COMPARATIVE ANALYSIS ON MAINTENNACE AND REPAIR COST OF DIFFERENT TYPES OF SHIPBOARD FIXED FIRE EXTINGUISHING SYSTEM

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To my beloved wife, my lovely son, my mother, my families, my lecturers and all my friends……

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ABSTRACT

Merchant ships could, by requirement, be fitted with any two of three different types of fixed fire extinguishing system (FFES); CO2 based, water based and foam based. Each system is quite unique and so as the maintenance and repair cost. Maintenance cost of FFES depends on ship size and type and the major cost categories are labor and material. Maintenance budget to sustain maintenance and repair work on FFES is always given lump sum to the ship's master and hence it is helpful if the master is provided with indication on how to apportion the budget by FFES type, by system's category and by system's components. This research intends to establish these ratios based on data collected from 31,980 DWT chemical tankers with GRT 22,116. Maintenance and repair cost data are split into categories and later further breakdown into components representing the types of works performed on the FFES systems. Probability of occurrence of their average annual values are also estimated using simple Gaussian Method. The result show that for FFES comprising of CO2 and water based system, the CO2 based system will take 7% of the lump sum budget, its labor cost will take 91% and SA CO2 Fixed Fire Sys Cylinder Test Certificate component will take 47.4% of the budgeted sum. For a CO2 and foam system, the CO2 based system will take 6% of the lump sum budget, its labor component will take 93% and PUC0611-Test Fire Pump 12M component will take 25.7%. For water and foam FFES system, water will take 4% of the budgeted sum, labor will take 100% and SA-Foam Analysis component will take 47.6%.

ABSTRAK

Bagi menepati syarat kapal-kapal dagang boleh dipasang dengan mana-mana dua daripada tiga jenis sistem pemadaman kebakaran tetap (FFES); berasaskan karbon dioksida (CO2), berasaskan air dan berasaskan busa. Setiap sistem adalah unik dan begitu juga kos senggaran dan baik pulihnya. Kos penyenggaraan FFES bergantung kepada saiz kapal dan jenis dan kategori utama kos adalah kos pekerja dan bahan. Bajet penyenggaraan untuk menanggung kerja penyenggaraan dan pembaikkan FFES di beri secara segumpal kepada nakhoda untuk semua sistem di atas kapal dan dengan itu ianya akan dapat membantu jika nakhoda kapal diberi petunjuk bagaimana membahagikan bajet tersebut mengikut jenis FFES, kategori sistem dan komponennya. Kajian in bercadang mewujudkan nisbah ini berdasarkan data dari kapal tangki minyak kimia bersaiz 31,980 DWT dengan 22,116 GRT. Data kos senggaraan dan baikpulih telah dipisahkan mengikut kategori sistem dan kemudian dipecahkan kepada komponen yang mewakili jenis kerja yang dilakukan ke atas FFES. Kebarangkalian berlakunya nilai-nilai purata tahunan telah dianggarkan dengan menggunakan kaedah Gaussian. Keputusan menunjukkan bahawa untuk FFES yang berasaskan CO2 dan air, CO2 akan mengambil 7% daripada bajet keseluruhan, kos buruhnya ialah 91% dan komponen utama iaitu SA CO2 Fixed Fire Sys Cylinder Test Certificate akan mengambil kira-kira 47.4% daripada jumlah bajet. Untuk FFES yang berasaskan CO2 dan busa, CO2 akan mengambil 6% dari bajet keseluruhan, manakala kos buruhnya 93% dan komponennya ialah PUC0611-Test Fire Pump 12M yang akan mengambil 25.7% daripada jumlah bajet diberikan. Untuk FFES yang berasaskan sistem air bersama busa, sistem berasakan air akan mengambil 4% daripada jumlah peruntukan yang akan diberikan, manakala komponen kerjanya adalah 94% dan kerja SA-Foam Analysis mengambil kira-kira 47.6%.

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LIST OF ABBREVIATIONS

AMOS M&P	AMOS Maintenance and Plan
CO_2	Carbon Dioxide
DWT	Deadweight Tonne
CLASSNK	Classification Society – Nippon Kaiji Kyokai
FFES	Fixed Fire Extinguishing System
IMO	International Maritime Organization
IMCO	Inter-Governmental Maritime Consultative Organization
MISC Berhad	Malaysia International Shipping Corporation Berhad
MTD	Melati Dua
MYR	Malaysian Ringgit
NFPA	National Fire Protection Association
GRT	Gross Registered Tonnage
SA	Shore Assistance
SOLAS	Safety of Life at Sea
12M	12 months
30M	30 months
48M	48 Months

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Overall, this study is focused on the cost component that influences the total cost for shipboard maintenance works on FFES. Besides that, this study is also intended to identify the critical cost component from each medium in order a safe budget level is met. In this chapter, the basic elements of the study are presented. Basically, this chapter covers the background, problem statement, aims and objectives, and scope of the study. The research methodology involved in conducting this study is also briefly explained. Lastly, a summary of all the chapters in this study are presented.

1.2 Research Background

FFES is a mandatory system to be installed on board of the vessel. The Owner of the vessel has an option to install all three or two different types of FFES onboard of their vessel subject to classification society approval. The most common types are water based, CO_2 based and foam based. This system is extremely crucial to the vessel. Although, this system is a secondary means in controlling the fire, the maintenance and services exercise should be carried out by the operators in regular intervals. This maintenance work will ensure that the system can be operated efficiently during an emergency situation.

FFES is the common system installed onboard of vessel. Thus throughout the years, the maintenance action needs by FFES are personnel, facilities, equipments and spare parts. The costs associated with these resources are grouped into two parts, the maintenance cost and the resources cost. Maintenance costs are the direct expenses related to a maintenance action, which is the man-hour, spare parts, rent of facility and special equipment. Resources costs are the cost of indirect expenses such as holding cost of spares, running cost of facilities, and training of personnel. For that reason, the owner of the vessel has to capture the initial cost and maintenance cost for this system in order to use and maintain the efficiency of the system. Therefore the maintenance and repair cost for FFES is mainly involving the labor man-hour rates and cost of replacement of the spare parts. As such, these elements will affect the total cost for each maintenance works carry out on FFES. Therefore, the total maintenance cost varies and fluctuating.

Traditionally, the main purpose of maintenance is to determine the most cost-effective maintenance strategy to be adopted. This strategy should provide the best possible balance between direct maintenance costs (labor, materials, administration) and the consequences or penalty of not performing maintenance as required (i.e. labour, materials, administration, loss of production and anticipated profit etc.) without prejudice to Health, Safety and Environmental (HSE) factors. As for MISC vessels, a suitable maintenance budget is prepared to the vessel for purchasing the spare parts and other ancillary expenses. For cost-effective reason, MISC's chemicals tanker was budgeted based on the previous history of the similar vessel such as total cost of purchasing the critical items and annual services. In addition, additional percentage is placed to offset the fluctuation rate in that financial year. This additional percentage varies and subject to finance department approval.

Hence, from the above approach, the estimated budget can be better estimated if the data for maintenance and repair cost over a period can be analyzed and compared between the different types of medium.

In conclusion, from the above findings, the researcher will carry a further study in determining the maintenance and repair cost of different types of shipboard FFES for chemicals tanker. The findings of the study can be used as a reference for future financial plan.

1.3 Problem Statement

Under the Safety of Life At Sea (SOLAS) Chapter II-2, Regulation 10, the installation of FFES on board a vessel is compulsory. In general FFES consists of three different types of medium used on merchant vessel. They are water, CO_2 and foam These FFES is very crucial for the vessel and crew in controlling and extinguishing the fire.

No formal attempt has been made to differentiate between maintenance cost and proposal budget decisions throughout the ship's life, because regardless of the ownership, a ship will continue to be repaired and traded until it is scrapped. Through market mechanisms, these costs will be borne by the company under maintenance cost. Therefore, the cost uncertainty for maintenance and repair time of different types of FFES is not properly studied.

Consequently, the maintenance activities of FFES are normally captured in the shipboard maintenance system. The maintenance cost is captured based on working hours and the cost of each spare part that is being utilized during the maintenance activities. The Chief Engineer who is working on the vessel will updating the working hours and spare parts that are being utilized in the maintenance system after completion of each works. These data are kept in the database and could be studied to assess the maintenance cost of FFES based on component and repair time.

In this work, the researcher will study on the component of each FFES and its repair time required based on the data collection from the maintenance system. By understanding the variation of cost component for each FFES; the researcher will be able to propose a safe budget level that can be used while allocating the maintenance and repair budget without worrying on the safety feature.

As such, this research attempts to identify the important components of maintenance works and repair cost for FFES medium. This component is assumed to be a factor in determining the total cost for each medium.

1.4 Research Objective

The objective of this thesis is to compare the maintenance and repair cost of the three types of shipboard FFES; water, CO_2 and foam based.

1.5 Scopes of Research

i. The type of ship selected is chemical tanker. This will minimise the cost variation due to labor price.
ii. The research data will be extracted from MISC's AMOS Maintenance & Plan Database.
iii. The statistical method is selected for determining the magnitude of cost variation and its probability of occurrence.
iv. The results should be accurate for water, CO_2 and foam based FFES fitted on chemical tankers on gross tonnage 22,116 only.

1.6 Significant of the study

The outcome of the study is to be useful for chemicals tanker, owners and operators to understand the critical factors that can influence the maintenance cost of FFES. It also is an advantage to the vessel operators in understanding the importance of each maintenance work during clarifying the maintenance cost for each type of medium used in FFES. In the long run, this study can be proposed as a part of periodic and continuous evaluations and reviews of the FFES.

1.7 Thesis Structure

This thesis is organized and presented through six chapters as below:-

Chapter one explains the overview of this research that will outline the objective, the problem statement, scope of the study and significance of study.

Chapter two discusses the relevant literature pertaining to FFES rules and requirement, type of FFES, AMOS Maintenance & Plan and maintenance action.

Chapter three describes the research approach adopted for this study, such as explanations on techniques of data collections and the data analysis methods. Each steps of the research methodology was described, beginning with the initial planning and preparation of this research until the final results.

The findings of this study were presented in chapter four. Comparisons for each FFES medium were presented, for the analysis purpose, a comparison on variance and probability for each medium were used to fulfill the research objectives.

Chapter five explains on the concluding notes on the researcher objectives. A conclusion was reached, based on the problem and data analysis of the study. Statistical analyses are used to identify the uncertainty value for each maintenance and repair cost of different types of shipboard fixed fire extinguishing system.

Lastly, the chapter six highlights the conclusions made from the study and the recommendations for further studies.

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