



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Andrew Shimshock; Philip Zehnder	Project Number J0399
Project Title HOARD: A Study into the Cancellation of Car Window Buffeting	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Car window buffeting is the rhythmic pressurization and depressurization of a cars cabin caused by Helmholtz oscillation. The purpose of this experiment was to optimize a device to cancel this buffeting. Cancellation was attained through both passive and active means. The device we designed(the Helmholtz Oscillation Advanced Reduction Device, or HOARD) attached to the window of the car (a 2008 Honda Odyssey) and can be configured to cancel in both manners.</p> <p>Methods/Materials In order to measure the degree of cancellation, a pressure sensor was placed in the center of the car. To test two different means of cancellation, two separate procedures were employed. In the passive configuration, HOARD deflects air up and over the buffeting window to cancel buffeting. We tested tow sizes of fin, 10 fin angles (the angle the fin forms with the car), and the presence/ absence of notches in the fins. In the active configuration, HOARD pulls quantities of air into the car to cancel buffeting through destructive interference. All data from both sets of trials were then compared against control data using a graphical analysis and Fast Fourier Transform.</p> <p>Results We found that the fins that worked the best to cancel Helmholtz Oscillation were the notched fins. This is because they act as a larger fin by extending farther away from the car, therefore deflecting more air up and over the window. We also found that 60 degrees was the optimal angle for cancelling Helmholtz Oscillation because it was not to steep as to make the air go over the fin into the car, and no to shallow to make no difference at all. The active HOARD generated enough pressure to theoretically cancel car window buffeting, but was never able to completely cancel it due to a lack of synchronicity with the buffeting.</p> <p>Conclusions/Discussion After testing our results supported our hypotheses. We found that both passive and active methods for noise cancellation in cars could be effective. This technology could be applied to many cars to mitigate irritating car window buffeting.</p>	
Summary Statement The purpose of this experiment is to determine if it is possible to cancel car window buffeting through passive and active methods	
Help Received One of our fathers helped cut wood with a table saw; A neighbor helped with CAD drawings; Dr. Ghandi helped us understand Fast Fourier Transforms; Mr. Wolfe (UNSW) answered a few questions about Helmholtz oscillation	