Feel the Forze

Forze Hydrogen Electric Racing is one of the world's leading university based projects at the forefront of hydrogen-electric racing car technology. The team is continually enhancing their car's performance to win the Supercar Challenge and they recently turned to 3D printing to accelerate design changes. 3D printed parts made with high performance Somos materials were used on the car to quickly implement new designs, saving time and money, which is crucial to maintaining the competitive edge in the racing community.

Each year, since 2007, approximately 50 students, mainly from TU Delft (Delft University of Technology) in the Netherlands, take over running Forze as a commercial entity to design and build zero-emission racing vehicles. The Forze hydrogen fuel cell technology is among the most advanced of its kind in the world and the students are constantly working to improve engine capacity and car performance. Their first vehicle, Forze I, had a top speed of 90km/h and acceleration of 0 to 100 km/h in 5.5 seconds. The latest vehicle, Forze VII, has been designed to achieve 210 km/h and goes from 0 to 100km/h in just 4 seconds.

The main challenge for the current Forze team was to enter Forze VII into the Supercar Challenge at the TT Circuit Assen in the Netherlands. To continue being successful in the Supercar Challenge, the team needs to continually refine vehicle performance. To help improve the speed and acceleration of the Forze VII, the team reconfigured system components to reduce space and weight. Specifically, the humidifier unit was repositioned which meant a moisture inlet manifold had to be new. Designed with compressed air, the humidifier injects moistureinto the fuel cell unit. To operate effectively, a hydrogen fuel cell needs moisture to prevent highly critical elements from drying out. This new inlet value had to be able to withstand compressed air pressure of 0.9 t/0 bar and temperatures up to 120°C.

Sjoerd van Empelen, one of the Fuel Cell Chiefs at Forze Hydrogen Electric Racing, says, "Initially we'd considered using aluminium to make the new inlet manifold, but it's an intricate shape and it had to be fitted into a very confined position and aluminium didn't give enough accuracy or flexibility. We needed an alternative solution and 3D printing offered the best way of producing the part to exact specifications with a material that was strong and heat resistant."

A colleague of van Empelen's, who had experience with the technology, suggested contacting Somos®, one of the leading developers of high-performance materials for 3D printing.

Forze created a CAD design and specification for the new inlet

Somos®

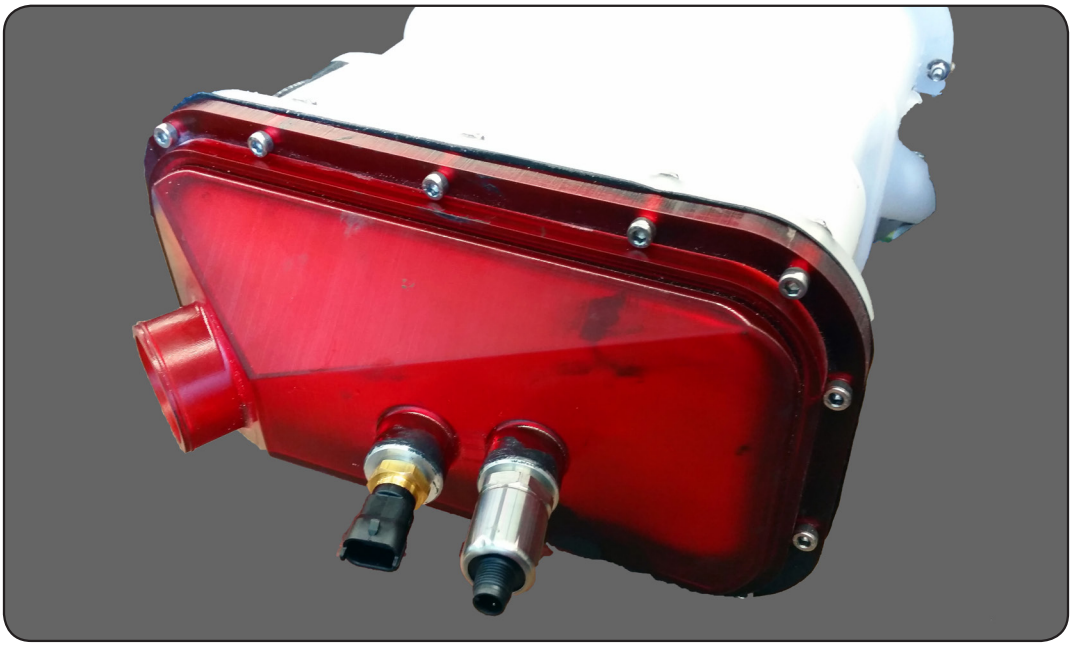
manifold that was presented to the Somos® technical team. They recommended Somos® ProtoTherm 12120, a 3D printing material designed for complex and demanding automotive and aerospace applications. Forze moved forward with using Somos® ProtoTherm 12120 due to its heat resistance capability, stability in high humidity environments and extremely accurate precision for small details. All of these performance requirements, plus a smooth surface, were required as the part would be fit directly on the car and used as an end-use part. Proform, a service bureau using Somos® materials in Switzerland, was commissioned to produce the inlet manifold. Printing the part took approximately 20 hours and due to the high quality surface a limited amount of finishing was needed.

"The goal for Forze Hydrogen Electric Racing is to show the world that hydrogen is a viable alternative to other energy sources and demonstrate this in an attractive way through racing. Forze is also giving students at Delft TU the opportunity to experience the application of technical education in the real world," says van Empelen.

Somos® has played an essential role in enabling the Forze team to develop and build the latest and most powerful vehicle. Van Empelen says, "Somos® ProtoTherm 12120 was crucial to the development of the fuel cell system in Forze VII. Without it, we would have struggled to re-fit the system components and would have spent more time and effort changing and moving parts and re-designing a whole section of the car."

The new inlet manifold has now been fitted into the Forze VII engine and is undergoing testing in preparation for the Supercar Challenge. The Supercar Challenge is a motor racing series open to various classes of touring cars, GTs and sports cars. Forze VII is expected to be the first and only zero-emission car competing in the competition.

Van Empelen says, "We have already had successful start-ups with the fuel cell system running at 50 percent capacity and with experience of the previous car, the Forze VI, we are definitely positive about increasing the power to 100 percent. The Supercar Challenge is an important milestone for Forze Hydrogen Electric Racing because we believe the Forze VII is currently one of the very few hydrogen electric racing cars in the world capable of competing against petrol powered vehicles. We feel confident to compete in the next race and 3D printing with Somos materials made it possible."



3D printed inlet manifold for Forze VII made with Somos® ProtoTherm 12120