CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
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Project Number
J0111

Project Title
What's the Drag with Swimming? How Effective Are Swim Caps in Reducing Drag?

Abstract

Objectives/Goals
My objective was to determine whether a swim cap reduces drag on a swimmer, and if so, whether a swimmer with long hair or short hair would benefit most. Similar to a cyclist wearing a helmet, I believe that it may be possible for a long haired swimmer to create a similar effect allowing water to flow smoothly over the head to the shoulders, filling in the gap in the neck area decreasing drag.

Methods/Materials
With my dad's help, I created a test rig (similar to a wind tunnel, for water), which was placed in our swimming pool. I placed a plastic model of a swimmer's head and torso on a slide inside the rig. A current was created using garden hoses, which put pressure on the swimmer ("drag"). Through a cable and lever system, pressure was applied to a scale. I measured the amount of drag in grams which was then converted to newtons. I did three tests for each category of swimmer, with and without a swim cap, with a short hair wig, long hair wig and no wig.

Results
The results showed wearing a swim cap reduced drag in all situations. The best drag reduction occurred by a long haired swimmer with a swim cap.

Conclusions/Discussion
My base test was a bald swimmer without a swim cap (0 newtons). All other tests were compared to that swimmer. Adding a swim cap to the bald swimmer, reduced the drag to -.0196 newtons. The short haired swimmer without a swim cap had 1.01 newtons of drag; this was reduced to -0.0785 newtons with a swim cap. The long haired swimmer without a swim cap had .539 newtons of drag; this was reduced to -.2844 newtons with a swim cap. The least amount of drag occurred with long hair in a swim cap, which confirmed my hypothesis.

I was correct that the long hair under a cap would perform best, but wrong because I was unable to fill in the gap at the nape of the neck as I originally thought. The caps used were too tight to allow the hair to be positioned where I initially wanted.

By observation, it appeared that drag reduction was achieved by diverting the water around the nape of the neck.

Summary Statement
My project compares drag reduction utilizing a swim cap over various lengths of hair.

Help Received
Prostethics, Etc. helped me create the "swimmer" used for my tests. Dad helped me build my test rig and perform the tests. Mom helped me with my display.