REV Newsletter

November 2015

Special points of interest:

- REV has a new project management system this year to foster professionalism and efficiency in our work
- Testa 3.0 received updates to its body including stronger mounts and a rear hatch
- Testa 3.0's back wheel assembly is being repaired as well as modified in order to integrate the drive system with our new motor
- Electronics has selected a new, more efficient motor for Testa 3.0 and is hard at work designing a new motor controller

Inside this issue:

REV: Rensselaer Electric Vehicle

Shell Eco-Marathon 2015: Where we Left Off

In the spring 2015 semester, as REV has for the past 5 years, the team competed in the Shell Eco Marathon Americas in Detroit, MI. After a disappointing motor controller malfunction in 2014 and multiple hiccups during the 2015 Marathon, finally getting REV's prototype vehicle, Testa 3.0, on the track was an exciting victory for the entire team. After meeting many challenges during the 2014-2015 school year, REV took a hard look at our team, our cars, and how to improve the efficiency of both. With a new management system and new goals in place, REV aims to again compete in the 2016 Shell Eco Marathon with an optimized Testa 3.0.

REV's Testa 3.0 on the track in Detroit, MI.

MAPS: Management and Project System

Rensselaer Electric Vehicle this year has taken on a new challenge in how we operate and function as a team. Over the summer we drafted into existence a Management And Project System (MAPS) which is based off of a combination of past years' experience and a management system used by software companies called *scrum*. MAPS is structured in such a way that multiple mechanisms are in place to catch mistakes, review designs, and eliminate resources wasted. MAPS deviates from previous management in the past that did not have as many institutionalized mechanisms for catching mistakes, documenting mistakes, and incorporating feedback into future design plans. Four major milestones exist which incorporate work input, time input, design reviews, manufacturing plans, documentation, and conditions of satisfaction. MAPS is a cyclical process which is depicted in the workflow diagram on page 2.

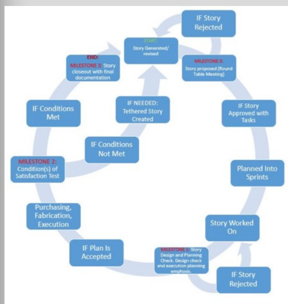
Milestone 0 starts with a project plan or a story which includes conditions of satisfaction for the project, tasks and their respective time estimates, and an expected date of completion. Once passed by the president and project manager, the tasks detailed in the Milestone 0 can be worked on until Milestone 01 can be achieved. Milestone 01 is an inclusive design review which requires approval from all system leads and officers. This enables the widest variety of concerns to be addressed from technical to financial. After Milestone 01 has been passed manufacturing may commence which also includes purchasing, fabrication, and execution. Milestone 02 occurs once the final product has been manufactured and assembled, the conditions of satisfaction as laid out in the original Milestone 0 are then applied to the final product. Milestone 02 is complete when the conditions of satisfaction are completed and the tests are signed off by the project manager. Milestone 03 is all encompassing project document which includes milestones 0-3. Milestone 03 also emphasizes the documentation of mistakes, lessons learned, and general advice learned for future manufacturing, and may serve as an archived precedent for future projects. Tethered stories also exist in the case of non-satisfactory products in which case designs may go through the cycle of Milestone 0-3 for redesign or the needed application of prototypes or unique empirical product information. The major application of having projects documented and broken down into milestones is the wide availability of archived stories to future club members to review calculations, manufacturing, and general resources the team has used in the past. The break up of projects into preplanned tasks and time estimates also allows the club to develop valuable time estimation and time management skills. Constant feedback from team members and officers also allows the system to constantly incorporate changes to improve project and system efficiencies. It is the hope of the team that MAPS will help to serve future generations of REV members in building more robust and well thought out electric cars for the future.

Body/Chassis Team

Since Rensselaer Electric Vehicle started its 2015-2016 season, the Body Chassis team has dedicated countless hours to their work. With numerous stories approved and moving along, two standouts take center stage. These two particular stories encompass work on creating a back access hatch and redesigning the mounts that keep the bottom of the body connected to the vehicle's chassis. The mission of the hatch is to make the motor and rear of the vehicle easily accessible for maintenance by multiple REV members. The mounts are being designed such that the bottom half of the body will be held closer to the main chassis and the materials being used to form the mounts are actually repurposed parts from an older car that was decommissioned this year. As the body chassis team of REV continues its diligent work, they hope to make a lasting mark in this year's Shell EcoMarathon.

New back hatch for access to back wheel

Two members test new body mounts by standing in Testa



MAPS workflow diagram

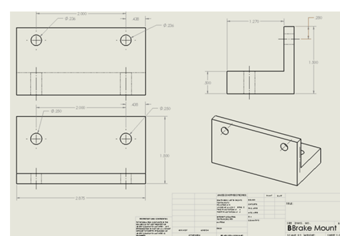
"It is the hope of the team that MAPS will help to serve future generations of REV members in building more robust and well thought out electric cars for the future. "

Drivetrain Team

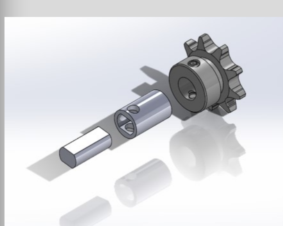
The Drivetrain subsystem has been working on a variety of projects to upgrade old systems. REV has purchased a new motor for Testa, which requires that many components be improved or modified to fit the new design. In addition, at the end of the Spring 2015 semester Testa's rear wheel hub was damaged during testing. Drivetrain has therefore been working to replace the rear wheel assembly with components that will fit the new motor.

It was determined that the failure last year was caused by a misalignment between the rear wheel brake caliper and brake rotor, which caused a great deal of stress on the hub to the point that the brake rotor screws sheared through the piece. In order to prevent this in the future, Drivetrain has been working on an improved rear brake mount that will hold the brake caliper securely and aligned with the brake rotor. The previous brake mount was made from two pieces and experienced an unacceptable amount of play when bolts were not tightened correctly; the new design features a single piece that will be adjusted to accommodate the brake caliper.

One of the improvements to Testa involves the chain drive system. The rear drive system previously used two chains to link the motor to the rear wheel in order to achieve a necessary gear ratio and sufficient torque to drive the car. The new system will use only one chain because the original connection between the intermediary gear and the body was not sufficiently strong. Drivetrain therefore sourced motor sprockets and wheel cassettes to achieve the correct gear ratio.



Drawings of the motor mount design

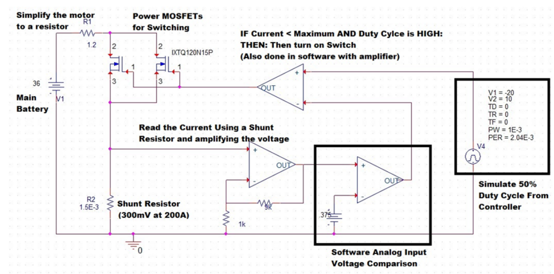


Sprocket adaptor assembly

To link the chain to the motor, the team purchased a 9-tooth sprocket and has designed an adapter to tightly attach the sprocket to the motor. This is necessary because the sprocket inner diameter is too large to fit onto the shaft of the selected motor. The figure on page 2 displays the design of the sprocket adapter as it fits to the sprocket and motor shaft. To manufacture the adapter the team will request EDM wire cutting services of a local engineering company, Troy Tool and Engineering.

Drivetrain is also designing a motor mount to fit the dimensions of the newer motor.

The motor mount takes the shape of a single rectangular sheet that is bolted directly onto the chassis, on which the motor itself is attached. The slots on which the motor is bolted allow one to introduce slack to the drive chain easily, as the motor bolts can be loosened and the motor adjusted forwards or backwards. A stock sheet of aluminum will be taken to the water-jet service run by the MANE department in order to create those slots. Mounting holes to attach the piece to the body will then be made. This design is also displayed on page 2.



PSpice simulation of simplified car circuit.

Electronics Team

To start off the Fall 2015 semester, the electronics system worked on acquiring a new motor for REV's current prototype car Testa. The vehicle previously utilized a brushed DC 6000W motor that had been on several other REV vehicles before it. However, this motor was neither efficient nor easy to control with its demanding current draw. Thus a downgraded motor to 1000W and an increased gear ratio will be more efficient and put less stress on the motor controller. Before mounting the motor in the car, several tests will be run to determine the motor's characteristics. As REV encourages students of all majors, some of the members that are interested in software developed programs to communicate with microcontrollers which will be able to detect the motor's temperatures and graph the motor's current draw with respect to time. Upon successful completion of these tests, the motor will be installed into Testa 3.0 with the help of the drivetrain team..

The new motor needs a new motor controller which is the other central task of the electronics team. In order to satisfy officials reviewing the electronics and to make it easier on new members, the motor controller consists of a very simple layout. It will use power MOSFETs to switch the motor on and off while also measuring the current to prevent it from exceeding a preset maximum value. While the previous car put all the controls at the driver's hands, the current upgrade to the car will change from a throttle to a pedal. This allows the driver to focus on steering and braking, both of which are done with the driver's hands. At the center of this motor controller is a microprocessor. Due to time constraints and a few other factors, a simple ATmega328 microprocessor will take this position. A big concern for the team is time commitment and the ability to teach new members. The simplicity of the motor controller does not call for a complex microprocessor that would take time for the team to learn.

Current work on this controller regards the heat dissipation from the MOSFETs and the efficient way to step down the voltage from the 36V battery to an acceptable voltage for the microprocessor. The team is also attempting to implement the model using OrCAD PSpice which poses some difficulties as the DC motor is a harder component to simulate. The Electronic System welcomes this challenge, though, as increased membership within the system allows more thorough work and better quality results.

"A big concern for the team is time commitment and the ability to teach new members. "

Testa 3.0's new 1000 W motor

Rensselaer Electric Vehicle

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Useful Links:
Shell Eco Marathon:
http://www.shell.com/global/environment-society/ecomarathon/events/americas.html

Rensselaer Electric Vehicle is an RPI student organization that works together to design, build, optimize, and compete electric vehicles. Our mission is to educate our members on the principles of the engineering design process and professional development through hands on experience and involvement. Drawing from our diverse talents, skill levels, and majors, we aim to create the most efficient vehicle possible.
All students are welcome to join at any time. Shoot us an email and check out our website below for more information!

Find us online!

http://rev.union.rpi.edu/