

# PENN STATE RACING

SEPTEMBER

2018



# TEAM NEWSLETTER



## A MESSAGE FROM THE TEAM

Dear Reader,

WE ARE back, and better than ever! As the fall semester begins, we are happy to be returning to what we do best: designing and building our race car. Over the summer, our team moved to a new workspace in the basement of the Sackett Building. We now have more room to expand and grow, inviting new members to come see our car and join our team all hours of the day. This has been invaluable to recruitment, as new members have many fun tasks to do such as organizing and organizing some more. In addition, we are rebuilding the 2017 car in order to increase amount of driver training we can do, and give new members some low-stakes hands-on opportunities to build a car.

As you may recall, last year our team made one of the largest design changes that the car has seen in a very long time. The carbon fiber monocoque design ended up being extremely successful, allowing our team to finish 34<sup>th</sup> out of the 114 teams that finished the competition. This year, we intend on improving the car by making it lighter, faster, and more reliable than last year, while also focusing on the management of the team, streamlining and minimizing many behind-the-scenes issues we often run into. In addition, being a validation year, we will have more time to focus on driver training and especially planning for design more than we have in many years.

Our team is excited to continue improving our previous design and every aspect of the car possible. With an updated rulebook, new shop location, new faculty advisor, and new additions to our team, we look forward to conquering the challenges that come our way. In this newsletter, you can expect to see the progress of each subsystem throughout the year. We are proud to continue representing our alumni, University, and sponsorship partners throughout the year, and most importantly, on and off the track at the Formula SAE competition in Michigan this upcoming May.

*Thank you for your continued support!*

# *PENN STATE RACING*

# AERODYNAMICS & COMPOSITES



Aerodynamics and composites worked alongside chassis last year to create the carbon fiber monocoque design. This was a design challenge, and we were able to overcome the difficulties and finish the competition with good placement out of the 114 finishing teams.

This year, lead Annie Orth is planning on making a more durable front wing because of previous damage to last year's front wing from the track. While we are planning on making the front wing stronger, we intend to keep its light-weight design. The rear wing will also be undergoing a design change, going from a two-element design from 2018 to an improved three-element design, which will allow us to produce much more downforce. We also selected a new airfoil for the wings based on analysis done over the summer.

Our side pods will also be undergoing a design change. We are completely redesigning the side pods to produce more downforce by combining the duct and middle wing from last year into one component to support the radiators. Additionally, based on CFD done this summer on various diffuser configurations, we will also be modifying our diffuser design. Finally, we will be redesigning all aero mounting to better support our aero components, given the amount of downforce we intend to make. We have already made significant design progress this year by using CFD to design the front wing, rear wing, and diffuser, and will soon be figuring out effective mounting configurations.



# CHASSIS



For the 2018 year, we determined that it was worth upgrading to a carbon fiber monocoque for our chassis, with a steel tube frame in the rear containing the engine. This allowed us to shed off almost 20 pounds, however making this drastic change was not without issues. At competition, we had an issue where we didn't fit the requirements for a 6 foot 5 person, making the monocoque a bit short, the sub-frame mounted a bit too close to the front, and redesigning our pedal tray without looking into the change in size of the monocoque vs the tube frame.

This year, lead David Hoffeditz hopes to make a higher quality chassis that meets performance targets that we originally wanted with last year's design. We have a years' experience with the monocoque manufacturing process now, and we are confident that we will be able to improve the car's stiffness and decrease weight while passing tech the first time.

Working alongside the control, brakes, and safety subsystem, we are hoping to improve driver comfort and improve the overall ergonomic design of the car. This year will be a year of improvement on the carbon fiber monocoque design. We will be conducting many more tests on the 2018 car to see what direction we want to go for designs, dimensions, and overall ergonomics of the 2019 car.



*2017 Car, repurposed for driver training*



*2018 car*

# CONTROL, BRAKES, & SAFETY



Controls, brakes, and safety is a new subsystem for the 2018-2019 year. This subsystem, led by Jason Gaydos, is focused on driver ergonomics and safety. Some of the subsystem's goals are to maintain a safe and comfortable driver position, improve packaging and serviceability of the car, reduce weight of braking system, produce ergonomic designs for driving position, steering wheel position, and gas & brake pedal position.

Gaydos highlighted the redesign projects that he will be collaborating with manufacturing, suspension, and powertrain to complete. The team is going to be switching to a four-lug hub design to eliminate the secondary locking mechanism and make changing the wheels faster and easier. They will also be redesigning the brake rotors to accommodate the four-lug hub and reduce the weight of the braking system. Another redesign project is the pedal tray, which was an ergonomic issue last year, with the pedals being too close to the driver and having poor pedal ratio. Redesigning the pedal tray will allow the 2019 car to accommodate taller drivers and change the mounting location of the master cylinders.



*2018 Car*



*Our New Workspace*

# POWERTRAIN



2019 is full of big plans and design changes. Headed by Michael Hand and Shane Straley, powertrain intends to make multiple changes that we couldn't make last year due to a shortage on time. We intend to switch from our previous pneumatic shifting system to an electronic system. There have been numerous issues with the shifting system in the past that kept our drivers from getting training to fully utilize the capabilities of the car at competition, and we intend to simplify the system. This year, we have partnered with ShiftFX, a company that develops aftermarket motorcycle parts. Our Technical Director Daniel Moore will be working heavily on this with his thesis being on designing the system. When completed, our car will have a fully automated shifting system that can be ran manually when desired by advanced drivers.

The 2019 car will run a rebuilt 2008 Yamaha YZF-R6 engine using high compression pistons. Along with that alteration, we are looking into ways to reduce weight through lightweight internals. One major way we plan on accomplishing this is by removing first and sixth gears and machining down what we can to reduce weight where possible.

This year is focused on data acquisition for the powertrain system. We will be going to the track and logging information such as coolant temperatures, fuel pressures, engine fuel tables, and oil temperatures. Powertrain's goal for this year is to make changes where possible to make a lighter and more reliable car.



*Rear of 2018 Car*

# SUSPENSION



*2018 Front Suspension*

This year's leads for suspension, Josh Stroup and Braden Heilman, plan to tune our new pushrod suspension set-up more than we could in the few short weeks before competition.

Heilman states that the suspension subsystem's plans for this year are based on the success of the design for the 2018 car. 2017 to 2018 was a major design change for suspension, changing from a pullrod suspension to a pushrod suspension. The suspension system on the 2018 car received positive reviews last year at Michigan, and team members are looking to validate and tune our existing setup.

Team members stated that the goal for this year is to reduce unsprung mass as much as possible. One of the ways the team plans to accomplish this weight reduction is by switching the materials of the previously steel A-arms, steering rods, tie rods, and push rods to carbon fiber and aluminum. The team is also looking to change the aluminum wheel barrels to carbon fiber barrels. Like many of the other subsystems, 2019 is a year of validation and testing for suspension. Motivated by the previously successful system, we look forward to working alongside the other subsystems, making the car lighter, faster, and more tunable than ever before.



*Wall of our workspace*



*2018 Car in action*

# MANUFACTURING



*Machining chips*

2019 manufacturing subsystem lead, Brock Hinton, looks forward to working alongside multiple subsystems. As always, he will be working within extreme tolerances in order to make sure parts are produced in a timely manner. This year's goal for most subsystems is weight reduction, and manufacturing is already working on removing excess material from the gears that are remaining after our removal of first and sixth gear. Manufacturing looks forward to welcoming new members and teaching them the basics of machining, welding, and fabrication. From here, all of our members will grow their skillsets as we are working with more aluminum parts than usual, so welding will be very precise. We will be welding the steel subframe, working with both MIG and TIG welding and focusing on the structural rigidity of our welds. We will continue using CNC machines and our waterjet machine to fabricate tabs and inserts.



*2018 Front lower balljoint clevis*



*Wheel nuts for the 2018 car*



*Machining in the CNC*

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# THANK YOU!

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



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**Bill Genet**  
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**Rob McAllister**  
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**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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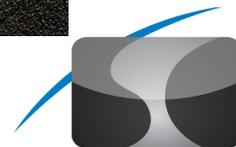


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