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Design of Lifeboat Releasing System for Ship Board Operation

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ABSTRACT

Lifeboat is one of important parts of the ship where without lifeboat, the ship not allowed to sail. Nowadays there were many problems on lifeboat releasing and handling system that involve injuries and fatalities, lifeboat should save people live but unfortunately lifeboat were cause loss of live on board ship during lifeboat operation. This study objective is to examine the factor and problem of lifeboat releasing operation. The factor, problem and activity were been highlight as the reference and guidelines for seafarer to prevent accident and problem during lifeboat operation. Several way and recommendation to minimize the problem is stated based on the factor determined. The factors have been examine are the design of lifeboat releasing system, maintenance of lifeboat and the training drill of lifeboat for this study and each relation was analysis by descriptive and qualitative in SPSS software. The mean and Pearson correlation tool were used to analysis the factor in this study. As the conclusion, the design of lifeboat releasing system show small relationship top lifeboat operation while lifeboat maintenance and training drill lifeboat show the strong relation to lifeboat releasing operation.

KEY WORDS: *Design, Maintenance training, Lifeboat, releasing system, Ship operation.*

NOMENCLATURE

GRA	Gravity Roller Trade davit
SPG	Single Pivot Gravity davit
FFD	Free Fall Davit
QD	Quadrantal Davit
GRP	Glass fibre-Reinforced Polyester
IMO	International Maritime Organization
MSB	Maritime Services Board

1.0 INTRODUCTION

1.1 Introduction

A lifeboat is a small and rigid boat carried crew and passenger for emergency evacuation in the event of a disaster aboard a ship. Lifeboat drills are required by law on larger commercial ships and rafts (life rafts) are also used.

Lifeboat is one of important parts of the ship where without lifeboat, the ship not allowed to sail. Lifeboat will be most needed to safe the crew on board while accident occurs. The important parts in lifeboat releasing system are lifeboat, davit, motor, hook and materials. All these parts need to be considering during ship repair, maintenance and lifeboat training, a lot of accident occur during training because of some failure part of system.

1.2 Problem Statement

Nowadays, we can see many accidents happen during training drill and maintenance on board ship and cause losses of life and injuries. These problem need to take serious because lifeboat supposed to save life of crew, not causing accident that involves life of crews and passengers.

1.3 Objective of Study

The objective of this study is to determine the factor influences lifeboat releasing system on board ship operation.

1.4 Scope of Study

The scopes of the study of the research are to investigate, determine as follow:

1. Design of lifeboat releasing system.
2. Maintenance of lifeboat, davit and other equipment mechanism.

3. Training drill and testing of lifeboat operation.

2.0 LITERATURE REVIEW

2.1 Introduction

A lifeboat is a small, rigid or inflatable boat carried for emergency evacuation during disaster on board ship. There are many type of lifeboat, such as inflatable lifeboat which is equipped with auto-inflation (carbon dioxide and nitrogen) canisters or mechanical pumps. Most of life raft is inflatable and it functions for temporary saving boat that only float on the sea water.

2.2 Main Part of Lifeboat

For lifeboat (shipboard), there are several parts that very important for handling lifeboat operation on board ship. All these part need to take account in designing a good handling system for lifeboat during on board operation and avoid accidents.

2.2.1 Davit

Davit is a structure, usually made of steel which is used to lower thing over an edge of the long drop-off , such as scaffolding down a building exterior or launching a lifeboat over the side of the ship.

Davit has always been designed to fit deck spaces that naval architect deemed necessary and variety of design emerged [3]:

i. Gravity Roller Trade davit(*GRA*) usually above promenade decks
ii. Single pivot gravity davit(*SPG*) for many different deck space
iii. Free fall davit(*FFD*) for free fall lifeboat on Stern
iv. Quadrantal davit (*QD*) old mechanical style, often cranked into outboard position

2.2.2 Launching Mechanisms

Lifeboat can be grouped into two group based how it was launched which is by using the davit launching method as shown in Figure 1 or free-fall launching as highlighted in Figure 2. These method based on the faith and economic status of the ship owner to choose [5,6].

Figure 1: Davit Launching mechanisms.

Davit launching system use arm to hold the aft and forward of the lifeboat. With the cable string on both side, the lifeboat will lowering after full loaded with passenger. After it reach the water, the crew inside the lifeboat will engage the cable and leave the abandoned ship [10].

2.2.2.1 Hook Launching Mechanisms

The free fall lifeboat hook launching system is originally developed specifically for offshore installation with large decks heights. During the water-entry phase, the angle between the lifeboat baseline and horizontal (water surface) is nearly the same as it is when the lifeboat is released (the angle of water entry nearly equal with the angle of the released). This system is insensitive to wind, as the boat providing positive headway due to its shape [2].

2.2.2.2 Skid Launching Mechanisms

The skid launching free fall lifeboat system was originally developed for merchant ships with moderate freeboards. When the boat is being released from the stowed position, it starts to glide down the skid. This is clearly show in Figure 2.

Figure 2: Free fall launching mechanism.

2.2.3 Material of Lifeboat Equipment

Basically, the material for lifeboat should have several criteria. Firstly the lifeboat must have good strength to resist the wave and resist the impact from launching especially free-fall launching type. Lifeboat appearance also needs to be fluorescent so that can be seen by rescue team [1]. Most of the material made up of lifeboat is steel, glass fibre-reinforced polyester (*GRP*) and aluminum.

2.3 Lifeboat Problem

There are many problem occur nowadays in handling lifeboat release system. These problems cause accidents and losses of life and cost during drill and actual handling lifeboat. These problems occur from long time ago and still nowadays still have in handling lifeboat problem. From time to time, the technologies, maintenance and material in lifeboat are upgrade and innovated but still accident occurs during releasing lifeboat.

Feb 2013, unacceptable levels of deaths and injuries during lifeboat drills have again been highlighted with the loss of five lives during a drill aboard the 'Malta-registered

Thomson Majesty' cruise ship in the Canaries. Three others were injured, two of them severely, when the davit-launched lifeboat fell while being recovered from the water towards the end of the

drill [7].

The luxury liner was due to set sail from the Canary Island of La Palma at 3pm Sunday bound for Madeira but the departure was delayed following the death of the five crew after the lifeboat they were checking plummeted 65 feet from the upper deck to the sea below. Authorities on the island said permission to depart at 3 pm Monday had been given by the judge after Civil Guard officers completed their investigations into the tragedy [6]. Bar chart in Figure 3 shows that accident happen and live lost due to type of process on board ship.

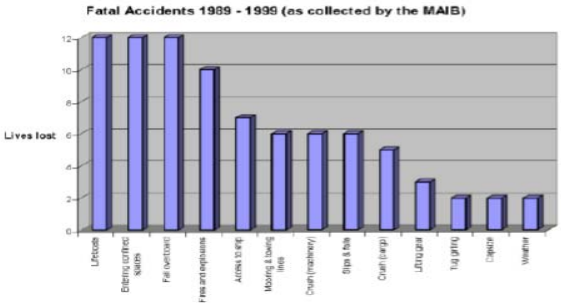

Figure 3: Fatal Accidents in 1989 to 1990.

The MAIB was not the only maritime agency to look at issues connected with lifeboats. In 1999 the Australian Maritime Services Board (*MSB*) submitted a summary of lifeboat accidents covering a seven year period to the *IMO*. The report contained reference to nine accidents involving lifeboats and highlighted deficiencies in design, training and equipment as being the main causes [3].

Figure 4 showing the analysis of Accident Cause and Effect and its Relationship to Seafarers' Hazard Perception. The majority of lifeboat accidents/incidents occurred when the vessel was a stable platform in the sheltered waters of a port facility. Even allowing for the fact that the majority of drills are conducted in port, this is a disturbing statistic.

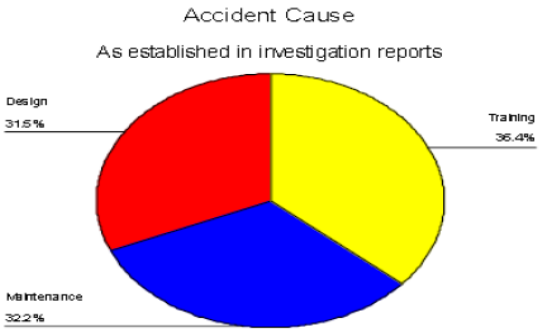

Figure 4: Pie chart of cause of accident.

In his report, the greatest response was from deck ratings but given that most vessels carry a proportionally larger compliment of deck rating than other ranks this was to be expected. The 'Other' category was almost entirely composed of trainee cadets [8].

It was not always possible to clearly allocate the cause to training, maintenance or design. Where the cause was not identified this was entered as such; where the established cause was other than training, maintenance or design, 'Other' was entered. With these variances removed the three primary causes of interest could be displayed [8].

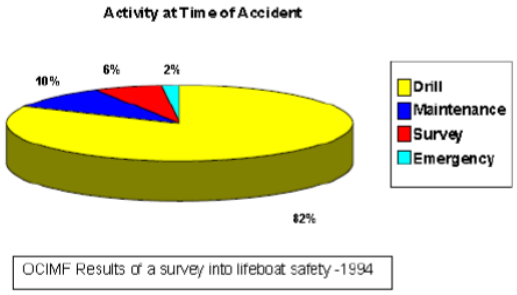

Figure 5: Pie chart of activity at time of accident in 1994 survey.

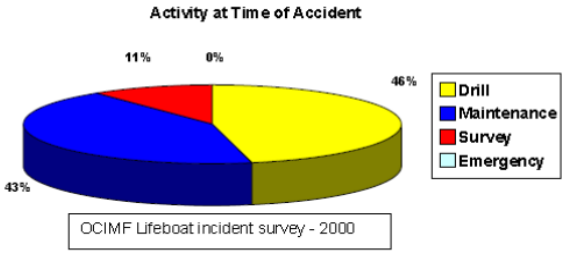

Figure 6: Pie chart of activity at time of accident in 2000 survey.

On whole, Figure 5 and Figure 6 are comparing the charts it appears that accidents during training drills had significantly reduced over the six-year period. However it was not possible to draw any conclusions about whether this was due to improved training techniques or to other factors [7].

3.0 METHODOLOGY

3.1 Introduction

This chapter discusses the methodology of the research. The main purpose of this research is to determine the problem during lifeboat releasing system on board ship operation. Therefore, this chapter consists of six main sections which are the research process, research instruments, and sample, research procedures, and data analysis. Hence, a numbers of ship crew, officer, engineer and lifeboat surveyor from Malaysia were selected as respondents. Moreover, questionnaires were used for the data collection of this study. The following section will explain the research instrument in detail.

3.2 Research Process
The process of this study is created to make the study easy to understand by explaining the flow of this study from beginning to the end. Saunders et al (2000) stated that, to ensure that the necessary preliminary work for later stages has been undertaken, there is a need to plan from the beginning of the process. The design of this study is important to examine the factors that influence auditor independence. For the purpose of this study, survey via questionnaire is exploited as a tool for data collection and analysis is made based on the data collected. The steps in designing the process of this study are shown in the flow chart below.

3.3 Location of Study
As stated in the previous chapter, the purpose of this study was to determine the problem during lifeboat releasing system on board operation. This study only focused on the respondents from Malaysia but some of them have experience with others foreign ship, that has been selected to conduct the study. The place was chosen is Johor port, West port and online survey questionnaire. Another method is by online questionnaire is apply because of some other seafarers are unreachable because most of them are sailing.

3.4 Respondent of Study
Seafarers are selected randomly but respondent from deck and engineering department are in priority first because these respondents have more experience and knowledge on ship operation and some of ship crew are not able to understand English. The distribution of the questionnaires was sent to the ship personally. However, only 36 questionnaires were answered and returned by the respondents while the other 19 questionnaires were not completed by the auditors as they were busy. In other word, only 65 percent of them gave commitment to answer all of the questions.

3.5 Data Collection Method
In accomplishing the purpose and objective of the study, primary data and secondary data have been used for the data collection in this study. Therefore, this section is divided into three subsections, namely quantitative approach, instrument of study, and research procedures.

3.5.1 Qualitative Data approach
This study is conducted by using quantitative research methodology and the instrument used to collect the primary data is through questionnaire which was adopted and modified based on the literature. The questionnaires contained 12 questions and were distributed directly to Port and personally trough online survey.

3.5.2 Instrument of Study
To obtain data and more accurate information on the study topic, primary data is used in this study. Normally, primary data is obtained by several methods. This study uses questionnaires as the method to obtain information and to achieve the objective of the study [9]. The questionnaires was constructed and modified from some example of survey about lifeboat accidents. The liker scale used in this survey was shown in Table 1.

Table 1: Five-Point Liker Scale used in this study.

Scale	Description
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

3.5.3 Research Procedure
First of all, the questionnaire was constructed and prepared where the questionnaire was adopted and modified from previous studies. After the questionnaire has been corrected and retuned, the questionnaires were distributed to the respondents to the location that has been selected as discussed before this. Then, the questionnaires were collected from the respondents and finally the primary data which is the answers from the respondents were analyzed.

3.6 Summary
This chapter explains the method used to conduct this study. A questionnaire has been constructed for the data collection where the questions were adopted and modified from previous studies. The respondent of this study consist of 36 seafarers from Malaysia. Quantitative analysis in the form of descriptive statistics was applied for data processing in this study. The next chapter will reveal and the results and a detailed analysis of the data obtained from the survey questionnaires.

4.0 RESULTS

This chapter is divided into two sections. The first section presents the demographic results of the respondents. While the second section explains the findings and objective of this study which is to examine the relationship between variables.

4.1 Introduction
The data obtained are analyzed using frequency, Pearson correlation, and mean. Frequency is used to calculate the percentage of the respondent's background. Mean is used to identify the degree of factors based on the total mean while Pearson correlation is used to measure the relationship between the factors that to verify the hypotheses. 0.00 = Sig. < 0.05 means that any number that falls between 0.00 and 0.05 is deemed significant to the aspect of independence.

4.2 Demographic Profiles of Respondent
Demographic data were used to investigate the background and problem and opinion from seafarer about lifeboat releasing system.

4.3 The Relationship Between The Factors and Lifeboat Releasing System

Table 2 shows the relationship of factor influence lifeboat releasing system based on the person correlation analysis.

From the analysis in Table 2, it shows that all the factors that influence lifeboat releasing operation consists of design of lifeboat releasing system, maintenance of lifeboat and training drill of lifeboat operation. Maintenance of lifeboat and training drill lifeboat operation has positive relationship and significance with the lifeboat releasing operation. However, for design of lifeboat releasing system, as highlighted in Table 3, it shows that there is no relationship between lifeboat releasing operations, since one of two of the variables not significant and shown no relationship based on Pearson correlation analysis.

Table 2: Summary of the Relationship between the Factors that Influence lifeboat releasing.

Independent Variable	Pearson Correlation	Sig.	Results
How safe is design of lifeboat releasing system	0.110	0.523	Not Significant And Positive Relationship
The Davit arrangement may not cause problem during lowering lifeboat.	0.350*	0.036	Significant And Positive Relationship
The Lifeboat design may not cause problem during lowering lifeboat.	-0.239	0.021	No Relationship
Maintenance process conducted properly (schedule, manual maker)	0.495**	0.002	Significant And Positive Relationship
Maintenance activity of lifeboat is safe	0.31	0.432 **	Significant And Positive Relationship
Training drill activity of lifeboat is safe	0.522**	0.001	Significant And Positive Relationship
Percent of well-trained crew on board	0.424**	0.010	Significant And Positive Relationship

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.005 level (2-tailed)

Another problem of maintenance is the wire not grease period as the wire may corrosion due to sea and rain water. The maintenance is not enough since the equipment expose to seawater and can cause corrosion and jammed of davit. Reports by owners and ships' officers point to many instances of neglected or incorrect maintenance, causing brake failure. Examples include excessive wear, oil or grease contamination, incorrect adjustment and assembly.

From the data analysis above, shows that the training drill of lifeboat operation has a significant and positive relationship with lifeboat releasing operation. These finding proved by MAIB (2008), one of the most disturbing factors about lifeboat statistics emerging is that the majority of accidents occurred during training drills. Most of the problem and accident occur during lifeboat training and these also because of training drill itself. The crews handling lifeboat were not fully well trained to handle lifeboat operation and cause problem such as human error and careless mistake [11].

Table 3: Summary of the relationship between design of lifeboat releasing and lifeboat releasing operation.

	Mean	Agreement Rating
How safe is design of lifeboat releasing system.	4.03	High
The Davit arrangement may not cause problem during lowering lifeboat.	4.42	High
The Lifeboat design may not cause problem during lowering lifeboat.	4.78	High
Maintenance process conducted properly.	3.56	Medium
Maintenance activity of lifeboat is safe.	3.94	High
Training drill activity of lifeboat is safe.	3.58	Medium
Percent of well-trained crew on board.	3.58	Medium

4.4 Suggestion and Solution

Based on the data analysis and others sources which are the feedback, recommendation and comment from survey, the solution have been suggest to improve lifeboat operation and minimize the problem during lifeboat releasing operation.

i. Design lifeboat releasing system with less maintenance

required

ii. Design lifeboat releasing system with easy and quick maintenance

iii. All ship is suggested to use similar design of lifeboat releasing operation.

iv. Never skip the maintenance period and follow the schedule by maker.

v. Keep the lifeboat equipment clean from corrosion due to seawater and rain, keep greasing the wire to prevent rusted.

vi. All crew should able to translate, understand and apply the maintenance and training from the manual and procedure book.

vii. All crew should wear personal protection equipment (PPE) during maintenance and training.

viii. All crew should understand the principle of lifeboat operation.

ix. Propose the clear and accurate description of equipment and operating principle in manual procedure.

5.0 CONCLUSION

This study examines the factors influencing lifeboat releasing lifeboat operation. Related problems that arose were the factors that led to this study to be conducted. The objectives of the study were developed based on the problems that had been identified.

Based on the results in the findings, the factors influencing lifeboat releasing operation were found that strong relationship were training drill of lifeboat and maintenance.

These analysis support by mean and Pearson correlation which are the maintenance of lifeboat show moderate relationship with lifeboat operation and the mean show medium agreement on the effectiveness of maintenance activity. As conclusion, maintenance is the factor of lifeboat releasing operation.

The design of lifeboat releasing system show small relationship with lifeboat operation by Pearson correlation analysis. These is support by mean analysis, the agreement range of design of lifeboat were high which are show the design of lifeboat may not cause lifeboat operation problem. As conclusion the factor of design lifeboat releasing system with lifeboat operation is small relation.

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