

The influence of occupational environment on formation of psycho-emotional stress among remote pilots of unmanned aircraft systems

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of the article

The aim of this study was to identify informative indicators and establish the level of perception of their impact on the formation of excessive psycho-emotional stress among remote pilots of unmanned aircraft systems (UASs) (class 1 “Light”) during their occupational activities.

Materials and methods. 41 servicemen aged 20–35 years old, who had experience in the management of UASs (class I “Light”) and were involved in the performance of a wide range of functional duties as operators of the moving objects, were studied based on the specially developed questionnaire (100-point scale) that reflected questions about the perception of the stress factor impact during their occupational activities. Statistical analysis of data was performed by descriptive and nonparametric statistics, as well as cluster, stepwise discriminant and factor analysis using the software package STATISTICA 13.3.

Results. Regarding the perceptions of “stress” factor influence, the UASs pilots (operators of moving objects) were divided into two groups: group 1 could be conventionally called “hypersusceptible”, and representatives of group 2 – “hyposusceptible”. At the same time, it was found that the resulting clustering of the data into two groups provided 99.9 % opportunity for further assignment of new operators to the designated groups using the obtained supporting discriminant model (solving rules). The hidden factors have been revealed that formed the functional state of the “hypersusceptible” UASs operators, which collectively explained 54.9 % of the data variance, and “hyposusceptible” ones, which collectively explained 62.1 % of the original data variance.

Conclusions. Two groups of operators, “hypersusceptible” and “hyposusceptible” to the influence of stress factors have been distinguished. The hidden factors that formed the functional state of the “hypersusceptible” UAS operators have been highlighted (the first factor “formation of fear of death” (F1↑) had 33.2 % rate and the second hidden factor “susceptibility to sensory stimuli” (F2↑), covered 21.7 % of the analyzed data variance). Two hidden factors that formed the functional state of the “hyposusceptible” UAS operators have been identified (the first factor “concentration of attention to performance of the functional duties” (F1↓) and the second factor “increased responsibility for occupational activity results” (F2↓). It has been established that there were radically different mechanisms of their functional state regulation, and “hyposusceptible” operators were more adapted to the performance of their functional duties due to the mechanisms of harmonizing their functional state and reducing experiences from the influence of harmful stress-forming factors.

Key words:

remote pilots, psycho-emotional stress, stress-forming factors, functional state, unmanned aircraft system.

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Вплив факторів професійного середовища на формування психоемоційного напруження у зовнішніх пілотів безпілотних авіаційних комплексів

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Мета роботи – встановити інформативні показники та визначити рівень відчуття їхнього впливу на формування надмірного психоемоційного напруження в зовнішніх пілотів безпілотних авіаційних комплексів (БпАК) І класу «Легкі» під час професійної діяльності.

Матеріали та методи. Обстежили 41 військовослужбовця віком 20–35 років (усі – чоловіки), які мали досвід управління БпАК І класу «Легкі» та були залучені до виконання широкого спектра професійних завдань. За спеціально розробленою анкетною, яка включала питання щодо відчуття впливу стресових факторів під час професійної діяльності, оцінювали їхній вплив за 100-бальною шкалою на функціональний стан (враховували основні стрес-чинники, що можуть позначитись на надійності виконання функціональних обов'язків операторів БпАК). Статистичний аналіз даних здійснили, застосувавши методи параметричної (t-критерій Стьюдента) статистики, кластерного та факторного аналізу, використали пакет програм Statistica 13.3.

Результати. Для аналізу результатів щодо вражень операторів БпАК від впливу компонентів фактора стресу застосували кластерний аналіз (метод k-середніх). Операторів БпАК поділили на дві групи: групу 1 можна умовно назвати «гіперсприйнятливими», а представників групи 2 – «гіпосприйнятливими». За всіма параметрами досліджених компонентів стресу групи відрізнялися на дуже високому рівні достовірності. Результати поділу на групи з допомогою кластерного аналізу підтверджені шляхом покріпового дискримінантного аналізу. Виявили, що такий поділ на дві групи дає 100 % змогу здійснювати надалі стратифікацію нових операторів до тієї чи іншої групи за допомогою отриманих розв'язувальних правил. Визначили приховані фактори, що формують функціональний стан «гіперсприйнятливих» операторів БпАК, які разом пояснюють 54,9 % дисперсії даних, і «гіпосприйнятливих», що разом пояснюють 62,1 % дисперсії вихідних даних.

Висновки. Визначили дві групи операторів, що відрізняються з високою вірогідністю: «гіперсприйнятливі» та «гіпосприйнятливі» щодо впливу компонентів фактору стресу. Виявили приховані фактори, що формують функціональний стан «гіперсприйнятливих» операторів БпАК і разом пояснюють 54,9 % дисперсії даних (перший фактор – «формування страху смерті» (F1↑) має вагу 33,2 %, другий фактор – «чутливість до сенсорних подразників» (F2↑) охоплює 21,7 % дисперсії).

Ключові слова:

зовнішні пілоти, безпілотний авіаційний комплекс, професійне середовище, функціональний стан.

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Визначили два приховані фактори, що формують функціональний стан «гіпосприйнятливих» операторів БПАК, які разом пояснюють 62,1 % дисперсії вихідних даних (перший фактор – «концентрація уваги до виконання професійних обов'язків» ($F_{1\downarrow}$), другий фактор – «підвищена відповідальність за результати професійної діяльності» ($F_{2\downarrow}$)). Виявили кардинально різні механізми регуляції їхнього функціонального стану, а «гіпосприйнятливі» оператори більш пристосовані до виконання професійних обов'язків в результаті впливу механізмів гармонізації функціонального стану та зниження переживань від впливу шкідливих стресоутворювальних факторів.

The use of unmanned aircrafts at combat environment makes an extremely important contribution to the military operation success, because the remote participation in such conditions where there is no threat for life loss and health of servicemen become a priority for all civilized armies of the world [1,2]. It is known that all unmanned aircraft systems (UASs) as well as unmanned aerial vehicles (UAVs) differ among themselves by class, purpose, type, location, take-off and landing method, and type of flight control system. In this study, we paid attention to the working conditions of remote pilots (in general meaning – operators) who manage such vehicles, which belong to the first class of UAVs "Light" (maximum take-off weight up to 150 kg) according to the rules for flying UAVs of the state aviation of Ukraine (approved by the order of the Ministry of Defense of Ukraine dated December 8, 2016 No. 66 [3]).

Effective occupational activity of operators is determined not only by the professionalism of the specialists, but also by the conditions in which the task is performed. That is why one of the leading factors in operational environment, which significantly affect the quality of work and the health of an employee, are those that contribute to psycho-emotional stress raising among servicemen [4]. The analysis of literature shows that the study of stress problem engages the attention of many national and foreign scientists [3,5,6]. The development of stress at the workplace in a person of any specialty leads to decreased working capacity, and its long-term and systematic impact contributes to the development of various diseases [7–9]. At the same time, the working conditions of UAS operators remain insufficiently studied, in particular, the literature does not sufficiently describe occupational hazards that can affect their occupational longevity [10].

In a study by W. Chappelle et al., the respondents independently singled out the most important factors of the operational environment that provoked the development of stress in them: understaffing, performance of additional duties and administrative tasks, shift work, long working hours, ergonomic design of the UAV ground control station, the need to maintain vigilance to large volumes of visual and sound data in real time [11]. Studies conducted by Israeli specialists have shown that the experience and age of an operator also had an effect, the level and intensity of stress were significantly higher among operators with more experience in their profession and over 25 years of age. They also have shown that the group of studied UAV operators did not suffer from clinical symptoms of post-traumatic stress disorder (PTSD) [12].

In addition, in their work, UAV operators may have experienced some stressful factors inherent in their profession, namely, remote participation in combat operations and, at the same time, the lack of a clear distinction between combat operations and personal / family life [13], sedentary work with a long stay in front of a screen, which is also a psychological problem in the computer video game com-

munity [14–16]. Hardison C. with their colleagues have shown that UAV operators involved in military operations had poor sleep quality, or they did not feel energetic and constantly felt tired when they woke up. The scientists have also found that 40 % of operators of attacked UAVs felt asleep during the performance of official duties due to chronic sleep deprivation [17].

As in many operator professions, the human factor also plays a leading role, and the price of mistake can be too high and lead to the failure of military operation, significant material losses and people death. This work requires accuracy and intact cognitive and mental abilities from the operator due to excessive psycho-emotional stress in this field, and it was not a desirable phenomenon [18]. Therefore, the extreme insistence of studying this problem is due not only to the need for high-quality performance of official activities, but also to preserve the occupational longevity of specialists, because the potential for UAV development and robotic systems in today's conditions has precise importance.

Aim

This study was conducted with the aim of identifying informative indicators and establishing the perception level of their influence on the formation of excessive psycho-emotional stress among remote pilots of UASs (class 1 "Light") during their occupational activities.

Materials and methods

Forty-one male servicemen, whose age ranged from 20 to 35 years, participated in the study. These specialists had sufficient experience (more than one year) in the management of class 1 "Light" UASs and were involved in the performance of a wide range of functional duties (tasks) and were examined using specially developed questionnaire (carried out on a 100-point scale).

Statistical verification of the contingent was calculated mathematically by determining the minimally sufficient volume of variants to characterize the small general sample (up to 200 people) and ensure its representativeness using the Student's test and power-based estimation [19].

To assess the feeling of the stress factor impact during the professional activity of operators, the questionnaire included certain stress factors specified in the Hygienic Classification of Labor presented in 2014 (order of the Ministry of Health of Ukraine dated 08.04.2014 No. 248 "On approval of State sanitary norms and rules "Hygienic Classification of labor according to indicators of harmfulness and dangerous factors of the production environment, difficulty and tension of the labor process" and supplemented with other questions that were noted by the operators during their previous oral questioning. This approach to building questionnaires was tested by us earlier and showed its effectiveness regarding other military operators [4].

This questionnaire reflected questions about the perception of the stress factor impact (the main stress factors that could affect the reliability of the functional duty task performance by UAS operators during their occupational activities: the appearance of visual signals on a control panel (devices); appearance of sound signals on the control panel (devices); the need to comply with negotiation regulations (communication with a dispatcher, management, etc.); lack of information and time for decision making; tense team relations at the workplace; fear of making a mistake that could lead to one's own death; fear of making a mistake that could lead to death of colleagues or civilians; awareness of the possibility that own actions might result in death of people during the official duty task performance; a sense of financial responsibility when working with expensive equipment; uncertainty in the trouble-free operation of equipment). These questions were formulated by us based on our own experience in the content-analysis of the service activities of remote pilots and the study of available publications on the mentioned issues.

All examinations were performed in accordance with ethical standards of the Responsible Committee and the Helsinki Declaration and approved by the Bioethics Commission of Ukrainian Military Medical Academy. Statistical analysis of the data was performed by descriptive and nonparametric statistics, as well as cluster, stepwise discriminant and factor analysis using the software package STATISTICA 13.3, license AXA9051924220FAACD-N.

Results

The assessment of subjective feelings of a particular person during the performance of tasks with UASs was used as approach to achieve the aim of this study. So, the degree of operator's negative experiences from conventionally called "stress" factor was quantitatively assessed, that reflected some informational and psychological components of excessive psycho-emotional stress formation among UAS operators. The effects of these components on the remote pilot's mental state were likely to be informative for assessing a person's stress resistance, as they reflected on emotional state in a certain way. They also reflected complex decision-making processes in conditions where the formation of these decisions was complicated by certain, sometimes rather rigid organizational reasons, technical events and psychophysiological limitations.

The analysis of the obtained results regarding the perceptions of UAS operators from the "stress" factor components provided a basis for opinion formation about the heterogeneity of these estimates obtained. Some people were very perceptive to the action of these components, others perceived their existence quite calmly. The cluster analysis (k-means method) was applied to the entire data array to confirm this point of formulated opinion. The results of this analysis are shown in *Table 1*.

When studying the data in detail, first of all, we noticed that all parameters of the studied stress components differed from each other at a very high level of significance. Taking into account the content of the studied perceptions and their level, the representatives of group 1 could be conditionally called "hypersusceptible", and the representatives

Table 1. The influence of stressful components of working conditions on the UAS pilots' perceptions

Characteristics of stressful components of working conditions	Groups of sensitivity to the action of the stress factor components			
	Group 1 (hypersusceptible)		Group 2 (hyposusceptible)	
	M ± m, score	CV, %	M ± m, score	CV, %
The appearance of visual signals on the control panel (devices)	36.2 ± 4.0 [#]	53.6	10.6 ± 3.3	129.1
The appearance of sound signals on the control panel (devices)	44.0 ± 3.9 [#]	42.8	11.9 ± 2.9	101.6
The need to comply with the negotiation regulations (communication with a dispatcher, management, etc.)	33.0 ± 4.3 [#]	62.2*	11.0 ± 2.7	100.6
Lack of information and time for decision making	50.7 ± 4.6 [#]	43.9**	13.2 ± 2.4	76.3
Tense team relations at the workplace	48.4 ± 6.7 [#]	66.3***	11.6 ± 2.7	94.6
Fear of making a mistake that could lead to one's own death	58.8 ± 5.7 [#]	46.3	24.7 ± 4.6	76.0
Fear of making a mistake that could lead to death of colleagues or civilians	72.4 ± 4.9 [#]	32.4	34.1 ± 5.1	62.0
Awareness of the possibility that own actions might result in death of people during the official duty task performance	70.4 ± 5.1 [#]	34.9	31.6 ± 4.8	62.0
A sense of financial responsibility when working with expensive equipment	67.5 ± 4.9 [#]	34.8	24.2 ± 5.6	95.3
Uncertainty in the trouble-free operation of equipment	47.7 ± 5.9 [#]	59.0*	16.8 ± 4.1	100.1

#: significant difference of means between groups 1 and 2 according to the Student's t-test corresponds to the P level <0.001; *, **, ***: significant difference of the corresponding data variances between groups 1 and 2 according to the Fisher's F test, corresponds to the P levels <0.05, P < 0.01 and P < 0.001, respectively.

of group 2 – "hyposusceptible" to the influence of stress factor components.

The obtained data from such groups formed by cluster analysis were also confirmed using stepwise discriminant analysis. At the same time, it was found that the resulting clustering of the data into two groups provided a 93.75 % capability (one false positive and one false negative were found after checking the studied sample) for further assignment of remote operators to one or another group with the help of the discriminant model (resulting solving rules), which is presented below.

$$G_{\uparrow} = -14.736 + 0.06 \times FR + 0.132 \times PDM + 0.169 \times SF + 0.149 \times LT,$$

$$G_{\downarrow} = -2.581 + 0.02 \times FR + 0.059 \times PD + 0.049 \times SF + 0.039 \times LT,$$

where: FR – a sense of financial responsibility when working with expensive equipment; PD – awareness of the possibility that own actions might result in death of people during the official duty task performance; SF – the appearance of sound signals on the control panel (devices); LT – lack of information and time for decision making. G_{\uparrow} – a group of "hypersusceptible" persons to the stress factors; G_{\downarrow} – a group of "hyposusceptible" persons to the stress factors.

In addition, the number of indicators that could be used to perform this selection was greatly reduced to the four informative indicators.

To determine a pilot belonging to a particular group we needed to calculate both equations. A higher calculation result indicated his or her belonging to the corresponding group.

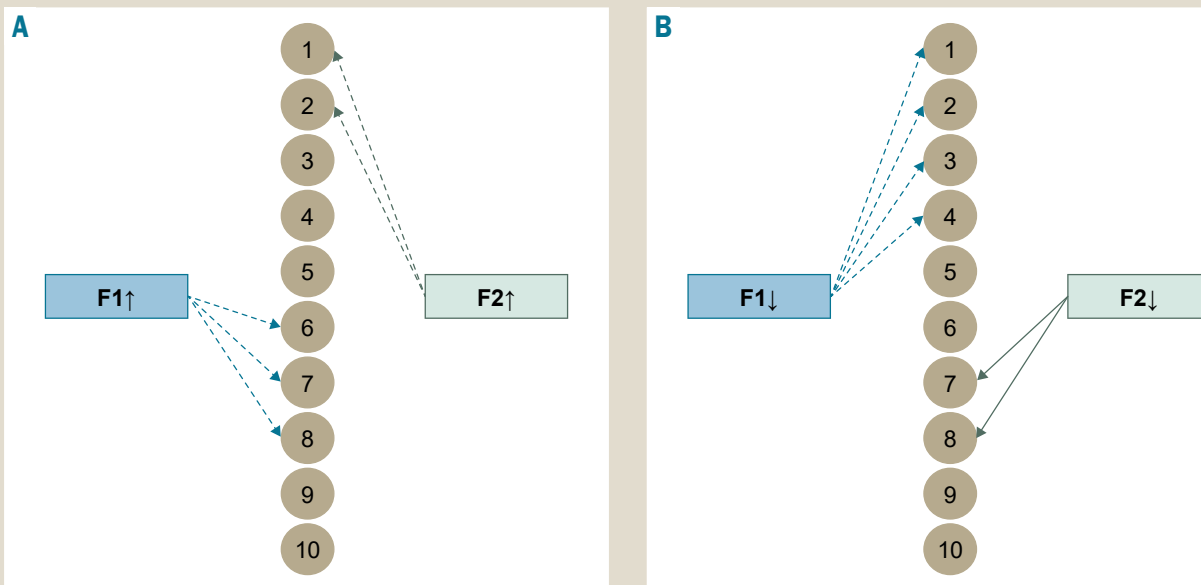


Fig. 1. Hidden factors shaping the functional state of UAS operators. A: "hypersusceptible", B: "hyposusceptible".

Notes: 1: the appearance of visual signals on the control panel (devices); 2: appearance of sound signals on the control panel (devices); 3: the need to comply with the negotiation regulations (communication with a dispatcher, management, etc.); 4: lack of information and time for decision making; 5: tense team relations at the workplace; 6: fear of making a mistake that could lead to one's own death; 7: fear of making a mistake that could lead to death of colleagues or civilians; 8: awareness of the possibility that own actions might result in death of people during the official duty task performance; 9: a sense of financial responsibility when working with expensive equipment; 10: uncertainty in the trouble-free operation of equipment; - - - -: reverse correlation, - - - -: direct correlation; F1↑: factor "formation of the fear of death"; F2↑: factor of "susceptibility to sensory stimuli"; F1↓: factor "concentration of attention to performance of the functional duties"; F2↓: factor of "increased responsibility for occupational activity results".

The certain list of informative indicators determining the assignment of a person to the appropriate group: G↑ or G↓ consisted of perceptions from the influence of moral and material stress factors (awareness of the possibility that own actions might result in death of people during the official duty task performance; the sense of financial responsibility when working with expensive equipment), warning signals (the appearance of sound signals on the control panel (devices)) and phenomena complicating and interfering with the occupational duty performance (lack of information and time for decision making). The general direction of the listed factors was related to the quality of the performed task and the main consequences of its implementation. Therefore, other researched factors could be considered secondary.

Considering the data of "hypersusceptible" operators it should be noted that some of them had quite high influence (Table 1). So, the greatest fear was to make a mistake that could lead to death of colleagues or civilians. This indicated a high level of responsibility of operators during the task performance. About the same level and quality were found with regard to "awareness of the possibility that own actions might result in death of people during the official duty task performance." Sufficient emotional stress caused "a sense of financial responsibility when working with expensive equipment". The smallest emotional changes were caused by events related to "the need to comply with the negotiation regulations (communication with a dispatcher, management, etc.)" and "the appearance of visual signals on the control panel (devices)". These elements of work were the most familiar and routine. Therefore, they had no a significant emotional meaning.

"Hyposusceptible" operators had feelings about the appearance of "fear of making a mistake that could lead to death of colleagues or civilians" and "awareness of the possibility

that own actions might result in death of people during the official duty task performance" which were the most intense. Perceptions of the factors "fear of making a mistake that could lead to one's own death" and "a sense of financial responsibility when working with expensive equipment" were somewhat lower in terms of their level. The presence of more extensive list of factors that strongly influenced the emotional state of "hyposusceptible" operators indicated that they had more adequate assessment of stress factors and possible acquisition of previous experience regarding their action. As for the factors that least caused emotional shifts, as was the case in the group of "hypersusceptible" operators, they were generated by events related to "the need to comply with the negotiation regulations (communication with a dispatcher, management, etc.)" and "the appearance of visual signals on the control panel (devices)". Such familiar elements of work had no a significant emotional meaning.

Thus, the analysis of the perceptions formed under the influence of the stress factor components showed the presence of two groups among remote pilots, which differed greatly in terms of the level of perceptions caused by these components. Selected groups of operators had a tendency to "hyper-" and "hyposusceptibility". However, the list of factors that caused stress in representatives of these groups was close enough. This fact indicated the presence of identical mechanisms of stress formation in both groups.

Perceptions from each of the stress factor components studied were formed not separately from the action of other components. Therefore, in order to clarify this interaction, it was advisable to reveal hidden complex factors that influenced the occurrence of the specified perceptions. Factor analysis was applied to implement such procedure and its results are shown in Fig. 1.

Using the method of principal components of factor analysis, two factors were identified, which together explained 54.9 % of data variance. The first of them (F1↑), which had 33.2 % rate, consisted of the following components: fear of making a mistake that could lead to one's own death, fear of making a mistake that could lead to death of colleagues or civilians, awareness of the possibility that own actions might result in death of people during the official duty task performance. As can be seen, their content was negatively related to the formation of fear of death from certain causes. Therefore, the factor F1↑ could be called the factor in the "formation of the fear of death". Considering the importance of the analyzed hidden factor, it should be noted that representatives of the "hypersensitive" to the components of the stress factor had a constant feeling of fear of death from any of the possible subjective reasons for the appearance of such occurrence in UAV operators. This phenomenon might indicate an increased level of anxiety among these persons.

The second hidden factor (F2↑), which covered 21.7 % of the analyzed data variance, consisted of two negatively related components: the appearance of visual signals on the control panel (devices), the appearance of sound signals on the control panel (devices). Taking into account the content of these components made it possible to emphasize that "hypersusceptible" persons had a sufficiently acute sense of the importance of any signals about the state of UAS. Based on these considerations, F2↑ could be called the factor of "susceptibility to sensory stimuli".

Thus, representatives of the group of "hyposusceptible" remote pilots were marked by increased susceptibility to the components of the factor contributing to the development of stress, associated with anxiety about possible fatal damage to various people from various causes, which might indicate a certain amount of self-doubt in their actions caused by increased anxiety. An additional second hidden factor confirmed this uncertainty of their actions among UAS pilots by the fact that they were highly susceptible to any occupationally conditioned sensory stimuli. Such thoughtfulness additionally strengthened the effect of the process of fear of death formation. The combined action of these hidden factors caused the effect of the appearance of a 3–4 times increased level of perceptions and direct feelings from the influence of components that caused a high psycho-emotional tension. A completely different structure of hidden system-forming factors was characteristic of "hyposusceptible" operators. The application of the method of the main components of factor analysis made it possible to highlight the peculiarities of the sensation formation under the influence of the stress factor components. The result of this analysis is presented in *Fig. 1B*.

As a result of this analysis, two hidden factors were identified too, which together explained 62.1 % of the original data variance. Comparing this rate with "hypersusceptible" operators, it can be noted that the accuracy of the data description among discussed group of persons was higher than "hypersusceptible" operators had. The perceptions in "hyposusceptible" operators were more ordered and determined by the influence of the studied stress components.

A discrete consideration of the selected hidden factor structure provided more information for the analysis of the emergence and development of perceptions under

the influence of discussed stress factors. The most powerful hidden factor F1↓ had a rate of 37.1 % and covered four components that caused the development of stress: the appearance of visual signals on the control panel (devices), the appearance of sound signals on the control panel (devices), the need to comply with the negotiation regulations (communication with a dispatcher, management, etc.), lack of information and time for decision making. The content of all listed components was associated with the thorough performance of occupational tasks. Perception of light and sound messages, communication with management, processing of information and decision-making in difficult conditions – the selection of a complex of such interrelated factors testified to the presence of significant concentration of attention at the workplace, significant responsibility for the final result of occupational activity. Therefore, the hidden factor, which had a negative correlation with its components, can be called the "concentration of attention to performance of the functional duties" factor.

Factor F2↓ covered 25.0 % of the analyzed data and consisted of two positively related components: fear of making a mistake that could lead to death of colleagues or civilians and awareness of the possibility that own actions might result in death of people during the official duty task performance. The content of the listed components was aimed at other people (but not at yourself, as it was in the case of "hypersusceptible" persons). Such state of affairs has led to the opinion that the "hyposusceptible" operators had a sense of increased responsibility for their occupational activity, an effort of high-quality performance of an assigned work. The result of the meaningful analysis of the received information could be interpreted by the received factor's content. Therefore, this factor can be called the factor of "increased responsibility for occupational activity results".

The presence of two complementary hidden factors that contributed to the formation of perceptions towards the action of the stress factor components, the presence in their components of controlling negative and positive unidirectional links with their hidden factors may indicate the presence of a powerful compensatory mechanism aimed at harmonization of occupational activity regulation among "hyposusceptible" operators. A decrease in the level of attention concentration increased the influence of factor F1↓ (the presence of a negative relationship with the components that affected the development of stress) and could be compensated by increasing responsibility for the result of professional activity (a positive relationship between the relevant stress components and the level of the hidden factor F2↓). The described controlling mechanism of balancing the influence of stress components probably contributed not only to the high-quality performance of work tasks, but also helped operators to reduce the level of anxiety regarding the impact of a complex of harmful stress-forming factors on them.

Discussion

A study on stress among UAS operators conducted by W. Chappelle et al. in 2014 has shown that 10.72 % of U.S. Air Force drone operators experienced a high level of distress, and 1.57 % of foreign pilots had high PTSD symptoms [11]. Another study has shown that 15.4 % of

crew operators of strike UAVs who used weapon experience had severe or extremely severe stress, and 27.3 % reported high emotional stress. Among the crew members of reconnaissance UAVs, who did not use weapons, these indicators were 19.4 % and 31.2 %, respectively [20].

Phillips A. et al. performed a similar study and found that the factors of the occupational environment had a more significant influence on the mental well-being of the British Armed Forces UAS operators than the influence of potentially traumatic events related to the performance of official tasks [20]. UAV operators experienced significant stress when they destroyed targets without fully knowing their actual origin [21,22].

In our work, informative indicators as well as the level of perception of their impact on the formation of excessive psycho-emotional stress among remote pilots of UAVs (class 1 "Light") during their professional activities have been determined. Also, our research generally provides an understanding of the stress-forming mechanisms in different groups with varied perception. The comparison between mechanisms of stress formation in persons "hyper-" and "hyposusceptible" to the development of stress indicated the presence of radically different mechanisms of their functional state regulation. "Hypersusceptible" individuals had unidirectional mechanisms of increasing anxiety and sensitivity to changes in the work environment. They did not have mechanisms to balance their functional state when performing professional tasks. "Hyposusceptible" operators were more adapted to the performance of their occupational duties. They had mechanisms for harmonizing their functional state and reducing experiences from the influence of harmful stress-forming factors. The results obtained should be taken into account when developing a complex of effective preventive measures to eliminate the negative impact of stress-forming factors in operational environment.

Conclusions

1. Two groups of operators, "hypersusceptible" and "hyposusceptible" to the influence of stress factors have been distinguished, which differed from each other at a high level of significance.

2. The hidden factors that formed the functional state of the "hypersusceptible" UAS operators and collectively explained 54.9 % of the data variance have been highlighted. The first factor "formation of fear of death" (F1↑) had 33.2 % rate. The second hidden factor "susceptibility to sensory stimuli" (F2↑), covered 21.7 % of the analyzed data variance and consisted of two negatively related components.

3. Two hidden factors that formed the functional state of the "hyposusceptible" UAS operators have been identified, which together explained 62.1 % of the initial data variance. The first factor "concentration of attention to performance of the functional duties" (F1↓) had 37.1 % rate and consisted of such components that caused the development of stress and had the negative correlation with it. The second factor "increased responsibility for occupational activity results" (F2↓) covered 25.0 % of the analyzed data and consisted of two positively related components.

4. It has been established that there were radically different mechanisms of their functional state regulation, and "hyposusceptible" operators were more adapted to the per-

formance of their functional duties due to the mechanisms of harmonizing their functional state and reducing experiences from the influence of harmful stress-forming factors.

Perspectives for further research. This research is a continuation of the study on different conditions in occupational environment of external pilots of UAS [23]. It is planned to study the specifics of the information load impact on the functional state of remote operators based on the study of the relationship structure among perceptions regarding the components of the work tension factor in different groups of military personnel, as well as the identification of hidden factors that influence the emotional state formation among operators with overloaded and underloaded information processing capabilities, etc.

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