Purdue Formula Society of Automotive Engineers Earns Podium Finishes in International Competition

stories.purdue.edu/podcast/purdue-formula-sae/

August 18, 2022

Experience

- By Kate Young
- August 18, 2022

In this episode of “This Is Purdue,” we’re talking to Boilermakers who are part of the Purdue Formula Society of Automotive Engineers (SAE) student organization.

Each year, Purdue students design and build custom race cars, then compete against hundreds of other universities from around the world, including teams from the U.S., Canada, Mexico, Venezuela, Brazil and Germany, as part of SAE’s Collegiate Design Series.

In June 2022, the Purdue Formula team finished second overall at Michigan International Speedway, their best finish in 30 years!

Listen as Purdue Formula team members Helen Rumsey (ME’24), Dominic Nocon (ME’22) and Arpit Agarwal (AAE’23) describe how this student organization provides hands-on experience to create innovative car designs and tests engineering skills with real-world problems.

Plus, as the podcast team goes behind the scenes, you'll hear the excitement surrounding the students' first live unveiling of their custom-built cars.

Full Podcast Episode Transcript

Kate: Hi, I'm Kate young and you are listening to, this is Purdue, the official podcast for Purdue university as a Purdue alum and Indiana native. I know firsthand about the family of students and professors who are in it together, persistently pursuing and relentlessly rethinking, who are the next game changer.

Difference makers, ceiling breakers, innovators who are these boiler makers join me as we feature students, faculty, and alumni taking small steps toward their giant leaps and inspiring others to do the same.

Arpit: Seeing all our team's hard work in countless hours actually come into fruition is one of the best feelings in the world.

When I joined this team getting. Into the top 15, even top 20 was not a guarantee. It was not something that we were confident about achieving as a team, seeing it build up from where it was from the start throughout, where it is now is amazing.

Kate: As we kick off another school year at Purdue, we're focusing on a student organization and going behind the scenes with the students themselves to learn more about the Purdue formula society of automotive engineers or SAE each year since 1983, these Purdue SAE students design and build custom race cars, then compete against hundreds of other universities from around the.

Including teams from the us, Canada, Mexico, Brazil, and Germany, as part of SAE collegiate design series in June, 2022, the Purdue formula SAE team finished second overall at Michigan international Speedway. Their best finish in 30 years, but it took plenty of persistence and teamwork to finally get. We caught up with a few of the 2021, 2022 Purdue formula SAE team members as they unveiled their race car at a live event this spring.

Listen in as Helen Rumsey, Dominic Nocon and Arpit Agarwal walk us through how this student organization provides hands on experience to create innovative car designs and test engineering skills with real world problems. Arpit, who is majoring in aeronautics and astronautics worked on the car's aerodynamics.

This year. He explains the SAE organization overall and the three different race cards that produce students build throughout the year, leading up to these summer competitions.

Arpit: This is the SAE unveiling event. SAE stands for society of automotive engineers. They hold like a collegiate design series where basically universities from all around the world, not just the us can compete against other universities.

And specifically these three are race car teams. So we got the internal combustion engine team, which the three of us are part of. Then we got the Baja team and then the electric racing team. So all of us kind of compete in like different lifestyle races. Lecture gracing and us kind of compete in more like auto cross style.

And then Baja does like off-roading endurance races. But yeah, it's all the SA organization. Like if you get really involved in the team, then you can get credit out of this. So as long as you're part of the mechanical engineering program, you're allowed to use this as your senior design project, but everyone else who's part of the team is just using this as a club.

So it is a lot of work, but it's a lot of fun.

Kate: To break these three teams and cars down further. The Purdue Baja SAE team builds single seat offroad cars. The Purdue formulas, SAE team builds a single seat formula style car with an internal combustion engine. And the electric racing team builds a similar formula style car with electric motors powered by a 300 volt battery pack.

That can go from zero to 60 in under four seconds. Now, as you probably can imagine designing and building these custom race cars takes. The teams start planning out their card in the summer. And once they're back on campus in August, they work on finalizing the

design elements. Here's Dominic, who was the chief engineer for this 2022 team.

He graduated with a mechanical engineering degree from Purdue, this spring, the summers

Dominic: Around may or June, once the competition ends from the previous year and a normal year, we would design all the way up until the end of October and then manufacturing from. At the end of October to the start of March, once the snow starts to melt.

And then once winter's over, we could go outside and test for install competition in May.

Kate: That's right. The students are always keeping their fingers crossed that March brings minimal snow because getting into these cars and practicing is an integral part of preparing for competitions. But for our pitch, shoveling snow at the grand pre track to get a few practice laps in was actually one of his favorite memories of the entire year.

Arpit: When we were initially testing the car. This was back in late February, early March. There was obviously snow on the ground and we tested our car at the pretty great pre track, which was fully covered in snow. The day that we first wanted go test and me alongside a couple, others went, bought some shovels from Menards and went and just shoveled the snow in the morning, such that enough to have it melt away so that we can go actually run the car later in the afternoon.

That is one of my favorite memories, just because it kind of shows our overall dedication of the team. We're willing to wake up and go and shovel an entire track just so we can take our car out for a couple hours and actually improve that it works. And it's just something that I guess not a lot of teams can say they have had to go do.

Kate: This year for the first time, Purdue SAE hosted a public event on campus to unveil all three teams. Custom-built race cars. Since the students design build and test these cars throughout the year and don't compete until summer. Most of Purdue students and faculty never get the chance to see these finished race cars before the semester ends.

But this year that all changed. Parents, family members, friends, and other students filled Fowler Hall to support these students. And the energy was electric. No pun intended. Jared Pike, the communications specialist for Purdue school of mechanical engineering served as the emcee for this live event.

Jared Pike: Purdue is the perfect place for students who are passionate about motor sports.

Every part of every car you see on the stage was designed and built by students here at. Except for maybe engines or tires or shocks. These cars are 100% per new engineer. And these students have poured thousands of hours of work into these cars. Most of it on their own time after classes. Are you ready to see our first car?

Kate: The podcast team was there and it was a blast meeting and interviewing some of these boiler makers, the official,

Jared Pike: this is Purdue podcast hosted by our own Kate young, who is here today. So say hi to her, get some podcast swag and pay attention to that story, because she is awesome.

Kate: That awesome podcast guest Jared is referring to while it's none other than Purdue mechanical engineering alum and indie car engineer, Angela Ashmore, who was also part of Purdue formula SAE.

When she was a student, if you haven't checked out our, this is Purdue episodes with Angela who was the first woman crew member to win that Indianapolis 500, by the way, be sure to watch on YouTube or listen on your favorite podcast. Okay, so sure Purdue SAE features heavy engineering work, but another key aspect of the student organization is the business and management side of building the cars.

The students are responsible for finding sponsors for their cars and negotiating for in kind donations of things like parts, materials, and services. Each team has a business team that helps raise and manage money. Dominic tells us more about the importance of these sponsors.

Dominic: On average, it takes probably around $70,000 to build at least the formula car. And a lot of that is done through the help of the mechanical engineering school, various other colleges on campus. But in addition to that, we have sponsors for parts such as like radiators or cooling tubes, et cetera, as well as our engine.

Kate: Boeing, Cummins, Ford and dozens of other companies have contributed as sponsors and their logo decals can be seen on different parts of these finished race cars, just as we would see in a professional racing series like IndyCar, Todd Nelson was also part of this live unveiling.

He serves as the managing director of Purdue, motor sports and faculty advisor for all three SAE teams. Todd told us that not only are these students developing professional skills to take into the real world, they're also essentially running a race team and small engineering firm.

Todd: They strengthen their engineering skills, as you can imagine, by building the cars and applying everything they've learned in their classrooms to design and build these, but they also gain an understanding and the importance of program management. So they can get all of this done in this tight timeline of one year and within their budget, which is essential.

And they also learn how to work with lots of different people and lots of different perspectives, lots of different opinions, and how to figure out what to do and how to get it done and be effective. And then my favorite, they learn incredible leadership skills. They're such good leaders that they get college students to voluntarily give up most of their social life and a lot of sleep to work on these cars.

Kate: For Todd, this role is extra special to him because he's a former Purdue formula SAE member himself.

Todd: As you can see there from the picture, I was heavily involved with formula as a student, when I was a mechanical engineering student back in the. And the, the experience was just absolutely invaluable to me. I used, uh, what I learned pretty much every day in my 15-year career in automotive and aerospace.

And so when Purdue actually offered me the job to come back here and said, would you like to be the faculty advisor as well? I almost fell off my chair and thought it was a

dream come true. And it has been, it's been absolutely amazing.

Kate: Okay. So as I mentioned, Purdue formula SAE had their best ever podium finish in June 2nd place overall.

So let's get into the competition side of SAE. This may and June, the teams traveled to Michigan international Speedway in Brooklyn, Michigan as part of SAE collegiate design series. This isn't a small competition. Remember there are dozens of university teams from the us, Canada, Mexico, Brazil, and Germany.

And this isn't limited to one big race. There's multiple events that the students are judged on and can earn podium finishes for. Helen is an upcoming junior studying mechanical engineering. And she serves as the chassis team lead for Purdue formula, SAE, Helen discusses the different events at these competitions.

Helen: at the competition we're competing for us specifically, we have like four dynamic events.

So we're doing like acceleration skid pad then as like our pit mentioned the auto cross and. An endurance, which is like out, across but longer. And then we also have the static events. So like the design event where we're presenting on like, why we made specific design decisions and all that. So it's more than just like racing the car.

It's also like our understanding of the car that we built. There's kind of like the two portions, like you want your car to do really well, but you also wanna make sure that everyone on the team has a good understanding of the design behind the car so that you can do well in the design. You could place first, an acceleration and like last an endurance, the results of all those races determine the results of the competition.

So there's multiple factors to it.

Kate: Arpit expands on what these competition weekends look like for the team.

Arpit: The competition is broke up into like four days. The first day is just kind of like you prepping your car and then all the SAE workers, like the volunteers are setting up the event. They're just kind of getting prepped on like doing all the behind the scenes work second day is where they actually inspect your car.

So to be able to compete in the race, you have to make sure that your car is actually safe. That means going through the rule book and making sure. You pass every single rule in the book, all the teams kind of get staged outside, like a bay, you go inside and then there's like assigned inspectors who like go through your car and just make sure everything like looks good.

And like, they check it. From there. The second to last day is where we do all the like auto cross events. That's where you're have a random course thrown at you. And then you just kind of like have the driver sit in, go around that random course. Then you have the acceleration event, which is like more of like a drag race.

You sit on the car and just floor it and just try to try to go as fast as possible. And then you have the skid pet event, which is just kind of going in, like figure eights, just kinda like circles. And then based on your results from those three events, they kind of like stage you on like, which place you're going for the endurance event.

And that's like the last day. So the last day is like all the teams competing. It's 22 kilometers. You all just like stage together and then your driver goes in and like each driver does like half of that. That's kind of like, I guess the full duration. So it starts off like inspecting the car. Then you go into like the small races and then it's the long one at the very.

Kate: The endurance race he just mentioned, goes for about 16 miles and takes around 20 minutes, which he says doesn't seem like a lot, but many things could go wrong during that timeframe. If the car isn't fully prepared ahead of this big race, he says just finishing the endurance race is a massive achievement.

And what about the drivers of these cars?

Arpit: There's four drivers in total. There's two that do like the auto cross and endurance event. Our chief engineer, Dominic right here is actually one of the drivers. And then there's two other drivers who do like acceleration and skip head event. How

Kate: do you get to be the driver and the chief engineer?

Dominic: Most of it's just putting a lot of work into the team over the years. I guess freshman year started out doing drive, train things, and then became, uh, power train team lead. In charge of all the engine and engine management stuff, my sophomore and junior years, when then I decided to take on the role for chief this year, last year, I was trained as an acceleration and skid pad driver, but I just kind of improved from there to get this position.

Kate: Now this year, the team entered their first competition in may at Michigan international Speedway. They finished ninth in the endurance race, third in design, and second in sales presentation. And when combined with all of the other events, they finished six place overall among 90 nineteens. They were also the fastest single cylinder engine on the grid.

These results are fantastic, but we are talking about boiler makers after all, they weren't ready to give up just quite yet. They were persistent. They were innovative. They work together and they reentered the car in another competition at Michigan international Speedway in. At this competition, the team plays second in design.

First in skid pad, third in auto cross, and second in the endurance race. And they jumped up to a second place. Finished overall, Arpit, who will be the future chief engineer of the 20 22, 20 23 Purdue formula S SAE team describes the feeling of bringing home nine trophies between two competitions.

Arpit: Seeing all our team's hard work and countless hours actually come into fruition and come with the results that we got is one of the best feelings in the world. When I joined this team getting into the top 15, even top 20 was. A guarantee. It was not something that we were confident about achieving as a team, seeing it build up from where it was from the start throughout, where it is now is amazing.

I am extremely proud and happy that I got to be part of the people that helped build up the fundamentals of the team. Build up the foundation to get where we are.

Kate: And what did it mean to Arpit and his teammates to make Purdue formula SAE history this summer?

Arpit: our team has finally figured out how to build a reliable and efficient car.

It's kind of weird in a sense that some other people think of this as like a, oh, you got second place. Like now what more is there for. I see this as a level, one achievement of our team, rather than being there at the top. The reason I say this is because. The goal of my team and just me personally, is to be a consistently winning team.

So just because we got second place this year doesn't necessarily mean that we've done all the achievements that we've wanted to do. I would really like to continue building on our fundamentals, continue making. Achieving more complex decisions overall, trying to aim for the number one spot and continuously aim for the number one spot, not just next year, but

the year after that, the year after that and be a team that can consistently live the competition, I think is going to be a very big goal in general and be something that our team strives for next.

Kate: Their persistence certainly paid. For Dominic and Arpit, a large part of why they wanted to come to Purdue university was because of Purdue formula SAE and its strong reputation. Here's Dominic.

Dominic: For me, I'm born and raised in San Francisco, California. When I was applying to colleges, I applied to Purdue because it's one of the best engineering schools in the country.

So I moved from the big city out to the Midwest. And I guess a lot of the ways I've been spending my time is on this team.

Kate: What was that adjustment like coming from a big city like that?

Dominic: It was pretty different, but, uh, I keeping myself busy on the team. This team is also one of the reasons why I applied to Purdue.

I saw they had a really good result in 2018 and that's where I wanted to apply and join like a highly competitive.

Kate: And here's Arpit who is from the Midwest, but didn't want to go to that one engineering school, about 30 minutes from his house.

Arpit: I'm from the suburbs of Detroit, Michigan. But I guess as an aerospace engineer, there's the Purdue cradle astronauts.

So obviously like this was like really up there alongside that, as Dom said, I kind of like looked up the results of this teams and wanted to join it. But my kind of thinking was like, I really just. Get out of my comfort zone. A lot of people I knew were going to like university Michigan. So I wanted to like, just get to know like different people.

So that's where I kind of like filtered out to like create all the astronauts, get to know different people and get a cool race team. As

Kate: for Helen while she was pretty much destined to become a Boilermaker.

Helen: I'm from Indiana. Both my parents went to Purdue and did Purdue engineering. It was always something that I considered kind of like grew up in a Purdue family at the end of the day, Purdue has a really good engineering program and there's a lot of opportunities like club wise, like this club that I'm in and like research and other stuff.

So I chose it because of that. And then also the in-state price. First intuition is really like hard to be like, you're hitting all the sweet spots economically. Like it really doesn't make sense to go anywhere but Purdue for me.

Kate: As for the Purdue formula, SAE students who graduated this spring, Todd says he's always been a big believer in using motor sports as a springboard for students' future careers.

Students are able to make connections and have those networking opportunities through this organization, between the judges and volunteers at these competitions, many of which come from massive companies like Ford, Honda, and Tesla. In fact, Arpit is currently in his second round of an internship with SpaceX.

He says the reason for this internship opportunity with a brand like SpaceX is all thanks to formula SA. Incoming sophomore. Troy crooks is majoring in

Troy: mechanical engineering technology and automation systems, integration, engineering technology.

Kate: You're gonna have to break that down for me.

Troy: okay. So I'm in mechanical engineering technology.

So that's in the school of Polytech. So I'm not in all of these guys are in the college of engineering. So I'm double majoring, which is only like five or six extra classes where I take more hands on like robotics classes and machining integration.

Kate: Troy is interested in pursuing a full-time job in professional motor sports after graduation.

So being a part of the Purdue formula, SAE is the perfect opportunity for him to learn and hone these skills.

Troy: So we're both freshmen, but like just looking at the experience, any racing, just getting my hands dirty. Ideally the dream job would be formula one, but, uh, who doesn't wanna work for a formula?

One Trackside would be so cool. They traveled like 23 different countries races all over the world. I feel like that'd be a really cool experience, but Indico car is so close. So getting an internship is a goal for the next couple years. Then see what happens.

Kate: Troy's formulas, SAE teammate. Zach McNabb is an incoming sophomore who is majoring in mechanical engineer.

Zach is interested in the professional motor sports world as well.

Zach: There's a lot of different classes and I think any of them would be really cool IMSA indie car formula one as well. And like all the formula two and three series over in Europe. Trackside I think would be really cool personally kind of traveling around with the team it's like getting that abroad opportunity.

Kate: Purdue SAE will be hosting a call out for all Purdue students on Wednesday, August 31st at 7:00 PM in the electrical engineering building. EE 129. Following short presentations from each SAE team, there will be a meet and greet at the engineering fountain here. Students can ask team leaders, questions in an informal setting and get a better idea of which team would be a good fit for them.

This episode was so fun because our podcast team was able to meet these students, chat in person and check out the unveiling of these incredible cars. Featuring students on this. Purdue is always really special to us. If you enjoy this episode, be sure to subscribe and leave us a review on apple podcasts.

Simply scroll down on the app and click write a review. We always love hearing your feedback. Thanks for listening to this is Purdue. For more information on this episode, visit our website at purdue.edu/podcast. There you can head over to your favorite podcast app to subscribe and leave us a review and as always boiler up.