KWM
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KWSP
High performance engineering

HOW 3D PRINTING GOT STRAKKA RACING READY FOR LE MANS.

Background

KWM is a high performance motorsport engineering company with a history of innovative race car and chassis design. Together with its sister company, KW Special Projects (KWSP), they delivered a unique solution for Strakka racing - in just eight weeks!

Strakka Racing is a British sports car team founded by racing driver and businessman Nick Leventis. Based at Silverstone in Northamptonshire, the company is perhaps best known for its victories in the iconic Le Mans series.

The team made history at the 2010, 1,000 km Hungaroring race, when it became the first in prototype sportscar history to win overall in an LMP2 class car.

The DOME S103 is Strakka's current sports car competing in the FIA World Endurance Championship.

KWM's facilities in Brackley, UK.

The technology challenge

Having worked hard to create a car following clarification from the FIA in late 2014, meant that the Strakka Racing team was faced with a big headache prior to homologation in February 2015.

Mounting the headrest supports on the door meant that the DOME S103's door assembly required a complete re-design in order to achieve FIA approval. The problem facing the Silverstone-based team was that the design, manufacture and testing of the new door assembly had to be completed in under eight weeks to meet the tight timescale.

Strakka Racing had previously worked with DOME's engineering team in Japan to develop the car. However, given the short timescales imposed on the project, and the need for a close, highly consultative working relationship, KWM, was approached. With its strong track record in motorsport engineering solutions, endurance race engineering and design, KWM was the obvious partner.

Reverse engineering puts strakka in pole position

Advances in additive manufacturing have enabled KW Motorsport (KWM) to engineer and deliver innovative solutions for Strakka Racing, the Silverstone based team. Working with the Brackley based engineering consultancy enabled Strakka to meet strict new regulations for its 2015 LMP2 car and be ready in time for homologation and first tests for the 2015 WEC championship.

Following initial project scoping, a core team was quickly assembled and a close working methodology was established between the two organisations.

The project was divided into two, four week blocks of work; design and development of the new door, and then testing and final manufacturing of the new carbon composite parts and component parts.

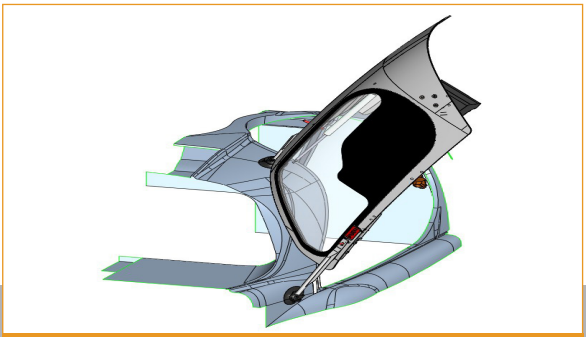
Salter takes up the story again: "We spent two weeks over the Christmas period designing and scheming out a complete set of retrofit parts, carrying over as many original elements as possible to keep the cost down. Then we had four weeks to manufacture the solution, including pattern work, mould composite parts, complex hinges, brackets and the door release mechanisms. It sounds relatively simple, but this all had to fit into the existing car, which made it incredibly challenging from a design perspective.

"We were continually facing constraints in terms of space availability and the positioning of elements such as the hinge mountings. This is where additive manufacturing really paid dividends, as we were able to quickly produce 3D printed prototype parts (in both metal and polymers) and fit them onto the racecar before final manufacture. This process allowed several iterations of parts to be made to test and validate, before the design was finalised and released for manufacturing."

To minimise the risk of not meeting the homologation deadline of 22 February – a situation that would have caused huge delays and implications for the race team and its plans for racing in the 2015 season – KWM actually 'printed' a complete door assembly, including all chassis interfaces and touch points, proof of concept hinges, latches and accurate representations of all packaging constraints. This prototype was then installed on the actual racecar to test and validate all functions of the new assembly (with the exception of the structural integrity). This meant KWM was able to build this prototype quickly using its in-house FDM machines, literally within 48 hours, while concurrently still finalising design details and initiating longer lead time tooling manufacturing, therefore reducing the project lead time dramatically. In addition, commissioning tooling with the knowledge the design had already been validated physically, therefore mitigating risks of the project not being successful.

Many of the final, complex parts of the re-designed door assembly were manufactured from lightweight titanium alloys. Somewhat surprisingly, these parts were also 3D printed and not five axis machined as would be traditionally the case – this decision was based on the components' intricate design, low volume and relatively high raw material cost.

"While many engineers might instinctively opt for traditional casting or CNC machining, using 3D printing was attractive as in this case it was quicker and cheaper. In the end, printing these parts using titanium was actually cheaper than making them in steel, so we got two benefits. This is because it is an additive, not subtractive process, so there is no waste material and you build the net shape you need very quickly and in a single process. Also, the final printed shape, made from laser



Prior to printing the prototype door mechanism, detailed CAD drawings were produced

3D printed door is fitting during the testing phase

> Working to such a tight deadline required a radical approach to our design, test and manufacturing process to compress it from months to just weeks, instead of a sequential design process we had to adopt simultaneous processes that accelerated development, but mitigated risk

Kieron Salter, managing director, KWM & KWSP

melted powdered titanium, requires very little final machining, which takes another expensive (and time consuming) manufacturing stage out of the process," explained Salter.

The adoption of additive manufacturing also allowed more design freedom and flexibility for the KWM team, despite the tight time constraints, so the final result was a very elegant, ergonomic and aerodynamic solution with design complexity that would be time and cost prohibitive using conventional machining processes.

"The expertise provided by KWM ensured we had a robust and proven design, created in the smallest timeframe," says team principal Dan Walmsley. "Additive manufacturing is now an effective solution that can survive the rigours of the harsh motorsport environment. These additive manufactured components were on the car at Le Mans and continue to function as the engineer intended."

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The final door design

Conclusion

Strakka Racing's DOME S103 passed homologation on 22 February this year and was able to enter the LMP2 series with its newly designed door and cockpit. Teamwork, rapid prototyping and the use of techniques such as additive manufacturing are testament to the innovation of the UK's motorsport engineering sector.

In its first outing at Silverstone in April 2015, the Strakka Racing car performed well above expectation, securing a podium place. The team, which comprises Nick Leventis, Danny Watts and Jonny Kane, now has the vehicle that can help them to remain competitive at the front of the grid in the highly competitive LMP2 World Endurance Championship.

KWM was also involved in Strakka's preparation for the 24 hour of Le Mans race in June and continues to be involved in the ongoing development of the Strakka Racing car.

KW Motorsport (KWM) is a high performance motorsport engineering company with a history of innovative race car and chassis design.

A sister company to KWSP, the business was launched in 2003 by Kieron Salter, ex-head of special projects at Reynard Motorsport. KWM develops high performance race cars and lightweight structures in particular for endurance and Le Mans 24 hour racing.

KWM offers high performance engineering services including whole vehicle and sub-system design to the motorsport and niche vehicle sectors. The business has successfully introduced its pioneering engineering capabilities, such as experience in lightweight structures and its can-do motorsport ethos, to other sectors including aerospace and healthcare. The resulting technology transfer led to the creation of KW Special Projects (KWSP) Limited in 2012, which was set up to introduce new manufacturing capabilities – such as additive manufacturing, 3D printing and inkjet printing - to non-motorsport industries.

Based in Brackley, also home to the F1 team, Mercedes AMG Petronas' facilities, KWM is at the heart of the UK's thriving Motorsport Valley. With 6,000 sq ft of office and R&D workshop space, KWM has the ability to facilitate large projects including design engineering, on site assembly, testing, R&D and commissioning.

01280 704768

www.kwspecialprojects.com

info@kwspecialprojects.com