

SIEMENS

Ingenuity for life

Automotive and transportation

AOTECH

Innovative firm uses Simcenter STAR-CCM+ to help Spark Racing Technology complete front wing project on time

Product

Simcenter

Business challenges

Rapidly develop design for a new Formula E front wing

Develop a futuristic-looking wing that exceeds the performance of the previous version

Meet requirements for time, collaboration, design, manufacturability and safety

Keys to success

Use Simcenter STAR-CCM+ to run high fidelity CFD simulations on the front wing

Use STAR-View to view CFD results from Simcenter STAR-CCM+, facilitating the sharing of aerodynamic data and providing a smooth workflow

Results

Completed wing project on time in under two months

Began production on time so the cars could be delivered to the teams for the third season of racing

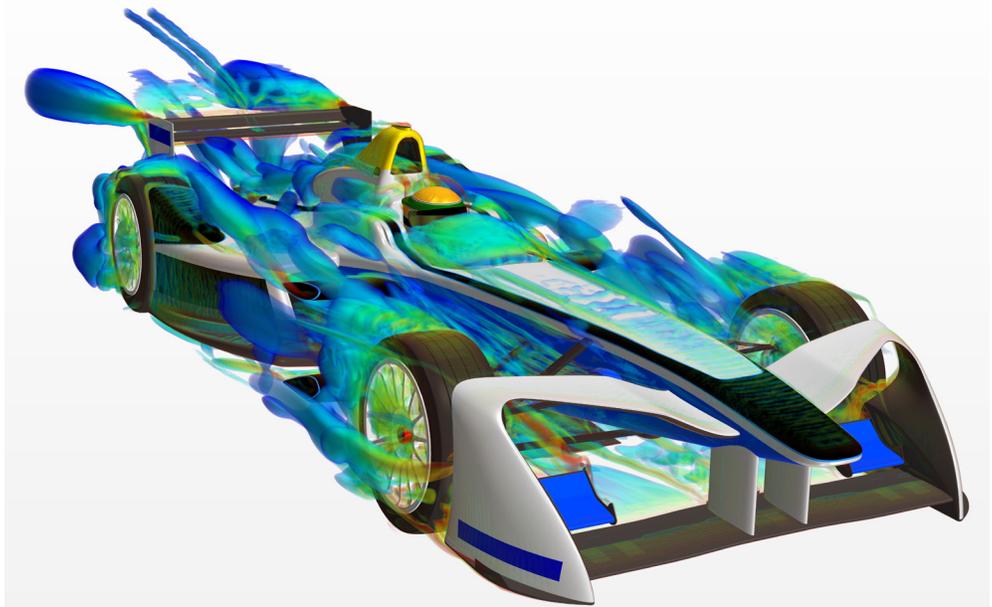
Siemens PLM Software solution helps AOTECH provide the aerodynamic expertise to fulfill the FIA Formula E project

Putting together a team

Motorsports provide the high tech proving ground for commercial vehicles. Electric cars may well be the future of personal mobility in our cities and on our highways, so moving to high-performance and high tech electric Formula-class racing is a natural step. Consequently, the International Automobile Federation (FIA) conceived the Formula E championship in 2012 and the inaugural event was held in 2014.

A futuristic design for Formula E racing seems to fit perfectly considering the potential destiny of electric car technology. At the same time, the aerodynamic performance of electric race car designs must be efficient and still meet safety and manufacturability requirements.

What kind of team and technology are needed to meet the challenge of combining design, manufacturability, safety and aerodynamic performance in a new Formula E race car? That would be a team of domain specialists who have a close working relationship and are equipped with top-of-the-line tools.



The FIA wanted a futuristic design for the Formula E race car's new front wing.

The futuristic design met the project's aesthetic and performance goals in addition to the manufacturability and safety requirements. The expertise of the teams, the collaborative relationship and a smooth technical process formed the three pillars that led to success.

Creating a new design for the front wing

The FIA is the governing body for motorsports. Additionally, the organization has a focus on "safe, sustainable and accessible mobility for all road users across the world." A key technology for sustainable mobility are electric vehicles. Indeed, electric vehicles could be the future of personal mobility. And the FIA wanted to update the race car design for the third season of the Formula E championship in a way that would visually reflect this futuristic idea.

The designer of the Formula E race car, Spark Racing Technology, needed to create a new design for the front wing. They wanted a futuristic design that would perform well and match or improve on the previous generation race car. Additionally, with the scheduled lead times required to deliver cars to the racing teams for the third season, the design project needed to be completed in two months.

To meet this pressing schedule, Spark Racing Technology turned to the aerodynamics experts at AOTECH. The team

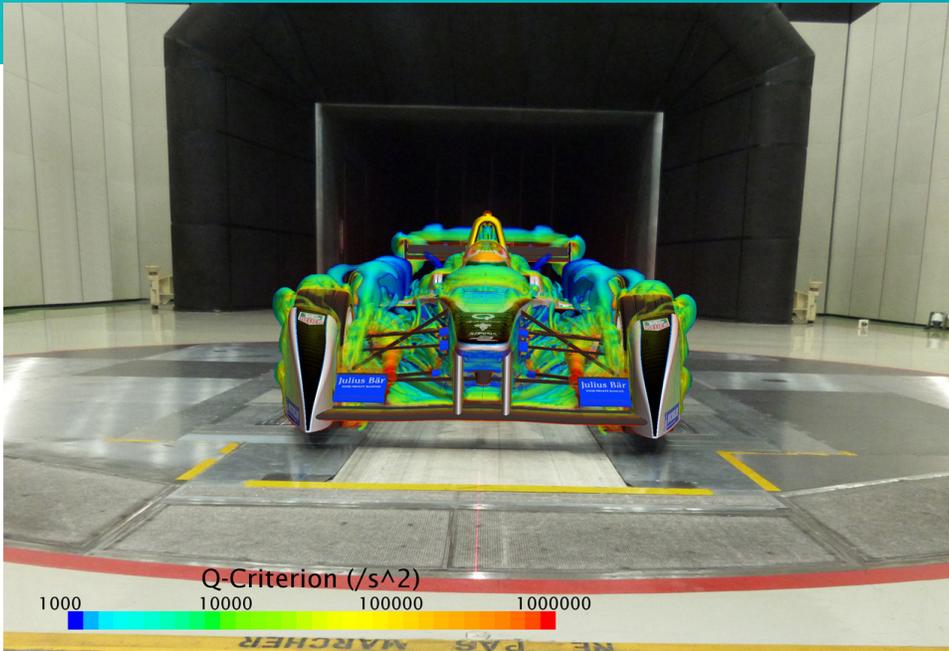
members from AOTECH and Spark Racing Technology are top experts in their fields, and have a close working relationship based on their previous projects.

The schedule demanded a tight coupling of design updates, simulation, analysis and feedback for design changes. The Spark Racing Technology and AOTECH teams set up their design/computer-aided design (CAD)/simulation processes to facilitate smooth transfers of design data, analysis results and proposed changes.

Serving racing customers

The aerodynamics manager at AOTECH is Christophe Perrin, who targeted motorsports as a career from a young age. He attended a French engineering university, ESTACA, which is known for its engineering studies in automotive and aerospace engineering, and focused his studies on aerodynamics. He found a place on the ART Grand Prix team, designing their Formula 3 race car in 2006, eventually becoming responsible for aerodynamic design at ART Grand Prix.

Since its inception, AOTECH has been using Simcenter STAR-CCM+ software from product lifecycle management (PLM) specialist Siemens PLM Software for external aerodynamic CFD studies.



AOTECH and Spark Racing Technology succeeded in creating a futuristic front wing design with improved aerodynamic efficiency.

The ART Grand Prix team achieved years of success: In the Formula 3 Euro Series, the ART Grand Prix team was undefeated in team and driver championships between 2004 and 2009. The aerodynamics team at ART Grand Prix added computational fluid dynamics (CFD) software to their analysis toolkit in 2008.

Perrin then moved to AOTECH when the company was founded in late 2010. AOTECH specializes in simulators for motorsports and external aerodynamics studies. Among other projects, AOTECH racing simulators are used to provide training for drivers who are going to participate in the 24 hours of Le Mans for the first time. The company works with many racing customers on aerodynamic studies, and AOTECH has since added commercial automotive manufacturers and tire manufacturers to their client list.

Meeting different objectives

Since its inception, AOTECH has been using Simcenter STAR-CCM+™ software from product lifecycle management (PLM) specialist Siemens PLM Software for external aerodynamic CFD studies. Simcenter STAR-CCM+, part of the Simcenter™ portfolio, provides a smooth workflow for external CFD analysis, a key benefit of AOTECH.

Like Formula 3, the aerodynamic designs for Formula E have different objectives from the aerodynamic design goals in Formula 1 race car design. For Formula 1™ racing, the primary design consideration is downforce. For Formula E, the aerodynamic design targets aerodynamic efficiency, which is a ratio between drag and downforce.

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Solutions/Services

Simcenter 3D
www.siemens.com/plm/simcenter3d

Simcenter STAR-CCM+
<http://mdx.plm.automation.siemens.com/>

Customer's primary business

AOTECH offers high technology products and services for the automotive industry. Manufacturers, race teams, engineers and drivers rely on their experience, tools and people to carry out ambitious projects.
www.aotech.fr

Customer location

Tigery, Essonne
France

This goal made the aerodynamic performance of the Formula E race car's new design extremely important. The wing's performance for both downforce and drag was a critical issue. It was possible to create a new, imaginative design, but it may have had a lower aerodynamic performance. The project faced four key constraints:

- Time: The project's schedule was compressed
- Collaboration: There needed to be teamwork between experts from the fields of design and aerodynamics
- Design: Finding the balance between aerodynamic performance and style
- Manufacturability and safety: Ensuring that it could be built and survive impact

Success rests on three pillars

These constraints set the stage for the collaboration between Spark Racing Technology and AOTECH. The firms created a smooth process for the design, with the process seamlessly flowing from the Spark Racing Technology designer to CAD modeling, then to Simcenter STAR-CCM+ for surface cleaning and meshing, simulation and, finally, to the postprocessing analysis. The front wing simulation contained 200 million cells and represented a complex aerodynamic simulation problem. The team needed half a day to clean,

prepare and remesh the model, and then launch a simulation. The Simcenter STAR-CCM+ simulation ran for another day on the company's 128-core cluster. Three hours were needed for postprocessing and analysis with the STAR-View+ free stand-alone viewer. The two teams reviewed the simulation results and the implications for the design. With such a smooth workflow and technology toolset, one of the most challenging phases was collaborating and communicating for the next revision of design changes.

Working nonstop through the end of 2015, the AOTECH team finished the analysis for Spark Racing Technology in February 2016. The futuristic design met the project's aesthetic and performance goals in addition to the manufacturability and safety requirements. The expertise of the teams, the collaborative relationship and a smooth technical process formed the three pillars that led to success. Production began and cars were delivered to the teams for the third season of the FIA Formula E racing series.

Siemens PLM Software

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