

Firstcut Helps U of M Team Gear Up for Formula SAE Competition



It isn't Formula One racing, where annual spending is measured in billions of dollars, but the college teams building Formula SAE (FSAE) open-wheeled race cars take their machines just as seriously. In this international competition

run by the Society of Automotive Engineers (SAE), cars compete in acceleration, skid-pad handling, autocross, and a 20-mile endurance/fuel economy run. Entries are also judged on design, cost, and the team's marketing presentation.

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In May of 2011, the University of Minnesota team was one of 98 competing at Michigan International Speedway. In compliance with Formula SAE's 610cc engine displacement limit, the team's entry was powered by a 599cc, four-cylinder, fuel injected Yamaha R6 motorcycle engine, purchased used. The car's frame was built

by hand, and while a few components were purchased off-the-shelf, most were designed, and in many cases fabricated, by team members.

Off to the Races

Andy Simon, chief engineer for the University of Minnesota team, describes the development process. "Teams have just nine months of a school year to produce a finished vehicle," he says. "We planned to spend five months doing design work, two months fabricating, and two months testing. Even with 25 and 30 volunteer team members, nine months and a limited budget doesn't leave a lot of room for mistakes, which is why we allocated so much time for design. I'd like to be able to say that nothing we did ever had to be done over, but it happens. But by emphasizing good design from the start, we kept rework to a minimum.

On the Basis of Good Design

"Our 3D CAD design was done in Solidworks. That let us check many aspects of fit and performance before we began fabrication, so when we finally did start making and assembling





parts, things worked right the first time. We bought some components, made others ourselves and, for some of our custom-designed aluminum parts, turned to Proto Labs' Firstcut service. Their automated machining process was quick, accurate, and inexpensive. Initially, we had them make our brake and accelerator pedals, a pair of differential mounts, and two CV joint cups. We probably could have machined them ourselves, but that would have taken at least 50 man-hours and we just didn't have that kind of time.

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"Overall, the development process went well this year, but still, by the time we got to testing we were running a little behind schedule. We had a few minor problems and, at the end of April, one major failure when a front wheel spindle broke. That's a part that needs to be turned on a lathe rather than milled; otherwise we'd have turned to Firstcut for a replacement. All of the parts they made for us have worked perfectly. I was particularly impressed with how quickly they got us quotes and finished parts. In one case we submitted a model on a Saturday and got a quote back on Sunday. That kind of blew me away."

"[Firstcut's] automated machining process was quick, accurate and inexpensive."

Lightening the Load

In early May, the team had Firstcut machine additional parts—two pairs of suspension bell cranks. The original prototypes had been made on a manual Bridgeport mill in the student machine shop to verify the design, but weight is a critical factor, so the team turned to Firstcut for lighter-weight parts to use in competition. "We've been extremely impressed with Firstcut's prices, the ease of uploading designs, and how quickly parts were made," says Simon.



The Finish Line

"The race went really well," he concluded. "We ended up finishing 56th overall, and we're pretty happy about it. A lot of generous donors, including Proto Labs, helped us produce our finished car. It was good to have services like Firstcut machining, which helped us make the most of those donations and meet tight deadlines without cutting corners."



Complete FSAE competition rules can be found at <http://students.sae.org/competitions/formulaseries/rules/2011fsaerules.pdf>.