



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Ethan C. Harris	Project Number S1003
Project Title Airprinting: Range and Interference	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I wanted to test the range of AirPrinting and what effect distance & materials would have on the signal strength and print properties.</p> <p>Methods/Materials Tape measure, Paper & pen, Masking tape, HP Envy 4520 AirPrinter, iPhone 7, iPhone 6, iPad 1st generation, Plastic cooler, Cardboard box, Aluminum Foil, Human Body, Microwave Oven, Circuit Box, Vehicle.</p> <p>Results After my measurements and averages, I found that I was correct to assume that the inside signals were much stronger than outside. I believe this is due to the umbrella effect of the wifi and the limited interference. Since the access point is located almost perfectly in the center of the house, it spreads to even the furthest reaches of the house. I was able to successfully print everywhere within my home.</p> <p>Conclusions/Discussion As with any good research project, it seems I ended my studies with more questions than answers. One of these questions related to bandwidth. I did a range of print test with an 11kb document at different distances but I never seemed to vary significantly from an approximate print time of 38 seconds. I tried these experiments again with a larger 4mb document and the phone was unable to send it to print. With additional research time (and an endless ink cartridge budget), I would have done more tests on the ability of the phone to send larger documents over an increasingly limited bandwidth. It would be interesting to learn if the time it takes to print is logarithmic. For example, how long would a 20mb document take to print at a rate of 20mbps, versus how long it would take a 100mb document to print at a rate of 100mbps? It would be interesting to chart this on a graph. I am also curious about the impact of the IOS on the wireless signal. I was not able to find anything in my research on this topic but I was curious if this had an impact on some of my tests where the iPhone 6 seemed to out-perform the iPhone 7. Lastly, I would like to do more research on the impact of other local wireless signals. I am certain that my evening tests were impacted by our neighbors' signals as well.</p>	
Summary Statement testing the range and items that interfere with airprinting.	
Help Received My mom took me to the store and purchased materials for me and my teacher Mr. Hunt told the whole class about this idea for the science fair, but I acted upon it.	