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Abstract

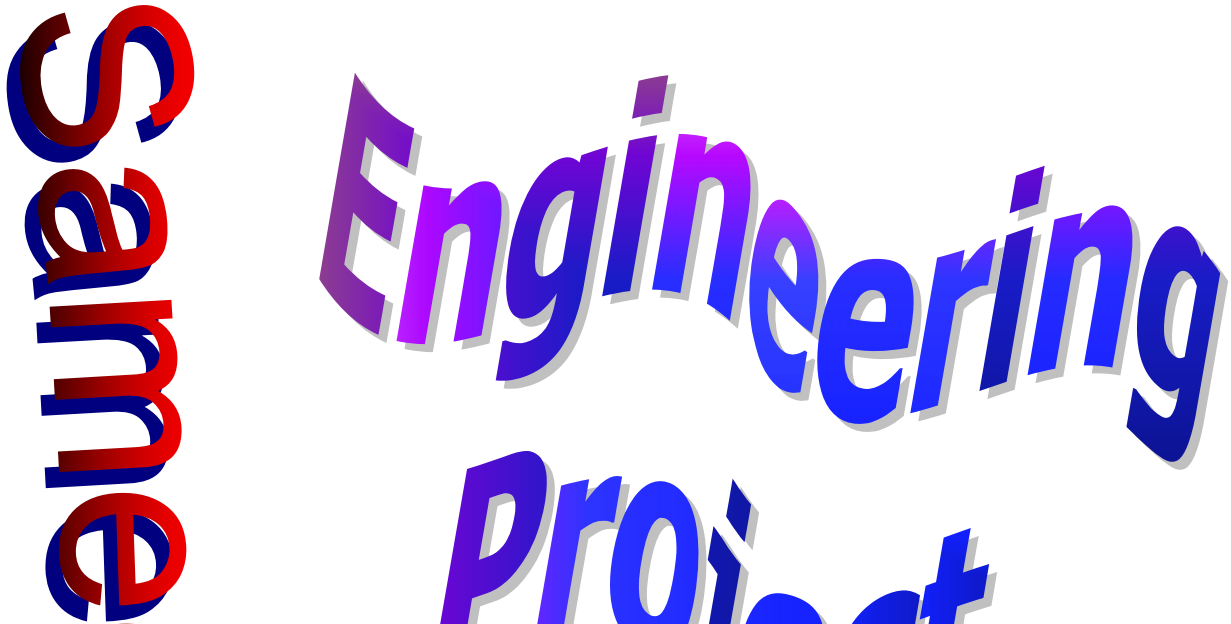
The purpose of my engineering project is to build a successful hovercraft. It is made of items like wood, tarp, screws, etc. I wanted to see if the holes should be bigger or smaller and if the tarp should be loose or tight. Also, I worked to see if the holes should be near the center or closer to the edge.

After finishing my hovercraft, I came upon some mistakes. I got new materials and redid the parts were problems occurred. I measured, cut, and attached more neatly and precisely the second time. I succeeded. I only had a few minor things that I could have done better. My hovercraft is powered by a powerful leaf blower and can hold a person!

Safety

Building this hovercraft was a task that required careful and safe builders. There were lots of safety precautions that needed to be taken in mind because of certain materials and tools.

We had a 4' by 4' slab of plywood. We had to handle it carefully so that no one would get hurt. When we cut it with an electric jigsaw, we had to wear eye protection. The saw had to be under control so that no one would get seriously hurt. We used scissors and duct tape which are not as harmful. But we had to be careful of our fingers when we used the stapler/staple gun. No one got hurt because we kept these things in mind and were careful.



Sameer Bansal's Engineering Project

Hovercraft

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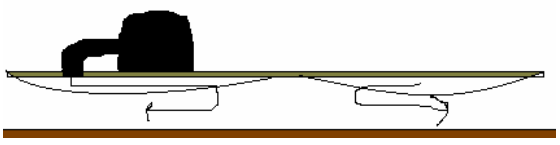
Acknowledgements

I greatly appreciate the time and effort my parents took so that I could finish this project they took me to stores to buy materials and tools and they helped me build the hovercraft. There were some nice people at Home Depot who told me

some tools that would help me make the hovercraft. Mr. Cave made the project and gave me a sheet with directions and a website with directions on how to build a hovercraft. I got to see my classmates projects on open house which helped me. I have to thank Toro for making my leaf blower… just kidding. I got a lot of help from different people on this project.

Purpose & Hypothesis

In a hovercraft, does the tarp have to be loose or tight, does the holes have to be near the center or closer to the edge? Those were my main questions to find out. I think that for the hovercraft to work properly, the tarp should be tight but not to tight. If the tarp is loose than the tarp would inflate but maybe not get of the



ground. I would think that you do not want the hovercraft tarp to be to tight either. I think that the holes should be near the

center so that when air comes out it is trapped inside the donut of tarp. Then in will push the hovercraft up so that it can escape, creating a film of air holding up the hovercraft. Also, I think that the holes should be small so that the air will not just come out. If the holes are small, then there will be good air pressure.

Review of Literature

History of Hovercraft

For centuries, there have been many attempts made to decrease friction between moving parts. Many ideas where experimented in the early 1900s until they came together by a man named Sir Christopher Cockerell.

His job was actually an electronic engineer, but he sailed small boats, like a craft he had designed and built himself, in his leisurely time. He pondered the idea about drag on his

hulls. He experimented with a variety of devices for introducing a film of air to reduce ‘drag’. He had a theory which was originally tested in 1955 using an empty KiteKat cat food tin inside a coffee tin, an industrial air blower and a pair of kitchen scales. Christopher Cockerell's idea was to build a vehicle that would move over the water's surface, floating on a layer of air. This would reduce friction between the water and vehicle. To test his hypothesis, he put a smaller can inside a larger can and used a hairdryer to blow air into them. He had produced a ‘skirt’ of air capable of supporting a weight. He came up with the word ‘lubrication’ for this layer of air between hull and water. He made a working model with a boat-building friend, and tried it out on a dock near his house. His hovercraft designs led to the first hovercraft to be produced commercially, the SRN1. This was in 1956.

Being treated with a great deal of disbelief, the Government of the day slapped a secrecy order on Cockerell's idea, eventually contracting Saunders-Roe to build a full sized hovercraft to test its feasibility. Cockerell also got the National Research Development Council, which fixed patents and rights, to protect the invention from being copied abroad. They also provided the necessary funds.

So the first hovercraft, the SR-N1 was flown from Calais to Dover in 2 hours on July 25th 1959. This craft, 30 feet in length with a 24 foot beam weighed 3½ tons. This gave the craft a 9 inch lift. SR-N4 , a later hovercraft ferry (1968) carried 254 passengers and 30 cars - later stretched to carry 396 passengers and 53 cars. Later, hovercrafts were and still are sometimes used for military purposes also. This is all thanks to Christopher Cockerell.

How a Hovercraft Works

A hovercraft is a vehicle that can go on both land and water and is supported by a cushion of pressurized air. They are usually assumed to be a bizarre kind of transportation, but they are actually quite simple. Hovercrafts are air cushion vehicles (ACVs) or ground effect machines. They are the most unique among vehicles that are supported by pressurized air.

Hovercrafts float on a cushion of air that has been forced under the craft by a fan. This causes the craft to rise up. The amount of lift can range from 6" to 108" , depending on the size of the craft. The amount of total weight that a hovercraft can raise is equal to cushion pressure multiplied by the area of the hovercraft. it is necessary to limit the cushion air from escaping. The air is contained by the use of what is called a skirt. Skirts are made of fabric, which allows a deep cushion.

Once "lifted" or "on cushion", force must be created to move the hovercraft forward. With many crafts, this is generated by a separate engine from the one used to create the lift, but with some, the same engine is used for both.

Now that the hovercraft has lift and thrust, it has to be steered. This is accomplished through the use of a system of rudders behind the fan, controlled by handlebars up front. Steering can also be controlled by the use of body weight displacement - a skill which is achieved after practice. Hovercrafts are used with the steering handlebars but also with out. The science part of hovercrafts is easy to understand.

Manufacturing and Business of Hovercrafts

There are tons of companies out selling hovercrafts. You can find a lot of hovercrafts on the internet. Hovercrafts are sold in all sizes - 1-2 people hovercrafts all the way through

30 people and cargo hovercrafts. Kids like me even build hovercrafts for school projects or science fairs. Prices are in the thousands. They go from $10,000 to about $30,000. Many companies compete on the internet - hov pod and neoteric are manufacturers. There is demand for hovercrafts, so there is the supply. I think that hovercrafts will get popular in the future. They are good vehicles. You could make good money from selling hovercrafts.

Materials

I needed many supplies for this project. The main piece of the hovercraft was a piece of plywood that is 4' by 4' with ½" thickness. I also used a tarp that was bigger than 5' square. I use a Frisbee in the middle held by a wood screw, 2 fender washers, and a bolt. I used scissors to cut holes and the outside of the tarp. I used a screw driver and drill to get the

wood screw in the wood. I used a leaf blower to power the hovercraft. I propped one side of the leaf blower on a small block of wood. To attach the tarp and leaf blower to the wood, I used duct tape and a staple gun. To cut the wood, I used an electrical jigsaw. Last but not least, I used a rag to wrap around the spout of the leaf blower so that it was air tight.

Methods and Procedures

I. Make the Wood Disk

A. Put nail in middle of plywood

B. Tie one end of string on nail and other end on pencil

C. Take pencil and move around nail drawing a circle with a 4' diameter

D. Lay wood on elevated surface

E. Take saw and cut on line

F. Trace spout of leaf blower on wood and cut that out too

G. Take out nail and drill hole in the middle for screw

II. Make Plastic Sheat

A. Draw and cut tarp into circle with diameter of about 4’ 9”

B. Take tarp and fold it into 4ths

C. Draw and cut 1 ½ holes on that side near center with a diameter of 2”

D. Unfold it and see 6 holes

E. Make tiny hole in center for screw

III. Attach Plastic Sheet to Wood

A. Lay tarp over wood so that middle holes match up

B. Drill hole in middle of Frisbee

C. Lay Frisbee on tarp so that middle holes still match up.

D. Screw wood screw starting from bottom

E. Add washer and bolt on other side and make as tight as you can without cracking Frisbee.

F. Lay every thing on ground with Frisbee on the bottom

G. Fold tarp over edge of wood

H. Make sure it is not too loose or to tight.

I. Put duct tape and staple to seal

IV. Put leaf blower on

A. Slide leaf blower in hole you made

B. Try to get it flush with the bottom of the wood.

C. Duct tape and staple around spout to make air tight

V. Done

A. Make sure everything is air tight

Results and Observations

At first, my tarp was loose. When I turned on the leaf blower, first of all, it was loud, but it didn't lift of the ground. It inflated, but didn't get of the ground. Unknowingly, I made the holes bigger. Then I turned it on and it did nothing. It just lay flat on the ground. So, I had a problem. I went to the store and got more tarp. This time, I cut the holes more precisely and smaller. When I put the tarp on again, I made it tighter. When I turned the leaf blower on, it lifted. Success! The only problem was that it was a little tilted, but it worked. This mistake and redo gave me the answers to my questions.

Conclusion

I was trying to figure out a couple of things. Should the holes be near the center or closer to the edge? I found that the holes should be near the center so that when the air comes up it pushes the hovercraft up to escape. Should the holes be small

or big? In my mistakes, I found that the holes should be about 2” in diameter so that there is good air pressure. If the holes are big, the air will just flow out. Should the tarp be tight or loose? Again, in my mistakes, I figured out that the tarp should be tight but not too tight. If the tarp is loose then the air will not be able to escape. Every thing was how I hypothesized. The holes should have a 2” diameter and be near the center on a fairly tight sheet of tarp.

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