Simplifying the Complex

Tecnun Motorsport Team Reduces Carbon Fiber Intake Manifold Weight By 60% With Stratasys 3D Printed Soluble Cores

The University of Navarra sets the benchmark for high standards in education, boasting Spain's highest post-graduate employment rate. Part of this success is the university's commitment to immerse students in as many real-life projects as possible. One example is the university's Tecnun School of Engineering, whose students participate in the annual Formula Student engineering competition.

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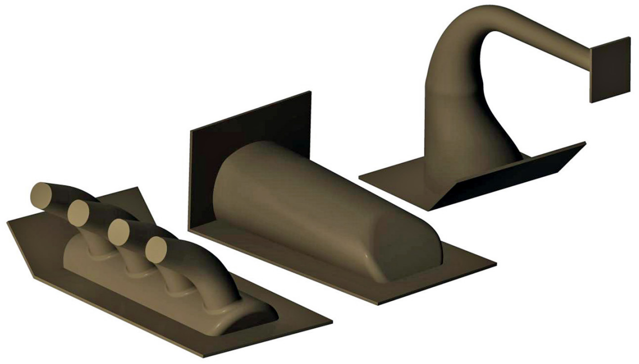

A 3D CAD render of the complex air intake design, comprising several individual components.

Harnessing the engineering skills acquired from their curriculum, the students compete against teams from other universities to design and build a formula race car. Tecnun's main objective for a recent competition was to use 3D printing to increase car performance. The team quickly identified the design of the intake manifold as a crucial element to success and an area in which the technology could be deployed. However, according to Javier Aperribay, Technical Director of Tecnun Motorsport, manufacturing an intake manifold is no easy task.

"The design of an intake manifold is extremely complex as it comprises several important components critical to the air distribution along the four intake manifolds," he explains.

Overcoming Limitations of Traditional Production Methods

The team chose to manufacture the intake manifold in carbon fiber composites to reduce weight and lower fuel consumption. Traditionally, manufacturing such a part would require a mold to lay up the composite materials and create the final part. CNC machining would be used to produce the mold in aluminum, but this is typically an inflexible and costly process. Any subsequent revisions would delay the project and add extra costs.

"With aluminum mold production traditionally taking two months, the team recognized the amount of creativity they could apply to their intake manifold design would be limited, as any iterations to the mold would be impossible, given the short deadline."

Turning Complex Designs Into Reality in a Few Hours

To support the university, local Stratasys reseller Pixel Sistemas sponsored the team and produced FDM sacrificial molds for the students. Using a Stratasys Fortus 450mcTM 3D Printer, a mold tool for the intake manifold was 3D printed in ST-130TM sacrificial tooling material and wrapped with carbon fiber composite material. Once cured, the internal sacrificial core was washed away, leaving the final composite part – a perfect process for the production of complex shapes.

"Introducing Stratasys FDM sacrificial tooling within the production process of the intake manifold allowed us to make it from carbon fiber instead of heavier, less efficient materials," says Aperribay. "The superior soluble characteristic of the ST-130 material enabled a more complex shape of the intake manifold compared to aluminum molds. The first mold for the intake manifold was 3D printed in just five hours, as opposed to the three weeks lead time associated with conventional aluminum molds."

The team also noted that during the curing process the material performed in high temperatures up to 121 °C and, at certain temperatures, pressures up to 620 kPa.

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Faster Production, More Optimization Time

Using the time saved during production, the team refined the design, achieving a final carbon fiber intake 60% lighter than one made with conventional production methods. Putting this accomplishment to the test, the Tecnun team took part in two International Formula Student races, achieving its best finish to-date. As the team looks to future races there is little doubt that FDM sacrificial tooling will play a crucial role in overcoming the next engineering challenges.

The final carbon fiber intake manifold employs a smooth surface finish for increased airflow and improved track performance.

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