

**VIABILITY STUDY ON THE APPLICATION OF ADVANCE BLASTING  
METHOD IN MALAYSIAN SHIPBUILDING INDUSTRY**

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*For my family, that special 'one'.....*

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## ABSTRACT

The main objective of this study is to propose application of advance blasting method in Malaysian shipbuilding industry; therefore it is hypothesis by replacing the current method with advance method would be more technically and economically beneficial. From the preliminary survey to the Malaysian shipbuilding or ship repair industry, the abrasive blasting methods are still being implemented for surface preparation. This technology, although effective in coating removal and establishment of surface profile, is laden with inherent problems, American and European yards began realizing the human and environmental consequences of open air abrasive blasting. To overcome such problem, the advanced method of ultra high pressure water jetting is used. However, this advanced ultra high pressure water jetting method is still not been implemented in Malaysian shipbuilding industry. With this back ground, a viability study was carrying out on the application advance blasting method to the local shipbuilding. The study focused on technical and economical aspects and comparison here made among several advance methods and against the present abrasive blasting method.

The result of the study indicated that,

- a. Technically, automated ultra high pressure water jetting is the best blasting method with the cleaning capability of  $90 \text{ m}^2$  per hour (12 times faster than abrasive blasting method) and equipped with external recovery system.
- b. On the economic aspect, the automated ultra high pressure water jetting method is only economically viable if the amount of cleaning job per year is larger (more than  $34,750 \text{ m}^2$ ), while for small cleaning job, the present method review the most cost effective.

## ABSTRAK

Objektif utama kajian ini adalah memperkenalkan penggunaan kaedah termaju alat semburan untuk menanggalkan lapisan cat bertekanan tinggi kepada industri pembinaan kapal di Malaysia. Oleh itu andaian dibuat dengan menggunakan kaedah termaju dapat memberi lebih kebaikan dari segi faktor teknikal dan ekonomi. Dari kajian tinjauan awal kepada industri pembinaan kapal di Malaysia, alat semburan tekanan tinggi menggunakan serpihan logam halus masih digunakan untuk melakukan kerja menanggalkan lapisan cat pada permukaan badan kapal. Teknologi ini didapati efektif untuk melakukan kerja menanggalkan lapisan cat tetapi ia telah menimbulkan beberapa masalah pencemaran. Syarikat pembaikan kapal di negara Amerika dan Eropah telah sedar pencemaran yang dihasilkan kepada pekerja dan kawasan sekitar tempat kerja dari penggunaan kaedah ini. Untuk mengatasi masalah ini alat termaju menggunakan semburan air bertekanan tinggi telah digunakan oleh mereka. Tetapi kaedah termaju ini masih belum diguna pakai oleh industri pembaikan kapal di Malaysia. Daripada masalah ini, kajian ini dibuat untuk membandingkan keupayaan penggunaan kaedah termaju ini kepada industri pembaikan kapal di Malaysia. Kajian ini ditumpukan kepada aspek teknikal dan ekonomi. Dan hasil kajian mendapati;

- a. Dari segi teknikal, alat semburan air bertekanan tinggi automatik adalah kaedah terbaik dengan keupayaan menanggalkan cat pada 90 meter persegi sejam (iaitu 12 kali lebih pantas daripada kaedah digunakan sekarang) dan mempunyai sistem kitar semula.
- b. Dari aspek ekonomi, alat semburan air bertekanan tinggi automatik mempunyai nilai ekonomi yang menguntungkan jika kerja-kerja menanggalkan cat setahun melebihi 34,750 meter persegi sementara jumlah kerja yang kurang dari yang dinyatakan penggunaan kaedah sekarang lebih kos efektif.

## CONTENTS

<b>CHAPTER</b>	<b>TITLE</b>	<b>PAGE</b>
	<b>ACKNOWLEDGEMENT</b>	iv
	<b>ABSTRACT</b>	v
	<b>ABSTRAK</b>	vi
	<b>CONTENTS</b>	vii
	<b>LIST OF TABLES</b>	x
	<b>LIST OF FIGURES</b>	xi
	<b>LIST OF SYMBOLS</b>	xii
	<b>LIST OF APPENDIXES</b>	xiii
<b>CHAPTER I</b>	<b>RESEARCH FRAMEWORK</b>	
	1.1 Introduction	1
	1.2 Problem Statement	3
	1.3 Objective	3
	1.4 Scope	4
	1.5 Thesis Organization	4
<b>CHAPTER II</b>	<b>LITERATURE REVIEW</b>	
	2.1 Introduction	6
	2.2 Literature Findings	6
	2.2.1 Water Jetting Stripping	7
	2.2.2 Preproduction Initiative-NELP High Pressure Water Jet System Test Plan	8
	2.3 Blast Cleaning Process	9
	2.3.1 Surface Preparation Standard	10
	2.3.2 Blasting Cleaning Method	12
	2.3.3 Abrasive Blasting	13

2.3.4	Vacuum Blasting	16
2.3.5	Water Jet Blasting	17
2.3.6	Evolution of Ultra High Pressure Water Jetting Equipment	17
2.3.7	Handheld Tools	18
2.3.8	Semi-Automated Systems	20
2.3.9	Fully Automated Systems	21
2.4	Closed Loop Systems	22
2.5	Summary	24

### **CHAPTER III**

### **RESEARCH METHODOLOGY**

3.1	Survey Method	26
3.2	Technical Analysis Method	27
3.2.1	Technical Capability	27
3.2.2	Cleaning Coverage	27
3.2.3	Surface Area	28
3.3	Economic Analysis Method	29
3.3.1	Principles of Economic Evaluation	30
3.3.2	Cash Flow Diagram	30
3.3.3	Net Present Value (NPV)	31
3.3.4	Internal Rate of Return (IRR)	31
3.3.5	The Payback Period	32
3.3.6	Break Even Analysis	33
3.4	Economic Analysis Input Parameter	33
3.5	Summary	34

### **CHAPTER IV**

### **SURVEY FINDING**

4.1	Preliminary Survey Data	35
4.2	Pilot Survey Data	36

	4.3	Summary	41
<b>CHAPTER V</b>		<b>TECHNICAL ANALYSIS</b>	
	5.1	Technical Capability	42
	5.2	Cleaning Coverage	46
	5.3	Surface Area	47
		5.3.1 Working Hours and Production Rate Per Year	47
		5.3.2 Number of Ship Per Year	49
	5.4	Conclusion	51
<b>CHAPTER VI</b>		<b>ECONOMIC ANALYSIS</b>	
	6.1	Introduction	52
	6.2	Assumption for Economic Variable	53
	6.3	Annual Operating Cost and Initial Cost	54
	6.4	Economic Evaluation Analysis	55
		6.4.1 Abrasive Blasting Method	55
		6.4.2 Hand-held Tools UHP Water Jetting Method	58
		6.4.3 Automated UHP Water Jetting Method	60
	6.5	Summary of Result	62
<b>CHAPTER VII</b>		<b>DISCUSSION AND FUTURE WORK</b>	
	7.1	Discussion	64
	7.2	Future Work	64
<b>CHAPTER VIII</b>		<b>CONCLUSION</b>	65
		<b>REFERENCES</b>	66
		<b>APPENDIX</b>	
		<b>APPENDIX A-J</b>	69-106



## LIST OF TABLES

<b>TABLES NO.</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Preparation grades for steel surfaces using blast cleaning	10
3.1	The input parameter for economic analysis	33
4.1	The survey data on technical and economic aspect on the abrasive of blasting method	37
4.2	The survey data on technical and economic aspect on the advance blasting method	39
5.1	Comparison on technical capability of the advance and current method	43
5.2	The comparison of the capability of the type blasting machine to cleaning surface area of the ship	46
5.3	The comparison of amount the ship can be clean per year	51
6.1	The initial cost and annual operating cost for the current and advanced methods	55
6.2	The result of NPV, IRR, pay back period and the break even point hand held tools UHP water jetting	60
6.3	The result of NPV, IRR, pay back period and the break even point of automated UHP water jetting	61
6.4	Summary of the result using simplifying assumption analysis	62

## LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	Surface appearance variation	12
2.2	Abrasive blasting machine	14
2.3	Vacuum blasting machine	16
2.4	The handheld tools of Ultra high pressure water jetting	19
2.5	Semi-automated systems enable one operator to put the full horsepower of one pump on the work surface	21
2.6	Fully automated robotic systems	22
4.1	Pie chart of result from nation wide survey data	36
6.1	The cash flow diagram for abrasive blasting method	56
6.2	The cash flow diagram of NPV for abrasive blasting method	56
6.3	The cash flow diagram for hand held tools UHP water jetting method	59
6.4	The cash flow diagram of NPV for hand held tools UHP water jetting method	59
6.5	The cash flow diagram for automated UHP water jetting method	60
6.6	The cash flow diagram of NPV for automated UHP water jetting method	61

## LIST OF SYMBOLS

$NPV$	-	Net Present Value
$N$	-	project life
$i$	-	discount rate or interest rate per interest periods
$C$	-	initial capital expenditure
$A_t$	-	net cash flow during year $t$
$E_t$	-	revenue of year $t$ resulting from the investment (cash flow that would not have occurred without the initial investment)
$t$	-	time
$IRR$	-	Internal Rate of Return
$n$	-	year
$P$	-	first project or present value
$A$	-	annual cost or annuity series value
$F$	-	future cost
$G$	-	gradient series value
$MARR$	-	minimum attractive rate of return
$DI$	-	import duty taxes
$FR$	-	freight charges
$In$	-	insurance
$L$	-	price of the machine

## LIST OF APPENDIXES

APPENDIXES	TITLE	PAGE
A	Shipyards and ship repairer survey list	69
B	E-mail and address of UHP manufacture or vendor	71
C	Personal interview questionnaires	72
D	E-mail questionnaires	78
E	Shipyards and ship repair that had been selected of preliminary survey research	81
F	The comparison of the result from the survey on the application of abrasive blasting method on the Malaysia Shipbuilding / Ship repair Industry	82
G	The results from e-mail questionnaire of ultra high pressure water jetting blasting for marine application	86
H	Initial cost	92
I	The calculation of operation cost	94
J	The calculation of cash flow, NPV, IRR, payback period and break even point of abrasive blasting method, hand held tool UHP water jetting method and automated UHP water jetting method by using excel program	103

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

Most large ocean-going vessels, whether they be crude oil tankers, bulk cargo ships, military, chemical tankers, generally have hull plating that is made up of steel which is protected by layers of anti-corrosive (usually epoxy) and antifouling coatings. Over time, such coatings succumb to failure modes of differing varieties.

These coating systems must be renewed, either partially or totally. This activity is called surface preparation and one of the main service parts of ship maintenance. The term surface preparation denotes the cleaning and removal of all substances that have a deleterious effect on coating effectiveness, (Piero Caridis, 2001).

For two decades, ship repairers and ship builders have implemented with abrasive blasting method to remove the coatings for metal surfaces preparation. From the emission standards code rules 2003, the definition of abrasive blasting means the operation of cleaning or preparing a surface by forcibly propelling a stream of abrasive material against the surface. The material used in abrasive blasting operations include but not limited to sand, slag, copper, garnet or walnut shells.

This technology, although effective in coating removal and establishment of surface profile, is laden with inherent problems, many of which have been documented throughout the mid-1980s to the present. This method is very inefficient for environment and workers concern. This process generates particulate matter, spent slag and heavy metals such as lead, nickel, zinc, silica and copper, from the breakdown of the removed pigmented coatings and substrate. Particulate matter or fine dust causes respiratory and other human health problems if inhaled. The dust can also degrade air and water quality. The need for precaution and protection when dealing with any source of airborne particulates necessitates the implementation of a formal corporate respiratory protection program that comprehensively addresses respiratory hazard determinations, worker training, and medical evaluations. In the 90s', American and European yards began realizing the human and environmental consequences of open air abrasive blasting.

In early to mid 1990s, ultra high pressure water jetting (UHP) blasting the alternatives method for removing coating from steel surfaces was introduced, mostly on a demonstration basis, to many U.S shipyards. Application of this system considered mainly due to environmentally conduciveness and on workers safety. Ultra high pressure water jetting is described as a means of coating removal using solely water at over 25,000 psi (1,666 bar) or greater. Ultra high pressure (UHP) water jetting has generally been known for its ability to leave its surfaces ultra clean, without distorting or imparting additional profile to the substrate, (Joint Technical Standard SSPC-SP 12/NACE 5, 1997)

From the preliminary survey to the Malaysian shipbuilding industry, the abrasive blasting methods are still widely used for surface preparation. The advance method that was introduced in the market such as high pressure water jetting still not implemented to Malaysian shipbuilding industry. With this back ground, the main objective of this study is to propose application of advance blasting method in Malaysian shipbuilding industry, therefore it is hypothesis by replacing the current method with advance method would be more technically and economically beneficial.

The study began with survey work on the type of blasting method that are being used in Malaysian shipyard, this to review the effectiveness and the efficiency of the present status. Then the advance blasting method that has been used on other countries or that are produced in the market will to be studied in order to determine its potential replacement to the current method. The study will focus on technical aspects and economical benefits of the potential blasting method.

From the technical and engineering economic study, the potential of advance blasting method will be analyzed to determine the operating cost, have a profitability investment, have a short period of time to clean the surface and to fulfill concerning both workers and environment safety in completing blasting cleaning task. The outcome of this study will be recommended as the potential of blasting method for Malaysian shipbuilding industry.

## **1.2 Problem Statement**

Alternatively several advance methods could be used to solve such problem. However in selecting which methods is the most suitable to the local shipbuilding industry, the following aspects need to be examine;

- a. Which of the method has the most technical capability and suitable for local used.
- b. What will be the economic return for this advance method taking into account various surface cleaning job scenario.

## **1.3 Objective**

The objectives of this study are as follows:

1. To study the potential application of various advance blasting cleaning method for shipbuilding industry in Malaysia.

2. To identify the advance blasting cleaning method that is technically and economically viable for Malaysian shipbuilding industry.

#### **1.4 Scope**

The scopes of this study are as follows:

1. Literature and background study on present and advance blasting cleaning methods.
2. National wide survey on the type of blasting cleaning method being used in the Malaysian shipyards.
3. Identify the potential advance blasting cleaning methods for Malaysian shipyard application.
4. Using technical capability analysis and engineering economic study to analysis of the potential blasting cleaning method.
5. To propose recommendation of the potential blasting cleaning method for Malaysian shipbuilding industry.

#### **1.5 Thesis Organization**

Chapter 1 gives an overview of the introduction and the problem of the statement. It reviews the background study of the current blasting cleaning process for surfaces preparation in ship maintenance and ship builders. It is also include objectives, scope and limitations and overall organization of the thesis.

Chapter 2 gives an overview to literature study on present and advance blasting cleaning methods, the several research of comparisons of using water jetting method with the abrasive blasting method that are done and the result of the research using ultra high pressure water jetting blasting method.

In chapter 3 gives the descriptions on how to carry out this study. This will describe the survey methods being used to get the data national wide. Also describe



the methods to analyze the technical capability of the method to cleaning the surface area such as the production rate, the versatility be required for detail work and areas that large machines cannot be reach and also the economic viability of the potential of blasting method that offer in the market to prepare that will replacing current blasting process for Malaysian shipbuilding industry.

Chapter 4 deals with the data that are collected from the survey study. This will describe a statically method to analyze the technical and economical data. The data is analyzed and to get the results in averages. Then this data and results will be used to the technical and economic analysis.

Chapter 5 deals with the technical analysis. The potential of advance blasting method will analyze, to determine production rate to clean the surface area, the versatility or the capability of the machine to clean all part of surface area of the ship and to fulfill concerning both workers and environment safety in completing blasting task.

Chapter 6 deals with the economic analysis. The potential of advance blasting method will be analyzed, in order to determine the economic return based on the initial cost, operating cost and the revenue.

And chapter 7 summarized the result and gives the recommendation and conclusion. This is followed by references and appendices.