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Project Number
S0309

Project Title
Investigating Fluid Patterns to Determine the Efficacy of an Airfoil

Abstract

Objectives/Goals
The focus of this research is on the optimization of wind power and airflow, and the experimental derivation of drag and lift on energy savings.

Methods/Materials
3D printed airfoils were created using the NACA 0012 airfoil and modifying the control group to biomimetically emulate natural designs such as Humpback Whale Tubercles as well. The force of drag was experimentally determined by measuring the amount the airfoil was pushed via a spring scale. The force of lift was experimentally determined by measuring the change in weight before and after the airflow over the airfoils.

Results
The results had shown a consistently lower drag force and consistently higher lift force in the experimental airfoil, with a delayed stall and flow separation as per the CFD (Computer Fluid Dynamics) simulations.

Conclusions/Discussion
Real world implications include reductions in the fuel economy of airplanes, windmills, next-generation cars, boats and other objects that move through fluids such as air or water.

Summary Statement
The aerodynamic efficacy of different airfoils, inspired from real world species, was determined by measuring the different aerodynamic forces on the airfoils, while a CFD simulation was used to verify our results and explain the mechanism.

Help Received
David Uken helped us in 3D printing our airfoil