

# PENN STATE RACING

NOVEMBER

2018



# TEAM NEWSLETTER



# A MESSAGE FROM THE TEAM

Dear Reader,

Snow and cold weather came early this year to State College, unfortunately bringing our track testing sessions to a close for the remainder of the year. Fortunately, our mock pit and driver simulator have been built and will be finalized over the next month, so driver training doesn't have to come to the same screeching halt that testing weather endured.

We have assembled the test panels for monocoque panel testing, and intend on laying up the carbon fiber for the monocoque as soon as the panel testing results are in. We will most likely have the monocoque assembled before the rear sub-frame, which is the opposite of last year.

The team has continued to finalize designs and made decisions regarding multiple parts on the car, including items such as the steering rack and tires. We have begun assembling our design binders and are starting to get our heads into the competition mode.

We are chugging right along as usual, finalizing and validating our ambitious designs. We are excited to see the large components of the 2019 car begin to be made and assembled. After Thanksgiving break, it's full steam ahead for carbon fiber layup.

*Thank you for your continued support!*

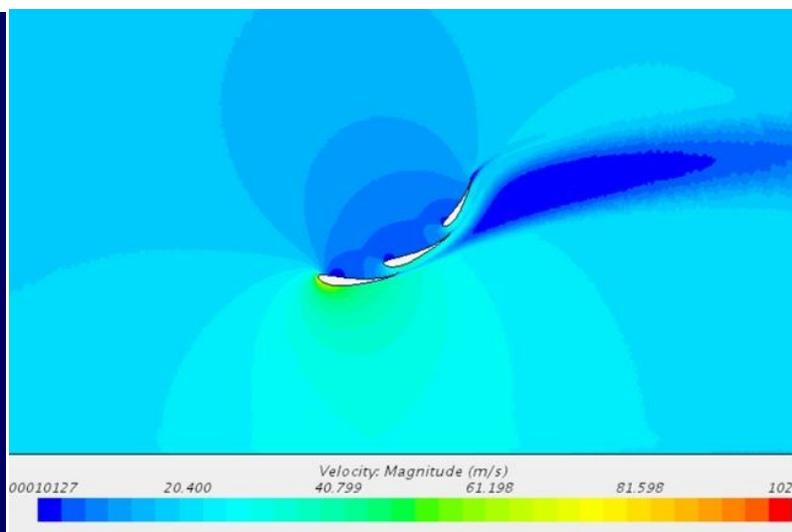
**PENN STATE RACING**

# AERODYNAMICS & COMPOSITES



This month, Aero successfully implemented a new front wing manufacturing method involving laying up carbon fiber around foam airfoil molds, while still using the vacuum bagging process to reduce the weight of the wing. We are awaiting the arrival of our rear wing foam molds and will use the same process to manufacture the rear wing within the next few weeks. The team finished designing our nosecone and nosecone mold, so we will CNC our mold once we get the go-ahead from the Penn State Digifab lab up at Stuckeman. We are so thankful for their help through our manufacturing process!

To manufacture the nosecone itself, we are looking forward to trying a resin-infusion process that will improve the surface finish of our carbon fiber parts. We are also almost finished with the design of our sidepods, which are effectively an inverted wing with a duct for the radiator inside the wing. We used CFD to demonstrate that this configuration produces an impressive amount of downforce and we are excited to implement this unique design. Once we finish our sidepod design process, we will manufacture our sidepod molds.

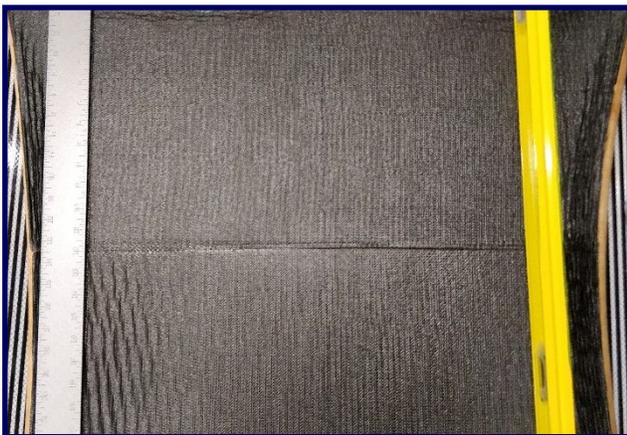


# CHASSIS



This month chassis received the carbon fiber materials they needed to make the panels required for testing. Penn State ARL allowed us to use their autoclave to properly cure the panels to their specification. The panels were laid up, then put into the autoclave, where they were heated and pressurized until they were cured. We hope to put the panels through the bend and shear tests soon so we can get the results and begin manufacturing the carbon fiber portion of the chassis.

We hope to have the rear subframe welded by Winter break. The tubes for the frame still need to be cut and profiled so that we can put them on our subframe jig and tack the tubes together in preparation for welding.



*Test Panels out of the autoclave*



*Carbon fiber work in Sackett*

# CONTROLS, BRAKES, & SAFETY



Over the past month, Controls, Brakes, and Safety has been working on finalizing the spindle design of the car, switching from center lug to 4 lug in hopes to increase reliability. In tandem with the spindle design, the updated brake rotor design has also been underway. We are planning on utilizing a floating rotor design and are working through material selection. The pedal tray has also begun re-designing with an improved brake pedal ratio and simplified throttle cable linkage to improve the drivers pedal feel. Aside from design, we have nearly finished our driving simulator in perfect timing for the cold weather.

Next month, we plan to finalize the corner design while collaborating with the suspension subsystem to design a 4-lug wheel center to fit with our new spindle design. In addition, once the driver simulator is completed, we plan on testing various driver's positions to determine which positions are most ergonomic as well as confirming that our new designs will pass the Percy test.

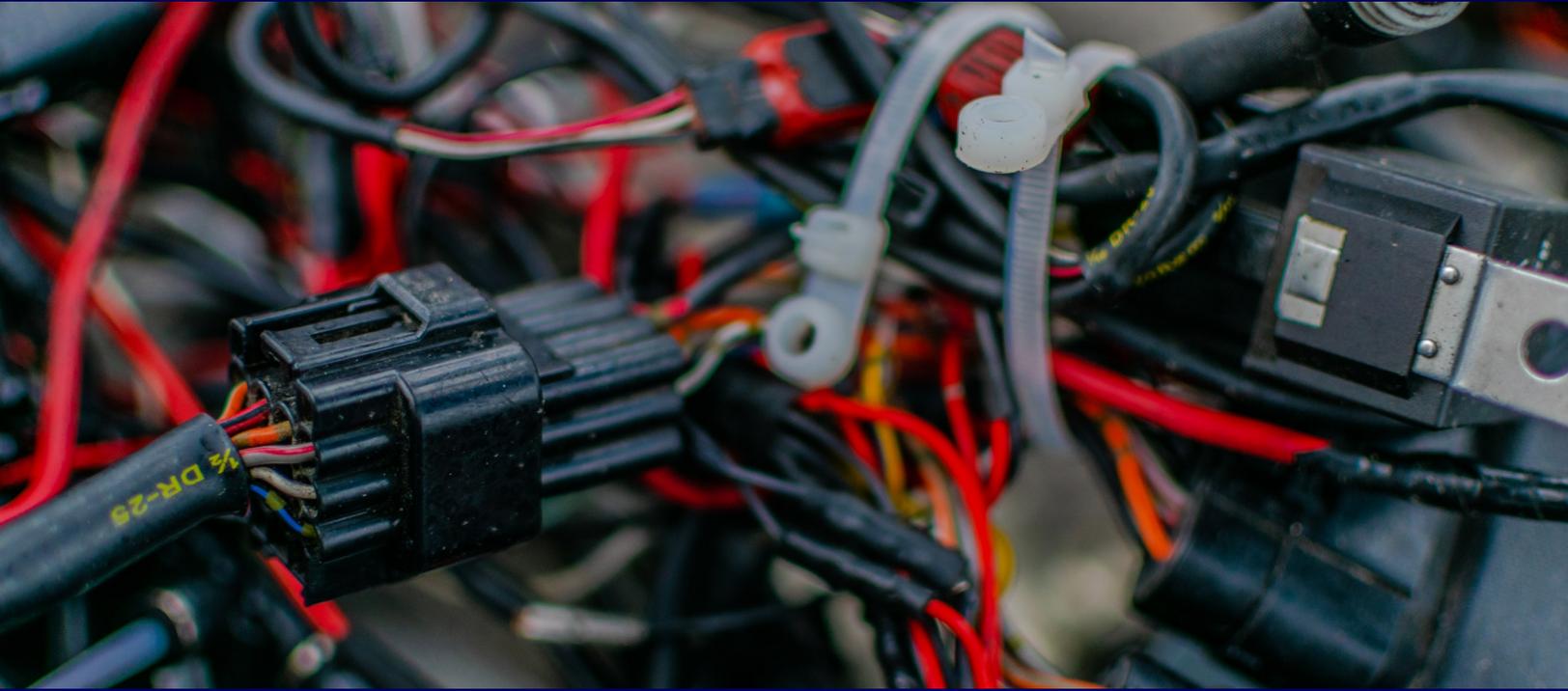


*2018 Car Dashboard*

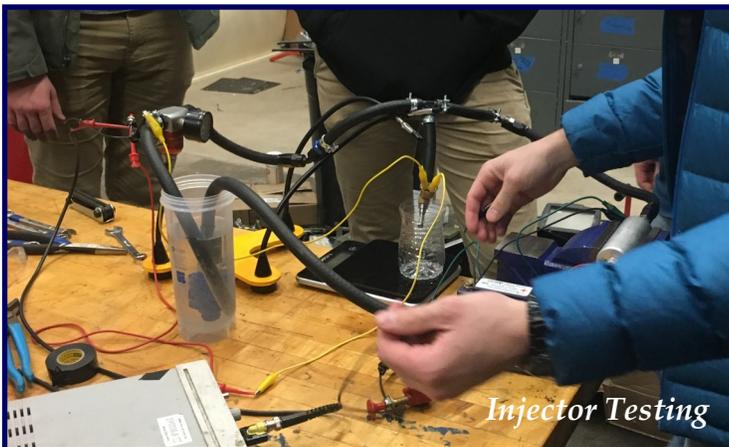


*2018 Car*

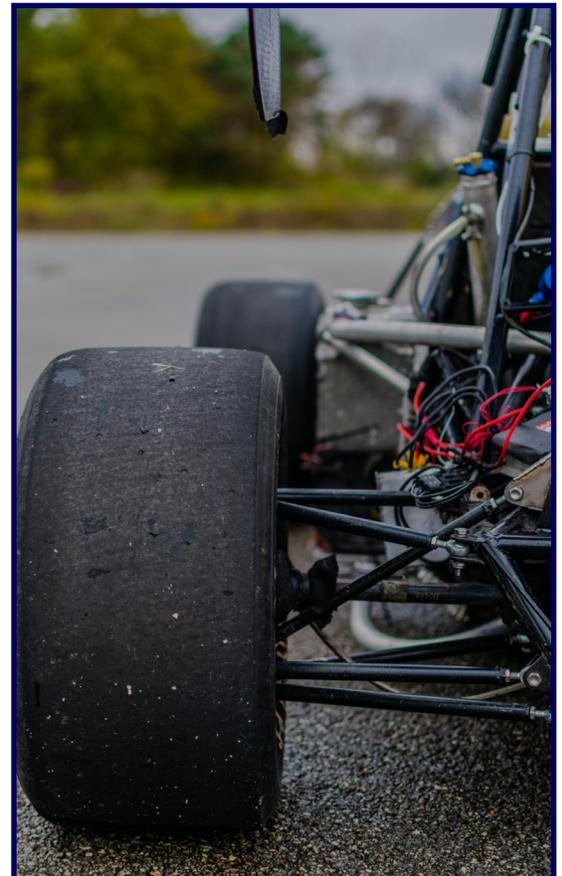
# POWERTRAIN



Powertrain subsystem is working hard to design for performance and reliability. Our differential bearing carriers have been optimized to be both lightweight and strong. Using SolidWorks simulations, we have stripped material in specific areas to reduce weight without losing the necessary strength we need. The drivetrain axles are being modified to deliver equal torque the wheels on either side. Since we use different length driveshaft axles, there is an unwanted torque bias towards one side of the car, causing a uneven power delivery from the tires to the ground. This issue will be resolved with torsional stiffness calculations and modification to the inner and outer diameter of the smaller shaft. Powertrain also spent time testing the injectors that we have chosen to run with water to check the flow rates.



*Injector Testing*



*Preparing to drive*

# SUSPENSION



This month in suspension, we went through more tire data to get a grasp on what kind of information we can pull from the tire testing consortium. We also updated our steering rack decision matrix so that we could make a more informed decision of which rack we will use on the 2019 car. The differential selection has also been completed, so we are excited to start the tuning process and make sure the car is as drivable as it can be from a suspension point of view. As we move forward, we are looking into new manufacturing methods for our bell-cranks and anti-roll bars, to help out our manufacturing team. We are about to begin on the manufacturing side of our suspension linkage, which is a new experience for the team since it will be our first time making a complete carbon fiber suspension.



*Steering Rack Selection*



*Carbon tubes*

# MANUFACTURING



Over the past month, half of manufacturing has been very busy getting new members into welding training as well as keeping up with the flow of making manual inserts, bushings, and tabs on the lathes and mills. Meanwhile over the past two weeks, the CAM for our new 2019 uprights has been completed in the rear, but is still in process for the fronts. The CNC machinists and programmers have been very busy almost every day making some of the more intricate parts such as the Mounting Clevises that connect the A-Arms to the Monocoque, as well as the Ball Joint Holders that connect the other ends of the A-Arms to the uprights. Both of which are made out of Titanium for added strength, as well as being a much lighter option than steel. For the upcoming month, manufacturing will continue practicing welding and the manual machinists will keep turning out parts! CNC machining will switch gears after finishing the Ball Joint Holders and start machining the Differential Carriers, as well as the uprights! Special Thanks to Austin Gordon, Joshua Wildonger, Hunter Sinay, My-Linh Budzien, and John Fedorek for their continuous help!



*Ball Joint Holders*



*Inserts*



# MEMBER OF THE MONTH

## JORDAN SMITH



Jordan is a freshman in mechanical engineering who has been contributing largely to powertrain. He joined the team right at the beginning of the semester, and has been highly involved ever since. His first design project was to redesign our fuel rail for our 2019 high compression engine. He began contributing to manufacturing as well, machining parts on our manual mills and lathes. He also travelled and spent the weekend with powertrain lead Shane Straley helping re-machine the cylinder head for the 2019 engine. Jordan has been a valuable member so far this year, and we look forward to his future contributions to the team!

**Congratulations, Jordan!**



# COMMUNITY OUTREACH

## YORK STEAM ACADEMY VISIT



On Friday, October 26th, the College of Engineering hosted a group of 45 students from a Title 1 STEAM Academy in the York area. We partnered with the COE Engineering Ambassadors and hosted the students in our workspace as part of their visit to Penn State. We showed the students our 2018 and 2017 cars as they asked questions about how components on our car work. We had a blast talking with these enthusiastic students about our work and sharing our passion for engineering with them!

# BRIDGESTONE

Your Journey, Our Passion



# THANK YOU!

In addition to our sponsors, we are thankful for the unending support of the following individuals:



**Dr. Thomas Juska**  
Applied Research Lab



**Admiral Paul Sullivan**  
Executive Director,  
Applied Research Lab



**Dr. Matthew Parkinson**  
Learning Factory Director



**Dr. Todd Palmer**  
Applied Research Lab



**Cindy Winkelblech**  
Program Administrator



**Dr. Gary Gray**  
FSAE Faculty Advisor



**Bill Genet**  
Learning Factory Supervisor



**Rob McAllister**  
Learning Factory Supervisor

We also thank all of the Penn State Formula SAE alumni that continue to provide us with invaluable guidance and assistance every year. Thank you!

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Penn State Formula SAE would like to express our most sincere gratitude for the generous university and corporate partners who made our project possible—it would be impossible without your continued support. Thank you for your support!

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