Revision in Airfoil Design to Increase Fuel Efficiency in Commercial Aircraft

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As demand for aviation rapidly grows with both the increasing population of humanity and the globalization of the world, the environmental effects that aviation contributes to climate change such as contrails and jet exhaust are increasingly garnering attention. Thus, this airfoil modification will increase overall lift-to-drag ratio (LDR) in common airfoils that will aid in leading to improved fuel economy in modern airplanes. A 3D-printed design of the National Advisory Committee for Aeronautics (NACA) 22112 and the supercritical phase 2 [SC(2)-0714] airfoils were tested in a wind tunnel through a 0° angle of attack (AOA) and verified through a computational fluid dynamics (CFD) simulation, in which there was a control and the attachment for each of the NACA and SC(2) airfoils. The drag and lift coefficients were then calculated, with an overall increase in both the drag and lift coefficients. However, there was a 6.5% increase in LDR in the SC(2) – 0714 airfoils in the CFD and an 8.2% increase in LDR in the tunnel. Similarly, a 0.3% increase in LDR in the CFD simulation and a 3.4% increase in LDR in the tunnel occurred for the NACA airfoils. The results approximate around 6-8% fuel efficiency for airliners utilizing the SC airfoils and 0-3% fuel efficiency for airliners with the NACA airfoils.

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