

# Formula SAE Electric

S17-1166

## 2018 Formula Electric Vehicle

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### Description of Proposal

Waterloo Formula Electric (WFE) is a student-run electric automotive design team originating as a hybrid automotive team in 2012. Dedicated to designing, engineering, and competing electric vehicles, the team has consistently competed in the annual SAE IEEE Formula Hybrid and, as of 2016, Formula Electric held at the New Hampshire Motor Speedway in Loudon, New Hampshire hosted by Dartmouth College. The team swept 1st Place in Autocross, Endurance, and Overall in Hybrid Category in 2015. However, winning first place did not stop the team from further engineering innovation. In 2016, the team made the decision to push their boundaries and shift focus onto electric vehicles, with the same purpose to create efficient vehicle technology, cultivate skilled and well-rounded engineering students with strong leadership, and develop strong community relations. Despite the challenges to compete in the electric race vehicle domain, in 2016 the team gained recognition by winning 1st place in Design and 4th place Overall in Formula SAE Hybrid's electric class. The team hopes that WEEF will continue to provide support this term to inspire innovation.

### Proposal Benefits

Waterloo Formula Electric provides the opportunity for any student to apply academic knowledge to real life; the team is open to any student regardless of educational background or prior knowledge. The team brings critical and innovative thinkers together and inspire new ideas during the entire process of the car's build, cultivating teamwork skills and leadership traits, which prepare them to become future leaders in the engineering fields. The team also provides the opportunity for both team members and the University to network with team sponsors. A handful of sponsors have become regular co-op employers, which opens up opportunities for non-team members as well.

### Estimated Equipment Lifetime

Brake system components will last four years.

Simulation computer will last five years.

RIGOL DP831A Power Supply will last ten years.

BK Precision high current supply will last ten years

Vehicle dynamics sensors will last five years.

CANalyzer will last forever.

Organizational bins will last ten years.

### Implementation Schedule

All items requested will be purchased in the summer and fall terms of 2017. They will be used for the expected lifetimes or longer.

### Additional Information

Brake system components are essential for vehicle functionality and safety. Some of the current brake system components are over a decade old and are difficult to find replacement parts for.

The simulation computer is essential for running FEA studies for the chassis. This analysis is safety critical and a rules requirement for our competition. Currently, using student laptops and/or CAD room computers has led to very slow solve times and frequent software crashes due to memory/processing power limits.



The RIGOL power supply is useful for debugging electrical components and PCBs going into the car. It allows for easy testing in the bay and at competition.

The high current supply is essential for providing shore power to the vehicle (running LV system while parked and with HV inactive). Currently we are using student owned supplies to get this done and the team needs a long term solution.

Vehicle dynamics sensors are essential for vehicle dynamis development and data driven design tasks on the team. It allows us to go a step above previous designs by capturing data about the vehicle such as suspension travel and steering angle while live on track.

The CANalyzer is a tool for debugging the CAN bus we employ on our vehicle. It allows for electronics and firmware debugging during vehicle build and operation.

Electrical organization bins are needed for the large components that the team had amassed over the years. Effective organization is essential for a productive work environment.

### Cost Breakdown

Item	Option1	Option2	Option3	Option4
Brakes system (calipers, pads, lines, etc)	\$ 1000	\$ 1000	\$ 1000	\$ 1000
Simulation computer	\$ 2000	\$ 2000	\$ 2000	\$ 2000
RIGOL DP831A Power Supply	\$ 1000	\$ 1000	\$ 1000	\$ 1000
BK Precision High Current Supply	\$ 700	\$ 700	\$ 700	\$ 700
Vehicle dynamics sensors	\$ 1500	\$ 1500	\$ 1500	\$ 750
CANalyzer	\$ 1000	\$ 1000	\$ 0	\$ 0
Electrical organization bins	\$ 500	\$ 0	\$ 0	\$ 0
<b>Total</b>	<b>\$ 7,700</b>	<b>\$ 7,200</b>	<b>\$ 6,200</b>	<b>\$ 5,450</b>