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Bachelor of Mechanical Engineering (Design and Innovation)’

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THE DESIGN AND DEVELOPMENT OF INFLATOR SYSTEM OF LIFE JACKET FOR EMERGENCY SITUATION IN THE WATER

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This report is submitted in accordance with requirement for the
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DECLARATION

"I hereby declared that this thesis titled
'The Design and Development of Inflator System of Life Jacket for Emergency Situation in the Water' is the result of my own effort except as cited in references".

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"This is dedicated for mum and dad"

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ABTRACT

In this project I will develop and design an inflator system for life jacket to save a life in an emergency situation. This inflator system of life jacket is using compress gas as an agent to inflate the life jacket when in emergency situation. The method used in preparing this project include the preparing of the objective, preparing of the scope, research, identifying customer needs, set product design specification (PDS), make functional model analysis, generate the concept, and choose the best concept. At the beginning stage, a research will be conducted to get all the information and data through internet research and survey approaches. Next, all the information and data will be study to generate several concept design of quick life jacket. Finally, the best design will be choosing to be fabricated. At the second phase of this project, the final design of the product will be drawn in CAD software. After that the fabrication of the product is being done. When the part of product had been fabricated and assembled, experimental testing will be conducted before project realisation and verification started. This project will end by verification of supervisor and panel of seminal. At the end of this project, the inflator system for life jacket has been successfully designed. It is able to inflate the life jacket in emergency situation. Lastly, I hope this design can be successful in the market if someone makes the improvements to this product.

ABSTRAK

Dalam projek ini, saya akan membina dan merekabentuk sejenis alat untuk mengembungkan jaket keselamatan bagi kegunaan semasa keadaan kecemasan di dalam air. Jaket keselamatan ini akan menggunakan sejenis gas bertekanan untuk mengembungkannya dengan kadar segera jika berlaku sebarang situasi yang mencemaskan di dalam air. Kaedah yang digunakan bagi persediaan projek ini termasuklah meyediakan objektif, mennyediakan skop, menjalankan penyelidikan, mengenalpasti keperluan pengguna, membuat spesifikasi rekabentuk produk, membuat fungsi model analisis, penjanaan konsep, dan pemilihan rekabentuk terbaik. Pada peringkat permulaan, penyelidikan telah dijalankan untuk mendapatkan segala informasi dan data yang berkaitan melalui penyelidikan internet dan juga tinjauan. Seterusnya, segala informasi dan data yang diperolehi akan dikaji bagi menjana beberapa konsep rekabentuk jaket keselamatan segera. Akhir sekali, reka bentuk yang terbaik akan dipilih untuk tujuan fabrikasi. Seterusnya proses fabrikasi projek ini terus dijalankan. Setelah produk ini telah siap difabrikasi dan dipasang, satu ujikaji telah dijalankan sebelum pengesahan projek dimulakan. Projek ini berakhir dengan pengesahan dari penyelia dan juga panel yang terlibat. Akhirnya, alat pengembung jaket keselamatan telah berjaya direka. Ianya dapat berfungsi dengan mengembungkan jaket keselamatan semasa keadaan kecemasan. Akhir sekali, saya berharap agar alat ini dapat dijual di pasaran jika seseorang melakukan sedikit pengubahsuaian dan penambahbaikan kepadanya.

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PFD	=	personal flotation device
N	=	Newton
kg	=	kilogram
cm	=	centimetre
m	=	meter
He	=	helium
K	=	Kelvin
CO_2	=	carbon dioxide
g	=	gram
s	=	second
mm	=	millimetre
°C	=	degree Celsius
°F	=	degree Fahrenheit
Cp	=	constant pressure
Cv	=	constant volume
Ci	=	cubic inches
PSI	=	pounds per square inch
STP	=	standard temperature and pressure
Q	=	volume flow rate
A	=	area
v	=	velocity
τ	=	shear stress
PDS	=	product design specification
RM	=	Ringgit Malaysia

Oz	=	ounce
g/l	=	gram per litre
V	=	volume
r	=	radius
D	=	diameter

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Life jacket is an important device when someone wants to do activities that involve water. Basically life jacket can avoid someone from drown in the water. There is several type of life jacket in the market nowadays. In this project I need to make research and develop an inflator system for life jacket. Hence this life jacket can expand in very fast for emergency situation in the water. This type of jacket will expand instantly when one button is pushing by the wearer. The working mechanism of this jacket is it will use compress carbon dioxide that will be kept in a small cartridge and this gas can be release into floating body of life jacket to expend the life jacket when the wearer press a button in emergency situation. Expanding process must be happen in very short time in order to save the wearer life.

1.1 Objective

The objectives that needed to be achieved in this project are:

a. To develop and design the inflation system for inflating the life jacket.
b. The life jacket should be able to inflate quickly in emergency situation.

c. It is using compress gas of carbon dioxide as an agent to inflate the life jacket.

1.2 Scope

Here are some scopes of study of the pneumatic impulse rocket for night parachute search lighting:

a. Make literature review about life jacket.
b. Make research about cost of inflator system for life jacket.
c. Identify the customer need of life jacket.
d. Identify the material that will be using to develop the inflator system of life jacket.
e. Make research and chose the concept design of inflator system.
f. Make fabrication of inflator system and make the analysis.

1.4 Project Essential

This project is important in order to design and develop one type of inflator system for life jacket that can inflate life jacket very fast in order to save life when emergency situation is happen in the water. We hope that the product which is developing through this project may be commercialized in the market.

CHAPTER II

LITERRATURE REVIEW

2.1 Introduction of Life Jacket

Life jacket is a device designed to assist a wearer, either conscious or unconscious, to keep afloat with his or her mouth and nose (airway) of his or her head's face above the water surface when in or on water. Actually life jacket is a personal flotation device (PFD).

Life jacket that was designed for civilians (recreational boaters, sailors, canoeists, kayakers) are differ from those design for use by passengers and crew of aircraft (airplanes, helicopters) and of commercial vessels (tugs, passenger ferries, cargo ships). Life jacket that being used by military and police and enforcement agencies generally have features not found on civilian or commercial models, for example compatibility with other worn kit (e.g. survival vest, bullet proof vest/ body armor, equipment harness) (Source: www.wikipedia.com)

Personal flotation devices (PFD) are available in different sizes and different sizes and different designs purposed for various levels of protection.

Figure 2.1: Example of life jacket (Source: www.doityourself.com)

2.2 History of Life Jacket

The traditional or ancient example of primitive life jackets can be traced back to inflated bladders of animal skins or hollow, sealed gourds, for support someone when crossing deeper streams and rivers.

At the beginning personal flotation devices (PFD) were not part of the equipment issued to naval sailors until the early of 1800s. For example at the Napoleonic Battle of Trafalgar, seamen who were press-ganged into naval service might have used such devices to jump from ship and swim to be free. It wasn't until lifesaving services were formed that personal safety of boat crews heading out in pulling boats generally in terrible sea conditions was addressed.

Purpose designed of buoyant safety devices consisting of simple blocks of wood or cork were used by Norwegian seamen. Cork is the outer bark of a species of oak The modern life jacket is generally credited to one Captain Ward, which is a Royal National Lifeboat Institution inspector in the in the United Kingdom. In 1854, he was created a

cork vest to be worn by lifeboat crews for both weather protection and buoyancy. (Source: www.wikipedia.org)

Cork is nice and can floaters but can be a little hard, so kapok, which is a fibrous vegetable material minutely honeycombed with air cells and a much softer alternative to cork, became the standard stuffing around the turn of the century. This was particularly useful on navy ships, because seamen wore their lifejackets even while sleeping.

Cork and kapok lifejackets were standard for many years. War was brought us the inflatable lifejacket, as worn by sailors and submariners. This military technology was then applied to consumer lifejackets and these have developed into the many styles that we see today.

In the 60's synthetic foams were developed and the foam lifejacket invented. This new technology brought with it the flexibility to produce all the variations that we currently see. Each sport could then have its own style of jacket, such as Ski or Angling vests. (Source: www.lifejackets.co.uk)

2.3 Essential of Life Jacket

More than 90% of deaths in boating are because of drowning, and 80% of those drowning victims were not wearing a life jacket. Hence, because life jacket can protect against drowning, it is important to wear a life jacket in order to prevent from drown in the water. In cold water, there are chances that someone can be infected by hypothermia, and wearing a life jacket can protect against hypothermia. (Source: www.narrowboatsale.com)

2.4 Types of Life Jackets

a. Type 1: Offshore Life Jacket

This life jacket is designed for extended survival in rough, open water. It usually will turn an unconscious person face up and has over 22 pounds of buoyancy. This is the best life jacket to keep you afloat in remote regions where rescue may be slow in coming. (Source: www.lifejacket.us)

Figure 2.2: Example of Type I life jacket (Source: www.marinesafetytt.com)

b. Type II: Near Shore Buoyant Vest

This classic life jacket comes in several sizes for adults and children and is for calm inland water where there is chance of fast rescue. It is less bulky and less expensive than a Type 1, and many will turn an unconscious person face up in the water. (Source: www.lifejacket.us)