GIAFFONE RACING
EXPANDING INTO NEW RACING MARKETS AND IMPROVING PERFORMANCE WITH SOLIDWORKS TOPOLOGY OPTIMIZATION TOOLS
Case Study

Giaffone Racing added SOLIDWORKS Simulation Professional topology optimization solutions to its existing SOLIDWORKS design and analysis implementation because topology studies allow the Brazilian car-racing manufacturer to more quickly develop lighter and stronger parts, as well as eliminate manufacturing limitations.

Challenge:
Streamline development to support expansion into new markets and use emerging manufacturing technologies while simultaneously reducing component weight and improving performance.

Solution:
Add SOLIDWORKS Simulation Professional analysis software topology optimization tools to its SOLIDWORKS Professional design, SOLIDWORKS Premium design and analysis, and SOLIDWORKS PDM Professional product data management solutions.

Results:
- Cut two months from suspension upright development cycle
- Reduced suspension upright weight by 60 percent
- Entered rally-race market with lighter, stronger, better-looking parts
- Supported both conventional and additive manufacturing

The Giaffone name has become synonymous with Brazilian car racing, as several members of the family have either competed in the IndyCar Series or won Brazilian stock car racing championships. This is why the stock car and racing component manufacturing company founded by the Giaffone family in 1990 as JL Racing Products changed its name to Giaffone Racing in early 2018: to capitalize on the racing family's name recognition.

The company name change also marked a new direction in the company's business strategy. In addition to maintaining its leadership position in the production of stock car bodies, chassis, engines, and suspensions for the top Brazilian motorsports circuits, Giaffone Racing announced its intention to begin developing racing vehicles, systems, and components for the off-road Rally Racing Series in early 2018. Over the years, Giaffone Racing has built a reputation for leveraging cutting-edge technology to deliver consistent quality and technical excellence in Brazilian auto racing, and the company's commitment to using emerging technical tools also paralleled its entrance into the off-road racing market.

"Management announced a new vision for the company that extends our product focus to all types of racing vehicles, not just stock cars for the asphalt track," explains Engineer Adriano Schommer. "In developing components and products for this new market, we also evaluated whether we would be able to tap new technologies, such as additive manufacturing, which is how we discovered the topology study capabilities of SOLIDWORKS® Simulation Professional software."

Giaffone Racing standardized on the SOLIDWORKS 3D development system in 2006, implementing SOLIDWORKS Professional design, SOLIDWORKS Premium design and analysis, and SOLIDWORKS PDM Professional product data management software. Because the company has realized substantial productivity gains since standardizing on integrated SOLIDWORKS solutions, including a 70 percent reduction in development time, and was interested in supporting additive manufacturing techniques, Giaffone engineers recently decided to add SOLIDWORKS Simulation Professional analysis software so they can utilize the software's new topology optimization tools, after learning from reseller SKA that those capabilities had been added to the latest software release.

"We have this vision of staying on the cutting edge of technology to drive our success," notes Engineering Coordinator Denis Ramon Peixoto. "Using topology studies to develop components for our off-road product line is in keeping with that vision. We always want to be thinking ahead and believe that SOLIDWORKS topology studies will help us more quickly develop lighter, stronger parts, as well as eliminate manufacturing limitations."

ENTERING RALLY-RACE MARKET WITH TECHNOLOGICAL EDGE

Giaffone Racing first used SOLIDWORKS topology study capabilities during the development of new components for the Brazilian Stock Car series, beginning with the suspension upright, or knuckle, which attaches the wheel, brake rotor, hub, brake caliper, and steering arm to the vehicle.
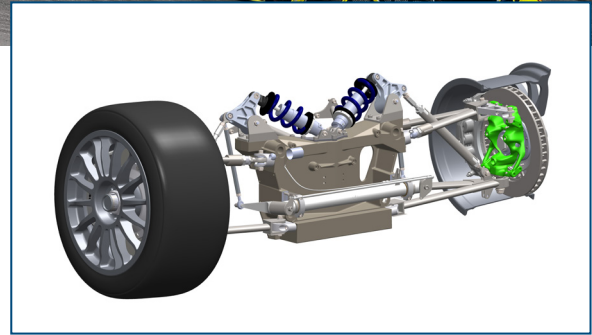
The idea is to get experience with this new design tool on the racing circuit to tackle the harsh environment of rally racing. At the moment, studies have been conducted for a Buggy V8 competing at the most challenging rally competition in Brazil, "Rally dos Sertões," where designed parts will run more than 3,600 km along four Brazilian states in 2019.

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>
> — Adriano Schommer, Engineer

With a SOLIDWORKS topology study, design engineers can automatically generate optimized component geometry to satisfy a given goal—such as balancing the weight-to-stiffness ratio, minimizing mass, or minimizing maximum displacement—based on the specific design space, loads, and geometric constraints, including those imposed by the manufacturing process.

"Instead of performing a bunch of design iterations to validate design performance and manufacturability, we used SOLIDWORKS topology tools to quickly generate the optimized shape for the new suspension upright," Peixoto says. "In addition to giving us a technological edge as we enter a new market, SOLIDWORKS topology optimization capabilities allowed us to cut two months out of the development cycle."

LIGHTER, STRONGER, STIFFER COMPONENTS

SOLIDWORKS topology studies not only save Giaffone Racing time, they also help designers quickly achieve their engineering goals—often by gaining valuable insights into the behavior of their designs. For example, during the development of the stock car suspension upright, Schommer conducted a topology study in partnership with the Latin American division of Dassault Systemès to minimize mass and refined the optimized shape to produce a design that reduced the weight of the upright by 60 percent, from 3 kg to 1 kg. Although strong enough to withstand stresses, the weight-optimized part was not stiff enough, an issue that Schommer easily addressed by slightly thickening the part in certain areas.

"The topology optimization tools in SOLIDWORKS Simulation Professional software are helping us to create lighter, stronger, and stiffer parts more quickly, without having to engage in trial-and-error design iterations," Schommer stresses. "On the upright, we ran a topology study in partnership with Jose Pereiras, Senior Technical Sales Manager in Chile. The experience of Jose was essential to provide confidence and get faster results from the process. We first optimized for weight, but found out that the design was not stiff enough. We then worked with the topology optimization profile to modify the design for strength and stiffness. With SOLIDWORKS topology optimization, we were able to get to the final design in a single iteration instead of many."

PRODUCING PARTS VIA CONVENTIONAL AND ADDITIVE MANUFACTURING

With SOLIDWORKS topology optimization capabilities, Giaffone Racing can continue to utilize conventional manufacturing techniques for many designs and tap additive manufacturing methods for parts that cannot be made with conventional methods. The new Brazilian stock car upright, for example, will be 3D printed in metal, most likely out of titanium, in partnership with AMS Brasil, the Brazilian market leader on additive manufacturing. Additive manufacturing eliminates many of the limitations of conventional machining, forging, and casting, such as parts with undercuts and hollow areas, enabling the creation of parts that heretofore were impossible to make.

"SOLIDWORKS topology optimization and additive manufacturing are new technologies that will help us achieve our expanding product development and manufacturing goals," Schommer says. "We are taking advantage of SOLIDWORKS topology optimization technology in order to create lighter, stronger, and better-looking parts."

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With SOLIDWORKS Simulation Professional topology study capabilities, Giaffone Racing is designing new components for the Brazilian Stock Car series, beginning with the suspension upright, or knuckle, shown here, which attaches the wheel, brake rotor, hub, brake caliper, and steering arm to the vehicle. With a SOLIDWORKS topology study, Giaffone optimized this component to reduce weight while maintaining stiffness.

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