

Design and Fabrication of Minihovercraft

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ABSTRACT: The purpose of my engineering project is to build a successful hovercraft. It is made of items like wood, tap, screws, blower etc. I wanted to see if the holes should be bigger or smaller and if the tarp should be loose or tight. Also, I worked to see if the holes should be near the centre or closer to the edge. By using our blower we run the project. We using two blowers one is used to control the direction and other one is to move the vehicle. Wood with stand whole part of the vehicle. A hovercraft or aircushion vehicle (ACV) is a craft, designed to travel over any smooth surface supported by a cushion of slow moving, high-pressure air, ejected downwards against the surface below, and contained within a skirt. Because they are supported by a cushion of air, hovercraft are unique among all forms of ground transportation in their ability to travel equally well over land, ice, and water. The lifting motion is controlled by a blower so that an air gap can be formed such separation between the bottom of the hovercraft and the ground provides a motion platform, on which the friction force between the hovercraft and the ground reduces to a very small amount Since a hovercraft does not have wheels, the forward motion is created through the propelling action, which is generated by the use of a propulsion fan. A hovercraft is also used for tourism. A hovercraft works on the principle of propulsion and is futuristic vehicle and can be used in many defence and miscellaneous applications. As the air pressure is increased the air lifts the craft by filling the cavity. The cavity or chamber in which the air is kept is called a 'plenum' chamber. At the point when the air pressure equals the weight of the hovercraft over the chambers surface area the hovercraft lifts and the air starts to escape around the edge of the skirt.

I. INTRODUCTION

Vehicles designed to travel close to but above ground or water. 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 down under the vehicle to create lift, Air propellers, water propellers, or water jets usually provide forward propulsion. Air-cushion vehicles can attain higher speeds than can either ships or most land vehicles and use much less power than helicopters of the same weight. Air-cushion suspension has also been applied to other forms of transportation, in particular trains, such as the French Aero train and the British hover train. Hovercraft is a transportation vehicle that rides slightly above the earth's surface. The air is 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 downward and inward direction. This type of vehicle can equally ride over ice, water, marsh, or relatively level land. 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. Hovercraft is hybrid vessels operated by a pilot as an aircraft rather than a captain as a marine vessel. They operate by creating a cushion of high-pressure air between the hull of the vessel and the surface below. Typically this cushion is contained within a flexible "skirt".

II. CONSTRUCTION

Components Used

1. LEAF BLOWER
2. WOOD
3. SKIRT
4. CHAIR
5. DUCT TAPE
6. BOLT&NUT

7. NAIL

Leaf Blower

A leaf blower is a gardening tool that propels air out of a nozzle to move yard debris such as leaves. Leaf blowers are usually powered by two-stroke engine or an electric motor, but four-stroke engines were recently introduced to partially address air pollution concerns. Leaf blowers are typically self-contained handheld units, or backpack mounted units with a handheld wand. A leaf blower is a gardening tool that propels air out of a nozzle to move yard debris such as leaves. Leaf blowers are typically self-contained handheld units, or backpack mounted units with a handheld wand.

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.

Wood Dimensions:

- Diameter of wood =105cm
- Thickness of wood=2cm
- Weight of wood=5kg
- Diameter of hole=2.54cm

Skirt

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.

Skirt Dimensions

- Length of skirt =120cm
- No of holes=6
- Hole of skirt=2.54cm
- Width of skirt=0.2cm

The air inflates the plastic which pushes upon the floor and provides a ground-hugging "skirt." This lifts the entire hovercraft. The coffee-can lid provides "strain relief" so that the inflated plastic doesn't tear loose from the centre. It also lifts up the vent holes so air can escape into the centre donut-hole. The air leaks along the floor and out from the edges of the hovercraft.

Chair

Chair is fixed on the top of the plywood and operator to sit on the chair and operate the vehicle. Which is comfortable to the operator?

Bolt & Nut

Bolt is fixed centre of the plywood where the skirt is tightly gripped. When the air blow on the skirt it forms in curve shaped it has some gap between ground and skirt.

Nail

Nail is used to fix skirt on the plywood where 1/2" inch nail is used. it is beaten on plywood and head is bend slightly. it is covered by the duct tape

III. WORKING PRINCIPLE

Blower Operation

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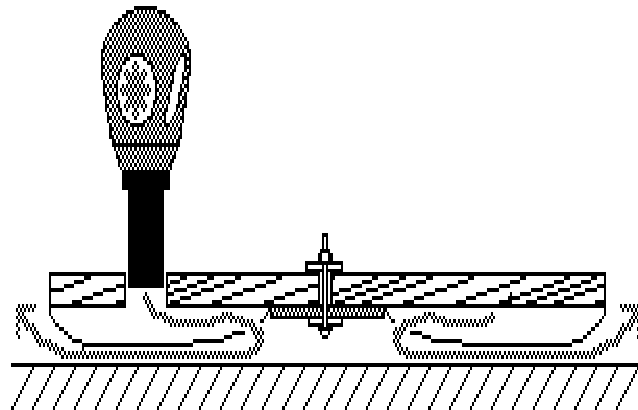


Fig: 1. Operation of Hovercraft

Working Of Hovercraft

Hovercrafts work on the two main principles of lift and propulsion. When dealing with a hovercraft, the existence of lift is imperative for the proper function of the vehicle. Lift is an essential factor because it is that which allows the craft to ride on a cushion of air several inches off the ground. This process, the process of attaining lift begins by directing airflow under the craft. In order to quarantine the air under the air cushion, a skirt is required. This is done in order to create pressure under the hovercraft which forces the vehicle off the ground. Attaining the proper amount of airflow is imperative for the maintenance of the craft's stability. .

If too much airflow is directed under the craft, it will then hover too high above the ground, resulting in the hovercraft to tip. Not enough lift will cause the craft to remain on the ground which defeats the very purpose of the hovercraft altogether. The source of the airflow which propels the craft off the ground is a fan. The fan can be used for lift and thrust. It can be dedicated to lift or thrust or even both simultaneously. In either case the passage where the air flows through to reach the air cushion affects the stability of the hovercraft.

This passage is a hole located on the base of the craft. Another vital component is the motor. The motor is usually located in the rear of the vehicle and is the heaviest of the components. Due to the weight of the motor, extra pressure is required under the area where the motor is positioned in order to attain hovering capabilities.

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The shape of the body also affects the stability of the hovercraft. The larger the area of the base, the more stable it will be. Wider base=greater stability. Longer and narrower shapes increase speed but decrease stability. Most hovercrafts have rounded ends, and offer both stability and speed. The skirt is another vital component. The common skirt is known as a bag skirt. It is comprised of a bag that covers the bottom of the base and has holes in it to allow air to escape and push the craft off the ground.

Each part of the skirt inflates independently which makes repairs much easier and improves stability. Unfortunately, the more stable a skirt, the slower it will go. When the hovercraft is finally able to move it will most definitely require steering capabilities. This is achieved through the use of rudders. These rudders can be controlled by a variety of devices including computers. Rudders cannot be too heavy otherwise they will weigh down the craft because they are located very close to the motor.

The shape of the rudder dictates how well it will be able to move air. When riding a hovercraft the natural state of motion is easily seen to be constant vector velocity with a constant rate of rotation.

A sloping floor will definitely change your velocity vector without changing your rate of rotation. In addition to Newton's three laws of motion it will become obvious that to avoid spinning or tilting the hovercraft you must apply the forces in line with the centre of mass of the combination of the craft and your body. Hovercrafts work on the two main principles of lift and propulsion.

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That which makes hovercrafts so efficient and different from other vehicles of its category is that very little force is required for it to move. Propulsion is that which makes the craft move. The source of this effect is the fan, which is used to move the air for propulsion. However odd as it may seem the fan produces more than enough force for the hovercraft to move. This is achieved through the existence of another major factor:

Hovercrafts have no contact with the ground; therefore any resistance the ground may produce under other circumstances is now non-existent for the craft. As explained above, the propulsion of the craft requires a fan but a normal fan is not sufficient. This is because a normal fan does not blow air straight back. Instead it spins the air in a spiral shape. Therefore engineers decided to use turbines or stationary blades, that un-spin the air. When air does not spin more of its kinetic energy can be used for translation and less is required for rotation.

IV. DESCRIPTION OF HOVERCRAFT

Leaf blowers whisk away leaves, grass clippings, twigs and all other manner of lawn detritus using the forceful propulsion of air. Manufacturers and vendors use the technical terminology of blower specifications to sell the power tools to consumers.

Specifications generally include the power of a unit, the power source for a unit and the size of the blower. As your leaf blower and vacuum is going to be dealing with a lot of rubbish and debris it is important that you clean it after use. The most important areas are the exhaust (or blower), the air filter, the mulches blades and the fan. It is also a good safety activity to always give your device a once over check before you actually begin using it.

As with all machinery consider having it serviced once a year. Not only will this ensure its effectiveness it will also increase its lifespan. The general climate of the country in which you live will define how often you use your leaf blower and how often and how long it is placed in hibernation. Storage then is an important issue.

You want to know that when the leaves are filling up the yard again you will not need to hot foot it down to the local DIY store because it is showing no signs of life. Always store your blower in a dry place over the winter months.

Advantages:

- Wildlife conservation and research
- Transportation or "island-hopping"
- Fishing anywhere ... including ice fishing
- Travelling from land to water where there is no boat dock
- Military services: Assault vehicles and transporting troops
- Dive recovery teams
- Retrieving birds from tailings ponds at mining sites
- Water management
- Border Patrol and Homeland Security
- Port authorities/drug enforcement
- TV and film companies (James Bond movies often use hovercraft)
- Entertainment at Disney World water shows
- Agricultural spraying; cranberry, rice and pecan farming.
- Survey work
- Forestry

V. CONCLUSION

Hovercrafts are generally simple mechanisms in theory. Yet the process from theory to manifestation is not as easy as it may seem. A plethora of problems exist and must be faced in order to attain a well function hovercraft. 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. One thing is certain; when building a hovercraft, be well aware of the demands of construction. Be prepared and willing to embrace failure for it is the only way to success. Only after failed attempts will you be able to finally design an effective hovercraft. When deciding whether or not to use a centrifugal blower for a particular hovercraft, you should carefully consider the advantages and disadvantages of these assemblies. If high pressure air flow is a necessity, the application may fit the characteristics of the device. If lower weight or similar requirements are needed, you may need to install equipment of a different type. Always follow the directions for the specific product you are using. If the manufacturer recommends procedures which differ from the standard practices above, accept the instructions for the product as the correct ones.



Fig: 2 – Hovercraft

VI. APPLICATIONS

- Distribution of famine or flood aid support craft. Relief work (United Nations).
- Civil emergency & infrastructure support
- Oil industry survey, exploration & pipeline patrol.
- Electrical Power-line patrol & safety.
- Remote mining access support vehicle.
- River, lake & port geological surveys.
- Mud & riverbed sampling.
- Environmental projects & clean-up operations.
- Airport bird scaring/support/rescue services.
- Coastal civil engineering & bridge construction & repair/maintenance.
- Transport, service & safety craft for river & low tide coastal work where 24-hour access is vital for staff safety.
- Fish farm & low tide access.

REFERENCES

1. en.wikipedia.org/wiki/Hovercraft
2. www.hovercraft.com/
3. airlifthovercraft.com/