# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## DEVELOPMENT OF AUTOMATED MAYNARD OPERATION SEQUENCE TECHNIQUE (MOST) WORK STUDY TECHNIQUE: CASE STUDY AT AEROSPACE MANUFACTURING COMPANY USING LEAN SIX SIGMA

This report submitted in accordance with requirements of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Management) with Honours.

by

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FACULTY OF MANUFACTURING ENGINEERING

2010

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# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**BORANG PENGESAHAN STATUS PROJEK SARJANA MUDA (PSM)**

TAJUK: DEVELOPMENT OF AUTOMATED MAYNARD OPERATION SEQUENCE TECHNIQUE (MOST) WORK STUDY TECHNIQUE: CASE STUDY AT AEROSPACE MANUFACTURING COMPANY USING LEAN SIX SIGMA

SESI PENGAJIAN: 2008/2009

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# ABSTRACT

This project addresses the application of Maynard Operation Sequence Technique (MOST) in manufacturing industry. The case study has been conducted in order to improve the current workplace environment from the manual system into the automated system. Hence, the development of the MOST (Maynard Operation Sequence Technique) template required the application of Lean Six Sigma where the Lean tools and techniques combined together with Six Sigma approach to achieve effective result. The objectives of the project is to develop an automated MOST template and perform work study in order to identify various waste occurring at selected production area. For this project, the aerospace manufacturing company selected which is a strategic platform to conduct the case study because this company already implement the MOST (Maynard Operation Sequence Technique) but in manual way. Killing two birds with an arrow, this project is a stepping stone that will give advantages to the both side of student and company themselves.


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# ABSTRAK

Projek yang dijalankan ini menekan penggunaan *Maynard Operation Sequence Technique (MOST)* teknik dalam industri pembuatan. Projek ini dijalankan bertujuan bagi meningkat suasana tempat kerja daripada menggunakan sistem manual kepada sistem automatik. Sekaligus, pembangunan *MOST (Maynard Operation Sequence Technique) template* menerusi penggunaan konsep *Lean Six Sigma* di mana teknik-teknik *Lean* bersama kombinasi *Six Sigma* dapat mencapat keputusan yang lebih berkesan dan bagus terutama kepada kajian kes yang dejalankan. Objektif projek ini ialah untuk membangunkan sistem automatik *MOST (Maynard Operation Sequence Technique) template* dan menjalankan kajian kes bagi mengkaji situasi yang membuktikan *template* baru membantu meningkatkan suasana kerja. Bagi mencapai objektif ini, sebuah kilang pembuatan untuk aero-angkasa dipilih sebagai sebuah platfom yang strategik kerana kilang pembuatan ini telah menjalankan kaedah *MOST (Maynard Operation Sequence Technique)* tetapi secara manual. Maka, projek ini dirangka sebagai batu loncatan yang membawa kebaikan kepada kedua-dua belah pihak iaitu pelajar dan juga syarikat.


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# DEDICATION

In the name of Allah S.W.T, Most Gracious, Most Merciful

A special dedicated to my beloved parents, En. Hj Ahmad bin Hashim and Puan Siti Halimah binti Shaari, whose care, unconditional love and sacrifice resulted in where I stand today. There are the best parents in the world – true blessings from God, indeed!!!

To my beloved family, whose sincerity, love, care and thoughtfulness that gave me the energy to complete this project. I love you all

To my supervisor, Puan Rohana binti Abdullah at
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And lastly to my entire lecturers, friends and other people who have encouraged, guided and inspired me throughout my education's journey.

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In the name of Allah, Most Gracious, Most Merciful

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Finally, I also express my deep gratitude to those who directly or indirectly helped me in completing this PSM project. This project is the result of the direct and indirect contributions of all these individuals. I am ever grateful to them.

Thank You Again, Wassalam.

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# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| AC | - | Aero-Composite |
| DMADV | - | Design, Measure, Analyze, Design, Verify |
| DMAIC | - | Define, Measure, Analyze, Improve and Control |
| DPMO | - | Defect Per Million Opportunities |
| FLELP | - | Fixed Leading Edge Lower Panels |
| FMEA | - | Failure Mode and Effect Analysis |
| IOFLE | - | Inboard Outer Fixed Leading Edge |
| MOST | - | Maynard Operation sequence Technique |
| MTM | - | Method-Time Measurement |
| MTM1 | - | Man-To-Machine (for 1 machine) |
| MTM2 | - | Man-To-Machine (for 2 machine) |
| NT | - | Normal Time |
| NVA | - | Non Value Added |
| OLE | - | Overall Labor Effectiveness |
| PDCA | - | Plan-Do-Check-Act |
| PHM | - | Prognostic Health Management |
| PTS | - | Predetermine Time Standard |
| R&D | - | Research & Development |
| ROI | - | Return of Investment |
| RUL | - | Remaining Health Management |
| SIPOC | - | Supplier, Input, Process, Output and Customer |
| SMED | - | Single-Minute-Exchange-Die |
| SPC | - | Statistical Process Control |
| ST | - | Standard Time |
| TMU | - | Time Measurement Unit |
| TPS | - | Toyota Production System |
| UK | - | United Kingdom |
| USA | - | United State of America |


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| | | |
|---|---|---|
| UTeM | - | Universiti Teknikal Malaysia Melaka |
| VA | - | Value added activities |
| σ | - | Sigma |

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# CHAPTER 1
# INTRODUCTION

Chapter one, the introduction of this report, describes the motivation for the project. The problem statements are also stated. The objectives, scope of the project, project significance and the expected output of this project are also presented in this chapter.

## 1.1 Project Background

This study addressed the application of lean six sigma concepts to the productivity and performance in the aerospace manufacturing industry. After World War II, Japan industry especially manufacturing industries had desperately looking to the new idea and technology to develop back their economy. Following by that, Thiichi Ohno and Shigeo Shingo introduced the concept of the Toyota Production System (TPS) which today also known as Lean Manufacturing. The main idea of this concept is eliminating waste. Technically, waste is anything that does not add any value to the activity. Taiichi Ohno initially has describe seven type of waste include overproduction, waiting, transportation, high inventory, unnecessary motion, over-processing, defective.

At that time, Europe and United States leave too far from what the Japanese has developed. In that case, European and American come to Japan for study about what the Japanese has implemented to increase their economy. As matter of fact, in 1990 James Womack wrote a book called “The Machine That Changed The World”. In his book, Womack has straightforward account of the history of automobile manufacturing


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combined with the study of Japanese, European, and American automotive assembly plants.

Lean Six Sigma is a highly disciplined process that helps company to focus on developing and delivering near-perfect products and services. The word is a statistical term that measures how far a given process deviates from perfection. The central idea behind Six Sigma is that if we can measure how many "defects" have in a process, which can systematically figure out how to eliminate them and get as close to "zero defects" as possible.

Manufacturing industries nowadays is extremely interested with the term of Lean Six Sigma where the power of combining these two tools are belief can help to increase the company performance and productivity. The manufacturers wish to survive and grow in this industries are faced with the ultimate need to reduce cost. In fact, the flow of the process planning need to be emphasized because at this stage of process contributes a lot for company productivity. The "Production without waste" only can be realized by taking consideration in term of increased the Value Added (VA) and eliminate Non-Value Added (NVA) of the activities.

## 1.2 Problem Statements

Recently, this aerospace manufacturing company has developed the team to perform the work study for the critical operation. However, they have used the traditional method of taking the data using the stop watch. Moreover, the data entry process was done manually which was very tidiness and took a long time to complete. To improve the data accuracy, the team started to use Maynard Operation Sequence Technique (MOST) to review the work study data. The application of Maynard Operation Sequence Technique (MOST) technique has successfully improved the data accuracy but the data entry process into Maynard Operation Sequence Technique (MOST) Excel template was still very tedious and time consuming. Moreover, there was also the possibility of doing


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