Optimizing Angle of Attack to Maximize Lift in a High-Endurance UAV

Archer, Michael (School: Bountiful High School)

This project was undertaken to discover the optimal angle of attack (AoA) to maximize pounds of lift produced from airfoils at low speeds. An initial selection of 20 airfoils was obtained by consulting online resources and databases. This initial selection was slimmed down to the 3 most promising candidates; the NACA 4412, the S1223, and the E423. All due to their high lift generating properties. Each of these candidates was imported into SolidWorks and then modeled into a wing with constant dimensions of 96" wingspan and 9.8" cord length; to simulate the test conditions, I am using SolidWorks Computational Fluid Dynamics Capabilities (CFD). Each airfoil was tested starting at 0 degrees AoA and then increased by 1 degree for 21 iterations. All tests were run at a constant velocity of 92.06 mph. At the base measurement of 0 degrees AoA, the NACA 4412 produced 12.4 lbs of lift, the E423 produced 2.7 lbs of lift, and the S1223 produced 1.3 lbs of lift. The amount of lift generated by the NACA 4412 peaked at 107.8 lbs of force with an AoA of 16. The maximum amount of lift generated by the E423 was 20.6 lbs of force with an AoA of 12. The S1223 generated 19.6 lbs of force at an AoA of 15. The NACA 4412 is the clear winner. This information will be critical to the larger project and development of my UAV.

Awards Won: