The Next Airbender: A Novel Approach to Airfoil Efficiency and the Optimization of the Lift-to-Drag Ratio

Seevers, Rachel

The purpose of this experiment was to study the potential benefits of a novel design on the efficiency of the lift and drag relationship for airfoils. The physics of the fluid flow dynamics are addressed with focus on the formation of wing-tip vortices and likewise the various efforts to suppress the strength and/or divert the direction of the drag-inducing air formations, as well as various other fluid flow dynamics including the boundary layer. In this research, a targeted yet energy efficient jet air curtain is strategically placed on airfoils in an attempt to manipulate the flow dynamics in a positive manor. A wide range of results are presented in both an empirical study as well as a multi-variable designed experiment using computational fluid dynamic simulation software. Together the findings conclude the potential lift-to-drag ratio improvement of up to 40% and this novel invention could truly revolutionize airfoil design by decreasing fuel waste and improving the overall efficiency of an aircraft. The designed experiment sheds light on seven key aspects that should be focused on during the optimization of the relationship between ambient air speed conditions and airfoil angle of attack, relative to the jet curtain.

Awards Won:

Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Intel ISEF Category

Society of Experimental Test Pilots: Certificate of Honorable Mention

NASA: Second Award of $750