

# Executive Summary – Zac Carico

## Contributions

### FPGA

- RISC-V Core
- TMR
- SPI interface
- LVDS UART
- GPIO ports

### Code

- UI for running various test programs and benchmarks over the micro USB port on PolarFire development board
- Library to handle user input in strings, characters, bytes, decimal, and hexadecimal.
- Established code documentation format to doxygen's formatting style
- Generated html files containing all code documentation

### PCB

- PCB routing and layout
- Accelerometer schematic
- PCB ordering
- Set up Altium's PCB documentation generator

### Documentation

- Executive Summary
- Final Report Document
- Code Documentation
- Schematics for all Smart Design circuits
- Small summary for Libero, PolarFire, and Soft Console data sheets
- Before you begin guide explaining Libero, Altium, and Soft Console, what troubles we had with each program, and what to do when someone runs into these errors

## Future Suggestions

My suggestion would be to create one team to solely work on the PCB, another work on the Libero parts, and have both teams work on parts of the programming. This way you don't have multiple people switching back and forth between completely different aspects of the project. If someone is waiting for something to be completed before they can work on their part, have them write code during the bottlenecks.

My other suggestion for future work would be to find ways to test small parts of the microcontroller on the FPGA instead of the entire thing, then bring everything together as they get fully tested. This way less time will be spent waiting for the synthesis and place & route to finish.

This project is doable for five students (especially when there isn't a global plague), but managing productivity and time is crucial to completing and testing everything.

## Timetable

WEEK	TIME	WORK DONE
1-3	18	<ul style="list-style-type: none"> <li>Completed all the leadership activities</li> <li>Researched TMR voting circuits</li> <li>Project proposal and planning</li> <li>Team meetings</li> </ul>
4	13	<ul style="list-style-type: none"> <li>Find 3 possible temperature sensors to use</li> <li>Find 3 possible radiation sensors to use</li> <li>Research into creating a software configurable PWM</li> <li>Research into the RISC-V ISA</li> </ul>
5	12	<ul style="list-style-type: none"> <li>Finished VHDL for a PWM</li> <li>Find a radiation sensor</li> <li>Research into accelerometer</li> </ul>
6	12	<ul style="list-style-type: none"> <li>Get Libero working</li> <li>Help team with VHDL and Altium stuff</li> <li>Create Altium Top Schematic</li> </ul>
7	11	<ul style="list-style-type: none"> <li>Helped teammates with Altium</li> <li>Created accelerometer schematic</li> <li>Tried to install Libero</li> </ul>
8	13	<ul style="list-style-type: none"> <li>Getting Libero to work found out the anti-virus hates us</li> <li>Getting a RISC-V implementation tutorial to work</li> <li>Help teammates with Altium</li> </ul>
9	13	<ul style="list-style-type: none"> <li>Implemented TMR on a RISC-V core</li> <li>Finished RISC-V implementation tutorial and figured out how to use Soft Console to program the core</li> <li>Helped teammates learn how to route PCB</li> <li>Routed parts of the PCB</li> <li>Fixed Libero again</li> </ul>
10-11	29	<ul style="list-style-type: none"> <li>Implemented SPI</li> <li>Created a SPI test program</li> <li>Created a UI to make testing hardware and software components easier</li> <li>Ordered the PCB</li> <li>Team planning and meeting</li> </ul>
12	15	<ul style="list-style-type: none"> <li>Completed a possible LVDS UART solution</li> </ul>

		<ul style="list-style-type: none"> <li>• Worked on creating a program that can let us use the FPGA to possibly finish more of this project with the school being closed</li> </ul>
13	17	<ul style="list-style-type: none"> <li>• Oral report</li> <li>• Documentation</li> <li>• Team meetings</li> <li>• Program to let next semester students work with the FPGA remotely</li> </ul>
14	25	<ul style="list-style-type: none"> <li>• Documentation</li> </ul>
<b>Total:</b>	<b>163/158</b>	