

## Amphibious Vehicle

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**Abstract-** An Amphibious vehicle is a means of transport, viable on land as well as on water even under water. It is simply may also called as Amphibian. Amphibious vehicle is a concept of vehicle having versatile usage. It can be put forward for the commercialization purpose with respect to various applications like in the field of military and rescue operations. Researchers are working on amphibious vehicle with capability to run in adverse conditions in efficient way. This paper focuses on concept of amphibious vehicle in detail. In later stage of paper we have explained and described the design and analysis of amphibious car. We have followed proper design procedure and enlisted the material used in detail. Capabilities of efficient amphibious vehicle will fulfil all the emerging needs of society. Success of every concept largely relies on research and development, though amphibious vehicle is yet to travel a long journey of innovative development, it has shown excellent potentials for future

benefits.

### Introduction

Vehicle design is one of the important aspects for the performance of a vehicle. When the vehicle moves across a medium at high speed, the medium will act on the vehicle in terms of resistance [1]. Air is one of the mediums of space that provide resistance when the vehicle is travelling at high speed due to air space densities. This contributes to the consumption of fuel used for vehicles. Besides that, the design of the vehicle should have an aura of attraction to people who see every detail of design in terms of creativity and aesthetic value. Therefore, in this paper design process is documented according to stage which the design starts from scratch. Selection of materials for the manufacture of basic materials is an important vehicle for ensuring that the vehicle is able to float on the water [2]. Among the criteria required material for manufacture of the vehicle is that it

must be durable, has good properties of waterproof, easy to set up and easy to do the repairs in the event of damage and maintenance work.

### Need of Amphibious Vehicle

About 75% of Earth's surface is covered by water. A vehicle that could travel on land and water could potentially change current transportation model. Transportation on land is very common but on the other hand

water ways are naturally available but are not considerably used relatively, and here the Amphibious vehicles are proved to be beneficial.

### LITERATURE SURVEY

#### 4.1 Amphibious Vehicle

There are not many vehicles of this type used in daily use. Only some vehicles are used and that are used in military. Some of them are as follows.

#### 4.2 Amphibious Cycles

An *Amphibious Cycle* is capable of operation on both land and water. The design which probably received the most coverage is Saidullah's Bicycle. This has been featured on both Discovery Channel and BBC News. The bike uses four rectangular air-filled floats for buoyancy, and is propelled using two fan blades which have been attached to the spokes. Moraga's Cyclo Amphibious uses a simple tricycle frame to support which provides both the floatation and thrust. The wings on the powered wheels propel the vehicle in a similar way to a paddle wheel. The most recent attempt, featured in the Southern Daily Echo (5 June 2008) and The Daily Telegraph (6 June 2008) is that of seven engineering students at the University of Southampton. The Amphibious Cycle combines a

recumbent frame with separate floats, and is propelled using a paddle wheel. A speed test on water achieved an average speed of 1.12 m/s. The cyclist was able to transition the cycle both into and out of the water unassisted. This elegant prototype has a real application in urban areas of flooding, as well as applications in the leisure industry [5].

**Amphibious buses**

Amphibious buses are employed in some locations as a tourist attraction. A recent design is the AmphiCoach GTS-1.



Fig. 4 Amphibious buses

**Construction and Working**

The Amphibian car consists of following part:-  
 TubeThe tube is located at the bottom side of the car frame or chassis. It has two valves are provided, one is to fill the air in tube and the other is for outlet valve to exhaust the air. When we want the car to run on the water then air filler machine is started for the filling the air in tube. Thus the tube is filled by air which will help the car to float on water and also carry the weight of car. Thus the tube serves the function that it help to float the car on water. The tube is manufacture of some special material which will not puncture easily.



**Fig. 8 Views of Model Amphibian Car**

There are two blades (fans) each of them having four plates used in amphibian car. These are circular in shape with some inclination. The diameter of the blades is slightly less than that of diameter of wheel, as the car has the front engine

rear wheel drive (frwd) the blades fitted on the rear axle which will propel the car on the water.

It serves the function to give motion like wheel, on water surface. Compressor (air filler) As its name indicates it serves as the function to fill the air in the tube with high pressure and instantly. It doesn't require fuel to work. The machine is connected to the battery. This machine requires the d c voltage of 12 volt. It is fitted in car body.

**Motor**

The motor transmits the power to rear axle with the help of bevel gear arrangement to transmit the power in 90° from motor to rear axle. The range of power required to it is 12v. The motor will run with the help of battery supply. (In model the motor will serve as the function of engine).

**Battery**

The battery used in the car is of 12v, 3.5amp. The battery is used to supply the power to air filler machine, motor and other equipments or accessories like head light, tail lamps and horns. It supplies dc current to the motor which requires 12v dc supply and also to the air filler machine.

**Transformer**

Transformer is used to reduce the ac power supply and charge the battery. It is fitted in the car body to charge the battery by connecting to ac supply. It requires 12 hrs to completely charge the battery.



Fig. 9 Demonstration of working

Table 1 Dimension of vehicle with part description

Sr. No.	Parts of vehicle	Dimension /weight
1	Size of the vehicle body	870 × 500 mm
2	Wheel diameter	190 mm
3	Diameter of rear shaft	10 mm
4	Size of blade	130 × 27 mm
5	Distance between front & rear wheel	330 mm
6	Total height of car	470 mm
7	Diameter of driver pulley	21 mm
8	Diameter of driven pulley	78 mm
9	Ground Clearance	150 mm
10	Total Wt. of vehicle	13.1 kg
11	Wt. of battery	2 kg
12	Wt. of motor	1 kg

In our model of amphibicar, we have used a wiper motor which is connected to the D.C. supply battery as an engine. The engine rotates the driver shaft and so the bevel gear rotates and due to which the power is transmitted from engine to rear shaft. As the rear shaft rotates the blades assembled on it also rotate with rear axle speed, thus the blades propel the vehicle in forward direction.

### Materials Used

Table 2 Material used for various parts of the amphibious car [7]

Sr. No.	Parts of vehicle	Material
1	Shaft	Stainless steel
2	Tube	Rubber
3	Gears	Cast Iron
4	Compressors	Fiber
5	Model Vehicle	Plastic
6	Blades	Cast Iron
7	Motor	Cast Iron
8	Base of Vehicle	Plywood

### System design

System design mainly concerns with various physical constrains, deciding basics working principles, space requirement, arrangement of various component etc. Following parameters are look upon in system design [8, 9] Selection of system based on physical constrains. The mechanical design has directs norms with the system design hence system is designed such that distinctions and dimensions thus obtain in mechanical design can be well fitted in to it. Arrangement of various components made simple

to utilized every possible space. Ease of maintenance and servicing achieved means of simplified lay out that enables quick decision assembly of component.

Scope of future improvement.

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### Design process

The design stage process of UTeM's AHV body is shown in Figure 1. The early stage of the design process is to create a conceptualization idea. Creativity is required to generate the ideas during the conceptualization stage. Brainstorming approach is used to produce as many ideas that are relevant for the AHV specification as described in Table 1.

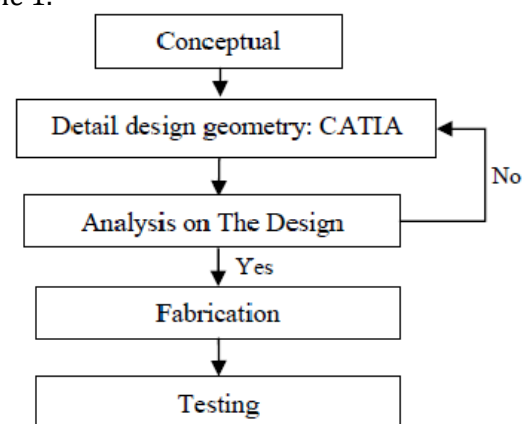


Figure 1: Shows flowchart of design phase for the amphibious vehicle body.

There are many ideas were produced but not reported as it actually the early step in designing



process and several concepts are feasible to proceed to conceptual designs while the irrelevant ideas are eliminated. Once the conceptual design is finalized, the Pugh's selection method is employed to conduct the analysis. The Pugh's selection and assessment are evaluated by summation of '+' and '-' that indicate the element present in the criteria. The '+' will be multiplied by weight that been assessed for every criteria before been total up and the result is presented in Table 2 using Pugh method. There are eight criteria to be concerned to evaluate the best selection for the concept design.

### Fabrication process

Fabrication process for the body of AHV is very crucial stage since all processes are executed manually and conventionally. Therefore, the most important aspect in fabrication process is to produce a good bodywork that meet the specifications and identical as possible to the design selected generate in CAD. The limitation in this process is to strictly follow the design specifications for the body of amphibious vehicle. The fabrication flow process for the body contains of several stages and it is shown in figure 4 below.

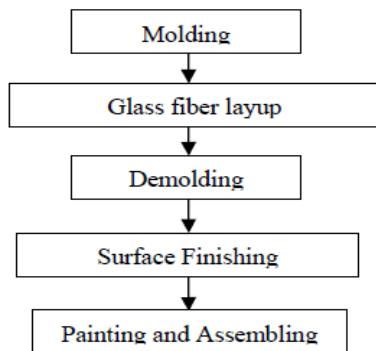


Figure 4: Fabrication process

Molding process is the most important stage where at this stage the quality of mold will influence the end product of the quality. A good quality of mold will quicker the time for surface finishing. The mold is made up from plywood which is use as a bone of the mold. Polystyrene is then applied to fill the empty space in the molding body. Wall filler will be used to fill pores of the molding surface and it will be sanding using sand paper to refine the surface finishing of mold.



Figure 5: Molding process

As the mould is completed, the glass fiber which is from chop strand mat and woven fabrics are used to fabricate the body by using hand layup technique. Figure 6 show the process of hand layup techniques. A release agent, liquid of wax form will be applied onto the mold. This allowed the finished product to be removed cleanly from the mold without any sticking problem that will affect the finished product quality. After the release agent have been applied to the entire surface mold, resin mixture which is consisting of polyester resin, epoxy type of resin is mixed together with its hardener and applied to the surface of the mold. Sheets of fibreglass cloth are cut and lay onto the mold, and then more resin mixture is added using brush a brush or roller. It is important to ensure that no air is trapped between the fiberglass clothed and mold and roller is used to remove the air pockets by pushing out the air pockets away from the fiberglass layer. Air pockets will cause fiberglass strength weaker. To add more layer of fiberglass, additional resin is applied and possibly sheets of fiberglass cloth also applied onto it. To make sure the resin is saturates evenly and air pockets are removed, hand pressure and roller are used. The work is executed quickly enough to complete the job before resin starts to cure, unless high temperature resins are which will not cure until the part is warmed.



Figure 6: Hand layup technique

Next, demolding process is executed to separate the product and mold. Demolding process must be done carefully to avoid defects in the product. The next process is the surface finishing stage. Car body filler putty and sand paper is used to gain smooth and continuous surface finishing. The final finishing can be observed in Figure



**Figure 7:** Surface finishing of the Bodywork

Lastly, the body undergoes painting process and it was assembled to the chassis by using bolt and nut. Marine seal applied to the area which is exposed openly and has gap between the surface to avoid leaking or water entering the body of the vehicle which can lead to additional weight problem to vehicle. The final product of the UTeM's Amphibious Hybrid Vehicle is shown in Figure



**Figure 8:** Shows the final bodywork for the UTeM's AHV.

## Conclusion

The development of body for amphibious is carried out based on the technical specification information required. The process started from the design selection stage and completed with the fabrication process of the bodywork. The AHV composite bodywork produced using fiberglass suit the AHV

capability to work on both the ground and water surface.

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