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IMPLEMENTATION OF THE PILOT COMMON PROJECT INTO UKRAINIAN AIRSPACE

Purpose: The improvement of an Air Traffic Management System should be continuous. It should correspond to the appearing requirements in the aviation sphere. The purpose of this article is to review the Pilot Common Project, possibility of its implementation into Ukrainian airspace and advices regarding its implementation. Also it is important to define the timescale of Pilot Common Project Air Traffic Management functionalities implementation into Ukrainian airspace.

Methods: basing on the analyzed data from The World Bank of Data, FlightRadar24.com statistics we defined the average amount of air traffic crossing Europe and Ukraine on annual basis. Considering the received results we made the evaluation on the necessity of Pilot Common Project implementation into Ukrainian airspace.

Results: Due to the changes of political situation on the territory of Ukraine the usage of flight routes over eastern part of Ukraine and Crimean Peninsula has been terminated, and the air traffic flows were distributed to bypass Ukraine. We have concluded that nowadays only three out of six Air Traffic Management functionalities will be the valuable improvement of Ukrainian Airspace. It is proposed to implement in Ukraine Initial Trajectory Information Sharing; Initial System Wide Information Management until 2025 year, while Airport Integration and Throughput have been advised to be established until 2024 year.

Discussion: The "high wall" that has appeared from the North-Eastern part till the Southern part of Ukraine due to the political situation in the country created an obstacle for the transition air traffic, and decreased the number of daily flights through Ukrainian airspace. That brought an enormous loss of air navigation service fees and, as a result, lack of financing of aviation transportation system in Ukraine. Nowadays, the only motivation to continue improvement of Ukrainian Air Traffic Management System is just to be in line with European Union airspace and to provide the high-quality service at the end of the day.

Keywords: Pilot Common Project, Air Traffic Management functionalities, Initial Trajectory Information Sharing, Initial System Wide Information Management, Airport Integration and Throughput, implementation of the project, capacity, efficiency, safety.

Introduction

The aviation industry made an enormous step from wooden-made gliders to new generation of fast, efficient and eco-friendly airplanes that are producing with a help of modern technologies. Airplanes became more efficient, less expensive in their manufacturing, more reliable and safe.

Such a fast growth of this sphere of transportation has led to the increment of the amount of flights per day. Eurocontrol's impressive medium term forecast of flight numbers in Europe, covering 44 markets for the period 2012 to 2019, sees an average growth rate of 2.3% per annum under its base case.

According to The World Bank of Data [1] in 2014 were performed almost 32 millions of registered flights worldwide (fig. 1). In Europe was performed approximately 5.5 millions of registered flights (fig. 1). It means that in average it was performed approximately 88.000 flights per day worldwide and a bit more than 15.000 flights per day within the European region accordingly.

According to flightradar24.com statistics [2] nowadays we have in average 140.000 flights per day worldwide. It shows that amount of air traffic has in-

creased almost for 160% within last two years. Furthermore, it is an unstoppable process.

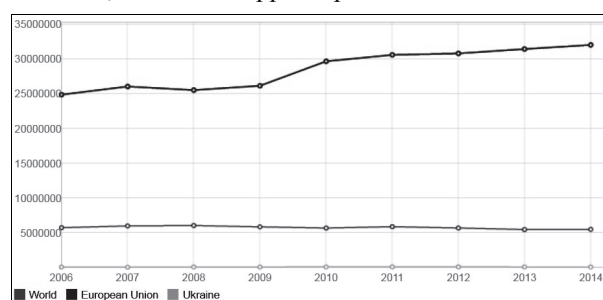


Fig. 1. Graph of registered flights per year according to The World Bank of data

1. Analysis of the latest research

The objectives and business models of airspace requirements are different for every country and every air navigation service provider. It depends on the sizes of a country and its airspace, its location, geographical location, geodetic data, amount of air traffic, etc. To make the European airspace more or less unique was created a special initiative, which is Single European Sky (SES). SES was reviewed and proposed in the Single European Sky first legislative package (SES I) [3]. The movement

towards harmonization of the European airspace was started. Nevertheless, this initiative has been interpreted differently by each country. As a result, the procedures and subprojects applied by different countries vary considerably, resulting in inconsistencies and discrepancies, affecting the efficiency of the whole Air Traffic Management (ATM) System. A new solution was needed. Thus, the idea of establishment of common projects has appeared. In the Commission Implementation Regulation (EU) No 409/2013 [4] were developed common requirements for common projects. The Pilot Common Project (PCP) established by the Commission Implementing Regulation (EU) No 716/2014 [5] as a very first set of ATM functionalities is called to regulate all the occurred inconveniences and to harmonize the process of SES establishment.

2. Single European Sky

In terms of fast growing demand of increasing an airspace efficiency and capacity, the immediate solution was needed. How the European Air Traffic Management authorities decided to deal with this situation? To troubleshoot this problem were developed several solutions.

To set up the Single European Sky, it is one of the possible responses to the demands of fast growing air traffic flow.

The Single European Sky - is a European Commission initiative by which the design, management and regulation of airspace will be coordinated throughout the European Union. [3] Basic idea of this initiative is to unify and to create a highly efficient interaction between all the airspace blocks within the Europe. This approach of the construction and setting up of European ATM system will lead to the increment of capacity, cost-efficiency, security and safety of air traffic flow over EU region.

The Single European Sky Air Traffic Management Research and Development (SESAR) authority was assigned as a responsible authority for SES implementation, and it is represents the technological fundament of the SES.

3. Pilot Common Project

SESAR aims to provide the EU by 2030 with a high performing air traffic management infrastructure that will enable the safe and eco-friendly operation and development of air traffic.

Commission Implementation Regulation (EU) No 409/2013 [4] created by the Euro Commission (EC) established the requirements related to the content of common projects, their setup, adoption, implementation and monitoring.

Development of the Commission Implementation Regulation (EU) No 409/2013 [4] gave the opportunity to establish the first common project. The EC has

adopted a Regulation for the implementation of the Pilot Common Project, the first set of Air Traffic Management functionalities that have been identified for wide scale coordinated deployment. Published on 27 June in the Official Journal of the European Union [8], the Regulation aims to ensure that the ATM functionalities developed within the SESAR Research and Innovation (R&I) are deployed in a timely, coordinated and synchronised way. Deployment in such a way is expected to bring important performance and cost benefits for European aviation industry. The project established by the Commission Implementing Regulation (EU) No 716/2014 [5], to support the implementation of the European ATM Master Plan.

The PCP is derived from the SESAR R&I Solutions and comprises the following ATM functionalities:

- Extended Arrival Management and Performance Based Navigation in the High Density Terminal Manoeuvring Areas;
- Airport Integration and Throughput;
- Flexible Airspace Management and Free Route;
- Network Collaborative Management;
- Initial System Wide Information Management;
- Initial Trajectory Information Sharing.

Furthermore, the European Commission intends to establish a Deployment Manager, whose job will be to implement the PCP and ultimately manage SESAR deployment activities. A review process by the European Commission will check progress towards deployment and the achievement of performance targets, as a result of the PCP.

This Regulation shall be applied to the European Air Traffic Management Network (EATMN) and the systems for air navigation services identified in Annex I to Regulation (EC) No 552/2004 [6].

4. Description of PCP ATM functionalities

1. Extended Arrival Management (AMAN) and Performance Based Navigation (PBN) in high density Terminal Maneuvering Areas (TMAs) improves the precision of the approach trajectory and facilitates air traffic sequencing at an earlier stage. Extended AMAN supports extension of the planning horizon out to a minimum of 180-200 nautical miles, up to and including the Top of Descent of arrival flights. PBN in high density TMAs covers the development and implementation of fuel efficient and/or environmental friendly procedures for arrival and departure (Required Navigation Performance 1 Standard Instrument Departures (RNP 1 SIDs), Standard Arrival Routes (STARs)) and approach (Required Navigation Performance Approach (RNP APCH)).

2. Airport Integration and Throughput facilitates the provision of approach and aerodrome control ser-

vices by improving runway safety and throughput, enhancing taxi integration and safety and reducing hazardous situations on the runway.

3. Combined operation of Flexible Airspace Management and Free Route enable airspace users to fly as closely as possible to their preferred trajectory without being constrained by fixed airspace structures or fixed route networks. It further allows operations that require segregation, for example military training, to take place safely and flexibly, and with minimum impact on other airspace users.

4. Network Collaborative Management improves the European ATM network performance, notably capacity and flight efficiency through exchange, modification and management of trajectory information. Flow Management shall move to a Cooperative Traffic Management (CTM) environment, optimising the delivery of traffic into sectors and airports and the need for Air Traffic Flow and Capacity Management (ATFCM) measures.

5. System Wide Information Management (SWIM) concerns the development of services for information exchange. SWIM comprises standards, infrastructure and governance enabling the management of information and its exchange between operational stakeholders via interoperable services.

Initial System Wide Information Management (iSWIM) supports information exchanges that are built on standards and delivered through an internet protocol-based network by SWIM enabled systems.

6. Initial Trajectory Information Sharing (i4D) consists of the improved use of target times and trajectory information, including where available the use of on-board 4D trajectory data by the ground ATC system and Network Manager Systems, implying fewer tactical interventions and improved de-confliction situation.

Operational and technical scope of the Initial Trajectory Information Sharing is in that target times and 4D trajectory data will be used to enhance ATM system performance.

Trajectory information and target times shall be enhanced by the use of air-ground trajectory exchange.

5. Implementation of the PCP into the Ukrainian airspace

All of the ATM functionalities of PCP are mandatory required to be implemented until 2030 within the EU airspace. While it is still not mandatory in Ukraine, it does not mean that Ukrainian Civil Aviation Authority cannot implement them. Unfortunately, taking into consideration the fact that Ukraine currently is in a state of war, not all the PCP ATM functionalities will be valuable to be implemented right now. Nowadays, according to The World Bank of Data [1], Ukraine has lost almost half of its air traffic flow in comparison with 2013 year. In 2014 after the annexation of Crimea, the

whole airspace over the peninsula was closed (fig. 2) and brought a severe loss of air traffic flow over Ukraine.

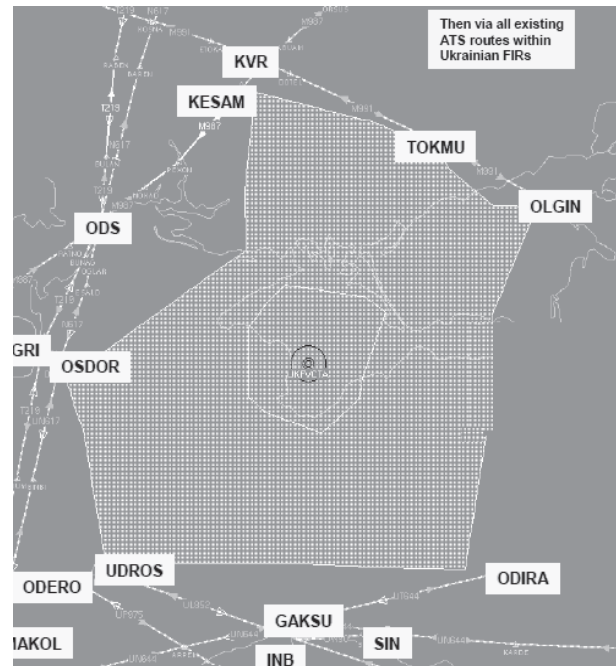


Fig. 2. Closed airspace over the Crimean Peninsula

Several months later after the horrible accident with Malaysian Airlines Flight 17 the whole airspace over the eastern part of Ukraine was closed (fig. 3). Thus, a big "wall" was created that led to the enormous reduction of a transit air traffic flow. All the airplanes which were coming from the Europe to Asia and vice versa were redirected through Turkey. Thus, all the airlines began to waste more money on the fuel due to the hook that had to be done to fly through the safe airspace.

Taking into account all these changes, the implementation of 3 out of 6 available PCP ATM functionalities into Ukrainian airspace will be expedient.

They are:

- Airport Integration and Throughput;
- Initial System Wide Information Management;
- Initial Trajectory Information Sharing.

1. Airport Integration and Throughput will bring tangible effect on a departing and approaching air traffic flow. This ATM functionality consists of:

- Synchronization of departure management with pre-departure sequencing;
- Departure Management Integrating Surface Management Constraints ATM tool;
- Time-Based Separation for Final Approach;
- Automated Assistance to Controller for Surface Movement Planning and Routing (improvement of an A-SMGCS);
- Airport Safety Nets.

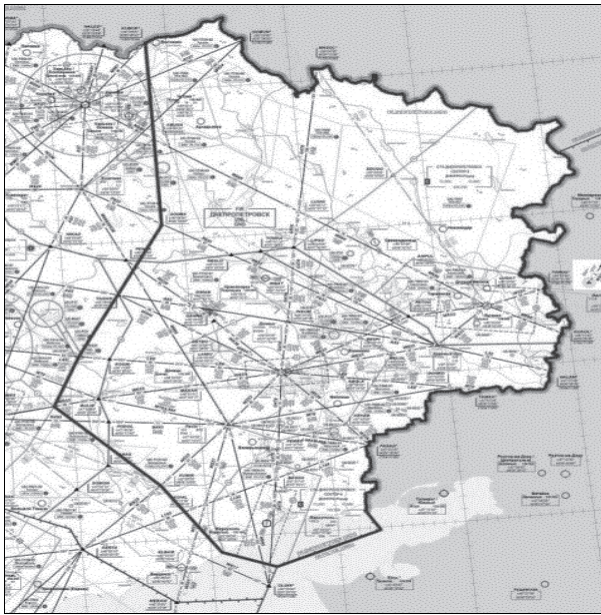


Fig. 3. Closed airspace over the eastern part of Ukrainian

Implementation of all these prerequisites will expedite aircraft movement on the ground and up in the air during the departing and approaching phases. Taking into consideration the density of air traffic flow in Ukraine, the best place to implement these ATM functionality will be Boryspil International Airport (IATA: KBP, ICAO: UKBB). Other airports should be reviewed by a responsible authority basing on the corresponding calculations and assessments to evaluate necessity of the Airport Integration and Throughput installation.

2. The implementation of the Initial System Wide Information Management will bring direct ATM business advantages that will be created by assuring the provision of high quality information delivered to the right people at the proper time. Given the transversal nature of SWIM which is to go across all ATM systems, data domains, and business trajectory phases (planning, execution, post-execution) and the wide range of ATM stakeholders, it is not expected that one solution and certainly not one single technology will fit all. Nevertheless it is recognized that global interoperability and standardisation are essential and iSWIM is expected to be an important driver for new and updated standards. This ATM functionality consists of:

- Common infrastructure components;
- SWIM Technical Infrastructure and Profiles;
- Aeronautical information exchange;
- Meteorological information exchange;
- Cooperative network information exchange;
- Flight information exchange.

Implementation of all these prerequisites will give the opportunity to iSWIM to become fully operational. That will lead to the overall capacity, efficiency, safety

and security improvement. Furthermore, partial reduction of workload on an Air Traffic Control Officer (ATCO) should be expected in terms of timely receiving of vitally important information for proper provision of Air Traffic Service.

Despite the current situation in Ukraine, the implementation of this ATM functionality should be done within all the Ukrainian airspace, because it brings an overall improvement in the service provision of each particular Air Traffic Service Unit.

3. The Initial Trajectory Information Sharing concept is based on the integration of time segment into the 3D aircraft movement trajectory and further sharing of the necessary information. It aims to ensure flight on a practically unrestricted, optimum trajectory for as long as possible in exchange for the aircraft being obliged to meet precisely an arrival time over a designated point.

How does it work? In example, when the aircraft is 200 NM or 40 minutes out from its final destination airport, ATCO initiates a trajectory negotiation process, by means of special datalink between the ATCO and the aircraft. First the 3D route is agreed between ATCO and the flight crew, including Standard Terminal Arrival Route and approach procedures applicable to the metering fix where the Control Area will be placed.

The final agreed 4D trajectory consists in a lateral route with altitude and/or speed constraints and a single time constraint to meet with a required accuracy over a waypoint of the trajectory. On the ground, the AMAN function optimizes its arrival sequence.

Once the negotiation process is completed, the flight crew agrees to fly the negotiated trajectory within required performance and the ATC agrees to facilitate the negotiated trajectory, subject to separation provision.

Initial 4D operations can also be applied in managing en-route sectors capacity, complexity and demand balancing, when the imposed time constraint is set a transfer point between two different sectors [7].

Taking into consideration the amount of crucial benefits that will be brought by the installation of this ATM functionality, its implementation within the whole Ukrainian airspace should be done in the shortest time.

Ukraine is not the part of EU still. As was mentioned before the implementation of these ATM functionalities is not mandatory for Ukraine. Nevertheless, as far as it 3 ATM functionalities were already proposed to be implemented above, the best way how to do it will be to follow the implementation plan agreed in EU [5]. That will help to simultaneously establish the SES. Thus, the same implementation plan supposed to be established in Ukraine (fig. 4).

Conclusion

Nowadays air traffic is increasing from day to day. Current ATM system has been pushed almost to its lim-

its. Since SES was developed, the whole EU is aimed to expedite its implementation. As the result airspace capacity increment, reduction of fuel emissions, improve-

ment of flight efficiency and rising of the level of safety are foreseen.

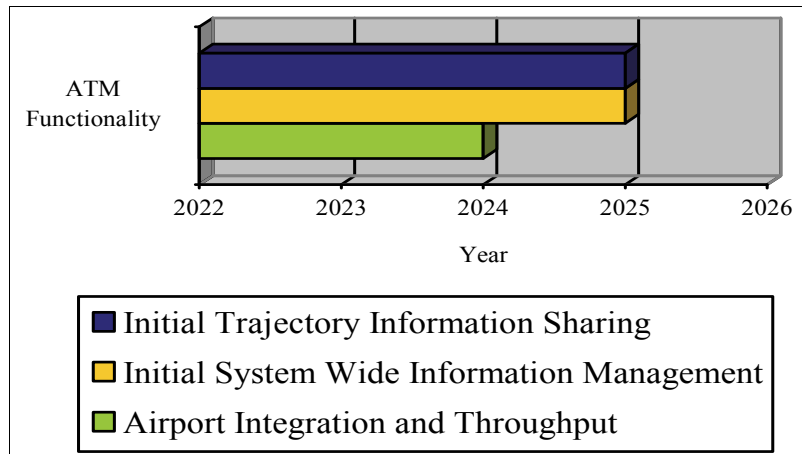


Fig. 4. Time scale of valuable PCP ATM functionalities implementation into Ukrainian airspace

Taking into account all the amount of crucial advantages Ukrainian Civil Aviation Authority (CAA) should review a variant of step implementation of PCP. According to the performed research we would recommend to implement three out of six ATM functionalities in the nearest future. Namely they are:

- Initial Trajectory Information Sharing;
- Initial System Wide Information Management
- Airport Integration and Throughput.

Basing on this research we also would like to propose the following time scale for the first step of the PCP establishment in Ukraine. According to fig. 4, Initial Trajectory Information Sharing and iSWIM are recommended to be implemented until the 2025 year, while Airport integration and Throughput is recommended to be finished until the 2024 year.

Other functionalities are supposed to be additionally reviewed and implemented after the normalization of situation in Ukraine, because it will lead to the opening of closed airspace, flight routes, and to the returning back of the transit air traffic flow.

As a result, the implemented PCP into Ukrainian airspace will help to handle all the amount of air traffic.

Also if Ukrainian CAA performs all of these implementation steps, Ukraine and its airspace will get in line with EU airspace at the end of the day.

That will bring invaluable advantages into the European Network Management.

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ВПРОВАДЖЕННЯ ПІЛОТНОГО СПІЛЬНОГО ПРОЕКТУ В УКРАЇНСЬКИЙ ПОВІТРЯНИЙ ПРОСТІР

О.С. Луппо, О.М. Алексеев, М.М. Богуненко, Т.А. Колесник

Мета: розвиток і вдосконалення системи організації повітряного руху повинні бути безперервними. Вона повинна відповідати вимогам у сфері авіаційних перевезень. Метою даної статті є розгляд пілотного спільного проекту, можливість його реалізації в українському повітряному просторі та поради щодо його реалізації. Також важливо визначити часові рамки реалізації функціональних можливостей пілотного спільного проекту в повітряному просторі України.

Методи: на основі проаналізованих даних із *The World Bank of Data*, статистики *FlightRadar24.com*, ми визначили середню кількість повітряного руху, що перетинає Європу і Україну щорічно. З огляду на отримані результати, ми зробили оцінку про необхідність реалізації пілотного спільного проекту в повітряному просторі України.

Результати: у зв'язку зі зміною політичної ситуації на території України, використання маршрутів польотів над східною частиною України та над Кримським півостровом було припинено і потоки повітряного руху були розподілені в обхід України. Ми зробили висновок, що в даний час тільки три з шести функціональних можливостей організації повітряного руху будуть цінним удосконаленням українського повітряного простору. Запропоновано запровадити в Україні *Initial Trajectory Information Sharing* та *Initial System Wide Information Management* до 2025 року, а *Airport Integration and Throughput* запропоновано бути встановленою до 2024 року.

Обговорення: "Висока стіна", що розтяглася від північно-східної частини до південної частини України, створила перешкоду для транзитного повітряного руху, а також зменшила кількість щоденних рейсів через повітряний простір України. Це викликало величезну втрату зборів за аеронавігаційне обслуговування і, як наслідок, відсутність фінансування авіаційної транспортної системи в Україні. У даний момент єдиною мотивацією продовжити вдосконалення української системи організації повітряного руху є необхідність відповідати рівню розвитку повітряного простору Європейського Союзу, щоб мати можливість забезпечити високу якість обслуговування.

Ключові слова: пілотний спільний проект, функціональні можливості організації повітряного руху, *Initial Trajectory Information Sharing*, *Initial System Wide Information Management*, *Airport Integration and Throughput*, впровадження проекту, пропускна здатність, ефективність, безпека.

**ВНЕДРЕНИЕ ПИЛОТНОГО СОВМЕСТНОГО ПРОЕКТА
В ВОЗДУШНОЕ ПРОСТРАНСТВО УКРАИНЫ**

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Цель: развитие и совершенствование системы организации воздушного движения должны быть непрерывными. Она должна соответствовать требованиям в области авиационных перевозок. Целью данной статьи является рассмотрение пилотного совместного проекта, возможность его реализации в украинском воздушном пространстве и советы по его реализации. Также важно определить временные рамки реализации функциональных возможностей пилотного совместного проекта в воздушном пространстве Украины.

Методы: на основе проанализированных данных с *The World Bank of Data*, статистики *FlightRadar24.com*, мы определили среднее количество воздушного движения, которое пересекает Европу и Украину ежегодно. Учитывая полученные результаты, мы провели оценку необходимости реализации пилотного совместного проекта в воздушном пространстве Украины.

Результаты: в связи с изменением политической ситуации на территории Украины, использование маршрутов полетов над восточной частью Украины и над Крымским полуостровом было прекращено и потоки воздушного движения были распределены в обход Украины. Мы сделали вывод, что в настоящее время только три из шести функциональных возможностей организации воздушного движения будут ценным усовершенствованием украинского воздушного пространства. Предложено внедрить в Украине *Initial Trajectory Information Sharing* и *Initial System Wide Information Management* до 2025 года, а *Airport Integration and Throughput* предложено быть установленной до 2024 года.

Обсуждение: "Высокая стена", которая растянулась от северо-восточной части до южной части Украины, создала препятствие для транзитного воздушного движения, а также уменьшила количество ежедневных рейсов через воздушное пространство Украины. Это вызвало огромные потери сборов за аэронавигационное обслуживание и, как следствие, отсутствие финансирования авиационной транспортной системы в Украине. В данный момент единственной мотивацией продолжить совершенствование украинской системы организации воздушного движения является необходимость соответствовать уровню развития воздушного пространства Европейского Союза, чтобы обеспечить высокое качество обслуживания.

Ключевые слова: пилотный совместный проект, функциональные возможности организации воздушного движения, *Initial Trajectory Information Sharing*, *Initial System Wide Information Management*, *Airport Integration and Throughput*, внедрения проекта, пропускная способность, эффективность, безопасность.