

Problem Statement

Aztec Electric Racing is an on-campus, student-led organization that designs, manufactures, tests, and races an electric race car in the annual Formula Society of Automotive Engineers (FSAE) Collegiate Design Series.

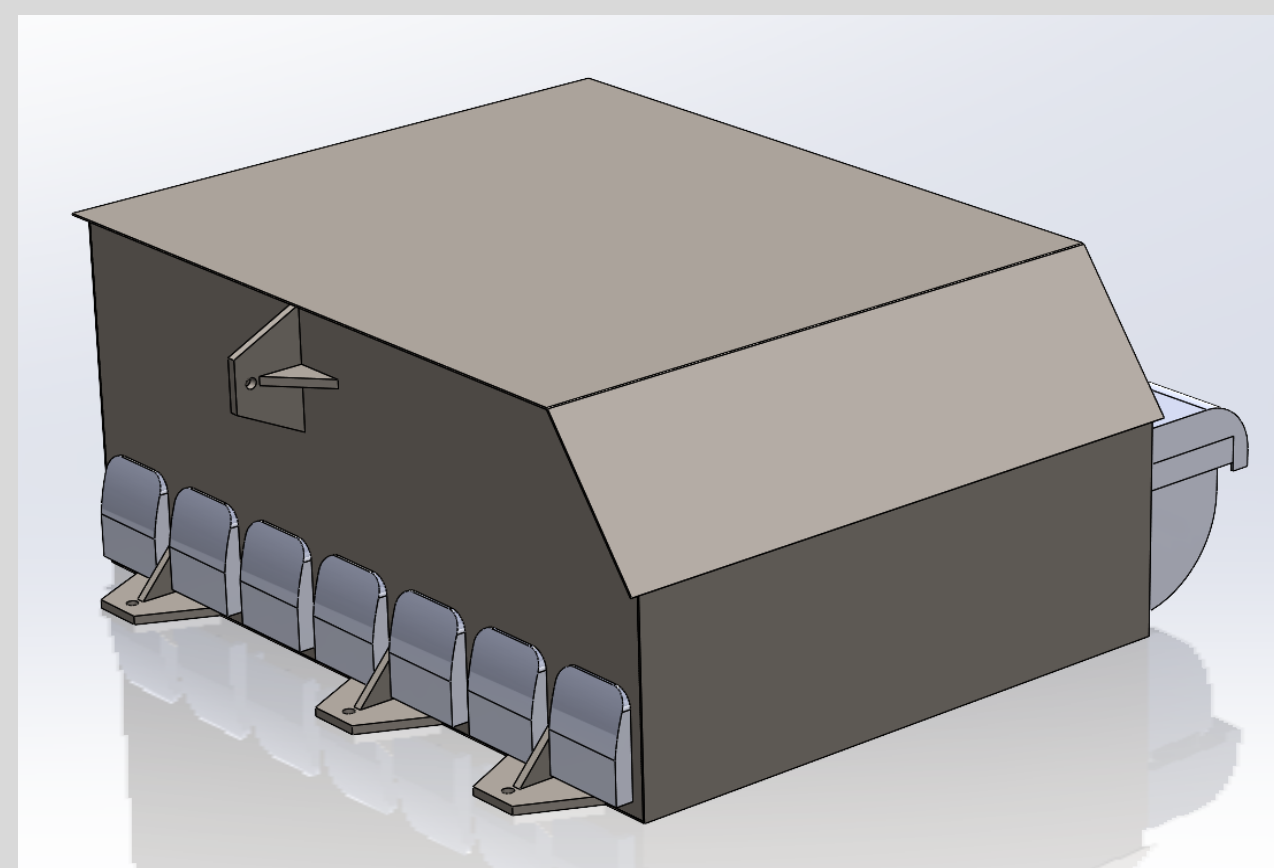
The Aztec Electric Racing team currently needs an accumulator which contains the electrical components necessary for supplying the high voltage needs of an electric race car. It must utilize an air-cooling system to keep the batteries and electrical components within their optimal operating temperature while the car is running. Our team's project is to design, test, and build an accumulator that will do so while staying within the regulations set by the FSAE.

Team Members

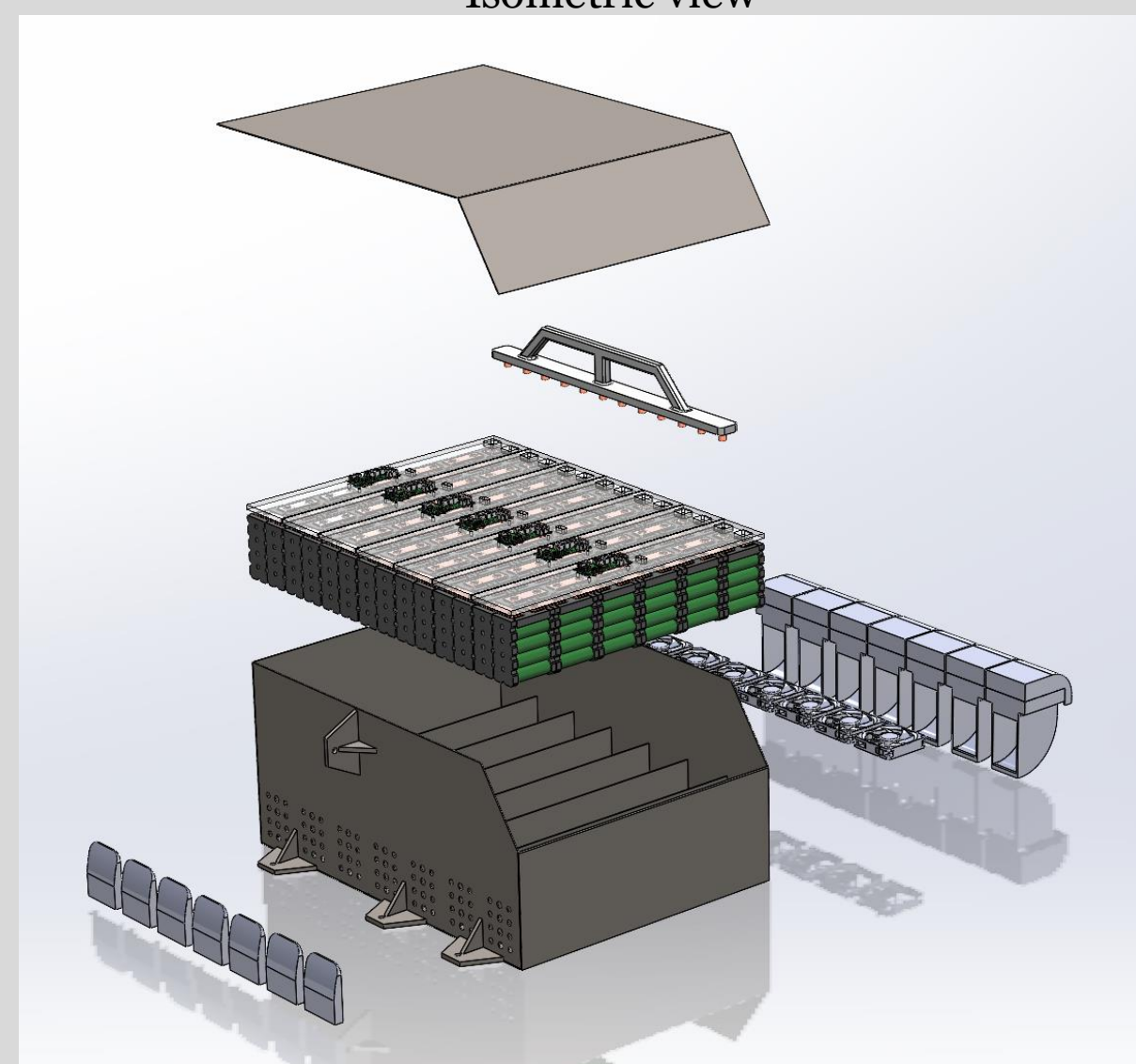


Ruqaiya Doctor Project Manager
Samantha Harris Procurement Manager
William Randall Design Engineer
Ethan Gao Test Engineer Safety Officer

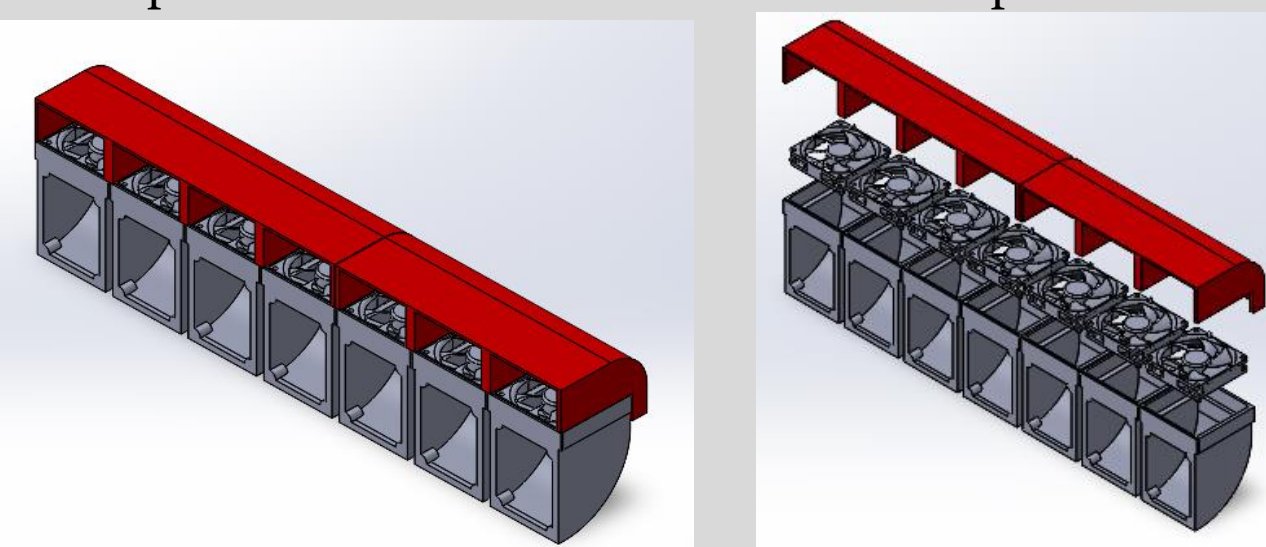
CAD Models



Isometric view

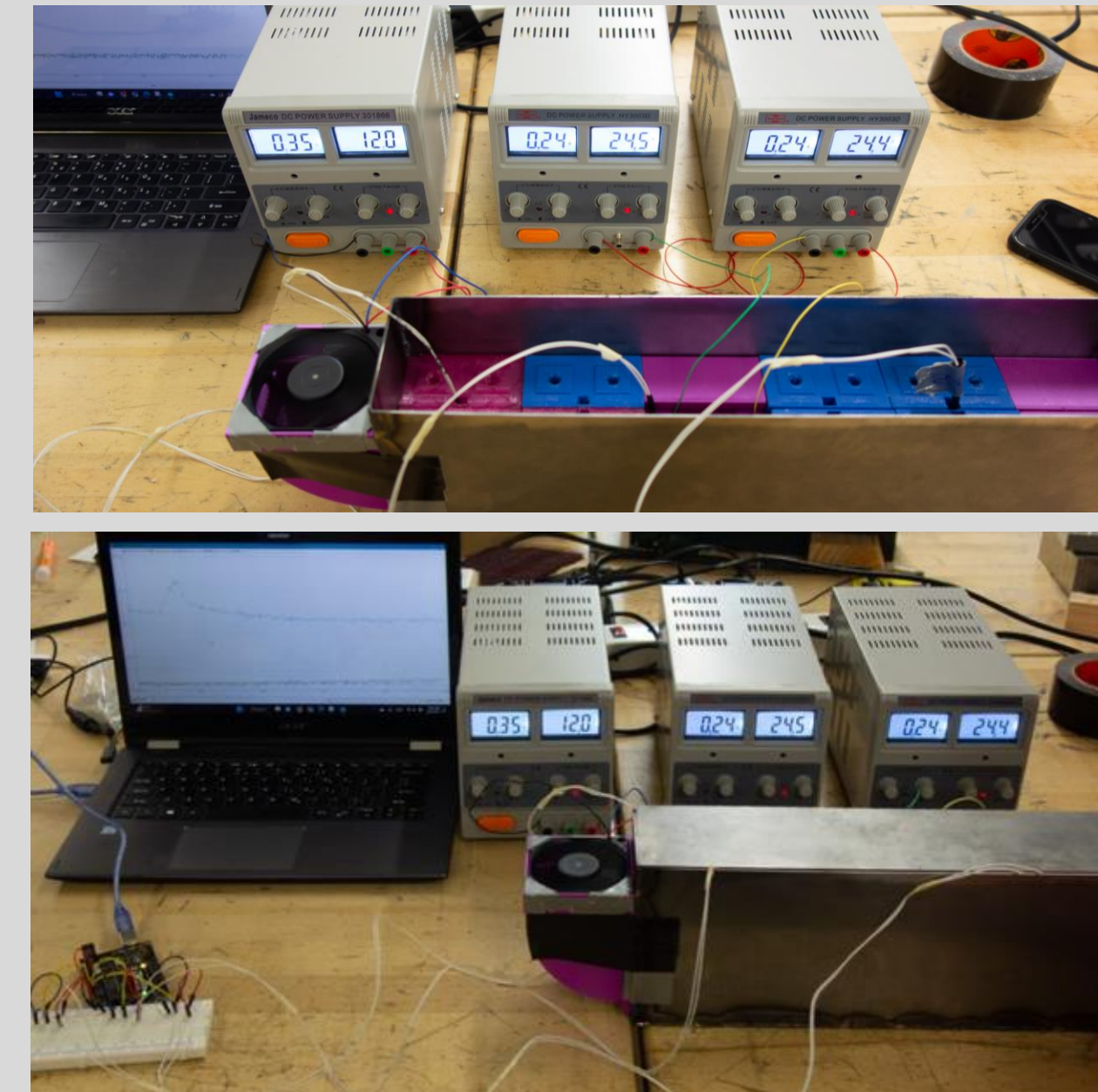


Exploded view with internal electrical components

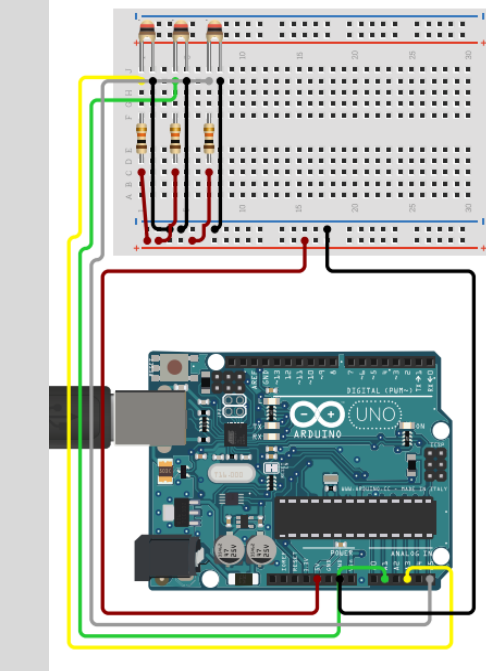


Isometric view of cooling system intake

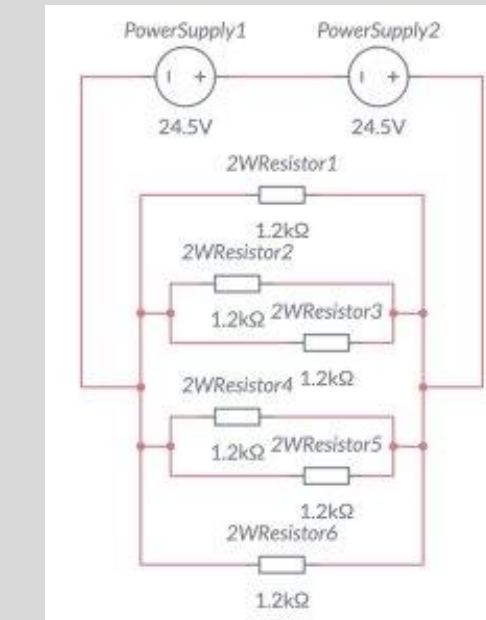
Test Methods



Single segment test bench



Circuit Diagram for Thermistors



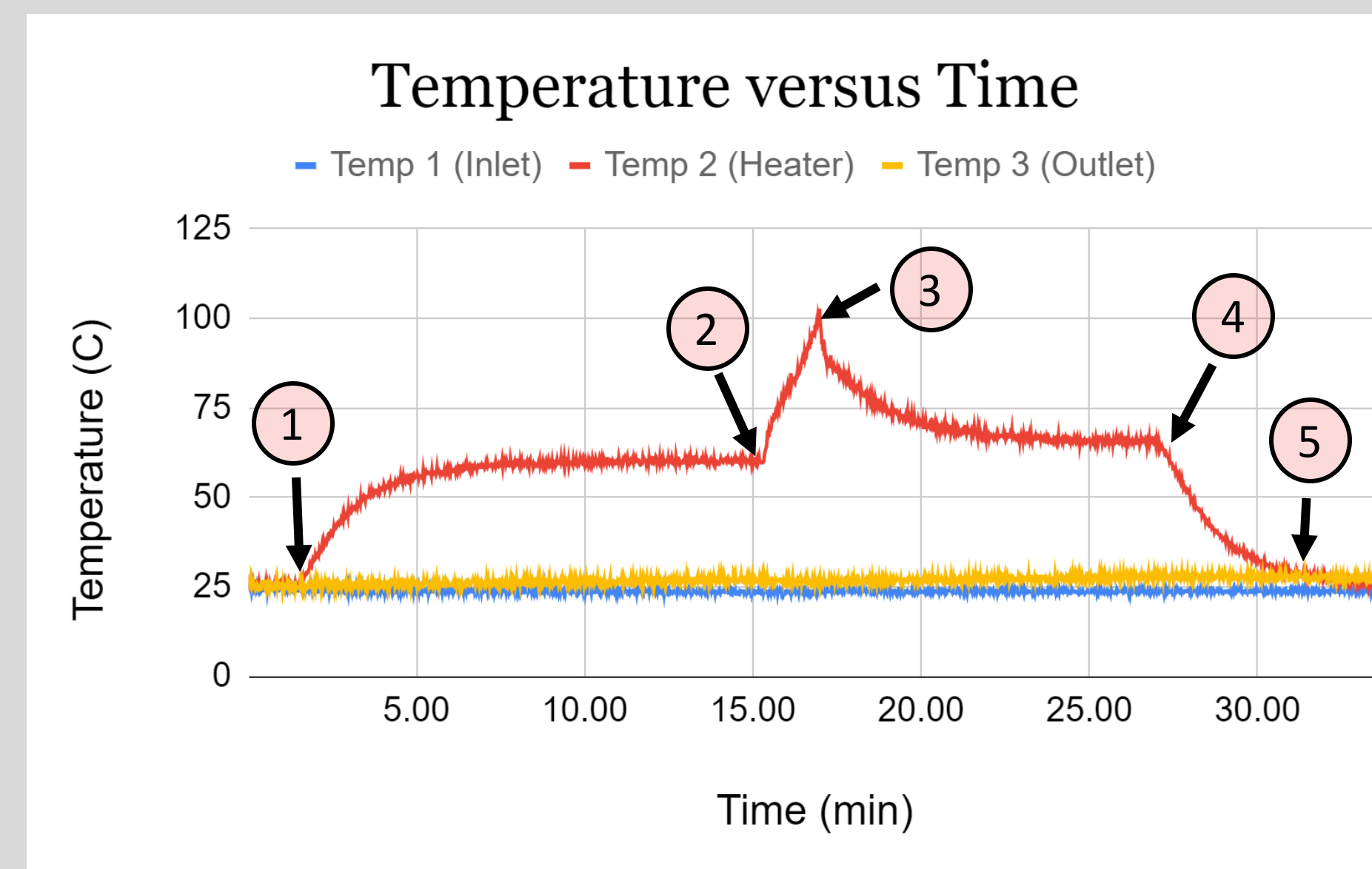
Schematic of resistor grid

1.2k Ohm resistors were configured in parallel to output 12W, representative of the heat generated in each segment. The grid was placed into the center of the segment with three thermistors placed at the inlet, center and outlet to record the temperature gradient across the channel. The trial run lasted 30 minutes, the duration of the endurance race portion of the competition.

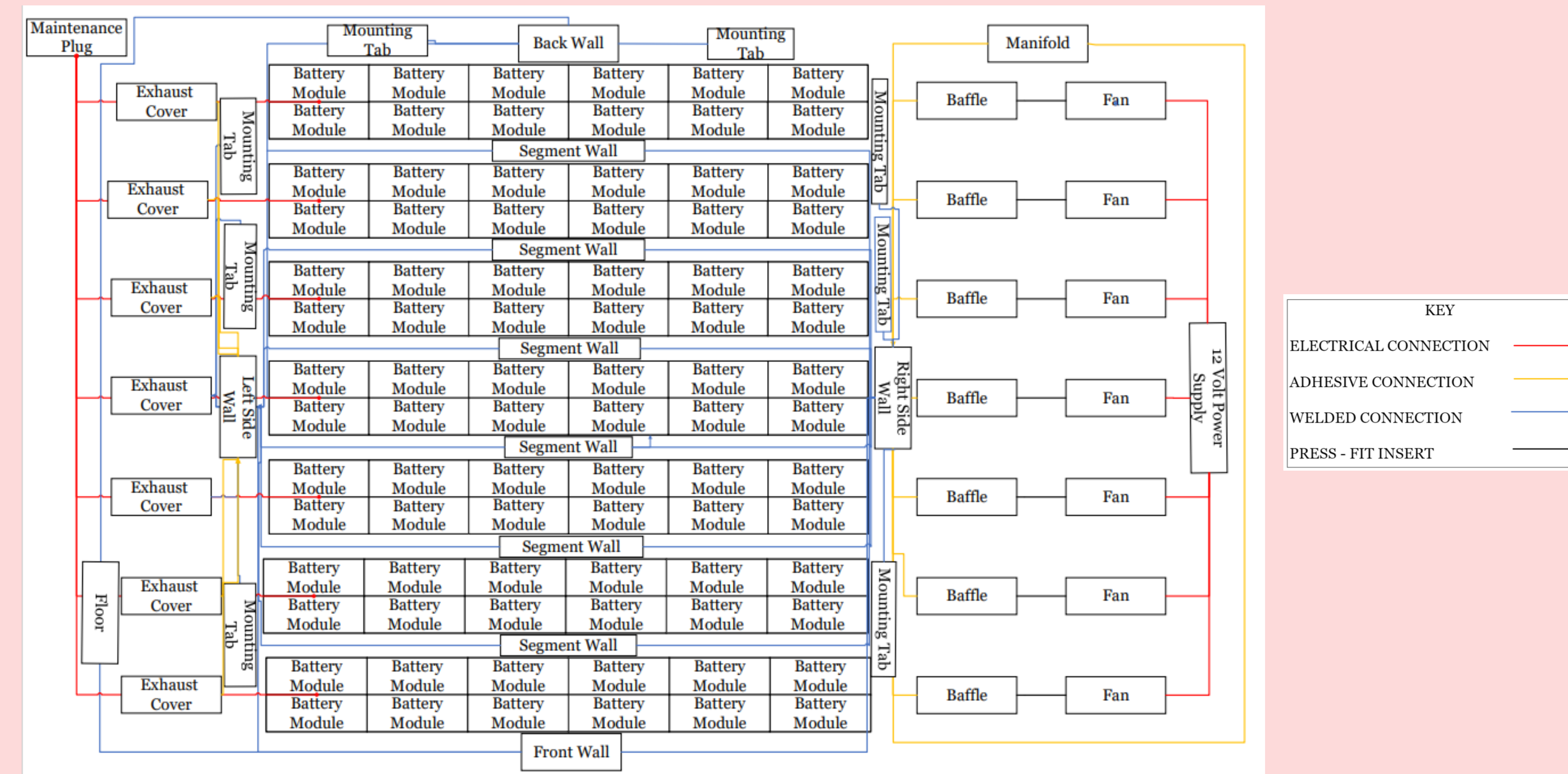
Tests were conducted under the assumption of maximum continuous load applied to the batteries. The car will not require full power during coasting, braking and partial throttle applications.

Test Results

- Starting temperature at the inlet, grid, and outlet is 25C. Heater and fan is turned on.
- The temperature of the grid stabilized at 60C and maintained the temperature for over 10 minutes. Fan is turned off.
- The temperature of the grid exceeds 100C within 2 minutes of the fan turning off. The fan is turned back on.
- After the fan is turned on again, the temperature stabilizes at a higher temperature of 65C. Heater is turned off.
- With the fans still on, the grid takes approximately 5 minutes to reach the starting temperature of 25C

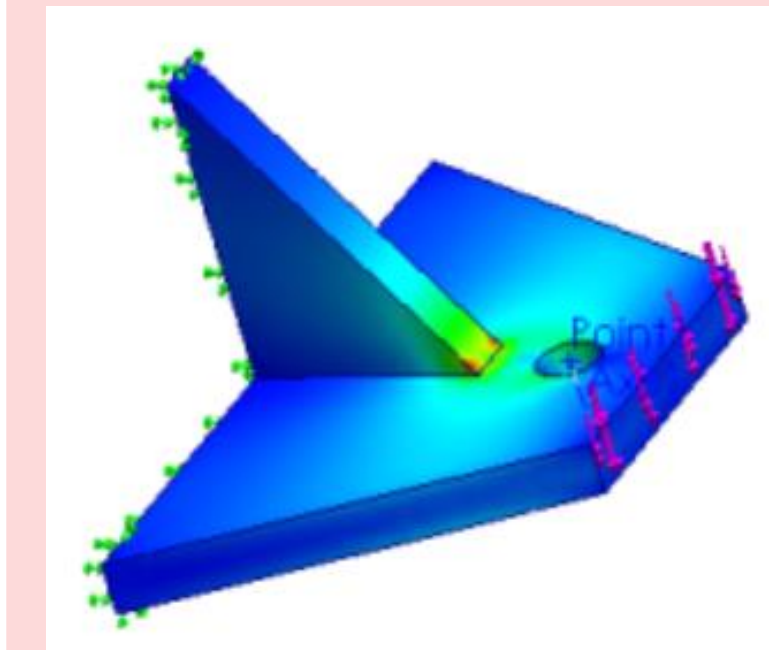


System Level Diagram

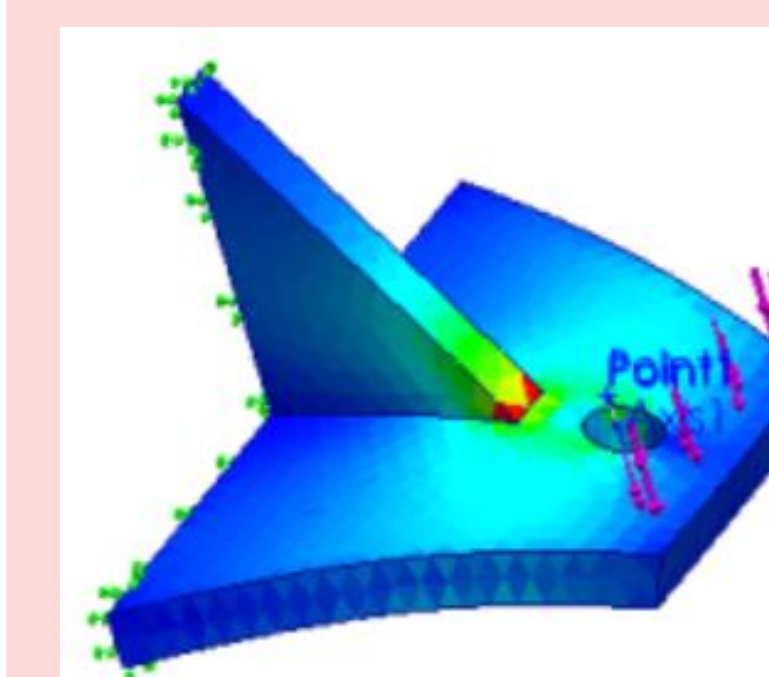


Finite Element Analysis

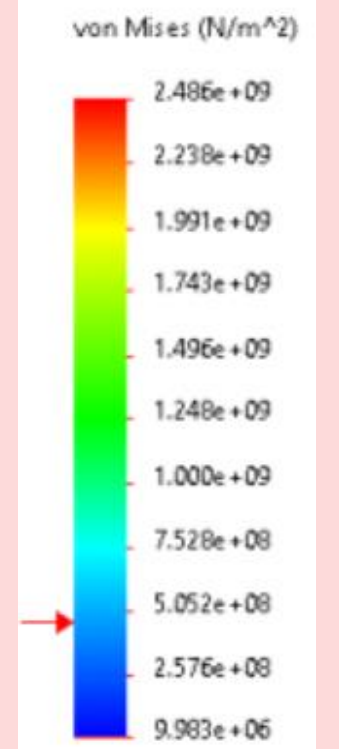
Chassis Mounting Tabs



Static Stress



Static Strain



Material:
0.25" 4130 Chromoly Steel

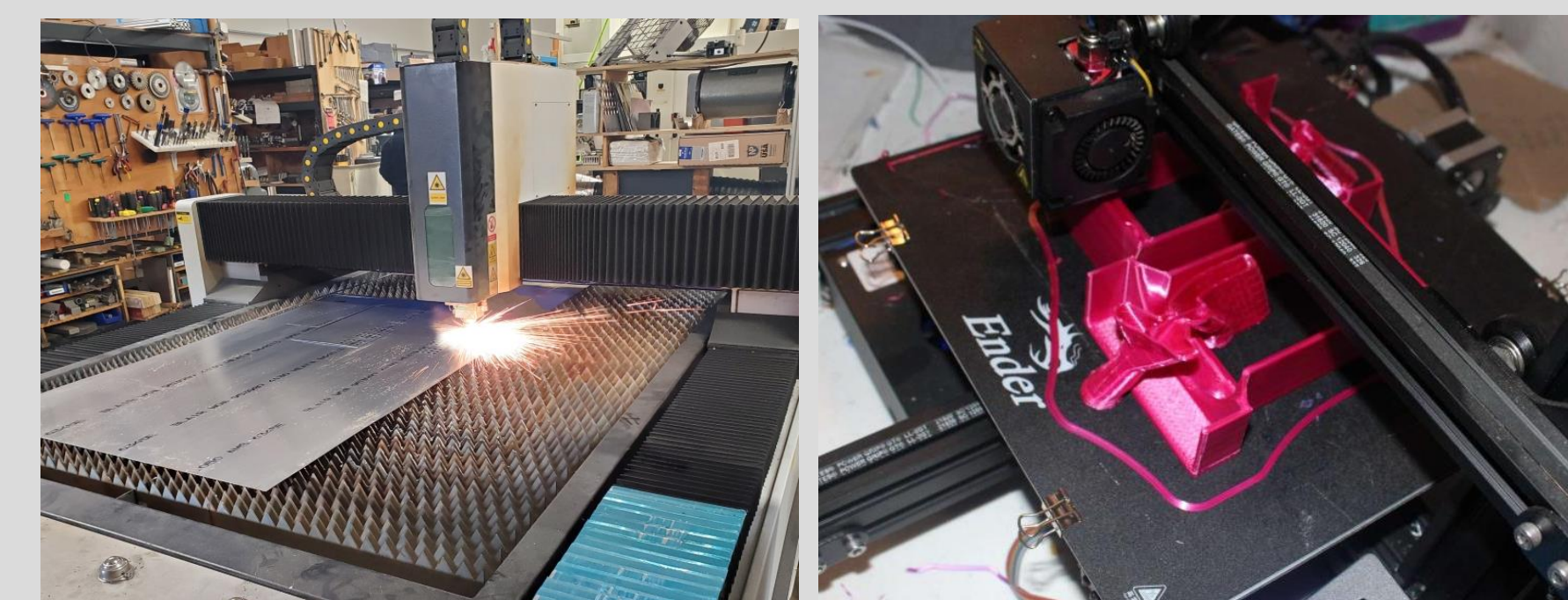
Yield Strength:
460 MPa

FSAE requirement:
Each attachment point, including any brackets, backing plates and inserts, must be able to withstand 15 kN in any direction

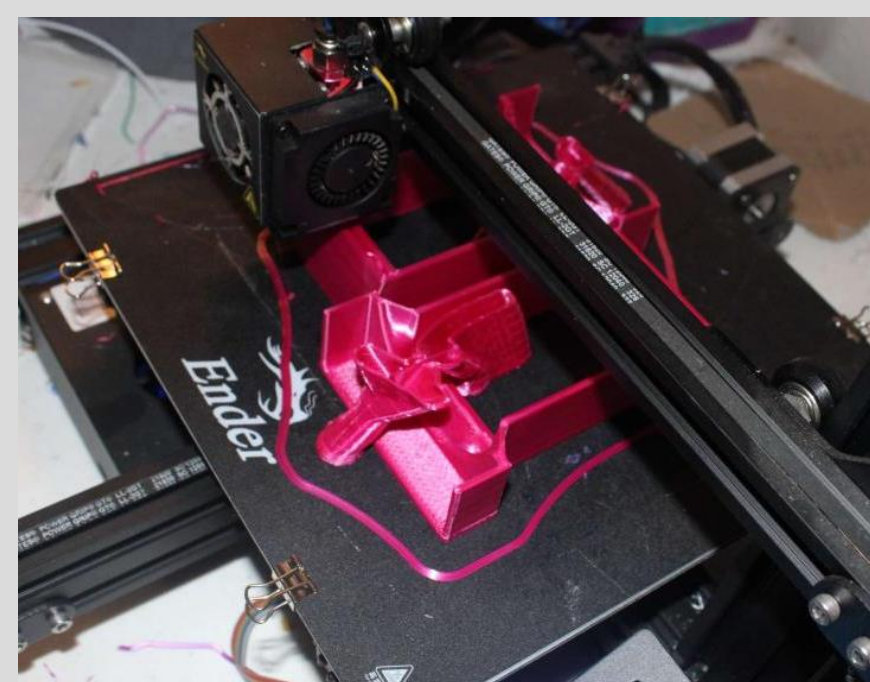
Manufacturing



Soldering resistors for test bench



Laser cutting sheet of accumulator floor



Printing baffles of cooling system

Acknowledgements

The ChargeOne+ Team would like to thank the following individuals for their guidance and support:

AER President
Andrew da Cunha
AER Alumnus
Eli Wooten
San Diego State University
Dr. Scott Shaffar