

APPLICATION OF REFERENCE MODELS TO DETERMINE THE PROFESSIONAL RELIABILITY OF AIR TRAFFIC CONTROLLERS AND CREATING A SIMULATOR

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Abstract—*Existent approaches to simulator training operators of air navigation systems were considered, were developed algorithmic models of operator's actions in Air Traffic Services Reporting office, working through typical processing instructions.*

Index Terms—Simulator training; performance; reliability; air traffic controller; air traffic control; air navigation system; reference mode.

I. INTRODUCTION

The normative model of ability to work of air traffic controller (ATC) is his educational qualification characteristics. According to the latest graduate – ATC controller should have basic knowledge of general scientific and professional knowledge of the basic laws of aerodynamics, fundamentals of aviation cartography and mapping of flight, meteorology main components for air safety, aviation security and order investigations of aviation accidents, operating principles, characteristics construction methods and application of existing and future communication systems, navigation and surveillance rules phraseology and maintaining radio communications. In addition in Ukraine, he must have ability to solve navigation tasks using modern air navigation systems use algorithms of functioning of modern systems of communication, navigation and surveillance, organize work according to the requirements of life safety and labor protection, to maintain radio communication in English and Russian, etc.

As for ATC controller characteristic adaptability to changing conditions, the importance of response time of a manager on objective circumstances of air traffic, the need to make decisions based on incomplete information about air conditions no less important is the individual ATC controller professionally important qualities: integrity, activity, consistency, creativity, endurance and restraint, politeness, communicative, initiative, self-criticism, perseverance etc. Significant role is understanding of the necessity and adherence to a healthy lifestyle that allows loading dose, avoid systemic congestion, develop and maintain their own stress resistance and labor activity in extreme situations; ability to learn, which makes it possible to adapt to the growing flow

of information and the consequences of scientific and technological progress. Furthermore, ATC controller should have the ability to select relevant information from a large volume of messages that have developed spatial imagination, which allows to correctly represent the position of aircraft in the airspace and predict their position after a certain period of time, be creative in finding solutions for professional tasks and have a high level of development of systems thinking, attention and memory [1].

So we can draw a conclusion that one of the major stages in assigning the above qualities is the simulator training.

II. SIMULATOR TRAINING

Simulator training is conducted on dispatcher simulators. Its aim is to improve working practices and ATC controller practical skills in ordinary and special conditions, conflict situations, special cases in flight and emergencies. Training can be done either at the initial levels of training, and in retraining during recovery / maintenance or training of ATC controllers. Simulator training in education and ATC training is an indispensable element in the formation of skills that are necessary in the management of air traffic, particularly in special cases and emergencies in flight aircraft.

There are four stages of exercise training (Fig. 1), which are determined by analyzing the situation in the ATC, and in the human perception of information, understanding and presentation.

Training are conducted at the training center, equipped with specialized and complex facility, and aimed at:

– fixing and deepening the knowledge gained during the initial training, the experience gained in the workplace and theoretical knowledge;

– expansion of emotional and volitional stability when working in special and extreme conditions;

– detecting errors in the ATC controllers and their timely correction [2].

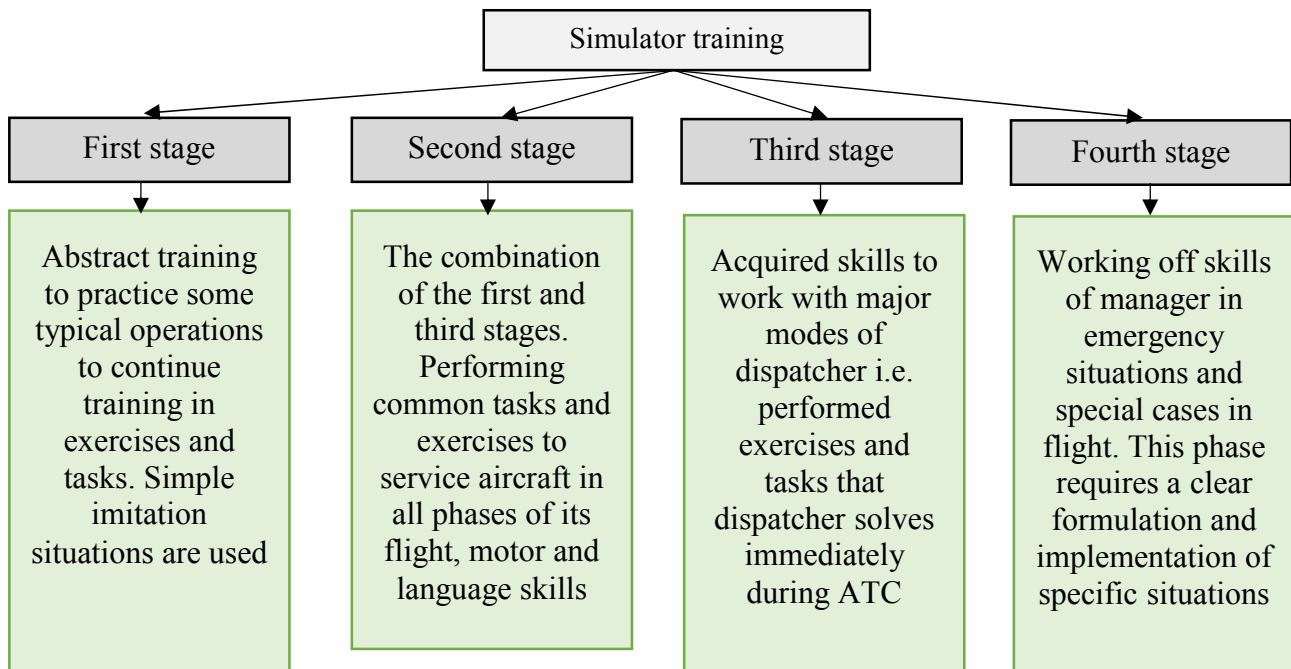


Fig 1. Stages of simulator training

Air traffic controllers simulators can be divided into three types (Fig. 2).

Procedural simulators – give the opportunity to acquire skills to perform certain partly practical operation during initial training in some ATC procedures without instructor, using the knowledge acquired in theoretical classes. Procedural trainers can develop and acquire skills only in specific ATC procedures. In addition, procedural simulators can be created based on a personal computer and be installed and used in primary training in educational institutions, which train specialist controller.

Modular training – provides an opportunity to train in a particular workplace zone of ATC. These simulators provide an opportunity to gain work skills and develop professionally important qualities of dispatchers. Two people are involved in the module training: ATC controller and pseudo-pilot. In addition, procedural simulators can be created based on a personal computer and be installed and used in schools and training center in traffic services during practical training at one of the points of ATC.

Using modular training makes it possible to simulate any existing zones of ATC, create any desired air situation and conduct training at any level of complexity, depending on the tasks received.

Complex training – allows training preparation for ATC controllers as a part of the controller shift that is the most similar to the duties performed on

the workplace, work off group skills and interaction with adjacent sectors or items of ATC. Complex simulators installed in schools where their operation is far more cost effective than enterprises', because the use of simulators requires suitable premises, a large number of instructors, operators and maintenance personnel [3].

VERIFICATION SYSTEM OF EXISTING SKILLS OF OPERATORS OF THE AIR NAVIGATION SYSTEMS ACQUIRED DURING SIMULATOR TRAINING

The skills that should be formed in the air traffic controller (Fig. 3) can be divided into several groups [3].

Verification of practical skills to ATC is conducted at a dispatcher control point maintaining:

- obtaining the qualification assessment;
- extension of the term of the dispatcher license;
- certification;
- advanced training.

Scheduled inspections of practical skills of ATC are conducted by ATC controller instructors and heads according to the job description and technology of ATC controller:

- before admission to independent work;
- before admission to independent work on a new control point and the transition from other enterprises;
- significant changes in the operating

environment or equipment;
 – before the independent work of the formed shift;
 – verifying qualifications;

– upgrading skills;
 – during a break in the work of one month or more, as well as significant changes in the operating procedures [4].

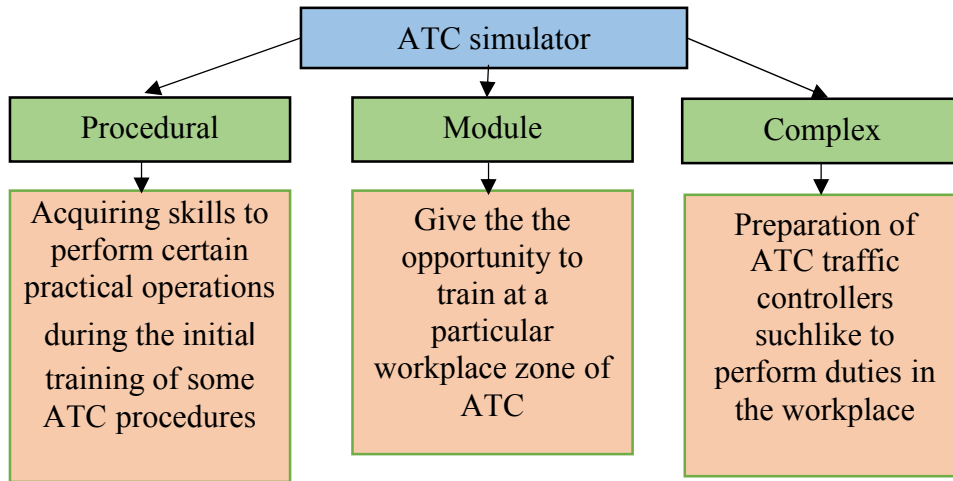


Fig. 2. A Air traffic controllers simulator

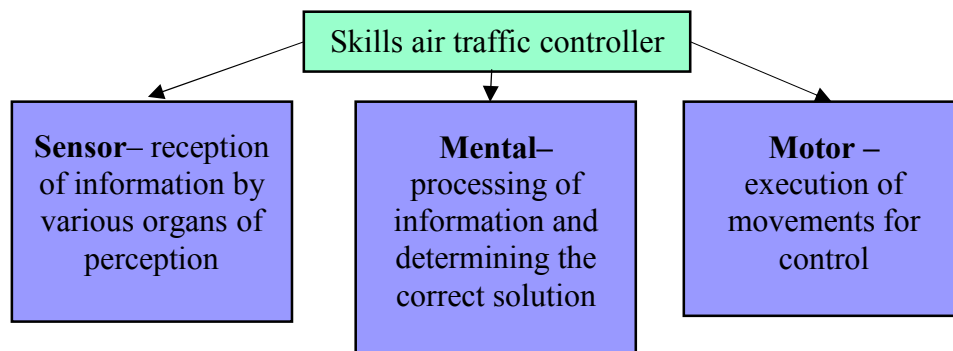


Fig. 3. Skills of aviation dispatcher

IV. JUSTIFICATION OF REQUIREMENTS FOR OPERATOR SIMULATORS OF AIR NAVIGATION SYSTEMS

It is possible to achieve a higher level of preparation if each ATC controller is taught with the most adapted program. This can significantly reduce the duration of study [5].

The process of professional training of air traffic controllers is performed by using modern methods and learning tools, such as simulators.

Organization ATC traffic controllers training using simulators allows to individualize the learning process and transfer the flow of information from the teacher or instructor to the training program / module [6].

There are a number of requirements to ATC simulators (Fig. 4) through which the dispatcher can raise the professional level of reliability and reduce

the level of risk that arise during the performance of professional duties. [7] – [8].

The main disadvantage of the simulator is that the simulator has no properties to assess the operator during the training of air traffic controller, the assessment is provided by the instructor but unfortunately, it is not possible now to objectively evaluate the executed work on the simulator considering the human factor.

V. THE ANALYSIS OF ALGORITHMIC MODELS OF OPERATOR’S ACTIONS IN AIR TRAFFIC SERVICES REPORTING OFFICE AND CONSTRUCTION OF REFERENCE MODELS.

A reference model is an abstract representation of the concepts and relationships between them in a certain subject area. Based on standard more specific and detailed models eventually embodied in the actually existing objects and mechanisms are built [9].

Work of the controller in Air Traffic Services Reporting Office is the fulfillment of the list of essential mandatory actions during the performance of official duties (Fig. 5).

For the formalization of algorithms, it is required to analyze the actions of controller in Air Traffic Services Reporting Office (Fig. 6). During his work the controller in Air Traffic Services Reporting Office uses just such reference model which describes the order of actions interacting: with the ATM, with the services of the airport, for reporting the incident by air movement, from UkSATSE AIS, with Eurocontrol on ATFM measures.

After analyzing the developed algorithmic models, it is possible to develop a virtual flight plan that reflects a certain air situation in which it is necessary to perform certain service procedures of air traffic in the specified period of time, which in turn allows performing most realistic work atmosphere of the dispatcher with heavy workload of airspace.

It helps to obtain real statistics of the operator's errors during the primary training. Such statistics will not only obtain a portrait of a particular operator, but also can be used when predicting risks related to the operation ANS of the operator, namely controller in Air Traffic Services Reporting Office.

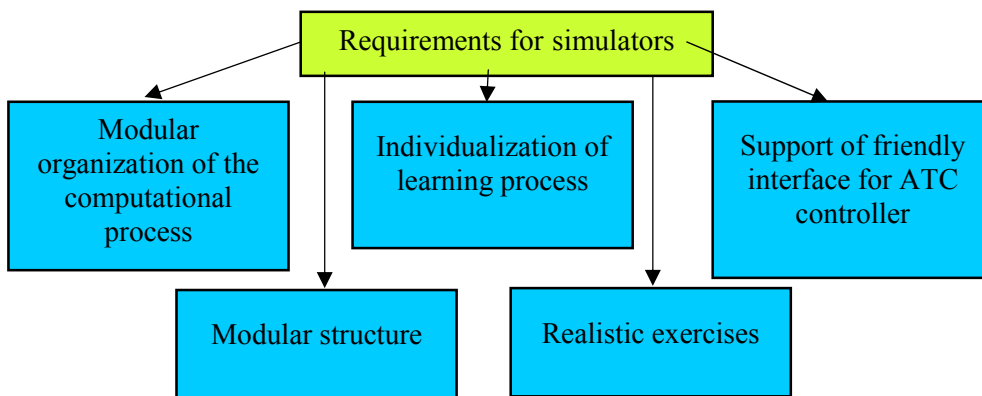


Fig. 4. Requirements for simulators for ATC controller

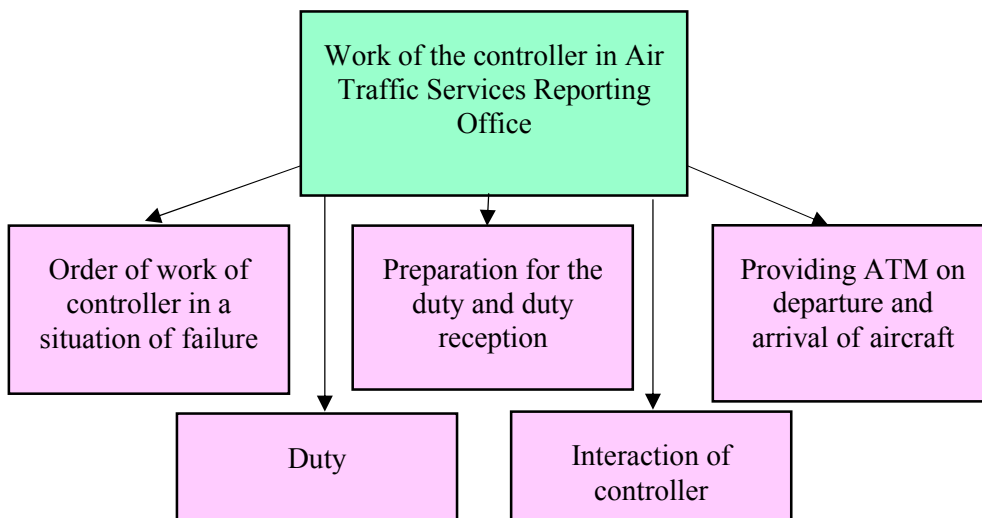


Fig. 5. The components of functioning of controller actions in Air Traffic Services Reporting Office

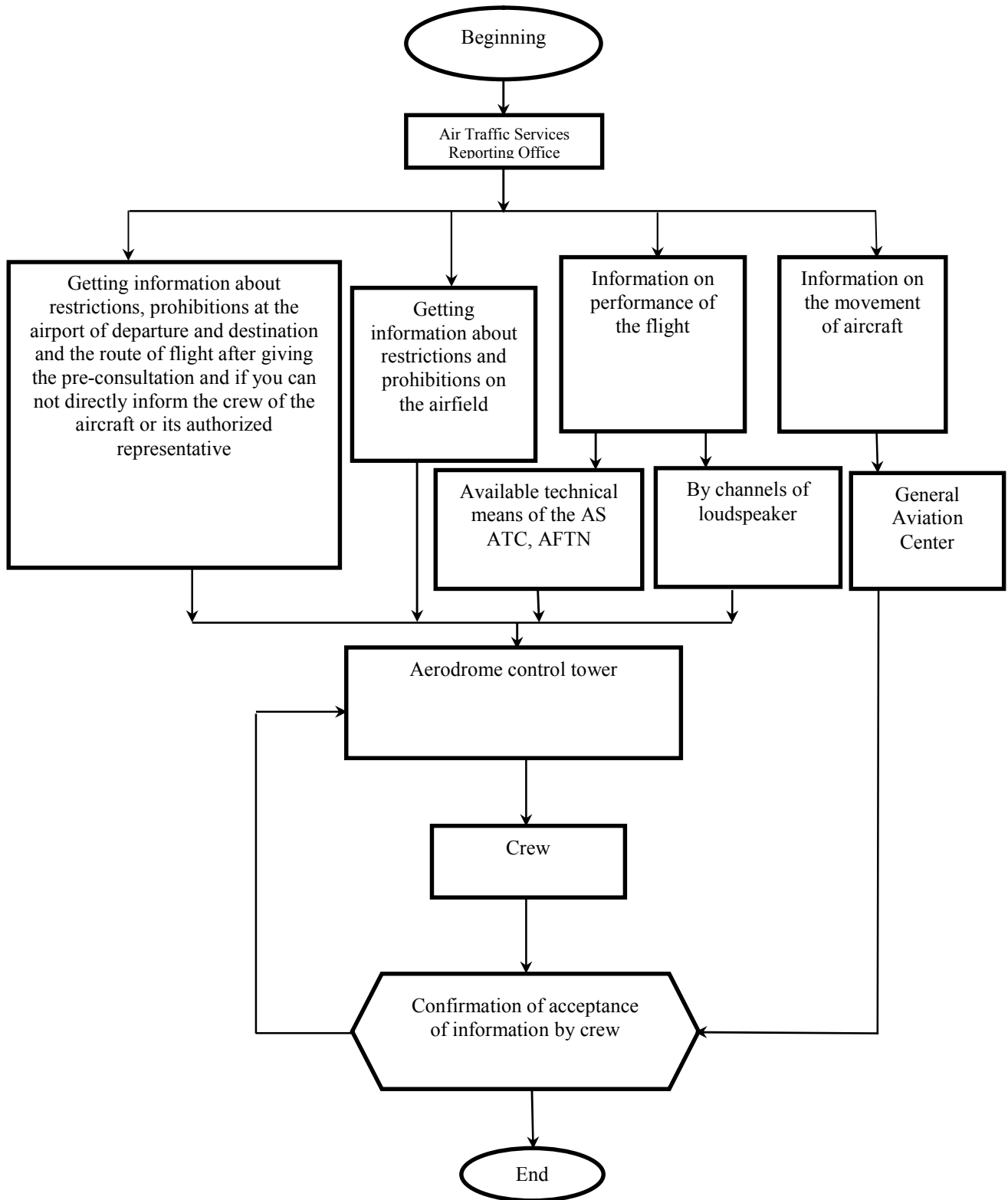


Fig. 6. Algorithm of Air Traffic Services Reporting Office controller interaction with ATC and airport

CONCLUSIONS

Reference model of work of controller in Air Traffic Services Reporting Office is the fastest correct sequence of actions on the control of airspace in any situation for the specified period.

Algorithmic models of actions of the controller in Air Traffic Services Reporting Office were developed by processing typical working instructions.

Due to the above-mentioned developments, it became possible for the first time to waive the

assessment of the examiner, which can maintain a human factor, and get an objective evaluation of the simulator module evaluation. And in the future on the base of simulator with module evaluation it would be possible to develop curriculum for training specialists for Air Traffic Services Reporting Office (ARO), which will reduce the probability of risks.

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Received 22 April 2015.

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Кожохіна О.В., Рудас С.І., Бондарев О.С., Застосування еталонних моделей для визначення професійної надійності авіаційного диспетчера та створення тренажеру

Розглянуто існуючі підходи до тренажерної підготовки операторів аеронавігаційних систем. Розроблено алгоритмічні моделі дій диспетчера пункту збору донесень щодо організації повітряного руху аеродромної диспетчерської вишки, шляхом опрацювання типової робочої інструкції.

Ключові слова: тренажерна підготовка; працездатність; надійність; авіадиспетчер; управління повітряним рухом; аеронавігаційна система; еталонна модель.

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Кожохина А. В., Рудас С. И., Бондарев А. С. Применение эталонных моделей для определения профессиональной надежности авиационного диспетчера и создание тренажера

Рассмотрены существующие подходы к тренажерной подготовки операторов аэронавигационных систем. Разработаны алгоритмические модели действий диспетчера пункта сбора донесений по организации воздушного движения аэродромной диспетчерской вышки, путем обработки типичной рабочей инструкции.

Ключевые слова: тренажерная подготовка, работоспособность, надежность, авиадиспетчер, управлении воздушным движением, аэронавигационная система, эталонная модель.

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Количество публикаций: 3.

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