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On the road to success: Gaucho Racing competes at the Michigan International Speedway

Any enthusiast will tell you, Formula One (F1) is peak motorsport. It's got speed and power, with technology born from the latest innovations, and strategy developed through teamwork and the minds of the finest in the field. From motor concept to race day, teams constantly encounter and deal with challenges big and small, and nothing is guaranteed until the race is over.

It's no surprise then, that engineering students with a taste for competition, excitement and a big challenge gravitate to F1 racecar building. It's certainly true of UC Santa Barbara's [Gaucho Racing](#), a club that has grown to more than 60 undergraduates, who take it upon themselves to build the iconic single-seat, open cockpit racecar and bring it to the summertime Formula SAE Electric (FSAE-E) races in Michigan.

"It's a national competition that happens every year at the Michigan International Speedway," said Thomas Yu, who has served as Gaucho Racing's president for the past year. A subset of the more traditional gas-powered, internal combustion collegiate F1 vehicle race series held by the SAE, this competition requires its participants to build all-electric racecars. "They have about a hundred or so teams that compete in a bunch of different events," Yu explained, events that hand out points based on everything from the car to the team's organizational skills and

business acumen.

The goal? To give engineering students a real-world taste of the automotive industry, and the repertoire to explore its many facets for future careers.

At the heart of the yearlong endeavor is the electric F1 car — consisting of a battery-powered drivetrain ensconced in a lightweight chassis that also contains the driver's seat and steering assembly, as well as the electronics that manage the various systems that regulate temperature, the interactions between powertrain components, and other aspects such as driver safety and braking.

"Gas-powered formula cars are horrendously expensive," said Kirk Fields, UCSB senior development engineer and Gaucho Racing's faculty advisor. "We really don't have the facilities to work on a gas-powered formula car. And even if we could do it and could scare up the expertise, most teams that are successful could spend \$500,000 to \$1 million on their car."

Indeed, many of SAE's heavy hitters come from the Midwest — home of the automotive industry — and are well-funded automotive engineering teams that have been around for years. In comparison, this generation of Gaucho Racing is still in relative infancy, with the electric FSAE team started in 2021 by mechanical engineering alumnus Nicholas Rivelle.

But UCSB abounds in mechanical and electrical engineering expertise, Fields said, and boasts a collaborative environment that encourages researchers from different fields to work together. These qualities, added to the fact that the automotive industry itself is leaning toward electric vehicles, puts Gaucho Racing in a good position to explore EV technology while also being competitive in the race. As a result, Gaucho Racing comprises a variety of disciplines — primarily mechanical and electrical and computer engineering, but the team works

to make room for any student of any discipline to contribute.

"We have seven or eight different sub-teams," said Alex Fu, Gaucho Racing's external VP and aerodynamics team lead. "The mechanical ones are chassis, aerodynamics, suspension and powertrain; and our electrical teams are high voltage, electronics and data. We also have a business team. We probably have

about 20 different majors that are spread out across all those different teams, and they all work on their respective components and then we come and integrate it all together.”

While the electric FSAE race takes place over six days in Michigan, the competition itself is year-round. The team competes with other engineering teams in aspects that are not part of the timed trials in Michigan, submitting reports and making presentations throughout the year to qualify for the race. But they’re also racing against the clock to build a car from scratch, meeting regularly at a dedicated machine shop on campus to fabricate the frame, install components, apply the fiberglass panel body, throw on the wheels and, time permitting, take the vehicle out on test runs. All this, while fundraising, making scholarly presentations about their work (FSAE is an academic competition at its core), and carving out time for other classes and whatever social lives the students can squeeze in.

“Life is an unending stream of extemporaneous problems. It’s how you approach those problems that matters.”

- civil engineer Henry Petroski (1942-2023) the “Poet Laureate of Technology”

For the team, it’s an object lesson in project management, forcing them to make some tough, real-world automotive engineering choices. For instance, choosing to use parts from last year’s car, which scored well but didn’t run due to unexpected events at the racetrack could save time, but could also lock the team out of better options for design, while building the car from the ground up might result in a better vehicle but would also take more time and money — resources in short supply — to execute. Likewise, replacing the car’s single battery-powered motor with a system with motors at each hub may increase the car’s performance, but the independent wheel control also increases the complexity of design for electrical engineers in the team. Each choice leads to a downstream effect that could be the difference between a good showing at Michigan or a poor one.

But for the participants, while a win in the short term is nice, they’re also playing the long game.

“In F1, you’re really trying to prove who’s the best of the best automotive engineers in the world,” Fu said. “But in SAE, because we’re all new engineers here, we’re trying to develop our skills so we can get into the workforce and really have that requisite knowledge to succeed.” With this in mind, it becomes important to incorporate different disciplines, try new things, risk making “mistakes,” as the young team builds its foundation.

“None of the work they’re doing is ‘useless’ at all,” Fields said. “That’s what we should be doing — learning and passing things along so that the team next year doesn’t have to do it again.”

And so they take their ideas from a combination of previous builds, new research as well as the invaluable things they learn from other teams at Michigan International Speedway, whether it’s the brake pad system, the steering wheel or the nose design.

In addition to all the things that satisfy rules and make the car go fast, driver comfort and safety is a priority — in particular heat management. Lithium battery fires are more intense and more difficult to put out than combustion engine fires; the team got that lesson when a car ahead of them in last year’s competition unexpectedly went up in flames, causing the race organizers to bar everyone who hadn’t already passed initial inspection from the dynamic events. Despite this, the team still managed to score solidly, owing to the strength of their documentation and reporting.

“We are doing ice water cooling before the race starts,” said mechanical engineering student Curren Somers, on this year’s strategy for keeping things within a reasonable temperature range for the 20 minutes it takes to complete the endurance race in sweltering Michigan summer temperatures without overheating and shutting down or worse, catching fire. Likewise with the firewall, which sits between the battery and engine and the driver, and the molded bucket seat, the team puts in work to make sure whoever is driving has the control and the confidence to put the car through its paces.

“The lessons learned when I don’t win only strengthen me.”

- Lewis Hamilton, F1 racecar driver, Ferrari

Armed with the most technologically advanced car the team has ever built, and hoping for the best, the Gaucho Racing made the trek from Santa Barbara to the Michigan International Speedway in June.

“The competition went pretty well as we scored the most points we ever had at FSAE Michigan,” said Fu, “but unfortunately we ran into some issues with our car’s steering and battery systems, preventing us from competing in the dynamic events of the competition.” Though no doubt a little bit disappointed that they couldn’t run their car, the team nevertheless shined in the static portion of the competition, scoring even better than last year in design, presentation and cost. As any engineer knows, iteration is the backbone of any successful build, and the team will be back for the next competition with new strategies and better ideas.

But what Gaucho Racing has won regardless of any score is the experience of working together and applying their individual talents and skills toward a common cause. They’ve learned to problem-solve and to think in both granular and big-picture terms and to be bold enough to innovate, but also humble enough to learn from others. These skills will be invaluable as some of the team members complete their degrees and advance into higher education or head into industry, while others turn into the senior members of the group, mentoring incoming students through both the grueling and fun aspects of building an electric F1 racecar.

“I think a big part of why people stick around is because of their friendships — they always have a support system behind them,” said Diego Vasquez, Gaucho Racing’s internal VP. In his three years of involvement with the organization, he’s noticed that even when things get difficult and team members feel like quitting, their shared passion for the project holds the team together.

“It’s because we’re each part of something bigger than ourselves,” he said, “and this thing is really special.”

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About UC Santa Barbara

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