September 2022

The beginning of fall has brought some exciting prospects to the team and allowed us to delve more into designs. Continue reading to learn more about events we attended and what our subsystems have been up to this month.
Events Recap

Involvement Fair

*August 24*

Our members had blast talking to other students at the Fall 2022 Involvement Fair! We had the car on display outside of the workshop as well as a display board at the actual fair. We received significant interest from potential members and had a large turnout at our new member meeting, which was August 25th.

Learning Factory Open House

*September 1*

A huge thank you to the Learning Factory, who invited us to have a display and the car at their Open House event. Connecting with students and other student organizations is always a fun time!

Smeal Involvement Fair

*September 8*

We attended the Fall 2022 Smeal College of Business Involvement Fair and were happy to talk to a different part of the university than we normally do. A big thank you to Becky Winge, the Student Engagement Coordinator of Smeal for helping us get involved and set up. We look forward to coming back in future years!
Subsystem Updates

Aerodynamics

Aero has been working on finalizing the design of the rear wing. With the help of many new members working on SimScale’s CFD software, we have run through over 12 iterations of the 4 element design in an effort to lock in the final design. Structures have been working on designing goosenecks for the rear wing using topology optimization in SolidWorks. Next, they will begin to look at the lateral loads the wing will experience. Manufacturing has been researching how to cut our own foam airfoils using a hotwire CNC. Testing has been collecting shock data from various test days including a straight line constant speed run to find our downforce coefficient from last year. This will be compared to our simulation numbers and help develop expectations for the package this year.

Chassis

The Chassis subsystem has spent the past few weeks familiarizing ourselves with this year's big projects and learning the theory behind why we do things a certain way. Chassis members learned about the different types of fibers that we use, how to best use their strengths in a layup, and how to manufacture testing panels. We are also starting a collaborative project with the Aerodynamics subsystem to make our nosecone designs more efficient. Moving forward, we hope to create the molds for this year's monocoque in the next few weeks.

Controls, Brakes, and Safety

This year, the Controls, Brakes, and Safety subsystem has been hard at work to prepare for the new 2023 electric car. Luckily for us, the subsystem got a head start on designs last year for this year’s car. The pedal tray is about mid-way through its design, which will be changing this year due to the lack of a clutch pedal as well as an electronically controlled throttle system, which will be actuated using a rotary potentiometer. So far, we have a brake pedal arm fully designed out of 6061-T6 aluminum, along with FEA completed to demonstrate the pedal’s ability to hold up to the required 2000N of force. With a recent change from a linear potentiometer to a rotary potentiometer, the accelerator pedal is in the process of being re-designed to accommodate it. The pedal face designs for both pedals are in progress. Finally, the geometry for the master cylinders on the brake pedal as well as the full pedal tray design are both in progress and are scheduled to be completed within one to two weeks.
Controls, Brakes, and Safety cont.

When it comes to the steering system and dashboard, we are focusing on driver comfort and general drivability of the car. To start, we are iterating on the steering wheel from last year to improve the fit and feel for the drivers. This year, we will continue to use the carbon fiber base plate with 3D printed TPU grips for improved feel. We will also continue to use the quick release system for easy cockpit entry and exit. To make the wheel as good as it can get, we are 3D printing prototypes each week and passing them around to members of the subsystem for feedback. This process will continue into the spring semester. The steering column mount, which bolts up to the top of the chassis to hold the shaft that the steering wheel attaches to, is currently a design in progress. Finally, we will continue to use the AiM MXS dashboard with its superior data logging capabilities, programmability, and readability for the driver.

The braking system of the 2023 car has also been scrutinized by our subsystem due to its many leakage issues on last year’s car. We have determined that many of the brake failures were caused by the angle of the brake reservoirs, allowing air pockets to bypass the fluid. This year, we are prioritizing reliability and serviceability for the braking system. First, our subsystem will be purchasing all new fittings, hard lines, and soft lines to prevent any leakage being caused by worn out fittings. The spindles, rotors, calipers, and pads will all mostly remain the same as last year due to a previously well-designed system. This decision is not yet finalized, though, as we plan on evaluating every part to determine if anything needs to be changed due to the highly likely weight distribution change due to the electric system.

Drivetrain

Over the past month and a half, Drivetrain has been busy finalizing key aspects of the car. With the switch to EV and a full monocoque, the motor, mounting, and cooling are all going to change. This gives our subsystem the chance to try different things this year. One of the first things that is changing is the gear ratio. We have worked extensively to find a range of gear ratios that will allow our car to preform best at the competition. We found that a gear ratio between 3.5 and 4 would work best for our car and are working to finalize the exact ratio. Furthermore, our subsystem has been collaborating with Suspension, Chassis, and High Voltage Electronics to coordinate the rear car components in the most efficient way possible. The coordinated effort was spearheaded by our Systems Engineer in an effort to facilitate conversations early in the design process. Over the next month, our subsystem hopes to have initial designs for the motor mounts, differential mounts, and the cooling system.
Finance

It has been an exciting month for the Penn State Formula Racing Finance subsystem. This month PSFR would like to welcome SEVEN new sponsors! Tesla, the Office of the Engineering Dean for Education, Institutes of Energy and the Environment, The Piper Group, Department of Mechanical Engineering, Engineering Undergraduate Council, and Battery and Energy Storage Technology Center will all be joining the team as sponsors this season. In other news, UPAC, the University Park Allocation Committee, has approved our equipment request to purchase electronics and suspension equipment. Make sure to keep an eye out for a PSFR donation link and Grow Penn State page that will be released soon!

High and Low Voltage Electronics

In the month of September, Electronics worked with Dr. Joel Anstrom in the High Voltage Lab to get the motor spinning! Pictured below is our enthusiastic HV Lead, Abdu Keeley. This is a huge milestone for us and puts the team one step closer to a complete electric powertrain. We have also been doing working on our on-board communication protocol. We will be using CAN bus with Teensy microcontrollers to handle computation and reduce the wire count on the vehicle. Shout out to our sponsor Altium for providing PCB design and all our members for putting in hard work! We are off to a great start for this semester and the year.
Outreach

Throughout September Outreach has been at work with a variety of projects. We have attended a number of new events, flyers and newsletters have been posted and sent out in order to reach a variety of potential members, designs for merchandise were finalized and orders are in progress, and social media posts have been consistent. Moving forward in the semester we are hoping to collaborate with a handful of other student organizations both engineering and business related, decide on the livery, continue with social media posts, and expand to different social media platforms. Thank you to Society of Hispanic Professional Engineers and Institute of Electrical and Electronics Engineers for presenting at one of our September full team meetings. Be sure to check out our Instagram to review our leadership spotlights and keep updated with us!

Suspension

Many changes will be made to this year’s suspension, mostly in the rear of the car. Since we are switching to a full monocoque chassis this year, the rear suspension will be completely redesigned. This month, we have already started redesigning the rear uprights in order to move the location of the pushrod to the upper A-Arm. This change will allow us to have a shorter pushrod to reduce the chances of our carbon fiber pushrod bucking under compression as well as made room for our driveshaft. In addition to these changes, the shock mounting position and anti-roll bar design will need to be changed.

In the front, minimal changes will be made for simplicity. Early in the design stage, the team decided to keep the exact same front monocoque design as the previous year. This allows us to keep the exact same suspension geometry as last year, reducing cost as well as allowing us to focus our efforts on the rear suspension. However, one change will be made this year: an addition of a front anti-roll bar. We are currently in the early design stages of the front ARB, doing only hand calculations to determine necessary spring rate.

On track, we are working on tuning the previous year’s car and experimenting with setups. This will allow us to better understand how our car works and handles. This has the added benefit of allowing us to tune our new car in a shorter time when we get closer to competition.
Sponsorships

Thank you to our sponsors for the year thus far:
- Altair, Altium, Braid, Calspan Tire Research Facility, Fibre Glast Development, Flex Seal, Gorilla Car Care, Institutes of Energy and the Environment, IZZE Sensors, Joe’s Racing Products, MasterCAM, Plascore, Prowire USA, Rapid Harness, Rock West Composites, Rod End Supply, SimScale, Stackpole Engineering, TeXtreme, Timet, Titanium Joe, Uline, and VI-Grade

We are looking forward to your continued support.

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And thank you to all others who have provided us with constant support throughout our switch to electric.

Contact Us

Interested in joining or sponsorship opportunities?
Please contact our team administration below or keep updated with our social media.

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