



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Michael B. Patacsil	Project Number J0120
Project Title Wingtip Drag Reduction: Spiroid vs. Up-turned Winglets	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I wanted to test if a wrap-around spiroid winglet design is significantly better at reducing drag by weakening wingtip vortices than traditional upturned winglets.</p> <p>Methods/Materials I constructed a homemade open-circuit wind tunnel to test my hypothesis. It was made from wood with clear polycarbonate in the front to show testing. I had an entrance cone made from a veterinary cone used for pets and a diffuser made from foam board. The powerplant of this wind tunnel is a leaf blower. I shaped a wing from a block of balsa wood for the wingtips to slide onto. For my project, I used 3 wingtips, one straight, one upturned, and one spiroid. Each wingtip is made of paper mache, has a mass of 5 grams and is 10 centimeters long. Each wingtip would be tested for drag 30 times each. Strings were attached to hanger wire and a wooden dowel protruding from the wind tunnel. The hanger wire would yaw with the wing on one side and the string on the other. I would then add weight to the center of the string until the hangar wire and wooden dowel are 4 centimeters apart. I would repeat with the next three wingtips.</p> <p>Results Test results showed that the spiroid winglets had less drag compared to the straight wingtip and the up-turned winglet. There was an 8%- 12% reduction compared to the upturned winglet and a 15%-20% compared to the control (straight) with a standard deviation of 5%.</p> <p>Conclusions/Discussion Based on the results of my testing, I concluded that spiroid winglets show promise in the future by improving aircraft performance and efficiency. Additional experimentation will test for its performance capabilities in order for this concept to become practical and to discover supplementary benefits such as improved lift, reduced noise, and superior stall characteristics.</p>	
Summary Statement My experiment tested the effectiveness and capabilities of wrap-around spiroid winglets in reducing wingtip drag by weakening and eliminating wingtip vortices as opposed to conventional up-turned winglets.	
Help Received Father bought materials and took photos; Mother helped with display and report; Uncles assisted in the construction of the wind tunnel; Grandfather provided crucial information on the science behind winglets and wind tunnels, as well as plenty of inspiration.	