

Psychophysiological Readiness of Tactical Aviation Pilots as a Subject of Multidisciplinary Research

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ABSTRACT

The work presents the problem of psychophysiological readiness of tactical aviation pilots as a relatively new scientific concept for modern aviation theory. It determines directly functional characteristics and efficiency of flight activity of pilots as a specific component of their fitness for work, influencing their professional and general health and career longevity. The author offers his vision of the composition of psychophysiological readiness. Here, the necessity of its study as a part of a separate multidisciplinary theory, which should unite the resources of special branches of medicine, psychology, educational science and other related disciplines, is substantiated.

Keywords

Aviation, Readiness, Pilot, Human Psychophysiology.

Introduction

Ukraine is a military aviation state with a rich tradition (the first flight schools for military pilots appeared on its territory in the early twentieth century, before the First World War), and the country is trying to actively develop its scientific, resource and educational potential in this area under difficult and unfavorable geopolitical conditions.

One of the priority tasks in this regard is to ensure high professional readiness of military pilot cadets in the higher military educational institution (HMEI). In the previous publications of the author issued as part of the doctoral thesis research for higher doctorate, we substantiated the component composition of professional readiness of future pilots of tactical aviation: theoretical readiness, actual flight readiness, psychological readiness, physical readiness and psychophysiological readiness [1,2]. The latter component is the least researched and difficult to study.

Based on the statistics of aviation events and research on it in recent years, the impact of the human factor on the danger of flights in civil and military aviation remains at a critically high level of 70-90% [3,4]. Under the conditions of progressive complication of military

aviation machinery and equipment, ultrahigh maneuverability and speed of modern combat aviation complexes, improvement of tactics of conducting air operations, tactical aviation pilots face the negative influence of numerous harmful factors connected with extreme intellectual, emotional, nervous and physical stress on the body and a real vital threat to human activity.

Taking such conditions into account, the study of psychophysiological readiness of tactical aviation pilots should begin with the first courses of their training in HMEI, and the research in this area based on a systematic approach should be regarded as a separate multidisciplinary field, which combines methodology and results of aviation medicine and psychology, professional aviation and military educational science. Unfortunately, no such studies are being conducted in Ukraine at present, which puts new relevance to the study of the problem.

The purpose of this article is to substantiate the psychophysiological readiness of tactical aviation pilots as a subject of multidisciplinary research.

Material and Methods

This paper is based on the data taken from open scientific literature and Internet sources (international segment of the World Wide Web) of recent decades, as well as empirical data (results of author's

observations, interviews and unpublished working materials of aviation physicians, psychologists and pilot instructors) collected by the author of this study in the last ten years at the premises of Ivan Kozhedub Kharkiv National Air Force University (Kharkiv, Ukraine).

The methodological core of the study of the problem was a modern mechanism of system-information research, which was used to compare existing scientific approaches, attitudes and points of view on the psychophysiological readiness of military pilots at several levels: structural (components of vision), evaluation (level of significance of vision), model (applicability of vision to specific conditions) and conceptual (perspective of the vision) level.

Furthermore, the author used an empirical comparison of informal indicators of the level of psychophysiological readiness of military pilot cadets of the 5th (graduation) academic year, 2020-2021, and the cadets of two previous academic years (control group (30 people) of military pilots of Ivan Kozhedub Kharkiv National Air Force University).

Results and Discussion

Modern NATO military science defines tactical aviation as the main independent type of air force, including fighter, bomber and assault aircraft which is designed to perform combat operations in the broadest conditions, both independently and jointly with the ground and naval forces [5]. In fact, tactical aviation is recognized as the main force of the Air Force.

Today, tactical aviation of Ukraine is equipped with 4th generation fighters, which are characterized by improved maneuverability, energy-efficient turbofan engines, the presence of computer subsystems (navigation, guidance, recognition, communication, etc.) and other essential characteristics that allow regarding them as combat aircraft complexes (CAC). According to the generally accepted statement, their piloting in combat conditions requires an educational and professional level comparable to the level of competence of the most complex professions in the world. For example, according to the State Sanitary Rules and Regulations of Ukraine "Hygienic classification of work by the indicators of harmfulness and danger of factors of the working environment, severity and intensity of the labor process, 2014", the hygienic estimate of pilot working conditions is class 3.3 by the stress factor, and the work complexity estimate is class 3.1, which corresponds to the most difficult conditions [6]. The above determines the fact that the professional activities of military pilots are considered in modern avionics, aeronautical engineering, theory of aviation psychology and educational science, as well as in aviation and military medicine within the framework of the so-called ergatic systems (complex control systems in the format of "operator (human) – machine (technical complex) – environment"), in which the pilot acts as an "operator of particularly complex systems", whose activities fall under the concept of hazardous occupations [3,7,8].

In the process of CAC operation, against the background of extreme flight conditions (especially in a real combat situation),

the pilot is significantly affected by physical and dynamic factors (vibroacoustic, microclimatic, light environment, etc.), stress factors (neuro-emotional, intellectual, sensory, etc.), which naturally causes appropriate psychophysiological reactions (behavioral, autonomic, endocrine and others) [9,10]. Critical mental load (intense intellectual activity, ultra-fast analysis of a large amount of various information and prompt decision-making related to the coordination of aircraft control movements in fast-changing conditions), load on the nervous system (constant stress, extreme nervous and emotional stress), physical activity (increase in heart rate to 170 beats/min., the action of alternating stresses in the range of 0.2-0.5 c.u. of atmospheric turbulence, muscle load bursts, etc.) [9] are a serious challenge for the pilot's body (primarily for cardiovascular, respiratory, visual, motor systems) and its psychophysiological functions (attention, perception, thinking, memory). All this objectively requires a comprehensive study at both medical and psychological, and at the technical (compatibility of the person with the CAC system) and pedagogical (training and preparation conditions) levels in order to prevent early illness, occupational "burnout", and thus increase career longevity of military pilots of tactical aviation. Thus, we are talking about their psychophysiological readiness as a prerequisite for professional suitability and general human health.

The problem of research on this issue in the science of Eastern Europe begins with the fact that the concept of "psychophysiological readiness" has no institutional status in multidisciplinary aviation theory and is practically not used in its thesaurus. Some aspects of the problem are narrowly studied in the context of such issues as psychophysiological characteristics of military pilots as components of their professionally significant qualities, psychophysiological support of professional activities of military pilots, psychophysiological assessment of the reliability of ergatic systems operators and some others. Let us assume that this state of affairs is primarily due to the fact that the components of the issue in the region are traditionally considered the subject of medical science (its branches – aviation and occupational medicine) and are usually considered only in this aspect. Meanwhile, foreign experience shows that at the international level, this problem has long outgrown the scope of a single science. Thus, all advanced aviation countries of the world have specialized psychophysiological centers for human research in aviation, which concentrate on complex innovative multidisciplinary (medical, psychological and even special pedagogical) research on this issue. We are convinced that in Ukraine, given the real military threat of the last seven years and the significant role of tactical aviation in the state defense and deterrence doctrine, the prerequisites and the need to establish such a scientific institution have become imminent.

When raising the problem of psychophysiological readiness of military pilots, it is important to understand and clearly outline its main components. A thorough analysis of special sources, long-term communication of the author with military medical and military-psychological professionals, as well as observation of the adaptation process of Ivan Kozhedub Kharkiv National Air Force University (the only Ukrainian university that trains

military pilots) graduates to their professional activities allow us to determine a number of key characteristics that can, with some caution, be attributed to the above components:

- Emotional and nervous stability.
- Resistance to fatigue and monotony.
- Ability to control personal functional state.
- Speed and accuracy of sensorimotor reactions of the body.
- Ability to act in conditions of complex system of activities and limited time.
- Ability to quickly mobilize the body's resources.

According to domestic and foreign experience, psychophysiological readiness of young military pilots is achieved through a complex set of measures consisting of special physical training, psychological training, training on the background of high personal motivation, well-established pedagogical conditions of professional training, regular special medical examinations and other elements. Therefore, psychophysiological readiness should naturally be the subject of multidisciplinary research.

Conclusions

Modern conditions of development and the level of special aviation sciences allow allocating psychophysiological readiness of tactical aviation pilots in a separate specific type of their professional readiness. It is characterized by a set of special qualities and properties of the human body to withstand and function effectively in particularly difficult and stressful conditions of combat flight. Since the specific psychophysiological state directly determines the functional characteristics and performance of pilots, it is advisable to combine the study of this type of professional readiness in a comprehensive multidisciplinary line of research.

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