



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**THE DEVELOPEMENT OF NEWLY DESIGN ARROW FOR
SLINGSHOT SHOOTING**

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology
Manufacturing in Product Design (Hons.)

by

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ABSTRACT

In developing new product, it is crucial to involve both product design and development with the time compression technologies. A well defined product design and development process of a product can be able to achieve the objectives and it has six phases which is product planning, concept generation, preliminary design, detail design, testing and mass production. Meanwhile, time compression technologies will help to enhance the development of the product using the manufacturing technologies, tool and technique to improve their production quantity, quality and reduce number of man power. The objective of this study is to innovate newly design arrow for slingshot shooting and the probability of the slingshot shooting as a new sport beside of getting better understanding about the development process. Literature review study was done through the books, journals, articles, internet, and other reference sources in order to get better understanding on this project. Basically, this project is focusing on the beginning of the phase until the concept testing of a product. The design of the arrow is essentially based on the point given by the expert during the interview session where it can be the design constrains. By using sketches to draft the concept selection and then SolidWork Software is use to design the 3D part. Then using Bits From Bytes (BFB) rapid prototyping machine to built the prototype of the arrows. During the testing with prototype, new data are collected and the information will be enough to complete the objective of this project.

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CHAPTER 1

INTRODUCTION

1.0 Introduction to Slingshot

Sport is a field that existed since centuries ago. Nowadays, sport field is one of the world-renowned and recognize by all ages. Slingshot is one of the shooting sport fields that are less known by people but it is known by some as a hunting medium. Figure 1 below show the Slingshot also known as the catapult was invented by Howard Ellenburg and his son in the winter of 1953.



Figure 1: The first wrist-braced slingshot or catapult by Howard Ellenburg and son. [1]

Normally slingshot is played along with its ammunition. The common types of ammos used are stones, marbles, lead slugs, plastic balls, paint ball and steel balls. [2] As the alternative ammo, people commonly use arrows as their shooting ammo. The arrows that normally used by people are the one that are used in archery. Typically, arrow has 23 to 32 inches in length and it is hard to use with slingshot and to carry anywhere. In advance, this project will develop and design new arrows that suitable to

shoot with slingshot. Using rapid prototyping (RP) and rapid tooling (RT) technology, this project will be carry to develop the physical part directly from a digital model from the 3D computer aided design (CAD) [3]. The ‘Watertight’ 3D CAD data can convert into standard triangulation language (STL) file for prototyping techniques in making the physical prototype [4]. Slingshot mostly known as a hunting game and need to be introduces to the new generation as a sport.

1.1 Objective of Project

In this project, the objectives that are needed to be achieved are:

- To innovate newly design arrow for slingshot shooting.
- To analyze the distance of shooting and the probability of the slingshot shooting as a new sport.
- To consider the rules and regulation for slingshot shooting in sport field.

1.2 Scope of Project

In this project, the work scopes are divided into two that is in PSM 1 and the other in PSM 2, the work scopes are as follow:

- Literature review.
- To conduct an interview with experts.
- Concept design with 3 ideas and using concept screening.
- Detail design of the chosen design.
- To design and fabricate the prototype of the arrow based on the data collect in the interview
- To conduct experiments of the prototype on the distance travelled by the arrow and the precision and accuracy of the arrow when hit the score board.
- To analyze the data gathered in the experiments with the calculation. Where the theoretical and experimental result will be compared.

- To write the technical report.

In this project, the work scopes are divided into two that is in PSM 1 and the other in PSM 2. In PSM 1, the literature review were done by doing research on paper works like History of slingshots, Archery's rules and regulation, Arrow anatomy study, Rapid Prototyping, Science and mathematics of arrow projectile. Next is to design and develop questionnaire for interview by using the information base on the research. After that, an interview with an expert is conducted by having Question & Answer (Q&A) session of the questionnaire that was developed before. And the final stage in PSM 1 is collects the data in the interview so that the design of the prototype can be developed.

The first stage in PSM 2 is to fabricate the physical prototype of the design from the PSM 1. Then, an experiment of the prototype is conducted on how the arrow works and how it will be played. Next, the collected data in the experiment will be compared and analyzed with the calculation or more precisely the theoretical data versus the experimental data. Lastly, the technical report of this whole project will be done following the formats and information that are gathered and given from the start to the end of this project

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter contains information that are collected from many sources and references such as book, journal, forum and even article from the internet. Basically, all the researches that are related to this project so that the possibility of achieving the project objectives can be proved.

All information that are related to the project has been collected and reviewed are merged following their priority and necessity. Each information and data are divided part by part subsequently in the section.

The elements in this chapter is about The Slingshot, Archery, Product Design and Development (PDD), Computer Aided Design (CAD) and last but not least, Rapid Prototyping (RP).

2.1 Slingshot

Starting from the history of the slingshot and following the moderns slingshot, these two element are clarified more in this part.

2.1.1 History of Slingshot

Slingshot typically has two types that is the one in the Biblical story, the first kind used by David to slay Goliath that consists of a pouch attached to two cords about two or to three feet long and the first wrist-braced slingshot or catapult by Howard Ellenburg and son.

Slingshots were a "do it yourself" item in early history that is typically made from a forked branch to form the "Y" shaped handle, with rubber strips sliced from items as inner tubes or other sources of good vulcanized rubber and firing suitably sized stones. Figure 2 show the example of the "Y" shaped forked branch with rubber strips.



Figure 2: "Y" shaped forked branch with rubber strips [5].

Slingshot were also capable hunting arms in the hands of a skilled user even though they were most associated with young vandals. They also capable of taking game such as quail, pheasant, rabbit, and dove if lead musket balls, buckshot or steel ball bearings were the firing projectiles. Placing multiple balls in the pouch produces a shotgun effect, such as firing a dozen ball beads at a time for hunting small birds. The slingshot can also be used to fire arrows with the addition of a suitable rest that allowing the hunting of medium sized game at short ranges. [5]

2.1.2 Modern Slingshot

The second type of the slingshot is consist of horns or prongs that called yoke, a handle and two elastic bands that one of each end is attached to the fork and the other end to a pouch. The one that will be used in this project is the second type of slingshot. The typical commercially manufactured slingshot come in various sizes and shape. Figure 3 show the component parts of a typical slingshot.

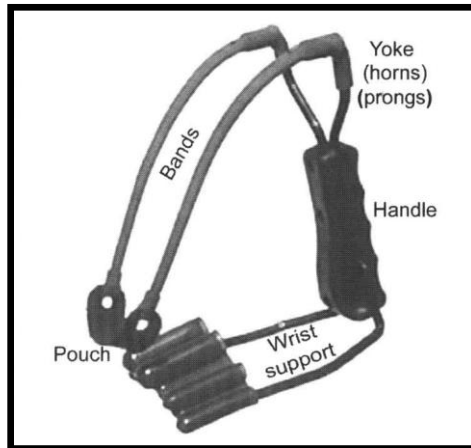


Figure 3: Component parts of a typical slingshot [6].

Normally slingshot is playing along with its ammunition. The common names for slingshot ammunition are including slug, works well for a metal ball. Next ammunition is pellet, the cylindrical shape pellet and projectile ammunition is the types of ammo including stones and arrows. Lastly is BB stand for Ball Bearing as the ammunition. The common types of ammo used are stones, marbles, lead slugs, plastic balls, paint ball and steel balls [6]. As the alternative ammo, people commonly use arrows as their shooting ammo.

2.2 Archery

Archery has been played an integral role in history and one of the oldest arts still practiced today. The bow and arrow was the weapon of choice for more than 50,000 years until the development of modern firearms, in almost every corner of the world. Nowadays, archery is more to the sports game rather than as hunting weapon.

2.2.1 Arrow details, specifications and materials

Basically an arrow contains a point, shaft, crest, index vane (feather), fletching and nock. Figure 4 shows the anatomy of an arrow.



Figure 4: Anatomy of an arrow [7].

1. Point

Metal insert (body of point is inserted inside arrow shaft) or outsert (body of point becomes a "cap") used at the front tip of an arrow shaft. The point acts as a weight as well as the hardest part to penetrate the target. For hunting and outdoor sports, the point used may differ in shape and size.

2. Shaft

Body of an arrow is usually made of carbon or aluminum. You may also find one made of wood or fiberglass.