

**ANALYSIS THE AWKWARD POSTURE
ERGONOMIC RISK AND WORKSTATION
SIMULATION AT AERO COMPOSITE INDUSTRY
(MECHANICAL ASSEMBLY)**

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WORKSTATION SIMULATION AT AERO COMPOSITE INDUSTRY
(MECHANICAL ASSEMBLY)**

This report is submitted in accordance with requirement of the University Teknikal Malaysia Melaka (UTeM) for Bachelor Degree of Manufacturing Engineering (Hons)

by

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirement for Degree of Manufacturing Engineering (Hons). The member of the supervisory committee are as follow:

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(Puan Ruzy Haryati Binti Hambali)

ABSTRAK

Risiko ergonomic adalah isu yang sering diperdengarkan dalam sektor industri pengilangan berpunca daripada kurang pengetahuan tentang cara postur yang betul dan ilmu tentang ergonomic itu sendiri. Berdasarkan kajian yang telah dibuat ia menunjukkan bahawa postur yang janggal dan kerja berat adalah isu yang sering berlaku dalam Aero Composite industry kerana industri ini banyak menggunakan proses secara manual. Tujuan kajian ini dilaksanakan adalah untuk menganalisis postur kerja di Aero Composite Industry. Empat objektif telah dibuat berdasarkan kenyataan masalah. Objektif pertama adalah, projek ini telah menggunakan kaedah RULA untuk menganalisa tahap risiko pekerja paling tinggi semasa bekerja. Kaedah yang digunakan dalam objektif ini adalah meniru postur pekerja dan menganalisa RULA menggunakan DELMIA V5 dan CATIA V5. Kemudian, untuk objektif kedua dalam projek ini adalah untuk membangunkan manikin dengan menggunakan populasi Aero Composite Industry. Manikin menggunakan populasi industri ini boleh digunakan untuk mengenal pasti RULA dan aktiviti pekerja yang sesuai semasa bekerja. Selain itu, projek ini adalah untuk mensimulasikan proses kerja pemasangan mekanikal untuk menganalisis risiko melalui simulasi. Projek ini menggunakan DELMIA V5 untuk mensimulasikan proses kerja di Aero Composite Industry. Oleh itu, simulasi ini telah dilakukan oleh simulasi global untuk keseluruhan jabatan dengan semua aktiviti proses manakala menyetempatan adalah aktiviti khusus yang telah dipilih berdasarkan aktiviti risiko tertinggi berlaku dalam Aero Composite Industry. Objektif terakhir adalah mencadangkan penambahbaikan kepada industri untuk membantu industri ini menyelesaikan isu-isu ergonomik serta meningkatkan produktiviti dan kualiti kehidupan para pekerja. Penyelidikan ini dijangka mewujudkan garis panduan reka bentuk untuk industri yang membantu pekerja menyelesaikan tugas yang lebih selamat dan lebih selesa di stesen kerja semasa bekerja.

ABSTRACT

Ergonomic risk is the common issues in manufacturing industry due to the less knowledge of ergonomic and awkward posture during working. Based on the previous study, it shows that awkward posture and heavy lifting were the most highlighted issues that occurs in Aero Composite industry because this industry that normally use manual handling working process. The aim of this study is to analyze the working posture at Aero Composite industry in mechanical assembly and suggest an conceptual design of improvement workstation. Four objective have been constructed based on the problem statement. The first objective that have been done the project use Rapid Upper Limb Assessment (RULA) in order to analyze the most level of risk of workers during working. The method that were used on this first objective are to make an RULA analysis CATIA V5 and DELMIA V5 is used to replicate the workers posture and make an RULA analysis. In this industry one of the highest ergonomic risk occurs at drilling activity. Then, for the second objective on this project is to develop manikin by using Aero Composite Industry population. This manikin industry population can be used to identify the RULA and the suitable activity of workers during working. Besides, this project is to simulate the working process of mechanical assembly to analyze the risk via simulation. This project use DELMIA V5 to simulate the working process at Aero Composite Industry. Therefore, these simulations have been done by globalize simulation for whole department with all process activity while localize is the specific activity that have been chosen based on the highest risk activity occurs in Aero Composite Industry. The last objective is to suggest improvement to the industry to assist this industry to solve the ergonomic issues as well to increase their productivity and quality of life of the workers. This research is expected to create a design guideline for the industry that help workers complete the job safer and more comfortable at the workstation during working.

DEDICATION

Thanks to god for giving me opportunity to complete this project successfully.

Thanks to my family that giving support from start until end of this project.

Thanks to my supervisor that always support and patient with me during this project occurs.

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LIST OF ABBREVIATION

RULA	-	Rapid Upper Limb Assessment
REBA	-	Rapid Entire Body Assessment
MSD	-	Musculoskeletal Disorder
NMQ	-	Nordic Musculoskeletal Questionnaire

CHAPTER 1

INTRODUCTION

1.0 Background of Project

Awkward posture is the most common issues nowadays is industry. This awkward posture issue can be explained as discomfort posture during working due to the muscle joint that is out of twisting limit or the muscle body does not have enough rest. In other words, the body has been compressed because of the workers have to performed their works in an extreme position. This issue has major impact to the performance of the workers. Therefore, in current manufacturing industry, the ergonomic in a workplace is important to the workers to ensure that they are in comfort level in order for the workers to increase the productivity and improve the quality of work and life.

In general, an Aero Composite Industry, general working tasks of the workers in this industry tends to perform an awkward posture. Based on observation that has been done during site visit at Aero Composite Industry it shows that the workers are doing their work manually such as manual drilling, push and pulling and heavy lifting. Besides, they need to lift the heavy part manually and this caused the muscle stress increased due to heavy lifting. In this project, it focusses on awkward posture and heavy lifting that have been done repeatedly.

Rapid Upper Limbs Assessment (RULA) analyze have been carried out during this project to analyze which part of the body having the high risk to get injuries at working stations. RULA is the analysis that focuses on human upper body. This method is used to investigate using commercial software DELMIA V5 software and generate to RULA analysis. From this RULA analysis, the result shows the body part with high risk and low risk of injuries.

Next, the ergonomic assessment has been taken in order to make the simulation using commercial Delmia V5. This software is used to simulate the movement of workers and worker activities in the industry. Body posture during working session is important during working because it cause fatigue for people. Orientation of body parts in working area while a worker performs a task can be defined as working posture (Nico *et al.*, 2004). Nowadays ergonomic is an important role in Malaysia because it can boost the productivity and competitiveness in Malaysia Industry. Based on the (SOCISO Annual report, 2012), it shows that the injuries in the head, neck, shoulder and lower limb, upper back and lower back.

Delmia V5 is the software that is applied to simulate the working process flow for some critical parts in the assembly and process flow. Delmia V5 is the combination between CATIA and Product Data Management (PDM) have to improve the productivity of industry. This software is used to see the worker activities, improve working posture of workers and to increase the productivity of industry. The DELMIA V5 is the platform allows manufacturing engineers to merge the virtual models of production equipment.

The aim and focus of this project is to emphasize on the scope of workers who suffer from muscle fatigue and whether or not it will affect the industrial productivity. Besides, this project is conducted using Nordic survey questionnaire, to analyze the limit of a person's ability level. The ergonomically designed workstation provides a healthy work environment, safety and increase efficiency and also reduce the work related to musculoskeletal disorder injuries. This research is expected to create a design guideline for the industry that can help workers complete the job safer and more comfortable at the workstation during working.

1.1 Problem Statement

This research conducted on the basis of observations in selected area of an Aero Composite Industry. Previous research reported that in aerospace industry, the most injuries arise from the issues of awkward posture and heavy lifting. There are several ergonomic risk factor which include repetition, awkward posture, excessive force or forceful exertions, vibration, static postures contact stress and extreme temperature (Jaffar *et al.*, 2011).

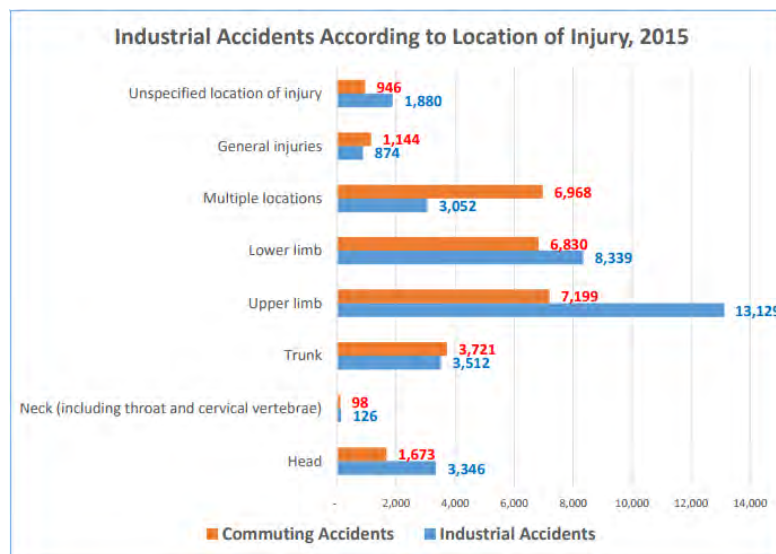


Figure 1.1: Industrial Accident (Bridger 2003).

According to (Bridger 2003) manufacturing industrial is the highest injuries occurs during working. This is due to posture that is being used unnecessarily based on workstation. In Figure 1.1 shows that upper limb injury the highest industrial accident trails by lower limb. These injuries caused from the safety issues, less knowledge and less training about ergonomic.

In addition, from the observation there are several information databases that have been collected from the workers at aerospace industrial. The main issue gained is back pain problem due to awkward posture and heavy lifting. Observation shows that the workers need to use high muscle strength during drilling process because the worker need to use upper body strength to push drill. Besides, the workers also need to lift heavy weight part to move

from place to other place. When this situation occurs in the industry it will directly affect the working task thus will affect the duration of mechanical part to be produced in aerospace industry.

1.2 Objective

Based from the problem statements stated, it necessary to come out with the clear and accurate solution regarding to the improved productivity. The objective for this research are as follow;

- 1) To investigate and analyze the working posture by using RULA method in relation to discomfort of workers.
- 2) To build manikin from the industry population using DELMIA V5.
- 3) To simulate the working posture and workstation layout using DELMIA V5 (Global and Local).
- 4) To suggest conceptual design of improvement workstation in industry.

1.3 Scope of Project

This project mainly focuses on the analysis and validation the workstation design. The target of this project is at the Mechanical Assembly Department of Aero Composite Industry. In this issues, it covers the human posture analysis during working and also covers the working movement of workers. Then, the Nordic survey have been given to 35 numbers of respondent at this department. When the surveys have been carry out observation and face

to face interview have been done. Besides, on this project elucidate the ergonomic issue due to increase the productivity of Aero Composite Industry. Commercially available, CATIA V5 and DELMIA V5 software used to simulate the design, RULA analysis and DELMIA V5 Simulation to prove the improvement and effective of the model. The limitation of the DELMIA V5 is it only just a simulation software but there no fabrication and real implementation regarding to the improvement posture. Lastly, this project focuses on the energy expansion that were used by workers per day by using DELMIA V5.

1.4 Significance of the Study

Results and outcome from this study can be applied in industry in order to solve the issue of working posture and working environment. The project significances are outline as follows:

- a) This project will come out with the solution how to improve the fatigue problem during working in industry.
- b) To develop the VR layout process.
- c) To increase the safety and health issue workers
- d) To increase the productivity and quality of product