

ALL THIS FUN, AND CREDIT, TOO?

A student competition to design and build autocrossers offers thrills, spills—and a day out of school

By Cynthia Claes and Christopher A. Sawyer

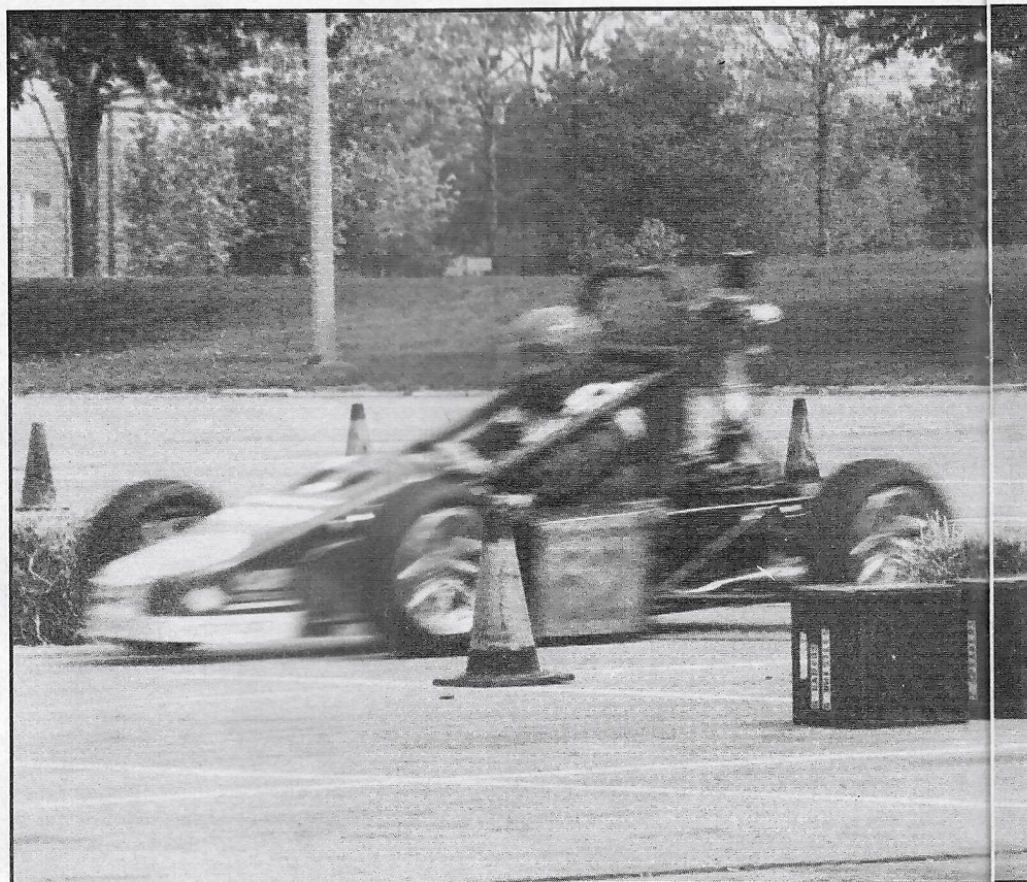
The weather was hot and hazy. The sun relentless. Out on the track competitors squared off in a battle with each other and the clock. Pitside the action was no less hot or heavy. Grease under the fingernails separated the onlookers from the participants. Even the drivers had dirty hands.

The drivers had dirty hands? What kind of racing is this anyway?

It's Formula SAE, and it's about as far from the rarefied atmosphere of Formula One as you can get. Formula SAE (that's the Society of Automotive Engineers) pits engineering students from around the country against each other in a competition to conceive, design, fabricate and race small formula-style cars. The competition is open to engineering students of all stripes. Among the throng in the makeshift pits are MEs (mechanical engineers), EEs (electrical engineers), AEs (aeronautical engineers), and—like any other racing series—more than a few EIEIOs.

This year the competition was held at the Lawrence Institute of Technology in Southfield, Michigan. "Larry Tech," as it is affectionately known, won the bidding war for the event, although we don't know if the medium of exchange was money or pocket protectors. But the Olympic spirit of dedicated amateurism was definitely part and parcel of the event.

How does Formula SAE work? Glad you asked. In essence, the students are contracted by an outside firm (the SAE) to produce a formula-style production prototype intended for the nonprofessional weekend autocrosser. To say the least, this is a high-performance car, but one that is inexpensive, easy to maintain, and reliable—everything a real race car isn't. The outside contractor sets a cost limit of \$6,000 on the cars, but this limit is figured against a production run of 1000 units. In other words, the prototype could run the students \$1.5 million if they could prove that it would cost \$6,000 or less in production. Sounds like the engineering students could also pick up a degree in Creative Account-



ing 101 if they wanted to.

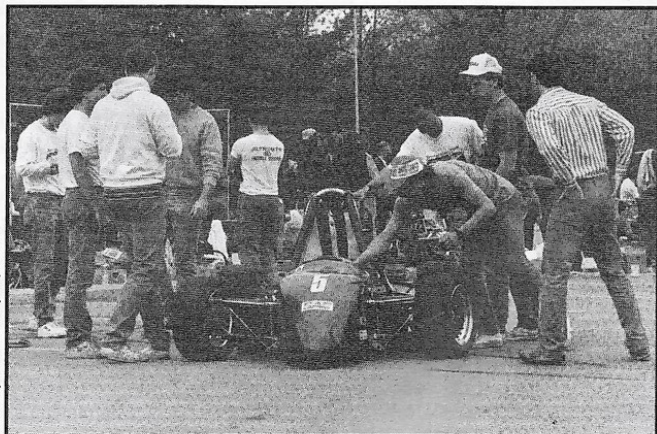
The cars are judged in three different categories: static inspection and engineering design, solo performance trials, and high-performance endurance. In each event the SAE has set minimum acceptable performance levels, and these are reflected in the scoring equations. A top score in every event would result in a total of 1000 points.

The rules are few and simple. Cars must have a wheelbase of at least 60 inches, wheel travel of at least two inches and a roll bar four inches above the tallest team driver's head. Six-point belts and helmets are required. Wheels must be between eight and 13 inches in diameter but tires are free of restrictions—one team ran Super

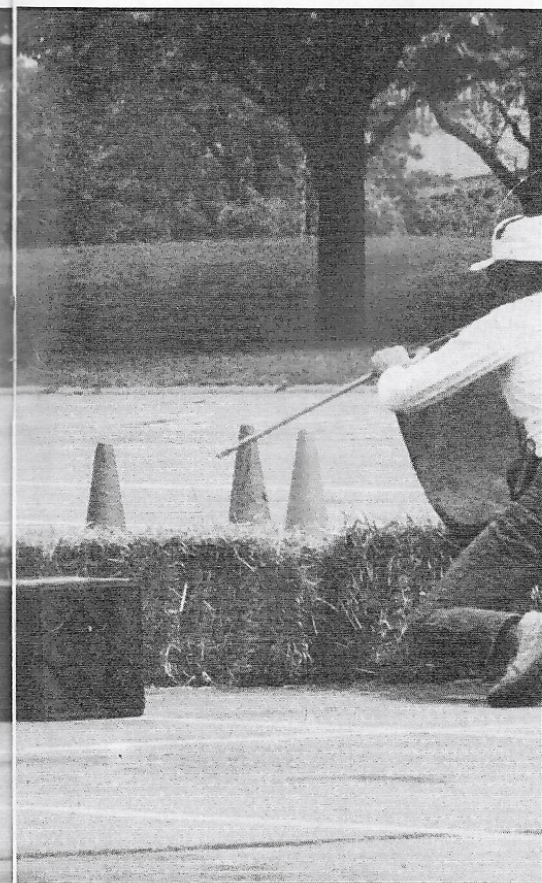
Veeco slicks. Engines are limited to four strokes and a maximum displacement of 610 cc, but can be modified to any extent (although any turbos, superchargers or fuel injection installations must be designed by the students). They can run on gasoline with a 20 mm air restrictor or on a prescribed gasoline/methanol mix with less restriction.

Sounds like a low-cost formula, right? Not always.

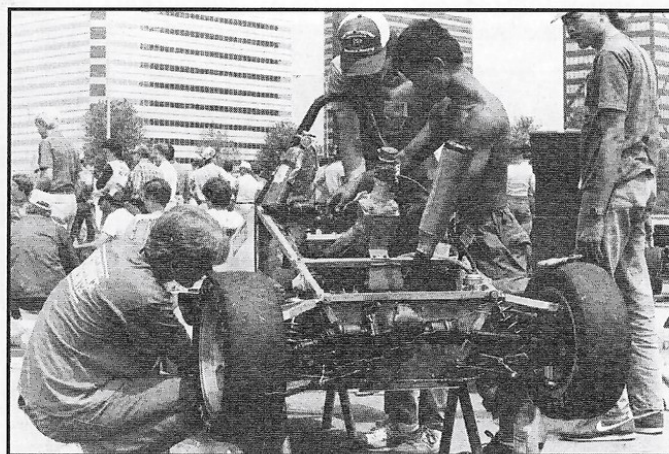
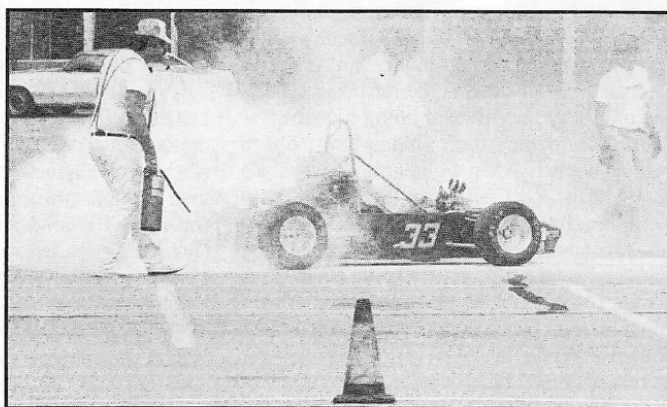
The overall winner (827 points) was the team from Cornell University. Its car was rumored to cost \$16,000—though Cornell would only admit to \$10,000 of that amount. The car had a Kawasaki Ninja engine (the powerplant of choice among the competitors), Torsen differential, four-



Endurance failures scuttled chances for two entries from former winner U. of Maryland (left and above); methanol-powered Formula Ford-like entry No. 1 was rumored to have an oversized fuel tank



Skid pad event aroused more enthusiasm than skill among competitors: winning number of 1.11 g was probably well below car's potential. One team took out timing lights, official behind hay bales is ready to bolt if necessary



Overuse of flammable duct tape extinguished hopes for Cal Poly (above); drag bike motor and Subaru BRAT diff (left) characterized the cheap but effective entry from Virginia Tech: it was running second in points until the engine cooked

wheel discs, coil-over shocks, and independent inboard suspension front and rear. Cornell's entry also carried Chevrolet and Mobil sponsorship.

Back in tenth place (411 points) was the car of Virginia Polytechnic, proof that the competition ran the spectrum from ultraviolet to infrared. It was built for a grand total of \$1,500, used a drag bike motor with 40,000 miles on the clock, carried little sponsorship and used the front differential from a Subaru BRAT rather than a Torsen. And until they broke, second place looked to be within their grasp. The fellas from Virginia Tech won the maneuverability competition and set the second fastest lap in the endurance portion of the event before

they cooked their motor early on.

"We cooked everything we could cook," a Virginia Tech crew member told us. "Five valves, the firewall, everything except the oil. We're running Mobil 1. Tell them that, we could use the sponsorship next year."

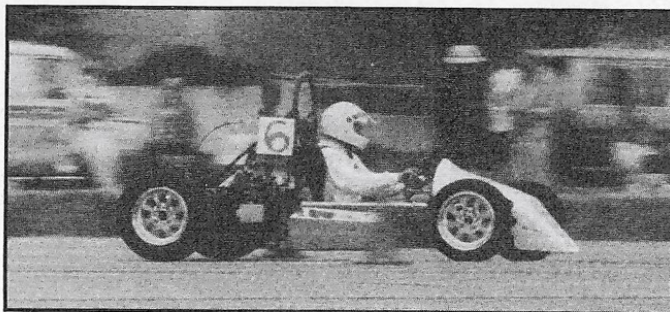
Sounds like a potential team owner to us. Cornell offered V. Tech a new head gasket and anything else that they could provide to help get Virginia's entry back on the track. Neighborliness like this could get these boys banned from certain pro racing series for life.

Except that they know Al George. Al George, the ever-loquacious Al George, was helping shepherd the Cornell

entry through the intricacies of the competition. George is a professor at Cornell on a one-year sabbatical with BMW with a connection or two.

For example, ask George if he has any racing experience, and he provides details on a computer program he wrote that helped Newman/Haas racing (that's Mario's team) decide what chassis and engine parameter they should run for each race on the CART schedule. Or how he taught Newman/Haas team engineer Tony Cicale about aerodynamics. Last year he was faculty adviser to the Cornell team, but this year he played the part of interested spectator/father confessor.

And while confession may be good for the soul, Al George thinks that Formula



Looks aren't everything: this L.I.T. entry won skid pad but failed the tough endurance course that stressed components and demanded a coordinated team effort in the pits

SAE may be just what the young engineer really needs. "This is a great program. There's no way to teach these kids teamwork in the classroom. This competition develops the kind of teamwork they'll need when they go to work in design and engineering," says George. "As faculty adviser, you try to guide them, but it's also necessary to let them make mistakes. That's the only way they're ever going to learn."

And learn they did. Things like using a torque wrench when tightening lug nuts so that wheels don't fall off in the heat of competition. (Before the first heat of the endurance race was complete, no fewer than three cars had a wheel part company. No serious damage, but lots of embarrassment.) But most learned real world lessons. Things like the difference between high horsepower numbers on the dyno and useable torque.

Once out of the starting gate the competitors were faced with a mid-straight left-hand kink and a hard, double-apex chicane. And

we mean *chicane*. All the top end in the world wouldn't help here. No siree. (In fact, the entire course was *sooooo* tight spectators expected an SCCA regional to break out at any moment.) What was needed here was some good ol' fashioned torque. About three bushels full. The lesson? If numbers were everything, accountants would rule the world.

This is not to say that engineering students can't count. They can. Especially when prize money is on the line. Cornell won \$1,000 and a trophy for its top place finish, and second and third place finishers (West Virginia University and University of Texas-Arlington) also received trophies. Prize money was also awarded to the winner of the static design competition, the school whose car showed the best use of composites, the entry that best used electronics, and the top finisher using a mix of methanol and

gasoline. In all, a sweep of the top places could net a school \$6,750.

All that was missing to make this a real racing event was a race queen because rumors of rules bending were already there. Who would do that, you say? Well, all of the fingers we saw were pointing at the University of Maryland entry and its (rumored) oversized fuel tank. The evidence? Well, *someone* tried to get the rules changed so that each endurance event had to be run without refueling, and Maryland was the only team that didn't cheer when the change was turned down on appeal.

But that's racing. The student designer must be able to find the limits of the rules. Both Gordon Murray's Brabham "fan car" (which was promptly disqualified after its first victory) or Andy Granatelli's turbine car (which caused USAC to ban turbines) pushed the limits with enough creativity to pass scrutineering, at least initially. It makes great theater.

And great theater ought to have an audience. Take away the parents and the crowd at L.I.T. was a little thin, certainly thinner than the show put on by the assembled students warranted. This was racing, carried from design, fabrication and testing through on-track competition, and performed by people who may one day be responsible for the design of the cars we drive. Don't miss it next year if Formula SAE comes to a college near you. ■

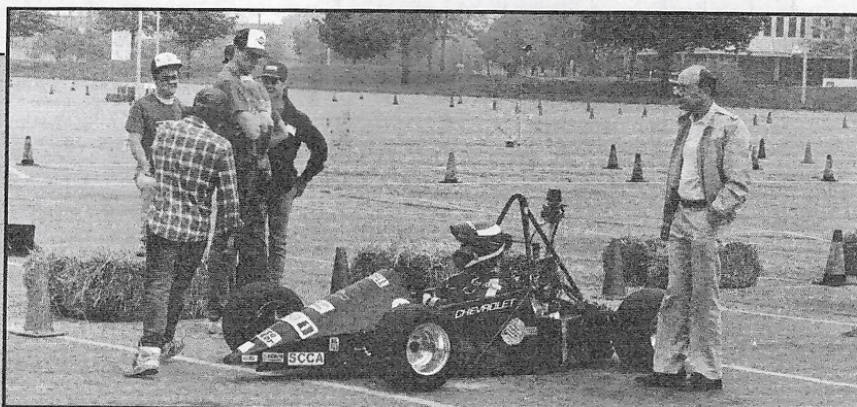
SAE appeal: A star rises over the parking lot

Everyone tried hard, but some folks just have talent

Remember this name: Jay O'Connell. Or rather, James C. O'Connell. A senior from Southboro, Mass., Jay is the lead driver for Cornell's Formula SAE team. He graduates this June with a degree in mechanical engineering, autocrosses a Porsche 911 and looks like a young Elio D'Angelis.

Everyone should have it this tough.

In the parking lot at the Formula SAE event Jay wasn't an easy person to miss, given the Nomex driving suit. Considering most of these guys were in shirt sleeves, Nomex should have been worth two or three seconds a lap, right? You know, the old intimidation game? Well, in Jay's case, it was worth more like *eight* seconds a lap: Jay was running consistent 40-second laps, his best a 39.7. Only Virginia Polytech came close with a lap at just over 42 seconds. The rest of the field was solidly in the high 40s and 50s.



Jay O'Connell, Cornell senior, 911 autocrosser and team 'ringer' prepares to take off

The key to Jay's fast lap was his approach to the chicane: "You have to feel your way through. Each lap you improve, cutting a shade here or there." Sounds like Alain Prost. In fact, watching him through the corner, shifting earlier each lap and letting his speed carry into the turn before braking he even *looked* like Alain Prost. Which isn't bad, considering he'd like to drive professionally.

But according to Cornell professor Al George, Jay's also a promising engineer. And there's the conflict. Does he pursue a career as a race driver or does he work his way up through the engineering ranks? In a large company, an engineer just out of

school often winds up stifled by the bureaucracy. He seldom works on all aspects of a single project. Unlike the world of racing, the line between success and failure is not always clear.

O'Connell, however, is a realist: "I know that if I go with a company like GM I'll have to spend some time slugging it out in the axle group." Ultimately, however, he would like to work for one of the major racing teams, or special vehicle operations group at one of the Big Three. Which, of course, is also the dream of the other Formula SAE competitors.

Like we said before, everyone should have it this tough. ■

Christopher A. Sawyer photo