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PREVENTION OF CREW AND PERSONNEL ERRORS RELATED WITH THE FAILURE OBLIGATORY ACTIONS CAUSED BY INAPPROPRIATE PSYCHOLOGICAL STATE

There are the accident investigation results caused by the failure obligatory actions of the crew members, aircraft maintenance staff, air traffic controllers at the airport. The nature of the errors of the human- operator in terms of simultaneous problems solutions with flight control psychological state counts. It is provided the recommendations for the errors prevention related with the failure obligatory action in terms of providing the flight safe completion.

Introduction. The problem of wrong actions of an experienced crew, or highly skilled maintenance staff of the aircraft in the airlines or the airport controller in the system (SHME) " System - Human - machine - environment ", after a world's series latest accidents, is not a new problem.

The recent research analysis . Especially serious consequences entail human operator wrong actions or wrong omissions, which for a defined time **went unnoticed** by the operator (or group of operators working together), whereby the opportunity to correct the error is excluded immediately during the person managed process course. In civil aviation the considered problem is directly related to aviation safety or to the aircraft operation. In the last decade continue to occur which are associated with crew members wrong action, objectively necessary for the flight safety or aircraft operation, brought us to assume the influence on the psychological state of a person, so it is proposed to investigate more closely the phenomenon of human operator skipping actions in different areas in civil aviation flight control [1].

Background. It is known [2] that a person's ***aptitude*** to errors in the management of complex technical systems, including modern avionics equipment, automated systems of civil aircraft, is one of the negative elements of human factor, which underlines the ***necessity*** to multiply the efforts in solving [3] this problem. Other words the common opinion that nature created so limited human possibilities that during the flight control process, crew approached to the the edge of their possibilities, which do not correspond to the results of research.

Analysis of recent research. It is known [4] that the current system allows the training of crew allows to distinguish several relatively independent approaches to the assessment and management of the process of formation of professional skills. For example, the characteristics of keeping accuracy of the flight parameters are the most informative indicators of formation within the skill reflex conceptual scheme. Allocation of the crew physiological parameters training level associated with the development of the functional system concept. In its turn, proponents of the physiologic activity concept consider the formation of the flying skills as the action transition regulation leading to the background level of skill and evaluate maturity of high-amplitude ratio skills (working) and low-amplitude (background) movements. Finally, based on the concept of psycho-physiological thresholds crew

training is regarded as a process of increasing the sensitivity of the person to perceive and discern meaningful signals and level of mastering is assessed by the degree of development of differentiation stimuli mechanisms.

Formulation of the problem. Each of these concepts [5] were a definite step in the development of methodological approaches to the evaluation of flying formation skills and had a positive impact on improving the methods of flight training and development of its principles: visibility, consistency and systematic character, individual approach for taking account of the functional and psychological state of the person . In addition, they allowed to substantiate such requirements for training facilities as the necessity for training as close as possible to the simulated conditions of real activity and simulation of individual signals in accordance with the differential and absolute threshold of human perception. Common for the considered conceptual schemes is the assessment of the acquiring skills process on externally observable characteristics (quality of activity, vegetative reactions, the characteristics of sensitivity thresholds, etc.).

The new approach. To solve the problems presented in the hypothesis [3] is as follows. The learning process contains not only in the externally observable forms, but also the change of its internal content, which is due to the mastered activity representation of the subject. Reliance on external indicators - is, figuratively speaking, view on the education "by the teacher's side." To estimate the same essence education it is necessary to look at it " by the disciple's point of view," his internal mental processes that ensure the assimilation of new material and determine the mechanisms of regulation of mastered actions.

A scientific result. Methodological approaches for the training quality assessing with reliance on external performance led to the fact that until nowadays the principles of flight training methods did not exclude "coaching" and "training" as a student in flight, and in simulated conditions and based on the copying of disciple's actions. The dominance of this approach in the development of technical training led to the creation of expensive complex flight simulators, which the application of a technique based on the exercises which are look like a real flight without regard due to the specific activity in simulated conditions.

The research basic material statement. The inspection of the crew errors and omissions causes allows to conclude that the reference to " ***nonchalance*** " of crew members cannot be accepted as a sufficient explanation for the omissions and errors in flight. Crew members are prone to errors and omissions, when they were forced to stop or too loaded by any of several problems which must be solved simultaneously, and delayed at a later time to perform tasks that must be carried out at this time. Professional experience of crew members does not compensate their tendency to errors given category.

The operation aviation technology control process under the current conditions becoming increasingly complex and laborious. On the one hand, the increasing complexity of the operation of new aviation technique and, consequently, the complexity and the labor intensity of this technique preparedness for the other purposes application.. However, chronic underfunding does not allow to perform the required measures comprehensively, which often caused the malfunctions and failures of the aircraft. In solving this problem, it seems necessary to estimate the

number and content of the tasks of technical operation management systems and the required size of the database at each management level.

Problem solving hypothesis. Put in [4]. Denoted in the experiment that for solving problems at the same time it is necessary:

- determine the necessity for solving the problem of aircraft control, operation, aviation safety;
- to construct a matrix "problem-time," which shows the entire set N of tasks and their approximate solving duration τ_{ij}, where i - the number aircraft control, and - j the number of exploitation control problem;
- to determine the solving of control problems in consideration with the frequency λ_{ij} of the aircraft loading operation in the given process

$$\delta_i = \sum_{j=1}^{N_i} \lambda_{ij} \tau_{ij}, \quad (1)$$

where N_i - number of exploitation control problems, solved by i - nd control lever;

- determine the size of the database required for the solution N_i tasks of each i - nd control in the overall process of flight safety;
- рассмотреть варианты состава технических средств авионики и для каждого to consider the options of avionics technical means hardware for each ℓ - nd variant to determine fulfillment of the conditions

$$\delta_i \le \overline{\delta}_\ell, \quad (2)$$

where δ_ℓ - maximum permissible loading of ℓ - nd variant;

$$k_i \le \overline{k}_\ell, \quad (3)$$

where k_ℓ - maximum allowable for ℓ - nd database volume variant.

Proposed to consider a variety of tasks of avionics technical complexes and operational management of safety processes, including the task of maintenance processes. Many tasks avionics technical operational processes have the form

$$N_{зэп} = F_1 N_{цэ}, \quad (4)$$

where F_1 - operator of point on the set projection;

$N_{цэ}$ - a multiplicity of avionics technical complexes exploitation goals.

A multiplicity of the technological processes maintenance tasks has the form:

$$N_{зтп} = F_2 N_{зэп}, \quad (5)$$

where F_2 - operator of point on the set projection;

Then the set of control avionics technical complexes operation problems is given by

$$N_{зуэ} = F_3 (N_{зтп} \times M_{фу}), \quad (6)$$

where $M_{фу}$ - many control functions in the technical complexes operation;

F_3 - operator which is carried out the tasks mapping process on a set of control functions.

Many avionics operation management tasks includes a subset of situational tasks, distribution operations management and technical complexes task between the links of a hierarchical network of aeronautical engineering

$$N_{зср} \subseteq N_{зуэ}, \quad (7)$$

where $N_{зср}$ - tasks situational distribution subset.

Then the set of the aircraft automated flight control and operation problems can be represented as:

$$N_{зауэ} = F_4 N_{зуэ}, \quad (8)$$

where F_4 - conversion operator control of the operation tasks variety and operation of a multiple tasks in the of aircraft automated control;

$N_{зауэ}$ - variety of the tasks of the aircraft automated flight control and operation.

Ooperators F_1, F_2, F_3, F_4 - linear operators of matrix type, size and content of which is determined by experts. Using the expression (1-8) it is possible to determine a set of computer-aided control of the aircraft and operation of avionics technical systems developed on the basis of methodology and software for solving these problems in civil aviation.

The major part. It is known [4] that the brain of the human operator in control of the aircraft, or flight, or maintenance of avionics has two ways of processing information related to the task:

1) "Controlled" control, which requires the constant presence of conscious attention of the human operator. Such control - slow, multiple effortless and has low productivity and required in problems with novel features, such as manual flight control;

2) "Automatic" control (control of the aircraft using the autopilot) - fast, with minimal effort, has a great performance; develops in the human operator through a long practice in the performance of the usual procedures; requires minimal control of the mind and are less prone to psychological influence.

Conclusions. Crew members also have the potential to create conditions that allow them to reduce the number of allowable errors action skipping through psychological overstrain. Primarily, the realization of the pilot's own ability to commit an error decreases its probability. Crew, maintenance staff and managers are particularly susceptible to errors when they work with avionics in the cockpit, or computers, or conduct radio communication or other activities, trying to detect other aircraft in the airspace surrounding the airport, perform aircraft failures procedures in flight.

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