

DESIGN AND FABRICATION OF HOVER CRAFT

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ABSTRACT

The air cushion vehicle or hovercraft, as it is popularly known is the newest vehicle in today's transport scene. A hovercraft vehicle also sometimes called an air cushion vehicle because it can move across land or water surfaces while being held off from the surfaces by a cushion of air. The thrust forces required are greatly reduced due to the reduction in frictional forces both static and dynamic. It is presently utilized all through the world as particular transports in a fiasco alleviation, coastguard, military and review applications and additionally for game or traveler administration.. This paper brings out the details of the theoretical study carried out for the successful propulsion of the hovercraft.

KEYWORDS: *Design, thrust, Propels fan, Air cushion vehicle, lift force, hover craft, Skirt, Air blower, Static and dynamic friction.*

INTRODUCTION:

An Air cushion vehicle is a vehicle that flies like a plane but can float like a boat, can drive like a car but will traverse ditches and gullies as it is a flat terrain. These vehicles are supported in various ways. Some of them have a specially designed wing that will lift them just off the surface over which they travel when they have reached a sufficient horizontal speed (the ground effect). Hovercrafts are usually supported by fans that force air out from the Air propellers, water propellers, or water jets usually provide forward propulsion. Air continuously forced under the vehicle by a fan, generating the cushion that greatly reduces friction between the moving vehicle and surface. The air is delivered through ducts and injected at the periphery of the vehicle in a forward and inward direction. This type of vehicle can equally ride over ice, water, marsh, or relatively level land. It is capable of travelling over land, water, mud or ice and other surfaces both at speed and when stationary.

HISTORY

In the beginning.....

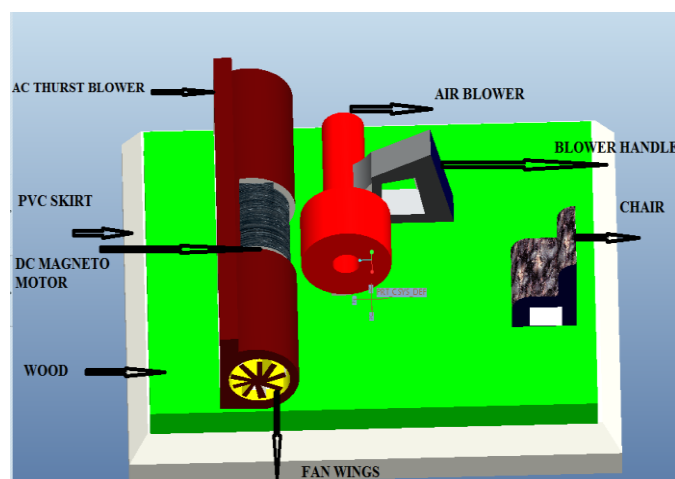
Hovercraft as we know them today started life as an experimental design to reduce the drag that was placed on boats and ships as they ploughed through water. The first recorded design for an air cushion vehicle was put forward by Swedish designer and philosopher Emmanuel Swedenborg in 1716. The craft resembled an upturned dinghy with a cockpit in the centre. Apertures on either side of this allowed the operator to raise or lower a pair of oar-like air scoops, which on downward strokes would force compressed air beneath the hull, thus raising it above the surface. The project was short-lived because it was never built, for soon Swedenborg soon realized that to operate such a machine required a source of energy far greater than that could be supplied by single human equipment. Not until the early 20th century was a Hovercraft practically possible, because only the internal combustion engine had the very high power to weight ratio suitable for Hover flight.

In the mid 1950s Christopher Cockrell, a brilliant British radio engineer and French engineer John Bertin, worked along with similar line of research, although they used different approaches to the problem of maintaining the air cushion. Cockrell while running a small boatyard in Norfolk Boards in the early 1950s began by exploring the use of air lubrication to reduce the hydrodynamic drag, first by employing a punt, then a 20 knot ex-naval launch as a test craft.

PRINCIPLE:

Hovercrafts work on the two main principles of lift and propulsion. Lift is an important factor because it is that which allows the craft to ride on a cushion of air. This process begins by directing. The air cushion makes the hovercraft essentially frictionless

MODEL FIGURE



COMPONENTS

AIR BLOWER

PVC FIBER GLASS SHEET [SKIRT]

AC THURST FAN

SWITCHING POWER SUPPL

WOOD

NUT & BOULTS

WORKING METHOD

1. AIR BLOWER

Air blowers generally use centrifugal force to propel air forward. Inside a centrifugal air blower is a wheel with small blades on the circumference and a casing to direct the flow of air into the center of the wheel and out toward the edge.

The design of the blades will affect how the air is propelled and how efficient the air blower is. Blade designs in air blowers are classified as forward-curved, backward-inclined, backward-curved, radial and airfoil.

A leaf blower is a gardening tool that propels air out of a nozzle to move yard debris such as leaves. Leaf blowers are powered by electric or gasoline motors. Gasoline models have traditionally been two-stroke engines, but four stroke engines were recently introduced to partially address air pollution concerns.

The main purpose of blower is to suck air from atmosphere to the beneath of skirt and hull. It can able to lift hovercraft and maintain less amount of surface traction. Noise pollution is also a concern with leaf blower, as they emit noise levels well above those required to cause hearing loss to both the operator and those nearby.

Specifications

Input power	600w
Speed	1600rpm
Air flow	3.3m ³ min
Weight	3.7kg
Dimensions	200*150*200



Figure:1 Air blower

PVC FIBER GLASS SHEET

[SKIRT]

The skirt of a hovercraft is one of its most design sensitive parts.

The skirt is made by a poly vinylchloride chemical. It is very strong and very thin size of sheet.

Skirt is which is used bottom of the plywood and the air is filled in the skirt. When air was blown into the space between the sheets it exited the bottom of the skirt in the same way it formerly exited the bottom of the fuselage, re creating the same momentum curtain, but this time at some distance from the bottom of the craft. The design must be just right or an uncomfortable ride for passengers or damage to the craft and the skirts results. Also, excessive wear of the skirt can occur if its edges are flapping up and down on the surface of the water. The skirt material has to be light flexible and durable all at the same time. The current skirts use Infringers at the lower edge of the skirt envelope which can be unbolted and replaced. By doing this there is a quick and easy way to counter the effects of wear without having to replace the whole skirt structure Skirt is the material which is made by the

Gelatin.

Specifications:

Type	Fiber glass
Chemical	Pvc
Length	200 mm
Breath	0.5mm
No of holes	1



Figure:2pvc skirt

AC THURST FAN

Hovercraft uses only one fan to provide both lift and thrust. The propulsion system as the name specifies to propel something by the application of the force.

The de magneto motor fixed in centre of the both sides of fan. motor and fan wings are connected by the help of shaft and rotating motion creating thrust force.

The simple meaning of propulsion is to give the motion in the forward direction. This system is useful in everything which we want to give motion, in air cushion vehicle the propulsion system is use to move it. The propulsion system is placed in the backside of the unit.

The propulsion system is A high pressure air and eject it from the end with a high velocity which move the unit to the forward side or direction. The concept of the propulsion system is based on the principle of the Newton’s Third Law according to which –

“Each and every action has equal and opposite reaction”.

Specifications

Type	Dc motor
Watts	500w
Voltage	12v
System length	30cm
Blade length	10cm

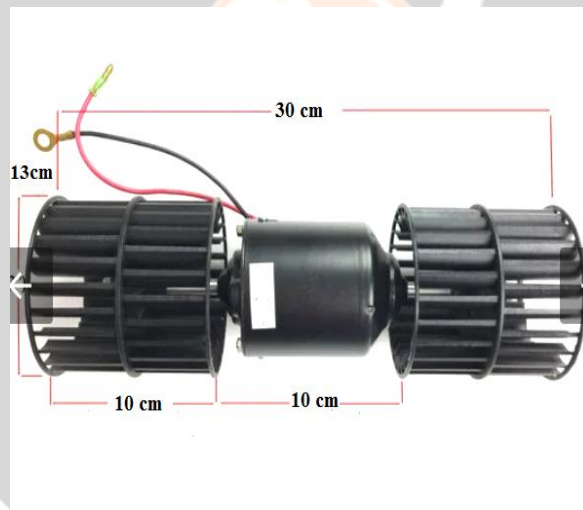


Figure:3 Ac thrust system

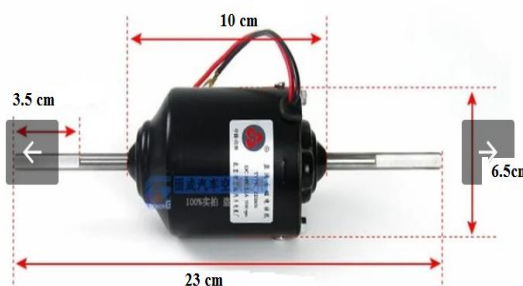


Figure:4 dc motor

POWER SWITCHING SUPPLY

BASIC WORKING

Power supply is an electronic circuit that is used for providing the electrical power to appliances or loads such as computers, machines, and so on. These electrical and electronic loads require various forms of power at different ranges and with different characteristics. So, for this reason the power is converted into the required forms (with desired qualities) by using some power electronic converters or power converters. Electrical and electronic loads work with various forms of power supplies, such as AC power supply, AC- to-DC power supply, High-voltage power supply, Programmable power supply, Uninterruptable power supply and Switch-mode power supply.

Specifications

Volts	12v
Watts	240w
Current	20 amps
Converter	Ac to Dc



Figure:5smps box

WHAT IS SMPS

The electronic power supply integrated with the switching regulator for converting the electrical power efficiently from one form to another form with desired characteristics is called as Switch-mode power supply. It is used to obtain regulated DC output voltage from unregulated AC or DC input voltage.



Figure:6 Switch mode power supply

Similar to other power supplies, switch-mode power supply is a complicated circuit that supplies power from a source to loads. Switch-mode power supply is essential for power consuming Electrical and electronic appliances and even for building electrical and electronic projects.

TYPES OF CONVERTERS

- DC to DC converter
- AC to DC converter
- Fly back converter
- Forward converter



Figure:7smps inner set up

AC to DC CONVERTER

The AC to DC converter SMPS has an AC input. It is converted into DC by rectification process using a rectifier and filter. This unregulated DC voltage is fed to the large-filter capacitor or PFC (Power Factor Correction) circuits for correction of power factor as it is affected. This is because around voltage peaks, the rectifier draws short current pulses having significantly high-frequency energy which affects the power factor to reduce.

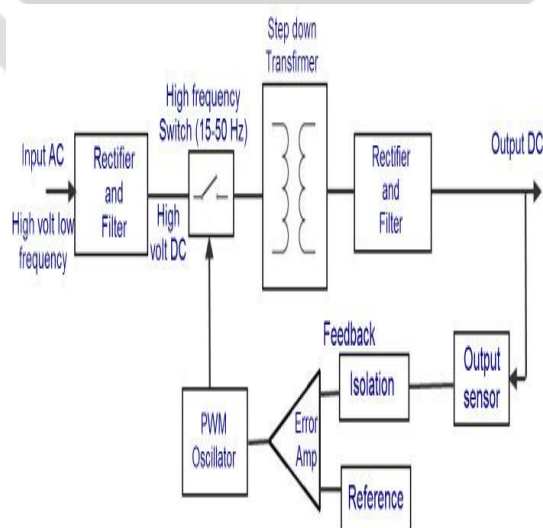


Figure:8AC to DC converter circuit diagram

It is almost similar to the above discussed DC to DC converter, but instead of direct DC power supply, here AC input is used. So, the combination of the rectifier and filter, shown in the block diagram is used for converting the AC into DC and switching is done by using a power MOSFET amplifier with which very high gain can be achieved. The MOSFET transistor has low on-resistance and can withstand high currents. The switching frequency is chosen such that it must be kept inaudible to normal human beings (mostly above 20KHz) and switching action is controlled by a feedback utilizing the PWM oscillator.

This AC voltage is again fed to the output transformer shown in the figure to step down or step up the voltage levels. Then, the output of this transformer is rectified and smoothed by using the output rectifier and filter. A feedback circuit is used to control the output voltage by comparing it with the reference voltage

WOOD

Ply wood is used which is placed top of the skirt which is the body of hover craft hole is placed on the ply wood. If does not lift the plywood up a bit to let the air get in and inflate the "skirt" the hovercraft will lift up slightly and start gliding around. The base of any ACV is made up like this that it can protect the vehicle from any causes. The base is also too strong which can bear the payload and also the other load for which it will be designed.

When the ACV is made for the commercial and rescue purpose in which the land surfaces are get covered then the base should be taken strong. The platform is a base of the Air cushion vehicle. The base is the thing on which the all equipment of the Air cushion vehicle is mounted. The base is basic requirement of the Air cushion vehicle on which all the design will take place. The base is taken by us is made of wood, wood have the elasticity when the load is applied so we take the wooden platform.

Specifications

Length	100 mm
Weight	2 kg
Thickness	1.5mm
Type	Ply wood



Figure:9 wood

FUTURE DEVELOPMENT

By using the hover principle many designs have arise.

One is the hover concept by replacing the cushion of low pressure air as inform the modern Hovercraft by high pressure pad it was thought that the pads of high pressure could replace the wheels of the car.

but there are two difficulties.

1. It is difficult to lift.

2. New method of propulsion is required

Then moved towards Hover train.

Here rails provide smooth surface for high pressure air and guidance from the track overcomes the problem of steering.

The future of hovercraft seems uncertain, but there is a good chance there will be huge hover ports all over the world, like the one in the picture.

Thinner hovercraft might be built so civilians can drive safely on roads.

It also seems likely that the larger hover vehicles will become larger than ever! Hovercrafts are likely to be capable of high flight.

CONCLUSION

The conclusion of our project is that we lift the weight above our expectation the blow of air from the narrow hole with high pressure and high RPM inside the skirt create the lift. When the air is blown inside the skirt with pressure, then the air is circulated in the skirt when the air is circulated the air is get the small hole outlet which create the pressurize the earth surface the which impact the earth surface and create the lift and also reduce the friction between the earth surface and the unit.

The plans and designs must be flawless. One must take under consideration the weight and the shape of each component in order to avoid problems such as instability and dysfunction. This is a marvelous machine which greatly cuts down the friction which in turn helps it to attain greater speed and more stability. Varieties of problems and factors have to be taken into account in designing and constructing a hovercraft. The difficulties involved maintaining stability and functional competency has limited the application to only transportation or for military purpose. The cost involved in the developing of a hovercraft is also another impediment to the widespread use of this machine.

LITERATURE OF REVIEW

1. Vasanth Kumar. P¹, Vignesh. K², Rajkumar. G³

Inventor of the hover craft, which is first prototype that proved the idea would work. The hovercraft is excellent multipurpose vehicles in today generation and simple constructions. An Air cushion vehicle is a vehicle that flies like a plane but can float like a boat, can drive like a car but will traverse ditches and gullies as it is a flat terrain.

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2. A.K. Amiruddin¹, S.M. Sapuan², A. Jaafar³ [International Journal of the Physical Sciences Vol. 6(17), pp. 4185-4194, 2 September, 2011 Available online at <http://www.academicjournals.org/IJPS>]

It was undertaken to construct an economical and robust hovercraft by using the aluminium Al6061-T6 (marine). In this study, the stability and ultimate strength of the aluminium Al 6061-T6 was tested to find its stands as the material for the hovercraft hull base development. Modern Hovercrafts are used for many applications where people and equipment need to travel at speed over water but be able load and unload on land. For example they are used as passenger or freight carriers, as recreational machines and even use warships.

REFERENCES

[1] Mantle, P. J., "Air Cushion Craft Development", David W. Taylor Naval Ship Research and Development Center, Bethesda, Maryland, DTNSRD80/012, 1980.

[2] Chung, .I., "Theoretical Investigation of Heave Dynamics of an Air Cushion Vehicle: Bag and Finger Skirt", Ph.D. dissertation. Institute for Aerospace Studies, University of Toronto, 1997.

[3] Nah, Seung-Hyeog, "The Development of an Expert System for Aircraft Initial Design (DESAID)", Ph.D. dissertation, Cranfield Institute of Technology, 1991.

[4] Perez, R. E., "Aircraft Conceptual Design Using Genetic Algorithms", 8th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, AIAA paper No., AIAA-2000-4938, 2000.

- [5] Chung, J. and Jung, T., "Optimization of an Air Cushion Vehicle Bag and Finge Skirt Using Genetic Algorithms", accepted to Journal o f Aerospace Science and Technology, Elsevier 2003.
- [6] Ryan G. W., "A Genetic Search Technique for Identification of Aircraft Departures" NASA Contractor Report 4688, Dryden Flight Research Center, 1995.
- [7] Moran, D.D., "Cushion Pressure Properties of a High Length-to-Beam Ratio Surface Effect Ship," NSRDC Report SPD-600-01, 1975.
- [8] Sullivan, P.A., Charest, P.A. and Ma, T., "Heave Stiffness of an Air Cushion Vehicle Bag and Finger Skirt," Journal of Ship Research, Vol. 38, No. 4, Dec. 1994.
- [9] Chung, J. and Sullivan, P.A., "Effects of Unsteady Fan Response on Heave Dynamics of an Air Cushion Vehicle Bag and Finger Skirt," AIAA-97-3512, 1997.
- [10] Doctors, L.J., "Nonlinear Motion of an Air-Cushion Vehicle over Waves," Journal of Hydronautics, Vol. 9, No. 2, April 1975, pp. 44-57.

