High performance engineering

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RE-ANIMATED ALFA

How skilled engineers used 3D printing to bring a rare Alfa Romeo Tipo back to life

Background

The Alfa Romeo Tipo 33/3 was one of only 12 cars made by the Italian manufacturer in the late sixties to compete in the World Sportscar Championships. Run by Autodelta, the works team, the car initially struggled, but found major success in 1971 at races in Buenos Aires, Sebring and Brands Hatch. It went on to gain a faithful following, and even played a starring role in the Hollywood movie, Le Mans, alongside Steve McQueen.

One of the remaining Tipos is being run by UK-based Martin Stretton Racing, a leading historic racecar restoration specialist. Like many race teams and restorers alike, Strettons are faced with a challenge that will only get harder as historic cars get older – the replacement of original parts.

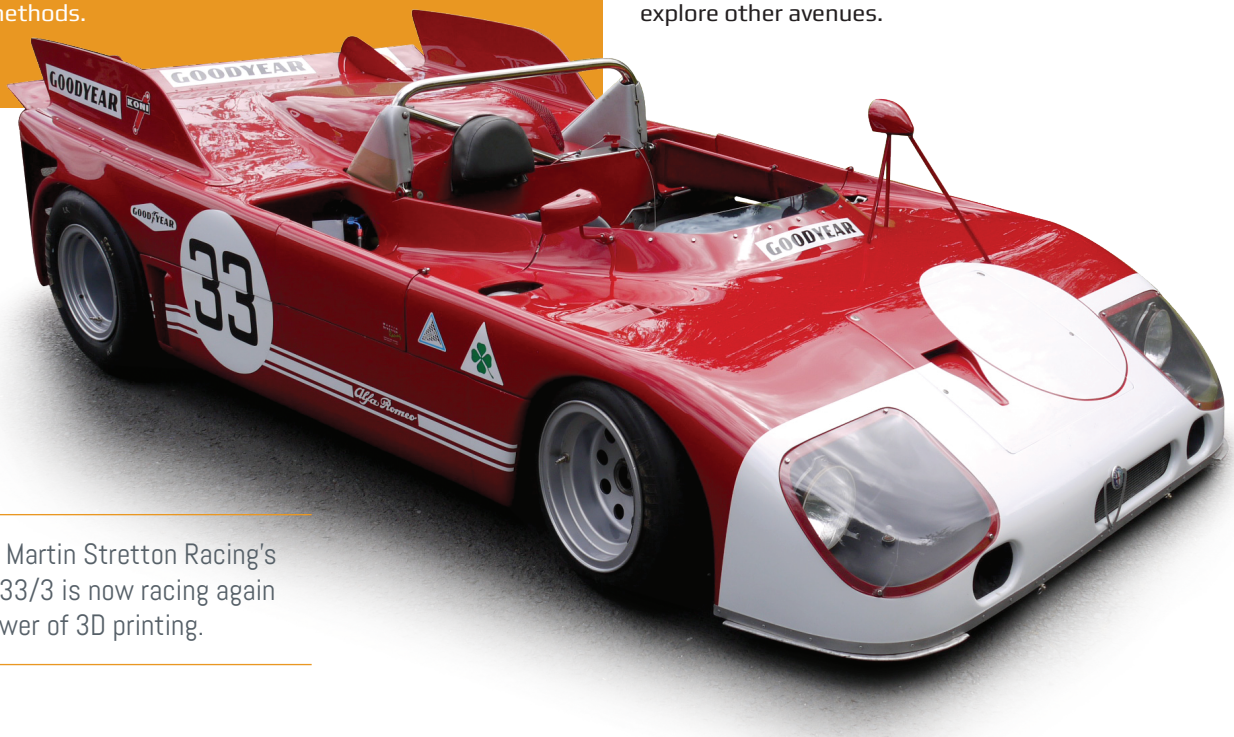
Emerging industrial technologies, such as additive manufacturing, often called 3D printing, are transforming the sector's response to the spare parts problem in the historic motorsport market. And when such know-how is used in conjunction with digital scanning techniques, this makes for a powerful mix. Employed by skilled engineers, these tools can be used to help re-manufacture one-off, original parts quickly and often at a fraction of the cost of traditional methods.

The engineering challenge

Faced with badly damaged parts that have kept its Alfa Romeo Tipo off the road for several seasons, Martin Stretton Racing turned to high performance engineering business KWSP to bring its rare works 1971 Alfa Romeo Tipo back to the grid.

The car's original, naturally aspirated, three litre V8 engine was in good working order, apart from a problematic front engine cover, which had deteriorated significantly in recent years and had been subject to numerous running repairs. As an integral working part of the vehicle's powertrain, the poor condition of the front cover had become a major issue. The final straw came when the car failed to start.

Martin Stretton explains: "This is a rare car – only one of twelve that were made and run by Autodelta – so when we were searching for a replacement cover, the options were limited. We found several alternatives that were close, but none of them were exact matches for our Alfa Tipo 33/3. In the end, we had to explore other avenues.



Back on track - Martin Stretton Racing's Alfa Romeo Tipo 33/3 is now racing again thanks to the power of 3D printing.

> While we had the original part to scan, undertaking a simple like-for-like photocopy operation would not solve the problem, as the original part we had was defective.

Stuart Banyard, head of advanced manufacturing, KWSP

"Having investigated the pattern making route, using skilled model makers, we realised that this would be a technically difficult project to deliver. It would also be prohibitively expensive. It was at this time that we began talking to the team at KWSP who invited us to visit their facility - next to Mercedes Petronas F1 - in Brackley, Northamptonshire.

"Touring the KWSP facility was a real eye-opener for me. It showed what could be done with skilled engineers using 3D printing. Components, body panels and complete structures can now be scanned, digitised, designed for manufacture and made within days using this approach. Previously, much of this would not have been possible. And if it was, it could have taken months."

The right solution

Originally cast in lightweight magnesium alloy, the Alfa's engine front cover had lost form and function. Unsightly welds were no longer keeping up with the number of cracks that now rendered the component redundant.

Having decided to remanufacture three new covers, the KWSP team set to work creating a digital CAD file of the component. This stage of the process involved scanning the badly corroded engine cover, along with the original water pump and housing. In fact, the engine cover was so badly worn it was no longer possible to recognise the distinctive Alfa Romeo logo on the outside of the original casting.

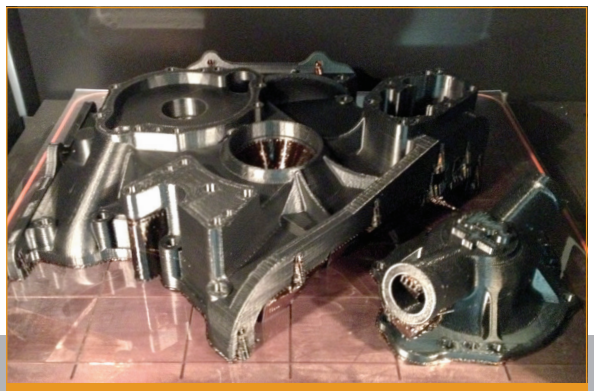
However, meeting this challenge comprised more than simply scanning the original part. Stuart Banyard, head of advanced manufacturing at KWSP, explains: "While we had the original part to scan, undertaking a simple like-for-like photocopy operation would not solve the problem, as the original part we had was defective. This is where the real value of our consultancy comes in. We were able to create a digital scan of the part – and then crucially, make vital changes to the design to bring it back to its original geometry and functionality.

"Intelligent use of CAD data allowed us to use the scanned part as a reference, enhancing structural elements as required to recreate the component into its intended form. This part of the process requires a lot of decision making from our design team, examining draft angles and other integral geometries of the CAD."

Eventually, a finished digital asset was created. Before committing to the casting process, a 3D prototype was printed in a high performance thermoplastic called PC ABS. Once printed overnight using one of KWSP's Stratasys machines, the cover prototype was fitted to the engine to confirm proof of concept.

Stuart added: "This is an important stage of the re-manufacturing process as it enables us to make any final changes to the design, without incurring significant cost. On this occasion, the part fitted perfectly and we were able to move straight to the finished casting process."

The original, eroded engine cover was in a poor condition.



Proof of concept engine parts were initially printed in high performance polycarbonate prior to final casting.

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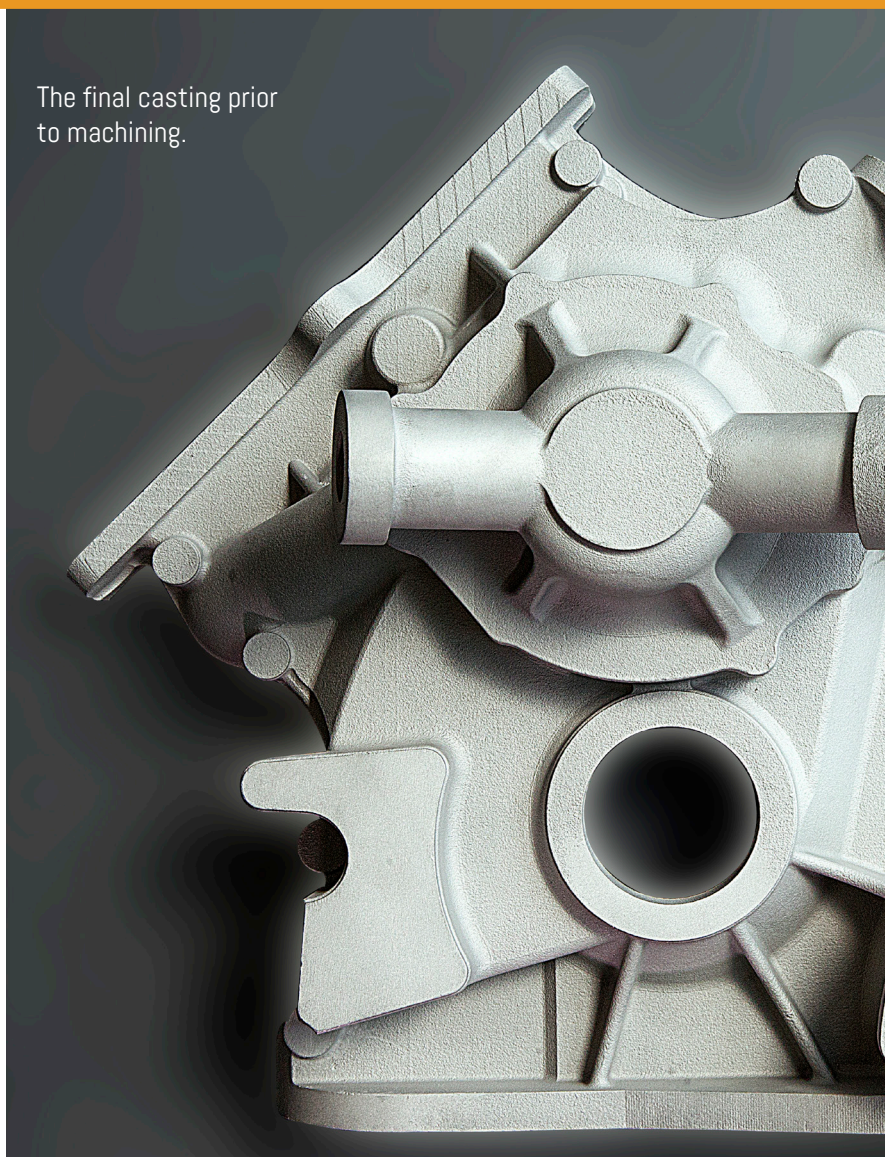
Martin Stretton, owner, Martin Stretton Racing

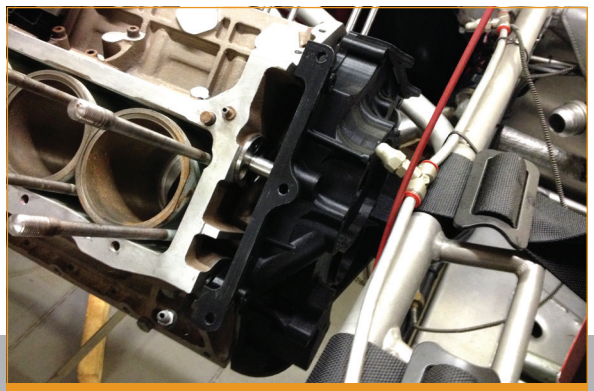
Back in the race

With the new aluminium (not magnesium for reasons of corrosion resistance) engine cover now fitted, Martin Stretton is happy with the result. "Without 3D printing, it would have been a lot more difficult to put this great Alfa on the road again. Of course, there are alternatives, but they would have been more than three times more costly – and less accurate. Thanks to this technology and the skills of the guys at KWSP we're now back on the grid with the knowledge that that we also have spare parts should we need them in the future. Even better, we have our own digital asset in the CAD file, which can be enhanced and amended should we want to explore this option in future."

Scanned, re-designed and prototyped in just a few days, the Alfa's engine cover shows how quickly the digital remanufacturing process can take. While still adhering to both the letter and spirit of FIA certification, the 3D process has huge potential in the historic motorsport market.



The final casting prior to machining.



The 3D printed cover (in black thermoplastic) is fitted - before the final casting is manufactured.

The finished castings are scanned for quality control.

KW Special Projects (KWSP) is an ambitious business specialising in digital fabrication and operating within the high performance engineering sector – designing, manufacturing and supplying complete solutions.

Established by Kieron Salter, founder and MD of KW Motorsport Ltd, KWSP provides services to meet the rapid growth in demand for a non-conventional approach to the integration of new processes and technologies into high performance engineering and manufacturing.

Guided by the principles of motorsport, the need for speed, efficiency and precision through the use of technology, materials and processes, KWSP takes a disruptive approach to clients' creative ideas – facilitating the transfer of knowledge from one sector to another.

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

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