



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

<b>Name(s)</b> <b>Thomas M. Karpishin</b>	<b>Project Number</b>  34022
<b>Project Title</b> <b>Laser Vibes: Design of a Laser-Based Vibration Sensor</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b></p> <ol style="list-style-type: none"><li>1. Build a vibration sensor using the reflection of a laser off of a liquid surface.</li><li>2. Test seven different liquids (acetone, methanol, ethanol, hexane, pentane, glycerol, and water) and determine which is most sensitive for detecting vibrations in my sensor.</li><li>3. Determine what properties of the liquids make them more sensitive to vibrations.</li></ol> <p><b>Methods/Materials</b></p> <p>A vibration sensor was designed and built by using a 650nm 5mW laser and a homemade laser-light sensor. The laser was reflected off of the surface of a liquid and the reflected light was aligned close to the light sensor so that vibrations of the liquid would cause it to move over the sensor.</p> <p>Seven different liquids were investigated to see which one was the most sensitive in detecting vibrations. For each measurement, a "pulse" vibration was initiated and the sensitivity of the liquid was determined by measuring the time that the reflected laser light continued to move after the vibration.</p> <p><b>Results</b></p> <p>A highly sensitive vibration sensor was constructed using laser reflection off of a liquid. Of the liquids tested, the results show that acetone was the most sensitive liquid for measuring vibrations. My results show that the most sensitive liquids were acetone, pentane, and hexane, which have the lowest boiling points, lowest viscosity, and lowest density. The least sensitive liquid was glycerol, which has the highest boiling point, viscosity, and density.</p> <p><b>Conclusions/Discussion</b></p> <p>A new type of vibration sensor was made using laser light reflection off of the surface of a liquid. Acetone proved to be the most sensitive liquid tested in this device. By graphing the relationship between the sensitivities of the liquids and their properties, I showed that the sensitivity of the liquid was correlated closely to density and boiling point and less correlated to viscosity. These findings will be useful in the design of future more sensitive vibration sensors based on the principle of reflected laser light.</p>	
<b>Summary Statement</b> I designed and investigated a new type of vibration sensor by monitoring the reflection of laser light off of a liquid surface.	
<b>Help Received</b> Father helped solder electronic circuits.	