October 2023

This month our subsystems were chugging along with their design work and some have even started preliminary prototyping and manufacturing! We’re super proud of the efforts put in by our members. We also had a few fun events throughout the month. Read more to see how we pushed through the spookiest month of the year!
Hello Nittany Motorsports Family and Friends,

The spookiest month of the year brought an exciting wave of activities to Nittany Motorsports. We started off October with the much-anticipated Penn State Homecoming parade, marking our second consecutive year participating. It gave us the wonderful opportunity to showcase our car to the university community and share our passion. Furthermore, we engaged in our second stadium cleanup after the Indiana-Penn State game, emphasizing the importance of such events in securing the essential funds required for our team's operations.

This month heralds the commencement of Nittany Motorsport's shop relocation. The Penn State Learning Factory has transitioned to a new facility, while engineering clubs from various corners of the campus are set to occupy the previous location. Nittany Motorsports has called the basement of Sackett building home for an extended period, and this transition promises a wealth of opportunities for the team. We've already formulated preliminary plans for the move and are optimistic about the prospect of being fully operational in our new shop by the midpoint of the upcoming semester.

We've made our way into November with an exciting new fundraiser that centered around the Michigan-Penn State game. Our members sold football squares to friends, family, etc. which gave the buyers a chance to win up to $250 at halftime or at the end of the game. We are continuing our creative push for fundraising, and your ongoing support for Nittany Motorsports is greatly valued, and we genuinely appreciate it.

With Sincere Gratitude,
Joel VanSkiver
Nittany Motorsports Team Captain
Events

STADIUM CLEAN UP #2
We attended a second stadium clean-up after the Indiana-PSU game. We were graciously added to the roster when another club canceled last minute. We had about 45 people come to clean and it was a valiant effort. Thank you to all of the dedicated members who set aside some sleep and their Sunday mornings to help get some revenue for the team!

TENNECO FACILITY VISIT
Tenneco graciously hosted some of our members at their Systems Protection facility in Exton, PA this month. Our Finance Lead, HVE Lead, and two Electronics members represented Nittany Motorsports and had a blast. We are thrilled to have Tenneco as one of our sponsors this year and look forward to continuing our relationship with them. Thank you Tenneco for a wonderful experience!

FORD INFO SESSION
Representatives from Ford’s Sunrise Produce Development Team held a virtual info session with our members! We learned a great deal about what the Sunrise team has to offer and how our experience on NMS relates to positions at Ford. Thank you to the Sunrise team for speaking with us!

HOMECOMING PARADE
For the second consecutive year, we walked in the PSU Homecoming Parade! We had members from various subsystems walk with the car and pass out candy and HotWheels cars to spectators. We enjoyed showing our school the passion we have for our car! Thank you PSU Homecoming for having us again this year.
Aerodynamics

October for Aero saw significant progress: The front wing design phase is complete, and manufacturing is now in progress. Front wing structures are in the prototyping phase, taking us closer to a complete design. The rear wing design is moving into its final phase after parameter sweeps are being finished up, while manufacturing performed epoxy ratio testing and endcap strength validation. Our testing group is analyzing track day data to validate performance targets and lap time simulations. Going into November, we hope to have the front wing finished by the end of the month, as well as the rear wing completed and ready for manufacturing. Our last few track days are coming up, so the testing group will be working hard to gather as much data as possible to use over the winter months. The front wing mounting design should be finalized next month as well, with more progress being made on rear wing structures.

Chassis

Chassis has been all about new things this month! We started getting into designs in most of the groups. The Roll Hoop project has started working on design matrices as well as sketches for the main roll hoop. Nosecone has started working on sketches, CFD with Aero, and is looking into ideas to make the connection more aerodynamic. Manufacturing is working with the new fiberglass and pitch carbon fiber to learn about the properties by creating tensile test panels. These will be cut soon and tested at ARL to figure out exactly what the properties look like. Firewall has been busy looking at rules, materials, and creating sketch ideas. With the new ergo jig data from CBS we are now looking at the pros and cons between a sheet firewall versus a double angle that would use the data gained from the ergo jig.

New to Chassis is the Weekly Chassis Newsletter which will start soon. The goal of the newsletter is to allow the team to know exactly what is happening with the design process of the chassis. It will include information about both major and minor chassis updates as well as updates from the rest of the team. The goal is to try to get a majority of questions answered in one easily accessible way. This newsletter will also include an opportunity for the team to ask questions and submit edit ideas for the chassis so that all the information can be consolidated easily. Next month we hope to have the chassis design finalized (we are almost done with v6). We also hope to start thinking about manufacturing most of our projects and looking at which designs are starting to stand out as being the best.
October may be spooky season for some, but for CBS it is business as usual! Our Steering and Dash team designed and built an ergo jig to assist our friends at Chassis with some design parameters. One member donated a bunch of old wood he had at his house and through creative design work, covered 90% of the project! A week was spent on crafting the design and how we wanted to make it customizable for NMS members to give Chassis useful feedback. The new Learning Factory space just opened the wood shop to students, so the team was hard at work sizing down the wood and built it later in the week.

Our Pedal Tray team is closing in on a final design and cross-checking it with FEA validation. We will soon be transitioning to early prototyping and manufacturing. The Steering and Dash team are now transitioning back to steering column design work as well as continuing the steering wheel design.

Our Spindles Brakes and Rotors team has been continuing research into thermal studies and other necessary vehicle dynamic factors. They have spent lots of time finding parts that we need to succeed as a subsystem this season. We are hoping to transition to some design work for the 2025 car when the manufacturing of new components on this project group are more feasible due to budget limitations.

Drivetrain

Drivetrain has been working hard in design and testing during the month of October. The cooling team has been able to get a functioning code that calculates all necessary variables to predict the needed size of the radiator. This is an extremely important and difficult step to ensure that the drivetrain is operating at the ideal temperature. Additionally, aerodynamics has been working to interface the radiators into the design of the aero package. In terms of the constant velocity joints, the team has found that tripod bearings will work best. The adjustable differential cap and mount is ready for initial prints. This is an important deadline, as once the drivetrain comes out of the 2023 car, we can begin to test fit the designs. The motor mount is also in a similar phase of design. FEA is being run to ensure proper material choice, as well as a proper factor of safety. Thank you to everyone on drivetrain who has been working to interface this year’s design with the rest of the car!
Finance

Finance has continued to work hard throughout the month of October to make sure everything financially related to the running of a race team has gone as smoothly as possible. We have been hard at work reconnecting with past sponsors, connecting with current sponsors, and reaching out to possible new sponsors. The team has also been working with all of the new members in the team to make sure everyone is up to date on the resources within the team that have to do with the finance subsystem. One highlight this month for the Finance subsystem was that we were able to visit Tenneco at their facility in Exton, PA to learn more about how our relationship can be mutually beneficial to both sides. We are extremely grateful to have sponsors like this supporting the team in our endeavors. The finance subsystem also participated in another Beaver Stadium cleanup event to help fund this year's competition racecar. Finance looks forward to continuing to work with all of the team's sponsors in the upcoming months and a strong finish to the fall semester.

High Voltage Electronics

High Voltage Electronics this month is moving into manufacturing. We largely solidified designs across the board and have begun to order components. Our budget is strained as always, and we are prioritizing what we can order now. In the very near future, we will be ordering all the metal for the new accumulator, and we have ordered the components for constructing our low voltage battery system. This will serve as a strong early venture into BMS design and fuse sizing.

The wiring harness team has gotten wire from our sponsor Remington Industries and will be receiving cable protection from the team over at Tenneco’s Systems Protection group. The team has begun to lay out the first version of the physical harness on a poster board and we will be able to get good early learning for the car’s real harness. This is our biggest opportunity for improvement from last year and we are excited to have such good progress!

We are working on tuning our HV system to squeeze out the most power. We are comfortably able to run the car at a good speed and power but are currently working on software to be able to squeeze the last few tenths out. We had a very successful track day last weekend where mostly electronics team members came, and we were able to get some slow, meticulous test-n-tune done. The team is excited to test for the next few weeks and push the limits on power!
Low Voltage Electronics

This month in Low Voltage, the focus is on the Mega-Boards getting finished up and being ready to order. These two boards will be the brain of the vehicle, handling tasks such as data acquisition, input control, and safety monitoring. When these boards are manufactured and shipped to the shop, we will start testing and validating all of the features on each of the boards. Sensor integration has finalized their list of sensors that will be on the 2024 vehicle and have continued to focus on the testing of the wheel speed sensors.

The launch control team switched focus for the time being in developing a Hardware-in-the-Loop (HIL) testbench that will be able validate the electrical signals and behavior of our PCBA's and harness. This is being done using a Raspberry Pi that will be able to simulate various inputs and measure the output of our custom hardware. The harness team has began to physically lay out all of the wires for the harness and will began to add connectors to the harness in the coming weeks.

Software team has been continuing to developing software tasks in their real-time operating system (RTOS) and is planning to test their code on the boards when they arrive. The wireless communication team has successfully uploaded code to the microcontroller wirelessly and is not beginning to focus on data acquisition.

Outreach

Outreach has had a great spooky month! We've hosted a few team socials with great turnout, especially at our Mario Kart tournament! Additionally, we participated in the Homecoming parade again this year and had a blast! We're very thankful for our members and their creativity towards bonding and improving team culture. We are getting ready to launch our merchandise for the fall semester in November! We will be offering a public shirt for ANYONE to purchase with proceeds going to our team. We appreciate all of your help and support throughout this semester, and we couldn't do what we do without you!
Suspension

Suspension has been making excellent progress with all of our deliverables in October! We started the month strong by starting manufacturing in the FAME Lab. Elijah and Alex were able to machine the first set of the roll shock adapter test pieces that will be tensile tested to determine failure modes. This testing will allow us to select the correct materials for the roll heave setup we will install on the new car. They have also taken the lead on interfacing with Mastercam and were able to secure licenses for the software, which the team is very excited to use. In a similar vein, material selection for the various components of the suspension package is underway as we start some of our design iteration process for critical parts.

We have the steering rack modeled and are working with CBS to finalize the location of the steering column and interface. We also identified the spline connection between the rack and column and are coordinating with CBS on final assembly. The steering column mounts have been modeled to account for the front chassis geometry and have also been added to the preliminary suspension package CAD. Moving on to testing, we had the opportunity to preliminarily test the torsional stiffness of the PSR23 chassis. While the data we collected was decent, we are aiming for another round of testing once the car has been dismantled to account for the other components still attached.

On the validation side, Deva is working on MATLAB scripts to validate steering forces experienced under dynamic conditions to determine the performance metrics of the steering system. This is in addition to the validation of tyre sizing as the team transitions to a lower profile tyre with the 16.5" Hoosiers. We are also performing stiffness and thickness calculations for the control arms with Kaelea taking the lead on the project, while Ethan has started to work on the kinematic analysis with an updated points file for the chassis models. Overall, we are on track to meet our semester and yearly goals and are excited to continue with the progress we have made so far!

Systems Integration

The systems meetings have continued. We have nearly made it through all the subsystems and had more collaboration meetings in between. The development of the car has been steady except a few typical difficulties. The design of the chassis may be changing due to budget and order restrictions, but it is nothing the team can't handle. For the following month, my goal is to get the subsystems to organize their departments to start the move to the new shop space. CBS, Suspension, and Drivetrain are the first three subsystems moving to the new space. Along with the move, another series of systems meetings will be planned to continue the collaboration efforts for the team.
Sponsorships

Thank you to our sponsors for the year thus far:
- Altair, Altium, BEST Center, Calspan Tire Research Facility, Hyper Racing, 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, Remington Industries, Rock West Composites, SimScale, Stackpole Engineering, The Piper Group, Uline, Tenneco, and VI-Grade
We are looking forward to your continued support!

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- The FAME Lab Staff
- The Larson Transportation Institute
- Stadium Clean-Up Staff and Coordinators
- PSU Homecoming
And thank you to all others who have provided us with constant support throughout our switch to electric! We are looking forward to a great year of car development!

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