Winter Recap 2023-24

Over the past two months, our subsystems have been working hard with their design work and are close to finalizing the full car CAD. Prototyping and manufacturing have started to pick up as we enter the key manufacturing season! 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 December and January to end the first semester and start the second!
Dear Nittany Motorsports Supporters,

We are in on our final approach towards competition. With a majority of our designs locked in and manufacturing underway, we are very excited to reveal PSR24 to all of you.

We invited all Penn State students to come to check out the club at our Spring 2024 New Member Meeting. This meeting is a quick introduction to what Nittany Motorsports is all about. We have quite a few students stop in. Many of these members came to our first Full Team Meeting of the semester a few days later. We are hoping they stick around!

We appreciate all of your support this season. With the ups and downs of building a race car, everyone has stuck with us. We could not do what we love without our sponsors, members, and university supporters. Thank you!

With Great Appreciation,
Joel VanSkiver,
Nittany Motorsports Captain
**Events**

**SPRING INVOLMENT FAIR**
This spring we got right to work on recruitment participating in the Penn State Spring Involvement Fair. We had representatives from almost every subsystem to talk to prospective members! We are looking forward to integrating the new members into our team.

**CHASSIS V. WORLD**
Coming into the new semester we had a Chassis V. World meeting where the team worked hard to finalize the design of the chassis making sure all the components would fit and do so in a rules-abiding manor. This catapulted the team closer to finalizing the CAD for the car and beginning the manufacturing season.

**CLIMB NITTANY SOCIAL**
We hosted our first team social of the semester at Climb Nittany. We had a fantastic turnout with members from almost every subsystem and different levels of climbing skills. Thanks to Climb Nittany for hosting their college day and making bouldering accessible to students!

**COMMUNICATIONS INVOLVEMENT FAIR**
We also participated in the College of Communications Involvement fair where we primarily focused on recruiting for our Outreach and Finance subsystems. Thank you to the Bellisario College of Communications for having us once again!
Aerodynamics

The rear wing's design is finalized and is ready for manufacturing which will begin this week. The front wing’s elements have all been manufactured and are awaiting assembly and final touches. Coast down data has been processed from track day and we have begun brainstorming ideas on how to extract downforce data. Front and rear wing structures have been finalized and we are in the process of developing manufacturing plans for them. Over the next month, the front wing will be assembled, with the rear wing manufactured and ready for assembly. The undertray will also be designed and finalized, ready for manufacturing.

Chassis

Snowy season is upon us and chassis is finishing up designs in anticipation of manufacturing. Since we recently switched to a tube frame design the designs of the chassis are constantly being updated to fill the needs of every subsystem. We are confident that the design will be finished this month and that we can then move on to focusing on the rest of our sub-teams and manufacturing. With the design period coming close to the end we are performing lots of FEA on our chassis designs to learn where the weak points are and how we can adjust around them. One of our main goals is trying to find a better way to manufacture and attach body panels to the tube frame. We have had lots of trial and error including zip ties and duct tape, but we have settled on using quick disconnects for areas of the car that we want to have access to. Body panel manufacturing is going well as we are trying to make test panels to attempt layups on an old titanium tube frame. Nose cone designs are also in full swing as we are working with the Aerodynamics team to decide which nose cones have the best setup for the car. The firewall is also going well as we have settled on manufacturing a double-angle firewall to better validate the results of the ergo jig that CBS built last semester. Current goals for many of our sub-teams include focusing on the manufacturing side as well as trying to find cost-effective materials.
Controls, Brakes, and Safety

CBS has been focused on finalizing the redesign of several projects to fit the new steel tube chassis. Most of what we have designed transfers over to the new style of chassis, but mounting our designs had to be overhauled. The Pedal Tray will have tabs to mount to, and we are hoping this change will allow an easier solution for making the pedal tray modular. We have a 3D-printed prototype as we finalize structural rigidity. The Steering Column had undergone some changes with new u-joints in an attempt to shorten the car’s wheelbase. The mount that will hold the column is subject to change, depending on what our friends in Chassis do with the front roll hoop. We are close to finalizing a rotor design that helps remove excess weight, we have been testing different designs in SolidWorks. Lastly, we are very close to starting manufacturing. The team has been starting documentation for step-by-step procedures to make manufacturing more efficient than in years past.

Drivetrain

Drivetrain has been working hard over winter break. Dade George, with the help of the cooling team, had finalized the radiator sizing and got the components on order (that have now arrived). This sets us up nicely to begin the testing phase for the cooling system, in hopes that we get the ever-so-important validation needed for the competition design review. This testing will be a collaboration with the Aero team to ensure that the placement provides ample airflow to the radiator. In the mounting department, Jonathan Quarrick and the motor mounting team, have made good strides in finalizing the motor mount design. The design will be finished shortly after the chassis design is complete. Nick Karpowicz and the CV joint team has done a great job in identifying if we can use the components that were previously installed to keep costs to a minimum. They will be doing physical testing to determine the angle of contact in the coming weeks. Finally, Zach Mosier was able to manufacture all 3 of the differential caps over break. This is a massive step in improving the vehicle dynamics of the 2024 EV.
Finance

Finance has continued to work hard throughout December and January 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. Finance looks forward to having a strong start to the spring semester!

High Voltage Electronics

This month, HVE activities slowed down as we finalized designs and prepared to go into full manufacturing in January when we returned 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 seals 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 funding 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 is 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 week in the Low Voltage Electronics subsystem, we are finishing up testing and integrating the first round of the two circuit boards that will be going on to the car. Throughout the testing process, we have found a few changes that will have to be made to the design for the next revision of the boards. No major changes will be made besides the addition of a step-down converter to better support the power distribution on the board.

On the software side of the projects, the wireless software updating feature for the car is continuing to be refined and is the next feature to be tested directly on board. The members of that project are now working on passing data analytics about the car wirelessly between our on-board microcontrollers and the website that we will be able to connect to via computer. The firmware team has continued to bring up the functionality of our CAN bus and communication with other sensors that will be used for the car's controls and data acquisition. These features are working to be validated by our testing team. They are designing a testing bench specifically for the car's software and other firmware features.

One final note is that the wiring harness team has begun to lay out their first harness and determine characteristics such as position and length of the wiring for estimated proper fitment. This will be finalized when the dimensions of the chassis are locked in place and can be used for final reference.

Outreach

The end of the fall semester and the beginning of this semester has been a pretty seamless transition for Outreach. We ended our semester with the conclusion of the merch order and the items shipped to State College in early January. We handed out the merchandise to members and non-members and have received nothing but compliments on the designs! We will be selling merch again this semester, so if you are interested in purchasing some to support the team, look out on Instagram for more information in February. Additionally, we planned our first team social for the semester and had members attend Climb Nittany for their student day. We had a great turnout with plenty of members from multiple subsystems showing their bouldering skills! We would like to have this event every month, and we really appreciate everyone who came out. Moving into February we have started planning our annual Diversity, Equity, Inclusion, and Belonging (DEIB) Workshop! One of our members, Alexa Jordan, is a master's student in HR and is leading the creation and implementation of this workshop. Stay tuned for next month's edition of the newsletter to see how that workshop pans out and for more information on our spring merchandise sale!
Suspension

Winter break has been a time for productivity for the suspension subsystem. After some in-depth inter-systems meetings as well as a Systems Meeting with the technical leads, we have finally finished our car’s Points file, which dictates the critical assembly mounting points in line with our vehicle dynamics goals. We also were able to fully define our vehicle wheelbase and component packaging. These updates are excellent news as they allow the entire team to finalize their designs and begin manufacturing as soon as possible. In the interim wait during the points file’s creation, we’ve been busy continuing to model various parts. The ball-joint holder and control arm assembly are our current priorities as we expect manufacturing to take up a significant time this semester. We are also working with CBS on the steering rack mount as well as chassis. We have also been working hard at simulating various kinematics and dynamics of our car. Our steering force validation script has yielded good results that we will be able to base our control arm designs on, as well as a preliminary Simulink model of the car, which will evolve into a fully customizable lap-time simulator. In manufacturing updates, we are in the process of ordering stock materials for our final models. Because of the time crunch, we are fully focusing on clocking in as much time in the Learning Factory as possible. Purchasing is the name of the game for us at this moment as we are working with Hoosier Tires to purchase our tire sets for the season and our industry partners to secure materials that will enable us to finish our build. Overall, it’s been a few very productive weeks and we can’t wait to make some more progress!

Systems Integration

Over the course of the last few months, the team has been hard at work moving toward getting a working car. From a systems integration standpoint, we are close to freezing all designs and ramping up manufacturing. We had one of our final full team CAD meetings to get the difficulties of the layout of the car ironed out. The following few weeks should consist of more specific and subsystem-focused design reviews and communication about spacing conflicts. As systems lead, I have also created a new group to help facilitate conversations from meetings that I am not able to attend. This group is known as the Systems Hardware Integration Team and it consists of a member from each subsystem that gives updates regarding designs, conflicts, manufacturing, and other various decisions. This is extremely helpful because I get a weekly summary of the subsystem meetings I am not able to attend. I can then take that summary and schedule meetings or facilitate conversations about various topics with a better plan on how to tackle problems. Over the next month, the team should have all designs finalized as well as a large chunk of manufacturing completed. I will be hosting design reviews, systems meetings, and team meetings to ensure NMS builds the best car we are capable of building.
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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