CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

S1802

Project Title

Surfing on Sound

Abstract

Objectives/Goals

In today's technology, smaller processing chips & parts are needed to make functional devices. Acoustic levitation ensures that certain parts of those devices can be made in a contaminant free environment. This project was designed to test the different conditions that are best suited to levitate an object.

Methods/Materials

This project began by borrowing an industrial speaker & a frequency generator from NASA, which were connected to a stereo amplifier. A 1½" florescent light tube was used to focus the sound. A concave circular soap dish was mounted & used as a reflector atop a tripod in order to change the distance between the speaker and the reflector. Pieces of tissue paper, Styrofoam, & plastic were weighed and modified so that each weighed 0.5 grams. Ear buds & headphones were worn during testing. Each material was placed into the acoustic field using clamp scissors at a starting frequency of 1 kHz to 20 kHz in increments of 5 kHz. At each 5 kHz interval, volume was increased in increments from 1 to 10. A dB meter was used to gauge the dB readings for each test. Half of the tests were conducted with a reflector to create a standing wave. On tests using the reflector, the distance of the reflector was changed for each kHz because of the different wavelengths. The formula to calculate wavelengths was lambda=c/f. The formula to calculate the distance was lambda/2 x a multiple of the wavelength. A multiple of 3 was chosen, which provided the appropriate distance, in inches, to set the reflector.

Results

In order to quantify the data, a rating scale was developed based on consistent visible findings: #1-no movement, #2-bouncing, #3-near levitation, #4-levitation. Near levitation was defined as the material floating in a constant position, while being supported by the tube or speaker on one edge. After analyzing 600 results, the total percentage of near levitation was 11.3%, bouncing was 60.67%, & no activity was 28%. Levitation was not able to be achieved. It was noted that the materials with the greater surface area, such as the Styrofoam, were more impacted by the sound waves.

Conclusions/Discussion

Overall, levitation could not be reached, however. Lower frequencies such as 1 kHz, produced a better outcome, as seen by a greater number of near levitations than bounces. The creation/maintenance of a proper standing wave was difficult due to not being able to procure proper amplifying and measuring devices.

Summary Statement

A Study to Determine the Effects Most Favorable for Acoustic Levitation

Help Received

Larry Wright for helping us design and conduct project;Liz Wright for guidance and support;Emily Wright for help with the board;Maria Caballero for the NASA documents;Lionel Banuelos for letting us borrow a triple beam balance.