"I verify that, I have read this report and from my opinion this thesis have fulfill the scope and quality requirement for Bachelor Mechanical Engineering (Design and Innovation)"

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Supervisor Name	: Mr. Hambali Boejang
Date	:……

REVERSE ENGINEERING APPLICATION IN THE DEVELOPMENT OF AUTOMOTIVE COMPONENT

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This report is submitted to the Faculty Mechanical Engineering in partial to fulfill the requirement for Bachelor Mechanical Engineering (Design and Innovation)

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MAY 2009

"I hereby declared that this report is a result of my own work except for the works that have been cited clearly in the references."

Signature : ……

Name : Elfirah Binti Ab. Rahman

Date : ……

My parents, supervisor and friends.

ACKNOWLEDGEMENT

First and foremost, my greatest gratitude to ALLAH S.W.T for giving me strength and opportunity to complete this report.

I would like to extend my appreciation to Mr. Hambali Boejang for his continuous support, concern, positive criticism and invaluable advice that helped me a lot throughout this project. Special recognition to all of every single person that helps me in any kind of help in my way to finish up my project during my time having problem and difficulties.

Finally, thank you to all individuals and groups who made this project as an exciting education period but are not being mentioned here.

ABSTRACT

The purpose of this project is to apply modern technologies such as Computer Aided Design (CAD), Reverse Engineering (RE), and Rapid Prototyping (RP) in the product development. The component will be selected and developed using Reverse Engineering system. Using RE system, the actual part will be scanned using 3Dimensional scanner and the scanned data will be manipulated in CAD using any CAD software. Then, using RP machine, the mock-up product will be fabricated from the 3D CAD data. Lastly, the mock-up product and the actual product will be analyzed using CAD to CAD analysis to know the deviation error.

ABSTRAK

Tujuan projek ini adalah untuk mengaplikasikan teknologi yang moden seperti Reka Bentuk Berbantukan Komputer (CAD), Kejuruteraan Terbalik (RE), dan Prototaip Pesat (RP) dalam pembangunan produk. Satu komponen akan dipilih dan dihasilkan menggunakan system Kejuruteraan Terbalik. Dengan menggunakan sistem RE, komponen asal akan diimbas menggunakan pengimbas 3Dimensi dan hasil data yang diimbas akan dimanipulasikan dalam CAD menggunakan sebarang perisian CAD. Kemudian, menggunakan mesin RP, produk model akan dihasilkan dari data CAD 3D. Akhirnya, produk model dan produk sebenar akan dianalisis menggunakan analisis CAD kepada CAD untuk mengetahui ralat sisihan.

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ABBREVIATION

PSM	Projek Sarjana Muda
CE	Concurrent Engineering
3D	Three Dimensional
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CAE	Computer Aided Engineering
RE	Reverse Engineeing
RP	Rapid Prototyping
IGES	Initial Graphics Exchange Specifications
STL	STereoLithography/ Standard Triangulation Language
FDM	Fused Deposition Modeling
ABS	Acrylonitrile Butadiene Styrene

CHAPTER 1

INTRODUCTION

1.1 Background of Project

In the traditional manufacturing process, information on how to achieve product quality, cost and variety is not fed back to the designer at a sufficiently early stage to be effective, so the whole process takes too long. The current trend in manufacturing technology requires high quality with acceptable levels of defects with a zero-defect philosophy [1]. It is also requires quick product design and can reduces manufacturing time due to time-to-market. In practice, a lot of product development is influenced by a combination of technology push and market pull. The push that comes from new technology especially in engineering, such as Computer Aided Design (CAD), Reverse Engineering (RE) and Rapid Prototyping (RP) and the pull is refers to market needs [2].

In this project, the relation between product development and technologies will be study. The methodology of the process using different way of product development will be done to see the difference and the applicable of the technology.

1.2 Problem Statement

Automotive industry currently has grown rapidly in this country. Parallel with this development, the demand for car's spare components and accessories are high. Therefore, to overcome this situation, the new technology of Reverse Engineering system can be seen as technology that can be apply in the development of automotive components to develop the data rapidly.

1.3 Aim of Project

The aim of this project is to apply modern technologies such as CAD, RE, and RP in the product development. The product that will be developed is a fog lamp. Using RE system, the actual part will be scanned and the scanned data will be manipulated in CAD. Then, using RP machine, the mock-up product will be fabricated from the 3D CAD data. Lastly, the mock-up product and the actual product will be analyzed using CAD to CAD analysis to know the difference of the dimension.

1.4 Objective

The objectives of this project are:

a. To develop CAD data for automotive component.
b. To produce the mock up of the automotive component.

1.5 Scope

The scopes of this project are:

a. To do literature search on design and product development, RE, RP and CAD.
b. To carry out the bottom up approach of design activities.
c. To manipulate the scanned data in CAD.
d. To fabricate the mock-up of the scanned data using RP machine.
e. To carry out part to part analysis.

CHAPTER 2

DESIGN AND PRODUCT DEVELOPMENT

2.1 Introduction

The demarcation between design and manufacturing may mean that quality is lost and that design changes to meet manufacturing requirements are needed at a late stage. These problems may be rectified by increased cooperative working between designers and manufacturing and other specialist throughout the product development phase. The design of the product and the manufacturing system should be developed simultaneously. This is known as concurrent engineering, which involves developing the design using multidisciplinary teams, combining expertise from such areas as materials, manufacturing processes, assembly, inspection, maintenance, marketing, performance and end use, and calling on specialist expertise, e.g. fatigue and fracture, or in noise and vibration [1].

2.2 Life Cycle of a Product

The life cycle of a product is shown in Figure 2.1. The life cycle of a product can be divided into 3 stages: the design phase, the manufacturing phase and the end-of-life phase. Traditionally, the design and manufacturing phases are separated and occur

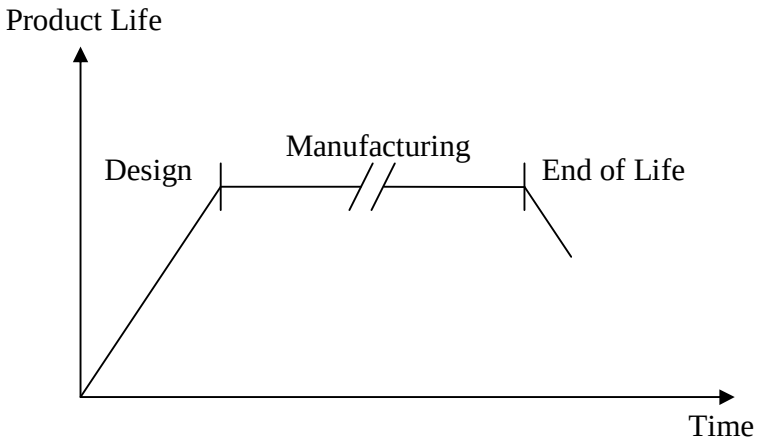

Figure 2.1: Product life cycle phase.

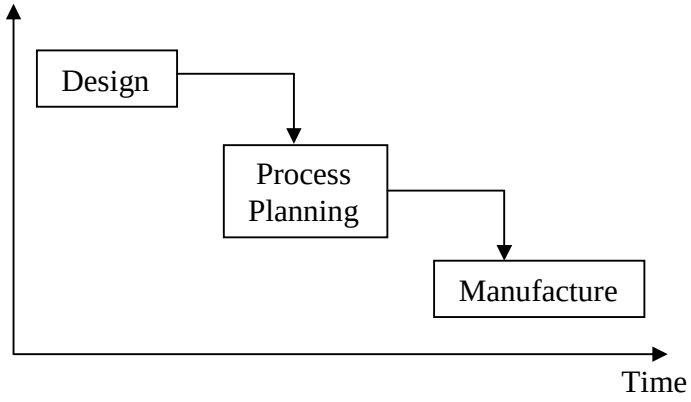

Figure 2.2: Sequential engineering.

sequentially with process planning as the activity which bridges the gap between the two phases, as shown in Figure 2.2. Thus, the design phase is used to prove a product design and to establish production methods before the product goes into production. For many products, the manufacturing phase which follows is characterized by years of steady output, during which it is hoped to recover the costs incurred at the design phase of the product and process development. Process planning is a relatively simple step, involving the translation of product and process design requirements into a set of manufacturing instructions which can be interpreted and carried out in the manufacturing facility.

In the present, manufacturing environment, the products are being continually redesigned and the useful life of a product is constantly under threat from competitors. This has restricted the manufacturing firms to invest resources in dedicated production facilities. Rather, flexible manufacturing systems are needed to cope up with existing product designs and future redesigns of these products [1].

2.3 Concurrent Engineering

Concurrent engineering (CE) deals with carrying out the design and manufacturing activities at the same time while designing the product. This allows the design engineer and manufacturing engineer to interactively trade off parameters to give an optimum design of product and process. The CE process should address the complete life cycle of a product, from prototype and test through manufacture, use, maintenance, repair, eventual disposal and recycling. These essences of CE are the interactive of product design and process planning into one common activity. Concurrent design helps improve the quality of early design decisions and has/a tremendous impact on life cycle cost of the product [1].

2.3.1 Past of Concurrent Engineering

The problems before CE exist are:

a. Traditional over the wall engineering.
   - Each stage of the development process is carried out separately, and the next stage cannot start until the previous stage is finished.

b. Cost and quality problems.
   - Design errors are detected only during manufacturing rather than eliminated during the design stage and preventing them from occurring in the production stage.

c. Lack of customer focus.
   - Did not involve customer during the development process

d. Hierarchical organization structure.
   - No formal organizational structure.

e. Function performance target.
   - Lack of business process flow in term of everyone busy with their own job scope and no communication occurs during the process.

The external influences of these problems are product complexity, product life time and delivery time. The criteria of good development project are:

a. Incorporate the needs of the customer.
b. Be based of clear goals and expectation.
c. Follow a clear path.
d. Identify problem earlier.
e. Optimize use of tools and techniques.

2.3.2 Present of Concurrent Engineering

CE is structured and controlled way of managing product or service development with respect to integrating resources and calendar time, sharing common goals and accurate information throughout. The definition of CE is "a systematic approach to the

integrated, concurrent design of products their related processes including manufacturing and support". This approach intends to cause the developers from the outset to consider all elements of product's life cycle from conception through to disposal including quality, cost, and schedule.

CE approach:

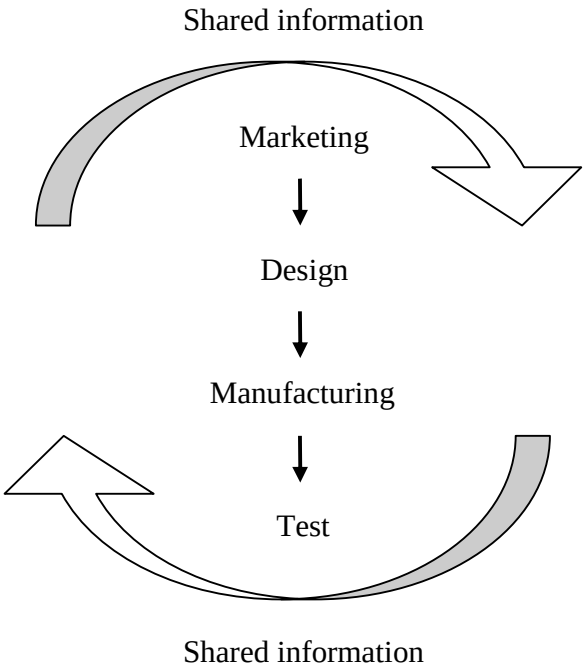

Figure 2.3: CE approach.

2.4 Importance and Benefits of Concurrent Engineering

Importance of CE:

a. Minimize product life cycle.
b. Decrease development and manufacturing costs.
c. Maximize product quality.
d. Teamwork.