CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
S1899

Project Title
The Relationship between Air Properties and the Deflection Experienced by an Electric Arc, Year 2

Abstract

Objectives/Goals
This experiment is a continuation on a previous experiment which was aimed determining whether or not properties of the air, such as temperature and relative humidity, had any influence in the behavior of electric arcs. The results of that experiment was that temperature had a strong correlation with arc deflections in the x-axis. The purpose of this year#s experiment thus was to further explore this relationship and have the experiment as a whole undergo rigorous control testing to verify the previous results.

Methods/Materials
A Tesla Coil was used as the electric arc generator. A plant growth chamber capable of controlling both temperature and humidity to a high degree of accuracy was used as the vessel for the experiment. Data would consist of pictures of arcs taken from above the arcs. These pictures were then process through Microsoft Paint. Maximum deflections of the arcs from an ideal path of the arc were collected, as were areas bounded between the arc and the ideal path. Statistical analysis on this data was then done through Microsoft Excel.

Results
It was found that the relationship discovered in the previous year, which was an inverse linear relationship, was an incomplete one. The actual relationship closer approximates an inverse J-curve with deflection reaching a positive peak at the 25°C mark and then decreases in either side of this mark; the average deflection was negative at the 12°C and 45°C marks. The control testing showed that the relationship was not caused by mechanical asymmetries inherent to the Tesla Coil or the controlled environment chamber.

Conclusions/Discussion
When taken in conjunction with the results from the previous year#s experiment, this project very clearly shows that electric arc behavior is related to temperature conditions. It implies that electric arc behavior, what is currently thought of as a chaotic and unpredictable phenomena, is more ordered and something that can perhaps even be predicted if enough research is done into the specific initial conditions which affect arc paths. Future studies would focus on creating statistical distributions to account for the variances of arc behavior within a data set and on manipulating the arc to strike specific targets through the manipulation of air.

Summary Statement
This project showed the full nature of the relationship that exists between the deflection of electric arcs from an idealized path and temperature and that such relationships exists independent of mechanical asymmetries.

Help Received
Professor Randy Harris and Professor Cort Anastasio of UC Davis assisted in the data analysis portion of the experiment. Mr. Dennis Lewis of the UC Davis Controlled Environment provided the climate chambers used for the experiment.