TEAMWORK DRIVES RED BULL RACING

Success in Formula One requires an enormous amount of coordination. Collaboration between engineering, IT and manufacturing allows the team to innovate rapidly, introducing new updates between every race. Teamwork, technology and a single goal all contribute to on-track performance in a sport where success is measured in fractions of a second.

By Matt Cadieux, CIO; **Nathan Sykes**, Head of Numerical Tools and Technologies; and **Al Peasland**, Head of Technical Partnerships, Red Bull Racing, Milton Keynes, UK

The pinnacle of car racing is Formula One, and Red Bull Racing is among the elite. Although a relatively young team for Formula One, Red Bull Racing stands out for its success and innovative approach to racing. All 700 members of the Red Bull Racing family are integral to the success of the team. A commitment to using all available tools — from sensors to advanced analysis — provide the skilled and expert team with the ability to overcome more experienced competitors.

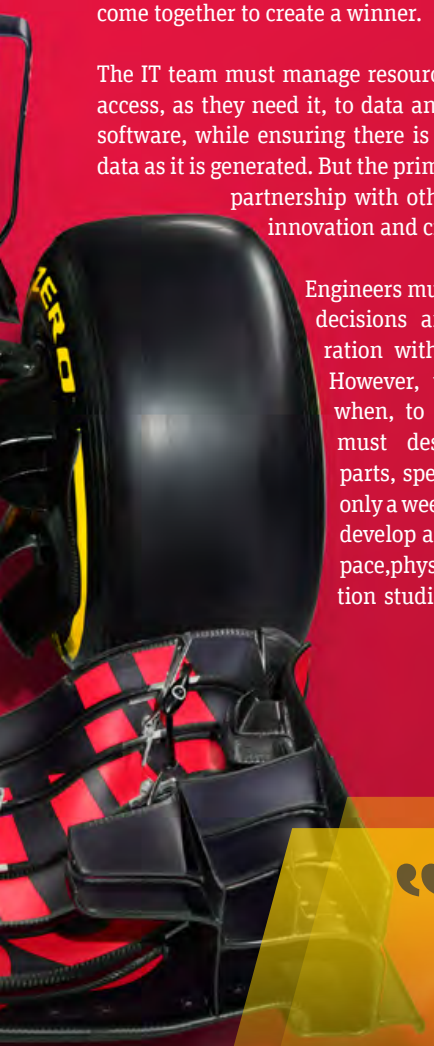
Teamwork Provides a Winning Advantage

To be successful throughout a race season, teamwork is a critical factor. Each of the racetracks is different, so after each race the team applies different configurations, to meet new specifications. This rapid pace of change rewards those who are able to quickly innovate and iterate to find the best solution. In an industry where development cycles are measured in hours and days rather than months and years, communication and collaboration are essential. Each Red Bull Racing employee has a specialty, and it is a substantial team effort to come together to create a winner.

The IT team must manage resources so that engineers have access, as they need it, to data and to simulation and other software, while ensuring there is sufficient storage for new data as it is generated. But the primary role of IT is working in partnership with other departments to ensure innovation and create a winning car.

Engineers must constantly make design decisions and trade-offs in collaboration with the entire organization. However, time is a limiting factor when, to be competitive, the team must design made-to-order new parts, specific to each race. There is only a week or two to design, test and develop all of these updates. At this pace,physical testing and validation studies are not always a viable option. A car is shipped to a race with dozens of optional parts and tested three times before the race — twice on the Friday before the race and once on Saturday, before qualifying, after which teams are not allowed to make further changes to the car prior to Sunday's race. Red Bull Racing relies heavily on engineering simulation — testing the design in a virtual environment using computers — to help steer the design changes for the car. The short timeline means the Red Bull Racing team needs to have confidence in the engineering simulation.

During the trial runs before a race, the driver's input regarding the car's performance is vital. If he is not confident in the car's performance, then he will not push the car to its absolute limit, and the performance of the car and the team suffers. Drivers need to be aware of the enhancements made to the car, and driver input on what works and what doesn't is important for the engineering team.



Red Bull Racing Driver
DANIEL RICCIARDO

"Speed is really important and it's not speed just on the track, it's speed of our development process."

—Matt Cadieux, CIO, Red Bull Racing

The teamwork goes beyond the direct Red Bull Racing employees to include coordination with technical partners like ANSYS. ANSYS engineers work on-site with Red Bull Racing engineers to ensure that the team gets the most out of the software. ANSYS is invested in what Red Bull Racing does and is part of the team. Red Bull Racing's partners must provide suites of technology, fully integrated solutions, and results that are cutting edge and best in class.

Driving Down Lap Times

The airflow around the car is a major factor in how the car performs during a race. The car needs to be aerodynamic to quickly cut through the air, but the driver must maintain control. In addition, airflow is vital to cool the brakes and the engine, and to create downforce to keep the car on the track.

In the "old days" of Formula One, development was heavily focused on the wind tunnel. To maintain the competitive nature of the sport, regulations change frequently, and the amount of wind tunnel testing is restricted by F1 regulations. In addition, wind tunnel testing is cost-prohibitive and cannot always keep up with the pace of innovation because physical models for wind tunnel testing require time and money to build. It would be difficult to remain competitive in today's environment without employing simulation to help guide development and reduce the time between design iterations. Without simulation, the tweaks made to the cars between races would need to be smaller because their effectiveness could not be easily tested. In addition, simulation gives engineers the ability to see the entire air flow around the various elements of the car and even determine how the air is reacting downstream.

Simulation is vital to Formula One racing. It allows teams to test design changes quickly in a virtual environment. A generic simulation is shown.

Using ANSYS software, Red Bull Racing can quickly run through each development on the car and make multiple iterations on those changes each day. This allows the team to make more substantial improvements that are apparent in the wind tunnel and on the track.

Leveraging the Internet of Things

Formula One racing is one of the most technologically driven sports. It requires optimizing the system of car and driver to reach their full potential. It is a data-driven business, and often races can be won or lost by the work that goes on before the team even arrives at the racetrack. The car is improved based on all of the available information and tools, and tuned to the individual driver. The consequence is that Formula One teams like Red Bull Racing have long been taking an Internet of Things (IoT) approach to instrumenting and analyzing their car.

The cars are fitted with hundreds of sensors measuring every element of the car's performance. This real-time data is used to micromanage the car, to provide advice to the driver (for example, when a pit stop is required) and to get the most out of the car during the race weekend. This data helps ensure that the driver and the car are optimized as a system. It also assists the team in assessing the health of the car and predicting any reliability issues before they become a problem. This data is fed back to the design engineering team to use as simulation input to optimize the car's future performance.

> *"Success is making sure that every component that hits the track works and takes us forward, which means we are out-developing the competition."*
>
> **—Nathan Sykes, Team Leader for CFD and FEA**

Teamwork, technology and a single goal all contribute to winning in a sport where success is measured in fractions of a second.

A Single Goal

Success is winning points on the racetrack and ultimately winning championships. Red Bull Racing has been fortunate to have been very successful for over a decade, with currently four World Championships.

Success on the track stems, in part, from pushing the business quickly and efficiently, and being agile enough to adapt to changes during the season. Winning with technology means having the best possible development process to efficiently design the fastest car. This means ensuring that you trust and understand your tools and processes.

On-track success requires collaboration at every level within the team — driver skills, engineering expertise and supporting service. Teamwork within the entire Red Bull Racing drives on-track performance.

Matt Cadieux

Al Peasland

Nathan Sykes

Red Bull Racing at a Glance

Employees: 700 Headquarters: Milton Keynes, UK First Season: 2005