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PLM MAKES JIMMIE JOHNSON GO FAST

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NASCAR frontrunner credits product lifecycle management for unbelievable winning season on the track.

Jimmie Johnson, a shoo-in with an 86-point lead, is expected to win his second consecutive NASCAR Nextel Cup Championship at the Ford 400 in Miami this Sunday. The tens of thousands of fans who attend the race, plus millions more who tune in to watch on television, will see him compete in his now famous No. 48 Chevrolet Monte Carlo with the huge LOWES logo emblazoned on the hood.

What the fans may not notice, though, is a small "Siemens PLM Software" logo on a window pillar of the car. And what they may not know is how heavily Johnson's racing team, Hendrick Motorsports, has depended on the vendor's product lifecycle management software to propel the organization—and Johnson himself—to first place in NASCAR both this season and last (see "Hendrick Gets Up to Speed," Baseline).

PLM is an extension of CAD/CAM engineering software that enables the real-time design and manipulation of complex equipment. These software packages track where and how parts are used, and allow designers and engineers to collaborate on changes, which saves time and money in making design adjustments.

Manufacturers use PLM systems for product design, engineering changes, bill of materials management, and overall tracking of products from conception to recycling. PLM software is especially useful for manufacturers launching a new product, such as a new engine and chassis for an automobile. For instance, electric-car startup Tesla Motors this week announced it had chosen Dassault Systemes' CATIA PLM Express for product development.

Throughout this season, the Hendrick team has relied on Siemens' Teamcenter software for the mechanical dependability to manage scores of race cars and hundreds of engines. Johnson, in turn, has used this newfound performance—and confidence—to achieve one of the most successful racing seasons of any NASCAR driver, with 10 wins and 20 top five finishes.

Johnson isn't the only Hendrick driver to take the winner's flag this season, with former champion Jeff Gordon also contending for the Nextel Cup title as late as the Phoenix race last weekend. Johnson's win in that race, of course, gave him a nearly insurmountable lead and lock on the championship, barring an unlikely no-finish on his part.

Going into the final Nextel Cup race at the Homestead/Miami Speedway Nov. 18, Hendrick drivers had racked up 18 wins,

the racing organization's most successful season ever. Before Johnson's victory at Phoenix Nov. 11, the two Hendrick superstars had amassed 16 wins and 40 finishes in the top five.

The Car of Tomorrow

The Hendrick achievement is all the more remarkable coming in a race season when NASCAR was switching car and engine platforms. NASCAR began a shift to the new "Car of Tomorrow," using it in 16 of 36 races in 2007. The basic engine and chassis are designed to make the cars safer and more cost-effective.

While most of the NASCAR teams struggled just to get ready for the first Car of Tomorrow race at Bristol Raceway last March, Hendrick stood out from the pack, having the new car's engine and chassis nailed from the starting flag. Hendrick drivers blasted off the starting line, winning the first five Car of Tomorrow events, and eight of the first 15. Most of the other racing teams didn't fully commit to the new car until after the season began, when NASCAR announced it would use the Car of Tomorrow full-time next year. Since then, five other teams won seven of the last 11 Car of Tomorrow races.

Consistent success in the world of racing today requires not only the best drivers but the best cars, technologies and management teams. With the introduction of the Car of Tomorrow, the demands on the engineering and mechanical teams supporting the Hendrick drivers were more daunting than ever.

"We've had a lot of change this year, but dealing with the new Car of Tomorrow has definitely been a tremendous challenge," says Jim Wall, engineering director at Hendrick, a racing organization with more than 500 employees based in Charlotte, N.C.

For one thing, Hendrick had to quickly get up to speed with the new RO7 engine, which becomes the new power plant for all teams using Chevrolet engines. It replaces the old standard SB2, the small-block Chevrolet motor NASCAR has used since the mid-1950s. Other teams made a similar shift to newer Ford or General Motors engines and chassis.

Hendrick's engineering department uses the Siemens PLM system to track the entire bill of materials—essentially all parts and components—used in its three families of engines for race, test and mockup.

"Being able to take the information on the new engine as it came in and put it in the system from the start was a big benefit to us," Wall says. "In the past, a lot of SB2 information was legacy information we had imported from various locations on the Hendrick campus. It was nice to only have to file information one time and have it in the database ready to be shared and leveraged" by the mechanics and the race teams.

Speed and Consistency

A key benefit of the PLM this year and in Johnson's Nextel Cup Championship last year was Hendrick's ability to guarantee drivers that every engine the mechanics rebuilt each week was almost identical in output.

"We try to make every engine on our weekly build cycle so it does perform the same," Wall explains. "We have about a one percent performance variation, and our goal, which I think we are getting pretty close to, is to get it down to half a percent variation, which is about plus or minus four horsepower."

The consistency of the engines as well as the overall dependability of the cars fielded by the Hendrick engineering team enable Johnson and the other team drivers to not only know the exact performance capability of their cars every week of the season, but to be able to depend on them in the final laps of a nose-to-nose race.

"We rebuild the engines each week so every driver has what we call a 'fresh' engine, so their chances of making it to the end of the race are really good," Wall adds. "We completely disassemble it and replace any components that are cycled out."

PLM also allows the racing organization to unerringly track even the smallest mechanical problems—a bit of rust or a loose part—from the time they're noticed and fed into the system to the time they're fixed—either internally or by action from the parts manufacturer. Both the drivers and the engineers can log problem reports into the PLM.

"Last Sunday at Phoenix we had to make changes because a couple of components were out of specification," Wall says. "We swapped them out at the track, because we were afraid of a durability issue coming up during the race."

Each week, Wall and his engineering and mechanical staff tackle the problems reported in the system by drivers and other staff members the prior week.

"It could be a supplier's problem, with a part out of spec," he says. "Or it could be something we did wrong internally. It may require a redesign of a part, or using a different material to avoid a failure. We log in a tremendous number of problems in our database."

Typical problems logged in 2007 are an improper materials change, bent parts, out-of-specification seals, defective cables, cracked pats, components developing excessive heat, and materials flaws. Since Hendrick began using Siemens' Teamcenter three years ago, it has logged 1,500 problem reports, including 600 in 2007.

"The PLM system gives us and our drivers more confidence," Wall says. "It's our technical memory. Each car and part has a searchable, indexed history."

One problem the staff discovered was a small external retaining ring on the engine's rocker arm assembly that was just a hair too big. The four-cent part could break off and float around in the engine. Hendrick's solution was to have its supplier purchase a 10-cent part built to military specs.

"The opportunity cost in the race can be huge if you have a very costly failure," Wall says. "A four-cent part can cost you the Daytona 500 or the Brickyard 400, or even the NASCAR championship. Everybody makes mistakes, but when we have a failure, we fix it and go forward. Mr. Hendrick is not so patient if you make the same mistake twice."

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