



**CALIFORNIA STATE SCIENCE FAIR  
2006 PROJECT SUMMARY**

<b>Name(s)</b> Andrea C. Collins	<b>Project Number</b> <b>S0204</b>
<b>Project Title</b> <b>Aviation Circuitry: How Protected Are They to the Ever-Changing Environment?</b>	
<b>Abstract</b> <b>Objectives/Goals</b> The circuit breaker is a necessity in any electronic device. It is the basic piece of equipment, which provides a continuous supply of power. Circuit breakers in airplanes and space shuttles are being modernized to prevent malfunctions. This project was designed to test what affect the varying atmospheric temperatures have on circuit breakers used in modern flight. If the environment#s temperature increases then the circuit breaker will pop at a lower current rating than at ambient temperature; if the environment#s temperature decreases then the circuit breaker will pop at a higher current rating than ambient temperature.	
<b>Methods/Materials</b> This project began five months ago with the assistance of a mechanical engineer. He explained how and why a circuit breaker pops with a certain amount of current. The information helped develop the procedure to test a 1A aircraft circuit breaker in two diverse temperatures, with respect to the ambient temperature#s breaking point. Three configurations were tested five times each. Dry ice and an embossing heat gun were used to simulate two diverse temperatures. A multi meter was used to measure and maintain temperature by a thermal couple, and to measure the total current in the circuit produced by eight light bulbs (two 40 watt and six 25 watt bulbs). This experiment concluded change in temperature impacts the time it takes a circuit breaker with a certain current rating to disengage.	
<b>Results</b> Temperature does have an effect on a circuit breakers breaking point. When a 1A circuit breaker was placed at ambient temperature of 80°F, it disengaged at an average time of 1 second with a current of 1.87Amps(A). The circuit breaker disengaged at an average time of 1.5 seconds with 1.65A and 8.3 seconds with 1.46A when a temperature of 139°F was applied to a circuit breaker. Finally, a temperature of -65°F was applied to a circuit breaker. The circuit breaker disengaged in an average 19.83 seconds with 1.87A.	
<b>Conclusions/Discussion</b> The hypothesis of this project was supported by data throughout the experiment. Environmental temperatures do affect the amount of time a circuit breaker can support a particular amount of current before breaking. An assumption can be made from the results that an aircraft#s circuit breaker may fail depending on the environmental temperature it is exposed to.	
<b>Summary Statement</b> This project was formed to see if environmental temperatures affect the amount of current a circuit breaker can support before it pops.	
<b>Help Received</b> Dad helped wire circuit box; Mechanical engineer helped gather aircraft circuit breaker information and supplies	