EXCELLENCIA
INTERNATIONAL MULTI-DISCIPLINARY JOURNAL OF EDUCATION
Volume 02, Issue 09, 2024 ISSN (E): 2994-9521

Air Traffic Control Technology

Rakhimov Jakhongir Jonikulovych [1]

[1] Teacher of the faculty of training and advanced training of aviation specialists at the Institute of military aviation of the Republic of Uzbekistan

Abstract:

The article considers the technology of air traffic control, as well as the problems of functioning of their system. The definition of the air traffic control system is given. Technologies and procedures of air traffic control, the main characteristics and features of the work of dispatchers, the technologies of the work of dispatchers of various control centers, as well as methods for assessing the quality and reliability of their activities are considered. The main attention is paid to the study of technological processes of air traffic control in various ATS.

Keywords: technology, aircraft movement, aerodrome, air traffic control, system.

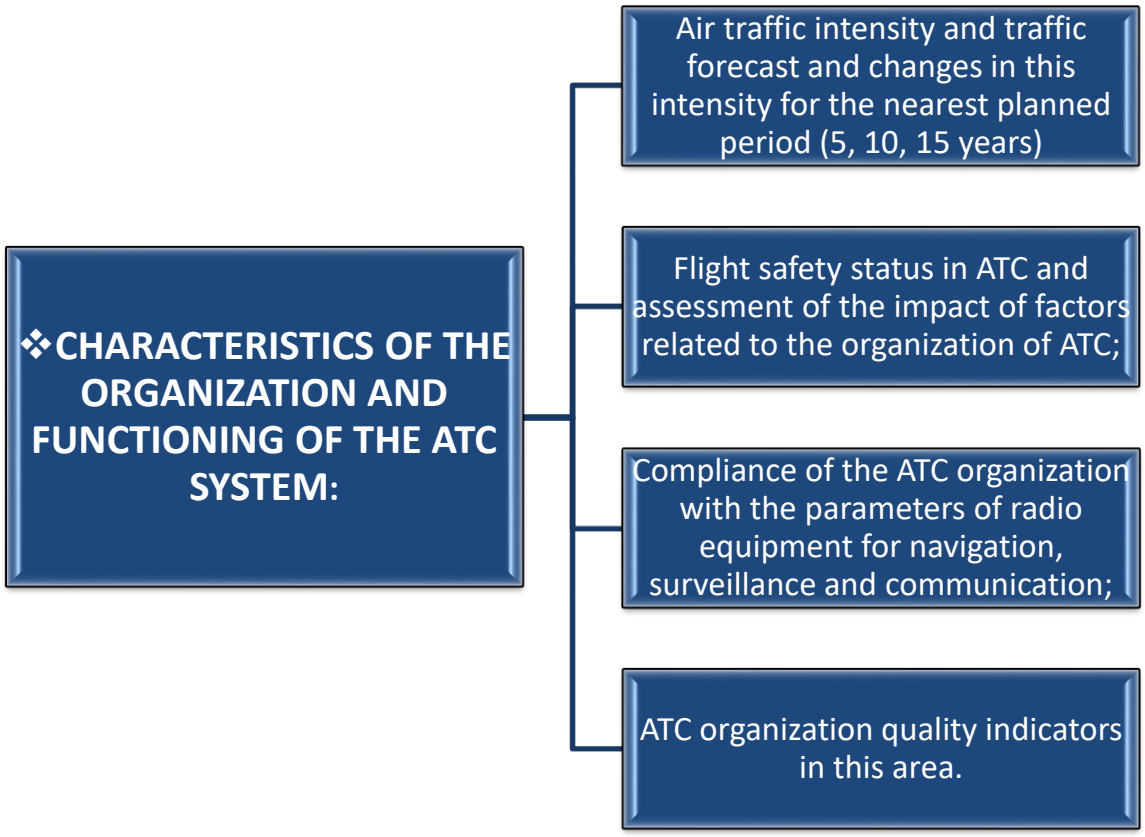
The air traffic control system is a complex polyergic system that controls dynamic objects and performs organizational functions. The main objective of the air traffic control (ATC) system is the most efficient use of airspace to enable aviation to perform its missions. The most efficient use of airspace will be the one that, under strict conditions of guaranteeing a given level of flight safety, achieves maximum values for the capacity of the ATC system elements, and the regularity and economy of aircraft flights. The main objectives of the ATC system are:

- organizing and improving the ATC system;
- high-quality, rational flight planning and support;
- high-quality direct ATC at all stages of aircraft flight (safe dispersal of aircraft in space in order to prevent their collision with each other, as well as with other objects in the air and on the ground);
- creating and maintaining an orderly and rapid flow of air traffic;
- providing aircraft crews with information necessary for the safe performance of flights;

- Notification of search and rescue services about aircraft requiring their services and assistance to them in the performance of their tasks.

The main principles of organizing the ATC system:

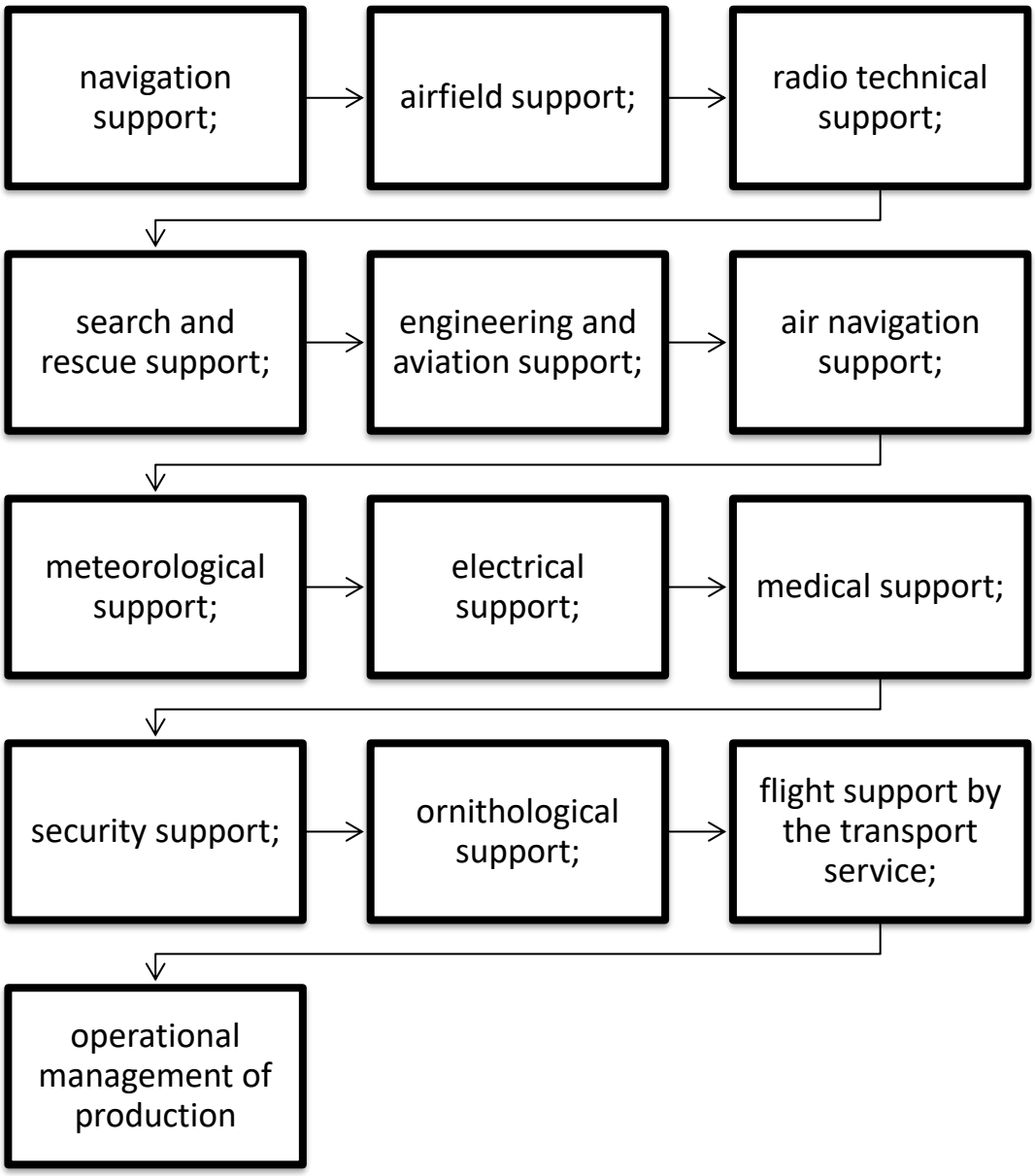
- Comprehensive study of ATC processes, i.e. versatility of the study of all existing factors and conditions and their interrelations at the organization stage.
- Uniformity, i.e. the desire in organizing ATC to obtain such structural solutions that will lead to a uniform load during ATC in all zones.
- Guarantee approach, i.e. calculation for the worst possible case, upon the occurrence of which the specified level of flight safety will still be ensured.
- Ensuring the continuity of the ATC system in time and space.
- Unity of command of direct ATC, i.e. such an order in which only one control center can control objects within the boundaries of one system contour, the dispatcher of which bears full responsibility for the quality of control.



Based on the above, the air traffic control system is a system that ensures planned, safe and economic activity for the beneficial use of the airport's working area and airspace, and is intended to ensure mandatory safety of aircraft flights. ATC technology is characterized by the rapidity of processes and the impossibility of stopping them. In this regard, the question arises about the need for a systemic (comprehensive) approach to solving issues of organizing the activities of ATC technology.

The ATC system includes a set of technical means of navigation, ATC, communication and landing, the structure of airspace, meteorological and other types of flight support, rules and procedures for

planning the use of airspace, air traffic flows and direct air traffic services. In addition, to ensure the operation of ATC technology, the following services and types of flight support were set out in the Flight Operations Manual:



1 Fig. Scheme of interaction of services of the air transport system

According to the fundamentals of the policy of the Republic of Uzbekistan in the field of civil aviation activities, restructuring the civil aviation industry in accordance with the tasks facing them, as well as the needs and economic capabilities of the state, modernization of the air traffic control system, ensuring rational loading of airport production capacities are priority areas. In such conditions, in matters of ensuring the operation of the ATC system, as well as in organizing the interaction of ATC services with flight support services, the leading place belongs to the traffic service. Failures of ground equipment and various aircraft systems create significant difficulties in the activities of traffic services. Flight safety cannot be ensured without well-organized measures to improve the qualifications of the personnel of the services providing flights, as well as the efficient work of traffic services, including interaction with flight support services.

A special place in the organization of the functioning of the ATC system, as well as in the improvement of the activities of the air transport system, is occupied by the qualification of personnel. The high rate of development of aviation technology places increased demands on aviation personnel. Aviation personnel include persons with special training and a certificate (certificate) and carrying out activities to ensure the safety of aircraft flights or aviation security, as well as activities to organize, perform, provide and service air transportation and flights of aircraft, aviation work, organize the use of airspace, organize and service air traffic. Persons from among the aviation personnel of civil aviation are allowed to work if they have a certificate (certificate). Persons who do not have a valid certificate with them are not allowed to perform the functional duties of an ATC dispatcher.

Air traffic controllers carry out air traffic control activities within the limits of qualification marks and marks on admission to work at a specific air traffic control point (sector) entered in the established manner in the air traffic controller certificate, as well as the established period of its validity and in the presence of a valid medical certificate on recognition of fitness for work as an air traffic controller, except for cases when the scope of work of an air traffic controller is limited to the performance of functional duties that do not require a medical certificate on recognition of fitness for work as an air traffic controller.

In order to maintain the proper level of knowledge to ensure flight safety in air traffic control, air traffic controllers must undergo refresher courses in their specialty once every three years. An air traffic controller must have the skills to act not only in routine situations, but also in specified special cases, as well as in unforeseen situations. An air traffic controller, in conditions of uncertainty, must be able to adequately assess the situation and promptly make a decision. Air traffic services - a system of coordinated actions to ensure the flights of aircraft, the purpose of which is to prevent collisions between them (and when moving along the area of the aerodrome, in addition - with obstacles in this area), maintain order and accelerate movement in the flow of aircraft, provide crews with information necessary for the execution of the flight, and notify search and rescue support bodies about aircraft in distress.

Air traffic services are performed by an ATS unit in a certain area of responsibility with certain boundaries of acceptance (transfer) of control. According to air legislation, the transfer boundary established on the taxiing route or on the flight path of an aircraft, at which aircraft traffic services are transferred from one unit to another. For each dispatch service unit, the boundaries of the responsibility zones are established taking into account the technical capabilities used by the air traffic services (ATS) unit, the means of radio technical support for flights. Air traffic services for aircraft performing flights in a specific part of the airspace, as well as the movement of aircraft on the maneuvering area of the aerodrome, are performed by only one ATS unit. Based on this, it can be concluded that an air traffic service unit must have a boundary of acceptance (transfer) of air traffic control only with another ATS unit.

Consequently, an air traffic control unit on an apron, having boundaries of acceptance and transfer of traffic control with an ATS unit, is an air traffic service unit, and the apron, in this case, is part of the maneuvering area. Another problem is the problem of professional training of personnel providing air traffic services (taxiing) on the apron. The absence of qualification requirements for certification, personnel taxiing aircraft on the apron do not undergo advanced training, do not undergo the procedure for extending the validity of the certificate (air traffic controller certificate or another certificate). The requirements for air traffic controllers and parachutist instructors" do not apply to personnel taxiing aircraft on the apron.

Thus, the dispatching staff providing aircraft traffic services (taxiing) on the apron are removed from the staff of aviation personnel, the air traffic control center for aircraft is removed from the traffic service and turned into a flight support service. Nevertheless, a more detailed assessment of

the organization of taxiing activities on the aprons of the airfield is required, the identification and elimination of inconsistencies in the documents regulating taxiing activities on the aprons, and for this purpose additional research in this area is necessary. Thus, in the field of ATC theory, it is necessary to note the intensive development of the theory and the introduction of methods for studying the dynamics and control for a class of hybrid systems, in which continuous processes are combined with discrete ones. Discrete processes, as a rule, control the process of switching from one continuous system to another from a certain set of admissible ones. Mathematical models, qualitative behavior, stability and controllability of hybrid systems, collective behavior in multi-agent systems, problems of group control, tasks of collective and flock control, intelligent components of ATC systems are studied.

Literature

1. Abdukayumov A, Maturazov I.S, & Sarsenbaev D.J (2024). Impact of digitalization on aircraft safety and aircraft maintenance. Science and innovation, 3 (Special Issue 17), 185-190. doi: 10.5281/zenodo.10748023
2. Aviation Week & Space Technology. (2020). Advances in aviation maintenance technology: A comprehensive overview. Aviation Week & Space Technology, 55(8), 30-45.
3. Ismailov T.K. (2023). Some current problems of air traffic control. Proceedings of the Moscow Institute of Physics and Technology, 1 (3), 194-214.
4. Knyazevsky, D.A. Air traffic organization and maintenance: textbook. Manual. Edition-2. - Ulyanovsk: UVAU GA (I), 2022.
5. Malyshev, R.G. (2023). Remote air traffic maintenance. Scientific Bulletin of the Moscow State Technical University of Civil Aviation, (10 (196)), 91-95.