



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Joseph A. Cestone	Project Number S0304
Project Title Using Electrical Current to Strengthen Wire	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment is to determine if conducting electricity in wire affects its metallic bonds and thus its tensile strength. It was hypothesized that if an electrical current were sent through a wire, then its tensile strength would be increased, because the voltage induces electron movement in the direction of the current, thereby aligning the metallic bonding along the length of the wire.</p> <p>Methods/Materials To test this theory, 30 gauge copper wire was tensioned with increasing force between a dual servo motor winch and a stationary clamp until tensile failure occurred, at which point the force required to break the wire was recorded. This experiment was performed 50 times: 25 times with 1.5 volts of power from a D-sized battery, and 25 times with no voltage.</p> <p>Results The wire with voltage averaged 7% stronger than the wire without voltage, when the batteries were fresh. Some trials had to be discarded due to loss of voltage in the battery. Calculated with the stalled torque of the motors and the radius of the winch, the maximum load of the wire was increased from 5.5 to 5.9 pounds.</p> <p>Conclusions/Discussion The results of the experiment supported the hypothesis that direct current can increase the strength of wire! This experiment demonstrates an easy way to manipulate metallic bonding to increase the strength and usefulness of wire, and its potential applications could be limitless!</p>	
Summary Statement This project tested the tensile strength of copper wire with and without electrical current, and found that the current strengthened the wire.	
Help Received I designed, built and performed the experiments myself. My grandfather, a retired electrician, gave me advice with electricity. My parents, aunt and uncle gave me grammatical suggestions and corrections.	