Improving the staff training methodology

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Abstract. As of September 2019, after the implementation of the IMO system of voluntary verification of member states, only 41 percent of member states have passed the verification. Based on these audits, the IMO made the following conclusions. The root reasons why organizations failed to pass the test were the following: insufficient procedure, insufficient resources, insufficient coordination of participants, lack of national regulations, absence of training programs. The organization shall determine the required level of competence of personnel responsible for maintaining the quality of services and products. If the level does not match, the organization must increase it. It is also the responsibility of the organization to evaluate the effectiveness of the measures taken, to ensure that personnel are aware of the significance and relevance of their activities, to keep records of education, training and experience of personnel. The purpose of the study is to determine the most promising and effective method for improving the training of transport industry workers. To achieve this goal, the following tasks were set: analysis of the methodology for improving the training of personnel in the transport industry, development of recommendations for improving the training of the ship's crew and employees of coastal services. The object of the study is social relations in training workers of the transport industry. The theoretical and methodological basis of the study is research on improving the training of personnel of the transport industry.

1 Introduction

Based on the Lloyd's Register, Fig. 1 presents an analysis of the causes of accidents of sea vessels of the world fleet (data of 2020). As can be seen, technical causes and violation of the integrity of the hull account for 23% of accidents, other accidents are related to the errors of the crew and coastal services.

Marine accidents can be divided into four groups:

1. Accidents related to damage to the ship's hull (collisions, groundings, bulks, storm damage). This type of accident accounts for 53% of all accidents. On average, once every 10 years, every ship suffers hull damage. The crew fights against the ingress of water into the vessel. In most cases, this struggle is successful, but in about two cases out of 100, the ship dies.
2. Fires and explosions account for approximately 6% of all accidents. The ship's crew is fighting against fire and smoke. In 15% of fires, they cannot be extinguished or localized, and the crew is forced to abandon the ship. For each fire-caused ship loss, there are approximately three times fewer victims than in case of hull damage.
3. Capsizing ships - "loss of stability" – accounts for 1% of all accidents. This is the most dangerous type of accident, in which there are two times more victims than with hull damage, and six times more than with fires.
4. Damage to mechanisms account for 27% of all accidents. With this type of accident, the crew fights for the survivability of technical equipment, and in some cases fights against steam. Proper elimination activities can help avoid human casualties.

The figure shows that the causes of all accidents are not the forces of nature or other irresistible force, but the lack of understanding of the qualities of the vessel, failure to comply with the simplest precautions, negligence, and short-sightedness of the employee. Unconditional compliance with the rules of transportation and safety standards, staffing with qualified seafarers, good maintenance - all these measures can reduce the risks of accidents, but do not eliminate them.

2 Materials and Methods

The main cause of sea accidents is the "human factor", which is insufficiently studied. First of all, this concerns adequate decisions made by operators in complex and uncontrollable cases of vehicle operation. Research allows for the development of methodologies and guidelines for assessing the competence of operators in order to reduce the number of accidents.

The decision-making procedure involves bringing the control object, forces, means and human resources (operators) in line with the selected anti-event scenario, which is modeled in certification courses for the transport industry. When making a decision, it is necessary to establish how much the choice of an anti-event at the previous stage corresponds to the current situation in which the object is located, since the coincidence of all conditions for ensuring full readiness to counteract in an emergency is rare.

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The importance lies in ensuring the readiness of the object and the sufficiency of resources for the implementation of the physical, logical and heuristic components of the anti-event scenario, as well as the operator-observer for its implementation. To evaluate and control the decision-making procedure, it is proposed to use Maktsev's consistency criterion which assesses the sufficiency and timeliness of all factors in the decision-making process for all selected elements of the anti-event scenario correlated to different situations. The presence of coincidences of all components implies the conditions under which the transition to the next stage is possible - the process of (successful) implementation. When assessing the consistency of an object and the chosen behavior strategy, three criteria are used: local, generalized local, and global.

Local criteria include components of situations such as regular, extreme, abnormal, emergency. Each of the components of situations interacts with decision-making stages such as physical, logical and heuristic ones. Possible emergencies can also be influenced by local criteria such as poor-quality medical care [1] When predicting an event in the negative scenario, an ideal value is created; when solving the situation, the result is compared with the ideal one.

The decision-making procedure allows you to mobilize forces, means and reserves to implement the anti-event scenario from AMS to AL, to assess the degree of readiness for its implementation, and in case of not being ready to reduce the pace of the transition, and reduce the number of scenes and acts by moving from an emergency to an ES or NS. Making a decision at an early stage provides the operator-observer with time to implement the anti-event scenario at a lower cost of resources and reserves.

Errors can occur at any stage, i.e. external conditions can change, which means that the function of the physical, logical and heuristic components is not implemented and, it is necessary to make a decision that compensates for these deviations. By controlling this process, the operator-observer organizes the passage of the anti-event scenario and forms a deviation check. Due to the fact that the elements of the physical, logical and heuristic components can prevent or, on the contrary, contribute to the implementation of the anti-event scenario, we will use the simulation method to control the implementation.

To control the anti-event scenario, there is a need for specialists capable of managing events. The degree of their readiness should correspond to the level of event management aimed at creating a synergy of the competencies of operators in the decisions made on the use of energy, material and human resources. In this regard, inadequate actions of operators in the event management process indicate a misunderstanding of the danger of an emergency due to the lack of competence. To do this, the operator should be trained to manage events. The training methodology includes the training of operators able to observe, assess emergencies; select an anti-event scenario; decide; implement an anti-event scenario.

The methodology for training workers in the transport industry is represented includes the following stages:

1. Presentation - preparation and determination of the initial conditions and the level of competence of operator-observers.
2. Training observers.
3. Implementation of new skills in event management.
4. Assessment of the quality of new knowledge, skills and abilities in managing events in emergency situations.

As part of the study, the author analyzes activities for the training of workers in the transport industry. Techniques have been developed to improve the work on training and certification of employees of the transport industry, in particular, to improve the training of the operator-mentor and operator-observer. To increase the
effectiveness of training, a new quality is introduced into training according to methodology that takes into account the value of individual relative indicators. A complex (generalized) indicator characterizes the level of quality of the management system; quantitative assessment of services can take on various numerical values:

\[ K_{ts} > 1 \] – the actual quality of the service is higher than the level of quality accepted as the basic one, and this will be a fundamentally new type of service. In this case, the producer can increase profits by setting higher prices;

\[ K_{ts} = 1 \] – TPU of a high quality level, corresponding to the level of service of the manufacturer of similar services, taken as the basic one;

\[ K_{ts} < 1 \] – TPU with a reduced quality level, which has worse consumer properties compared to a service with levels taken as the base comparison option.

Thus, the approach makes it possible to quantify the level of quality of certification services, which will allow for the improvement of:

- the quality and efficiency of the services provided for certification of employees of the transport industry;
- methods of course implementation [3];
- technical means.

To control situations, there is a need for specialists capable of managing events. The degree of their readiness should correspond to the level of event management aimed at creating a synergy of the competencies of managers in the decisions made on the use of energy, material and human resources. In this regard, inadequate actions of managers indicate a misunderstanding of the danger of an emergency situation due to low competence [4]. Training and assessment of the appropriate degree of readiness of the staff to manage events should be carried out. The method of pre-trip training includes training of operators capable of to perform the following tasks: observation; assessment of emergencies; formation and selection of an anti-event scenario; decision-making; implementation of an anti-event scenario. When evaluating, a reference value of time and error-free execution of actions aimed at implementing the event management process is set in the form of an integral indicator of an ideal anti-event scenario containing a 100% result, and any errors and delays in implementing anti-event scenarios lead to the accrual of penalty points, summarized in real integral indicator (I) presented in Fig. 2.

The criterion of competence of operators is determined by the minimum deviation of the integral indicator of the scenario from the standard. To ensure the synchronism of the components of the anti-event scenario, the time performance indicator is determined by the error value, and the criterion for assessing the competence of observer operators is based on knowledge, skills and abilities by the method of expert evaluation. [5] The purpose of the training methodology is to develop an understanding of the degree of danger of the adverse events and to master the methods to prevent them.

3 Results and Discussion

The assessment of the quality of the service for certification of employees of the transport industry is a set of operations that include a choice of indicators of quality properties, determining their relative numerical weight values and quantitative values of a complex indicator in order to make a decision in the service quality management.[2] Therefore, the general algorithm for quantifying the provision of certification services can be represented as the following sequence of actions:

- determination of absolute values of single and basic indicators of service quality;
- determination of weight coefficients of single indicators;
- determination of quantitative values of a complex indicator of service quality.

The task of forming a comprehensive indicator of the quality of the certification service is determined by the method of convolving single indicators, which is understood as a set of logical and mathematical operations using individual indicators or their combination.

To generalize single indicators into a single complex indicator, it is necessary to determine the functional dependence that would correspond to the objective correlation of single indicators. However, the task of quantifying certification services is difficult, it is not possible to determine the exact functional dependence at this stage.

The calculation formulas are chosen according to a methodology that takes into account the value of individual relative indicators. A complex (generalized) indicator characterizes the level of quality of the management system; quantitative assessment of services can take on various numerical values:

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4 Conclusion

Despite the use of automated means in the maritime transportation, the human plays a significant role both in the preparation of automated software and in the training of personnel [6]. Most sea accidents occur due to errors made staff. Consequently, insufficient attention has been paid at one of the stages of training of seafarers and employees of coastal services. Analyzing sea accidents, their causes and consequences, it should be said that there is a need to improve the quality of the management system in terms of certification and training of seafarers and employees of coastal services who are undergoing training or retraining [7].

The effectiveness of prevention of sea emergencies, the speed and effectiveness of eliminating consequences of sea accidents depend on the professionalism of transport industry workers. [8]

In order to avoid sea emergencies, it is necessary to carry out high-quality training of personnel at all stages. It is also worth paying attention to the competence of personnel training workers in the transport industry, for example, operators, mentors whose level of training determines the effectiveness of training of maritime and river transport personnel.

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