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The objective of this research is to determine the effect on aerodynamic performance due to changes of winglets design variables found of the Boeing 737-700 aircraft. The various winglet types studied in this research include the blended, canted, wingtip fence and split scimitar. The variables include height, sweep angle, taper ratio, and the inclination angle. These variables are altered in 5% increments from -15% to +15% of their original baseline values. Each altered winglet design only changes one variable at a time while keeping all other variables constant. The altered models are compared to the original by finding the aerodynamic efficiency though Computational Fluid Dynamics in Solidworks. For this study, aerodynamic efficiency is defined as lift to drag ratio generated by the isolated wing coupled with the corresponding winglet design. For empirical analysis, the optimized winglets are scaled down, 3D printed and tested for their aerodynamic efficiency in the AEROLAB subsonic Educational Wind Tunnel.

This study concludes that the blended winglet reaches peak aerodynamic efficiency with an increase to the sweep angle of +10% of the original baseline blended winglet value found on the B737-700 winglet. Additionally, aerodynamic efficiency of the canted winglet peaks at an inclination angle of 45 degrees. The Wingtip fence winglet derived from the Airbus A320 preformed the best at its baseline values. Lastly, the split scimitar winglet performs best with the lower member as the full cord length and scaled down to 50% of the top member. This study focuses on the relative changes of each winglet and its changes to the aerodynamic efficiency.