April 2023

April marks our last full month in the academic year and comes with loads of exciting news! With more and more progress being conducted on all parts of the car, we are growing more and more excited as a team to do testing and compete in June. Keep reading for specifics and keep your eyes peeled for news of our upcoming livery unveiling!
Friends of Penn State Formula Racing,

It’s approaching finals week, and despite the looming stress and hours spent studying, I often find myself in a very reflective mood at this point in the semester. The past month has brought with it one head-scratching challenge after another, which led to setbacks, schedule shuffling, and half the alphabet’s worth of backup plans. It’s a tribute to the dedication and tenacity of the team that all have taken these complications in stride, and worked hard to come up with creative ideas and methods to bounce back.

Fortunately, the past month has not been only firefighting – all necessary approvals were received from FSAE technical judges, and exciting progress was made in particular on the Electronics front with a functioning battery accumulator! It’s not exclusive to that subsystem, though – projects around the team are being completed daily and many are ready to integrate into the final vehicle.

Of course, we were unable to unveil on April 25th as originally planned – please accept my sincere apologies for missing that much-anticipated reveal. Being one of the many dates in our schedule that was reshuffled, our new plan is to unveil our new challenger, PSR23, the week of May 7 via our social media channels and email, as well as have a live event for those who are on campus and would like to see it in person. Make sure you’re following us on Instagram and TikTok at @pennstate.fsae – you won’t want to miss it!

With major projects like the monocoque chassis, battery accumulator, and suspension system in working order, what’s left is to spend time bringing the many puzzle pieces together. Several dedicated members will be sticking around through the first part of their summers to complete and begin testing on PSR23. I would like to thank them again for their steadfast commitment to making this ambitious project a reality.

PSFR also recently hosted its annual elections for the incoming team of Leads. I’d like to congratulate all who were nominated and elected, and in particular give a shoutout to Joel VanSkiver, the Team Captain-Elect, whose work has been spectacular this year and in whose hands I have exceptional faith putting the team. I also want to thank all of our graduating seniors, all of whom I’ve worked closely with this year and in years past. I look forward to making the final push to competition with you all.

Please enjoy this end-of-the-school year installment of the newsletter, and keep an eye out for the official unveiling of PSR23! As always, thank you for your incredible support of the team.

Best regards,

Nate Dreyer, Team Captain
In addition, with the monocoque now in one piece our parts can start to be assembled. With the help of many laser cut mounting jigs, construction of the front wing has begun with the mounting of our midplates. Next will be adding the rest of the front wing elements and getting the rear wing in place with the addition of the main roll hoops. The side pods will also be mounted in preparation for our wind tunnel testing at Ford. It’s all starting to come together!
Chassis

April has been a busy month for Chassis as we used our finished molds to create the chassis layups. With a couple of obstacles, namely the fact that we couldn’t cook the chassis in one piece, the layups took longer than expected. The molds were separated and each part was cooked separately to allow them to be bagged correctly. With some help from ARL, our monocoque has come back and looks gorgeous! Chassis members also worked to align the two halves of the chassis and attach them together to make our chassis into one piece. Currently we are working on finishing roll hoops as well as mounting the sections of other subsystems to get a rolling chassis.

Controls, Brakes, and Safety

As the team is coming into finals season, CBS has been finishing up our parts so we can be ready to install everything in the chassis when it is complete. As shown in the photo, the pedal tray is virtually complete thanks to the large amount of time our members have spent in the learning factory in the last month. There are only a few kinks to work out of the design, but all in all the pedals feel wonderful and the drivers are excited to see how they are when the car is complete. The steering system has had a few minor issues along the way, but is also complete, as shown in the attached photo. The splined shafts and double-d connections worked well and will be refined once installed in the car. Finally, the spindles are yet again complete and are prepared to be pressed into the new uprights when suspension has them ready for us. The CBS subsystem is excited to get our parts into the car and hopefully make it into the testing phase, so we are prepared for competition in June!
Drivetrain

Throughout this month, Drivetrain has been busy finalizing plans for competition in June. With the semester coming to a close, most members won’t be available the month before competition. With this in mind, Drivetrain has been hard at work in the shop. Toward the beginning of the month, the members of Drivetrain put aside their work to help Chassis manufacture the monocoque. This was an extremely time consuming project that pushed Drivetrain's schedule back. Even with that redirection of attention, Drivetrain completed almost all of our desired tasks. The differential, motor bearings, and differential itself were pressed in to the mounts. The motor and motor shaft are the last things left to press/bolt in to place. All cooling components except for the pumps have arrived and are ready to be placed in the chassis. The sprocket adapter bolt pattern was CNCed and the blank is being sent to Saint Mary's Tool and Die to be turned down and cut in half. The last things Drivetrain needs to do is bolt everything in to the monocoque and start testing. This year has brought on many challenges and I (Josh Kaleida, Drivetrain Lead) am extremely proud of all my members for the amount of work they’ve put in throughout the year!

Finance

Our Finance team has been putting a lot of effort into the business presentation, which is now almost complete and being fine-tuned for the event on May 11th. We’ve also been diligently working on the cost report, as the competition is just over a month away. We’re looking forward to seeing everyone in Michigan and can’t wait to showcase our hard work.
This month was all manufacturing. Our Electrical Systems Form (ESF) was fully accepted, and we went full throttle on accumulator assembly. The metal box was completed early in the month, and then we moved on to insulation. We lined all exposed metal with 1/32 in fiberglass sheets insulating to over 6kV. This ensures no ground faults or short circuits can occur from inside the accumulator. Next cells were fit into their respective locations. This process was quite challenging as tolerances from manufacturing should have been better accounted for. This is something we will ensure to do next iteration. Next, the cell taps were wiring to the cells and thermistors plugged into the thermal sensitive diode arrays along each module. This was a major step and allowed us to verify that all systems worked as expected. Lastly, we charged the accumulator for the first time the week before finals. This was a large integration project as many systems had to work together. This went very well, and we experienced only minor hiccups. All cells but one charged properly; we will be replacing the faulty cell, so it does not affect our overall capacity. At this point, all accumulator systems are fully functional, and wiring will be cleaned up next week. Our goal is to submit a pre-tech inspection video within two weeks. This is a huge update from High Voltage as we have now successfully built PSFR’s first custom lithium-ion battery pack! Huge shoutout to the team and everyone who has worked so hard in making this two-year dream into a reality.
Low Voltage Electronics

On the Low Voltage side of things, the subsystem is currently in the stage of integration and testing. We have now gotten all six of the original boards working correctly now and because of this, we were able to finish assembling the shutdown circuit for the vehicle. We have three more circuit boards in the works that should wrap up the last of our PCB orders for the vehicle. This includes an microcontroller shield that gets attached to the STM32 and allows it to correctly interact with other hardware and user-interface devices, the accelerator pedal position hardware, and some relay boards to allow direct interfacing with the shutdown circuit.

On the firmware side of things, the members have developed several critical tasks to run on the STM32 devices including the ready-to-drive, throttle-to-CAN, and other sensor functionality. Within this project, we are beginning to validate these tasks to make sure that everything is behaving as expected.

Outreach

April has been a month of painting for Outreach! With more and more parts of the car being manufactured, we've been able to get a go at starting on painting the livery. See the photo below of a painted airfoil to see the shade of pink we decided to go with! As mentioned by Nate, we will be doing an unveiling of the car on our social media sometime during the week of May 7th so keep your eyes peeled! Additionally, project managers and subsystem highlights are still ongoing - we hope it's been nice to be able to put some of the awesome work being done to our members' faces. We are also hoping to highlight our amazing graduating seniors through a senior video being released soon and having our seniors take graduation pictures alongside the car.

Alongside the Finance subsystem, the business presentation has been coming along nicely. Our members have been practicing for the event on May 11th and are growing more confident! Also make sure to follow and keep updated with all of our social media, including Facebook, Instagram, and TikTok, where all of the usernames can be found on page 9.
Suspension

Just as in March, April was another month of manufacturing. We have made huge strides towards finishing all of our parts. The big parts that were completed include: the rear carbon links and the first operation of the rear uprights. The carbon links were a fun part to make because it required the use of aerospace methods to epoxy the aluminum inserts into the tubes. We also finished the rear clevises and the front anti-roll bar mounts. We are looking to continue this momentum into May. The uprights will need to be flipped to machine the second operation. The rear anti-roll bar blade also needs to be machined and we need to drill all of the mounting holes in the chassis. Other than that, we are right on track to make the deadline for the Ford wind tunnel test.
Sponsorships

Thank you to our sponsors for the year thus far:

- Altair, Altium, BEST Center, Calspan Tire Research Facility, MasterCAM, Penn State Department of Mechanical Engineering, Penn State Engineering & Entrepreneurship Program, Penn State Engineering Undergraduate Program, Penn State Institute of Energy and the Environment, Rapid Harness, Rock West Composites, SimScale, Stackpole Engineering, The Piper Group, Uline, and VI-Grade

We are looking forward to your continued support.

Acknowledgements

We would like to take the time to acknowledge the following groups:

- The FAME Lab at Penn State
- The Happy Valley Adventure Bureau
- The Learning Factory

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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