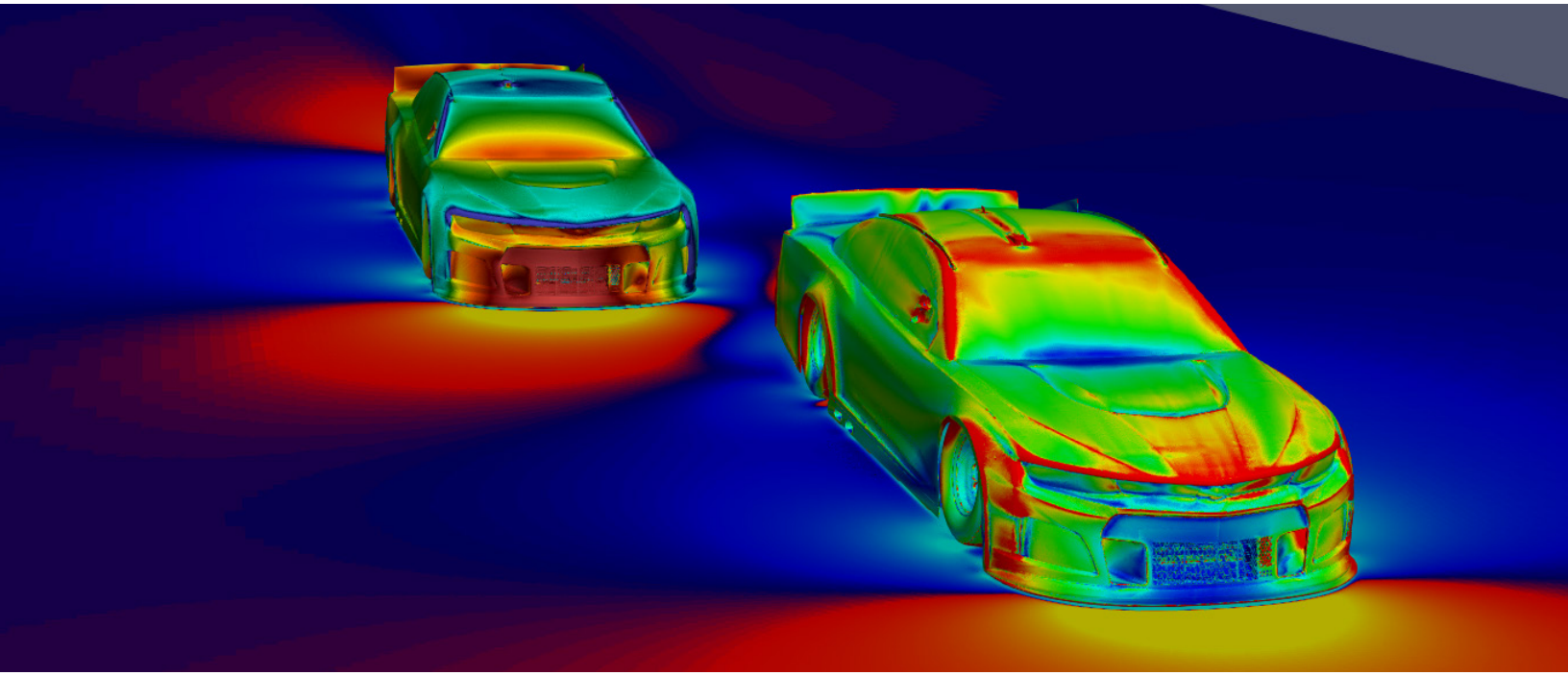
NIMBIX
CASE STUDY

Richard Childress Racing partners with Nimbix and ANSYS to improve the aerodynamic performance for its legendary NASCAR race cars



"Accuracy is very important to us. JARVICE™ and the Nimbix Cloud gave us the HPC resources to run computational fluid dynamics (CFD) simulations using ANSYS Fluent, which provides solutions with a high level of accuracy. Those results give us the optimal design to build, test, and take to the wind tunnel with confidence. When the results from the CFD simulations and wind tunnel agree, they eventually end up on the track. And when we've got cars in the winner's circle, that's when my job is successful."

Colby Mazzuca
CFD Engineer,
Richard Childress Racing

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INTRODUCTION

One of the most acclaimed organizations in NASCAR competition, Richard Childress Racing (RCR) is dedicated to using cutting-edge technologies to build winning race cars from the ground up. To stay at the top of the competitive racing industry, they need to make sure every part in every car is optimally designed. One way to do that is to run CFD analysis for aerodynamic simulations to ensure peak performance.

But RCR's expertise is in high-performance race cars, says Colby Mazzuca, CFD Engineer for RCR, not in writing simulation software nor in maintaining the high-performance computing (HPC) resources required to run it. RCR worked with ANSYS to develop its Adjoint Solver CFD simulation software, providing the extreme accuracy necessary to optimize the aerodynamics and component geometries of its cars. But they also needed a partner with an HPC cloud infrastructure able to handle those computations in a timely fashion—without the investment and maintenance required by an in-house solution. After partnering with Nimbix, RCR had the computing resources it needed to optimize its car designs even further—keeping the winner's circle squarely in its sights.

CHALLENGES

Building highly aerodynamic automotive parts requires a lot of design testing, both in simulations and in an actual wind tunnel. Before partnering with an HPC provider, RCR couldn't run the CFD simulations with higher mesh counts required to obtain the precision results it needed. As a result, it had to build and test more of their designs in a wind tunnel, a time-consuming and expensive process, considering using the wind tunnel costed $2,000 an hour.

RCR had previously outsourced running its simulations to a third party, but because RCR wasn't the firm's only client, its simulations would often be delayed while they waited their turn in the queue. And since the firm also had finite number of engineers and cluster time to apply to RCR's simulations, it often took multiple days from start to finish before RCR received its data.

TECHNOLOGY USED

RCR used the Nimbix Cloud powered by JARVICE to run ANSYS Fluent R2 and R3, specifically focusing on the shape optimization capabilities in Fluent Adjoint Solver for analysis of aerodynamic performance of its designs. By using the Nimbix Cloud and the Adjoint Solver, RCR was able to use a mesh count of over 615 million points to obtain a much greater degree of accuracy than with its previous provider using other simulation tools. These results provided RCR engineers with excellent design insights onto the shape-sensitive regions of the car, as well as guiding them to make intelligent design modifications and improve the external aerodynamic performance of RCR's cars.

For most simulations, the Adjoint Solver uses 400 cores. ANSYS engineers also ran multiple cases using 400, 600, and 800 cores to demonstrate the linear scalability of both the Nimbix Cloud infrastructure and the ANSYS software.

"Being able to do those simulations in-house on demand has sped up the process exponentially," says Mazzuca. "It literally went from days to hours. The data is often ready faster than I can be ready for it."

ENGINEERING SOLUTION

Using the Nimbix Cloud allows RCR to run its CFD simulations with a higher mesh count, to obtain results with accurate precision, and to give its engineers greater confidence in their designs. That translates to spending less time and money to build racing cars that need to be tested in the wind tunnel. Thanks to RCR's partnership with Nimbix and ANSYS, it can now:

- Run CFD simulations faster to improve the external aero dynamic performance, thereby improving speed on the track.
- Utilize more accurate simulation solutions and reduce the number of physical models (and cost) needed for wind tunnel testing.
- Bring new, improved designs to development faster based on the numerical data generated by the Adjoint Solver.

BENEFITS

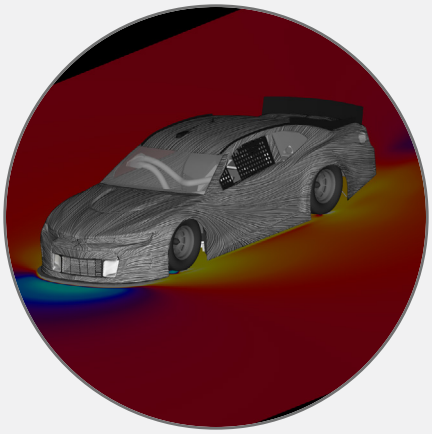
RCR engineers now perform CFD simulations in a matter of hours, not days, using the HPC resources of the Nimbix Cloud. Engineers are happy with the accuracy of the ANSYS Fluent Adjoint solutions, which are confirmed by data from wind tunnel tests, giving them the confidence to move forward with the results. Going into 2020, RCR foresees faster cars and more trips to the winner's circle, which will also have a positive effect on its bottom line.

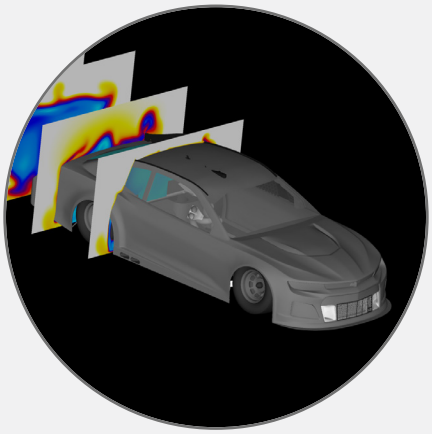
With Nimbix's user-friendly interface, designers who have lesser technical know-how have no issues using the platform. With a few clicks, they can spin up a cluster with the desired number of cores and memory to push their designs through—without having to learn the technical details of super and accelerated computing infrastructure.

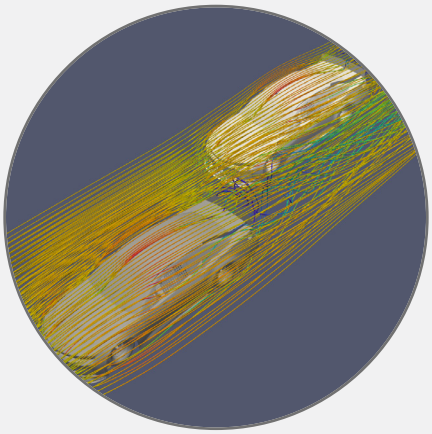
"Designers should be designing," says Mazzuca. "They shouldn't be maintaining infrastructure and figuring out how to deploy things. Partnering with Nimbix and ANSYS allows us to design more aerodynamic race cars, faster and more cost effectively, so we can keep our sites squarely on the winner's circle."

COMPANY DESCRIPTION

Richard Childress Racing (RCR) has been a NASCAR racing institution since its inception in 1969. Over that span, RCR has fielded teams in NASCAR's top three racing series', and its subsidiary ECR Engines builds engines for several other NASCAR teams. In its 50-year history RCR has won 15 championships and over 200 victories in NASCAR's top three series and is the first organization in NASCAR history to win championships across all three national touring series.







Using JARVICE and the Nimbix Cloud, Richard Childress Racing runs the CFD simulations and analyses required to test the aerodynamic performance of its racing cars.