

ELECTRIC VEHICLE TEAM

SPONSORSHIP PACKET

2017 - 2018

ROCHESTER INSTITUTE OF TECHNOLOGY





Our Purpose

The RIT Electric Vehicle Team (EVT) is a student-run organization dedicated to promoting the viability of electric vehicles through real-world demonstrations of electric drivetrains in action. The team has designed and built a fully electric superbike that is raced in events at the professional level.



New Jersey Motorsports Park 2017

About the Team

The three main subgroups within EVT are the electrical engineering, mechanical engineering, and firmware/software engineering teams. These three groups work together seamlessly to design, create, and integrate the different components of the motorcycle. The main goal of the team is to foster the available talent in each member as much as possible, providing opportunities to apply theoretical knowledge learned in the classroom. From the start, new members are challenged to innovate through the design, construction, and optimization of electric bicycles. This experience provides the opportunity to learn about the fundamental concepts of electric drivetrains.

After the introductory project is complete, members are then challenged with intermediary development vehicles, such as the team's electric go-kart. The vehicle was built for an Imagine RIT competition, so improvements are made on an annual basis. Experienced members earn the privilege to collaborate and improve on REV1, and design REV2. The intention of all these projects is to provide a more advanced learning experience for the members, as well as providing a trial platform for future technologies that will be implemented on the motorcycle.

Racing Events

Previous Competitors:

- eMotoRacing Varsity Challenge
New Jersey MotorSports Park (NJMP)
Milleville, New Jersey

Future Competitions:

- eMotoRacing Varsity Challenge
Barber MotorSports Park
Barber, Alabama
- Pikes Peak International Hill Climb
Pikes Peak Summit
Cascade, Colorado

The Rider

Karl Smolenski is an engineer at Cornell University's Laboratory for Accelerator Based Sciences and Education. As a hobby, Smolenski competes professionally in motorbike races. Some of the national races that he's participated in include the:

- 1998 AMA's in Loudon, NH
- 2000 VRRA's in Shubenacadie, Nova Scotia
- 2004 AHRMA's in Daytona, Florida.
- Isle of Man



2010
Club Formation

August 2012
REV 1
(RIT Electric
Vehicle 1)
conception

Jan 2015
REV 1
design compete

June 2015
REV 1 build
complete

Nov 2015
Complete
software
& improve data
collection system

March 2016
New revision
of hardware
on IMU & BMS

July 2016
2nd place
at NJMP

April 2017
New battery
pack using
900 18650's

2019
Pikes Peak

August 2011
"Hellboy" motor
bike prototyping
platform

August 2013
"Hobbes"
Go-kart
prototyping
platform

April 2015
XALT 12
cell Li+ pack
complete

July 2015
NJMP
1st Place
first race

Nov 2015
XALT 14 cell
Li+ pack
complete

April 2016
Custom
rear subframe
completed

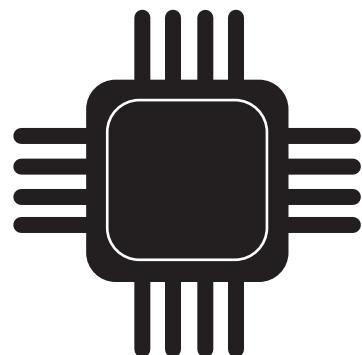
March 2017
Zero motor
upgrade
55HP → 75HP

July 2017
3rd place
at NJMP

REV 2

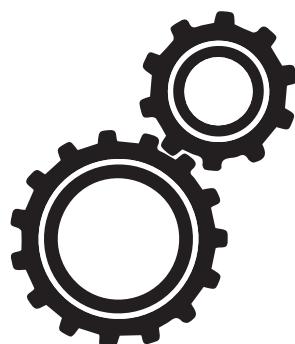
Electrical

The electrical team is responsible for all custom circuit design and electrical system integration for the superbike. The team works on a diverse set of projects that include the battery management system, inertial measurement unit, low voltage subsystem, and the supercharger. The team continues to set itself apart by designing everything in-house, guaranteeing maximized bike performance and safety throughout the duration of the race. With the implementation of advanced battery characterization and cutting edge architecture inspired from the best companies in the world, the team continues to redefine the impossible.



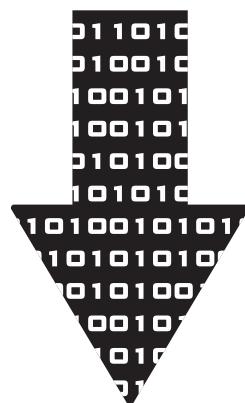
Mechanical

The mechanical team is responsible for the design of various components on the motorcycle, as well as the integration of everything inside the frame. Custom designs include the battery enclosures, a custom rear subframe, housing for all circuit boards, and carbon fiber fairings. The largest challenges faced by this team included designing the battery enclosures and integrating the motor, and motor controller into a motorcycle frame previously designed for a gasoline engine. In addition to the design work, the mechanical team is responsible for manufacturing several of the parts used on the bike. This team is vital in ensuring that all of the major components of the motorcycle meet technical and safety specifications, as well as work seamlessly together.



Firmware

The firmware team is a multidisciplinary design team dedicated to building the software systems required to field a competitive race vehicle. The work covers a wide range of activities including data collection regarding vehicle performance, the balancing of individual cells inside the battery packs, managing the rider-vehicle interface, and high-speed charger control. The electrical and firmware teams work very closely to develop a complete system of high-quality devices that are flexible enough to allow the team to design a race vehicle that is optimized for any situation.



BATTERIES

REV1's battery pack is made up of 24 XALT 63 Amp-Hour high power cells arranged in a series configuration. This yields a system with a maximum voltage of 100.8 Volts, a maximum current draw of 720 Amps, and an energy storage capacity of 5.6 Kilowatt-Hours. The entire assembly consists of two sheet aluminum containment modules, each housing 12 individual cells isolated from each other by vulcanized fiber insulation, and connected via copper bus bars. Thermal management of the pack is provided by custom phase change material from AllCell Technologies. This material is composed of a wax impregnated graphite matrix that melts and maintains a constant temperature at 48 C, thereby limiting the maximum temperature that the cells themselves can achieve.

SUBFRAME

The subframe is the component of the frame that seats the rider and houses the motor controller. The custom design raises the incline of the seat to accommodate for the motor controller housed underneath. This feature was necessary to ensure there would be no interference with the rear tire during full compression of the suspension. The custom sub-frame is compact and efficient, it houses a critical component of the drivetrain while maintaining the structural integrity of the motorcycle.

MOTOR

REV1's motor is a Z-Force 75-7 unit designed by Zero Motorcycles in California. This model is a synchronous three phase, radial flux, surface mounted permanent magnet machine. It is capable of producing 95 Nm of torque and 38 kW of power at the output shaft, and can spin up to 6000 RPM. The motor is air cooled via aluminum heat sinks mounted to the exterior of its casing.



GATEWAY

The Gateway is responsible for retrieving and sending data real time from all components on the bike. Not only is it a major part of our data analytics but also acts similarly to an ECU as it will make performance decisions based on the environment. The Gateway consists of a CAN module paired with a raspberry PI. Another important component on the bike is the Sevcon Motor Controller which allows for precise control over the Z-Force Motor. The controller captures many data points for our Gateway to access and read through for further analysis.

BMS/IMU

EVT's custom Battery Management System collects data on individual cells in each battery including voltage, pressure, and temperature. Additionally, the cells can be kept from drifting too far out of balance and in event of an error operation of the superbike can be suspended. With this information and control, the superbike can maintain racetime conditions safety being a certainty and the long-term health of the lithium-ion cells guaranteed. The inertial measurement unit is a second custom embedded system that collects acceleration, rotation rates, and altitude data. This data is then sent over the CAN bus to the gateway, which acts as a storage location until the data is collected. The IMU allows us to optimize lap times based upon previously collected data and give our rider more performance feedback.

REV1

ROCHESTER INSTITUTE OF TECHNOLOGY ELECTRIC VEHICLE 1

REV 2

Custom Frame Maximizing Electric Drivetrain Potential

Why build a fully custom electric superbike?

- Battery centered frame design
- Custom carbon-fiber fairings
- Effective weight distribution
- Higher energy density
- More powerful motor
- Faster top speed

What it Takes

Frame

Design frame to accommodate a higher battery volume

Motor Controller

Custom software integration to maximize motor output

Suspension

Tuned to accommodate a custom electric drive train

Batteries

Cutting edge battery architecture and integration to increase power and endurance

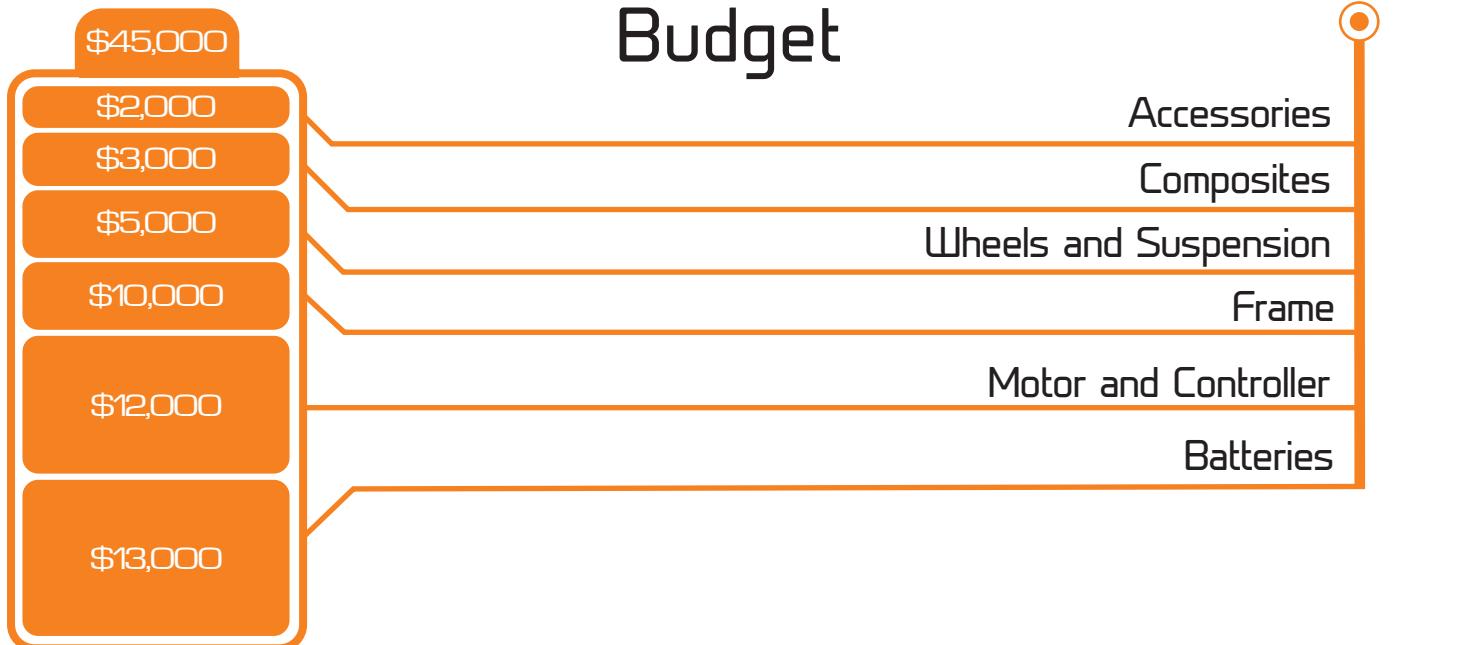
Telemetry

Integrated telemetry system records bike metrics to monitor and adjust race performance

Motor

State of the art motor to efficiently transfer power from the electric drive train to the wheels

Budget



Sponsorship Benefits

Ways To Invest



Materials



Services



Money

Sponsorship Tiers

KILOWATT SPONSOR \$250 - \$999

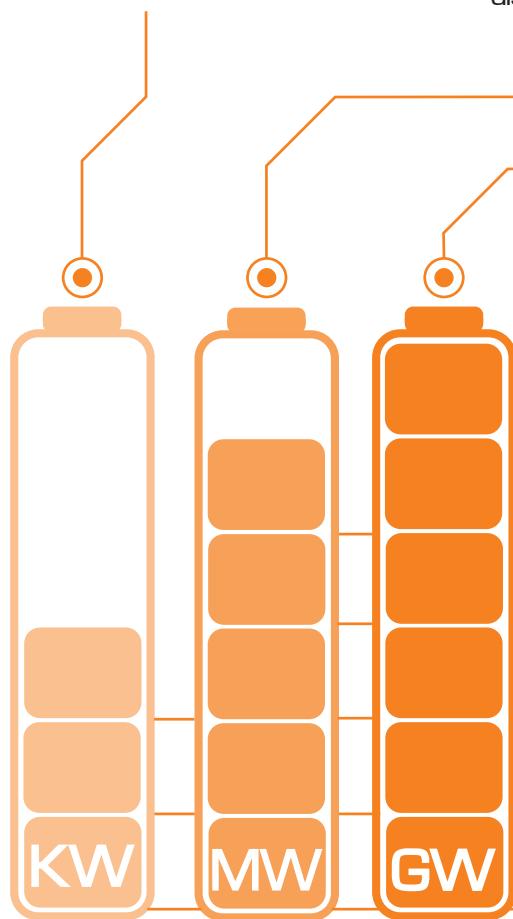
A Kilowatt level sponsor receives a smaller logo display.

MEGAWATT SPONSOR \$1,000 - \$3,999

The Megawatt level sponsor receives their company name displayed on the bike.

GIGAWATT SPONSOR \$4,000 and above

Gigawatt sponsors are our most generous benefactors who receive the largest logo promotional display on all EVT paraphernalia.



Company logo prominently on REV 1 & REV2

Company name on REV 1 & REV 2

Company logo on team t-shirts

Company logo on team banner

Company logo on team website

Invitation to Sponsor Day

Contact information

Thank you for your time and for considering sponsoring the Electric Vehicle Team. If you have any questions or would like to know more about what we do, please feel free to reach out to the contacts listed below.

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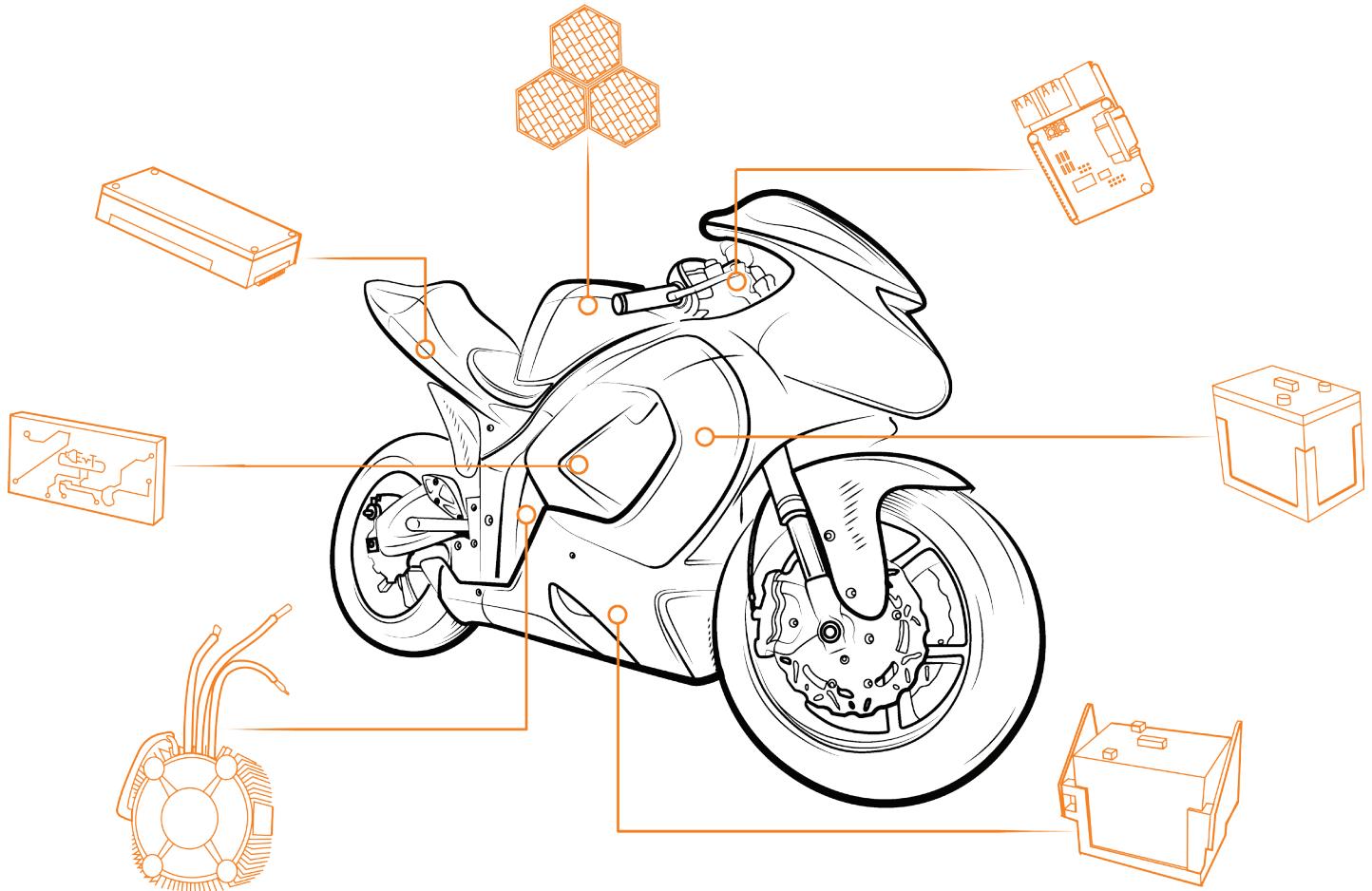


evt@rit.edu



Instagram:
[rit_electric_vehicle_team](#)

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Contact Us!



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