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MODERN OPPORTUNITIES FOR AIR SAFETY MANAGEMENT

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Abstract

The article describes the process of the basic elements of SMS, which is a security policy, through a radical change in industrial relations and the creation of "non-punitive" production environment, and defines the attitude to the experts in their erroneous actions, as well as the introduction of a system of voluntary notification of personnel about dangerous factors (risk factors), errors and incidents. The basis for the creation and reliable functioning of SMS is the formation of modern professional and corporate culture in the airline. An important part of it is a positive safety culture. All this should allow us to reach an acceptable level of aviation safety.

Keywords: risks; aviation activity; safety management system; risk management

1. Introduction

According to the statistics for the last ten years on aviation accidents and incidents, the issues of ensuring the guaranteed level of safety of flight are the most urgent, since the problematic issues in the functioning of aviation activity are explained by the lack of a general-theoretical basis. and conventional science-based approaches to flight safety management, the development of which should be based on the ICAO requirement, which specifies that no region should have an accidents| and incidents frequency greater than twice that global. These are the following main areas:

- the introduction of acceptable guaranteed level of safety of flight in the state;
- mandatory procedures to ensure the development and implementation of a flight safety management system (SMS);
- mandatory procedures to ensure the immediate management of the safety flight within the accepted or established level (continuous monitoring and regular assessment of flight safety, corrective actions required to maintain and monitor agreed flight safety performance, analysis of flight information, accident risk management, etc.).

Analysis of recent research and publications. Various aspects of risk management in socio-economic systems are considered in [1-3], in these works the nature of occurrence of risks is studied, their classification and various methods of qualitative and quantitative assessment are presented, recommendations for organization of risk management and decision making in conditions of uncertainty. In [4, 6], approaches to the use of economic and mathematical methods at different stages of risk management are proposed.

The analysis of modern scientific works reveals that, to date, statistical methods are most often used to estimate risks, which include Bayesian networks - an effective tool for graphically representing the cause and effect relationships between many variables. At the same time, existing and practiced risk management methods and tools do not fully allow for various types of information uncertainty to be identified and for quantitative and qualitative risk characteristics to be analyzed, and therefore for risk assessment and management to be taken into account.

2. Goal

In view of the above, there is a need to develop a methodology for providing and maintaining a guaranteed level of safety flight in aviation activity (hereinafter methodology) is to integrate into a single set of tasks of evaluation, verification and security of aviation activity, as a complex hierarchical structure with independent critical elements, and hardware, software, network and ergonomic components, which are also a means of

security.

3. Theoretical part

Aviation security is considered to be a state of the art of qi-free aviation, at which the risk of causing damage to people or property is reduced to an acceptable level as a result of a continuous process of determining and managing the level of danger in the following areas [3]:

- flight safety - a condition in which the risk of injury or injury to persons / property is limited to an acceptable level;
- aviation security - the state of protection of civil aviation against acts of unlawful interference with its activities;
- ecological safety - the state of environmental protection from the negative consequences of aviation activity;
- economic security - the state of the most efficient use of resources to prevent threats and ensure the stable functioning of aviation;
- information security - state of aviation security from internal and external information threats.

State regulation of civil aviation activities is carried out by the State Aviation Service of Ukraine. One of the areas of implementation of comprehensive measures for ensuring flight safety, aviation, environmental, economic and information security is the certification of aviation entities [3]. In the conditions of technology development and improvement there is a problem of “human factor”. In managing complex processes, which is more acute for aviation than for most life-threatening industries. This is primarily due to the stringent requirements imposed on the human operator due to the high speed of the processes occurring in the aviation ergatic system and their potential danger to human life and health.

The prevention of adverse aviation events in civil aviation has so far relied mainly on the concept of flight safety, the main principle of which is a retroactive approach, the essence of which is that the system of prevention of aviation events and incidents is aimed at, for strict adherence to regulatory requirements and implementation of preventive recommendations developed as a result of the investigation of the accidents [3]. This approach does not imply continuous pre-emptive work aimed at preventing negative events before they happen. Therefore, it does not meet the current requirements for flight safety.

At the moment, there is a new proactive approach to over-running accidents, the so-called proactive approach. The new ideology of preventing accidents and incidents involves the creation of an air traffic management system (SMS) at the airline, which

- Detects actual and potential security threats;
- Ensures that corrective measures are taken to reduce risk / risk factors;
- provides continuous monitoring and regular assessment of the achieved level of flight safety.

This approach in the prevention of aviation actions was called "proactive" [1].

In addition, the basic elements of SMS are security policy, a radical change in industrial relations and the creation of "non-cartel" production environment, determines the attitude to professionals in the performance of erroneous actions, as well as the implementation of a system of voluntary notification of staff about dangerous factors (risk factors) , soaps and incidents. The basis for the creation and reliable functioning of SMS is the formation of modern professional and corporate culture in the airline. An important part of it is a positive safety culture. All this should allow us to reach an acceptable level of aviation activity.

At the same time, when considering the management of aviation activity, it is necessary, first of all, to ensure that the ANS has an optimal (strictly balanced) structure, reliable functioning of each component and good protection against negative phenomena.

Thus, flight safety management is a fundamentally new highly effective way of preventing adverse aviation events, fundamentally changing the style of production activity and industrial relations. The transition to aviation activity management is a radical one, in the process of which a number of problems should be solved. However, the implementation of SMS does not undermine the development of standards and their strict implementation. For a deeper understanding of the ideology of air traffic control, it is advisable to dwell separately on the content of a "proactive" approach in addressing aviation accident prevention.

PBA - approach. In the case of ICAO, it is constantly developing and refining more proactive, risk-based methods to further reduce the number of aviation events in the world, and calling on aviation communities to recognize the importance of adopting a unified global approach to improving and monitoring security [2].

The modern performance-based approach (PBA) [5] is based on the following three principles:

- the main focus on the desired / necessary results;

- making informed decisions, focused on the desired / desired results;

- use of facts and data in making decisions.

The principle of "use of facts and data in decision making" suggests that the tasks must meet the SMART criterion [5], which is an abbreviation of five English words:

• specific (specific),
• measurable,
• achievable,
• relevant (comparative)
• Timebound (timed).

Such a level of accuracy of task definitions can only be achieved by a consistent and structured description of the heterogeneous components of the aviation industry - aviation enterprises, aviation personnel, aviation infrastructure, technical equipment, procedures, rules and information aimed at creating conditions and the use of airspace by a person using aircraft [6].

As part of improving the new concept of AP prevention, the ideology of flight safety management with quantitative assessment of PR in terms of risk and uncertainty is proposed.

Innovative processes in SMS are related to the use of management tools of all kinds.

The implementation of SMS functions requires not only abstract ideas, goals, and strategies to achieve them. A clear mathematical rationale for each decision is required, supported by the analysis of statistical, financial and economic data on the state of the internal and external environment of the SMS. In addition, the implementation of the management decision itself requires the use of a number of mathematical tools to calculate, control and predict the target values of strategic indicators of the implementation of a particular program or project. When calculating such calculations, a large number of factors and indicators should be taken into account, as well as risk assessments. To simplify these tasks, information systems of various kinds are used.

Consider the basic mathematical methods used in innovation. Here is a classification of methods, depending on the type of solved problems.

The method of chain substitutions allows you to mathematically determine the dependence of the main characteristics of the organization's activities on the factors that influence it. In addition, such dependence will be of considerable value and can be analyzed in the implementation of different scenarios of the UPS process. As a result, the organization will be able to take preventative measures to respond to changing factors. In order to identify the impact of each factor on the considered indicators, use the method of elimination.

Factor analysis is a procedure for determining the force of the influence of factors on a function or a result (a useful effect of the object, the elements of total costs, labor productivity, fund-giving, etc.) in order to rank the factors for developing a plan of organizational and technical measures to improve function.

All the above methods of analysis should be used when conducting system analysis.

System analysis - a comprehensive analysis of an object as a system from the standpoint of a systematic approach, including:

- analysis of the quality level of all components of all sub-systems of the SMS;

- analysis of external and internal factors;

- analysis of the scientific level of aviation management

With UPS, the task of forecasting is one of the main. Because all investment calculations allow the use of forecast values of the main indicators of the organization's activity.

The regulatory forecasting method can be used for various purposes. Normative forecast means targeted forecasting.

One of the most common methods of normative prediction can be distinguished: information-logical models, goal trees, flowcharts of successive tasks, morphological models. Goal trees can be used to analyze systems or processes for presenting them in the form of levels of complexity, levels of causal relationships, or hierarchical levels. In cases where the system or process can be decomposed into elements, morphological models and ILMs can be used that can be transformed independently. In cases where the system, process can be represented in the form of one, as well as several chains of successive steps, you use the flowcharts of the sequence of tasks.

Extrapolation is a method of scientific research that is based on the dissemination of past and present trends, patterns, relationships to the future development of the object of forecasting. The purpose of extrapolation methods is to show what the future state of an object may be if its current is developed at the same speed or acceleration as in the past. The use of extrapolation methods implies two

assumptions: a) basic factors, trends of the past will retain their manifestation in the future; b) the phenomenon under study develops on a smooth trajectory that can be expressed, described mathematically.

Parametric forecasting methods are divided into two types: specific indicators and regression equations.

To establish regression equations, it is necessary that the number of statistics be at least three times the number of factors. For facilities that do not meet these requirements, the benefit or cost is recommended to be determined by specific indicators.

Statistical forecasting methods incorporate a large number of modern methods of analysis and forecasting based on statistical information. The scientific base of statistical forecasting methods is applied statistics and decision theory. Methods and tools of applied statistics are applied in many fields of activity of organizations. They are used not only for forecasting. Economics trick is responsible for solving economic problems within the framework of applied statistics.

The methods that can be used in forecasting include: regression analysis, time series analysis, panel analysis.

Decision-making theory is based on the use of concepts and methods of mathematics, economics, statistics, management and psychology in order to study the patterns of choice of alternatives. The core of the theory is the method of choice under uncertainty. Prediction is a task in which the researcher is forced to face a great degree of uncertainty about the realization of certain events in the future. In such a situation, predictions are made of a possible event implementation. Then the choice is made on the basis of the use of one of the tools of decision theory, for example by fuzzy logic.

Artificial neural networks provide great opportunities to make predictions of a new level of accuracy. Unlike the standard forecasting methods described above, they involve the construction and calculation of nonlinear mathematical models. This greatly increases the accuracy of the forecasting and provides additional capabilities for accounting for more factors that affect the forecast parameter. The ability of a neural network to predict is directly mediated by its ability to generalize and highlight hidden relationships between inputs and outputs. After training, the network is able to predict the future value of a sequence based on several previous values and (or) any current factors. It should be noted that forecasting is only possible when previous changes really do determine the future.

Another task that needs to be solved within the SMS is optimization. The solution to this problem is due to the use of linear and nonlinear programming methods, as well as special methods of operations research. Linear programming – linear transformation of changes in systems of linear equations. These include: simplex method, distribution method, static matrix method for solving material balances, game theory, transport problem, dual problem, etc.

The index method finds its application at almost all stages of innovative design. It allows you to compare the current performance of the project implementing organization with past values. Allows you to compare product characteristics and can serve as a tool to evaluate the degree of implementation of the plan when implementing a project. Moreover, the index method can also be used to solve some prediction problems. For example, the index method is used in predicting the useful effect, equipment capacity of each type. Types of increased costs of resources as a whole by enterprise. Forecasting period up to 5 years.

Similarly, a comparative method, a balance method, a method of chain substitutions, a method of elimination, a graphical method can be used to solve a number of narrow problems at different stages of development of an innovative project. All these methods can act as elements of a systematic analysis of the organization carried out in the framework of evaluating the possibility of implementing an innovative project.

More profound methods of analysis, such as factor analysis, must be used to make management decisions on project implementation.

Artificial neural networks (SNMs) are mathematical models, as well as their software or hardware realizations, built on the principle of the organization and functioning of biological neural networks - between the nerve cells of a living organism. The advantages of neural networks over basic methods in pro-gnosis lie in their ability to isolate and narrow hidden latencies between input and output. If there is any relationship between input and output, even if it cannot be detected by traditional correlation methods, then the neural network is able to automatically tune into it with a given degree of accuracy. In addition, modern neural networks have additional features: they allow you to evaluate the relative importance of different types of input information, reduce its volume

without loss of essential data, recognize the symptoms of approaching critical situations, etc.

Consider the main tasks that neural networks can solve in the framework of innovative design:

- cash flow forecasting;
- sales forecasting;
- forecasting demand for new products;
- forecasting changes in the price level of materials and components of the product;
- forecasting the cost of an innovative product.

4. Conclusions

Due to the similarity of the nature of the appearance of risks and the relevance of their reduction increased to an acceptable level. For various critical parts of the system - reducing the level of risk makes it urgent to create a methodology to ensure and maintain a guaranteed level of safety of future flights.

For various critical parts of the system - reducing the level of risk makes it urgent to create a methodology to ensure and maintain a guaranteed level of safety of future flights. The purpose of the methodology is to integrate into a single set of tasks the assessment, provision and verification of the security of aviation, as a complex hierarchical structure with independent critical elements, as well as hardware, software, network and ergo components, which are both a means and an object of safety [3,4].

Implementation of the guaranteed result is to implement the management processes in such a way as to prevent the transition of the infrastructure or its systems to a potentially hazardous state. Besides to ensure the blocking (exception) of the relevant technical object in the event of a threat of transition or when the transition to a dangerous state and minimization of the consequences of such a transition.

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Сучасні можливості для управління безпекою польотів в аеронавігаційній системі

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У статті наведено процес базовими елементами СУБП якою є політика безпеки, через радикальну зміну виробничих відносин і створення «некарательного» виробничого середовища, та визначає ставлення до фахівців при виконанні ними помилкових дій, а також впровадження системи добровільних повідомлень персоналу про небезпечні фактори (фактори ризику), помилки та інциденти. Фундаментом для створення і надійного функціонування СУБП служить формування сучасної професійної та корпоративної культури в авіакомпанії. Важливим її складовою стає позитивна культура безпеки. Все це в сукупності повинно дозволити досягти прийнятного рівня безпеки польотів.

Ключові слова: ризики; прийняття рішень; фактори ризику; причинно-наслідкові зв’язки; система підтримки прийняття рішень

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Современные возможности для управления безопасностью полетов в аэронавигационной системе

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В статье приведены процесс базовыми элементами СУБП какова политика безопасности, из-за радикального изменения производственных отношений и создания «некарательной» производственной среды, и определяет отношение к специалистам при выполнении ими ошибочных действий, а также внедрение системы добровольных сообщений персонала о опасных факторах (факторах риска), ошибках и инцидентах. Фундаментом для создания и надежного функционирования СУБП служит формирование современной профессиональной и корпоративной культуры в авиакомпании. Важной ее составляющей становится положительная культура безопасности. Все это в совокупности должно позволить достичь приемлемого уровня безопасности полетов.

Ключевые слова: риски; принятие решений; факторы риска; причинно-следственные связи; система поддержки принятия решений

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