



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

Name(s) Alisa Y. Hathaway	Project Number 38605
Project Title Detection of Improvised Explosive Devices Using a Phased Array Radar System	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Improvised Explosive Devices have injured or killed more than 40,000 people in 2018. In order to address this grave issue, the detection of IEDs is important. The scientist believes that if this project is feasible, and if the phased array radar system is effectively created, then a significant amount of lives can be saved; IEDs can be located and terminated before they destroy civilian lives.</p> <p>Methods/Materials This experiment required many different materials, divided into two major sub-systems. The materials for the first sub-system, called the #Antenna Component# included: (4) dual patch antennas, (4) front end modules, (4) SPDT RF switches, (4) phase shifters, (2) shift registers, capacitors of various sorts, one SMA Connector, (4) 6 pin and 6 socket connectors, a circuit board, and an Arduino Uno. The second sub-system, called the #Radar Function# consists of a Transmitter, consisting of a radar pulse generator, amplifier, Voltage controlled Oscillator; and a receiver, consisting of a Low noise amplifier, Mixer, and a video amplifier. A power supply, laptop computer and signal analyzer machine were utilized as well.</p> <p>Results The dual-patch antenna had a signal increase in 19 dB, based off of CST Microwave Studio and Antenna Magus analysis. The Phased Array RADAR was created and implemented, with detailed analysis on the usage of the VCO, Chirp Generator, and other components of the RADAR itself. The RADAR was tested with many different experiments, allowing the chirp generator to function and detect a human baseline, a human with a metal shield, and a human with a bundle of metal (emulating an IED). The results demonstrated that the RADAR was able to function and operate as intended, with the device detecting a significant change in the chirp. Through the continual trial and experimentation, the scientist was able to observe that the RADAR was able to detect IEDs.</p> <p>Conclusions/Discussion The Phased Array RADAR system was effectively designed and created, and the scientist was able to utilize the hardware for a simulated IED detection. From this experiment, the scientist learned about the benefits of a Phased Array RADAR system, and its efficiency in terms of locating and detecting IEDs, thus offering the potential for saving many lives.</p>	
Summary Statement This project was to detect Improvised Explosive Devices using a Phased Array Radar System, which is more efficient and cost-effective than current applications.	
Help Received Mr. Yamamoto -- question help Mr. Pandya-- lab supplies Mr. Herndon -- lab supplies Ms. Klose--teacher in charge, guidance My Parents --encouragement Rohde & Schwarz -lab equipment Mr. Elio--lab equipment	