COMPANY

Nissan Motorsport

LOCATION

Australia

SOFTWARE

Autodesk® Product Design Suite
Autodesk® Simulation
Autodesk® Vault
Autodesk® Inventor®
Autodesk® AutoCAD®

Nissan Altima Ready to race in just 8 months

A fully integrated Autodesk digital prototyping design environment enables Nissan Motorsport to meet "impossible" deadlines

The availability of the Autodesk digital prototyping software has allowed us to do things in a half or a quarter of the time it used to take, but speed is not the only issue here. If we had managed to build our car and get it to the track for the first race and we suffered a whole series of failures, then any time-saving would be put into sharp contrast. We need to be 'right the first time' and 'reliable the first time' otherwise any time-saving is a waste of effort. Autodesk Simulation is key to reliability.

—Todd Kelly
Owner, Driver and Director
Nissan Motorsport

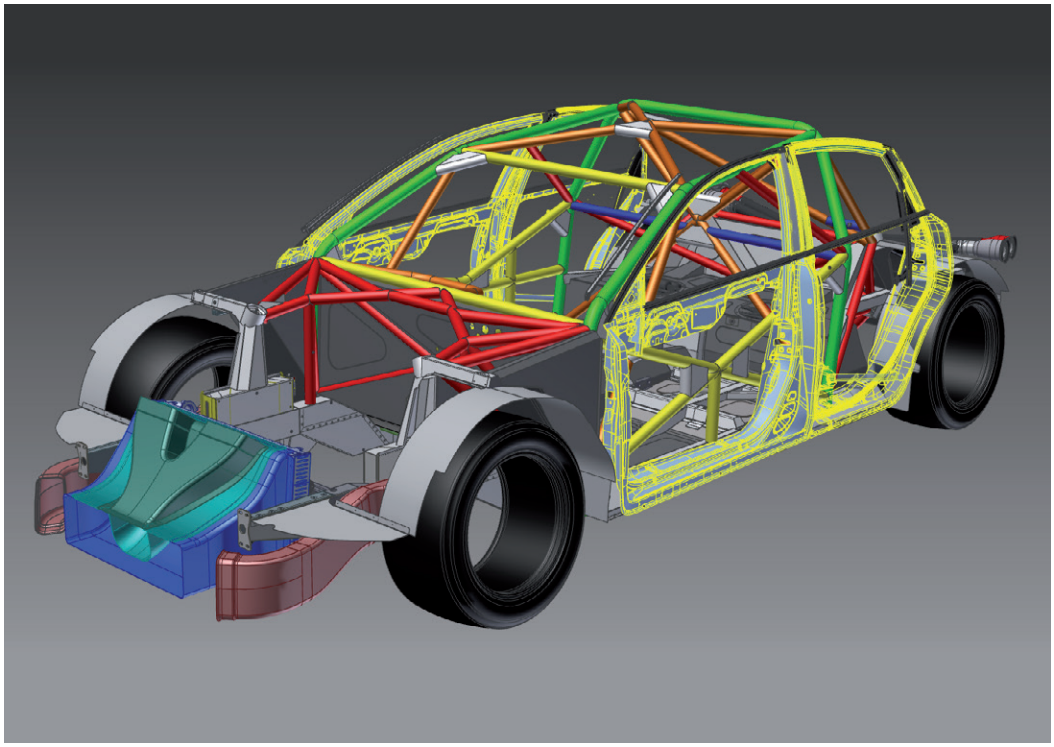

Image courtesy of Nissan Motorsport.

Project summary

In a bid to race in the worldwide V8 Supercar Championship, Nissan engaged Kelly Racing, Australia (now Nissan Motorsport, Australia) to design and build a racing version of the Nissan Altima to compete under the new Car of the Future (COTF) V8 Supercar Rules. When the relationship was set up, it only left eight months to design and build the four cars to race in 2013.

"When we got the deal with Nissan we didn't have any CAD of the Nissan Altima or the engine and we only had about 8 months to do the job," says Kelly. "We had to go from scratch to get the first car on the track and it took about 24,000 hours. If we didn't have the technical capability in-house using world-class productive software, we would have been in big trouble. Without Autodesk digital prototyping we wouldn't have been able to get the first car on the track."

The challenge

It's quite normal to have six to eight months to design a new car in the leading motorsport categories, but Nissan Motorsport had to design and build a totally new car, to new rules and modify an existing production engine, the Nissan VK56DE, at the same time. To some extent if you say it quickly that doesn't sound too bad, but in reality the team had to come up with a design that they were confident they could race competitively. This confidence had to extend to being able to make or order enough of the new parts to go racing for a whole season. And this with virtually no opportunity to do any physical testing of the parts or the assembled cars.

"Because of the shortened timescales virtually everything in this car was a one-off we didn't have the time to go through several iterations," says Alex Somerset, Nissan Motorsport's Chief Designer.

AUTODESK.

"The only way that we can move as fast as we do, is by having quality engineers and an experienced knowledge base backed up by state-of-the-art Autodesk digital prototyping software," says Kelly.

"So we basically launched a car that had about 80% of its potential at launch. We know that, and we accept that - it's far better to have an 80% car running than 100% car not making the first race. We are now beginning to do some of the development work that we couldn't do in our journey to the first race."

The solution

"Nissan Motorsport has 10 seats of Autodesk Product Design Suite and manages data with Vault, which means that most people have the opportunity to access the designs even in the machine shop," says Somerset. "We have instances where the people in the machine shop have identified elements of a component that could be machined more effectively in slightly different ways. So they can make the change to the model and pass it back to the engineer for sign off in an effort to make the whole manufacturing process more efficient. Everybody in the organization is acquainted with the software so they can readily communicate with each other. We use Inventor files in the same way that more administrative organizations communicate using Microsoft Office files."

"We have also tried to get away from a paper-based design and manufacturing environment," says Somerset.

"We want everybody communicating with the digital prototypes so that actual changes get made to the models directly, rather than risking cumulative errors by passing paper around to make changes."

"This works as long as the design environment is implemented with discipline and the right procedures are in place. This makes sure that the appropriate checks and balances are made in every instance and appropriate levels of sign off still included in the process," says Somerset.

The results

"Because of the availability and the integration of the software we managed to reduce the occurrence and the impact of mistakes in the manufacturing process," says Somerset. "This is critical especially in our initial design and build process where 'right first time' is mandatory - it's not an option. We have not eliminated all mistakes because that's impossible in a business that's moving as fast as ours, but it is possible to minimize mistakes and mitigate their impact using Autodesk digital prototyping software across the business. The great thing with integrated software is that data is entered once and then it can be transferred to other processes.

> Motorsport is very closely linked to sponsorship, we wouldn't be able to retain our sponsors if we were continually failing on the track. There are so many parts that have the potential to fail, so if we didn't have the capability to design and simulate them to ensure that they would be adequate for their job it could threaten the future of our business.
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> **—Todd Kelly**
> Owner, Driver and Director
> Nissan Motorsport

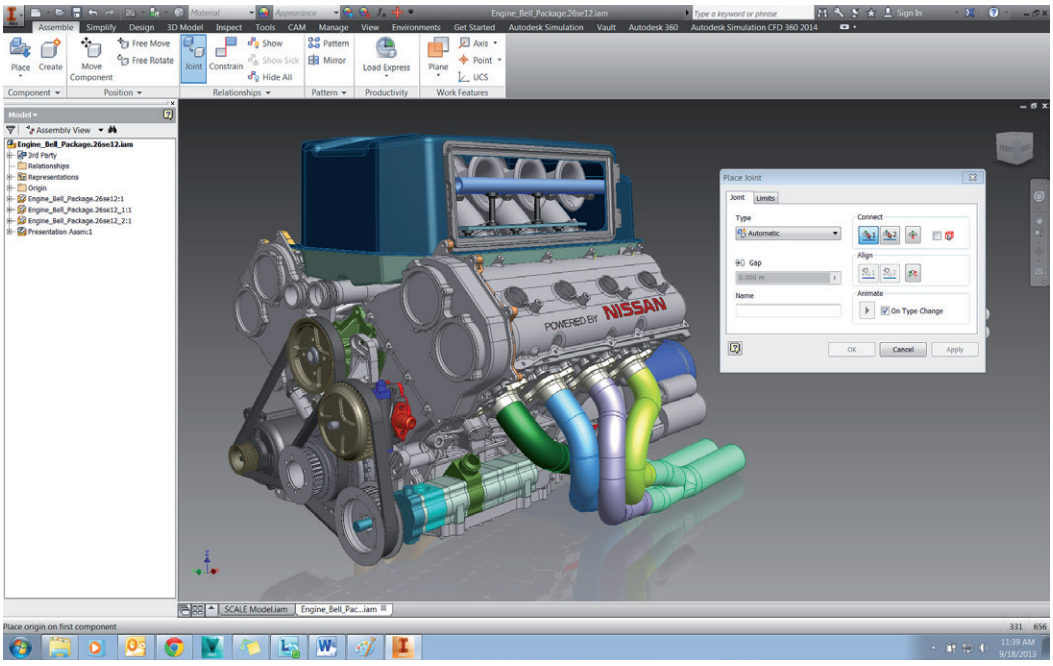

Image courtesy of Nissan Motorsport.

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Also you can update a part very, very quickly and using the Vault software there is no possibility of making the wrong revision of a component. If you update a part, Product Design Suite also updates every instance of that part in assemblies and subassemblies. There is no possibility of using out of date parts. These are essential features in our high-pressure environment."

"The Autodesk digital prototyping software was instrumental in the engine development efforts. The ability to design and review components quickly was essential in such a protracted programme," says Kelly. "Having all the engineers familiar with the software is also very important, because it provides them with a communication platform that needs very little additional explanation. It is possible to have several people moving the same job or part of the project forward. So a single digital prototype can be handed from one person to another within the development process, without wasting time getting the new person up to speed with the component. We can pass around Inventor files like other organizations pass around Word files. Having the whole design team up to speed with Product Design Suite makes a huge difference in how we prioritize and get jobs done much more effectively."

"Typically we go to each race weekend with one or more new parts designed to make the car more reliable or faster," says Kelly. "Racing is about constantly evolving design for better reliability or performance and unlike any other industry we have only a couple of weeks between races to produce sometimes a completely new and race-critical part."

"At the end of one such weekend we identified the dry sump system as an area where the performance was lacking," says Somerset, "We selected the various elements we needed to improve and got to work."

"In relation to the redesign of the dry sump, it was quite a complicated modification that we proposed, which probably involved a week to week and a half in design," says Kelly. "In the latter part of that process we ordered the material and in three weeks we expected to have a part to fit to the car. We developed an interesting digital prototype using CFD (Computational Fluid Dynamics) simulation to validate the concept. Most people in our industry wouldn't really associate CFD with sumps even though hot oil is a fluid with computationally relevant characteristics. It's absolutely critical that the flow through the sump is appropriate to what we're trying to achieve. When we get this right it has the capacity to increase engine performance and ultimately straight-line speed."

"The key in this operation is that the people doing the work are actually very experienced people," says Kelly. "So it is possible to do the redesign, the CFD simulation and the machining in three weeks because of the quality of the people doing the work and having ready access to powerful software."

"Without this it could take up to three months and probably two or three prototypes before arriving at the final design for the new sump. As things are, with digital prototyping we can fit the part to the car in three weeks and it will probably stay on the car for three years."

"The Autodesk Simulation tools for CFD are very exciting because a relative novice user can get the basic model to solve and you only need an aerodynamics (CFD) specialist involved to apply the right boundary conditions and interpret the results," says Somerset. "But getting a basic model to solve and generate some downforce results only takes a matter of minutes."

"The dynamics simulation and stress analysis of the whole car is the area that I would like to concentrate on next," says Somerset. "This is something that the Product Design Suite lets us do very accurately. Because mass and inertia are calculated directly inside Inventor, we can complete a theoretical balance for the car much quicker than we could hope to achieve without the software. Once we have the theoretical balance we can then correlate that to the 'on track' performance of the car much quicker than we could without the Autodesk digital prototyping software. Once correlated, we'll understand better the affect of design changes on the car's balance and use this knowledge to improve our prediction of the effects of those changes on the track."

Learn more

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www.autodesk.com/automotive

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