



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Loren Newton	Project Number S0321
Project Title Cones-Chutes-Coils: Novel Proposals to Ebb Wingtip Vortices	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To investigate if, curvature forms of Cones, Chutes, and Coils could be better options than Winglets as wingtip devices that minimized wingtip vortices.</p> <p>Methods/Materials Test wings of equal length and airfoil shape were attached with crafted straight coils, straight chutes, descending-cones, ascending-cones, and 90#-winglets, each having the same weight but five different diameters/height. I had built a wind tunnel test rig that equipped with lift and drag measurements. For each wing I mounted on the test platform, I performed a string test for presence/absence of induced vortices, and record the lift and drag generated after an equal duration. In other words, I had recorded a total of 250 data; 2 readings from each of the 5 trials for each of the 25 wings. I had also derived formula for the optimal diameter of the winglet devices.</p> <p>Results My experiment showed that Cones, Chutes, and Coils did reduce wingtip vortices while also generated comparable higher Lift than Winglets, of the same weight. Largest Chutes achieved the highest L/D Ratio, and Coils produced the least Drag, while Descending-Cones, regardless of sizes, caused the most Drag, and the lowest L/D Ratio. According to NASA, "Winglets are responsible for increased mileage rates of as much as 7%." From my Comparison Chart, Chutes could increase 13% more Lift, and Coils could raise 18% more L/D Ratio; and thereby saving at least 10% more fuel than Winglets.</p> <p>Conclusions/Discussion Chutes and Coils also generated Drag, but much higher L/D Ratio than Winglets of the same size, and therefore proved to be better than Winglets in improving flight efficiency and saving fuel, with smaller sizes. Chutes were most effective in generating Lift; most useful in high-lift mission. Coils were most effective in minimizing Drag; most useful in low-drag operation. Chutes and Coils should be further studied for implementations in place of Winglets, as they could be smaller in sizes, easily fabricated separately perhaps by 3D printers, allowing economical retrofitting. Cones should be ruled out as wingtip devices.</p>	
Summary Statement Explore effects of other wingtip devices options.	
Help Received NASA Glen Research Center website. My dad helped shopping for material, supervising use of power tools, and trouble-shooting test setup.	