PROJECT S.H.R.E.D.

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Abstract

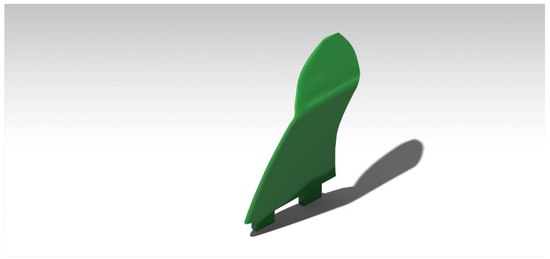
The goal of this project is to determine whether changes from the typical surfboard fin design can produce reduced drag, increased lift or a combination of both which would result in an increase in surfing performance. This was done by comparing a standard FCS fin, two experimental fins produced by other companies and a fin designed by this project. The fin was designed using engineering analysis with the help of programs such as xFoil, CATIA and ANSYS. The fins were tested against each other both in the water while surfing and in a wind tunnel.

Introduction

Since the inception of surfing, surfboard fin design has changed very little. This is due to the surfing industry mainly relying on qualitative feedback for improvement. Additionally, fin performance can be difficult to measure as the waves change on a daily basis

Approach

- Design a fin using aerodynamic principles.
- Model the fin and use CFD analysis for it.
- Perform wind tunnel testing against other fins.
- Test the fin in the water for accurate results.

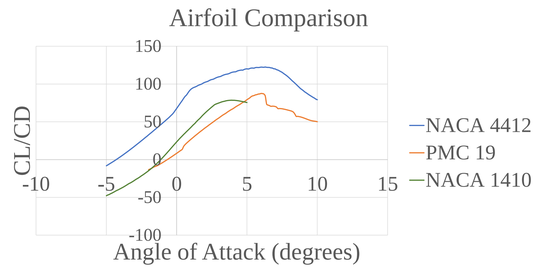


CATIA model of the Project S.H.R.E.D. design.

Design

The Project S.H.R.E.D. fin was designed by:

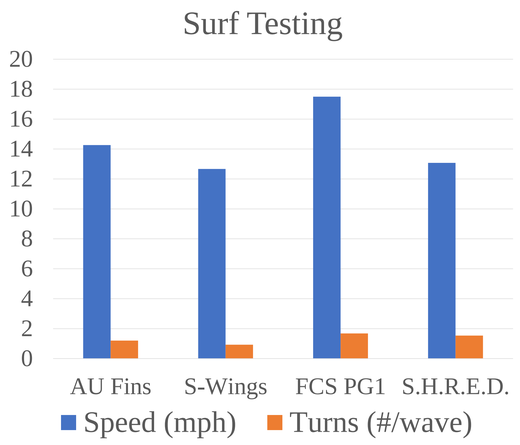
- Determining base foil shape from xFoil analysis.
- Optimizing the fin base length, sweep and depth.
- Addition of winglet to reduce tip vortices.



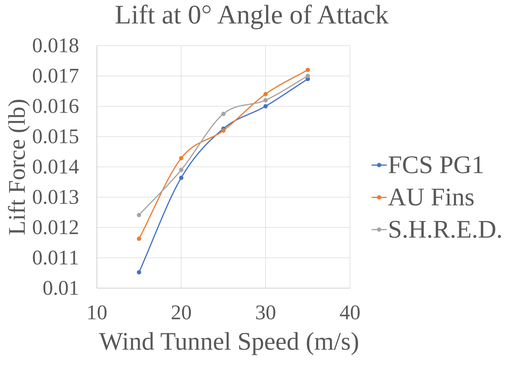
Results

- Surfing data was collected by GoPro GPS telemetry software.
- Higher speeds while surfing and increased number of turns are desirable.

GPS data obtained while surfing.



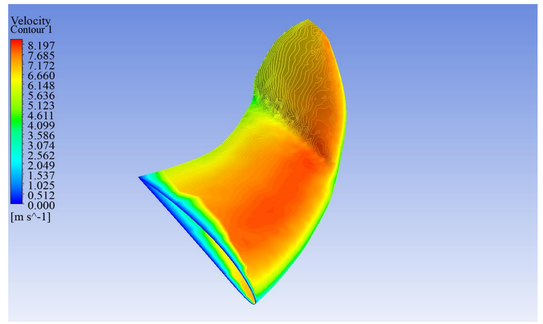
- Wind tunnel testing was done to have controlled environment testing.
- More lift generated by the fins means more speed in the water.
- The data shows the trends of the fins as the wind tunnel speed increases.



CFD Analysis

The goals of the CFD analysis were to:

- Simulate the flow around each fin design at the proper Reynold's number.
- Show how the winglet design affects fluid flow.
- Obtain lift and drag forces from the simulation to compare to wind tunnel values.



ANSYS Fluent simulation of flow over the project's fin

Conclusion

- Although the Reynold's number was not met in wind tunnel testing, the general trend is that the fins generate similar lift.
- In the water, the standard FCS fins had higher average speeds than the experimental fins.
- The water testing has many sources of error including different wave heights, different surfing locations and GPS data error.
- The ANSYS simulation showed reduced vortices for the project's fin design.

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