



CALIFORNIA STATE SCIENCE FAIR 2004 PROJECT SUMMARY

Name(s) Reed Shea	Project Number S0108
Project Title What Size Hydrofoil Does My Sailboat Need?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To find out what size hydrofoil(s) would be needed to lift and sustain a small sailboat, with myself on it, out of the water. I own a small sailboat, and want to put hydrofoils on it. The reason for this is to make the boat go faster, and doing this as a science project seemed like a perfect way to learn about hydrofoils</p> <p>Methods/Materials I did a lot of research, contacting professors as well as people in the business of hydrofoil design. I also used a program called FoilSim, developed and written (in Java) by a group of people at NASA. This was a large part of my project, and gave me the foundation for my actual experiment. My experiment was conducted by running water down a sluice to a model hydrofoil which I'd built. I placed the foil upside down, so that I could measure the downforce made by the flow of the water. The foil could move up and down, but was anchored so that it couldn't move backwards with the flow of the water. I rigged up a small contraption using a few scales and some fishing line to measure this force, which is the lift produced by the foil.</p> <p>Results I had great results from the FoilSim program that I used, as well as from calculations I did with my mentor (my dad, who has a BA in aerospace engineering). Of course, the numbers that I found wouldn't correspond exactly with real-life data, because I didn't calculate in factors such as induced drag or any kind of friction. Unfortunately, my testing apparatus didn't work as well as I'd hoped. The main reason for this is that I used too small a scale, and the flow of the water was too fast. I calculated how to get the water to flow at 12mph, which it did, however this was too fast for the small size of the foil. The data taken from my trials differed from my theoretical calculations by a factor of six.</p> <p>Conclusions/Discussion Because of the inaccuracies of my testing apparatus, I'm inclined to have more faith in my calculated data. If I did my project over again, I would have a larger-scale model. I tried to do that originally, however when I found out that testing tanks cost about \$50 per hour to run, I decided that it would be more cost-effective to make my own apparatus. Although my project doesn't have much in the way of real-world applications, I learned a lot from it, in a subject that interests me. The information and knowledge gained will help me tremendously if and when I design and build hydrofoils for my boat.</p>	
Summary Statement Finding the necessary hydrofoil area to keep a small sailboat, with myself on it, out of the water.	
Help Received I contacted multiple professors and people in the business of hydrofoil design by email, and recieved some general information back from them. My dad helped me out building my testing apparatus, as well as during testing.	