

To Increase Endurance and Durability of Battery Powered RC Hovercraft

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Abstract: - The air cushion vehicle or "HOVERCRAFT" as it is popularly known as newest vehicle in today's UAV mission as well it is different from other RC vehicle, it has some new challenges. Modern DC electric powered hovercraft has some difficulties regarding its endurance because of its battery power and passive devices. To avoid this demerit in small size hovercraft this has weight of 3 to 5 kilogram. I can use foldable solar panel on the top most surface of the hovercraft for charging 2 cell lip battery (5000 Mah). With the help of lithium battery charging module. So during operation of hovercraft in day time, solar panel will continuously charge the battery. Thus the endurance of hovercraft can be increased.

1. Introduction

A hovercraft, also known as an air-cushion vehicle or ACV, is a craft capable of traveling 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. Hovercraft use blowers to produce a large volume of air below the hull that is slightly above atmospheric pressure. The pressure difference between the higher pressure air below the hull and lower pressure ambient air above it produces lift, which causes the hull to float above the running surface.

Mostly hovercrafts are made of engine thrusters and wooden hull. These types of hovercrafts are mostly manned and run on fuel. Today the air cushion vehicle or "HOVERCRAFT" as it is gaining popularity to be known as newest vehicle in today's UAV mission. It's an innovative approach towards USVs (Unmanned Surface Vehicles) as well as it is different from other RC vehicle as it has the core inherited properties of travelling on both land and water. However as the

development of such complex machines proceeds it has been seen the some new challenges are encountered every now and then.

From the basic functionality of hovercraft it is clear that the creation of cushion pressure is a continuous process, and hence huge amount of power is required to run this operation. For this very reason, Hovercraft enthusiasts do not prefer electric powered hovercrafts because of their extremely low endurance. Even for hobby hovercrafts makers, fuelled engine manned hovercraft is first choice of fabrication than the RC based electric hovercraft.

In this paper, we are going to tackle this very problem. Our aim is to eliminate the problems related to endurance of an electric hovercraft and in addition to that we want the hovercraft system to be more rugged and durable. This can be achieved in number of ways and our research shows that one of the best ways to do that is depicted in this paper.



Fig 1. Hovercraft Model without Solar Panel

2. Our Proposal

The innovative device we are going to use in battery powered small hovercraft is either FM16-5400 90 W, or F16-1200 20 W, we use any one solar panel from these two as per our requirement. The main difference between these two foldable solar panels is Voltage and current.

TP 4056 1.2A is a charging module. It is junction between battery and solar panel with the help of micro USB cable. From battery terminal one connection will go to lift motor and other will go to thrust motor with the help of star(Y) connection. Lift motor and thrust motor connected with 18 amp 2 Electronics Speed Controller (ESC) each and 53.800 MHz receiver.

And whole structure of hovercraft is made up of carbon fibre material to increase the Durability of hovercraft. Carbon fibre is a water proof material so that water won't decompose the hull section of hovercraft. Two motor are scorpion 1090 Kv are used to produce lift and thrust. Rudder is used for controlling the direction of hovercraft.

This complete implementation will be designed in 3D modelling software like Catia or Solid works. After development of the complete hovercraft design, the 3D model will be induced with material characteristics like carbon fibre parts, foam hull, skirt fabric and other appendages. These material attributers are then transferred to any analysis software along with the 3D model and the analysed against all the possible stresses and structural soundness.

Specification of foldable solar panel

Operating voltage: 15.4 V

Wattage: 90 Watts

Current: 5.4 Amps

Folded: 11" *14" (356 mm * 279 mm)

Unfolded: 54.5"*68" (1384 mm * 1724 mm)

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Weight: 3 to 4 lbs.

Operating voltage and current are typical values when tested under load at AM 1.5 lighting conditions.

We are going to design hovercraft with the help of solar panel and electronics equipment which are mention above. Designing of block diagram of electronics parts of motor we have done in CAD modelling.

3. Methodology

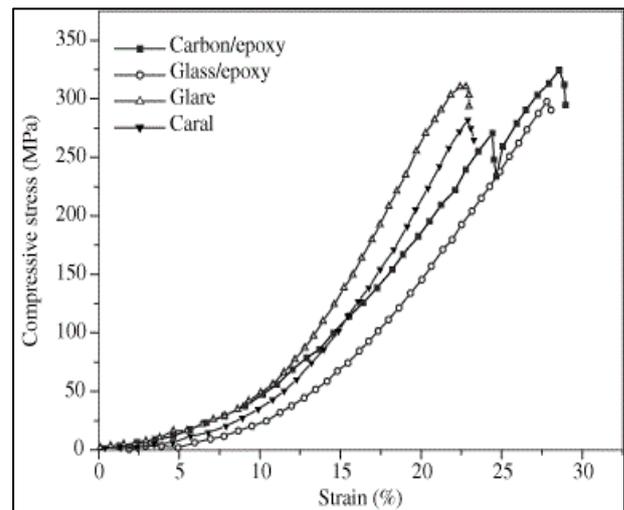


Fig 2. Compressive Behaviour of the Laminates Studied

The given above diagram represent mechanical properties of carbon, glass, etc. when % of strain is increase on carbon/epoxy compressive stress also increased. These results are achieved from standard testing methods on the taken materials. The same results were confirmed with analysis software. This will show the strength of material and it can be clearly seen that carbon has the highest endurance against strain percentage and thus carbon fibre is best material to increase the strength and durability of hovercraft.

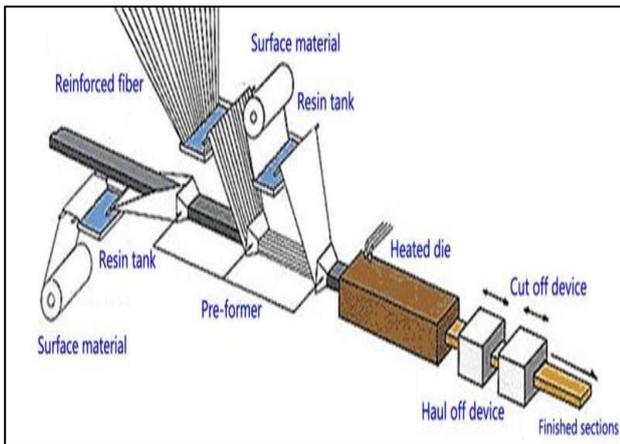


Fig 3. Making of fibre material

The above diagram represents the making of fibre material by using four different type of material. With the help of injection moulding The material here used are surface material, reinforced fibre, former, resin etc. these material are passing through the heat die. After heat treatment material is passing through the device which cut the material according to the given dimensions.

This specific method is one of the ways a custom carbon fibre part can be fabricated. Using different spools of carbon fibre threads and then weaving them together with a matrix of epoxy resin can make a good carbon fibre part.

4. Block Diagram

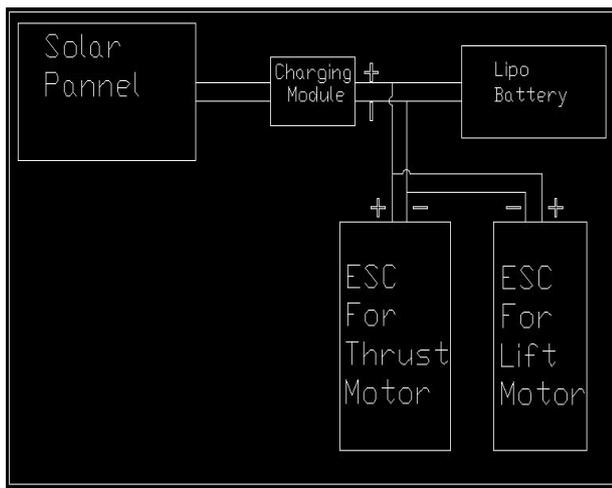


Fig 4. Connection Diagram of Electronics Parts of Hovercraft

Given above, the block diagram shows that the base circuit has solar panel on it. Solar Panel consists of photovoltaic cell which converts heat energy from

the sun into electrical energy. This electrical energy can be used for the hovercraft. Electrical energy from the solar panel flows in charging module with the help of micro USB cable. The Battery Module is attached with 2 cell Lipo battery each of 5000 Mah. The battery gets charged and provides more endurance. From batter with star connector electrical energy transferring in two pair of ESC which is mention in above block diagram.

5. Conclusion

After complete power estimation and material selection it was found out that with the help of solar panel it can be possible to increase the endurance of an electric hovercraft up to 30% to 45% (Approx.). If we are using hovercraft for water based application we can increase our area of operation and more endurance can be achieved countering the effects of water drag and long mission time. Moreover, it will also decrease the cost of battery replacing again and again.

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