



Mechanical Engineering Project Proposal Example

Engineering (University of Moratuwa)



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DEPARTMENT OF MECHANICAL ENGINEERING
FACULTY OF ENGINEERING



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University of Moratuwa
Katubedde, Moratuwa
Sri Lanka

Date: 22nd April 2013

Dear sir/madam,

Requesting financial assistance for the University Hovercraft Design project

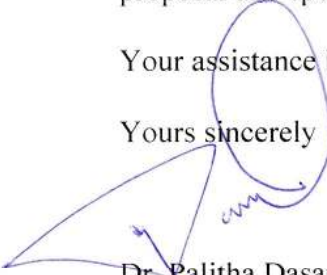
The University of Moratuwa, Department of Mechanical Engineering is one of the premier technological centers for research and innovation in Sri Lanka. We have a proud history of academia and its creative adaptation on a wide range of applications that are of domestic as well as global significance.

A hovercraft is a vehicle that is capable of travelling on both land and water. It has been an effective and efficient means of transportation for the past five decades. However, this technology is not widely implemented in Sri Lanka. We have identified that it has the potential of significant cost reduction and as a more efficient, reliable and environmental friendly substitute for most civilian as well as defense applications. Considering all factors, a group of 2nd year undergraduates have taken the initiative of designing and building a working model of a hovercraft to convey its feasibility and practicality.

Raw materials, engines, mechanical components, etc, require us to meet a sum of approximately Rs. 1.25 million. Thus we solicit your valuable patronage as this will be an ideal opportunity to advertise your company while supporting a project which has the capability of revolutionizing logistics and maritime defense in Sri Lanka. The project proposal and sponsorship schemes are attached herewith.

Your assistance in this project will be greatly appreciated.

Yours sincerely


Dr. Palitha Dasanayake
Head
Department of Mechanical Eng



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Dr. V. P. C. Dassanayake
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PROJECT PROPOSAL

Designing a Hovercraft

Department of Mechanical Engineering

University of Moratuwa

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1. Introduction

A hovercraft, as known by the world today, is a type of an air-cushion vehicle (ACV) with the capability of traveling on both land and on water. It had been in use for over half a century and gone through various modifications since then, to apply its unique features to modern day transportation needs.

We, a team of 2nd year engineering undergraduates of the University of Moratuwa, Department of Mechanical Engineering, would like to inaugurate this transportation technology to Sri Lanka by proposing a project to design and build a dual-seat hovercraft.

The designing and adding modifications to the hovercraft will be carried out in such a way that it will best suit the transportation needs and topography of Sri Lanka.

The project will be conducted under the supervision of,

- Dr. Palitha Dasanayake (Head of Department – Mechanical Engineering)
- Dr. Nirosch Jayaweera (Senior lecturer)
- Mr. Sasiranga De Silva (Lecturer)

2. Project Goal

As engineering undergraduates of DOME UoM, Our goal is to conduct a study on Hovercraft technology and ultimately design and manufacture a cost effective working model, using the knowledge and skills of the finest undergraduate talent in the island and the facilities of our very own country.

3. Objectives

- To design and build a hovercraft to be presented at exhibitions such as Deyata Kirula, Techno Lanka, INNOMECH and EXMO.
- To analyze the potential capabilities of designing and building hovercrafts locally and to assess the advantages of such a conveyance to Sri Lanka.
- To identify potential research areas related to hovercraft technology and implement upon completion of the project.
- To introduce an energy-efficient way of travelling and search for other utilities of implementing this technology.
- To understand the applications of basic engineering principles learnt as a mechanical engineering student and to improve professional and teamwork skills.
- To get hands on experience with various manufacturing methods and engineering tools.

4. Why a Hovercraft?

The Hovercraft is internationally renowned for its ability to travel on diverse terrains. As a vehicle which can be effectively deployed on land, water, ice and marsh lands, the Hovercraft is a true masterpiece of engineering technology. They are now used throughout the world as specialized transports in disaster relief, coastguard, military and survey applications as well as for sport or passenger service.

Although it holds high potential to provide efficient solutions to many transport problems in the island, the concept of the Hovercraft is still new to Sri Lanka.

The design and development of the hovercraft will be carried out in such a way that it best adapts and addresses the applications unique to our country.

5. Department of Mechanical Engineering of UoM

University of Moratuwa is undoubtedly the best technological university in Sri Lanka. Currently, the university is home to over 4000 undergraduates and 600 academic staff. Apart from the academic prestige it is renowned for, the University exposes its students to a variety of sports, clubs and other cultural activities.

The Department of Mechanical Engineering of University of Moratuwa throughout its 37 years history has moulded its undergraduates and graduate students into dynamic world class engineers. With over 300 students and 30 research faculty and lecturers the department has cemented its place as one of the nation's top Mechanical Engineering Programs.

This study evaluates the feasibility of manufacturing a hovercraft in University of Moratuwa premises by 2nd year mechanical engineering undergraduates. As this project consumes lot of resources, checking for the feasibility is essential. This study shows that this project is workable and also it highlights the benefits of undertaking this project.

6.1 Technical feasibility

A hovercraft, also known as an air-cushion vehicle or ACV, is a craft capable of travelling over land, water, mud or ice and other surfaces both at speed and when stationary. Hovercrafts are hybrid vessels operated by a pilot as an aircraft rather than a captain as a marine vessel. This is an existing technology which has been tried and tested before. Therefore the risk of failing is minimal. The project will further carry out research in improving the maneuverability of hovercrafts. This will include several innovative design concepts which will initially be tested in university laboratories before testing them under actual circumstances, which will again minimize the risk to the pilot.

The idea is to build up the whole hovercraft in house with only the engine and the skirt material being imported. More research is expected to be done, in conjunction with the Department of Chemical Engineering and the Department of Textile and Materials Science, to investigate the possibility of manufacturing the skirt material locally. Support from Sri Lanka Navy will also be given, to use their fiberglass manufacturing plant and research facilities in order to build the platform of the hovercraft. As mechanical engineering undergraduates the technical knowledge and skills required are developed during the academic years. University of Moratuwa is fully facilitated all the required machinery workshops. The project will be undertaken with the guidance of senior lecturers. Hence the knowledge and support is utilized.

The above facts show that the project is technically feasible.

6.2 Social feasibility

The engineering students who are undertaking the project and the users are taken into consideration under social feasibility. As the undergraduates carryout the production with great knowledge under supervision, the safety is 100% assured. This is a vehicle which is capable of travelling over land, water, mud or ice and other surfaces both at speed and when stationary. So the users will have multiple advantages. As it is guaranteed by University of Moratuwa, the safety of the user is assured.

These facts prove the social feasibility.

6.3 Ecological feasibility

A hovercraft minimizes the required force to propel it forward by two main methods in compared to other road and marine transportation systems. One is, by moving on a cushion of air, it makes very little or no contact at all with the surface that it's traveling on, hence producing a minimum amount of friction. The other is, by minimizing the area of hull contact with the water, thus reducing the drag force considerably when compared to boats. These factors lead to less fuel consumption in hovercrafts and lower the harmful gas emissions to the environment. Also due to that minimum contact with surface, the damage to shore environment, such as beaches, mud flats and vegetation is virtually nil.

Considering Sri Lanka, A hovercraft can be used to best advantage in shallow water and drying areas such as wetlands, swamps, and river delta which inhabits varieties of species and indigenous birds. In these sensitive areas, nearly no transportation means are available. Yet hovercrafts are able to operate in these areas in an environmentally friendly way. Another advantage is that, it creates virtually no underwater noise or sea bed erosion and requires no docks, piers or dredged channels to operate off many beach sites. Hence fish or marine life is not affected.

The hovercraft hull is a sealed unit. Therefore any accidental discharges and leaks are fully contained within the hull structure to be pumped out at an appropriate shore facility. Additionally, there is no exhaust discharge into the water as with most conventional water craft, thus eliminating the pollution of the marine environment by oil and fuel particles

Considering these facts, it is obvious that hovercrafts have significantly lower the environmental impact than any other watercraft currently operating.

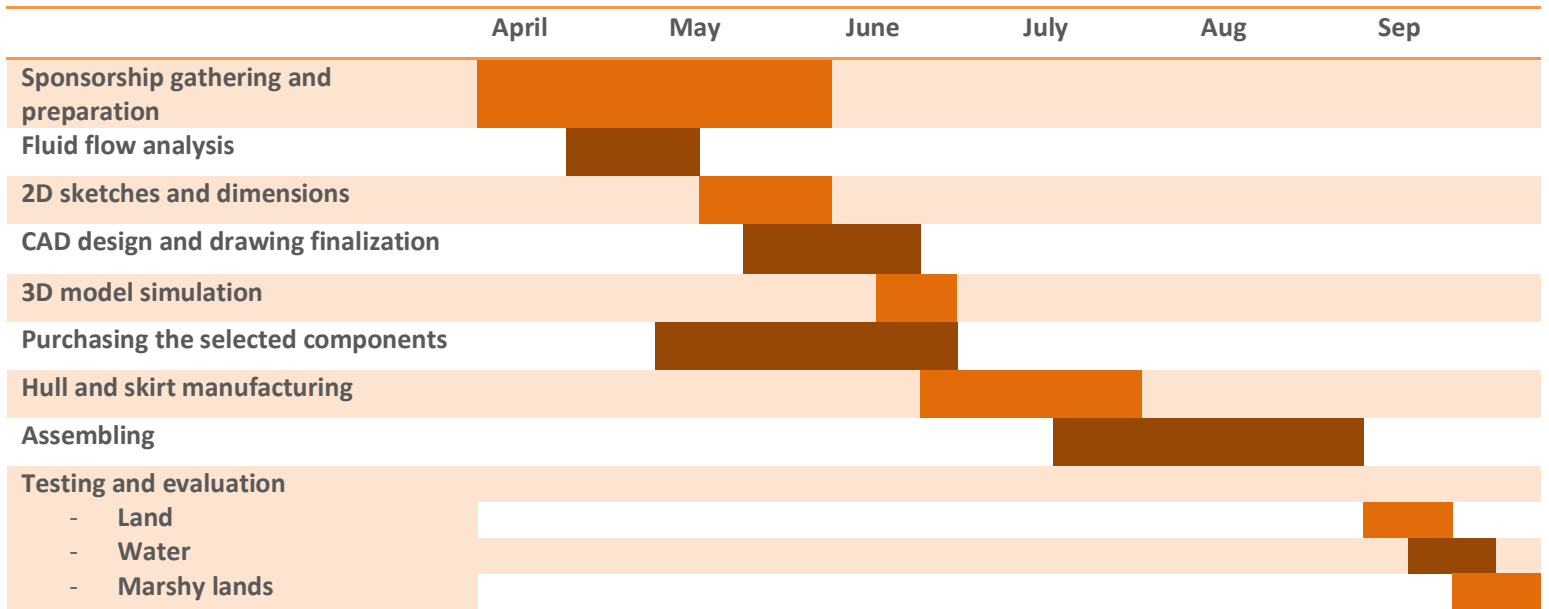
6.4 Financial feasibility

A thorough research was carried out to analyze the financial feasibility of this project.

The budgeted costs which can be categorized as capital costs and revenue costs are analyzed to evaluate the full estimated cost of the hovercraft. The quantitative and qualitative benefits are then analyzed to see whether this project is favorable in financial aspect.

The following sections will discuss the financial feasibility in detail.

7. Project Outline



8. Cost Analysis

Initial costs

Item	Qty	Prize(USD)
Research costs		200
- Skirt designs		
- Air flow (models)		

Capital costs

Item	Qty	Prize(USD)
Lift Engine (Rotax 277, 27HP)	1	1900
Trust Engine(Rotax 503, 48HP)	1	2900
Fuel Tank and pump	1	100
Skirt material (Urethane-Coated Nylon Fabric)	60sq.mtr.	800
Hull (Fiber glass)		2350
Lift propeller (24" 4 fiberglass-reinforced polyamide blades)	1	300
Trust propeller(31" 3 fiberglass-reinforced polyamide blades in a 6-blade hub)	1	300
Total		8650

Revenue costs

Item	Qty	Prize(USD)
Machining		230
- Shafts		
- Pulleys		
- Gears		
- Other		
- Rudders		
Assembling costs		260
- Welding		
- Nuts and bolts		
- Rivets		
Batteries (12V 12AH sealed lead acid)	2	100
Rudders (mechanism)	4	100
Miscellaneous		200
Fuel (Testing)		250
Total		1140

Initial costs (USD)	200
Capital costs (USD)	8650
Revenue costs (USD)	1140
Total estimated cost (USD)	9990

Average price of a dual seat hovercraft with separate lift and thrust engines currently costs over USD 20,000 in the market. Additional taxation should be added, if imported to Sri Lanka.

9. Hovercraft



Considering the benefits of this project qualitative benefits play a significant part over quantitative benefits. Even though qualitative benefits are monetary non-measurable these benefits make the project more favorable.

9.1 Qualitative benefits

- Rescue purposes of hovercraft

Hovercraft has the ability to hover above land, thin ice, and water, even during flood conditions, is a lifesaving asset to both victims and rescuers. Due to their unique capability to safely access areas that no other rescue vehicle can reach, hovercraft are used in a diversity of rescue scenarios. These include, but are not limited to

- Rescue operations on rivers, lakes and oceans in ice, swift water and mud
- Search and rescue missions in floods, shallows, wetlands, bogs, marshes and sand
- Rescue operations in Tsunami
- Dive team recovery missions
- Aircraft crashes

These services provided are priceless benefits.

9.2 Quantitative benefits

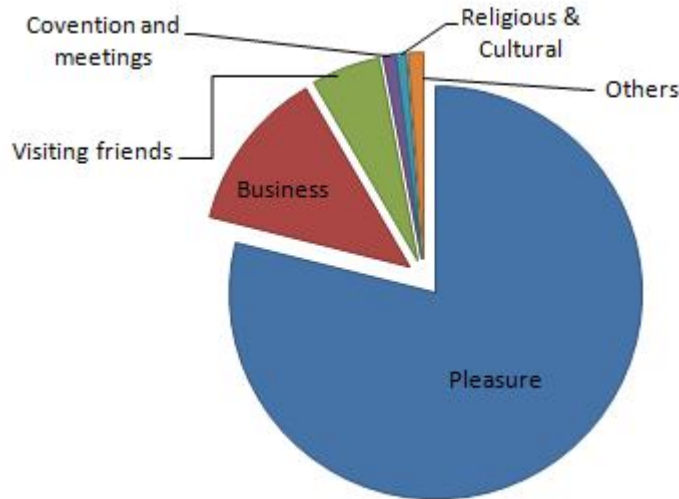
- **Tourism**

Sri Lanka Tourism has surged to a new high record of 654,476 arrivals in 2010, surpassing the previous all-time high hits due to the post conflict peaceful environment.

The foreign exchange earnings increased by 62.0% from Rs. 40,133.00 million to Rs. 65,018.00 million. Foreign Exchange (FE) receipts per tourist per day recorded an increase of US \$ 6.2, from US \$ 81.8 in 2009 to US \$ 88.0 in 2010.

Out of these more than 75% falls under the purpose of pleasure.

Purpose of Visit 2009 - 2010



Purpose	2009	2010
Pleasure	80.00%	78.90%
Business	8.60%	12.70%
Visiting Friends & Relations	5.20%	5.40%
Convention & Meetings	1.40%	1.00%
Religious & Cultural	2.00%	0.80%
Others	2.80%	1.20%

[http://www.sltda.lk/sites/default/files/Annual Statistical Report 2010.pdf](http://www.sltda.lk/sites/default/files/Annual%20Statistical%20Report%202010.pdf)

One of key areas in which the use of hovercrafts will be highly beneficial is the growing industry of tourism. The ability of a hovercraft to travel on both land and water will pave way for a whole new experience for passengers. Riding the hovercraft will not be just another cruise at sea. It will have the unique feel of being part airplane and part speed boat. Tourists will be able to get up close with aquatic wildlife and enjoy the excitement the ride has to offer.

These facts shows that hovercrafts play a significant role in tourism hence directly increase the revenues from tourism.

Cost-benefit analysis

From the above analysis, considering the costs and benefits, the benefits highlight over the costs. So this project can be classified as financially feasible.

Our Hovercraft sponsors will be a valuable part of our successful effort. The estimate for the Hovercraft Project totals to 9990 USD (1.26 million LKR). Therefore the success of this project will depend heavily on the commercial partnerships built with our esteemed sponsors. This will aid us in obtaining the necessary items and services for making the hovercraft a reality.

Sponsors will benefit from the national/international exhibitions, public appearances, press releases, website, and news coverage. The craft will travel nationally for exhibitions, where engineers and students from around the world will see them. We hope that you will be a part of our project which is going to be the **1st hovercraft project by a university in Sri Lanka.**

You will gain:

- **Brand awareness**

Your company will be able to approach and present itself to a number of leading professionals and young engineering talent. You will be given the opportunity to market your brand name and logo on the final product, all printed material, banners and other visual material. These will be on display during the launch, operation and various other exhibitions.

- **Unprecedented reputation of enriching the future leaders of the nation**

Being a university, the University of Moratuwa is at the forefront of nurturing the finest innovators and leaders. Therefore your involvement will not only benefit the undergraduate students, but also the nation at large.

- **Opportunity to exercise in Corporate Social Responsibility related projects.**

Being well equipped with engineering knowledge and laboratory facilities, the only restriction in successfully completing this project is lack of funds. Therefore, our aspiration is to overcome that hurdle and achieve our targets.

A sponsorship scheme which has been drawn up to obtain the required funding has been attached herewith.

Platinum Sponsor | 200,000 LKR

- Your company will be considered our main partner for Hovercraft project. You will be benefitted with increased brand awareness during all the public appearances of the Hovercraft. This would include,
 - High-Profile placement of your company name and logo on the **Hovercraft forehead**
 - Your company's name on our Hovercraft's audio visual presentation
 - Printed logo and name on the hovercraft will be displayed on electronic and printed media
 - Invitation to a Hovercraft ride at University premises and Bolgoda Lake
 - Promotional appearance of the Hovercraft at your location
 - Company logo prominently displayed in the backdrop
 - Company logo on every promotional material including banners, backdrops and posters
 - Ability to display a video presentation of your company in the launching ceremony and distribute fliers and brochures of yours products
 - Company logo and link to your company website on the University website
 - Your company's name on the show case at the Mechanical Engineering Department premises
 - Your company's name on the team casual t-shirt
 - "Thank You" Signage – Your company logo will be featured on sponsor appreciation signage throughout the launching ceremony, with all sponsoring companies logos listed

- Your company will be given priority in future public appearances of the Hovercraft

Gold Sponsor | 150,000 LKR

- Your company will be benefited with increased brand awareness during all the public appearances of the Hovercraft. It includes,
 - Your Company's name and logo on the **Hovercraft side panels**
 - Printed logo and name on the hovercraft will be displayed on electronic and printed media
 - Invitation to a Hovercraft ride at University premises and Bolgoda Lake
 - Ability to display a video presentation of your company in the launching ceremony and distribute fliers and brochures of yours products
 - Company logo and link to your company website on the University website
 - Your company's name on the show case at the Mechanical Engineering Department premises
 - Company logo on every promotional material including banners, backdrops and posters
 - Your company's name on the team casual t-shirt
 - "Thank You" Signage – Your company logo will be featured on sponsor appreciation signage throughout the launching ceremony, with all sponsoring companies logos listed

Silver Sponsor | 100,000 LKR

- Your company will be benefited with increased brand awareness during all the public appearances of the Hovercraft. It includes,
 - Your company's name and logo on the **Hovercraft rudders**
 - Printed logo and name on the hovercraft will be displayed on electronic and printed media
 - Company logo and link to your company website on the University website
 - Your company's name on the show case at the Mechanical Engineering Department premises
 - Your company's name on the team casual t-shirt
 - Company logo on every promotional material including banners, backdrops and posters
 - Fliers and brochures of the company can be distributed on the day of the launching ceremony
 - "Thank You" Signage – Your company logo will be featured on sponsor appreciation signage throughout the launching ceremony, with all sponsoring companies logos listed

Bronze Sponsor | 50,000 LKR

- Your company will be benefited with increased brand awareness during all the public appearances of the Hovercraft. It includes,
- Printed logo and name on the hovercraft will be displayed on electronic and printed media
 - Your company's name on the show case at the Mechanical Engineering Department premises
 - Your company's name on the team casual t-shirt
 - Company logo on every promotional material including banners, backdrops and posters
 - Fliers and brochures of the company can be distributed on the day of the launching ceremony
 - "Thank You" Signage – Your company logo will be featured on sponsor appreciation signage throughout the launching ceremony, with all sponsoring companies logos listed

Banner Sponsor

One banner –10,000 LKR

Three banners – 25,000 LKR

We will be happy to work with donations of all kinds, large or small. We want your sponsorship to benefit your company as much as possible. Let us know what we can do to make your donation worthwhile.

Please draw the cheque in favor of 'MECH ENG SOCIETY'

Account number: 0000307736

Branch code and name: BOC 030 KATUBEDDA BRANCH

Our intent is to be in the upper echelon of competitive universities. Your participation in this exciting and challenging educational experience will be greatly appreciated and used with accountability to our advisers and University of Moratuwa.

For more information about our project, please visit our website at:

<http://www.mech.mrt.ac.lk/projects/hovercraft>

If you have any questions or comments, please don't hesitate to contact us:

Mr.Sasiranga De Silva – Lecturer (Project supervisor)

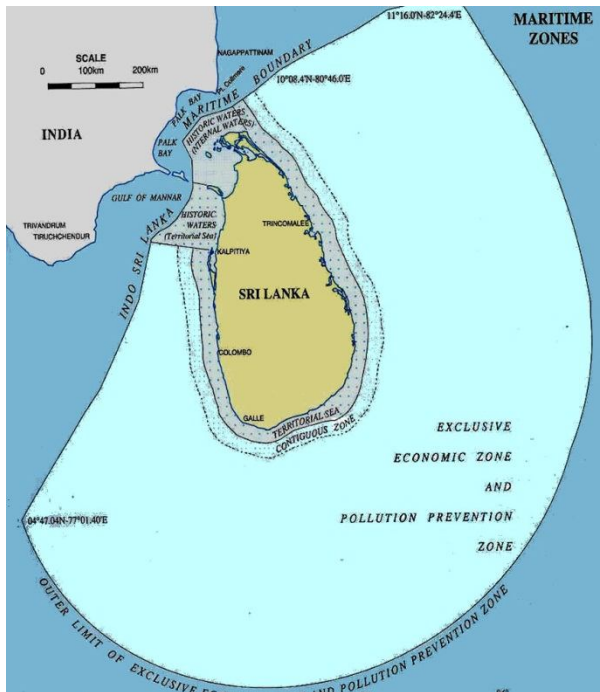
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11. Annex**Maritime Security and National Defense in Sri Lankan seas**

Sri Lanka is an island nation strategically located in the center of the Indian Ocean. We have sovereign rights for over 500000km² of the ocean and a coastline 1770km long. Containing several bays and shallow seas, Sri Lanka has a huge influence over global maritime trade routes as well as global security and defense. And in recent times, controlling the rising piracy issues and human trafficking along these naval lines will be a positive measure for global security as a whole and for the betterment of global trade lines along this route.

Figure: Sri Lankan maritime boundaries

Feasibility of employing hovercrafts for Sri Lankan maritime defense

- Its rapid deployment capability with the ability to converge on an enemy target with minimum delay
- Higher energy efficiency compared to conventional buoyant watercrafts (i.e. ships and boats) due to fluidic resistance from contact of water
- Improvement of coastal defence efficiency will eventually decrease the number of security units that needs to be deployed to maintain coastal defence
- Ability to maneuver land based terrain along with oceanic floors

In combination, we believe that hovercrafts are the most suitable crafts to be used for maritime defence in Sri Lanka and this region. It will not only improve defence and security in the region, but will reduce the costs on maritime defence making an impact on the overall defence budget.