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PROCEDURE OF IMPLEMENTATION OF ARRIVAL AND DEPARTURE MANAGER SYSTEMS IN UKRAINIAN AIRSPACE

The aim of this study is to highlight the necessity of airspace capacity enhancement, how it will influence on safe, economical and effective operation of civil aviation. Describing of the work of two decisions-supporting systems for air traffic controllers – Arrival and Departure Manager. Point the importance of implementation of these systems in Ukrainian airspace, with the purpose of achieving a sufficiently high level of capacity and satisfy the expected growth of traffic flows. Analysis of the process of creation aircraft sequences by Arrival and Departure Manager, which information for system data processing needed, consideration of the supporting platform of information exchange between airport units – Airport Collaborative Decision Making. Obtained advantages from the usage of Arrival and Departure Manager Systems. Developed, proposed and described the schemes, by which these systems will operate within Ukrainian airspace after installation. Defined profits from implementation of Arrival and Departure Manager Systems in aeronautical system of Ukraine within the framework of program Single European Sky Air Traffic Management Research (SESAR). Necessity of implementation of new strategies and technologies during air traffic service provision in order to improve aeronautical system of Ukraine and correspond to European standards and requirements.

Keywords: *aeronautical system of Ukraine; air traffic management; air traffic services; arrival sequencing; capacity; departure sequencing; Single European Sky Air Traffic Management Research; workload.*

Introduction

Capacity is the one of the major factor that influence on nowadays safety of aviation. As we know the amount of flight increases rapidly and the capacity still at the same level. Therefore, to provide service for as many flights as possible with the required level of safety we should look through the concept of airspace and implement new strategies and technologies.

In the early 90's it was recognized by many experts that the most workloaded European airports would become the bottlenecks of the whole Air Traffic Management (ATM) system, if in the light of the forecasted increase of air traffic the procedures of air transportations at would not be significantly improved. This statement has been proved by reality.

Arrival and departure management identified as important issue, which needed to be improved by implementation of decision supporting systems for ATC controllers usage [1].

Analysis of the latest research. Air traffic management involves organize and control the flow of traffic on the ground and in the airspace around the airport in a safe and efficient manner. Typically, it considers two distinct problems: The Arrival Management Problem (AMAN) and the Departure Management Problem (DMAN). The AMAN problem involves landing sequencing and ensuring proper separation.

The DMAN problem decides the take-off times and sequences for departing airplanes.

In this article, we will talk about the AMAN DMAN algorithm of operation.

AMAN is the arrival management which sequencing aircraft by the time and allowing Air Traffic Controller do not waist time for construction of queue for landing.

It accounts the changes of aircraft movement and flight parameters making the queue changes flexible.

DMAN is the departure management system. This system allows create queue for departure accounting the time of start-up engines, time for taxiing and taking off. So, we do not need to create sequence for line up, because the system creates it and we can use calculated data.

But the only problem is their implementation. As you could know, we need detailed plan how to develop the strategy and installation of special equipment. In this article, we provide with the algorithm of operation of these two systems.

1. AMAN

The AMAN helps to air traffic controllers to create sequence of arrival flights at a given portion of airspace. AMAN distributes the workload by improving coordination between Area Control Center (ACC) and Approach

Control Center (APP) and between sectors in ACC and between APP and Tower (TWR). AMAN provides a list of sequenced arrivals (Arrival Sequencing List – ASL) in order to ensure a safe separation between two successive landings on a constraint point (Initial Approach Fix (IAF), aerodrome or runway) and ensures optimum runways utilization and the quickest landing time for aircraft [2].

The AMAN computes the optimized times over the TMA Entry Fixes and Scheduled Time of Arrival (STA). Several ASLs may be defined for different constraint point within the Area of Responsibility [3]. In order to insure the proper separation among arrival flights, ASL can be automatically or manually updated and automatic advisory are also issued. When a flight lands (reaches the constraint point) or is re-routed to alternative airport it is automatically deleted from the ASL [4].

AMAN benefits

– Approach planning for defining the approach sequence for the entire area of responsibility of an airport;

– Arrival management for calculating precisely timed approach paths based on the definitions generated by approach planning, from the point where aircraft enter the planning area to the runway threshold;

– Approach monitoring for continuous monitoring of separation between all aircraft in the terminal control area and compliance with the planned 4D approach paths;

– Information management server providing reliable information to all airport stakeholders [5].

2. DMAN

The DMAN tool takes into account the scheduled departure time, slot constraints, runway constraints and airport factors [6]. In such a way, it improves traffic predictability, cost efficiency and environmental protection, as well as safety. By taking into consideration information such as the aircraft's preparedness to leave its parking position, runway capacity and slot constraints, tower controllers can optimize the pre-departure sequence.

In order to build sequences, DMAN needs access to accurate information about the status of individual flights and airport units work done from different systems. The airport collaborative decision-making (A-CDM) [7] platform supports this information exchange. For example, the airline provide the target off-block time (TOBT), while the tower controller uses tables, which generate variable taxi times to achieve the target take-off time (TTOT). Information about departure slots or calculated take-off times (CTOTs) is sourced from the Network Manager, responsible for flow control across the whole of Europe [8].

Integration of DMAN with AMAN enables the mutual coordination of departure and arrival flows. In such a way, traffic flows smoothly directed to the runways and en-route phase of flight [9].

DMAN benefits

– Improved predictability and stability of departure sequence, start-up approval time and off-time blocks;

– Enhanced tactical runway scheduling;

– Reduced waiting and taxi times and runway delays;

– Significant reduction in fuel burn and CO_2 emissions [10].

3. AMAN and DMAN procedure

With respect to key data, which receive AMAN and DMAN systems, to airport parties, with which they are interacting, we developed and proposing the schemes, by which this systems will operate within Ukrainian airspace. They are describing the steps of collection, processing and storage of information, which systems receive and send from/to different airport stakeholders in order to create arrival and departure sequences. Detailed explanation of AMAN system scheme of functioning within Ukrainian airspace represented on Fig. 1 and of DMAN system represented on Fig. 2.

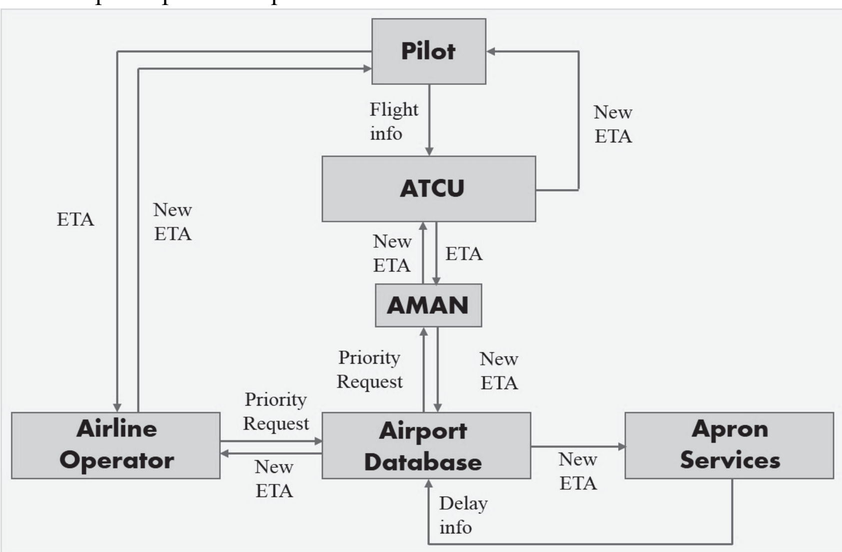

Fig. 1. AMAN scheme of functioning within Ukrainian airspace

Fig. 1 can be explained by brief description following:

– Radar screens and flight crew provide ATCU with information about aircraft position, altitude and speed. ATCU according to this information calculates Estimated Time of Arrival (ETA).

– Flight crew provides Airline Operator with flight information, and then it transmits to the Airport Database with priority requests (which aircraft arrive earlier with respect to its speed and position).

– In turn, Airport Database receives information about stand and gate occupancy from Apron Services.

– AMAN receives information obtained both Airport Database and ATCU. Than it calculates new ETA with respect to delays in Apron Services, wake vortex categories of aircraft and appropriate separation to it and transmits new ETA to ATCU and Airline Operator through Airport Database.

– Pilots receive new ETA from Airline operator and ATCU creates arrival sequence of aircraft by adjusting of speed and other procedures. Pilots pass points of instrument approach at calculated time with respect to ETA.

Fig. 2 can be explained by brief description following:

– Airport services report to the Departure Supervisor about their work done (catering, refueling, deicing, etc.) or about probable delays in operation.

– According to received information Departure Supervisor calculates Estimated Off-Block Time (EOBT), transmits it to the Air Traffic Control Unit (ATCU) and Airport Database, and then EOBT received by Apron Services.

– Simultaneously, Airport Database and ATCU receive departure slot from Central Flow Management Unit (CFMU) in order to build departure sequence and enhance runway capacity.

– Than DMAN gives its decision to the ATCU about built up departure sequence.

– With respect to DMAN decision, ATCU transmits push – back approval to flight crew and EOBT.

– ATCU input EOBT and slot in DMAN system.

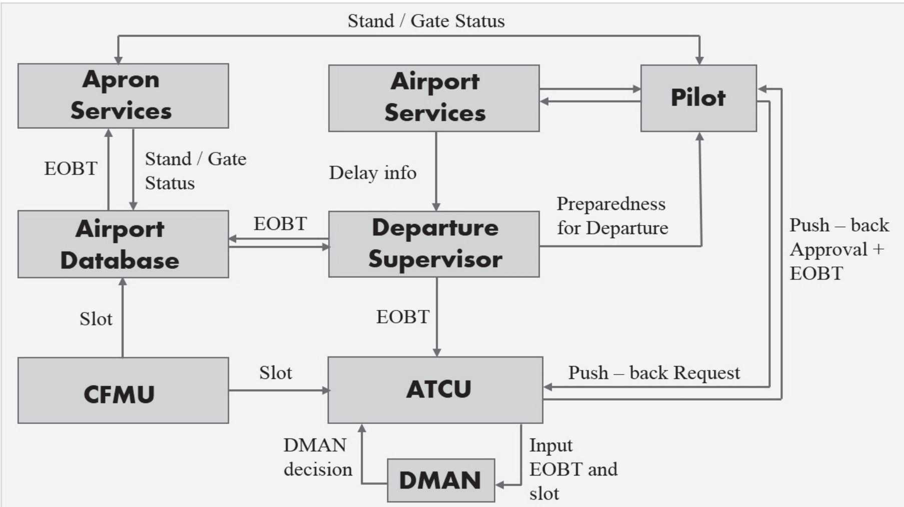

Fig. 2. DMAN scheme of functioning within Ukrainian airspace

4. AMAN and DMAN implementation status in Ukraine

As Ukraine is the member of European organization of safety of air navigation EUROCONTROL, it should meet the requirements of this organization. EUROCONTROL implements the Single European Sky ATM Research (SESAR) program, which foresees the advanced use of European airspace and implementation of different systems and procedures, which will support this program. Therefore, installation of AMAN and DMAN systems in ATC units, which provide service for big volumes of traffic, is the one of the requirements of this problem.

Therefore, installation of AMAN and DMAN systems in Ukrainian airspace is obligatory requirement within the framework of European ATM Master Plan, which will bring the following advantages:

– increased airspace and airport capacity;

– reduced time of holding procedures and number of holdings in terminal control areas;

– better and organized work of airport services and proper stand and gate utilisation.

In 2017, Ukraine expects an increase of traffic volumes, and these systems will help to manage traffic demands quite efficiently and flexibly.

Conclusions

Decisions of DMAN and AMAN are not compulsory for ATCU. They may be omitted by ATCU in case of emergency traffic and unusual situations. Therefore, AMAN and DMAN systems are such supplementary tool which helps to ATCU provide runway and airspace capacity through the creation of departure and arrival sequence.

Installation of AMAN and DMAN systems is nowadays requirement for all modern ANSs thoughout the world. Therefore, implementation of these systems is a big necessity for Ukraine in order to correspond to progressive States in the field of air navigation.

In such a way we will receive enhanced model of Ukrainian ANS and model of ATS provision and will be able to gain such benefits which are indicated below:

– increased capacity of airspace and flexible managements of traffic flows;

– reduced ATC workload due increased number of holding procedures;

– enhanced quality of work of airport stakeholders;

– improved stand and gate utilization planning;

– fuel-saving arrivals due to absence of holding aircraft and reduced environmental pollutions by the products of fuel burning and noise;

– take-offs and arrivals according to schedule.

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ПРОЦЕДУРА ВПРОВАДЖЕННЯ СИСТЕМ ОРГАНІЗАЦІЇ ПОТОКІВ ПОВІТРЯНИХ КОРАБЛІВ, ЩО ПРИБУВАЮТЬ ТА ВИЛІТАЮТЬ В ПОВІТРЯНОМУ ПРОСТОРІ УКРАЇНИ

О.Є. Луппо, О.М. Алєксєєв, К.І. Логачова, Г.О. Сергєєва

Метою цієї статті є висвітлити необхідність збільшення пропускної спроможності повітряного простору, та яким чином вона впливає на безпечність, економічність та ефективність цивільної авіації. Опис роботи двох систем, що підтримують прийняття рішень диспетчерами управління повітряного руху - систем організації потоків повітряних кораблів, що прибувають та вилітають. Зазначити необхідність впровадження цих систем у повітряному просторі України з метою досягнення достатньо високого рівня пропускної спроможності та задовільнити зростаючі потоки повітряного руху, що очікується. Аналіз процесу створення черговості повітряних кораблів системами, яка інформація необхідна для системної обробки даних. Ознайомлення з допоміжною платформою обміну даними між службами аеропорту – об'єднаною системою прийняття рішень. Визначені переваги від використання систем організації потоків повітряних кораблів, що прибувають та вилітають. Розроблено, запропоновано та описано схеми, за якими ці системи будуть функціонувати у повітряному просторі України після їх введення у дію. Встановлені позитивні сторони впровадження в аеронавігаційну систему України систем організації потоків повітряних кораблів, що прибувають та вилітають, в межах програми Єдине Небо Європи. Необхідність впровадження нових стратегій та технологій під час обслуговування повітряного руху з метою вдосконалення аеронавігаційної системи України та відповідності Європейським стандартам та вимогам.

Ключові слова: *аеронавігаційна система України; Єдине небо Європи; завантаженість; обслуговування повітряного руху; організація повітряного руху; черговість заходження на посадку; черговість на виліт.*

ПРОЦЕДУРА ВНЕДРЕНИЯ СИСТЕМ ОРГАНИЗАЦИИ ПОТОКОВ ПРИБЫВАЮЩИХ И ВЫЛЕТАЮЩИХ ВОЗДУШНЫХ СУДЕН В ВОЗДУШНОМ ПРОСТРАНСТВЕ УКРАИНЫ

А.Е. Луппо, О.Н. Алексеев, К.И. Логачёва, А.А. Сергеева

Целью этой статьи является показать необходимость увеличения пропускной способности воздушного пространства и каким образом она влияет на безопасность, экономичность и эффективность гражданской авиации. Описание работы двух систем, которые поддерживают принятие решений диспетчерами управления воздушным движением – систем организации потоков прибывающих и вылетающих воздушных суден. Отметить важность внедрения этих систем в воздушном пространстве Украины с целью достижения достаточно высокого уровня пропускной способности и удовлетворения потребностей ожидаемых растущих потоков воздушного движения. Анализ процесса создания системами очередности воздушных судов, информации, необходимой для системной обработки данных. Ознакомление со вспомогательной платформой обмена данными между службами аэропорта – объединенной системой принятия решений. Определены преимущества от использования систем организации потоков пребывающих и убывающих воздушных судов. Разработаны, предложены и описаны схемы, по которым эти системы будут функционировать в воздушном пространстве Украины после их установки. Определены позитивные стороны от внедрения в аэронавигационную систему Украины систем организации прибывающих и вылетающих потоков воздушных суден в рамках программы Единое небо Европы. Необходимость внедрения новых стратегий и технологий во время предоставления обслуживания воздушного движения с целью усовершенствования аэронавигационной системы Украины и соответствия Европейским требованиям и стандартам.

Ключевые слова: *аэронавигационная система Украины; Единое небо Европы; загруженность авиадиспетчера; обслуживание воздушного движения; организация воздушного движения; очередность захода на посадку; очередность на вылет.*