



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Tyler Robertson</b>	<b>Project Number</b> <b>S0323</b>
<b>Project Title</b> <b>Project POWER: A Swift Water Warning System, Year Two</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> Every spring, people drown in local rivers because they underestimate the power and danger of the river flow from melting mountain snow. The purpose was to design, construct, and test Project POWER: a portable swift water warning system that alerts swimmers of dangerous water conditions.</p> <p><b>Methods</b> In Year Two, the buoy was redesigned to improve its portability and visibility. A temperature sensor, radio transceiver, and additional LED lights were added to the buoy. An onshore station was also designed and built to provide local real-time display of river velocity and temperature using radio telemetry data from the buoy. The onshore station included an audio alarm, LED lights, a radio transceiver, and an LCD display. When water velocity or temperature reached a set threshold, LED lights on the buoy and station changed from green to red, and an audio alarm was elicited at the onshore station to provide both visual and audio warnings for potential swimmers at the river's edge. The buoy and onshore station both utilized Arduino microcontrollers and were powered by 12Ah batteries connected to 9W solar panels. Flow meter and temperature sensor calibrations were completed in an exercise pool with variable flow rates. Proof of concept trials were completed on the San Joaquin and Tule Rivers with two different anchoring systems, placing the buoy in the area of highest water velocity.</p> <p><b>Results</b> The buoy anchoring system worked well with both the across-the-river control line and the bridge access line. Radio telemetry was effective in sending river data from the buoy to the onshore station. Audio and visual alerts responded correctly to the set threshold for both temperature and water velocity. Compared to Year One, the POWER buoy demonstrated improved flow rate accuracy in both higher and lower river currents.</p> <p><b>Conclusions</b> Project POWER demonstrates the potential to save lives by alerting swimmers onsite of quickly developing unsafe river, tidal, or even flood conditions.</p>	
<b>Summary Statement</b> I designed and built a swift water warning system that provides swimmers visual and audio alerts when local river conditions are unsafe (current too fast or water too cold).	
<b>Help Received</b> I designed, built, and programmed the prototypes myself. A member of the Tulare County Sheriff's Swiftwater Rescue team assisted with buoy placement on the Tule River. The Canoe Specialist from Scout Island assisted with buoy placement on the San Joaquin River.	