Wind Tunnel Demonstration of Airfoil Drag Reduction

Spilman, Dale

Using an open-circuit wind tunnel of researcher’s own design and construction, several alternative designs of airfoil caps were tested to measure impacts of various shapes to drag. Practical experience was gained in design and sizing and sourcing materials as well as construction techniques needed to complete the test apparatus. The key factor in designing the wind tunnel was the size necessary to adequately test an airfoil big enough to produce meaning differences in drag. A key limitation was the sensitivity of the force sensitive resistor. Drag was measured by attaching the airfoil to a tilt table and measuring the rotation force on the fulcrum. Based on the data collected during this experiment, conclusions from the project include: 1. Turbulent flow from a axial fan can be conditioned using smaller diameter tubes to achieve laminar flow i.e. smooth flow. 2. Drag varies by the proportional square of the air velocity. 3. Protruding rounded cylinder end cap generated the least amount of drag. 4. Square end cap generated the most drag in all configurations tested. Equipped now with an adequate test apparatus, exploration will continue on behavior of more complex airfoil performance in subsequent projects and may include computer models/computational dynamics in my research.

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