Rubric 3. SAFETY ON TRANSPORT

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STATE AND TRAIT ANXIETY WHEN MAKING MANAGEMENT DECISIONS ON THE TRANSPORT

Problems of accidents on maritime fleet for reasons of anxiety has not been studied before. The article presents data on the level of state and trait anxiety of navigators, which are characterized by mental state of high tension, due to the specific situation. Charles D. Spielberger method of testing of ship captains showed that normal (average) level of state anxiety is 62.7 %, and trait anxiety – 52.6 %. Controlling the anxiety may lead to reduction of accidents on transport.

Keywords: safety of navigation, accidents, state anxiety, trait anxiety

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РЕАКТИВНАЯ И ЛИЧНАЯ ТРЕВОГА ПРИ ПРИНЯТИИ УПРАВЛЕНЧЕСКИХ РЕШЕНИЙ НА ТРАНСПОРТЕ

Проблемы аварий на морском флоте по причинам тревожности ранее не изучались. В статье представлены данные об уровне реактивной и личностной тревожности навигаторов, которые характеризуются психическим состоянием высокого напряжения, обусловленным конкретной ситуацией. Метод тестирования Чарльза Д. Спилбергера среди капитанов показал, что нормальный (средний) уровень реактивной тревоги составляет 62,7 %, а личной тревоги – 52,6 %. Контроль тревожности может привести к снижению аварийности на транспорте.

Ключевые слова: безопасность судоходства, аварии, реактивная тревога, черта тревоги

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INTRODUCTION

Problems of reducing transport accidents, continues to be relevant. Efforts aimed at the reduction of accidents are of a multidimensional nature.

Experts rightly extend the problem associated with solutions of reducing accidents in the design and commissioning of automated control systems. The current level of state of automation in transportation is at a high level. But any automation requires control by the person in the event of extraordinary situations.

At present, there is urgent need to know the strengths and weaknesses of human in general and, as a consequence, projecting specific person's, who makes the decisions, physiological parameters to them, which is especially important for an operator who is in standby mode. Such uncertainty leads to accidents.

First, one will need to conduct research on problems connected with human factor that lead to adoption of inadequate solutions.

Of course, human factor issues need be addressed comprehensively. Only analysis of synthetic data can provide objective results. But for beginning, it is necessary to isolate the problem and thoroughly exploring it.

The human factor is a function of many variables, with anxiety being one of them.

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Accidents caused by human factor are the result of ill-considered risks that arise as a consequence of the lack of psychophysiological professional selection, inappropriate medical examinations and maintenance, poor vocational training, working conditions and leisure.

Ivan Pavlov focused on the fact that only the balance between organism and the external environment can ensure the optimal functioning of a person, and most importantly is typical for the state of full health [1].

For the working on maritime fleet, process of re-adaptation is, in fact, a permanent condition. This is caused by the need to constantly adapt to dynamic conditions of a ship that impact on psychophysiological state of a person. This together with change of climate zones, and jet lag, as well as change of crew members during voyage, especially officers, socio-psychological conditions of life on a ship, ever-lasting stress, which is a cause of excessive working hours on the vessel under conditions of high informational overload related to management decisions, etc. [2].

As a result of a complex of unfavorable factors, permanent re-adaptation process leads to imbalance of "balance between the organism and the external environment".

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Shipping community, understanding and recognizing the role impact of the human factor on the level of accidents, however, do not pay due attention to the issue of psycho-physiological selection of cadets and further monitoring in the process of work at maritime fleet [3].

Meanwhile, many years of experience in psycho-physiological selection in industry and US Army allows us to state reduction of accidents caused fault by personnel by 40–70 %, reduction of expulsions from educational institutions from 30–40 % to 5–8 %, and decrease of expenses for preparation of specialists of 30-40 % as well. At the same time, the increase of the reliability of control systems was 10–25 % [4].

The issue of reducing accidents rate in maritime fleet and transport in general, continues to be relevant. Measures aimed at reducing accidents rate should have a multi-vector nature.

Some experts see a cardinal solution in the design and commissioning of automatic vessels, which are not staffed by crews at all. "German scientists are implementing a project that will allow manning ships in the oceans from an office, which is somewhere in Germany, America or China. Fraunhofer Centre of Maritime logistics is designing Maritime Unmanned Navigation. The aim of the project is create systems to run large-capacity vessels autonomously, without crews" [5].

Of course, the prospect is tempting, especially since the achieved level of the current state of navigation automation is at a high level. But the question arises - how it will look at the first stage of the implementation of total automation? It is natural to believe that all vessels cannot be simultaneously replaced with automated vessels. Moreover, appearance of automated vessels is a far-off prospect, and, with regards to automated fishing fleet and navy ships – it is even from the realm of fantasy. Today, the person-person combination may not solve the problem of uncertainty and the same is for the "man-machine" tandem in a situation of uncertainty and it will be more difficult to coordinate their actions.

In this regard, to have automated vessels will require a change in the COLREGs. After all, the ships with the crew on board will not just have to disperse from automated ships, and, literally, jump from to a side. All this will add nervousness in situation of uncertainty.

If one has to analyze today's documentation on navigation safety, it will take a lot of time and effort. As result, a new document will be born, even more difficult to understand. For example, the STCW Convention has appeared and has been amended several times ever since.

In modern conditions of increasing navigation intensity, sizes of ships and the nature of goods transported, the necessity to know the strengths and weaknesses of a person have increased appreciably. Today it is important to design actions for management decision-making not by a person in general, but

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by a certain person who makes management decisions, taking into account their psychophysiological characteristics at the moment. This is particularly relevant in situations of uncertainty. After all, in the end, it is uncertainty that leads to accidents [3].

Of course, human factor needs to be addressed comprehensively. It is obvious that only analysis of available synthesized data is capable of giving a result, but for this purpose it is necessary to isolate specific problems and to study them thoroughly.

The psychological aspects of human factor influence on accidents in maritime fleet have not been studied, but the results of the analysis of aviation accidents related to human factor for the period between 1990–1994 showed that in 31 % of cases, aviation accidents are directly related to the lack of psycho-emotional stability in crews [6].

Human factor is a function of a set of variables, with anxiety being one of them [8].

There are simultaneously two psycho-emotional states which are caused by trait and state anxiety.

Trait anxiety represents a stable tendency whereby a person perceives the world warily, with added value, anxiously, suspiciously. Both low and high levels of trait anxiety contribute to inadequate responses to situations. Very high trait anxiety positively correlates with the presence of neurotic conflict with emotional and neurotic breakdowns and with psychosomatic diseases.

State anxiety characterizes the mental state of increased tension caused by a specific situation in which the subject is involved. For example, in situation relating to passing a difficult exam. A high level of state anxiety contributes to the deterioration of the parameters of memory, attention, intelligence.

State anxiety is formed on the basis of trait anxiety. State anxiety, complementing trait anxiety, forms the basis on which a person makes a decision.

However, it would be wrong to perceive anxiety as a negative quality. Certainly, an average level of anxiety is natural and binding feature of active personality.

The tests conducted to determine psycho-physiological parameters in 199 applicants at the Professional Psychological Training Laboratory at the Maritime College of St. Petersburg in 2006, showed that trait anxiety was higher than normal in 31 % of the applicants, and state anxiety was above normal level in 40 %.

In 2016-2017 testing was conducted among navigators, attendees of qualification upgrade courses at Admiral Makarov State University of Maritime and Inland Shipping. For testing scale anxiety (State-Trait Anxiety Inventory Charles D. Spielberger) was used. [7].

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Anxiety level is divided into low, medium, high and very high. 77 cadets, aged 18–22, of 3–4 courses of the Navigation Faculty took part in testing (Fig. 1).

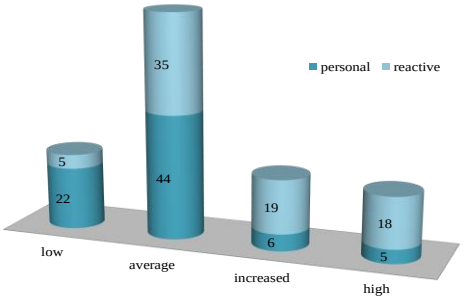

Fig. 1. Levels of State and Trait Anxiety in Students of 3-4 Courses

From the analysis of the chart it may be seen, that the average level (normal) of trait anxiety was inherent in 57.1 %, and the trait level of anxiety was 45.5 %.

Increased and high level of trait anxiety are inherent in 14.3 % of participants, and increased and high level of state anxiety – in 48.0 % of participants.

Low level of trait anxiety was inherent in 28.6 %, and low level of state anxiety – in 6.5 % of cadets who participated in testing.

The diagram of the results of the testing of navigators is placed below. The age of the participants was from 23 to 67 years. They were ship captains, chief mates of the captain, 2nd mate of the captain and watch officers. The number of participants in the testing in this category was 187 people (Fig. 2).

From the analysis of the diagram it is seen that the average level (normal) of trait anxiety was inherent in 63.6 %, and state level of anxiety – in 58.3 %.

Increased and high levels of trait anxiety were inherent in 36.4 % of participants, and increased and high levels of state anxiety – in 9.1 %.

Increased and high levels of trait anxiety and, especially, state anxiety can lead to a state of panic or even fear.

Low level of trait anxiety was inherent in 27.3 %, and low level of state anxiety – in 5.3 % of skippers participating in testing.

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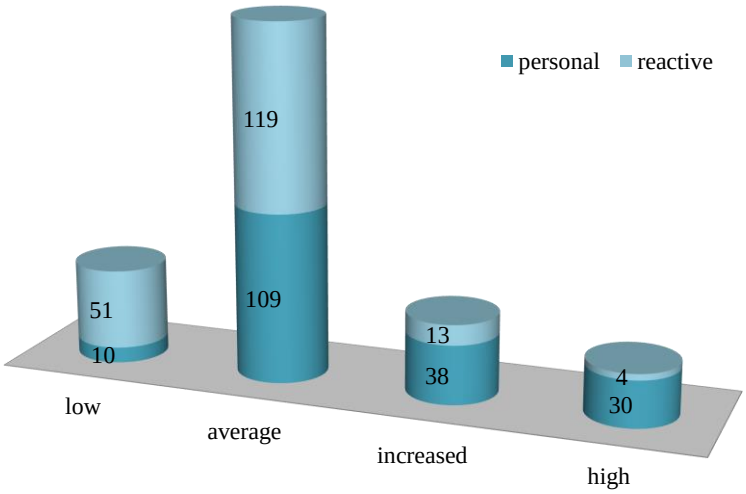

Fig. 2. Levels of State and Trait Anxiety in Navigators

According to the Yerkes-Dodson law, the most effective behavior is characteristic of the optimal (average) level of anxiety.

Increased and high levels of trait, and, especially, state anxiety can lead to a state of panic or even fear.

Thus, such an important indicator as anxiety is out of control, and, therefore, we cannot talk about a high level of safety of navigation.

According to the insurance company P&I Club UK through the fault of watch officers 25 % of accidents occurs, accidents caused by pilots – 7 %, and those caused by watch mechanics – 2 %.

Such a significant difference is due to high dynamics of changes in situations that the shift assistant must handle the number of feedbacks on the bridge is very different from the number of feedbacks in the engine room.

In connection with the above, the document on the definition of risk by International Maritime Organization and its formula R=FS (Risk – a combination of frequency and severity of the consequences of the accident) are clearly ineffective [8].

Nobel prize winner Hermann Hesse wrote: “If we had a branch of science courageous and conscientious enough to occupy itself with human beings rather than simply mechanics of life’s phenomena…these matters of fact would be common knowledge”. Understanding the importance of the consequences of accidents in the fleet for the environment without engaging man is criminal.

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CONCLUSION

To seek out workarounds in matters of maritime safety, such as the introduction of new amendments and new documents, without considering psychophysiological parameters, is inappropriate. We should recognize the obvious facts, among which there is, for instance, the reduction of ships' crews which is not justified, especially the reduction of watch posts, ensuring the safety of navigation directly. The composition of the navigation watch and the duties of the skippers should be reviewed to minimize risks. Then one does not have to “invent” formulas in which such persons would be a part of the process.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК / References

1. Павловские среды. – Т. 2. – М., 1952. [Pavlovskie sredy. Vol. 2. Moscow; 1952. (In Russ.)].
2. Guidelines on Fatigue. – International Maritime Organization. London – 2002. – 114 p.
3. Григорьев Н. Человеческий фактор – матрица аварийности // Морской флот. – 2016. – № 2 (1524). – С. 22–25. [Grigorev N. Human factor – matrix of accidents. *Maritime Fleet*. 2016;2(1524):22-25. (In Russ.)].
4. Универсальный психодиагностический комплекс // Новый оборонный заказ. Стратегии. – 2011. – № 2(14), – С. 83. [Universal'nyj psihodiagnosticheskij kompleks. *Novyj oboronnyj zakaz. Strategii*. 2011;2(14):83. (In Russ.)].
5. Перспектива будущего – суда без экипажей. Доступно по: http://jura.diena.lt/ru/novosti/raznoje/-505440. Ссылка активна на: 19.10.2019. [Perspektiva budushchego – suda bez ekipazhej. [Internet]. [cited 2019 Nov 19]. Available from: http://jura.diena.lt/ru/novosti/raznoje/-505440. (In Russ.)].
6. Клюев А.В., Качалкин А.Н., Диденко Э.Б., и др. Психологические аспекты проблемы человеческого фактора в авиационной аварийности. Анализ и стратегия профилактики. – М.: Текст, 1996. – 85 с. Доступно по: https://ru.b-ok.cc/book/3193774/28609c. Ссылка активна на: 19.10.2019. [Klyuev AV, Kachalkin AN, Didenko EhB. *Psihologicheskie aspekty problemy chelovecheskogo faktora v aviacionnoj avarijnosti. Analiz i strategiya profilaktiki*. Moscow: Tekst; 1996. 85 p. [Internet]. [cited 2019 Nov 19]. Available from: https://ru.b-ok.cc/book/3193774/28609c. (In Russ.)].
7. Двинин А.П., Романченко И.А. Психодиагностика: образование и кадровый менеджмент. Учебно-диагностическое пособие. – СПб.: Люмьер, 2015. – 148 с. [Dvinin AP, Romanchenko IA. *Psihodiagnostika: obrazovanie i kadrovyj menedzhment. Uchebno-diagnosticheskoe posobie*. St. Petersburg: Lumiere; 2015. 148 p. (In Russ.)].
8. MSC-MEPC.2/Circ.12 Revised Guidelines for Formal Safety Assessment (FSA) for Use in the IMO Rule-Making Process. [Internet]. [cited 2018 July 1]. Available from: https://edocs.imo.org/FinalDocuments/English/MSC-MEPC.2-Circ.12-Rev.1(E).docx.

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