APPLICATION OF ACCURACY CONTROL SYSTEM IN BATAM SHIPYARD

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A dissertation submitted in partial fulfilment of the
requirements for the award of the degree of
Master of Engineering (Marine Technology)

Faculty of Mechanical Engineering
Universiti Teknologi Malaysia

APRIL 2005

ACKNOWLEDGEMENT

Praise to Allah, the Most Gracious and Most Merciful, Who has created the mankind with knowledge, wisdom and power. Being the best creation of Allah, one still has to depend on other for many aspects directly and indirectly. This is, however, not an exception that during the course of study the author received so much help, cooperation, and encouragement that need to duly acknowledge.

In preparing this study, author was in contact with many people, academicians, and practitioners. They have contributed towards my understanding and thoughts. In particular, author wish to express my sincere appreciation to my supervisor Mr. Hj. Yahya Bin Samian, for encouragement, guidance, friendship and valuable comments in completion of this work. Without your guidance, support and interest, this dissertation would not have been the same as presented here.

I am also very thankful to PT. Pan-United Shipyard that allow me to conduct the survey in that shipyard, especially to Mr. Mr. A. Gofur, Mr. Andi BS, Mr. Setio, Mr. Agung, Mr. M. Sitorus, Mr. Deny, for all information and support.

A warmest gratitude and special dedication to my mother, father, and sister for their understanding, patient, and support. A special dedication to my habibati for her support, love, and joy. Special gratitude to all my classmates especially Mr. Atef and Azri and my best friends in UTM, Rival, Imen, Fikri, Gunawan, Mr. Haris, Mr. Dony, Nasir, Mr. Amrifan, Mr. Nazori, etc that I cannot mention all them here.

To my beloved mother, father, sisters and my habibati

ABSTRACT

Accuracy Control System (ACS) in shipbuilding industries is proven to have reduced production time, rework, and improved productivity and finally achieved quality of product. This concept had been implemented in many shipyards worldwide especially in Japan, USA and Europe. With the recent shipbuilding development in Batam region, with the emergence of more than forty shipyards, the application of ACS could brought a significant impact to the well being and competitiveness at Batam shipyards. Therefore, this research study is carried out to determine the status of the level of ACS implementation in Batam shipyards, hence proposed for suitable improvement or implementation wherever necessary. This research started with two different surveys; first survey conducted at fourteen shipyards by using questionnaire in order to determine the present status of ACS application. The second survey was conducted on a specific shipyard, i.e. PT. Pan-United Shipyard in order to determine the present quality system employed. A pilot study on the initial implementation of ACS has also been carried out in this shipyard. A stern block (block 1) of a ongoing project (Hull 163) has been selected for the study and the measurement was taken and recorded systematically. Based on these measurements, several analysis have been performed which lead to the conclusion that the percentage of rework, production time and production cost can be reduced significantly with the ACS implementation. Based on these findings, a proposal was then recommended to the shipyards on how ACS can be initiated. It is hope that with this recommendation, the quality of ship produced can be improved, hence reduces production cost and increase competitiveness.

ABSTRAK

Sistem Kawalan Ketepatan (SKK) dalam Industri pembinaan kapal telah terbukti dapat mengurangkan masa pengeluaran, kerja semula, membaiki produktiviti dan akhirnya didapatkan kualiti pengeluaran. Kaedah ini telah diguna pakai dalam syarikat pembinaan kapal di seluruh dunia khususnya diJepun, USA, Eropah. Dengan perkembangan terkini dikawasan perindustrian Batam yang semakin meningkat, dengan jumlah limbungan kapal pada masa ini telah melebihi empat puluh buah, maka penggunaan SKK dijangkau dapat membawa kesan yang besar kepada pembinaan kapal dan seterusnya meningkatkan daya saing. Oleh kerana itu, penyelidikan ini telah dilakukan untuk menentukan status tahap penggunaaan SKK di kawasan Batam, kemudianya mengutarakan cadangan untuk pembaikan atau pelaksanaan mengikut diperlukan. Penyelidikan ini dimulai dengan dua kajiselidik iaitu; pertama kajiselidik secara umum terhadap empat belas limbungan kapal dengan menggunakan borang soal selidik untuk menentukan tahap penggunaan SKK dilimbungan kapal di Batam. Kajian kedua pula adalah secara terperinci yang telah dilakukan dilimbungan PT. Pan-United untuk mengetahui sistem kualiti yang digunakan. Satu kajian percubaan terhadap SKK telah dilakukan pada limbungan kapal ini. Blok buritan (Blok 1) dari projek kapal yang sedang dibina (Hull 163) telah dipilih untuk kajian ini dan pengukuran telah dilakukan dan dicatat keatasnya secara sistematik. Berdasarkan data dari hasil pengukuran, beberapa analisis telah dilakukan yang telah menghasilkan kesimpulan bahawa peratus bagi kerja semula, masa dan pembiayaan pengeluaran dapat diturunkan dengan penerapan SKK. Hasil dari kajian tersebut cadangan untuk pelaksanaan SKK telah di syurkan kepada limbungan kapal tersebut. Diharapkan dari kajian ini, kualiti kapal yang dikeluarkan dapat ditingkatkan, seterusnya akan menurunkan pembiayaan pengeluaran dan meningkatkan persaingan.

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LIST OF SYMBOLS

A	-	Required Design Dimensional
A_2	-	A Constant value for determine the UCL and LCL, which base on N
ACS	-	Accuracy Control System
ABS	-	American Bureau of Shipping
AUT	-	Area Under Tolerance
BPR	-	Business Process Re-Engineering
CNC	-	Cutting Nesting Computerize
d_2	-	A Constant value for determine sd, which base on N
D_3	-	A Constant value for determine LCL in Range Chat, which base on N
D_3	-	A Constant value for determine UCL in Range Chat, which base on N
FCAW	-	Flux Core Arc Welding
GMAW	-	Gas Metal Arc Welding
LWL	-	Lower Control Limit
MIG	-	Metal inert Gas
N	-	Number of Sample taken
QA	-	Quality Assurance
QC	-	Quality Control
QCI	-	Quality Checksheet Instruction
QP	-	Quality Procedure
QC	-	Quality Control
R	-	Range
	-	$X_{MAX} - X_{MIN}$

$\bar{R}$	-	R-Bar
	-	$\frac{\sum \text{Range}}{N}$
SAW	-	Submerge Arc Welding
sd	-	Standard Deviation
	-	$\frac{\bar{R}}{d_2}$
SMAW	-	Shield Metal Arc Welding
SPC	-	Statistical Process Control
SQC	-	Statistical Quality Control
T	-	Measurement
TIG	-	Tungsten Inert Gas
TPM	-	Technical Process Measurement
UCL	-	Upper Control Limit
WI	-	Working Instruction
WPS	-	Welding Procedure Specification
WQT	-	Welder Qualification Record
X	-	Measurement Taken – Design Requirement
	-	T - A
X_{MAX}	-	The highest X value from data/measurement taken
X_{MIN}	-	The lowest X value from data/measurement taken
$\bar{X}$	-	X-Bar
	-	$\frac{\sum X}{N}$
$\bar{\bar{X}}$	-	X-Double Bar
		$\frac{\sum \bar{X}}{N}$

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CHAPTER I

INTRODUCTION

1.1 Background of Study

Ship production involves many stages of fabrication process. Through out these processes, it is expected that dimension variance could occurred and if it is not managed properly it could cause dimensionally related problems which will lead to rework and delay. This problem can be controlled and minimized through good dimensional management practices called Accuracy Control System (ACS).

The use of accuracy control system ensures that parts can be manufactured to the required dimensions and tolerances. This system will minimize the potential rework during product assembly and that assure product quality. In ship production, this enables the building of large sections/ blocks/ modules with minimum dimensional variation and distortion that would require rework and potential impacting product performance. This ultimately equates to reduced production time, lower costs, and good product quality.

Accuracy Control System in shipbuilding industries has proven to have reduced production time, rework, and improved productivity and finally achieved quality product. This concept was first introduced in shipbuilding industries in 1980 by the Ikawajima-Harima Heavy Industries Co (IHI) and has been adopted by The US and European Shipbuilders a decade later. ACS has been documented in numerous technical papers and conferences in the shipbuilding field for over fifteen years.

Although ACS has been established for more that a decade and has been implemented in shipyard world wide especially in Japan, USA and Europe, the implementation in ASEAN country including Batam area has not been reported or studied.

Recently, there are forty-one (41) of Shipyards and Offshoreyards in Batam Island [1] and they are essential factors in the acceleration of economic growth to increase the local income, invite more the national and international investment [2]. In order to improve their productivity and meet the standard ship requirement, this ACS concept should be employed in order to maximize productivity and produce high quality product. With the high quality and low cost product, Batam shipyard industries could improve their capability to compete with other shipyard in the world.

1.2 Statement of The Problem

In the carrying out the ACS study, several issue will be addressed as follow;

1. What is the present status of Accuracy Control System implemented in Batam shipyards?
2. For the shipyards which already implement the ACS, how successful are they and what are the problems faced?
3. For shipyard without Accuracy Control System, what is their present quality system employed and how ACS can be initiated?

1.3 Objectives

The objectives of this project are as follow:

a. To determine the present status application of accuracy control system in Batam shipyards in general.

b. To carry out detail study in a selected shipyard in order to propose or to improve the implementation of ACS

1.4 Scopes

The scopes of this project are as follow:

1. Study in generally of the present status of Batam shipyards in implements Accuracy Control system.
2. Study in details of the present status of selected shipyard in implements Accuracy Control system. The selected shipyard will be selected one from three of Batam major shipyards; Mc. Dermott Batam or Nippon Steel Batam or Pan-United Indonesia Batam.
3. Study of the rework based on one block only, and determine the obstacle and caused of rework which are faced, benefits implement of ACS to the selected shipyard.
4. Study of suitable approach in order to improve the ACS in selected shipyard.

1.4.1 Schedule of Activities

To do of this project, the schedules of activities are shown in Table 1.1 and Table 1.2. In Table 1.1 is pre-project which divided into seven task activities which are contains i.e. selection of topic, literature review, preliminary survey, preparation report of project 1, date submit of proposal, preparation of presentation and project 1 presentation. This project activity is start on 21 June 2004 to 24 October 2004.

Table 1.1 : Project Activities on 1ST Semester between 21 June 04 through 23 December 04

No	Description	Start	Finish	Mounts / Week																	
				June		July 04				August 04				September 04				October 04			
				3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Topic Selection	21/06/04	07/06/04																		
2	Literature Review	07/06/04	31/08/04																		
3	Preliminary Survey	03/08/04	15/08/04																		
4	Preparation Report	01/09/04	01/10/04																		
5	First Report (Proposal)	02/10/04	02/10/04																		
6	Preparation Presentation	02/10/04	10/10/04																		
7	Presentation	22/10//04	22/04/04																		

Table 1.2 shows the activities of project 2 which are contain of eight task activities i.e. general survey and detail survey activates, the analysis of the collection of data, prepare the result and discussion, and lastly prepare the final report and the final presentation. Its will continue from 25 October 2004 until 27 March 2005.

Table 1.2 : Project Activities 2ND Semester between 22 November 04 through 27 March 05

No	Description	Start	Finish	Mounts / Week																	
				Nov		December 04				January 05				February 05				March 05			
				3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Qualitative Survey	27/10/04	27/11/04																		
2	Submit Qualitative Survey	25/10/04	27/10/04																		
3	Collect Qualitative Survey	25/11/04	25/11/04																		
4	Analysis Collection Data	01/01/05	30/01/05																		
5	Preparation Report	01/02/05	14/03/05																		
6	Final Report	11/03/05	11/03/05																		
7	Preparation Presentation	11/03/05	24/03/05																		
8	Presentation	25/03/05	25/03/05																		

1.5 Research Methodology

The general survey will be subjected to present status of Batam shipyards in implement the Accuracy Control System and the detail study in the selected shipyard on the implementation of the ACS and finally to propose or to improve the implementation of ACS.

1.5.1 General Survey

In order to conduct the general survey, the procedure are to survey the Batam shipyard based on the questionnaire and the data will be complied through statistical technique. The questionnaire will be made base on the Accuracy Control Standard which have been documented and presented in journals and books. The flowchart of general survey is shown in Figure 1.1.

1.5.2 Detail Survey

The detail survey will be conducted by gathering information about statistical process control (SPC) data from a selected shipyard in order to maximize their productivity reduce the rework, based on data from projects that have done in period 2000 through 2005. This survey will conduct at three phases; planning, executing and evaluating [7]. The flowchart of detail survey is shown in Figure 1.2

In other site, if selected shipyard not use the ACS for achieves the aims of the project, the survey will conducted in present running project. The data required to be taken in planning and executing phases. In executing stage the data will taken based on one block construction only.

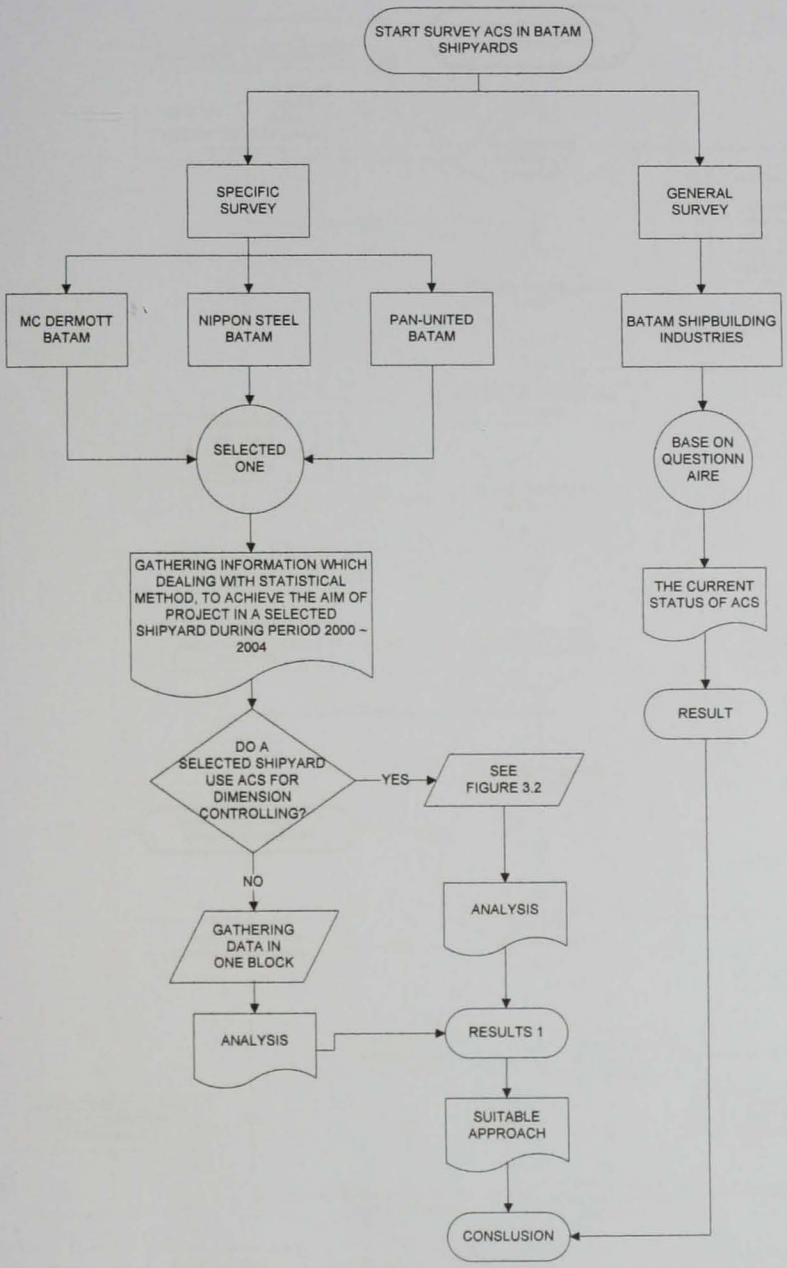

Figure 1.1 Flowchart for Conduct Detail survey and General Survey

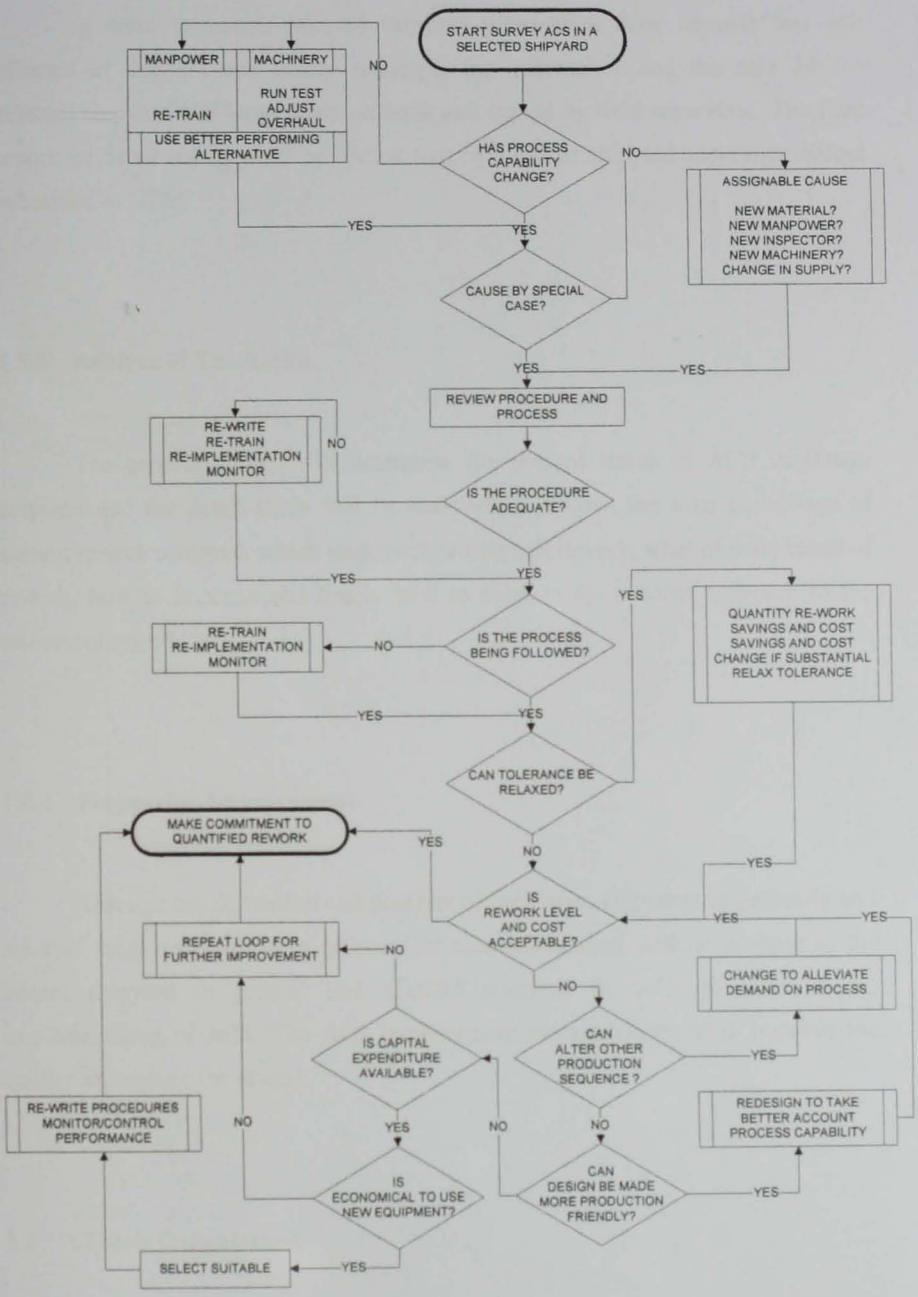

Figure 1.2 Flowchart of Guideline Conducting Detail survey

In order to secure selected shipyard information data, because this will effected to shipyard and author activities, the information and the data for the selected shipyard will write down on book and signed by field supervisor. The final report for detail survey shall be review first by selected shipyard supervisor before submitted to UTM.

1.5.3 Analyze of The Result

The general survey will determine the present status of ACS in Batam shipyard and the detail study will be analyzed as follow; the total percentage of current rework occurred, which stage required highest rework, what of main cause of rework, how to improve and finally how to propose the suitable approach to the selected shipyard.

1.5.4 Proposal of Improvement

Through the discussion and analysis of the Batam shipyards in generally and selected shipyard in detail, a proposal of recommendation will be propose to the Batam shipyard in general and selected shipyard in order to improve the implementation of ACS. The ACS improvement proposal initiated to improve the quality and reduce the rework.

1.6 Thesis Organization

This thesis started with Chapter 1; introduction of ACS, the issue will be addressed, the expected outcome of this thesis. Beside those sections, methodology research section is methods which are be used to achieve the aim of this project. The second chapter is literature review, in this chapter will be describes the related

research study which had been conducted in many shipyards in the world. The next chapter is the ACS theory, which describe how, what, which, who and why ACS implemented from planning phase, executing phase and analysis phase. The fourth chapter will be describes the result of the general survey and the detail survey, while the ACS application in a selected shipyard will be discussed in this chapter. Furthermore, results from the ACS Application will be analyzed for the quality improvement and all this analyzes will be described in chapter five. Based on result and data of the chapter four and five, the proposal for ACS application improvement will be proposed to Batam shipyards and a selected shipyard. Finally, the conclusion of this thesis is presented in chapter seven.