



**CALIFORNIA STATE SCIENCE FAIR  
2015 PROJECT SUMMARY**

<b>Name(s)</b> <b>Anika M. Hayes</b>	<b>Project Number</b> <b>J0915</b>
<b>Project Title</b> <b>Building a 3D Printing Pen</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> My goal is to build a benchtop model which shows the concepts and mechanics of a 3D printing pen.</p> <p><b>Methods/Materials</b> I first researched my topic and started to make my logic diagrams. Then, I bought my materials, including the Arduino Uno micro controller board, J-head hotend nozzle, 5 line 4 phase step motor, Kootek DC 5V 4 phase test module board, and relay. I practiced using the Arduino board with tutorials from the Vilsro manual. I created the individual circuits and programs by referring to online programs, which I modified for my use. I manufactured the phenolic board base. I attached the individual parts to my board and combined the programs and circuits.</p> <p><b>Results</b> For my project I was able to research, build and design the necessary circuits and programs to create a benchtop model of a 3D printing pen. I was able to see how a relay, thermistor and motor circuit are all necessary to make a 3D printing pen work. Each of the circuits worked individually, however, I was not able to combine all the programs and make the model work in unison. I was able to combine the two programs without getting an error alert but, when tested the different circuits would not work together.</p> <p><b>Conclusions/Discussion</b> I found that a motor, relay and thermistor circuit are all necessary components for building a 3D printing pen. I believe that with more time I can fix the programming bugs and get my benchtop model to work together. Also with specialized parts and some added components such as a portable battery package, this idea, with these circuits could become a safe, handheld, 3D printing pen.</p>	
<b>Summary Statement</b> This project explores the components necessary to build a 3D printing pen.	
<b>Help Received</b> My dad, Matt Hayes helped me manufacture the hardware of this project. Chris Nestlerode, helped me work through my final program. Andy Stoller helped me complete my first logic diagrams. My Uncle, Dan McNamara helped me work through the energy flow of the project.	