

From virtual to real in one adrenalin rush

NX and Teamcenter are the digital backbone for a 600-strong team focused on strength, speed and spirit

Business challenges

Success in Driver and Constructor World Championships

Keys to success

Collaboration within a concurrent, virtual world

Parametric modeling within NX to enable easy experimentation and swift prototyping

Conclusive testing before cutting metal or laminating carbon fiber

Digital data that drives in-house and supplier manufacturing

Integration of design and manufacturing within a single BOM environment

Results

Proposed changes reviewed in 3D

Modifications made rapidly

Manufacturing time cut to hours and supplier parts quickly available

Better racing performance

RED BULL RACING

Unrelenting focus on evolution and innovation

"There's no room for complacency in this sport," observes Christian Horner, team principal of Red Bull Racing, after the team finished second in the 2009 Championship. As he spoke, the team was already manufacturing its 2010 car, because Formula 1® success demands an unrelenting focus on evolution and innovation.

"We talk about racing 'cars,' but they cannot really be compared with what we drive on a normal road," comments Steve Nevey, Red Bull Racing's business and technical development manager.

"The flow of air over, under and through a racing car determines its ultimate speed and the way it functions, for example the engine is fed and cooled by airflow. The emphasis on aerodynamics and weight means that we are designing and manufacturing technical machines that are closer to an aircraft than a saloon (sedan) car. They are finely balanced to begin with and then continually refined for speed and accuracy."

Red Bull Racing's development process has to be as swift and precise as these amazing vehicles and the company rely on NX™ software for CAD/CAM/CAE and Teamcenter® software to capture and manage knowledge. It is a creative and collaborative, virtual world from which the real, live car emerges almost fully formed and ready to be put to the test on the track. "We call it our digital backbone," says Nevey. "NX and Teamcenter sit at the heart of the company and they feed data to our manufacturing facilities; we could not manage without them."

Rigorous and dynamic regulations

Design of the car begins with the overall aerodynamic package and what is referred to as the chassis: the carbon fiber survival cell in which the driver sits. The engine is bolted to the back of the cell and the gearbox attached behind the engine. Systems such as hydraulics and suspension need to fit in and around these components, with the radiators being positioned on either side of the driver.



Testing the RB6.

PLM Software

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*Steve Nevey
Business and Technical
Development Manager
Red Bull Racing*

Formula 1 regulations are refined each year and the design has to meet rigorous criteria. Major changes were instituted for the 2009 season and one of the challenges for 2010 is how to manage the ban on refueling during the race. This means that suspension, transmission and braking systems all have to be fortified to carry a high-capacity fuel tank that is longer, wider and heavier as it must carry twice as much. A continuing requirement for 2010 is that the gearbox has to last for four races so, with the additional fuel, it has to be even more robust, yet as light as ever. In addition, the Restricted Resource Agreement introduced by the Federation International de la Automobile (FIA) is essentially a budget cap, which means that overall efficiency in the design and production process needs to be at the top of the agenda.

The design also has to accommodate the unique properties of each Grand Prix® location. Clearance from the ground, known as ride height, is on average 5-6 centimeters (cm), but this figure needs to be varied according to the relative smoothness of the track, as does the stiffness of the suspension. Aerodynamic downforce, which pushes the car onto the ground, also needs to be modified via wing size and angle. On bumpy, twisty circuits such as Monaco, where downforce is critical, the wings need to be higher. On circuits where there are many straights, such as Monza, then the wings can be shallower to support sprinting. Nevey notes, “It’s a constant battle between downforce and drag.”

The car is therefore designed as a complete kit: a core product with a range of interchangeable parts that act as alternative build options for different types of terrain. “We end up with a huge bunch of bits,” says Nevey. “We initially had a dilemma as to what actually constitutes a bill of materials (BOM). After considering our options we decided to think in terms of the whole BOM, so instead of creating different suspension assemblies, for example, we have one that incorporates different springs, dampers and roll bars.”

Race, review, modify and manufacture – all in a week’s work

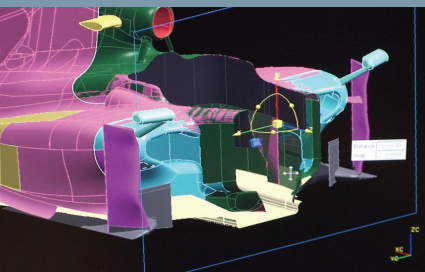
In addition to planned adjustments, the design team of 180 NX users is on the alert to make performance-enhancing modifications after every race. There is a continual fine-tuning of the design and any amendments have to be driven from the discussion stage through implementation, testing and manufacturing in the space between races. Sometimes this can be as little as one week and parts are often carried to the circuit within hours of the starting lights going out. There is no room for error or delay. “NX allows our 180 designers to operate in a virtual world, shaving time off at every step,” says Nevey. “NX is an excellent NC programming tool and members of Siemens’ professional services team have been brilliant at helping us to get the most out of our tools. They have, for example, demonstrated



Race bays at Milton Keynes Factory, where everything comes together.



Design engineer at work.



NX software display.

Solutions/Services

NX

www.siemens.com/nx

Teamcenter

www.siemens.com/teamcenter

Support services

Client's primary business

Red Bull Racing is a Formula 1 team, established in 2005.

www.redbullracing.com**Client location**

Milton Keynes
United Kingdom

"We need to concentrate on racing so we need partners who understand our business and can advise us on the best tools and methods. Siemens is a true 'Innovation Partner.'"

Steve Nevey
Business and Technical
Development Manager
Red Bull Racing



Testing Day – RB6 February 2010.

how to make the most of parametric modeling when we are still at the experimental stage and how to adopt new methods. One of these is the use of stereolithography whereby CAD data is used to 'print' on a tank of liquid resin, solidify certain areas and build up a 3D prototype by creating successive layers."

Size is significant. Nevey explains, "We are dealing with around 15 major assemblies and about 4000 parts. The most important element is that our hundreds of engineers and technicians have access to the same accurate data and designers are aware of each other's changes. With NX and Teamcenter we can see only what is right." As NX feeds Teamcenter, Teamcenter feeds Red Bull Racing's enterprise resource planning (ERP) system and this enables the BOM to be directly carried over into manufacturing. "For us that means that there is no duplicated input. As soon as a design is released it automatically becomes a BOM," says Nevey. "Working in a single BOM environment like this we always get accurate and consistent assembly data."

Responsible energy consumption

While the burning of fuel attracts obvious attention in a Grand Prix, there is a whole story about the responsible use of energy behind Red Bull Racing's podium wins. "I defy anyone to find a more energy efficient internal combustion engine," says Nevey. "The technology that goes into our pursuit of performance eventually spills over into other fields. At the same time we are working with Siemens to make our factory buildings smarter, optimize our production environment and minimize energy use in the whole development process."

Red Bull Racing is constantly looking to see what it can improve on and off the track. "We need to concentrate on racing so we need partners who understand our business and can advise us on the best tools and methods. Siemens is a true 'Innovation Partner,' putting in a great effort. The Siemens guys have come in here and identified problems we did not even know we had. They want to see their products work and the support we get is great."

Speed

Ultimately, all this work behind the scenes has one purpose: shorter lap times. A design change that drops the lap time by a fraction of a second can determine the race. The digital lifecycle management and visualization capabilities of Teamcenter complement the knowledge-driven automation capabilities of NX. Both work in sync to provide an integrated design-through-manufacturing environment – and advantage – to Red Bull Racing.

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