

O. V. Kozhokhina,  
Y. V. Grishchenko PhD of Tech. Sci.,  
(National Aviation University, Ukraine)

## **METHODS OF AIR TRAFFIC CONTROLLERS ANTI-STRESS TRAINING**

*Consider work features of air traffic controllers. The main negative factor in their work is stress. Proposed a combined method for determining the stress effect. It's using anti-stress training on the software package "Anti-console" with noninvasive diagnostic blood parameters.*

The problem of stability and reliability of the human operator under the action of extreme factors and the development of psychological stress has attracted attention and gained some shape as an independent area of research due to the development of technology, systems of automated production management, and especially the computerization of all spheres of activity.

Air traffic controllers are people trained to expedite and maintain safe and orderly flow of air traffic in the global air traffic control system. The position of air traffic controller is the one that requires highly specialized knowledge, skills, and abilities. Controllers apply separation rules to keep aircraft at a safe distance from each other in their area of responsibility and move all aircraft safely and efficiently through their assigned sector of airspace.

Because controllers have an incredibly large responsibility while on duty (often in aviation, "on position"), the ATC profession is consistently regarded around the world as one of the most challenging careers, and can be notoriously stressful depending on many variables (equipment, configurations, weather, traffic volume, human factors, etc.).

Duty of air traffic controllers is characterized by high psychologically-emotional and intellectual orientation and belongs to the most stressful and emotionally intense types of professional activities. From the efficiency of the controller and their ability to perform their work in time and accurately depends not only the capacity of air traffic management, but also safety in general [3].

Air traffic in modern conditions is a highly complicated problem that is connected with human and organizational factors. It is directed at minimizing the negative basic processes that may occur. These negative processes include various accidents, such as crash, disasters, precedents and other events. In organizing work of air traffic controllers it is necessary to analyze and identify patterns of activity with new approaches to develop new performance indicators, means of improving the work of air traffic controller in normal and extreme conditions.

Statistics on Aviation accidents show that the percentage of accidents, air traffic controllers are responsible for is large enough and it's necessary to optimize their performance. Unfortunately, nowadays, approaches used in the ergonomics, engineering psychology, aviation psychology, aviation medicine and other areas connected to operational factors make it impossible to qualitatively improve the efficiency of air traffic controllers. This is caused by the fact that these approaches are used without a moment analysis of the actual load of air traffic controllers, their degree of fatigue, and loss of workability. That is why the efficiency of air traffic controller can vary in considerable range at normal and stress conditions.

Stress is a term that is commonly used today but has become increasingly difficult to define. It shares, to some extent, common meanings in both the biological and psychological sciences. Stress typically describes a negative concept that can have an impact on one's mental and physical well-being, but it is unclear what exactly defines stress and whether or not stress is a cause, an effect, or the process connecting the two. With organisms as complex as humans, stress can take on entirely concrete or abstract meanings with highly subjective qualities, satisfying definitions of both cause and effect in ways that can be both tangible and intangible [1].

Stress is a factor that has the greatest negative effect on professional activities of air traffic controllers, because it affects the quality of their work. Stress has an effect on such psychological parameters as the perseveration of attention, logical thinking, spatial imagination, the mobility of

nervous processes, memory and several of physiological processes - heartbeat, blood pressure, etc.

The level of stress and body state of air traffic controllers can be estimated using the following experiments: psychometric test "ВНИМАНИЕ" on the Schulte tables, blood pressure, tremor, and the surface temperature of the hands. It's recommended to conduct psychometric test on air traffic controllers on the anti-consoles of the workplaces using a special software package "Anticonsole" testing change of the blood parameters during the load test, as well as before and after them, in addition to these experiments.

Anti-stress training relates to aviation domain such as flight controls, especially to methods for determining the health and preparedness of pilots and air traffic controllers to perform their duties with integrated avionics failures. Anti-stress training is a way to prevent accidents caused by aircraft of the human factor, due to unpreparedness of pilots and air traffic controllers to complex avionics failures in its operation.

Anti console is the technical device. It's operating principle opposite to the principle of common console. The software package "Anti-console" is based on a failure occurs, the software in avionics in the aircraft operator's air traffic control rather than in the usual sequence of keys to change the remote control.

Anti-stress training of pilots and air traffic controllers in case of failures of aviation equipment during its operation using a set of "Anti-console" helps to reduce the number of pill-prepared operators, admitted to the performance of their duties. It will reduce the number of accidents by getting statistical data and analysis of "handwriting" of the operator under normal conditions, a single failure and complete failure of aircraft [2].

To obtain more complete information about the state controller in anti-stress training and checking measurements of some parameters of blood should be performed. This will not only get reliable information about the state of the operator, but also allow estimating the dynamics of changes of their condition during the stress effects and after them.

Laboratory tests of blood based on invasive techniques are associated with injury of patients, the possibility of infection, as well as long procedure of obtaining a diagnostic result. Therefore, for diagnosing the state of air traffic controllers is preferable to use non-invasive method for determining blood parameters that exceed laboratory methods of, effectiveness and efficiency.

When you select blood parameters to estimate the intensity of the negative effects of stress and tiredness on air traffic controllers some requirements should be considered that significantly increase the information content and quality of assessment:

1. The parameter must vary significantly in the period from the beginning of the negative impact until the recovery period.

2. The parameter should be highly correlated with a measure of negative impact.

These requirements correspond to bilirubin, hemoglobin and glucose, which can not only help to identify the air traffic controller's stress, but also their deviation from the norm, may indicate developing diseases associated with stress.

**Hemoglobin** is the iron-containing oxygen-transport metalloprotein in the red blood cells of all vertebrates as well as the tissues of some invertebrates. Hemoglobin in the blood carries oxygen from the respiratory organs to the rest of the body where it releases the oxygen to burn nutrients to provide energy to power the functions of the organism, and collects the resultant carbon dioxide to bring it back to the respiratory organs to be dispensed from the organism [6].

At increased hemoglobin there are observed fatigue, drowsiness, partial or complete loss of appetite, blurred vision and pale skin. The symptoms of low hemoglobin are: general weakness, dizziness, shortness of breath, palpitations, fainting, drowsiness and headache.

A problem for obtaining accurate data may be the emotional state of the patient, when hemoglobin is measured non-invasively. With excitement initial blood concentration per unit of surface area of skin can increase, the person blushes and this causes an error in the determination of hemoglobin levels noninvasively.

**Bilirubin** is the yellow breakdown product of normal heme catabolism. Bilirubin is excreted in bile and urine, and elevated levels may indicate certain diseases. It is responsible for the yellow

color of bruises, the yellow color of urine, the brown color of faces, and the yellow discoloration in jaundice [6].

Research of recent decades has shown that the low value of bilirubin may indicate coronary heart disease. Elevated levels of bilirubin may indicate a liver disease, intoxication, violation of the right of the digestive enzymes.

Pigmentation of bilirubin appears in the upper layers of the skin. For non-invasive measurement of bilirubin to the patient is required to bleed section of skin tissue by applying pressure of 105 Pa to avoid the error caused by the presence of hemoglobin.

**Glucose** is a simple sugar (monosaccharide) and an important carbohydrate in biology. Cells use it as the primary source of energy and a metabolic intermediate. Glucose is one of the main products of photosynthesis and fuels for cellular respiration. Glucose exists in several different molecular structures, but all of these structures can be divided into two families of mirror-images (stereoisomers) [6].

During stress into the blood stand out hormones (cortisol, epinephrine) that quickly increase blood glucose due to its release from the liver (liver - a place of storage of glucose in a modified state - glycogen). This phenomenon is a protective reaction of the organism. Since glucose - the main source of energy, it provides a high level of the body's ability to respond to a foreign stimulus. Therefore significant hyperglycemia can be observed even at the slightest stress. The glucose level returns to normal, when the stress is over [4].

Stress causes a pronounced decrease in the affinity of hemoglobin for oxygen in the blood, which in turn increases the oxygen tension in hepatocytes and activates free-radical processes in the liver microsomes. It will therefore be a reduction in the hemoglobin level, and at long-term effects stress increase in the level of bilirubin.

Nowadays non-invasive optical-electronic devices measure, mainly one parameter of blood. They use a broadband pulsed light source with a further analysis of the absorption of light at certain wavelengths due to narrow-band interference filters and separate photodetectors.

Therefore, especially for the diagnosis of negative impacts of stress on the body of the air traffic controller a combined non-invasive electro-optical device hemobiliglucometer (HBG-1) was developed. It incorporates new approaches to treatment and correlation of the received information and also ergonomic design was developed [6].

Non-invasive measurement of blood parameters such as bilirubin, hemoglobin and glucose in combination with psycho-physiological tests will allow to fully characterize the state of the air traffic controller and depending on the received load improve the efficiency of their operation.

The goal of this work is at the prevention of accidents associated with the increasing complexity of air traffic controller's activity and also to identify patterns of activity operators and their teams in the navigation service systems and motion control.

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