CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38150

Project Title

Comparison of Two Different Propulsion Systems: Combustion vs. Magnetism

Abstract

Objectives/Goals

Can a magnetic-based propulsion system successfully propel a free-floating vehicle forward? If so, how does it's performance compare to jet propulsion systems?

Methods/Materials

Magnetic-based model was composed of Styrofoam, suspended in the air via the repulsion of opposing magnets on the bottom of the vehicle and a cardboard track. The vehicle would travel along the track via the attraction of magnets on the bow of the vehicle towards a stationary magnet at the end of the track (30.48cm). Additionally, another Styrofoam vehicle was placed on water, which was separated into two equal halves attached by a straw. The lagging half had a magnet affixed to it; while rotating a magnetic bar near the leading half (north to south). A combustion based propulsion system was modeled using a rocket simulation, created using a water bottle "rocket" fueled with ½ teaspoon of rubbing alcohol which was ignited using a barbecue lighter, which was inserted to the mouth of the bottle, inside a PVC pipe and sealed using low-flammability paper wadding. Data from 6 trials per vehicle type were used to calculate force, "work", speed, and efficiency.

Results

The average time for the magnetism-powered vehicle to travel 9 centimeters is 0.34 seconds, its average speed is 0.48 m/s, thus taking an average of 0.61 seconds to travel 30.48 centimeters, with 100% efficiency. However, the trial of the vehicle floating in water, resulted in minimal net movement forward. The combustion based propulsion system resulted in the following: The average time for the bottle rocket to travel 30.48 centimeters is about 0.92 seconds, and it took an average time of roughly 1.85 seconds to travel the average distance of about 4.8698 meters. The average speed for the bottle rockets is 2.63 m/s, with 93% efficiency.

Conclusions/Discussion

In conclusion, the data indicates that magnetic-based propulsion systems could be a preferred method of propulsion for long distance space travel from an efficiency standpoint. However, this means of travel would likely need to be coupled with smaller thrust engines near the front, to keep one half of the vessel stationary (relative to the other), in order to produce forward motion. For shorter distance space travel and with heavier payloads, combustion based propulsion systems would be preferred as they generate more energy and thus are able to do more "work".

Summary Statement

A comparison of jet propulsion and magnetic propulsion in space travel.

Help Received

Special thanks to Mrs. Kruczyk for helping me with the project documents and my family for assisting me with the experiments. I came up with the idea for this project, designed the experiments and created the CAD drawing of the final proposed vessel.

Preliminary