CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
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Project Number
S0213

Project Title
A Fuel Cell Powered Underwater Glider for Marine Exploration

Abstract

Objectives/Goals
Underwater gliders are used for long-term oceanic studies and missions, such as ship scanning for the navy (invisible to sonar), underwater mapping, and temperature mapping for global warming studies. These gliders are expensive and not very efficient, making them an uncommon tool for ocean researchers. The goal of this project was to build an efficient, low cost underwater glider that recycles energy by using a fuel cell as its method of propulsion. Additionally, I analyzed the glider's performance and demonstrated its feasibility with the simple prototype. More efficient and lower cost gliders could be used more commonly throughout the world#s oceans.

Methods/Materials
A buoyancy engine allows underwater gliders to glide downward under the influence of gravity and upward, propelled by buoyancy. Normal buoyancy engines do this by expanding and compressing gas to change the volume and buoyancy. I have used a fuel cell to produce and consume gas instead of expanding and compressing it. This new buoyancy engine increases the efficiency from 12-15% to 50-75%. The fuel cell for this project was ten times the power of last year#s conceptual buoyancy engine model and has the potential and the ability to power the half-sized glider I#ve built. In this project, I designed, built, and tested a simple underwater glider powered by a fuel cell buoyancy engine. In addition, I wrote a computer simulation to analyze its performance.

Results
The efficiency of this glider is a significant improvement on current underwater gliders being used for ocean research and mapping. This new buoyancy engine powers a glider designed to travel at .25 m/sec while staying trimmed and stable in the water. The design of the glider was done experimentally, virtually and numerically to produce the most simple and reasonable design for aerodynamic performance and construction.

Conclusions/Discussion
The simulation and experimental tests show that this new idea is practical, and could revolutionize methods for some types of marine research. There are other ways to improve energy efficiency, and much more work would be needed for a fully maneuverable and data-collecting vehicle. I have yet to install a control system or sensors in the glider, but this project is the first step toward a powerful tool that would allow researchers to study the ocean in new, exciting ways.

Summary Statement
I designed, built, and tested a simple underwater glider powered by a fuel cell buoyancy engine and wrote a computer simulation to summarize the effects of drag, lift, weight, buoyancy, and pressure on speed, efficiency, and stability.

Help Received
Mother helped paste board, father answered questions about simulation equations, Blake and Sebby from the Gunn Robotics Team helped with welding/construction.