SIEMENS

NX

Wirth Research

Wirth Research puts Acura in Sebring pole position with integrated NX CAE tools

Industry

Automotive

Business challenges

Designing the all-new petrol engined Acura ARX-02a sports car to beat the dominant Audi and Peugeot diesels

Keys to success

Using the integrated CAE tools of NX to ensure vehicle integrity and reliability

Results

First time out, beating Audi and Peugeot to pole position in the Mobil 1 Twelve Hours of Sebring

Productivity and efficiency soar while production costs plummet

The toughest sports car race in the world

It may be that 24 Heures du Mans is the oldest, fastest and longest endurance sports car race of all but many distinguish the Mobil 1 Twelve Hours of Sebring as the toughest. To stand any chance of success, a good car is vital and make no mistake, the all-new LMP1 category Acura ARX-02a sports car is good. LMP1 is the Premier category of Le Mans prototypes and includes the Audi and Peugeot diesels that have dominated this class of racing in recent years. The power and torque advantage of these cars is so huge that petrol powered cars have not been able to compete; until this year, that is. In its first race ever in LMP1, the Acura has proved to be the fastest, as Indy 500 winner Scott Dixon put the No. 6 de Ferran XM Radio Acura on the pole at Sebring with a stunning run against stalwarts Audi and Peugeot.

Wirth Research excels

Wirth Research specializes in research, development, design and manufacture for the motor racing industry and other high technology sectors. In 2008 the company received a Queen's Award for Enterprise, achieving growth in export sales of 378 percent over three years. This outstanding achievement is the result of a small number of strategic partnerships of which Honda Performance Development (HPD) is the main one. This partnership culminated





Images courtesy of Acura Motorsports

"If the suspension changes or if the dampers change, the gearbox designer can input a different clearance or damper cutout and also get a result in half an hour. He can then analyze the new box in just a couple of hours, which is unbelievably good and is more or less real time as far as we are concerned."

Paul Crooks Head of Design Wirth Research in winning both the 2004 and 2005 Indy Racing League drivers' and engine manufacturers' championships before switching in 2006 to focus on Honda's prestigious Acura brand entry in the American Le Mans Series.

Development in the digital domain

Darren Davies, engineering manager at Wirth Research, notes, "We were charged by Honda Performance Development with designing the all-new Acura to take their petrol engine and beat the diesels. We have a very strong company philosophy that has come right from the top: development in the digital domain. That is why we have designed, engineered and simulated the complete Acura in NX from the outset. starting just over a year ago. You don't make reliability at the track, you create a reliable car in the design office and NX is the integrated tool we use for all our design work and all our reliability work. Prototyping is nonexistent – we don't make anything until we know it is right. The Acura is definitely right."

Keeping design, engineering and simulation in one place

At Wirth Research, a single integrated design infrastructure is important to project success. Davies explains, "In a large enterprise, the organizational and the engineering challenges are generally so huge that the problem becomes how to transfer knowledge between a design group and a CAE group. However, like 90 percent of the companies in the world, we are considered a small to medium enterprise, in our case around 50 staff, and our solution to the problem is simple: we keep design and CAE – engineering and simulation – in one place."

Davies points out, "Our engineers are responsible for the whole job and they carry out their own analysis using the embedded tools in NX. Our CAE group is strictly about creating the environment, the NX CAE infrastructure, so the engineers can use it to engineer. Our approach







cuts out delays and errors of communication between lots of people across lots of disciplines. The motivation and interest is great and we get the job done and with fewer people. Quite simply, I do not think we could have produced the Acura in the way we have done it without NX."

Integrated CAE tools

Paul Crooks is head of Design at Wirth Research and quotes an example of the company's approach in action: "The gearbox is at the very heart of the new Acura and everything links to it – the engine, the chassis, the rear suspension, the rear wing – and it supports the rear bodywork, too. The design constantly evolves through the life of the car and as any linked item changes, so the gearbox has to change. One of the major design objectives for the Acura was to keep the rear of the car very light. That required a change to the whole "The business case for using NX for CAE is immense and indisputable. Our productivity and our engineering efficiency have gone up significantly beyond normal measure and our development costs have plummeted. We have fewer steps but with each one we get a better return and we spend less doing it."

Darren Davies Engineering Manager Wirth Research





gearbox concept. Gearbox cases are generally cast in magnesium to a simple and conservative design. The material properties of magnesium preclude thin wall casting, so gearboxes tend to be very heavy."

Crooks explains, "For the Acura, we changed to a thin wall aluminium casting and have saved a huge amount of weight. Once it is designed, we use NX integrated Nastran solver to analyze the casting at its nominal thickness and at its upper and lower tolerance limits. Owing to possible wall thickness variation during casting, we had to be sure the case would be safe at the lower limit and not too heavy at the upper limit. In NX, we can change the wall thickness just by changing a parameter. Say we want to reduce the thickness by one millimeter; we just enter that parameter in the expression in NX and the whole model regenerates in less than 30 minutes even though this means the recomputing of over 4,000 features, different fillet blends, holes, bosses and so on." Crooks adds, "Until NX came along with its integrated CAE tools, that same process would take two weeks and without being able to check the best and worst cases very quickly at any point in the design process, we would not have had the confidence to use a thin wall casting."

FEA in near real-time

However, there is more to the gearbox than just its wall thickness, as Crooks points out, "If the suspension changes or if the dampers change, the gearbox designer can input a different clearance or damper cutout and also get a result in half an hour. He can then analyze the new box in just a couple of hours, which is unbelievably good and is more or less real time as far as we are concerned. Previously, the designer would have to do the analysis once at the beginning to see if he was on the right lines and then it would not be done again until the design was finished." Crooks notes, "The engineer would keep his fingers crossed that all the decisions made on the way were good ones. With NX, CAE is an integral part of the design process. Meshing, solving, visualization: it's all integrated in the menu and that's what makes the whole approach viable."

High level of customer trust

Wirth Research puts a very high value on customer commitment. "The way we do it, with each engineer responsible for the design and CAE of everything in his vehicle 'locale,' really strikes a chord with the other companies I talk to," Davies says. "They want to know that this approach can

Solutions/Services

NX www.siemens.com/nx

Customer's primary business

Wirth Research provides specialist engineering services: research, development, design and manufacture for the motor racing industry and other high technology sectors. www.wirthresearch.com

Customer location

United Kingdom

"With NX, CAE is an integral part of the design process. Meshing, solving, visualization: it's all integrated and that's what makes the whole approach viable."

Paul Crooks Head of Design Wirth Research deliver real benefits to engineering SMEs. I tell them that, philosophically, you have to commit. If you dabble with simulation you will always blame it if things go wrong and you will revert to your old-fashioned ways when the going gets tough. You have to decide which tool you are going to use and then attack your whole work by solving the problems you find along the way."

Davies specifically illuminates on prototypes: "If you must build prototypes, build them with the aim of using them to solve problems with the CAE process, not just to find out what is going on. It works for us. In fact, I cannot remember when we last sent an item to the track that did not perform as expected and our customers have high levels of trust in what we deliver to the track."

As a long time user of Siemens' NX[™] software, Davies points out, "It is a true technical partnership with Siemens getting us going forward with this. We have our own approach, our own processes and our own engineering expertise whilst Siemens has the software. Their consultants have been working with us and we have gradually walked towards the position where we can use their tools to enable our philosophy. We now have some 137 seats of NX for design, with an additional 12 for CAE and we are working with Siemens on further developments."

Indisputable business case

According to Davies, "The processes we are applying and the design and CAE tools we are using are directly applicable to road cars. We are getting interest from car manufacturers and to me it's just a question of time before what we do is used in mainstream road car engineering.





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