

CURRENT EVENTS

Pikes Peak Results & Team Projects for the Upcoming Season

Hello Buckeye Current friends, family, alumni, and sponsors! With a new semester in full swing the team is once again hard at work developing the newest generation of our electric racing motorcycles. As you may be aware, our fourth attempt at Pikes Peak International Hill Climb this past June did not end in ideal fashion. After many long hours of intense yet valuable testing and tuning in the weeks before race day, the team felt that the bike was prepared to run our fastest time yet. Unfortunately, the bike crashed near the top of the mountain cutting short a pace that would have resulted in the fastest mountain climb in team history.

As disappointing as the end of last season was, the team is extremely excited about the projects we are working on this year. At the forefront is RW-4, a new bike built from the ground up. This bike will take advantage of a student designed frame and front suspension along with an entirely new powertrain system. RW-4 is slated to run in the 2020 Isle of Man TT Zero, back to the team's roots in electric racing.

This project was kicked off last year as initial requirements were developed and some design work was done (specifically on the headstock and front suspension components). This occurred simultaneously while the team focused on revamping RW-3 for its final run up Pikes Peak.

In addition to this custom design work, the team is revisiting many

other aspects of our bikes' functionality that we believe can be optimized during this new build cycle. One system that has already had been refined this year to increase accuracy is our powertrain simulation tool. The velocity profile, tractive force, and overall pack and powertrain models have all been improved to give a more comprehensive powertrain analysis and better inform powertrain component selection. A



more in-depth explanation of this tool can be found on the next page. Another aspect includes cell characterization and module design, where the team is trying to increase modularity and ease of pack installation to cater to the energy needs of any race. On the datalogging side, we're looking to improve real-time data tracking and analysis by working with Bosch to implement a telemetry system to track cell temperatures, coolant temperatures and flow

rate, and wheel speed amongst other data. As these projects continue to develop they will be covered more in depth in future newsletters.

Finally, an organizational change that the team made in the past year dealt with leadership structure. Retaining the Project Manager and Operations Manager positions, three other members were voted onto an inaugural board of directors that support the decision making process and operational side of the team. The 2018-19 leadership roster is below.

2018-19 Team Leadership



Aaronn Sergent
Project Manager



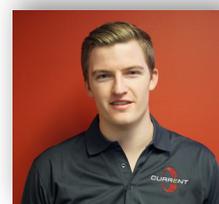
Mason Hayes
Operations Manager



Chase Granlund
Board Member

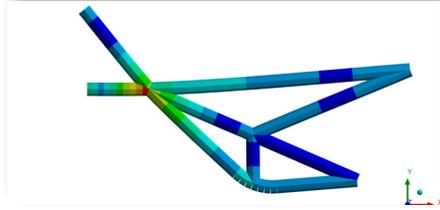


Quincey Patterson
Board Member

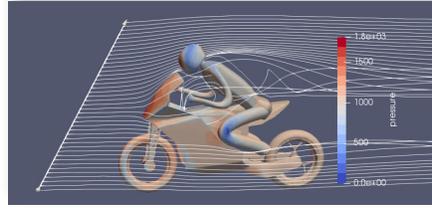


Zach Salyer
Board Member

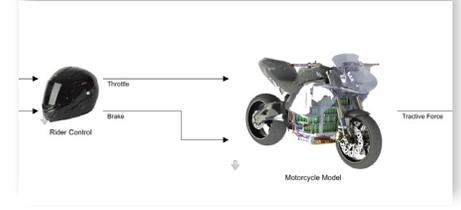
Technical Highlight: Simulations



FEA is used to analyze stress and strain on mechanical components to ensure that the team has sufficient factors of safety guarding against failure. To determine our loading conditions on structural components of the bike we take the highest accelerations recorded at previous competitions and use those with an estimated vehicle weight to define static loading conditions. The structures are being modeled as beams connected at common nodes for comparative analysis. Currently the headstock, frame, and rear uprights are designed as separate subassemblies, but we plan to trial designs consisting of a welded headstock and frame subassembly and a welded headstock, frame rail, and upright assembly to fully explore the design space. When the team arrives at a design worthy of testing we will create mixed element, fully featured models incorporating welds and mounting locations into the analysis. The team plans to iterate through designs using simulation, manufactured prototypes for destructive testing, and continue refinement of the simulation setup.



CFD is used to determine the coefficient of drag for the bike. First, a mesh is made around the bike and rider and a flow velocity is specified, then other properties like temperature, density, and viscosity, are double checked - although those values are generally kept at default. The results of the simulation gives pressure forces on the bike from which the drag force and drag coefficient can be found. The results also show the velocity of the air at any point around the bike, which the team uses to optimize radiator placement. It also allows visualization of how air flows around the bike and where the flow separates from the bike, which is helpful for designing the fairings. For example, if the simulation shows that the windshield is directing air into the riders face then we could adjust the angle of the windshield to redirect the flow around the rider. These simulation results will be used to inform changes that can be made to optimize the RW-4 fairings and lower the overall drag on the bike and maximize lap speed at the isle of man.



SimBALink-CL is a point mass, longitudinal vehicle simulator. The team uses this to determine powertrain performance and theoretical lap times. The input to this system is a velocity profile generated from Isle of Man GPS data by: determining a corner radius for each given point, identifying the apexes, and calculating the maximum velocities at these apexes. Then a maximum lateral acceleration is calculated from max lean angle and lateral acceleration. Velocities between apexes are found by calculating accelerations from maximum longitudinal acceleration and friction limits. This method of calculating a velocity profile is referred to as a quasi-static velocity profile. SimBALink takes that velocity profile and attempts to follow it as closely as possible. This determines the torque our motor can produce based on the speed we're traveling. This torque is multiplied based on a gear ratio, applied at the rear wheel, and resistive forces are subtracted to calculate a net force. Then $F=ma$, gives an acceleration for the bike. Given all this information, theoretical lap times are calculated.

Daniel Mikrut



Hometown: Chicago, Illinois

Year: Sophomore

Major: Mechanical Engineering

Hobbies: Computers, Cars, Motorcycles

Projects: "Last year I reworked the cooling system on RW3x3. This year, I am designing the cooling system for RW4. Last year I had a base to start off with, and I just needed to improve on that previous design, but this year I'm responsible for the entire system. This means choosing the radiator, designing the reservoirs, routing the tubing, and finding/manufacturing any custom parts or fittings that we need."

Favorite Team Memory: "My favorite team memory has to be Pikes Peak. It was stressful and busy, but I got to know everyone better and felt like I was a part of something bigger than just an OSU club."

Favorite Part of OSU: "My favorite part of OSU is the opportunity we have to go out and do something we like. There's a huge variety of clubs you can join or research you can do."



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