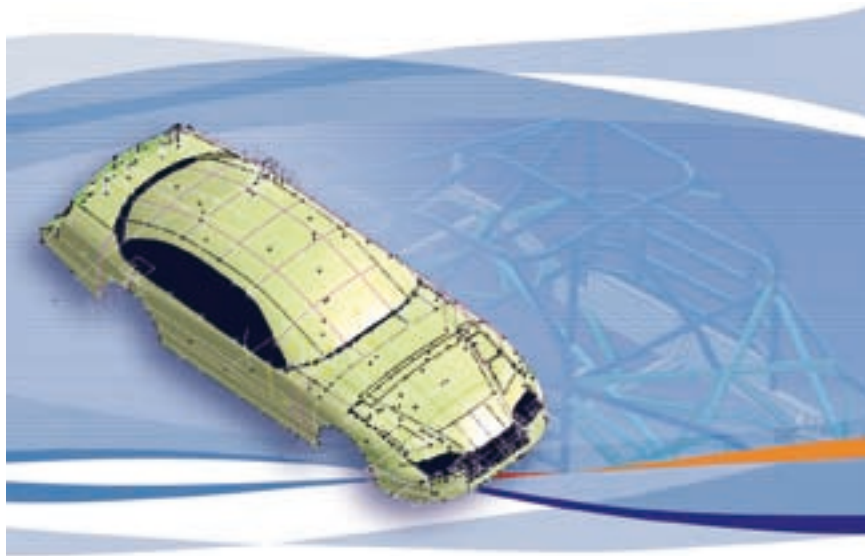


Evernham Motorsports engineers a winning program with CATIA V5 and SMARTEAM



“Try importing a 20-million-point cloud into most systems and they will choke and die. We knew CATIA V5 and SMARTEAM could do the job.”

– Dr. Eric Warren, Technical Director, Evernham Motorsports.

Overview

■ The Challenge

To achieve its goal of excellence through engineering, NASCAR team Evernham Motorsports needed to replace a mixture of mismatched engineering tools.

■ The Solution

Evernham chose IBM Product Lifecycle Management (PLM), including CATIA V5 and SMARTEAM from Dassault Systèmes, for their engineering power and data exchange capabilities with Dodge, its primary sponsor.

■ The Benefit

IBM PLM solutions allow Evernham to quickly respond to NASCAR rule changes, exploit simulation and analysis to maximize each car's performance, and cut cycle times by 50 percent.

An engineering-centric philosophy

In the competitive world of NASCAR racing, the difference between first and last place is fractions of a second per lap, a gap that Dr. Eric Warren, Technical Director of Evernham Motorsports, knows will only get smaller.

“As they tighten the rules, it becomes more important to understand how the car works from an engineering perspective,” Warren says. “When the difference between first and last place is 2/10ths of a second per lap, trial and error in the shop or on the track no longer works.”

Officials at Evernham Motorsports therefore believe mechanical prowess, the sport's traditional source of advantage, is being surpassed by engineering excellence. The company, founded in 1999 by Ray Evernham, legendary crew chief for NASCAR superstar Jeff Gordon at the height of his success, is one of NASCAR's first engineering-centric organizations.

"I actually oversee the construction of the cars, which is unusual," says Warren, an aerospace engineer by training. "That's traditionally the crew chief's or team director's responsibility. It reflects that we're an organization founded on engineering."

Engineering a winning record

Evernham Motorsports operates two teams sponsored by Dodge and will add a third Dodge team, sponsored by Valvoline, in the 2006 season. Like Dodge parent DaimlerChrysler, Evernham relies on IBM PLM, including CATIA V5 and SMARTEAM from Dassault Systèmes, in its engineering program.

Warren and Evernham believe the company's quick rise to the top of the NASCAR leader boards reflects its engineering focus. In just its fifth season, Evernham's Number 19 Dodge Charger team was in the Nextel Cup championship chase for the second straight year, finishing the year in 9th place in the overall championship.

"If you look at the top NASCAR organizations, we've reached this point at a much faster pace than anyone that came before us," Warren says with obvious pride. "We think it shows our philosophy is paying off."

An integrated solution for an integrated strategy

In NASCAR, the need for speed on the race track is rivalled only by the need for speed in engineering. Evernham's teams turn out a new engine design every four months. A body configuration lasts no more than two months. Construction of a car, start to finish, can take as little as 18 days, including building a chassis from scratch and custom-forming most of the sheet metal for the body by hand.

But when Warren joined Evernham Motorsports in 2002, he inherited a mismatched set of engineering tools that couldn't keep pace. It didn't take him long to replace those tools with IBM PLM, including CATIA V5 and SMARTEAM from Dassault Systèmes.

Since then, the system has cut weeks off some tasks while enabling others that were simply impossible before. "To scan 20 million points into our old Imageware package and build a surface would have taken us at least two weeks, and we probably would have been forced to break the digital model into pieces and then reassemble it, which always means errors," Warren says. "CATIA V5 can handle the entire data set, so now we can do that same work in something like four days" – an improvement of more than 70 percent.

SMARTEAM, meanwhile, intelligently stores, maps and tracks all of Evernham's CATIA V5 product designs and related engineering data, allowing quick access to specific knowledge from the company's voluminous database. SMARTEAM also provides the proper structure and context for all data, enhancing Evernham's ability to iterate from existing designs and freeing time for innovation.

Engineering for every advantage

Steve Oliver, Deputy Director of Design Services, is in charge of Evernham's engine development program. His team's mission is to produce more horsepower with less weight, an endless cycle of designing, analyzing and machining parts dozens of times daily.

"We used to design in one package, analyze in another and machine in a third, and they all had different user interfaces," Oliver says. "With CATIA V5, it's one click to move from design to analysis and then another click to move to NC programming. That's invaluable because each one of our engineers performs all three tasks, and they only have to learn one user interface. A lot of packages – even CATIA V4 – are really good at only one or two. CATIA V5 is great at all three. It has cut at least 50 percent off our development times."

Oliver's engineers spend their days asking 'what if?' in a rapid-fire cycle that searches for any fractional advantage. The faster they can move between design, analysis, NC programming and back again, the better their chances of discovering a major breakthrough that will pay off on the track. "We're constantly iterating to get more power," Oliver says, "and we push all the parts to the limit all the time."

"Pushing all the parts to the limit" explains why the accuracy of Finite Element Analysis (FEA) in CATIA V5 is so critical. Oliver says, "Because we design, analyze and do the machine programming, we're not analysis gurus. When we first started using FEA in CATIA V5, it was so easy compared to what we had used before that I was worried, frankly, about how accurate it would be. But when we put the parts on the track, our models and the FEA correlate exactly with where we see failures. To get such accuracy from a bunch of generalists using a tool as easy as this one – it's truly phenomenal."

When someone on the team discovers a power-boosting design, the ability to immediately machine that part in-house is another competitive edge, Oliver says. "If we find a substantial power gain, we make 60-80 sets immediately to get it on all the engines, and CATIA V5 speeds that process significantly."

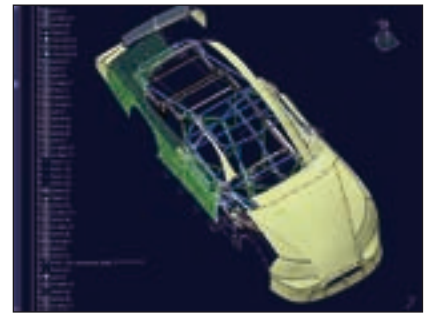
Precision that pays

Evernham Motorsports pairs the knowledge of its engineers with the precision simulation capabilities of CATIA V5 to identify the minute combinations of changes that generate victory on the track.

"If you're testing on the racetrack, environmental variations such as wind and tire wear limit your repeatability," Warren explains. "You can't tell if you've actually found improvements worth 2/10ths of a second because the measuring stick changes with each run."

Armed with a precise digital model of a car, however, Evernham Motorsports' engineers can use structural, aerodynamic and vehicle dynamic analysis and packaging studies to prove out the best configurations. CATIA V5 data can even be used in another custom software tool that models each racetrack on the NASCAR circuit, allowing the team to see how a design will perform under specific track conditions.

Digital simulation is not only more accurate – it's more available. As NASCAR cuts back on the amount of on-track testing each team can perform, simulation must pick up the slack. But when the team does get a chance to test on the track, their digital models and data can go with them.



Evernham's mobile units, known as transporters because they are used to transport race cars to the track, are networked back to the computers at Evernham headquarters. "All of our CATIA data, plus a lot of other data, is stored in SMARTEAM," Warren says. "Using SMARTEAM Web Navigator, we can link from our trucks, transporters and facilities at the track to our database of information here at the shop. If we want to pull that data into a specific track simulation, we use SMARTEAM for access."

Every team director and driver receives detailed briefings using track simulations to illustrate how the engineering choices combine to deliver top speed. "We spend a lot of time with the driver, explaining to him what each change will do and why, particularly when the change is not intuitive because it's the culmination of three or four factors," Warren says. "It helps the driver and team director, when they're in a race and have to make a judgment call, to make the right one."

Engineering at the speed of NASCAR

Each time an engineer makes a change, CATIA V5 automatically adjusts all interrelated parts and systems, saving time and ensuring consistency. SMARTEAM manages versions and variations, allowing engineers to track what has been tried before and quickly revert to a previous design if a change doesn't deliver the anticipated results.

The system also facilitates quick changes based on knowledge gained from a recent race or in response to a NASCAR rule change. Warren cites a recent case in which NASCAR changed the limit on camber angle of the wheels, just after Evernham had completed its track tests for an upcoming race. With just a few days of notice, the team re-designed the suspension to deliver the same performance under the more restrictive rule.

"Because we had the CAD models stored in SMARTEAM, we could make the changes immediately and verify that they would deliver the performance we wanted," Warren says. "If we'd been forced to do it with our old technology we probably could have, but we would have had less assurance going into the race that we'd achieved our goal."

Forging into the future

Although many traditionalists may reject Evernham's engineering focus, Warren believes the company is helping to forge the sport's future. "Our intent is to prove that engineering is central to the process, not an add-on or afterthought," he says.

"Some of the teams that were dominant in the past are now weak because they didn't keep up with the times. NASCAR as a whole is resisting the technology because their goal is to make everything equal. We're aiming to be better than equal and the technology supports that."

Evernham Motorsports' future, Warren believes, lies in building its technological capabilities both broader and deeper. "We don't claim to have it all figured out or we'd win every week," he concedes with a chuckle. "But we're confident the more we learn, the more often we will win."

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