



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Jacob O. Spencer	Project Number J0319
Project Title Determining Strength by Measuring Strain	
Abstract Objectives/Goals The objective is to discover how much stiffer a wooden sample will be if foam and fiberglass is added to it. Methods/Materials The procedures to conduct this experiment take place in several steps. The first is obtaining the necessary materials for making the samples and test apparatus. The second is building the test fixture to hold the samples. The third is cutting out the wooden test samples and applying a strain gauge to them. The fourth is the assembly of an electrical circuit which can be used to incorporate a strain gauge. The fifth is the testing of the wooden samples, including adding subsequent material layers to them (the foam and fiberglass). I tested three samples, three times for a total of 3 trials. Results My data proved that out of the three different samples, the one with all three layers of plywood, foam, and fiberglass was the stiffest, followed by plywood and foam, and then just plywood. This is because in order for the fiberglass samples to displace a certain amount of millimeters, a much larger amount of force was required to be applied. The additional force needed for fiberglass samples was large enough to indicate that the fiberglass is a very advantageous layer for strengthening a structure. Conclusions/Discussion I concluded that as the additional materials were added the strain decreased for a given applied force. Likewise, by adding additional materials the force needed to reach a certain displacement increased. The data from the plywood samples were consistent and had low applied force and high strain gauge values. The data from the foam samples tended to be more varied, possibly because the foam samples differed from sample to sample due to construction differences, and perhaps human error in the measurements. The fiberglass samples were predictable and clearly showed their superior stiffness to the other samples. My experiment can apply to construction of buildings and boats of all sorts, because my experiment shows different ways of increasing the strength in plywood.	
Summary Statement My project is about testing wood, foam, and fiberglass samples in order to conclude what material combination is the stiffest, thus discovering which would be most effective in constructing a kayak.	
Help Received I received help from my father, Nathan Spencer. He advised me on almost every aspect of the project so the experiment would yield reliable results. I would like to thank John Smalley for help in amplifying the wheat stone bridge circuit. I would like to thank Nathan Masters for supplying Adrino equipment.	