Reducing the Impact of Wingtip Vortices on Aircraft Through the Use of a Novel Winglet Design

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For the past two decades, the aviation industry has been increasingly placing a heightened focus on maximizing the efficiency of air travel to both maximize profits as well as to minimize environmental impacts. One of the many inefficiencies that has been reduced, is wingtip vortices, a rotating flow of air generated by all wings due to the pressure differential created by an airfoil. This reduces the overall efficiency of an aircraft and results in higher emissions and operation costs. Winglets have been developed to reduce the effects of wingtip vortices and have been developed through several designs (raked wingtip, split scimitar, spiroid). This project seeks to create a novel winglet design that offers a 1% improvement in lift to drag ratio (2.5% fuel efficiency increase). Designs were modeled in Computer Aided Design (CAD) and then physically built using additive manufacturing. These wing sections were then tested in a wind tunnel at varying angles of attack and data recorded against a control. The designs created showed significant improvements at the highest angles of attack where wingtip vortices are known to be strongest, but failed to improve when considering a standard flight profile. Future research will consider active options that can reduce the impact of the devices at low angles of attack while still maintaining the efficiency gains found at the highest angles of attack.

Awards Won:

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