics and non-Russian engines.

In July 2018, at the Farnborough Aviation Exhibition, Antonov signed a general agreement with the world-renowned Boeing Corporation, under which it will supply Antonov with spare parts for new aircraft. The document states that the international corporation will supply materials and spare parts for the new "Antonov" aircraft, and in the future will provide service around the globe. In the near future, Boeing Corporation has planned to create in Ukraine warehouses with aviation materials and equipment for local aircraft plants [13].

In addition to the design and production of passenger and transport aircraft, there is a network of aviation repair companies in the aviation industry of Ukraine that renews, increases the resource of operation and modernizes aviation equipment.

Ukraine is one of the few countries in the world that carries out a full cycle of manufacturing and operation of modern special purpose aircraft. Now more than 80 such aircraft have been developed, which perform a wide range of tasks. They are used for pest control in agriculture and forestry, plant nutrition, airspace monitoring and remote sensing of land, fire fighting, aerial photography, assistance to sick and wounded and more. For example, only in 2018, aviation enterprises processed 569.2 thousand hectares of agricultural land [6].

Ukraine's fire aviation is represented by the aircraft of the modern generation An-32P, which was created on the basis of the An-32 - the only aircraft in the world intended for aerodromes located at altitudes above 4000 m.

Modern sanitary aviation, which is designed to provide emergency medical care and quick transportation of patients and victims, was created on the basis of the AN-26 aircraft. In 2001, the Odessa Aircraft Repair Plant carried out the corresponding re-equipment in the resuscitation and operating version of the An-26SH aircraft. The converted plane was named An-26 "Vita". In the second half of 2007, the An-26 "Vita" underwent repair, received navigation equipment complying with the requirements of ICAO, and was certified for flights on international routes. Along with the implementation of sanitary-evacuation flights An-26 "Vita" was involved in international exercises. In particular, in July 2010, it participated in the Sea Breeze 2010 exercise. In connection with the aggression of Russia in the East of Ukraine and the anti-terrorist operation in 2015, a new An-26 aircraft was re-equipped in the sanitary-evacuation version, which was called "Rescuer", and another An-26 was converted in the resuscitation and evacuation variant for the State Emergency Service.

A promising sector of the aviation industry of Ukraine is the enterprises that produce ultra-light aircraft (UFOs): ultralight aircraft, hang gliders, trikes and paragliders. Officially, mass production of UFOs in Ukraine is being undertaken, in particular, by such firms as Aeropract (Kyiv), Aeros (Kyiv), Lilienthal (Kharkiv), OstVestConsulting (Kherson). Most of the devices are exported (among the countries that buy Ukrainian UFOs are the USA, Australia, New Zealand, the United Kingdom, France, etc.) [12].

In today's economic environment, one of the most promising and dynamic industries is business aviation, that is, performing business transportation, in the course of which UFOs are used for business-related flights. Only 2% of the population can be individual consumers of business aviation services. Increasing demand for business transportation is possible through the use of business aviation by small and medium-sized businesses [10]. Today, Ukrainian business aviation is another sector of the economy that is largely exported from Ukraine, and almost all agreements in this sector are conducted outside the country.

Certain achievements distinguished domestic

aviators, designers, scientists, engineers, technicians and students in the creation of unmanned aerial vehicles (UAVs), which represent one of the leading directions in the development of modern world aviation. They are not inferior to their foreign counterparts and having a significantly lower cost of production, are in great demand and are used in various sectors of the Ukrainian economy, at state borders and the like. They are developed by creative teams both at enterprises (SE Antonov, etc.), scientific institutions, and at leading universities in Ukraine. During the Farnborough International Aerospace Show on July 17, Antonov State Enterprise and the Swiss company AIR-IONTECHNOLOGIESSA signed a Memorandum of Understanding to establish partnerships in the development, testing, certification and serial production of hybrid and fully electric unmanned aerial vehicles on the basis of a modular unified multifunctional development platform of this company to perform various civilian and military tasks.

The National Aviation University (NAU) actively began to deal with unmanned aerial issues at the turn of the XX-XXI centuries. It has organized the Scientific production center of unmanned aviation "Virazh", which has already created 7 types of unmanned aviation systems with electric motors and piston engines (M-6-3 "Lark", M-7V5 "Sky patrol", M-10 "OKO 2" and others), which, in particular, have been used since 2015 in counter-terrorism operations in eastern Ukraine. The development of stratospheric unmanned aerial systems is ongoing to ensure a global coverage and use of the Internet without a satellite. An integral part of this process is the testing of UAVs at the Bila Tserkva airdrome and their introduction into serial production. A number of customers have been identified for the university's UAVs - from the Oboronprom concern, Novaia Poshta, Amazon (USA), Kazakhstan companies, Arab countries and others.

A team of enthusiasts of the National Technical University of Ukraine "KPI" with the participation of a group of engineers of "Meridian" and the support of an investor (venture fund of Academician Mikhalevych) created in 2015 an unmanned aerial vehicle - a spy "Spectator". The Ministry of Defense has ordered the first batch of these drones, and by agreement with OJSC Meridian launched a separate line for the production of UAVs with a capacity of more than 100 units per year [14].

The motto for civil aviation "Personnel solve everything!", which belongs to the railway engineer, statesman Klavdii Nemishaiev, appointed in 1885 to be the chief of the nationalized Southwestern railway of the Russian Empire and which he quickly raised to the European level, is still relevant in modern conditions. The training of aviation specialists in civil aviation is carried out by state and private educational institutions. Powerful among them are the National Aviation University (comprising the Flight Academy and Aviation Colleges), the National Aerospace University (Kharkiv), and the National Technical University of Ukraine "KPI", where the Faculty of Aviation and Space Systems is organized. They implement the Innovation Development Strategies developed on the basis of current legislation. In particular, the NAU's Sustainable Innovation Development Strategy for 2018-2023 sets an ambitious goal of transforming the University into a global aviation and space industry innovation center to make a meaningful contribution to society at the national and international levels. Here, after the European Regional Aviation Security Center at the NAU was created by the ICAO Council in 1996, in 2002, the second such ICAO center was opened - to train state inspectors on flight safety and airworthiness of aircraft. The ICAO Institute was set up next year to bring together international and national centers aimed at enhancing the level of civil aviation security. The ICAO Institute received ECCA certification in 2012 and was included in the network of European / North Atlantic region training centers. Since 2003, nearly 10,000 employees of airlines, airports, aviation companies from Ukraine and 77 countries have been trained and retrained here [15].

An important innovation was the creation of an International Pilot Training Center for Ukraine and the EU based on the NAU in Kyiv and its structural unit - the Flight Academy in Kropyvnytsky. It complies with the European requirements of JAR-FSL-1 and is quite relevant because, as noted by ICAO Secretary General Fan Liu at the Second ICAO World Summit "New Generation of Aviation Professionals" (NGAP2), in 2036, at least 620000 pilots will be needed globally for managing aircraft with a capacity of 100 or more passengers [17].

Aviation universities not only train highly qualified specialists, but also fruitfully work on scientific development of topical fundamental and applied problems of aviation. In particular, the

NAU's priority is to study the aerothermogasodynamics of power plants of aircraft and spacecraft and their subsystems, to create environmentally friendly fuel for air-jet engines (BIOJET10, BIOJET20, BIOJET30) with domestic components of vegetable origin and the like.

3. Conclusions

In the twenty-first century, civil aviation of Ukraine has, as a result of complex changes, achieved a positive dynamic in the development of all its components. It was a new stage, a stage of intensive process of integration of domestic aviation into international aviation organizations, adaptation of the regulatory framework in accordance with ICAO standards and recommended practice, the period of the conclusion of dozens of international agreements on air services. Liberalization and expansion of international and domestic passenger and cargo transportation, modernization and improvement of aviation industry infrastructure, attraction of leading low-cost companies for direct inter-regional connections and introduction of "land" prices for Ukrainians took place. Thanks to talented designers and engineers, Ukraine's aviation enterprises, overcoming certain problems, created new and modernized existing aircraft models, introduced the latest aviation technology using nanomaterials and modern technologies. Ukraine's contribution to solving national and global problems of aviation safety and flight safety, to training aviation specialists and to solving other issues of the aviation industry was significant.

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Трансформації цивільної авіації України у XXI столітті

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Постановка проблеми. Цивільна авіація України відіграє суттєву роль в житті суспільства та на міжнародній арені. Вона виконує багатопланові функції – пасажиро- та вантажоперевезення, проведення авіаційних робіт в аграрному і лісному господарствах, надання медичної допомоги, здійснення пошуково-рятувальних операцій, пожежогасіння, будівельних робіт, культурно-спортивних заходів, наукових досліджень тощо. Наразі актуальним є об'єктивне висвітлення діяльності авіаційної галузі особливо у зв'язку з тим, що тут залишається чимало проблем, які створюють негативне враження про українську авіацію, уявлення про її занепад в сучасних умовах.

Мета. Проаналізувати діяльність цивільної авіації України з початку XXI ст. до сьогодні і, застосовуючи проблемно-хронологічний метод, комплексно дослідити процеси трансформацій в авіаційній галузі за основними її функціональними напрямками та визначити їх характерні особливості. Акцентувати на інтеграції української авіації до європейського і світового авіаційного простору, тенденціях авіаперевезень, інноваціях в розвитку аеропортів і авіакомпаній, проблемах літакобудування різних типів повітряних суден та безпілотної авіації, підготовці авіафахівців в сучасних умовах. **Результати:** Нове XXI століття стало і новим етапом в розвитку цивільної авіації України, для якої, завдяки проведеним трансформаціям, характерним стала позитивна динаміка її зростання. В основному відбувався послідовний процес інтеграції вітчизняної авіації до міжнародних авіаційних організацій, активніше впроваджувалися стандарти та рекомендована практика ІКАО, зростали авіаперевезення. Застосовувалися інновації у літакобудуванні та галузевій інфраструктурі, посилювалася увага до проблем авіаційної безпеки і безпеки польотів, науково-технічних розробок, здійснювалися заходи щодо вирішення глобальних проблем, зокрема підвищення рівня екологічності авіаційного транспорту, якості підготовки авіафахівців тощо. Проте, маючи потужний потенціал в усіх сферах авіаційної галузі, він використовується з ряду зовнішніх і внутрішніх причин недостатньо, а вирішення існуючих проблем буде сприяти сталому розвитку як авіатранспортній галузі, економіки України, так і міжнародного співробітництва.

Ключові слова: цивільна авіація України; трансформація; інтеграція; авіаперевезення; авіакомпанії; літакобудування; підготовка авіафахівців

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Трансформации гражданской авиации Украины в XXI столетии

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Постановка проблемы. Гражданская авиация Украины играет существенную роль в жизни общества и на международной арене. Она выполняет многоплановые функции – пассажиро- и грузоперевозки, проведение авиационных работ в аграрном и лесном хозяйствах, осуществление медицинской помощи, поисково-спасательных операций, пожаротушения, строительных работ, культурно-спортивных мероприятий, научных исследований и др. Ныне актуальным является объективное освещение деятельности авиационной отрасли, особенно в связи с тем, что здесь остается немало проблем, которые создают негативное представление об украинской авиации, впечатление о ее упадке в современных условиях. **Цель.** Проанализировать деятельность гражданской авиации Украины с начала XXI ст. до настоящего времени и, применяя проблемно-хронологический метод, комплексно исследовать процессы трансформаций в авиационной отрасли по основным ее функциональным направлениям и определить их характерные особенности. Акцентировать на интеграции украинской авиации в европейское и мировое авиационное пространство, тенденциях авиоперевозок, инновациях в развитии аэропортов и авиаккомпаний, проблемах самолетостроения разных типов воздушных судов и беспилотной авиации, подготовке авиаспециалистов в современных условиях. **Результаты:** Новое XXI столетие стало и новым этапом в развитии гражданской авиации Украины, для которой, благодаря проведенным трансформациям, характерным стала позитивная динамика ее роста. В основном состоялся последовательный процесс интеграции отечественной авиации к международным авиационным организациям, активнее внедрялись стандарты и рекомендованная практика ИКАО, возросли авиоперевозки. Внедрялись инновации в самолетостроении и отраслевой инфраструктуре, повышалось внимание к проблемам авиационной безопасности и безопасности полетов, научно-техническим разработкам, осуществлялись меры относительно решения глобальных проблем, в частности повышения уровня экологичности авиационного транспорта, качеству подготовки авиаспециалистов и др. Однако, имея мощный потенциал во всех сферах авиационной отрасли, он используется по ряду внешних и внутренних причин недостаточно, а решение существующих проблем будет способствовать устойчивому развитию как авиатранспортной отрасли, экономики Украины, так и международного сотрудничества.

Ключевые слова: гражданская авиация Украины; трансформация; интеграция; авиоперевозки; авиаккомпания; самолетостроение; подготовка авиаспециалистов

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