University Race Team Benefits from SLS Engine System

The Oregon State University Formula SAE team used 3D Systems' Selective Laser Sintering (SLS®) technology for an efficient intake system in its Formula-style race car.

In the past, the OSU Team constructed intakes by hand, using pipes and composite materials - a time-consuming process that produced inconsistent geometries and ineffective design.

3D Systems, a Team sponsor, used a highly productive Sintering System in its Rapid Manufacturing Center (RMC) and tough DuraForm® PA Plastic to build three complete systems, with four runners and injector bungs from the plenum to the engine, from the CAD data created by the OSU Team. Thanks to 3D Systems' Quickparts®, the Sintered intake system evolved in design, complying with SAE regulations, and the final design was raced in competition.

> *"Both our competitors and judges were impressed with the quality of our intake system, and many spy shots were taken," said Jonathan Brady, Oregon State SAE Engine Team Co-Captain. "Due to the final design from 3D Systems, our engine was able to start dependably and make more efficient use of both fuel and air, which provided consistent performance as well as an overall lightweight system."*

Under-the-Hood Excellence
Duraform® PA plastic withstands the most challenging environments - including under-the-hood applications in motorsports. With high strength and heat and chemical resistance, DuraForm PA Plastic is a tough plastic for custom manufacturing of end-use parts.

The new Sintered intake, measuring about 15 by 12 by 8 inches, or 381 by 304 by 203 mm, was a big improvement from the intake the OSU Team had built by hand for competition the previous year.

The evolution of the team's intake system (above): The top photo is a 1.3 L plenum with curved, tapered runners. Below that image is a 1.5 L plenum with curved runners built in a thicker material. Because of the curved runner, the injector is aimed at the back of the intake valve, allowing for more consistent vaporization. On the car (right) is a 1.4 L plenum with s-curve runners, allowing for a box formation in the plenum.

"Hand manufacturing entailed bending and welding small sections of tubing for the s-curves, and a laborious process in composites for the plenum," Brady said. "Our team compared the two intakes back-to-back and immediately noticed how easily the car started, and the difference in both performance and fuel mileage."

The Road to Competition

Before competition, the OSU team completed a full CAD model of the race car, advanced engineering analysis and testing, part manufacturing, vendor relations and finance.

At the Fontana Speedway in California where more than 80 universities from around the world were competing, the OSU Team placed 10th in the Design category, 4th in both the Acceleration and Skidpad categories (no other team did so well in both events), and was on track to post the fastest lap times in Autocross and Endurance when they suffered oil shaft and sensor failures. Even with those failures, the Team placed 22nd.

OSU Formula Car Stats

0-60 mph in **3.4** seconds

81 hp at **12,000** rpm

92 mph top speed

1.4 g lateral acceleration

What is Formula SAE?

Formula SAE is a student design competition organized by SAE International (formerly the Society of Automotive Engineers). The first competition, originally called the Mini Indy, was held in 1978.

The concept behind Formula SAE is that a fictional manufacturing company has contracted a design team to develop a small Formula-style racecar. The prototype racecar is to be evaluated for its potential as a production item. The target marketing group for the race car is the nonprofessional weekend autocross racer. Each student team designs, builds and tests a prototype based on a series of rules whose purpose is both to ensure onsite event operations and promote clever problem solving.

Currently, more than 200 universities around the world conceive, design, fabricate and test their racecar, battling head-to-head in a three-day multiple event competition.

An Optimistic Prognosis

Dr. Rake is optimistic on the future of these techniques. "It's true that using 3-D prototypes is rather expensive now," he says, "but costs are coming down and insurance companies are more willing to pay for these procedures because they help reduce our operating room time, they help ensure a better outcome for the patient, and they can help us avoid additional surgeries. I see this becoming more and more prevalent in coming years as our profession and the patients experience the advantages."