Dear reader,

October has been another month filled with exciting manufacturing and design developments for Penn State Racing. The fabrication of our carbon fiber monocoque is proceeding at a more than satisfactory pace, and its progress will continue throughout the month of November. Alongside Chassis though, new designs throughout the Electronics, Manufacturing, Powertrain, Suspension, and Aerodynamics & Composites subsystems are taking shape. We have set an aggressive completed car deadline for spring break this year, and meeting that deadline will demand the full dedication of our membership. We have also been revisiting the 2017 systems to understand and improve upon them when the weather permits track accessibility.

Penn State Racing has also been working to increase involvement within the community. By redoubling our outreach efforts, we hope to expand interest in our organization beyond the scope of the University. That expanded interest may lead to increased membership from existing and incoming students, or even support from enthusiastic local businesses. We have already begun efforts to collaborate with a local TV network, high school STEM programs, and more. Excitingly, we will also be participating in this year’s homecoming parade on Friday, November 10th. Pictured above is our team-built “float.”

Stay tuned to our social media accounts, which can be found towards the end of the newsletter, to receive updates on upcoming events or features.

In this newsletter, you will see progress made in each subsystem this month, as well as a “Member of the Month” page in which we feature new members who have made significant contributions.

Thank you for your continued support!
Aerodynamics & Composites has been working diligently this month to finalize wing profiles and mounting methods. New packaging solutions for powertrain and suspension assemblies, namely the switch to dual radiators and pushrod suspension actuation, are making room for more aggressive aerodynamic components. As a result, The 2018 package will be largely different from last year’s. It will feature new side pods, multi-element wings, and a full underbody diffuser that all aim to increase downforce and decrease drag.

Next month, Aerodynamics & Composites will continue to test new wing profiles in Computational Fluid Dynamics. With the generous support of SIEMENS, we have been able to produce data in Star CCM+ that will be valuable during the Design event at competition. Additionally, we have been working closely with an engineer at Ford who has helped to guide our design decisions. The manufacturing of our aerodynamic components will occur after our carbon monocoque is completed, as that will demand the attention of our Aerodynamics & Composites leadership for the coming month. Our wings will once again be composed of carbon fiber generously gifted to our team by TeXtreme.
The machining of the mold for our carbon-fiber monocoque began this month. Material from the high-density foam donated by DUNA inc. is being removed with a specialized end mill to form the correct shape. The mold will then be sanded, gel coated, and laid up with carbon. The fiber layup skills of our Aerodynamics & Composites subsystem will prove useful when forming and curing the monocoque. The rear sub-frame has also seen significant progress this month. With only a few tubes to go, this year could be the soonest in recent years that we finish frame-related welding. Chassis members will then be able to dedicate their welding abilities to other components.

Not only will the 2018 chassis be lighter and more torsionally rigid than last year’s, but we anticipate that it will also take less time to manufacture. The mold can be machined in a CNC mill much faster than metal or even MDF materials. The high density foam will also not require much preparation before it is ready for carbon layup, while previous years have required many man-hours of sanding and reparation. If all goes smoothly, the monocoque mold will be complete this month.
With the wiring diagrams complete, we await only materials to begin fabricating and configuring all vehicle harnesses. Last year, the wiring harnesses were made at the same time as the steel tube frame. This proved difficult without a template to reference for appropriate wire lengths and fastening points. This year, however, we have decided to postpone wiring until we have a completed chassis. Having a physical model to help determine effective wiring routes will make fabrication easier and will hopefully lead to a more reliable system. In the meantime, we will continue to refine our pneumatic shifting system. This month, we wired and programmed our Shifting Control Unit (SCU) to carry out the appropriate upshift, downshift, and launch functions. We also assembled a simple shifting test jig to observe whether the system was operating as preferred. Upon completion of the rear sub-frame, we will mount the transmission to validate our packaging and confirm rules compliance.
October was a busy month for Powertrain. The transition to dual-radiators has mandated constant contribution from our devoted members. Likewise, choosing a new configuration for our stainless-steel exhaust has proven a demanding task. Although the stainless-steel in this exhaust will be heavier than last year’s titanium, we have decided that the time saved on welding the former would be worth the added weight. While the rest of the powertrain system remains similar to last year, we will have to be careful to make sure it’s new mounting positions do not interfere with other components.

In November, we will mount an engine in the newly completed sub-frame to begin the assembly process. The differential and fuel system will follow shortly thereafter, ideally mated to the engine by Thanksgiving break.
Minor adjustments to the balljoint clevises were made this month to ensure full suspension travel. We are also finalizing a design for new bellcranks which would utilize parallel carbon fiber plates. The carbon fiber would reduce unsprung mass, leading to more responsive damping and overall improved ride quality.

November will be dedicated to finalizing anti-roll bar designs and developing the consequent manufacturing plan. By Thanksgiving break, we plan to have our new shocks in, courtesy of Fox Shocks. These shocks use compressed air to suspend the car, and are significantly lighter than last year’s conventional spring-damper suspension. We can also assemble the completed A-arms, ball-joint holders, ball-joint clevises, and uprights this month upon the completion of our rear sub-frame.

Suspension is also brainstorming methods to benchmark the performance of last year’s vehicle. The Design judges at the FSAE Michigan competition emphasized that even establishing simple performance metrics can go a long way in proving that new designs were implemented consciously. Those tests will take place at our track, weather permitting.
The Manufacturing subsystem provides a great medium for new members to be introduced to the team. Those who are eager to contribute are assigned minor machining tasks as an opportunity to learn critical skills and get to know the team. Simultaneously, the productivity from those new members alleviates the workload for our tag team of Manufacturing leads, who must focus on completing more complex parts. Their combined efforts have led to continuous progress and an impressive portfolio of completed parts.

Manufacturing will continue their diligent work throughout the upcoming month. The uprights have occupied the CNC machine for nearly all of October, but Manufacturing will soon finish those and promptly move on to the differential carriers and suspension clevises. Wheel spindles have been completed thanks to the efforts of a talented senior machinist.

We would also like to take a moment to thank The Learning Factory and its supervisors, whose endless support, resources, and advice have allowed our team to accomplish all it has. Having access to storage space, capable machines, and the expertise of the staff is privilege we do not take for granted.
MEMBER OF THE MONTH

BROCK HINTON

Brock, a freshman on the team, has been greatly helpful in his first two months. He has taken advantage of the many opportunities that our Manufacturing subsystem has to offer, having machined axle nuts, spacers, and chassis tabs. He has also helped to develop rigs that will test our chassis and our differential bearing carriers. Brock plans to continue contributing to both the Manufacturing and Powertrain subsystems this year, and we are looking forward to it. Outside of the team, Brock enjoys working with his hands, and even owns his own knifemaking business back at home! Brock is grateful for all the team has taught him so far and is happy to have an outlet for his interests and abilities.

Congratulations, Brock!
THANK YOU!

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

- **Dr. Thomas Juska**
  Applied Research Lab

- **Dr. Karen Thole**
  Department Head, Mechanical and Nuclear Engineering

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

- **Dr. Matthew Parkinson**
  Learning Factory Director

- **Dr. Todd Palmer**
  Applied Research Lab

- **Cindy Winkelblech**
  Program Administrator

- **Becky Benson**
  Administrative Support Assistant

- **Bill Genet**
  Learning Factory Supervisor

- **Dr. Stephanie Stockar**
  FSAE Faculty Advisor

- **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!

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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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