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Virtual design advantage

Design simulation, analysis shortens product development schedules

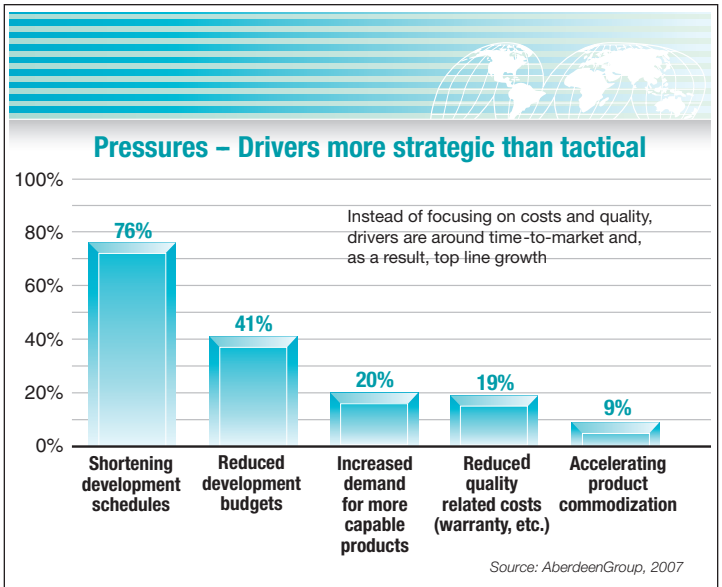
By Jim Fulcher

Anyone who questions the importance of being first to market with a new product should talk to executives at companies whose products compete with Apple's iPod or Toyota's Prius. Prius and the iPod remain clear market leaders several years after their debut. And Apple has put even more distance between itself and competitors by making innovation part of its best practices and a proven, repeatable process.

A company can improve its ability to get innovative products to market faster many ways. One of the most effective methods has proven to be use of design simulation technology.

Design simulation is fundamentally focused around the idea of saving time and money by replacing use of physical prototypes and tests with "virtual" prototypes and simulations. The result is that users are able to engineer better products because they gain an improved understanding of product performance, says Frank Kovacs, VP, strategic alliances, at MSC Software, a supplier of enterprise simulation solutions.

MSC, for example, delivers technology to customers who look at and analyze product performance in areas such as motion, stress & fatigue, noise & vibration, and predictability of product lifespan. Its technology has been used prolifically in the aerospace and automotive industries—in other words, to help design anything that moves, flies, or drives, Kovacs says.



According to participants in an Aberdeen research survey, getting product to market on time is the number-one pressure they face. Adopting an engineering simulation initiative can help meet that goal.

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Weighing the benefits at TI Automotive

When leadership at TI Automotive—a global supplier of fuel storage and delivery systems for cars and trucks—evaluated the company's product development process, it discovered repeated design and test cycles.

"In other words, it was a build-and-break process," says Brian Brandner, global design engineering director at TI Automotive, Warren, Mich., which has more than 20,000 employees, and 130 facilities throughout 28 countries.

"What we wanted to do instead was move design simulation up ahead of physical prototype testing so we could more effectively design products," Brandner says. "That would enable the company to eliminate costly physical prototypes, reduce product development time, and get product to market faster."

In the past, the overall product development process consisted of taking customer requirements, developing 3D CAD drawings, and building blow-molded prototypes. Then, the company completed a series of tests, such as pressure in a vacuum, drop tests on the fuel tanks, sag tests, and burst tests. Those same tests were run with simulations before moving on to tooling and design manufacturing,

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"MSC's approach is to take an enterprise view of the total simulation needs of manufacturing companies today. This platform enables key strategies to be the driving force in bringing new products to market, addressing more robust simulation requirements, and enabling supplier engineering outsourcing," Kovacs says. "We're delivering next-generation technology on a common platform, not just more robust views.

"This common platform will allow for a more complete behavior simulation, the consideration of new alternatives, and to perform more simulation sooner. Uniquely, this will allow a true enterprise simulation capability across organizational boundaries, and integrate into the product life-cycle management (PLM) environment."

Average performance in competitive framework quantified the time saved by the best-in-class

Competitive framework	Mean number of virtual iterations	Mean number of physical prototypes	Mean rounds of testing
Best-in-class	7.3 iterations	2.7 prototypes	2.8 rounds
Average	9.4 iterations	3.1 prototypes	3.5 rounds
Laggard	4.5 iterations	3.8 prototypes	4.7 rounds
Difference	2.8 iterations	1.1 prototypes	1.9 rounds

Best-in-class are succeeding in trading virtual prototypes for physical prototypes and rounds of testing

Source: AberdeenGroup, 2007

Best-in-class companies using design simulation use more virtual prototypes, fewer physical prototypes, and fewer rounds of testing than laggards. And while they execute fewer rounds of testing, they also are twice as likely to hit their quality goals.

Face the marketplace pressure

Global competition means manufacturers face increasing pressure to reduce costs while also improving quality. As importantly, companies want to substantially slash product development cycle time and meet shorter time-to-market goals.

Getting to market on-time is the number-one pressure companies reported in an Aberdeen research survey,

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Brandner says.

The problem that TI faced was that simulation was disconnected from the design process. Compounding the situation was that in going from CAD geometry to simulation models, many data translations or fixes were necessary. TI really only had one simulation expert in the company, which kept analysis from being scaled across the enterprise, Brandner says.

"The bottom line was that the company—due to the nature of its products and manufacturing methodology—had very complex simulations. Predicting how a design would behave or how it would perform was a best guess based on the experience of the people who had been there the longest," Brandner says. "That experience was something that they found impossible to capture for reuse by other people, which led to many design changes late in the product development cycle. Therefore, we had to have many physical prototypes for validation. It really wasn't a very efficient process."

Using design simulation to support its product development process would enable TI to account for complexities of manufacturing upfront, and, additionally, would move simulation from the desktop of one expert engineer to that of many engineers.

"In general, we wanted to accelerate the design process, reduce our costs—the costs of numerous physical prototypes, tooling changes, and so on—and effectively use simulation to gain strategic advantage," Brandner says.

Focus on design simulation

Since then, TI has implemented an engineering simulation solution from MSC Software, the supplier of enterprise simulation solutions. The benefits have been significant.

For instance, TI Automotive now is able to run virtual tests without having to rely on the one in-house expert. In fact, 10 people run simulations today, and those 10 engineers are globally dispersed, which eliminates the previous bottleneck, Brandner says. Simulation has become a virtual training tool for designers and engineers to better understand the important characteristics of a fuel tank.

TI reduced physical prototyping, and analysis time went from two weeks to four days per design. In fact, the majority of the four days is spent computing results. Hence, with less than a half hour of user effort, engineers are able to create a new design, run all of the simulations, and receive results, Brandner says.

As would be expected, those capabilities have driven notable enterprise savings.

"There's been a tremendous impact on costs. We're saving $1.5 million annually through a 30-percent reduction in physical prototyping. By reducing the costs of tool changes moving into the production phase—we eliminated those late design changes and moved to a situation where we design things right the first time," Brandner says. "Product development time has been reduced tremendously as well. We cut it by 25 percent, which literally took months off the product development process."

Finally, use of simulation has brought gains to the top line as well, by demonstrating significant engineering expertise and competitiveness to end customers early in the sales cycle, Brandner says.

"We're able to produce proposals for fuel tank designs that are almost validated, before ever receiving a contract," Brandner says.

says Chad Jackson, research & service director, Aberdeen Group. Adopting an engineering simulation initiative can help meet that goal, he says.

According to Aberdeen research, best-in-class companies are almost twice as likely to launch products on time as other companies, Jackson says. Furthermore, they're almost twice as likely as other companies to hit their product revenue goals.

"These best-in-class companies are working to shrink product development schedules. The way they're doing that is by exchanging physical prototypes for virtual prototypes," Jackson says. "By

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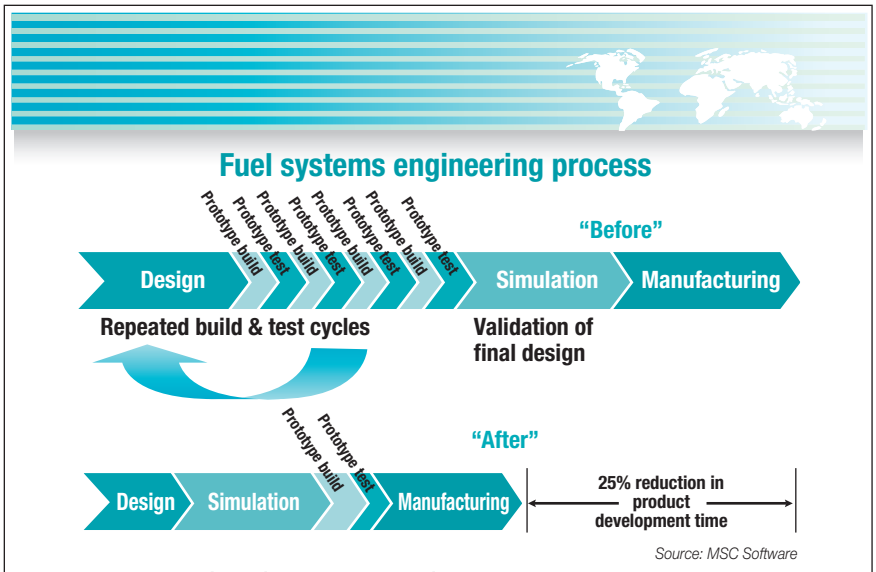

Source: MSC Software

In the past, TI Automotive relied on repeated design & text cycles for product development. Today, the company employs design simulation before physical prototype testing to more effectively design products. That enables the company to elminate costly physical prototypes, reduce product development time, and get product to market faster.

Tested and proven methodology

MSC Software's solutions, partnership with IBM offer significant benefits for manufacturers

It's one challenge to make use of design simulations. It's another altogether to make that capability available across the enterprise.

That's why, in addition to application-specific tools such as the MD Nastran finite-element analysis technology, MSC Software also offers integrated enterprise solutions—SimDesigner, SimXpert, and SimManager, says Frank Kovacs, VP, strategic alliances, MSC Software. They enable the advantages of enterprise-level simulation.

SimManager, for example, makes it easy to manage the sources of information, track & audit where data came from, and see how it was applied in the engineering process. It also captures best-practices methods, stores them, and makes them available across the enterprise, Kovacs says. That's possible because it manages not only the information, but also the methods and large-scale workflows involved, and then the simulation processes themselves as they execute, he says.

"Consequently, this has proven to be a great way to interact with product life-cycle management investments, retain best practices and knowledge, and leverage it across the new product development environment," Kovacs says.

One of the factors driving this successful approach is that MSC is a long-time business partner in development and delivery of its technology with IBM, Kovacs says. MSC's robust services-oriented architecture allows its technology to be layered into existing environments easily, scaled quickly, and integrated with both product data management (PDM) and ERP solutions.

As a truly scalable solution, SimManager supports the requirements of small and large organizations, from departmental teams to the full engineering enterprise. SimManager Workgroup Edition offers a rapidly deployed solution to manage simulation data and content "out of the box." SimManager Enterprise Edition is a 100 percent compatible solution that adds the ability to configure the system look and feel, and simulation process flow, to match specific customer scenarios. These solutions enable customers to start small with Workgroup Edition and get immediate benefit from SimManager, and at any point later easily upgrade to the Enterprise Edition to get even more value by managing simulation processes.

There's more to the relationship than that, however, Kovacs points out. The relationship with IBM enables, for instance, the delivery of MD Nastran in an on-demand environment. MSC worked with IBM in development and delivery of the SimManager enterprise solution to bundle IBM's WebSphere and DB2 with the product, complete scale testing, and jointly sell in the automotive, aerospace, high tech, electronics, and manufacturing markets. Finally, MSC works with IBM Global Services to integrate technologies to the enterprise environment.

"If we look at the value our customer's gain—as they deploy first SimDesigner, then move onto SimManager; and onto complete delivery—they see significant product development cycle time reduction," Kovacs says. "There's acceptance in the marketplace, which validates our approach. Our customers grow into the technology as their business allows."

Together, MSC and IBM are combining their technology, infrastructure savvy, and integration expertise to help all size companies be innovative. They can increase revenue, reduce time to market, and lower costs associated with design and test of manufactured products—all this as a direct result from the right use of analysis, simulation, and enhanced enterprisewide automation of best practices and processes.

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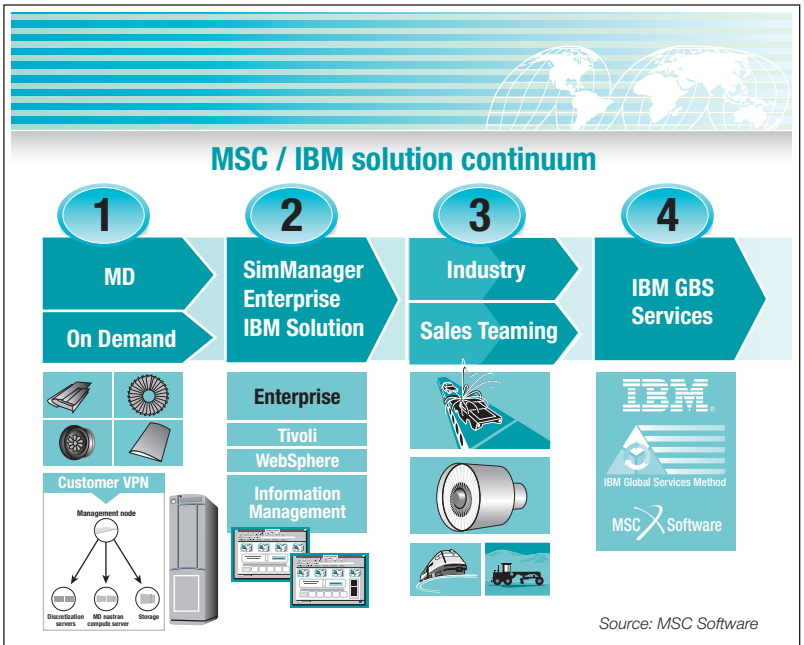
increasing the range of simulations explored, they address issues before they start spending capital, creating physical prototypes, and testing. Use of virtual prototypes also reduces the total number of physical prototypes."

While that's the goal, the question is, does this strategy work? The answer, says Jackson, is a resounding "yes."

"When you compare the number of virtual iterations between best-in-class companies and laggards, best-in-class companies perform 2.8 more virtual iterations than laggards," Jackson says.

"They also build fewer physical prototypes and execute fewer rounds of testing than laggard companies—and, by the way, these best-in-class companies get product to market on-time and hit their cost targets as well. They are twice as likely to hit their quality goals," Jackson says. "They are able to do less yet still hit product development goals more frequently than laggards."



Source: MSC Software

Partnering with IBM offers many benefits for MSC Software, a supplier of enterprise simulation solutions. It enables, for instance, the MD Nastran solution to be delivered in an on-demand environment. MSC and IBM also jointly sell in the automtive, aerospace, high tech, electronics, and manufacturing markets. Finally, MSC works with IBM Global Services to integrate technologies to the enterprice environment.

Quantifiable results

It can be difficult to determine return-on-investment for some capital initiatives. Not so with engineering design simulation. Hard-dollar savings can be calculated based on how much it costs to build a prototype, and how long the process takes.

Aberdeen realizes that not all prototypes cost the same amount of money to build, so its calculations take into account product complexity, and correspondingly, the cost and time associated with building a prototype based on that product complexity, Jackson says.

"Research shows that quantifiable savings of companies using design simulation can range from 14 days to 109 days on the product development cycle, and cost savings can range from $8,300 to $1.3 million, depending on the company and products it makes," Jackson says.

"That's a dramatic difference," says Jackson, "especially when remembering that shrinking product development schedules was the number-one pressure these companies reported."

Furthermore, there's an opportunity to gain additional value, Jackson says, through continuous improvement that comes from capturing—and then leveraging—knowledge and experience.

First of all, companies build fewer physical prototypes because they instead create virtual prototypes, Jackson says. But, they also can sometimes skip the virtual prototype because they're able to see that historically they made certain decisions, and already know the impact of those decisions on product performance, he says.

"Best-in-class companies are almost twice as likely to use knowledge management systems and also five times as likely as other companies to use different wizard, template, or guide systems to deliver knowledge back to users," Jackson says.

"They gain additional value by using these capture and delivery systems to avoid making engineers look through all of the interrelationships between the simulation testing and product decisions. They want delivery to be easier for the end user so past findings and lessons learned, for example, will more likely be used."