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The complex assessment psychophysiological state

The human factor is understood as the result of the flight crew of the flight in the occurrence of abnormal situations. Therefore, at the present stage of aviation development, the problem of increasing the level of psycho-physiological training of the aircraft flight crew is an urgent problem, which, in turn, provides the necessary level of flight safety. The paper is dedicated to the complex assessment of the operators' of psycho-physiological state under the extreme working conditions (being represented at a conceptual level). The results of the assessment of the psycho-physiological state of the aircraft flight crew are presented as applied results. The assessment parameters of the psycho-physiological state are determined as a result of the research of the characterization of the information-energy field of the cerebral cortex limbic system.

The professional activity of the flight crew refers to the extreme types of activity associated with work in a three-dimensional space under the lasting influence of extreme flight factors in the conditions of constant readiness for changes in the flight regime. Under such conditions of production activity, the aircraft flight safety essentially depends on the level of the flight crew psychophysiological training. The analysis of the parameters for the flight crew psycho-physiological state assessment is carried out both at the stages of professional selection and at the stages of rehabilitation [1]. The specifics of the psycho-physiological state of the flight personnel assessment is that, in addition to objective factors of influence on the body, it is also necessary to take into account subjective factors, which in most cases prevail. The subjective factors are: age, gender, work experience, and the category of flight personnel temperament. Concerning the definition of categorical temperament of pilots, a special identification technique has been developed and tested. As a result of the developed methodology implementation, the optimal composition of the temperament categories, which includes 36 subsystems formed of four basic systems: choleric, sanguine, phlegmatic and melancholic. In each of the temperament categories subsystems, the same pilots are grouped into the classes, with the human body medical and biological corresponding to the same (optimal) parameters of homeostasis. In this case, special attention is paid to the crew members blood analysis results identification, with the same subsystems defined in the temperament categories [2]. The implementation of these procedures takes place in the process of experimental research planning. Such training of the operator allows us to obtain, at measurements, the correct values of the parameters of the specialists' psycho-physiological state that are grouped into identical classes according to the temperament categories. The kefalo-electroencephalographic complex (KEC) has been used for the non-invasive measurement of the parameters of the information-energy field of the limbic system [3].

With regard to the use of the kefalographic part of the above mentioned complex, it has been established that the parameters of the information-energy field of the limbic system of the cerebral cortex of the human have a direct and reverse

histominoenergetic relation with the otolithic and vestibular apparatus ampulnary systems [3]. The reaction of such a relationship manifests itself in the dynamics of the displacement of the head vertex center. Taking into account the foregoing information, the kefalogy system is capable of non-invasively measuring the parameters of the limbic system information-energy field, which can be applied for the evaluation of flight crew members psychophysiological state [4].

The electroencephalographic part of the complex is configured to measure certain signals of the cerebral cortex biorhythms. Of the nine biorhythms, those that characterize the dynamics of the transformation of the information and energy field of the limbic system are identified. In general, in experimental research studies, the kefalo-electroencephalographic complex was used in parallel to measure all parameters under which the psycho-physiological state of flight personnel has been assessed [5].

Taking into account that the basis of the proposed approach is a preliminary method of grouping specialists according to identical medical-biological characteristics and parameters, an algorithm has been developed, the essence of which is as follows:

- determination of the temperament type according to the Eysenck test, followed by the assessment of the higher nervous activity type (TT);
- definition of a three-chord index of the specialist's body (height to foot length) (T);
- definition of the mental criticality level (N);
- determination of the level of motivation and approval (M);
- grouping the flight crew according to the specified parameters and indicators/

The general methodology for assessing the psycho-physiological state follows the next algorithm:

1. Separation of the studied specialists of the flight composition into groups
2. Comparative analysis of collected cephalographic studies with the received for each group of normalized parameters for indirect measurement of the parameters of the energy field.
3. Comparative analysis of electroencephalographic studies of α-rhythms, determination of the criterion of energy stability and comparison of it with the normalized values.
4. Calculation of the integral criterion for assessing the psycho-physiological state of the flight composition.
5. Determination of the parameters of the prediction of the psycho-physiological state in the performance of professional duties.

The method of decision making concerning estimation of psycho-physiological state of specialists of extreme kinds of activity is offered. The factors influencing the process of assessing the pilots' psycho-physiological state are determined, taking into account the fact that the method of grouping pilots according to the categories of temperament is developed and the method of studying the function of static equilibrium is improved.

As a result of the information and energy field researches of the cerebral cortex limbic system, parameters of the psycho-physiological state assessment are determined. With the help of the proposed cellophage electroencephalographic complex, the parameters of the psycho-physiological state are determined and evaluated. For which the normalized values have been established, which makes it

possible to attribute the investigated specialist to one of the groups, of which the first two characterize the stability of the psycho-physiological state, while the other two characterize a group of specialists unstable to stress factors in the performance of their official duties. Estimation of the psycho-physiological state of pilots according to normalized indicators of kefalographic and electroencephalographic studies, provides an opportunity to determine an integral criterion for assessing the psycho-physiological state with the possibility of predicting the body's stability for stress situations. The proposed method for assessing the psycho-physiological state is universal and can be applied to any operators of extreme activities.

While fiber fracture occurs subsidence signal, i.e. change in the amount of reflected light is 6-18%, so the error of the results obtained in different conditions should not exceed 75% of this value that should not be greater than 4% of the maximum value of the sample.

References

1. Sukhraj Kaur, Jyoteesh Malhotra, "On Statistical Behavioral Investigations of Body Movements of Human Body Area Channel", International Journal of Computer Network and Information Security(IJCNIS), Vol.8, No.10, pp.29-36, 2016. DOI: 10.5815/ijcnis.2016.10.04
2. DhouhaMaatar, Régis Fournier, Amine Naitali, ZiedLachiri, "Human Balance and Stability Behavior Analysis Using Spatial and Temporal Stabilometric Parameters", IJIGSP, vol.5, no.6, pp.33-42, 2013. DOI: 10.5815/ijigsp.2013.06.05
3. Yu.Yu. Onykiienko and V.D. Kuzovik, "Hardware-software complex of estimation of operator psychophysiological state", Newest scientific-educational achievements in transport medicine, pp. 109–111, 2011. (In Russian)
4. J. E. Visser, M. G. Carpenter, H. van der Kooij, and B. R. Bloem, "The clinical utility of posturography," Clinical Neurophysiology, vol. 119, no. 11, pp. 2424–2436, 2008.
5. T. Tossavainen, E. Toppila, I. Pyykkö, P. M. Forsman, M. Juhola, and J. Starck, "Virtual reality in posturography," IEEE Transactions on Information Technology in Biomedicine, vol. 10, no. 2, pp. 282–292, 2006.