# CALIFORNIA STATE SCIENCE FAIR
# 2015 PROJECT SUMMARY

**Name(s)**
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**Project Number**
**J1722**

**Project Title**
## The Effect of Temperature and Frequency on Sound Transmission

**Abstract**

**Objectives/Goals**
My objective was to determine if sound transmission is affected by temperature and frequency. I hypothesized that sound transmission is affected by temperature and frequency. I thought that colder temperatures would transmit sound better than warm temperatures. Sound requires air to travel, and cold air is denser than warm air. This means that there are more air molecules compacted into cold air than warm air. Also, I thought that sound transmission vs. frequency would differ depending on frequency, as the density of air would affect which frequencies transmitted well and poorly.

**Methods/Materials**
Using plexiglass, I built a box 121.92 cm x 60.96 cm x 60.96 cm. Inside the box, I placed two mini electric fans to mix the air, two thermocouples, and two heat lamps that I used to alter the temperature. Outside the box, I had a digital thermometer, which connected to the thermocouples and showed the temperature at two different places inside the box. Also, on my Apple computer, I used the application FuzzMeasure to produce sound from 80 Hertz to 10,000 Hertz. Finally, to project the sound into the box, I used a Bose speaker at one end of the box. To record the sounds made by FuzzMeasure, I used a Yeti Microphone at the other end of the box.

I heated up the air in the box to 21 degrees Celsius using the heat lamps and the fans to make sure the temperature was even. Then, I used FuzzMeasure to run a sweep of sound frequencies from 80 Hertz to 10,000 Hertz and plot the data on a graph. I repeated this procedure at 27 degrees, 32 degrees, and 38 degrees Celsius.

**Results**
My results showed that air at lower temperatures transmitted sound better than air at higher temperatures. I also saw that at lower temperatures, there were clear frequencies where sound transmitted particularly well, whereas at higher temperatures, sound transmission varied much less with frequency.

**Conclusions/Discussion**
I concluded that temperature and frequency do affect sound transmission. The air at lower temperatures transmitted sound better than the air at higher temperatures. Also, higher temperatures seemed to diminish the effect of changing frequency on sound transmission.

**Summary Statement**
The central focus of my project was to learn whether temperature and frequency affect sound transmission.

**Help Received**
My dad bought all the materials needed, helped me construct my box, and helped me drill holes in the plexiglass. My brother taught me how to use the FuzzMeasure software application, and my mom helped me proof my write-up and abstract.