Certain issues to minimize the human factor impact in transportation security

Averin Dmitrii Valerevich[1], Ovchenkov Nikolayi Ivanovich[2]
[1] FSUE State Research Institute of Civil Aviation, Moscow, Russian Federation
[2] Yaroslavl State University,Yaroslavl, Russian Federation

Abstract. *Aviation security as a topical area of scientific research is marked contrast to other application tasks of security sector. The specific nature aims at dealing with research objects that differ in considerable uncertainty of identification and description. In such a case, the requirements for aviation security systems are constantly becoming more complex, and the methodology of scientific research on security issues lags far behind the common trend of civil aviation development.*

In the last few years, the trend to improve aviation security management systems in transportation industry has become a transition from classical schemes of regulatory management to schemes of computer-assisted management using procedures with the challenge of reducing the human factor. In fact, the human factor is not the only criterion for management in such systems. We can identify a number of factors that reduce the effectiveness of security management in the current system, and their impact is not fully investigated. A system analysis of these factors shows that each of them is not only related to the human factor, but the parameters of these factors' influence on the management efficiency are largely determined by the human component. In this case, the human factor becomes the main criterion for optimal aviation security management. There is a problem of minimizing the negative impact of the human factor on aviation security management procedures. The authors of this work offer and study an original approach to solving this problem.

KEYWORDS: *SECURITY, AVIATION SECURITY, AUTOMATED MANAGEMENT, MINIMIZATION OF THE HUMAN FACTOR.*

The human factor (HF) in the field of security, especially in the field of aviation security (AS), is purely negative, and it is clear that it cannot be excluded. The aviation security management system, being the ergatic system, has a superior human component. The overall level of aviation security is largely determined by the level of personnel's professional training and adequate results of their professional activities, even if there is a developed system of the object's protection equipment. In-depth studies of the human factor in security show the negative impact of personnel on security parameters [1].

When switching to AS management in modern security systems, the task is to minimize the human factor and replace human impact on security processes with automated procedures without human participation.

The authors consider this approach as inappropriate for the following reasons.

1. Fully automated security systems are utopian in some sense, since any automation involves almost complete algorithmization of the procedures that implement it. Most processes are difficult to formally describe and algorithmize in aviation security, and the tasks to be solved are poorly formalized and poorly structured.

2. The proportion of the human factor in implementing security procedures are notably increasing to the extent that security systems develop and become more complex. Hence, there is a rather serious contradiction between the human factor and the problem of forming and using a complex of technical means in a real situation, where minimizing the human factor is hardly an option.

3. Mud-slinging a person as the weakest unit is crucially ineligible, because there is a wide class of tasks, processes, procedures, where a person (specialist), and only he, has essential advantages compared with technology.

In other words, the question should not be about minimizing the human factor, but about a significant change in the meaning and content of the human factor concept (Picture 1).

We can select the personality factor (PF) from the human factor concept, in other words, everything related to the characteristics of a person. In this part, the study of the HF consists of strengths and weaknesses of a specialist as a participant in the production process, with the consequent limitation of his participation in accordance with professional capabilities.

In the second part, you can concentrate on what is related to technology and its interaction with a specialist. Here the issue is whether the mutual adaptation of human and technical parameters to the conditions and tasks are solved within the framework of AS management.

We wish to draw attention to the third aspect, which in modern works on the human factor remains outside the scope of the study. During production operations in progress, the personnel of aviation organizations often exceeds the defined activity algorithm, guided not necessarily by any negative intent. Mostly on the contrary, in order to improve the efficiency of their work, the personnel makes while attractive decisions that can lead to highly negative results, up to an aviation accident with disastrous consequences. In this case, the personnel of the aviation organization involved in ensuring aviation security becomes a source of danger and is able to bring the situation with the object of study out of balance, which is manifested, at least, through deviations from the requirements for aviation security to the object. In this case, there is a task to manage these deviations in order to minimize them, and the control parameter becomes a threat from the aviation organization's personnel in relation to the safety of the object. This is now the most urgent and timely task.

There is proposed an innovative approach, focusing on the following. The main problem of the human factor's study is the lack of opportunities to unify the parameters of the object of study, determined by the insurmountable complexity of the human component. It is enough to say that today there is no human (operator) model that is sufficiently adequate from a practical point of view. The author puts forward the following hypothesis to solve this problem: it is proposed to consider the human factor as a complex system in terms of system engineering, consisting of many elements, each of which represents a human operator, whose functions are different, but which are united by a single goal of professional activity. In this case, the human factor can be considered as a certain threat, which becomes comparable to the threats defined in the intruder model [2].

From the point of view of aviation security, it is proposed to consider the human (personal) factor as an unavoidable evil, excluding the useful component, and all its negative manifestations are classified as security threats. In this case, the methodological apparatus developed for the protection of transport infrastructure objects can be applied to the study of the human factor in order to reduce and / or exclude its influence in aviation security, i.e. the well-known formula begins to work: detection-reflection-elimination.

The personnel threat (PT) in aviation security is a state of inadequacy of the operator's professional readiness and the parameters of the situation in the security system defined by the limiting level of psychophysiological parameters of the person, allowing the occurrence of negative events.

As a result, a new situation emerges when it is necessary to minimize not the human factor, but the task is to regulate the negative influence of the aviation organization's personnel on the procedures for performing production activities, considering this influence as a threat to the object's security. In this case, they change approaches to solving the problem and research methods.

The personnel threat is not always a potential event. These threats are quite often implemented, manifesting as negative results of the aviation specialist's activity, which can be an act of unlawful interference (AUI) or even a terrorist act. Scientific research of personnel threats is aimed at developing and implementing a special

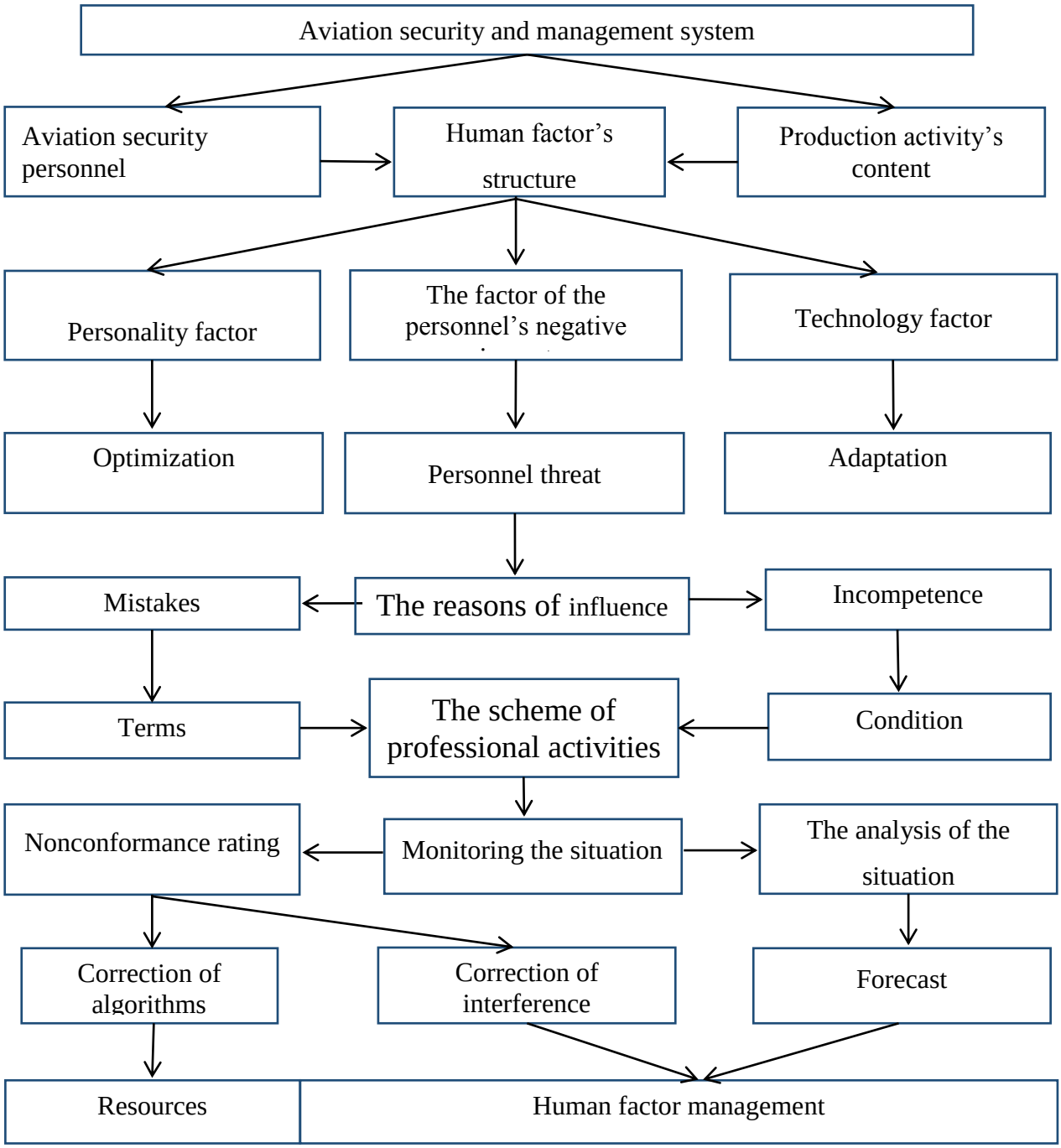
methodology for working out such threats according to the formula" detection-reflection-elimination", i.e. threats to personnel are included on equal terms in the set of potential threats to the transport infrastructure object.

Personnel threats as threats to airport security are implemented in the form of unauthorized interference in aviation security procedures. This means that in the course of their professional activities, aviation security personnel perform certain actions that are not provided for by their functional responsibilities and are not included in their target functionality. These actions may occur as a result of personnel mistakes or some other reasons, but in any case they lead to deviations from certain standard operating procedures (SOP) of the activity.

Personnel threats are considered to be some by-product of a professional activity of an aviation security specialist. This means that it is impossible to single out a separate threat or classify them in any way. It is impossible to study the threats of personnel as potential for the same reason, i.e. it is impossible to develop a counteraction device for each threat in advance. This is the main difficulty in investigating personnel threats, which prevents the use of mathematical models and other classical research methods.

The problems associated with the human factor are multifaceted and quite complex. Classical approaches to solving these problems have almost run out. The idea of the new approach consists of a fundamental revision of the physical meaning of the human factor, understanding that the HF is still not a factor, but a much more complex and multifaceted category that belongs to complex systems and has a cost functional that does not subject to strict mathematical description.

An entirely new situation occurs when you need to not minimize the human factor, but the task is to regulate the negative influence of the aviation organization's personnel on the procedures for performing production activities, considering this influence as a threat to the object's security. In this case, they change approaches to solving the problem and research methods.



Picture 1. *On the new content of the human factor concept*

The reasons that determine the factor of personnel's negative influence are associated with mistakes in the wider sense of this term; the conditions for the implementation of production activities; the level of professional readiness of aviation personnel and the state in which the specialist is in the process of work. These reasons are apparent in the main point, namely: there are discrepancies, deviations, inconsistencies with the algorithm of activity. The fact is that in aviation security, all production activities are strictly regulated and legalized in the format of standard operating procedures (SOP), which assume compliance with the established requirements. The personnel of an aviation organization in the implementation of their professional function is in a certain situation, the parameters of which are determined by the parameters of the SOP and the parameters of the real algorithm of professional activity of a particular specialist. A security threat to the object under study appears if there are discrepancies between these parameters. In this case, in order to minimize the negative impact of personnel, it is necessary to monitor the situation, evaluate emerging inconsistencies, and analyze them from the point of view of the measures taken. Minimization of the negative is possible in two directions: correction of the algorithm (SOP) and correction of the procedure of the specialist's activity. In both cases, certain resources are required, the inclusion of which in the process minimizes the negative impact of personnel. In this case, the negative influence of the staff becomes manageable.

Further study consists of developing methods and procedures to minimize the negative impact of aviation organization personnel in the aviation security system.

Unauthorized interference of aviation security personnel represents certain deviations or inconsistencies from the standard operating procedures (SOP) approved in advance. These deviations are recorded and evaluated during the monitoring process. They are thus the negative impact that is called unauthorized interference or personnel threat in the field of aviation security [3,4,5].

Therefore, reducing the level of negative influence of airport security personnel is contemplated on the basis of managing unauthorized interference by the criterion of personnel threat using the method of instrumental correction of the algorithm of professional activity of an aviation specialist and the method of managing aviation personnel by the criterion of the quality of their professional readiness to perform their functional duties.

REFERENCES

1. **Elisov L. N., Ovchenkov N. I., Fadeev R. S**. Introduction to the theory of aviation security, [edited by Elisov L.N.], Yaroslavl: Filigree. 2016. 320 PP.

2. **Elisov L. N.** To the question of the accuracy of heuristic algorithms for solving optimization problems in operation // Scientific Bulletin the Moscow State Technical University. 2012. No. 179. P. 123-126.

3. **Elisov L. N**. Methodology and means of qualimetry of civil aviation engineering and technical staff. Abstract of the thesis for the degree of doctor of technical sciences / / Moscow, 1995.

4. **Ovchenkov N.I., Elisov L. N.** Vulnerability assessment of transport infrastructure and vehicles in civil aviation / / Scientific Bulletin of the Moscow State Technical University. 2014. No. 204. P. 65-68.

5. **Elisov L. N., Ovchenkov N.,I.** Aviation security as an object of mathematical modeling / / Scientific Bulletin of the Moscow State Technical University. 2017. Volume 20, No. 3. P. 13-20.