



**CALIFORNIA STATE SCIENCE FAIR  
2003 PROJECT SUMMARY**

<b>Name(s)</b> <b>Patrick J.G. Saris</b>	<b>Project Number</b> <b>J0133</b>
<b>Project Title</b> <b>Positive Effects of Turbulence on Wind Turbines</b>	
<b>Abstract</b> <b>Objectives/Goals</b> The objective is to determine how the surface texture and shape of turbulators affect turbine rotor performance. I hypothesize that turbulators with a textured surface or a zigzag shape will result in greater performance than turbulators with a smooth surface or rectangular shape. <b>Methods/Materials</b> A wind tunnel and rotor were built. The rotor was made with two left wings of an airplane with zero angle of attack. Six turbulators of equal surface area were made with different texture/shape combinations: fine sand paper/zigzag, coarse sand paper/zigzag, ribblets/zigzag, smooth/zigzag, ribblet/rectangle, smooth/rectangle. Each was tested on the rotating rotor three times for three minutes each. Voltage generated was recorded with a Vernier probe. <b>Results</b> The turbulator made with the ribblet/zigzag combination consistently improved rotor performance the most. The smooth/rectangular turbulator actually decreased rotor performance. <b>Conclusions/Discussion</b> Turbulators are known to prevent laminar flow separation by generating microturbulence, increasing lift and decreasing drag. My conclusion is that both surface texture and shape of the turbulators affect rotor performance and that turbulators with ribblets in a zigzag shape will significantly improve the performance of wind turbines.	
<b>Summary Statement</b> This project investigates how the shape and texture of turbulators affect the performance of wind turbines..	
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