SIMULATORS BASED TRAININGS - A KEY TO MINIMIZE MARITIME ACCIDENTS AND PERSPECTIVES

Prof. Bhoopathy Bhaskaran[1] and Dr. D. Rajasekar[2]

[1]Faculty, Department of Marine Engineering,
AMET deemed to be University,
135, East Coast Road, Kanathur, Chennai-603112, India

[2]Associate Professor, AMET Business School
AMET deemed to be University
135, East Coast Road, Kanathur, Chennai-60112, India

Abstract : Ocean is much enourmous. It gives us many wealth and prospects. Shipping is one of the most promosing industries from ancient times. However, shipping through marine vessels is having high risks due to unofreseen accidents. A small mistake by a crew member may lead to big maritime accident and cause huge economic loss. Systematic maritime trade has come into commercial front since the early 19th century. During the early 19th century many sefety equipments and control equipments were developed for safe and efficient shipping throuh marine vessels. Meterological forecasting and meterological techniques have largely contributed to avoid any mishappening in the sea. However, the maritime accidents happening now and then are causing a searious concern over the growth of shipping industry. Maritime accidents could cause heavy economic loss. Hence, several stratgies for the prevention and or minimization of maritime accidents are considered by shipping professionals and policy makers. Simulation based training before entering into shipping career is having many perspectives. Simulation based training regimes helps to understand stress, perceive situational awareness and familiarity with errors that could happen realtime. The simulators provide the trainer a first hand experience in tackling difficult situations. The simulators help them to experience the mistakes. In this context, this article is aiming to emphasize that the human component error is playing a significant role in maritime accidents. Further, the aricle also provide an overview about the prospects of imparting maritime training with simulators which could be a potential choice to reduce human errors.

IndexTerms - **Human factors, human error, maritime accidents, shipping, simulator training**

I. INTRODUCTION

According to the World Maritime Organization, 90% of the world trade is possible through maritime transport only. It is considered as Worlds most efficient economy as it contributes enoumoursly (IMO, 2018). Since almost 90% of the trade is faciliated through shipping, the traffic in the World Oceans is going high every year. The increased marine traffic is mainly due to the globalization drived increase in the maritime transport. Present day ships are most sophisticated with enormous safety systems; yet, it is inevitable to avoid maritime accidents (Uğurlu et al., 2016). For the past four decades, efforts are seriously undertaken to enhance the strcutural and fucntional aspects of the ships to ensure firm quality with the ultimate goal to reduce or prevent maritime accidents.

Various factors such as hull design, stability systems, propulsion systems and navigational equipment have been under constant improvement to achieve accident free maritime transport. Many innovative imporvments in the ship systems have made them to be exceedingly solid. Beyond these innovative improvements, maritime accident rate is high and shipping world could not totally eliminate the danger of accidents. The published literature, gained experience at sea and analysis has clearly indicated that ship structure and framework dependability are relatiively having less role when compared to human erros with reference to maritime accidents. Ships are run by people through propelled by machines. Whereever human is engaed it is inevitable to have errors and if that error happens in shipping sector, the effects are disasterous. Estimates suggest that around 75-96% of marine accidents are

caused either directly or indirectly by human mistake. Human errors at varying percentages have been reported to be responsible for maritime accidents (Frith, 2017; Chan et al., 2016).

Figure 1, provides a diagrammatic representation of the percent level of human errors associated with maritime accidents.

Figure 1. Contribution of human errors on different types of martime accidents
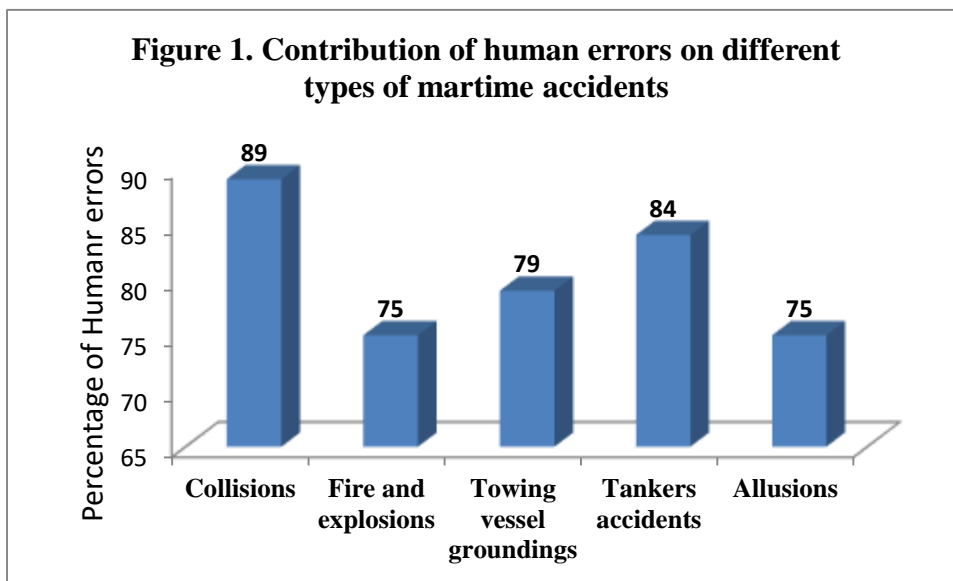
From the previous studies, it is found evident that more prominent steps are to be taken toward reducing marine accidents. This can be achieved by focusing on the various types of human errors that cause maritime accidents and relationship of human with the new innovation in modern day ships (Chan et al., 2016).

Studies have found that there is an apparent gap in the entry level maritime officers with reference to their experiential learning which is called as apprenticeship traditionally. This loss of apprenticeship or experiential learning is becoming the major issue in maritime training at world level (Chiotoroiu et al., 2006). Similar to many other specialized professional systems, the work forms on board have been a protest of broad computerization. The prime roles of human in modern day computerized ships are planning, controlling and supervision. Nonetheless, in basic and special situations, maritime professional need to progress efficiently. Such special situations need adaptable critical thinking, act of spontaneity and instinct. AS modern days ships are functioning with less number of crewmembers on board, the inexperience or loss of apprenticeship by the junior officers seems to emerge as a critical issue. These kinds of skill gap issues are more evidently seen or experienced in tanker shipping. This is mainly due to the requests on junior officers which are higher in this branch of shipping industry as compared for instance with the field of container shipping.

II. HUMAN FACTORS AND MARITIME ACCIDENTS

In a recent review, Chan et al. (2016) have emphasized that the International Maritime Organization (IMO, the World Apex Body for Maritime Education and Training, has put into operation the International Safety Management (ISM) Code during 1998. Despite that, human errors still exist and it is hard to be eliminated. Human factors that could influence maritime safety can be comfortably categoriezed as follows.

Sl.No.	Type of Factor	Examples
1	Authoritative factors	1. Administration sense of duty regarding safety 2. Safety training 3. Open correspondence 4. Natural control and administration 5. Stable workforce 6. Positive safety advancement approach
2	Gathering factors	1. Line administration style 2. Great supervision and clear comprehension of claim and other group members" parts and obligations.
3	Individual/Singular factors	1. Human-machine interface 2. Skill 3. Stress 4. Inspiration 5. Workload of an individual

Many research studies have been done at various periods to find the role of human factors in maritime accidents. Frith (2017) has emphasized that more than 75% of maritime accidents are due to human errors.Chan et al. (2016) have made a theoretical but a critical analysis on human factors with special reference to maritime accidents. Their study from the background of Malaysiyan Shipping industry has concluded that human factors are the major cause for maritime accidents. They further emphasized that the research on the influence of human factors towards maritime accidents need tobe comprehensively undertaken as maritime accidents leads to lot of human casualities, loss of capital and also cause marine pollution.

Nielsen and Jungnickel, (2003) have reported that marine inquiries can be considered as a useful tool for the analysis of the cause of maritime accidents. While analysing the influence of competence of a maritime professional and organisational culture as the comparative reasons for maritime accidents, Barnett (2005) has found that onboard violations, lack of onboard situational awareness, and failures in management practice could lead to disasterous maritime accidents. More recently, Bowo and Furusho (2018) have made an analysis of maritime accidents in selected five countries (Canada, Indonesia, Japan, Australia, and England) by applying a scientific methodology called HEART. They have used the data from 125 marine accidents in the selected countries. They found that human errors are the prime cause for maritime accidents. Their analysis has clearly indicated that many of the accidents have happened mainly due to the negligence of even very minor issues. While analysing various factors that could prevent maritime accidents, they concluded that good communication among seafarers has pivotal role in preventing maritime accidents (Bowo and Furusho, 2018).

III. SIMULATORS IN TRAINING OF SEAFARERS

The employment of simulators in Maritime Education and Training is by the Standard of Training, Certification and Watch keeping for Seafarers (STCW) convention that gives wheels to instruction and training in simulators and in addition implementation based competency tests (Section An I/6; Section An I/12 of STCW conventions). Simulators are devises or a set of devises that provides situations equivalent to the real time operations and gives users a feel of real time experience. Now, simulators are being used in almost all professional training regimes. In the Maritime Education and Training, use of simulators is having the following applications.

1. It helps to identify risks related with actual systems operation
2. It helps to avoid damage in case of an accident and or injury
3. Training can be imparted for high level competency with less cost
4. Training and assessment can be accurate

Though the simulators based training is having valid prospects in Maritime Education and Training (MET), it is reported that identification of training procedures for the instruction and imparting maritime training and practices that would ensure valid and reliable results of simulator-based education is still a hurdle. Hence, there is an immediate requirement for experimental investigations that see the sights of the use of simulator-based training and assessment with reference to reducing the maritime accidents (Sellberg, 2017). The use of simulators in the training and certification in Maritime Education and Training (MET) havce been in practice from the early years of 1950s when they are inrtoduced for the first time. Hanzu-Pazara et al. (2008) described how test system based training was presented in MET with the essential purpose to prepare route abilities, for example, entry arranging and the master/pilot relationship. Studies and reviews worldwide have concluded that human errors in maritime accidents can be reduced to a greater extent by employing simulators, both engine room simulators and bridge simulators (Dumitrache et al., 2010; Stan et al., 2010).

IV. IMPACT OF SIMULATOR BASED TRAINING FOR SEAFARERS

As permitted by the International Maritime Organization's (IMO) Standard of Training, Certification and Watch keeping for Seafarers (STCW), the MET Institutions have made simulator based training as one of the important component in the MET. To guarantee that future mariners can act appropriately and securely, this tradition focuses on those simulators ought to be utilized for both training and appraisal. Martime training through ship simulators are being in practice for the past two decades with full effectiveness. It was emphazised by Nazir and Hjelmervik, (2018) the training for the young sea farers through the simulators contribute to the enhanced learning. It also attributes to the training for them in creating and solving abnormalities and malfunctions, as and when needed.

Sellberg (2017) has provided a methodical review about the utilization of simulators in maritime education and training (MET), with a focus on bridge operations during navigation training and assessment. Kandemir et al (2018) have recently reported about the effectiveness of ship simulators to train Marine Engineers at MET Institutes. They emphasize that full mission engine room simulators (FM-ERSs) are the key infrastructures to provide minimum competencies as suggested in the STCW conventions. In Marine Engineering domain, simulator based training offer following key aspects

1. Selection of competency
2. Description of the engine room scenario
3. Identification of suitable task
4. Observation of the key procedure
5. Collection of data
6. Preparation for initial condition
7. Briefing
8. Performing designated exercises
9. Training assessment

10. Debriefing

With the use of ship simulators, ship motions and maneuvering tactics can be trained, assessed. More important is the seafarers can learn the pratices with simulator at their own learning pace. Simulator based training in MET is more productive. It offers a congenial and collaborative teaching-learning experience between the trainer and trainee. Simulator based training often equates and at times much cost effective that training seafarers in real ship using conventional methods. It can be concluded that simulator based maritime training could be cost effective, time consuming and accurate.

V. SIMULATOR TRAINING TO REDUCE MARITIME ACCIDENTS

Right from the ancient times, world has rightly realized the economic impact of maritime accidents. Many scientific studies have been done and found that human errors are the major factors in causing maritime accidents. For example, Ugurlu et al. (2015) have studied the causative factors for maritime accidents in Turkey for the past few years. They have analyzed more than 800 maritime accidents in Turkey using a standard method; analytic hierarchy process (AHP) methodology.Their analysis has clearly implied that humar error is the major factor for accidents in the studied cases. Hence, they recommended that measures are to be taken or devised to ensure that ship crue is entirely competent with sound mind and body, to navigate in the toughest waters with minimal or nil accidents at sea. Hanzu-Pazara et al. (2008) have reported that simulator training can be beneficial to the maritime professional who operates complex machineries which ultimately may lead to reducing the workload of such professionals. Benefits of simulator training towards reducing humar errors

1. As approved by STCW conventions, Seafarer could get essential competency
2. It can be used for skill enhancement
3. Cost effective
4. Time consuming

Usually, in simulator based training regimes, students will be provided with a scenario, which they may face when on board. They will be trained in simulators to tackle the scenario and they can be assessed for the designated learning outcomes. After having adopted modern technologies to the larger extent, ships and offshore platforms are becoming more and more complex places to work. Besides, many of the ships are having less manning in the crew where one needs to establish quick skills, error free decision making and handling unforeseen toughest situations at sea. Hence, simulator based maritime education and training is considered as the key factor for reducing maritime accidents.

VI. SUMMARY

Studies done worldwide have concluded that human errors contribute majority for the maritime accidents. Simulators have been found to be effective tools in providing training to the emerging seafarers. Simulator based training programmes have also been found to reduce the human errors and eventually reduce maritime accidents. More emphasis is to be given for simulator based training in maritime education.

VII. ACKNOWLEDGEMENT

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