MSC Software

CASE STUDY

MSC Software: Case Study - Pratt & Miller

Motorsports to Mission Critical

How Simulation Propelled Pratt & Miller into New Markets

Pratt & Miller learned how to develop vehicles under tight deadlines and get them right the first time as a highly successful designer and builder of race cars. In 2005, the company created an Engineering Services Division to bring the same skills to industrial customers. The company found a niche developing showcase vehicles, fully engineered working prototypes, for defense contractors, under deadlines as short as a few months. Vehicle dynamics simulation using MSC Software's Adams software plays a key role by making it possible to evaluate and optimize the performance of critical vehicle subsystems long before prototypes and even detailed CAD models of the vehicle are available. Recently, the company created a prototype of a new wheeled military vehicle in only 12 weeks. The ability to develop showcase vehicles so quickly has helped the Engineering Services Division increase its revenues by a factor of 100 and its engineering staff by 122 people in just 7 years.

Roots in Racing

Founded by Gary Pratt and Jim Miller in 1989, Pratt & Miller focused exclusively on racing during the company's early years. The Pratt & Miller team played a key role in eight consecutive GT1 manufacturer and team championships for Chevrolet and Corvette Racing in the American Le Mans Series together with 7 class wins in the 24 hour LeMans, the words most prestigious sports car race. The company also implemented Cadillac's 1st factory race program that delivered manufacturers' and drivers' championships, changing the public perception of GM's premium brand. In addition, Pratt & Miller-built Pontiacs and later Camaros have earned team, manufacturers' and drivers' championships in the Grand-Am Rolex Sports Car Series.

In 2005, Pratt & Miller decided to diversify into other industries, creating the Engineering Services Division. In 2008, when difficult economic conditions caused a downturn in

Key Highlights:

Industry

Automotive & Defense

PRATT & MILLER

Challenge

Develop vehicles under tight deadlines

MSC Software Solutions

Adams, Adams/Car

Benefits

- Quickly build and test functional virtual prototypes of complete vehicles and vehicle subsystems
- Tests are performed in a fraction of the time
- Design the front and rear suspension during the first few weeks of the project, long before there was a complete CAD model of the vehicle

"A good Adams model is absolutely critical for FEA. Without it, engineers would be working in the dark."

"This type of fast turnaround has enabled us to develop a thriving business supporting defense contractors and other wheeled vehicle manufacturers."

Jesper Slättengren, Pratt & Miller

corporate support for racing, this became an important division. "In motorsports, you have to have fast turnaround, and there is no room for errors," said Jesper Slättengren, Manager Modeling & Simulation for Pratt & Miller. "It was normal for us to develop a race car in six months compared to three or four years typically required by major automobile OEMs. We achieved fast turnaround through our expertise in the use of advanced computer-aided tools and processes. We felt that these same skills might help us in the engineering services business."

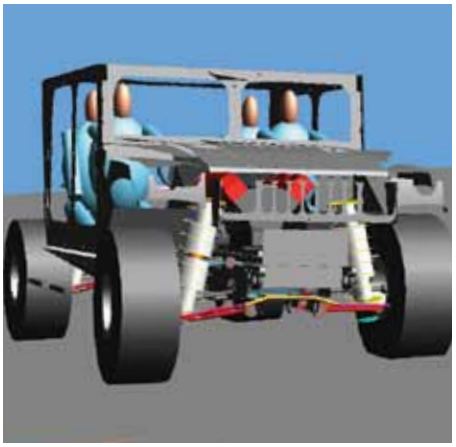
The division targeted the automotive OEMs and their suppliers and defense agencies and contractors specializing in wheeled vehicles. The latter turned out to be an important niche for Pratt & Miller. Defense contractors are typically given hundreds of pages of specifications for a new vehicle. They must submit lengthy written proposals for their proposed solution and often a showcase vehicle as well. The proposals have tight deadlines and the contractors, who are used to working on huge projects that extend for years or even decades, often aren't able to turn around a complete vehicle in that timeframe. Now they have the option of hiring Pratt & Miller Engineering Services to do that work.

Simulation Enables Development of a Fully Engineered Military Showcase Vehicle in Only 12 Weeks

MSC Software's Adams vehicle dynamics simulation, which has long been a key component of the company's race car development, has turned out to be equally critical to the success of these projects. "With showcase vehicles, there is no time to build and test," Slättengren said. The Engineering Services Division uses Adams/Car to quickly build and test functional virtual prototypes of complete vehicles and vehicle subsystems. Slättengren appreciates Adams/Car's specific functionality for automotive development, such as modules for chassis, tire, driveline, and driver simulation. "Adams/Car is stronger in automotive-type modeling than any of its competitors," he noted.

Working in the Adams/Car environment, Pratt & Miller engineers simulate vehicle performance under actual road and off-road conditions, performing the same tests their prototype vehicles will eventually face in a test lab or on a test track. With Adams, however, these tests are performed in a fraction of the time, which is particularly important in situations such as prototype vehicle development, when components such as springs can have lead times as long as 8 weeks. "There is no way you can physically test 4 or 5 different types of springs when your timeframe to deliver the prototype is only months," Slättengren said.

In addition to using Adams/Car to simulate the performance of different vehicle configurations, engineers in Pratt & Miller's Engineering Services Division use the software to generate loads for finite element analysis (FEA). "A good Adams model is absolutely critical for FEA," Slättengren explained. "Without it engineers would be working in the dark."



Blank sheet to Prototype in 12 weeks

To illustrate the value of Adams simulations in situations where prototype vehicles must be designed and built extremely quickly, Slättengren offers the example of a project his division recently did for a defense contractor. The contractor wanted to respond to an RFP issued by a branch of the military. In addition to the paper bid, they needed to submit a prototype vehicle that met the project's requirements. Believing the timeframe was too short for them to create

the prototype in-house, they hired Pratt & Miller Engineering Services to do that work, giving them a deadline of 12 weeks.

The military had drawn up a list of several hundred specifications for the vehicle, including how many occupants it must hold, the turning radius, minimum speed over half-round obstacles of various heights, occupant impact limits over different off-road profiles, minimum lateral acceleration during cornering (i.e. 0.5g to 0.6g without wheel liftoff), and so on. Tire size, power train and transmission were specified by the contractor.

Pratt & Miller engineers used Adams/Car to design the front and rear suspension during the first few weeks of the project, long before there was a complete CAD model of the vehicle. One Adams analyst and two to three designers worked full-time on the front suspension while a similar team focused on the rear suspension. Adams simulations were used to evaluate and tune the suspension according to the specifications and also to supply loads to the designers for use in their FEA analyses.

The real-time collaboration between the Adams analysts and designers resulted in a rough suspension design at about three weeks into the project. "The suspension was about 90% done from a topology standpoint," said Slättengren. "Some suspension components would still change because they needed to be weight-optimized, but we knew where everything would connect."

From there they created a full vehicle model in Adams to evaluate the loads on the driver and passengers, making sure the impacts fell within the specified range. "Doing a traditional iteration of springs, dampers and anti-roll bars can take many, many weeks, or even months because there are a lot of conflicting requirements," explained Slättengren. To speed up the process, his group used HEEDS optimization software from Red Cedar Technology to set up a series of Adams analyses that automatically simulated spring, damper and anti-roll bar combinations through a range of sizes and properties. By using HEEDS to automate the optimization process, the team accomplished in a weekend what would have taken months by hand.

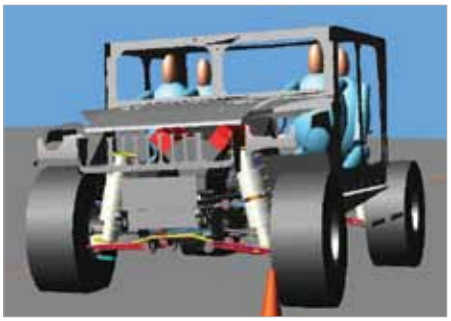
Five weeks into the project, the majority of the Adams simulation was done and all of the vehicle's key performance variables were set. Adams was only needed after that point to re-optimize springs and dampers whenever the mass distribution of the vehicle changed. The next week was taken up by detailed design and creating component drawings. By week six the company had started building the frame. At week 8 they put in the suspension. The remaining time was devoted to body work.

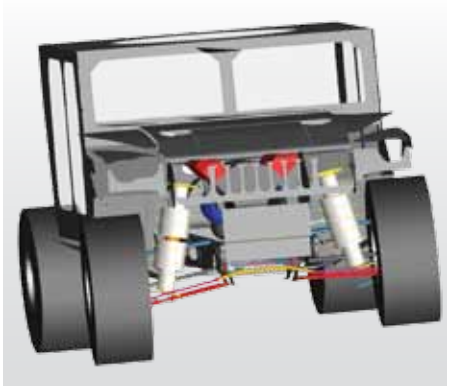
Business Expansion

"We think this is the fastest an engineered vehicle has ever been designed," Slättengren concluded.

"This type of fast turnaround has enabled us to develop a thriving business supporting defense contractors and other wheeled vehicle manufacturers. Our Adams expertise has been the cornerstone of the success of our Engineering Services Division. In our division, we have about 60 years combined Adams experience, which is probably more than any other North American consulting team outside of MSC. This expertise has helped us grow from a standing start in 2005 to eight-digits in revenues this year."

Please visit www.prattmiller.com for more information.





About MSC Software

MSC Software is one of the ten original software companies and the worldwide leader in multidiscipline simulation. As a trusted partner, MSC Software helps companies improve quality, save time and reduce costs associated with design and test of manufactured products. Academic institutions, researchers, and students employ MSC technology to expand individual knowledge as well as expand the horizon of simulation. MSC Software employs 1,000 professionals in 20 countries. For additional information about MSC Software's products and services, please visit www.mscsoftware.com.

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About Adams

Multibody Dynamics Simulation

Adams is the most widely used multibody dynamics and motion analysis software in the world. Adams helps engineers to study the dynamics of moving parts, how loads and forces are distributed throughout mechanical systems, and to improve and optimize the performance of their products.

Traditional "build and test" design methods are expensive, time consuming, and impossible to do sometimes. CAD-based tools help to evaluate things like interference between parts, and basic kinematic motion, but neglect the true physics-based dynamics of complex mechanical systems. FEA is suited for studying linear vibration and transient dynamics, but inefficient at analyzing large rotations and other highly nonlinear motion of full mechanical systems.

Adams multibody dynamics software enables engineers to easily create and test virtual prototypes of mechanical systems in a fraction of the time and cost required for physical build and test. Unlike most CAD embedded tools, Adams incorporates real physics by simultaneously solving equations for kinematics, statics, quasi-statics, and dynamics.

Utilizing multibody dynamics solution technology, Adams runs nonlinear dynamics in a fraction of the time required by FEA solutions. Loads and forces computed by Adams simulations improve the accuracy of FEA by providing better assessment of how they vary throughout a full range of motion and operating environments.

Optional modules available with Adams allow users to integrate mechanical components, pneumatics, hydraulics, electronics, and control systems technologies to build and test virtual prototypes that accurately account for the interactions between these subsystems.

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