November 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 November and toward the end of the first semester!
Dear Friends of Nittany Motorsports,

I hope this message finds you well. November was a busy month for our team, we participated in our third and final stadium cleanup of the fall semester in Michigan. These cleanup events were instrumental in bolstering our team's fundraising efforts, contributing significantly to our overall financial goals. Additionally, we proudly took part in our inaugural Giving Tuesday event, where a single donation campaign resulted in nearly 10% of our annual budget being successfully raised.

As we approach the conclusion of the fall semester, our team is intelligently winding down subsystem activities to allow our dedicated members ample time for final exams and academic commitments. Despite this temporary shift in focus, we are immensely thankful for the progress we've made thus far. The recent decision to revert to a steel tube chassis sparked a paradigm shift in the designs of several project groups, yet our collective progress remains nothing short of extraordinary.

With the upcoming graduation of our Suspension Lead, Robbie Bahnsen, in just a few weeks, we recently conducted an election during our final Full Team Meeting to determine his successor. We're pleased to announce that Elijah Gruver has been elected by the team to take on the leadership role within our Suspension Subsystem for the remainder of the year.

We extend our heartfelt gratitude for your unwavering support. Your encouragement and contributions have been instrumental in propelling us forward.

Thank you for being an integral part of our journey.

Best Regards,
Joel VanSkiver Team Captain
Events

TRACK DAY
We concluded our fall testing with two track days. We were able to run multiple acceleration and autocross stints and completed brake tests. Additionally, we successfully completed one full endurance run with charge left in the battery at the end. This is monumental for the 2023 car testing and data for our 2024 car. Huge thank you to everyone who helped out on these track days and promoted a safe testing environment for our team.

SHOP MOVE-OUT
We will be moving from our Sackett Building workshop to the old Learning Factory shop by May 2024 to combine workspaces with other engineering clubs. In order to get ahead of the move-out, our mechanical subsystems moved their belongings to the new workspace. Thank you to all of the members who helped organize and transport items between the workshops! We are looking forward to the new workspace, but will greatly miss our current workshop.

STADIUM CLEAN UP 3
We participated in another stadium clean up after the Michigan football game. Our team got the student section this time, which returns more profit for our car development! We're super thankful to the stadium clean up team for having us, and to the dedicated members who came out.

MASTERCAM SESSIONS
The manufacturing project managers in suspension put on Mastercam instructional sessions to educate members on how to use Mastercam to create CNC toolpaths. They went over the basics and more advanced topics in order to best utilize the new hybrid machines in the Learning Factory, and manufacture better parts.
Aerodynamics

Great progress was made last month: 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 finalized hot wire calibration and foam core cutting for ~2/3 of the front wing. Our testing group is analyzing the final track day data to validate performance targets and lap time simulations. Finishing the semester, we hope to have the front wing ready for assembly by the end of the schoolyear, as well as the rear wing completed and ready for manufacturing. The testing group will be working hard to finish up analyzing track day data and start to make improvements to the lap time model. The front wing mounting design should be finalized as well, with more progress being made on rear wing structures.

Chassis

Chassis has had an eventful November as the previous goal of manufacturing a monocoque has been changed to building a tube frame. This is to help ensure that the chassis can be completed on time as well as help with material costs. We have been busy looking to find materials for the new tube frame as well as completely redesigning it. This change has had a profound impact on some of the project groups as the roll hoops are now structurally integrated into the tube frame and the nose cone will blend more into an aero cover to help with the aerodynamics of the car. There has been a lot of work throughout the team to ensure this redesign goes smoothly and this has been accomplished by continuing the Chassis Newsletter as well as implementing new methods to request chassis redesigns. We are getting close to working full tilt on the SES and many of the members are excited to learn more about the chassis through this process. We wish all of our members luck with finals coming up and happy holidays.
November saw new changes for the team and the direction of manufacturing the chassis. The switch away from a monocoque and to steel tube was a surprise, but CBS is ready to move ahead with this new design! We are modifying our pedal tray and the mounting of the tray. The change to steel tube actually helped the team introduce a modular tray! We are excited to adapt the tray and improve the team’s ability to support varying heights of several drivers. The steering and dash team will have to modify the way the column mounts to the chassis, but we are confident that we will see improvements in doing so with the change to the chassis. Lastly, the Spindles, Brakes, and Rotors are unaffected by the change so they can continue their work in thermal studies and research of materials.

We are thankful for our members, sponsors, and faculty to support our efforts and ability to build and compete with a race car each year!!!

Drivetrain

Drivetrain has been hard at work designing the motor and differential mounts. With the recent switch of the chassis from a monocoque to a steel tube frame, many of the designs had to be reworked from the ground up. While this is a minor setback, we are excited to get creative. Being that we have never mounted the EV drivetrain in a tube frame chassis this far, the design concepts are completely new. While the chassis design may have just changed, we are happy to report that we are much farther in the design phase than we expected to be! Shoutout to all of the hard work that every single drivetrain member has been putting into these new designs!
**Finance**

Finance has continued to work hard throughout November 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 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 from the month is that the team participated in the last stadium cleanup fundraiser of the fall semester. The team also participated in the Penn State 2023 Giving Tuesday campaign where we raised additional funds for this year’s racecar. Finance looks forward to finishing out this fall semester strong and looks forward to the new year when we will start working on additional fundraising as well as some competition-related activities.

**High Voltage Electronics**

This month, HVE activities slowed down as we finalized designs and prepared to go into full manufacturing in January when we return to school. We have been in the welding booth at the EDI building a lot and are practicing Aluminum TIG for when we weld up our battery box.

We have also been working on PCB housing as the LV team tests their first round of PCBs. We will use 3d printed boxes with gasket seal to keep them waterproof. Our goal with the housings and wiring harness is to lay out the vehicle wiring once we have working PCBs. Over break, we will order a lot of components and harness materials (pending founding approval) so we can do full manufacturing in the spring. We are in a good spot as a whole and should be good to go as long as we have a chassis in time. Additionally, we manufactured a smaller LV battery which will save us weight and space in the car.

The accumulator team has finalized designs for the battery redesign and are working on an installation system to drastically reduce the time it takes us to mount the battery in the car. This will help a lot at competition as we have to take it in and out many times.
Low Voltage Electronics

This month in Low Voltage Electronics has been an eventful one! Both primary front and rear PCBs have been finalized, ordered, and manufactured. The team recently was able to power up and program the rear PCB and the plan is to continue testing throughout the next week. With all the components for the PCBs arriving recently, the wiring harness team has continued their work on the physical harness. Their plan is to begin attaching connectors to the harness that they have laid out so far. The sensor team will also be moving forward in validating the sensors on the PCBs that just came in, making sure that they are able to interface with the devices to acquire real-world data.

On the software side of things, the wireless upload team has been building up the support for wireless data acquisition from the car, which will allow us to view diagnostics from the car in real time. The firmware team has continued to develop features to support the new PCBs and plans to test the latest version of their code on the STM in the coming weeks.

Finally, our team working on our Hardware-in-the-Loop (HIL) testbench has continued to improve their testing setup for the PCBs that have just arrived. With this, the PCBs will be subject to simulation scenarios such as being connected to other devices on the vehicle without requiring all the components of a full electric car.

Outreach

November was the month of merchandise for our team! Our hard work on merch designs finally paid off as the order finally went out. Members were able to choose from a selection of shirts, a flag, hats, hoodies, and stickers with our new logo on them. We are very proud of all of the members who assisted with putting merchandise together, and we’re even more excited for it to come in. We even offered a public shirt via our Instagram which was a first for our team. We are very thankful for those who supported us through that. Lastly, we participated in Giving Tuesday this year and raised $2,000! Thank you to those who supported us- we can’t do what we do without you! Outreach is wrapping up the semester with a study session instead of a meeting, and we wish all of our members, friends, family, and supporters happy holidays!
Down in Suspension, things have been progressing steadily in the month of November. Obviously, our vehicle's design went through a major change, and that has affected our workflow and induced inter-subsystem discrepancies that we are in the process of fixing. What does that mean for our projects? Nothing major. Instead of designing the suspension and vehicle dynamics around the monocoque chassis, we are now instead defining the critical points needed for optimal performance that the chassis will use to design the tube frame. We have therefore assigned more focus on the underlying kinematics of our vehicle to make the full design process as quick as possible without sacrificing quality. Deva and Ethan are working to finish this kinematics package by the end of the semester, which will be critical to the design of the suspension points file.

Because the shift to a steel-tube frame means that all mounting positions have to be reworked, it brings a considerable challenge to decide which designs will carry over to the new chassis and which ones will be discarded. After a lengthy decision process involving various subsystems, we have elected to continue the incorporation of the roll/heave decoupled system. Having a steel tube frame gives us a lot more area to work around it, and also has the benefit of making our mounts easy to package. This decision means that we don't need completely rethink our fundamental designs, but just to adapt and work with changing constraints - an area that Nittany Motorsports has a long history of navigating.

On a personal note, we are sad to announce that Robby Bahnsen, our lead since June will be graduating and will depart the team at the end of the semester. Robby has been a crucial part of not just Suspension, but also the entire team over his three years of involvement and we will dearly miss him and his insight. Under the guidance of our newly elected head of suspension, Elijah Gruver, we will continue our hard work and progress we have achieved this semester.

The new year will bring newer challenges, and we are excited to do our best!

This month was a slow month for systems. A series of smaller meetings were held to determine designs for all the subsystems. A full team design review is in the works for early next semester. The creation of a systems skeleton crew has also been in the works this month to allow for a greater connection between the systems integration lead and the subsystems. The plan for the skeleton crew is to allow a member of each subsystem to be dedicated to communication with myself and the other subsystems. This will hopefully create a more cohesive team and broader communication. A lot of work is planned for rapid completion through the beginning of next semester.
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!

Acknowledgments

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

- The Learning Factory Staff
- 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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