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Engineering Students Win in Vehicle Competitions

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CEDARVILLE, OHIO -- Cedarville University's automotive engineers are on a roll … literally.

Led by senior mechanical engineering student Micah Zell, Cedarville's supermileage team won a technical innovation award at the 2021 Shell Eco-Marathon Americas Off-Track Awards for its vehicle's hydraulic brake system. Zell, from Hershey, Pennsylvania, began developing the brakes as a sophomore and implemented them this past year in accordance with Shell's new hydraulic brake requirement.

"The main objective of the Shell competition is to build a vehicle with the highest fuel efficiency," Zell said. "Though they didn't have the on-track competition in California this year due to COVID, we were still able to submit reports and designs remotely for the off-track awards."

Achieving these high gas mileages — well into the thousands — requires specialized vehicles. Cedarville's vehicle, "Sting," is ultra-lightweight with a carbon fiber frame, a highly modified Yamaha scooter engine and three 20-inch bicycle wheels, coming in at approximately 100 pounds.

With vehicle construction in mind, the issues of fuel efficiency and brake-design are closely related. Stronger brakes work better at stopping cars, but if they do not completely release, they drag, which lowers gas mileage.

During inspection, Shell requires all teams to pass a brake-strength test, but they had encountered issues over the years with teams adjusting their cable-brake systems after passing the brake test.

"Cable operated brakes are similar to bicycles," Zell explained. "They're very easy to adjust, so Shell required teams to switch to hydraulic brakes because they're much more difficult to adjust after inspection. That was a challenge for us, though, because Sting was so small that we couldn't find a hydraulic cylinder to actuate on drum brakes inside of the hub."

Even so, like any good engineer, Zell developed and revised designs to solve this problem, ultimately coming up with his winning idea: a small, donut-shaped brake.

"We looked around and tried some things, and we eventually found a small brake the shape of a donut — only 4 inches in diameter — and fit it around the axel. It took a lot of machining adaptation to fit the steering system, but we ended up with what's probably one of the smallest hydraulic brakes out there."

“The solution that Micah engineered required a complete redesign of the front end and extensive modifications,” Zavodney added. “It was well designed, fit compactly and worked exceptionally well.”

In addition to being recognized for this technical innovation at the Shell awards, which Cedarville has competed at every year since its inception in America in 2007, the supermileage team also recently presented a second vehicle at the Society of Automotive Engineers (SAE) Supermileage competition. Josiah Hirschler, a senior civil engineering student from Chillicothe, Ohio, led this team with Brianna Ice, a senior mechanical engineering major from Dover, Ohio, who served as the overall team leader for both the Shell and SAE competitions.

SAE’s competition mirrors Shell’s, seeking vehicles with excellent fuel efficiency. Karcharias, Greek for “shark,” is Cedarville’s newest competition car, and it has lower drag than Sting.

Cedarville has historically performed well at the SAE competition, winning first place overall supermileage in 2020, an award based on their 25-page written design report and an oral design report. Additionally, “Momentum,” SAE International’s official student magazine, has featured Cedarville both in past stories and on the April 2021 cover.

“Often when I tell people about the fuel-efficiency challenge, they guess that we’re hitting 80, 90 miles a gallon, and I tell them, ‘that’s only two digits,’” Dr. Larry Zavodney, senior professor of mechanical engineering, added. “They’re shocked when they hear we’re into the thousands.”

Having completed their oral presentation about Karcharias on May 13, in addition to submitting their 25-page written report, the SAE supermileage team is currently waiting to hear back from SAE on their placement.

“I’m very proud of the work these students did,” Zavodney shared.

Located in southwest Ohio, Cedarville University is an accredited, Christ-centered, Baptist institution with an enrollment of 4,550 undergraduate, graduate, and online students in more than 150 areas of study. Founded in 1887, Cedarville is one of the largest private universities in Ohio, recognized nationally for its authentic Christian community, rigorous academic programs, including the Bachelor of Science in Mechanical Engineering program, strong graduation, and retention rates, accredited professional and health science offerings, and high student engagement ranking. For more information about the University, visit www.cedarville.edu.

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