UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PROPOSE OF SUITABLE SYSTEM TO IMPROVE THE DUST COLLECTOR SYSTEM IN TRIM BOOTH CTRM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Manufacturing Engineering Technology (Process and Technology) with Honours.

by

LEE CHAI FEN
B 071410238
940516-01-6602

FACULTY OF ENGINEERING TECHNOLOGY
2017

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: Propose of Suitable System to Improve The Dust Collector System in Trim Booth CTRM

SESI PENGAJIAN: 2017/18 Semester 1

Saya LEE CHAI FEN

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (✓)

☐	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	TIDAK TERHAD	

Disahkan oleh:

_____ _____

Alamat Tetap:

15, Jalan Emas 1,

Taman Bukit Makmur

85010 Segamat, Johor

Cop Rasmi:

Tarikh: _____ Tarikh: _____

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

FAKULTI TEKNOLOGI KEJURUTERAAN
Tel : +606 234 6623 | Faks : +606 23406526

Rujukan Kami (Our Ref) :
Rujukan Tuan (Your Ref) :

18 DEC 2017

Pustakawan
Perpustakaan UTeM
Universiti Teknikal Malaysia Melaka
Hang Tuah Jaya,
76100 Durian Tunggal,
Melaka.

Tuan/Puan,

PENGKELASAN LAPORAN PSM SEBAGAI SULIT/TERHAD LAPORAN PROJEK SARJANA MUDA TEKNOLOGI KEJURUTERAAN PEMBUATAN BACHELOR'S DEGREE IN MANUFACTURING ENGINEERING ECHNOLOGY (PROCESS AND TECHNOLOGY) WITH HONOURS: LEE CHAI FEN

Sukacita dimaklumkan bahawa Laporan PSM yang tersebut di atas bertajuk *"*Propose of Suitable System to Improve The Dust Collector System in Trim Booth CTRM*"* mohon dikelaskan sebagai *SULIT / TERHAD untuk tempoh LIMA (5) tahun dari tarikh surat ini.

2. Hal ini adalah kerana IANYA MERUPAKAN PROJEK YANG DITAJA OLEH SYARIKAT LUAR DAN HASIL KAJIANNYA ADALAH SULIT.

Sekian dimaklumkan. Terima kasih.

Yang benar,

_____
Tandatangan dan Cop Penyelia

* Potong yang tidak berkenaan

NOTA: BORANG INI HANYA DIISI JIKA DIKLASIFIKASIKAN SEBAGAI SULIT DAN TERHAD. JIKA LAPORAN DIKELASKAN SEBAGAI **TIDAK TERHAD**, MAKA BORANG INI **TIDAK PERLU DISERTAKAN** DALAM LAPORAN PSM.

DECLARATION

I hereby, declared this report entitled "Propose of suitable system to improve the dust collector system in trim booth, CTRM" is the results of my own research except as cited in references.

Signature	:	…….
Author's Name	:	LEE CHAI FEN
Date	:	

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor's Degree in Manufacturing Engineering Technology (Process and Technology) with Honour. The member of the supervisory is as follow:

……

Nur Farah Bazilah Binti Wakhi Anuar

ABSTRAK

Peningkatan semasa manual trim stesen adalah matlamat utama dalam projek ini. Kepincangan sistem pengumpul habuk yang menyebabkan kakitangan perlu membersihkan secara manual sehingga debu yang terperangkap dalam lorong sistem pengumpul habuk. Ini akan membawa kesan yang serius kepada pekerja-pekerja di sekitar stesen kawasan kerja trim kerana zarah debu tersebar dan tersebar di sekitar kawasan itu. Yang tidak mencukupi sedutan udara akan menyebabkan ketidakcekapan mengurangkan operasi dan ini akan menyebabkan kualiti miskin produk akhir. Oleh itu, pekerja perlu kerja semula kerana pencemaran pada permukaan bahagian menjejaskan kualiti bahagian. Pekerja juga perlu untuk mengumpul secara manual dan membersihkan semua debu setiap minggu dan pengumpulan habuk mengambil masa lima hingga enam jam yang boleh dikatakan bahawa pembaziran tenaga kerja. Selain itu, debu yang terperangkap di udara dan terlekat pada dinding dan lantai kerana tiada sistem bertiup di kawasan stesen trim. Selain daripada itu, bahaya bunyi akan mewujudkan dan akan kesan buruk ke atas sistem pendengaran. Yang tidak cekap sistem pengumpul habuk di stesen trim juga menyebabkan CTRM mengalami kerugian terutamanya dalam kos. Oleh itu, manual trim stesen semasa yang telah digunakan sejak empat tahun yang lalu perlu bertambah baik kerana yang direka, penyelenggaraan dan keupayaan yang membawa isu utama seperti alam sekitar, keselamatan dan kesihatan kepada semua kakitangan dalam CTRM terhad.

ABSTRACT

The improvement of current manual trim booth is the main aim on this project. The malfunction of the dust collector system that cause the staff need to manually clean up the dust that trapped in the drain of the dust collector system. This will bring serious impact to workers around the trim booth working area because the dust particle dispersed and spread out around the area. The insufficient of suction of air will cause inefficiency of trimming operational and this will cause poor quality of the final product. Therefore, worker need to rework because of the contamination on part surface affect parts quality. Workers also need to manually collect and clean up all the dust every week and the collection of dust take five to six hours which can be said that waste of manpower. Besides, the dust trapped in the air and stick to the wall and floor due to no blowing system in trim booth area. Other than that, noise hazard will create and will adverse impact on hearing system. The inefficient of dust collector system in trim booth also causes CTRM suffer losses especially in cost. Thus, the current manual trim booth which has been used since for past four years need to be improve due to its limited designed, maintenance and capability that bring major issue such as environment, safety and health to all employees in CTRM.

DEDICATION

To my beloved parents, Lee Bon Leong and Tan Siew Hong whose words of encouragement and push for tenacity ring in my ears. I also dedicate my dissertation work to my sisters Lee Chai Pei and Lee Chai Li for giving support and relieve stress in my research.

A special dealing of gratitude to my friend, Carol Pan Zi Ting who has accompany and supported me throughout this research. I also appreciate the support from Chee Yik Pei and Chang Chia Wen in giving advice relative to my technical knowledge. I also dedicate this study to Lok Soo Kee for guiding me in soft skill.

ACKNOWLEDGEMENT

I would like to thank my supervisor, Miss Nur Farah Bazilah Binti Wakhi Anuar who is more than generous with her expertise and precious time. Thank you for her countless hours of reading, reflecting, encouraging throughout this research and study. A special thanks to Mr. Mazran Bin Ahmad who gives advice and guidance during the final year project one. The completion of this research is a valuable experience with their connotation and willingness to give feedback.

I wish to acknowledge and thank Miss Mariyah, the people in-charge in trim booth, CTRM for continued support with giving information that allowing me to conduct my research and providing assistance requested.

TABLE OF CONTENT

LIST OF TABELS

LIST OF CHARTS

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

CTRM	-	Composites Technology Research Malaysia Sdn Bhd
FYP	-	final year project
NPTEL	-	National Programme on Technology Enhanced Learning
OSHA	-	Occupational Safety and Health Administration
EHS	-	Environment/ Health/ Safety
GFS	-	Global Finishing Solutions
CFM	-	Cubic feet per minute
QC	-	Quality control
TSB	-	Transportation Safety Board
C	-	Cause
E	-	Effect
DMAIC	-	Define, measure, analysis, improve, control
ACGIH	-	Association Advancing Occupational and Environmental Health
DOSH	-	Department of Occupational Safety and Health
IAQ	-	Indoor Air Quality
ASHRAE	-	American Society of Heating, Refrigeration, and Air Conditioning Engineerings
MERV	-	Minimum Efficiency Reporting Value
NAFA	-	National Air Filtration Association
NASA	-	National Aeronautics and Space Administration
PPE	-	Personal protective equipment
UAS	-	United Air Specialists
TLV	-	Threshold Limit Values
PEL	-	Permissible Exposure Limit
TWA	-	Time Weight Average
MCB	-	Main Control Board

SOP	-	Safety Operation Procedure
mg/m^3	-	milligram per meter cube
h/d	-	hour per day
d/wk	-	day per week
◦C	-	degree celsius
m	-	meter
kW	-	kilowatt
µm	-	micrometer

CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter generally present the project background, problem statement, objective and scope to make reader understand the topic and flow that this project. This chapter also reveal the clear mindset of researcher. An efficiency solution or method is proposed to improve the malfunction of the dust collector system in trim booth CTRM after this research done.

1.1 Project Background

Composites Technology Research Malaysia Sdn Bhd (CTRM) is the company that chosen to complete this project. It is consigned with a strategic role to develop high technology based industry, in other words, it is the Aerospace and Composites industries. According to Bernan, aerospace industry included companies producing aircraft, guided missiles, spaces vehicles, aircraft engines, propulsion units and related parts. Aircraft overhaul, rebuilding, and conversion also comprised. There are 42 percent of full-time workers were injury cause in the aerospace products and parts industry (Bernan, 2008).

Nowadays, various composites materials have been used in aerospace engineering industry not only because of the capability of change of their properties in compliance with structural assignment but also a broad range of chemical characteristics and physicomechanical (G.I. Zagainov et al., 2012). Sanjay Mazumdar also determined that most of the transportation industry use composite materials because the products fabricated by using composite materials are in light weight and relatively stronger.

Pinckney. R.L. defines that the combination of materials for its special properties provided, design flexibility and versatility of trimming the material properties by selecting related fibres which having high or low modules, fibre orientation, concentration and distribution of fibres and selection of cross sectional area, and fabrication techniques has make the composite product development success. Most of the transportation industry choose to use composite materials because the combination of two or more materials that make the composite is more work than just using traditional monolithic metals such as steel and aluminium (Autar K. Kaw, 2005).

Although composite materials have its advantages to fabricate many parts of aerospace, it also consists limitation. Here is the problem facing in CTRM. Most of the aerospace parts will be manufactured by using the process of trimming, chamfering and drilling but the most attention process in this project is trimming process in trim booth CTRM. The breakdown of the dust collector system causes the staff in trim booth need to manually clean up the dust (carbon fibre composite) that trapped in the drain of the dust collector system. This will bring serious impact to workers around the trim booth working area because the dust particle dispersed and spread out around the area. Workers may have respiratory disease if they accidentally inhale the carbon dust. This is because less than 0.1 micrometers of ultrafine particles have been indicated to deposit by diffusion throughout the respiratory tract (Feron et al., 2001).

Carbon fibre composite dust will be dispersed around the working area when manufacturing process done to carbon fibre composite and these processes may cause an occupational risk (Jones HD et al., 1982). Owen et al. also has proved that these carbon fibre composite will cause harm to human body with his experiment that exposed rats to polyacrylnitrile based carbon fibre (20 mg/m^3) for about 16 weeks (6 h/d, 5d/wk). In this experiment, he found that the respirability of the rats become low and cause lung burden. This is because of the accumulation of alveolar macrophages. Therefore, carbon fibre composite dusts need to be set according to the occupational exposure limits by a well function of dust collector system.

Dust collection has the aim of reducing the dust, ensure the safety and health of employees, improve the quality of products and guarantee of products by collecting and taking away the composite in local environment that bring harm to human body**.** The breakdown of dust collector system in trim booth will make the dust particles that drift around the air and stick on the product surface, machines and workers (Mcfadden

et al., 2002). The insufficient of suction of air will cause inefficiency of trimming operational and this will cause rotten quality of the final product. According to Johnson Q.G., 2008, this situation happened maybe because of the smaller exhaust fan not provide necessary speed to endure the additional airflow resistance and the result is low air velocity that causes carbon dust to spread out of the air and block the ducts. Therefore, worker need to rework because of the contamination on part surface affect parts quality. Other than that, workers also need to manually collect and clean up all the dust every week and the collection of dust take five to six hours which can be said that waste of manpower. This cleaning up process cannot exceed than 8 hours that stated in the noise exposure standard by ACGIH.

Besides, the dust trapped in the air and stick to the wall and floor due to no blowing system in trim booth area. Other than that, noise hazard will create and bring adverse impact on hearing system. There are many detrimental effects such as lower down the performance, high blood pressure, hard to sleep and temporary hearing loss that cause by the higher level of noise (Frank R. Spellman et al., 2011). The inefficient of dust collector system in trim booth also causes CTRM suffer losses especially in cost. Thus, the current manual trim booth which has been used since for past four years need to be improve due to its limited designed, maintenance and capability that bring big issues such as environment, safety and health to all employees in CTRM.

1.2 Problem Statement

The dust collector system in trim booth malfunction and cause the dust carbon particle dispersed and polluted in the working area. Therefore, high manpower turn over due to the poor environment and safety issue. The dust carbon is considered a dangerous component that will cause severe health problem to the staff that work in the trim booth CTRM. Besides, the company may face the problem of profit decline due to the high manpower and the waste of resources. Thus, a fast, simple and relatively inexpensive method need to be apply in the trim booth. After the project, the health of staff can be guarantee. Other than that, the productivity production line in trim booth will indirectly improve.

1.3 Objective

The main objective of this project is to study and recommend solution to improve the dust collection system in trim booth CTRM:

I. To propose suitable system to improve the dust collector system in trim booth.
II. To recommend cost effective dust collector system.
III. To validate the recommended system is suitable to be used in trim booth.

By the suitable and inexpensive system that apply in trim booth, the situation of breakdown of dust collection system can be improve and the carbon fibre composite dusts can be reduced. Other than that, the waste of manpower (staff that need to clean up the carbon fibre composite dusts every week) in this department can be improved. This will make the production line works smoothly, increase productivity and ensure health of employees in this department.

1.4 Scope

This project has been done in trim booth CTRM by focusing on the problem of dust collector system. Data collected in the form of interview or survey from trim booth staff. This project is focus on the recommendation system which is DustHog MCB series cross ventilation cartridge dust collector in CTRM to improve the current manual trim booth in CTRM. DustHog MCB series cross ventilation cartridge dust collector is limited by the people in-charge in trim booth, CTRM. The comparison of cost of the recommendation system and the existing system also has been considered in this project. Besides, the study has been conducted on proposed system to make sure it is suitable to be used in trim booth, CTRM.

1.5 Organization of Report

Researcher can learn and has an experience of conducting a good research project. There are three chapter for Final Year Project (FYP) I and another two chapter in FYP II. The table below indicate some explanation of each chapter:

Table 1.1 Organization explanation

Chapter	Title	Explanation
1	Introduction	Consist of project background, problem statement, objective, scope
2	Literature Review	Discussion of published information in a particularly subject area. Summarize and synthesize the ideas of others.
3	Methodology	Design and planning of the research.
4	Result, Analysis and Discussion	Discussion of summary data
5	Conclusion and Recommendations	Conclude all the process done before and state the improvement

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter will describe about the aerospace manufacturing industry and the major materials used in aerospace industry. Carbon dust hazard and the requirement of dust collection system to improve the carbon dust.

2.1 Aerospace manufacturing industry

Aerospace industry is the company that involves the research, design, development, manufacture, and production about all the aviation business like aerospace systems, including manned and unmanned aircraft; missiles, space-launch vehicles, and spacecraft; propulsion, guidance, and control units for all the foregoing; and a variety of airborne and ground-based equipment essential to operation, testing, and maintenance of flight vehicles is known as aerospace industry (John G. Wensveen, 2007). The main product and service in CTRM is on aero structure which focus on Nacelle and Wing programs but this company also expand the business into automotive, marine and other land transports.

Nacelle is streamlined enclosures used primarily to protect the main frame and the components attached to it. Figure 2.1 show the difference parts of the nacelle. The main function of nacelle is to reduce the aerodynamic resistance from wind therefore nacelle is ellipse or round in shaped. The engine and nacelle are positioned in front end of fuselage for most of the single-engine aircraft while for multiengine aircraft, the engine and nacelle is placed in to the wings or attached to the fuselage at the tail part of fuselage or in other word, empennage.

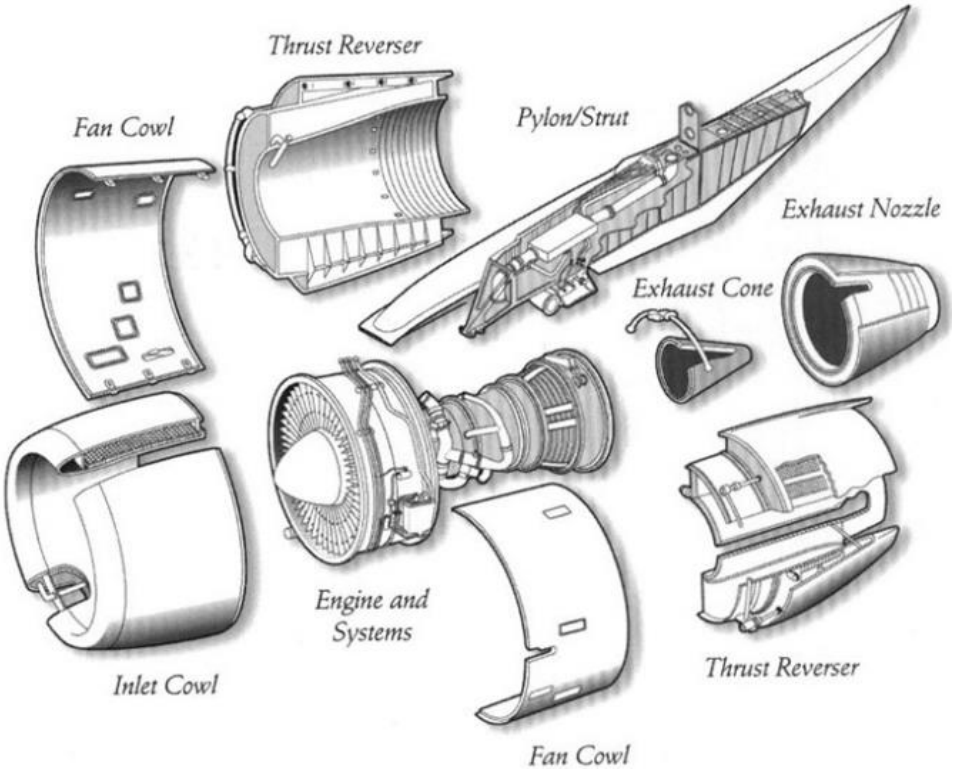

Figure 2.1 The difference parts of the nacelle (Cadence Aerospace)

2.1.1 Manufacturing process towards composite materials

The operations that involves in CTRM are aerospace manufacturing, assemblies and composite testing but manufacturing process is the main operation in the industry. The mechanical properties of composite materials make it become more and more popular to be used in fabrication of aerospace products. Thus, the manufacturing process like cutting, drilling, trimming, part removal and joining process are important to apply in the fabrication of composite materials based products. The using of manufacturing process is depend on the size, geometry and raw material input used to the parts.

Processing operation and assembly operation are the type of manufacturing process. The transformation of materials from one state to another advanced state is called processing operation. In this operation, the change of appearance, properties, and shape of the staring materials will

happen when other materials are added to it. For aerospace industry, the processing operations are performed not only on assembled items but also the on individual components. Assembly operation can be defined as the joining of two or more components and result a new entity by joining process. Chart 2.1 show the classification of manufacturing process.

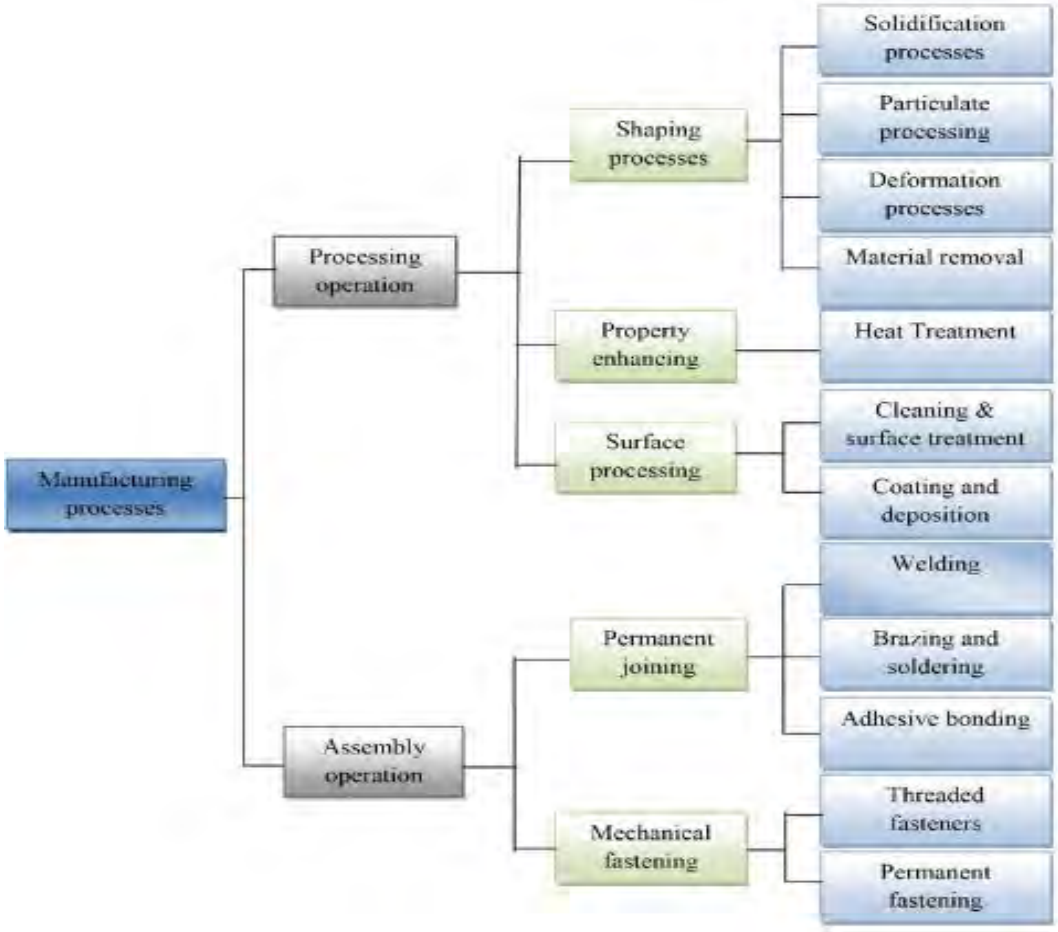

Chart 2.1 The classification of manufacturing process (NPTEL)

All the machining tools need to be select carefully due to the nature and variety of composite material, if not surface roughness on the parts will produced and may cause the shorter lifetime of the products (Guneri Akovali, 2001). Besides, trimming and other machining operations are required to produce high accuracy and smooth surface before the composite materials parts being assembly (S.T. Peters, 1998). This show the important of manufacturing process to produce aerospace components.