



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Kaycee C. Miller	Project Number J0121
Project Title Rotating into the Future of Flight	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of my project is to demonstrate that a coaxial contra-rotating proprotor can outperform a single proprotor used on current rotor aircraft today. History, designs, concepts, advantages and disadvantages will be experimented and discussed throughout my project.</p> <p>Methods/Materials I used a wind tunnel to test free spinning proprotors to validate my hypothesis. I installed single and coaxial proprotor models in my wind tunnel and looked for any changes to thrust, pitch, or roll performance characteristics.</p> <p>Key materials include: concrete form tube, cardboard separator, fan, camera, paper, pencil, computer/printer, cutting tools, glue, fishing line, wooden dowels and spoons, woodworking tools, tape measure, and screws.</p> <p>Results I noticed the single proprotor experienced characteristics of roll, while the coaxial proprotor maintained smooth performance when both propellers were contra-rotating at effectively the same rate. Additionally, the coaxial proprotor exhibited greater thrust characteristics.</p> <p>Conclusions/Discussion I concluded that the coaxial proprotor performed with more significant overall flight characteristics versus the single proprotor because of the torque affecting the single propeller along with the aerodynamic affect of retreating blade stall (RBS), whereby the advancing blade on a propeller outperforms the retreating blade. The coaxial contra-rotating propellers equal out both the effects of torque and RBS.</p>	
Summary Statement My project resolves the question of whether a coaxial contra-rotating proprotor propulsion system can outperform more popular modern single proprotor systems.	
Help Received My father helped me build my wind tunnel and proprotor models, drove me around to collect materials, and assisted with organizing my notebook and display board.	