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You can reach us at [de-editors@deskeng.com](mailto:de-editors@deskeng.com). **DE**

Sincerely,

Jamie Gooch, Managing Editor

*Desktop Engineering*

# DE

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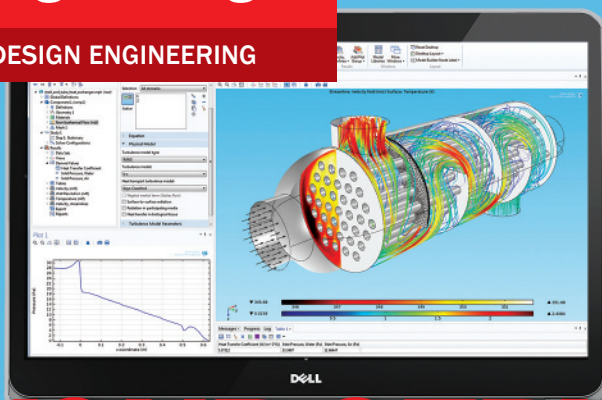
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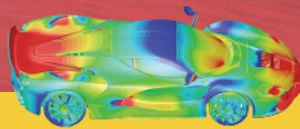
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## Recalls and Responsibility

**W**ith all of the technology available to simulate, test and manage vehicle parts and systems, why have U.S. automotive recalls already exceeded 12 million this year? *Bloomberg* reports this year's recall rates are on track to be the highest in a decade. It's already more than half of all the U.S. automotive recalls last year.

It's not just one automaker or supplier making recall headlines.

- 6.4 million vehicles are being recalled by Toyota for two potential problems: an electrical cable could be damaged when turning the steering wheel, disabling the driver's side airbags, and defective seat adjustment springs could prevent front seats from locking.

- 644,354 vehicles are being recalled by Chrysler because brake boosters may corrode, allowing water to get inside and limit braking ability.

- 348,950 Ford Escapes are being recalled because a control arm attachment could corrode and cause drivers to lose the ability to steer.

**The most advanced PLM software in the world is only as good as the people using it.**

- 156,137 luxury cars and SUVs are being recalled by BMW for defective engine bolts.

- 150,201 Volkswagen Passats are being recalled for a loose headlight connection.

- 42,000 Mazda6's are being recalled because spiders, yes spiders, could weave a web in the evaporative canister vent hose, blocking it and thus affecting fuel tank pressure enough to crack the tank.

Those are just some of the automotive recalls for the month of April, according to the National Highway Traffic Safety Administration (NHTSA), and April is only halfway over as I write this column. I would argue that technology makes it easier than ever to find problems, and automakers are issuing more recalls to fix those problems as quickly as possible. That makes the 2.2 million General Motors cars that are being recalled for defective ignition switches even more troubling. The recalls — or more specifically, the sluggishness with which they were issued — have been linked to 13 deaths, and are the subject of a Congressional inquiry focusing on why it took so long for a recall to be issued.

"Documents produced to the committee show that both NHTSA and GM received complaints and data about problems with ignition switches and airbags," said House Energy and Commerce Committee Chairman Fred Upton (R-MI) during his opening remarks at the Oversight and Investigations Subcommittee hearing April 1. "These complaints go back at least a decade. NHTSA engineers did crash investigations as early as '05, and twice examined whether complaints with airbags constituted a trend. GM submitted Early Warning Reports to NHTSA, including data about crashes in the recalled cars. With all this information available, why did it take so long to issue the recall?"

### The Limits of Technology

The latest reports on GM's failure to recall the faulty switches focus on a few of the 200,000+ pages of documents released by the Subcommittee. While details are still emerging, emails and faxes to a supplier seem to indicate a design engineer approved changing the defective part in 2006 without creating a new part number, which made the problem difficult to trace and delayed the recall for years.

Let's assume (and hope) that GM no longer relies on faxes and emails to communicate and collaborate as much as it did in 2005. Even so, the most advanced product lifecycle management software in the world is only as good as the people using it. Technology is just a tool; it's how people use it (or don't) that matters.

Yes, cars are more and more complicated. Yes, engineers are being asked to do more in less time. No, it's not acceptable that a design flaw not be rectified for a decade. The technological tools are available to manage the complications and allow more design iterations in less time. The cultural norms still have some catching up to do.

"GM employees have always been encouraged to raise safety concerns, whether openly or anonymously, and are empowered to be persistent," wrote GM CEO Mary Barra in a recent blog post directed at her employees. Barra has been CEO since Jan. 15. "We will learn from our recent experience, and it will make us better."

The recall is a harsh wake-up call for GM and other companies struggling to keep pace with today's engineering demands. To err is human, but we need better training, leadership and cultural systems in place to implement and use the technological tools that enable us to catch and correct those errors more quickly. **DE**

**Jamie Gooch** is the managing editor of *Desktop Engineering*. Contact him at [de-editors@deskeng.com](mailto:de-editors@deskeng.com).

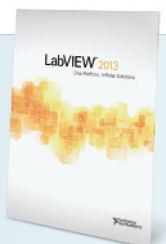


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# Engineering Services



This special issue of *Desktop Engineering* includes our second annual Engineering Services Directory, as well as features on rapid prototyping, testing, analysis, design and cloud computing services.

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**ON THE COVER:** Graphic illustration of a heat exchange model, courtesy of COMSOL, on a Dell Precision M3800 mobile workstation, courtesy of Dell. Server tray image courtesy of iStock.

**Correction:** In the April issue of *Desktop Engineering*, a review of the HP Z230 workstation stated that Intel HD graphics does not support the SolidWorks RealView feature needed to run the SPECapc benchmark for SolidWorks. *Desktop Engineering* would like to clarify that it was the benchmark that would not run on a system equipped with only integrated Intel HD graphics, not that such a configuration doesn't support the RealView feature in SolidWorks.

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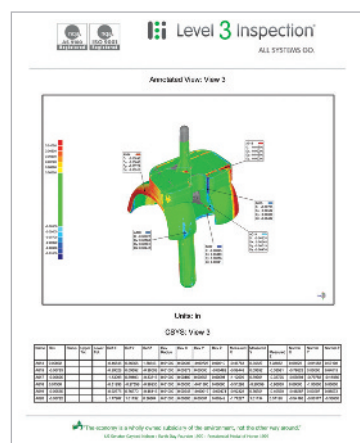
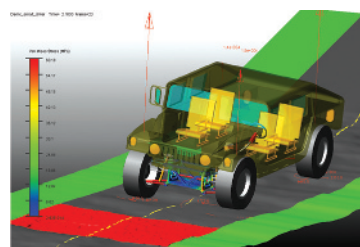
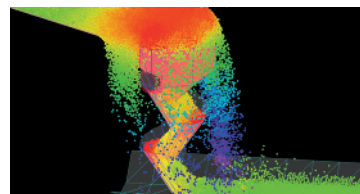
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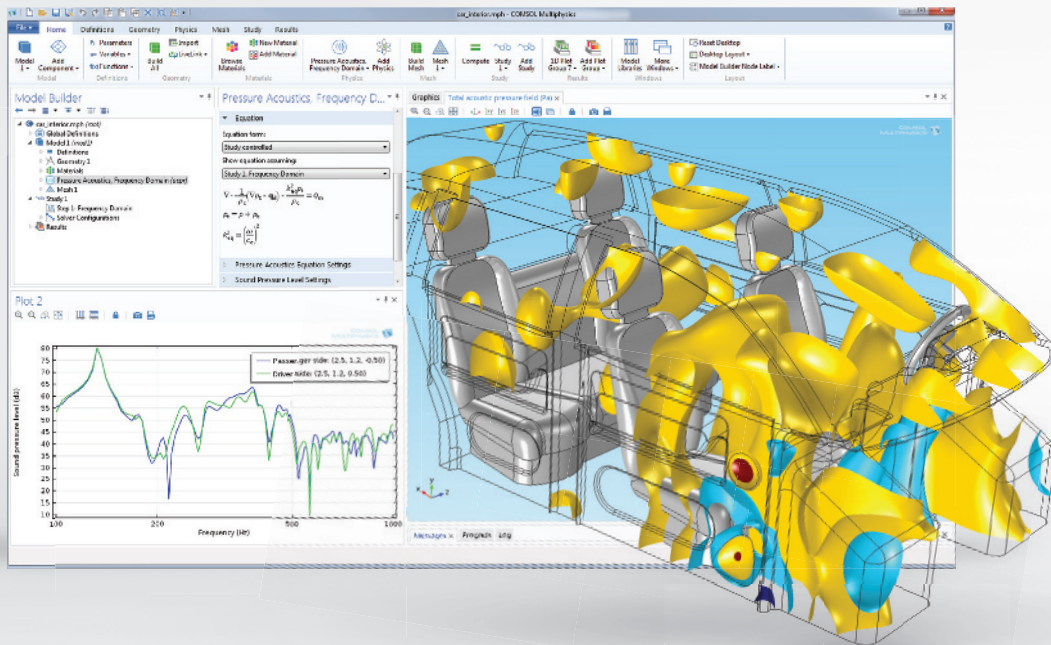
Companies are starting to understand that it's a matter of "innovate or die," but how to drive that innovation?

By Mark Clarkson





**ACOUSTIC ANALYSIS:** This model simulates the acoustics inside a sedan and includes sound sources at the typical loudspeaker locations. Results show the total acoustic pressure field and the frequency response at points inside the cabin.



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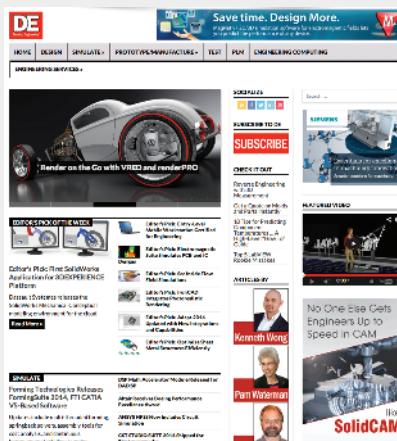
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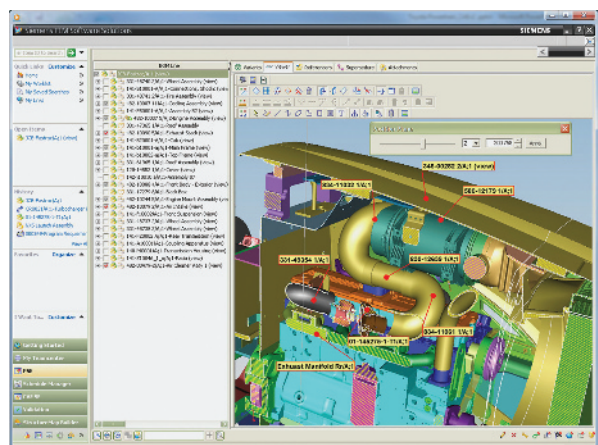
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## Autodesk Takes ZWCAD to Court for Copyright Infringement

**D**id China-based ZWSOFT copy some of Autodesk's AutoCAD code while developing a competing product? Autodesk seems to think so. On March 26, the company filed a case against ZWCAD Software Co., Ltd., ZWCAD Design Co., Ltd. and Global Force Direct, LLC. (ZWCAD's sales arm targeting the U.S. market), alleging copyright infringement and trade secret misappropriation.

In the complaint filed with The U.S. District Court, Northern California, Autodesk writes, "The 'new' ZWCAD+ is not merely an AutoCAD 'work-a-like,' and it does not just share similar interfaces and commands. In crucial and unmistakable ways, ZWCAD+ performs identically to prior versions of AutoCAD. This duplication, which is at the source code level, could not have been accomplished through coincidence or the application of similar programming logic." The complaint cites "the existence of 'bugs,' programming remnants, and other idiosyncrasies in software code" that suggest a shared origin.

### Autodesk is asking for, among other things:

- entry of judgment holding defendants liable for infringing the Autodesk copyrights;
- entry of judgment holding defendants liable for misappropriating Autodesk's trade secrets;
- an order that all copies made or used in violation of Autodesk's copyrights or trade secrets, and all means by which such copies may be reproduced, be impounded and destroyed or otherwise reasonably disposed of; and
- damages in an amount greater than \$75,000.00 or in the alternative for copyright infringement.



**Did ZWCAD+'s similarity to AutoCAD result from source code infringement? It's now the subject of a U.S. case.**

In response, ZWCAD Design, a division of ZWSOFT, issued a public statement defending its product. ZWCAD states it developed ZWCAD+ independently, a fact verified by the National Copyright Administration of the People's Republic of China. It also says Autodesk's allegation is "merely a unilateral conclusion based on some similarities of function and interface."

ZWCAD Design pointed out Autodesk has filed a similar case against it and its partners in the Netherlands.

In ZWCAD's view, the U.S. lawsuit is just an extension of Autodesk's "vicious market competition plan." The company accuses Autodesk of "using its resource advantage in a bid to strike down a future competitor." Furthermore, it interprets Autodesk's 80% price cut of AutoCAD in China in 2009 as a move that "violated the principle of fair and free market competition."

Greg Eden, VP of Autodesk and the company's brand and communication manager, said, "We believe ZWSOFT developed its core product with unau-

thorized use of our technology. We have taken this (legal) action as part of our continued efforts to defend our intellectual property. While we encourage vigorous competition in the market place, we cannot tolerate IP infringement."

Despite the availability of many free or low-cost 2D drafting programs, AutoCAD and AutoCAD LT still remain the industry standard. Rival products include DoubleCAD XT (from IMSI/Design), DraftSight (from Dassault Sytèmes), ARES (from Graebert) and ZWCAD+, the subject of Autodesk's recent lawsuit. Since AutoCAD is Autodesk's intellectual property, those who want to create a competing product usually relies on IntelliCAD's technology, an alternative for reading and writing DWG files compatible with AutoCAD.

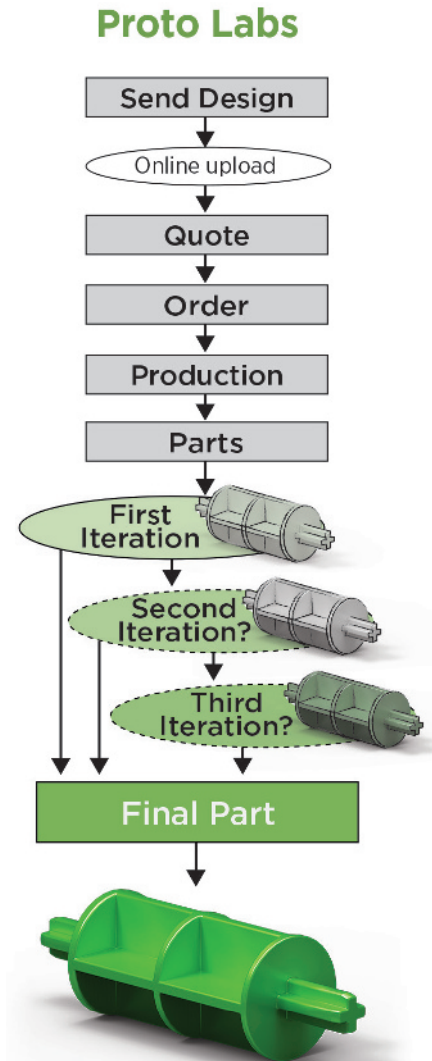
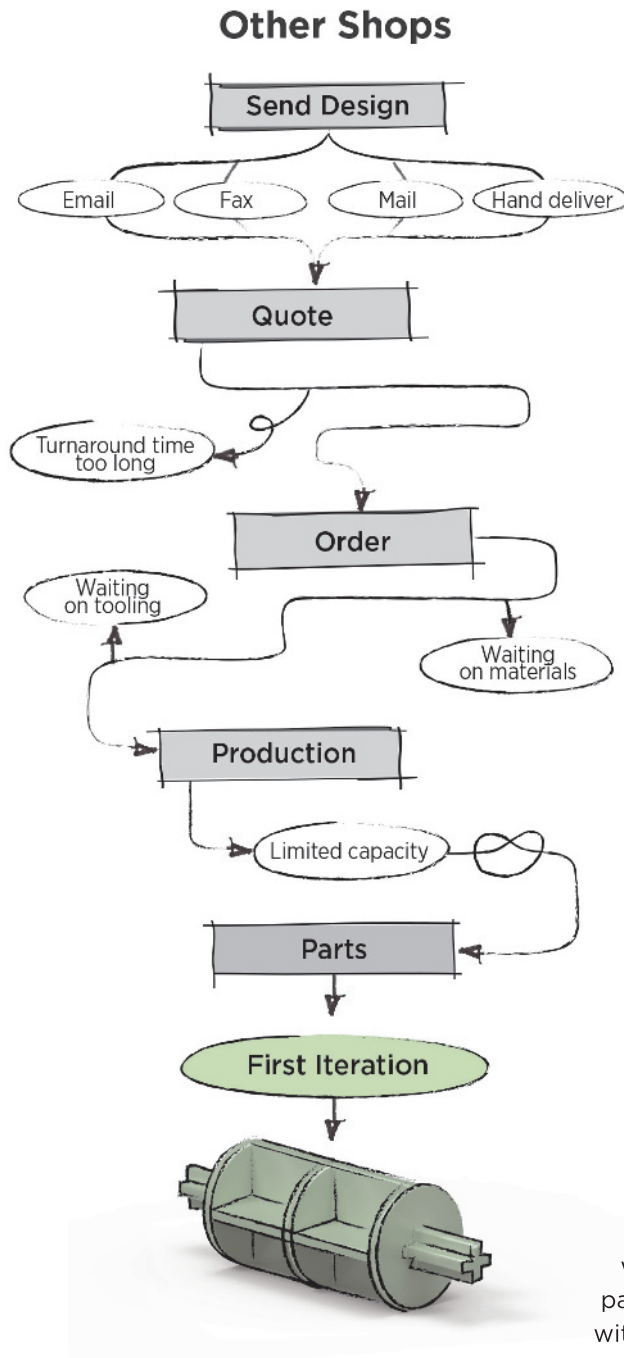
ZWCAD is marketed to mechanical and architectural sectors, as is AutoCAD. In 2010, ZWSOFT acquired the U.S. 3D CAD company VX CAD/CAM, leading to the eventual launch of ZW3D, a 3D mechanical modeling package.

— K. Wong

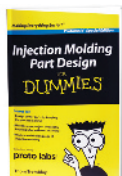


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## NVIDIA GTC 2014: Find Your Device in the Cloud

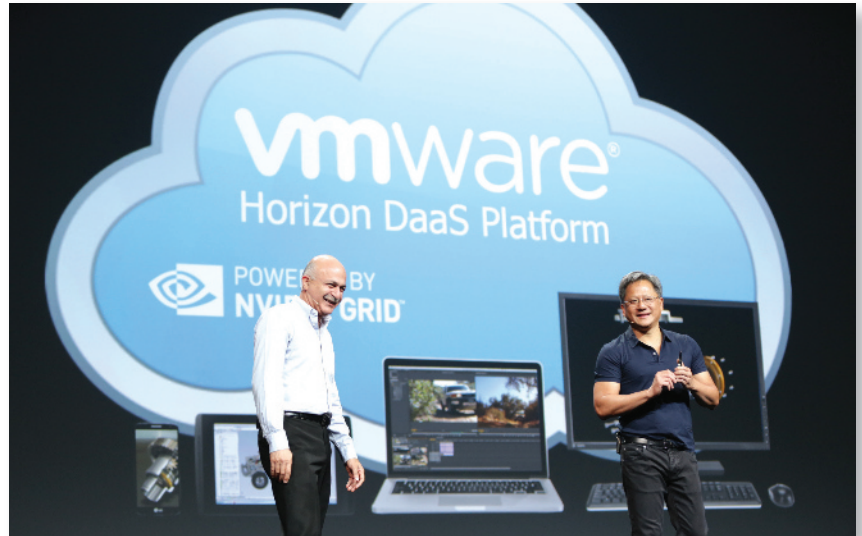
In March, at the NVIDIA GPU Technology Conference (San Jose, CA), NVIDIA CEO Jen-Hsun Huang shared the stage with Ben Fathi, CTO of VMware, the company that might foster enterprises operating in a computer-less environment. Huang introduced Fathi as the point man from “the largest and one of the most important virtualization companies in the world.”

Fathi and Huang took the opportunity to discuss Horizon Desktop-as-a-Service (DaaS), VMware’s business that delivers Windows desktops as virtual machines available on-demand, accessible remotely. Just as Software-as-a-Service vendors deliver software as a service over the Internet, VMware plans to deliver “Windows desktops and applications as a cloud service, to any device, anywhere, with predictable costs,” explained the company.

The foundation technology is NVIDIA Grid’s GPU-based HPC hardware, and VMware’s cloud setup. VMware’s partner NaviSite is the first to offer Horizon DaaS products to enterprises. Later, in 2015, virtual GPUs will become part of Horizon DaaS offerings. “The prototype is running in our lab,” said Fathi. “It’s looking great.”

Pat Lee, VMware’s director of end user clients, clarified that VMware itself also offers DaaS directly to end users; however, enterprises that want to implement DaaS solutions for its users will most likely be served by partners like NaviSite.

Virtual machines have long been part of enterprise IT setups; however, they’re not usually considered ideal for applications that require interactive, real-time 3D graphics. Presently, those who work with compute-intense CAD and simulation software tend to rely on powerful workstations, as most would find virtual machines inadequate. But DaaS solutions with virtual GPUs offer



VMware’s CTO Ben Fathi and NVIDIA CEO Jen-Hsun Huang discussed Horizon DaaS, or desktop-as-a-service. Image courtesy of NVIDIA

tantalizing possibilities. Huang described virtualizing the GPU — made possible by NVIDIA Kepler architecture — as “one of the greatest endeavors of (NVIDIA).”

VMware’s Lee pointed out, with DaaS, “You don’t have to worry about maintaining the infrastructure; you can work from wherever you want; you just have a monthly charge.” The proposition is particularly appealing to businesses that want to be able to adjust the volume of desktops they deploy depending on seasonal needs and peak demands. Without upfront investment in hardware, they may rely on DaaS providers to deliver the additional computing power on-demand. Virtual machines, unlike physical machines, are deleted once the users have cancelled their subscription. This feature may be viewed by some as a way to minimize potential IP compromise.

Design software with straightforward licensing policies (usually tied to a machine or a user) is easily deployed on DaaS products; however, for those using simulation software with licens-

ing policies that restrict the number of cores that can be used, DaaS offerings may raise new questions on performance and licensing costs.

The Achilles’ heel to DaaS may be bandwidth. Lee assured attendees that software like Dassault Systèmes’ CATIA will perform on virtual machines with virtual GPUs just as it does on real workstations. However, the data transfer between the virtual machine and the client device — the tablet, laptop, or lightweight computer you’re using to control the virtual machine — affects the software’s responsiveness.

DaaS is the natural successor to — and perhaps the inevitable outcome out — SaaS, driven by the tech consumers’ desire to pay for access, capacity, and usage, not for ownership. The GPU, specifically the virtual GPU, plays an important role in promoting DaaS as a viable alternative to powerful workstations, as many design and engineering programs rely on the graphics processor to produce physically accurate, ray-traced visuals that can pass for realism.

— K. Wong



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## Weigh Cost Viability of Product Designs

**W**hile engineers have made simulation of structural properties or fluid dynamics an integral part of their workflows, they haven't applied the same rigor to analyzing the cost aspect of product design — a scenario aPriori hopes to change with the latest release of its flagship product cost management software.

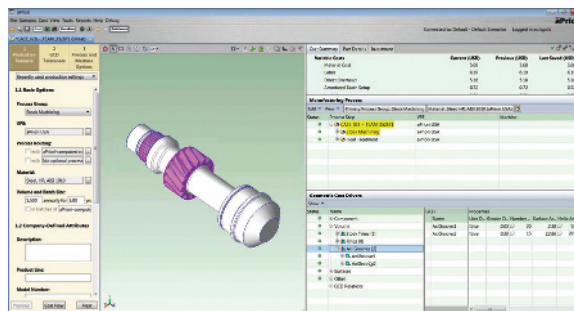
aPriori 2014r1 is stocked with a variety of new enterprise capabilities mixed with ease-of-use enhancements designed to make predicting product costs more accessible to engineers. The upgrade expands the types of components and parts that can be costed in the software and delivers features that allow costing capabilities to be leveraged across a wider swath of users in the enterprise as well as among external partners.

Julie Driscoll, aPriori's vice president of strategic marketing and product management, positioned the new release as an essential tool for manufacturers looking for cost reduction. Faced with fluc-

tuations in commodity pricing and availability, escalating costs and quality concerns related to outsourcing, and garden variety sourcing decisions that can make or break a product's profitability, manufacturers can no longer rely on traditional methods of cost analysis — i.e., manual spreadsheets — if they want to remain competitive.

For example, Driscoll cited manufacturers' need to tailor product variants for local markets and the changing fuel economy standards in the automotive industry as examples of design challenges that up the ante for companies to have a clearer picture of cost.

"There is a need to understand the cost/value tradeoff as you try to optimize an offering for different markets or for understanding that balance of



**aPriori 2014r1 includes new capabilities for costing complex machined components like gears, which are typically very expensive and difficult to cost.**

*Image Courtesy of aPriori*

achieving fuel efficiency by lightening the car and producing something people want to buy," Driscoll explains. "As companies move forward, there are tradeoffs where they should manufacture or source from, or what materials they should use. What we are trying to do is bring cost awareness back into the design process."

— B. Stackpole

## A Spotlight on Lightweighting

**W**ith emerging fuel standards and a continuous push for innovation and cost efficiencies driving lightweighting requirements to the next level, Altair, in collaboration with the Center for Automotive Research (CAR), is hosting a competition to encourage awareness and recognize industry achievements in weight reduction.

The 2014 Altair Enlighten Award, now in its second year, is designed to spark innovations and technologies that provide practical design approaches to achieving the mass reductions that are necessary to meet the new, more stringent fuel economy standards, Altair officials said.

"For the most part, automo-

tive companies recognize that vehicle lightweighting has to play a dominant role in designing for fuel economy and CO<sub>2</sub> reduction," noted Dave Mason, Altair's vice president, global automotive. "We've been involved for 10 or 15-plus years, but there hasn't been an award that recognized those achievements. We're trying to create an environment to inspire advancements and collaboration with industry leaders to drive innovation in this area."

Each part or component submitted in the competition must be in production within a three-year window. Entry submissions for the 2014 Altair Enlighten Award can be made now through May 23.

— B. Stackpole



**Last year's winner of the Altair Enlighten Award was BASF, which developed a front seat pan that uses a continuous thermoplastic fiber laminate for the structural stiffness.**

*Image Courtesy of BASF*



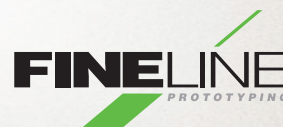


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### Texas Tech Research Focuses on Strengthening 3D Printing Materials



Brandon Sweeney, a chemical engineering graduate student at Texas Tech, wants a 3D printed plastic prototype that is strong enough to be used in the field most of the time.

Sweeney and his fellow researchers at Texas Tech are working on a method to improve the strength and durability of plastic parts.

The foundation of Sweeney's work is carbon nanotubes. Each nanotube is stronger than steel, and will bond with other materials if heated. To achieve this, the research team surrounds standard plastic filament with carbon nanotubes, then feeds the material into a 3D printer. The carbon nanotubes become sandwiched between layers of plastic as the AM process built an object. The finished object is then microwaved, forcing the carbon nanotubes to bond with the filament.

**MORE →** [rapidreadytech.com/?p=6377](http://rapidreadytech.com/?p=6377)

### Amazon Tests Print-on-Demand Services

Amazon has taken note of the potential for sales in the print-on-demand market. The result is a partnership with 3DLT to launch a pilot program offering both print-on-demand items and digital designs ready to be printed at home, or at the office, if you are sneaky enough.

Amazon has shown increasing interest in riding the AM wave. The company began by launching a 3D printer sales department last June, and followed with an initial offering of 3D scanners in January. Amazon has since expanded its scanner selection by adding products from Artec to the mix.

**MORE →** [rapidreadytech.com/?p=6352](http://rapidreadytech.com/?p=6352)

### Chuck Hull to be Inducted into the National Inventors Hall of Fame

3D printing is well on its way to revolutionizing manufacturing. While the technology has only gained some measure of popular appeal in the last few years, its roots go back 30 years and can be traced to 3D Systems' founder and CTO, Chuck Hull.



This year Hull's achievement will be recognized as he is inducted into the National Inventors Hall of Fame. He will join luminaries of invention such as Thomas Edison, Eli Whitney, and the Wright Brothers. The formal ceremony will take place May 21, at the United States Patent and Trademark Office in Alexandria, VA.

**MORE →** [rapidreadytech.com/?p=6342](http://rapidreadytech.com/?p=6342)

### President Announces Two New Innovation Institutes

The President recently announced the launch of two new institutes led by the Department of Defense and supported by a \$140 million in Federal funding that has been matched by \$140 million in private funding. The new innovation hub in Detroit will focus on lightweight and modern metals manufacturing, while the hub in Chicago will concentrate on digital manufacturing and design technologies.

"The economy has changed," said President Obama. "And if we want to attract more good manufacturing jobs to America, we've got to make sure we're on the cutting edge of new manufacturing techniques and technologies. That's what these new hubs are all about. They're partnerships — they bring together companies and universities to develop cutting-edge technology, train workers to use that technology, and make sure research is turned into real-world products made by American workers."

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### Renishaw 3D Prints a Bike for Empire Cycles

**R**enishaw and Empire Cycles have designed and printed the entire frame of a bike using additive manufacturing (AM). The completed titanium mountain bike frame is not only as strong as a frame built using traditional methods, but is 33% lighter, making for an easier ride.

Chris Williams, managing director of Empire Cycles, first approached Renishaw to assist in building a lighter seat post bracket. The project was so successful that Renishaw and Empire Cycles decided to attempt to build an entire bike using AM and principles of design freedom offered by the technology. Although some bicycles have begun to use carbon fiber, titanium was the material selected not only because of its strength and reduced weight, but also for its durability.

Williams was already experimenting with 3D printed bicycle parts, and with the assistance of Renishaw's technical staff was able to put together a plan to build an entire frame using Renishaw's laser melting AM process. The original seat post bracket was produced with a 44% savings in weight. The overall reduction in weight of the bicycle frame was not only due to material, but also the result of eliminating support structures that were found to be unnecessary in the final AM-built design.

**MORE →** [rapidreadytech.com/?p=6243](http://rapidreadytech.com/?p=6243)

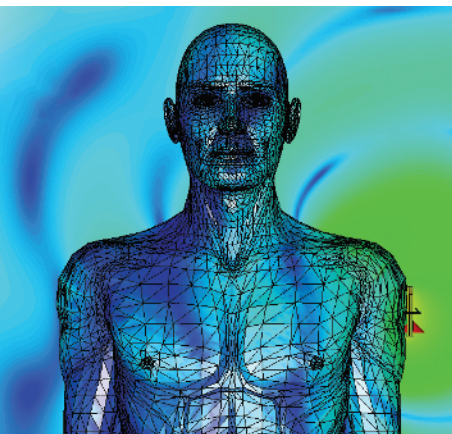






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# RAPID to Run Alongside The Big M

**A**dditive manufacturing (AM) continues to grow by leaps and bounds, driving innovation and creating new opportunities for manufacturing. New conventions dedicated to AM have begun to sprout up all over the globe, but the granddaddy in North America is SME's RAPID conference and exposition. For nearly 25 years, RAPID has brought together industry leaders to share information about developments in 3D printing, and has provided a meeting ground for AM businesses and customers.

## Multiple Shows, One Location

This year RAPID will run alongside the International Manufacturing Research Conference, and The Big M manufacturing conference in Detroit, MI. The event will run from June 9 through June 12 at the Cobo Center. Unsurprisingly, AM will be one focus of the Big M, with RAPID's customary range of lectures, seminars and other educational opportunities providing a solid framework of knowledge for the conference.

"SME is excited to connect the well-respected RAPID community with leaders, educators and researchers from the manufacturing industry at large through the co-location of The Big M and the International Manufacturing Research Conference," said Debbie Holton, director of events and industry strategy for SME. "We want these groups to share innovations and solutions that address manufacturing's challenges – the skills gap, global competition, new technologies like 3D printing, and more."

## New 3D Printing Sessions

While The Big M will last four days, RAPID itself will run for the

usual two and a half days, covering 13 topic areas surrounding AM including some new sessions, which include:

- **Economic and Business Considerations** – Engage in strategies for evaluating what is right for your application.
  - **Automated Post Finishing of Parts** – Learn how automated post finishing of additive manufacturing parts will lower costs and allow users to further explore into mainstream manufacturing production numbers and applications.
  - **Product Design and Machine Design Considerations Using Additive Manufacturing** – Hear from the designers who are incorporating new design techniques.
  - **Materials for Additive Manufacturing Applications** – Examine case studies and research and development activities that continue to advance the applications of additive manufacturing and 3D printing.
- According to SME, the 2014 RAPID Conference & Exposition will have the largest exhibit floor in its 24-year history, and will offer a record number of presentations. The event has added four additional topic areas to the previous nine; 20 new presentations for a total of 95 and new, hands-on demos and activities.

For example, RAPID will be home to a "Personal 3D Playground" which will give attendees some hands-on experience with 3D printers and 3D scanners. In addition, Materialise will be running 3D printed slot car races on the show floor, and the Innovation Exchange will display the most ground-breaking advances in additive manufacturing over the years.



## Medical & Dental Advances

Due in part to the customization needs inherent in the medical and dental industries, AM has seen significant uptake in those areas. The medical and dental speaking track will focus on the growth in use and scope throughout both industries, such as prototyping, bio-modeling/anatomical modeling and direct production of implantable metal implants or scaffolds for tissue engineering.

"3D printing plays a critical role in the medical industry: it is used for surgical planning and is now being used to manufacture medical devices including 3D-printed airway



**Stratasys recently introduced VeroGlaze (MED620) dental material for use with its Objet EdenV and OrthoDesk 3D Printers.**

splints that have been implanted to save infants' lives," said Dr. Glenn E. Green, associate professor of pediatric otolaryngology at the University of Michigan. "At RAPID 2014, we're going to further explore current 3D-printed tools and future possibilities that will allow us to better all of our lives."



## Synergis and Advance 2000 Team Up to Deliver Cloud Computing

Synergis Engineering Design Solutions has announced a partnership with Advance2000, allowing both companies to offer IT solutions such as cloud collaboration to their customers.

The partnership, a company press release states, will focus on combining the expertise and technologies of both companies for clients needing engineering design solutions and IT or cloud services.

"Partnering with Advance2000 allows our customers to receive additional services through Synergis that will help not only in their engineering and design groups, but throughout the entire organization," said Kristen Tomasic, divisional vice president for Synergis Engineering Design Solutions.

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## OnRamp Opens Second Austin Data Center

OnRamp, a data center operations company, is opening a 42,000 sq. ft. location in Austin, TX.

The center was built to meet growing demand for high-security hosting, cloud computing, high-density colocation and disaster recovery services.

This data center was designed for high density computing, and is capable of delivering speeds upward of 30kW per rack. Additionally, the center will be staffed by engineers to provide support 24/7.

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## Lab IX Partners with Mantis Vision

Flextronics' subsidiary, Lab IX, has entered into an agreement with Mantis Vision, a company that develops

and designs 3D image and motion capture hardware.

According to a company press release, Flextronics is working with Mantis Vision to develop first-to-market, scalable delivery of customized scanning solutions. These products are designed for consumer-facing solutions such as 3D embedded mobile and peripheral devices.

"We believe that the 3D market is one of the best examples of a disruptive technology today, and Mantis Vision is leading the way with its first-to-market advantage," said Lior Susan, vice president and head of Lab IX.

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## Medical OEMs Turn to Contract Manufacturing

Micron Products Inc. has created an integrated system for orthopedic implant manufacturing that cuts costs and eliminates supply chain breaks, a company press release states.

This new system was created to meet the growing demand for contract manufacturing. Micron also provides original equipment manufacturers with design, engineering and manufacturing services.

"Medical device manufacturers, large and small, benefit from outsourcing," said Salvatore Emma, Jr., president and CEO of Micron Products. "With Micron's systems, technologies and expertise, it doesn't matter whether we're making 10,000 pieces or just a single one-off customized to match a patient's specific anatomy

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## Patti Engineering, Hagbros Precision Ally

Control systems integration company Patti Engineering has announced a new partnership with design and manufacturing company Hagbros Precision.

According to a company press

release, the companies have worked together in the past and are joining services to provide turnkey solutions and manufacturing solutions. Hagbros Precision's manufacturing center in Texas houses Computer Numerical Controlled (CNC) machines, and is able to perform precision turning, milling, surface grinding and Electrical Discharge Machining.

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## ARC Group Expands Metal Additive Manufacturing

ARC Group Worldwide announced that 3D Material Technologies (3DMT), its additive manufacturing division, has purchased two EOS EOSINT M280 Direct Metal Laser Sintering (DMLS) 3D printers.



"EOS laser-sintering is a leading technology for aerospace and medical components, which make the 3D printers a strategic fit for our existing business. 3DMT provides engineering, prototyping, and short run production services in order to accelerate our customer's ability to access their respective markets as quickly and efficiently as possible," said Ashley Nichols, general manager of 3DMT.

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### Harris Aerospace Inc. Launches

Jon Harris, CEO and senior engineer, announced the launch of Harris Aerospace Inc. in Brighton, MI.

According to a company press release, the company specializes in aerodynamics, computational fluid dynamics (CFD), thermal analysis, infrared signatures, radar signatures and advanced simulation techniques. It also provides design, simulation, analysis, research, development and rapid prototyping services for its clients.

**MORE →** [deskeng.com/services/903](http://deskeng.com/services/903)

### Nexxt Technologies Works with 3D Printing Ally

Nexxt Technologies and 3D Printing Ally have formed a partnership to offer customers a larger variety of 3D printing solutions across multiple industries, including medical, aerospace and consumer goods.

Nexxt Technologies is a provider of sales, service and installation of 3D Systems' printing line. It also offers rapid prototyping, scanning, digital manufacturing and 3D printing. 3D Printing Ally accommodates 3D modeling, scanning, CAD, reverse engineering, parts inspection, smoothing and plating.

**MORE →** [deskeng.com/services/848](http://deskeng.com/services/848)

### Entigral Systems Launches Professional Services Group

Entigral Systems is launching a services group focused on assisting potential customers and systems integrators with their implementation of radio frequency identification (RFID) solutions.

According to a company press release, this group will specialize in discovering potential process improvement to deliver turn-key installations, RFID consulting, site surveys, system design, pilot testing,

project management, ROI analysis, system installation and post-installation services.

**MORE →** [deskeng.com/services/850](http://deskeng.com/services/850)

### Contract Engineering Services Offers Gratis Help to Inventors

Contract Engineering Services (CES) has announced a new initiative to assist independent inventors.

This new service, according to CES Principal Steven Pedersen, is offering up to two hours of gratis consultation for any independent inventor who contacts the company via its website. After signing a non-disclosure agreement, CES will listen to each inventor's ideas and provide constructive feedback. The company will also offer advice regarding IP definition, patent research, concept drawing and strategy consultation.

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### Sites Medical LLC Plans Expansion in Indiana

Sites Medical LLC, a medical device company has announced its plans to

expand operations in Columbia City, IN.

According to a company press release published on Indiana Economic Development Corporation (IDEC), the company will invest \$1.9 million into an approximately 8,000 sq. ft. facility. Its services will include specialty testing, prototyping, specialty manufacturing and quality and regulatory services.

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### Amtek Announces Acquisition of Interplex

Singapore-based Amtek Engineering has announced its plan to acquire Interplex industries to create a global precision engineering services firm.

According to an article published on *Today*, the deal is expected to be completed in the first half of 2015 and cost Amtek up to \$210 million (USD).

Interplex specializes in manufacturing miniature precision engineered solutions for customized applications, and serves the automotive, industrial/electrical mobile devices and medical original equipment industries.

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### Find Help Fast

**D**esktop Engineering has created the Engineering Services Directory — a compilation of companies that can help you throughout engineering process, from concept design to testing, and everything in-between.

Available online at [deskeng.com/services](http://deskeng.com/services) and in this annual print, our directory gives you access to more than 130 companies and counting that specialize in CAD modeling, design analysis, industrial design services, IT, product testing, rapid prototyping/reverse engineering and educational services.

The directory gives you the opportunity to contact companies that will be available to support your day-to-day or long-term engineering needs, allowing you to optimize cost and time in all stages of design.

The directory comes at no cost to you, and doesn't require an additional subscription.

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# Discover Better Designs, Faster

Drive product innovation through simulation and optimization.

**Q: What services do you provide to design engineers, and engineering and IT management?**

**A:** Proto Labs has two quick-turn manufacturing services available for prototyping. Our Firstcut CNC Machining Service can mill parts from more than 30 different metal and plastic materials, which work well for fixtures, jigs and one-offs. The second service we offer is Protomold Injection Molding for low-production of engineering-grade thermoplastic, metal and liquid silicone rubber parts. We staff a team of engineers that can talk peer to peer with customers to help solve any design issues that arise, and we supply a library of easily accessible resources to help design engineers and their teams design better parts.

**Q: What are the top challenges being faced by the engineering teams you serve?**

**A:** Speed to market is a constant challenge that engineering teams are confronted with as they work to develop products. To achieve that, they need timely and quality feedback on their 3D CAD models in areas like tool and part pricing as well as the manufacturability of their designs. They need parts made from real materials to test form, fit and function.



One of Proto Labs' manufacturing facilities.

And since many teams have aggressive development schedules, they need parts produced as fast as possible. When that criteria is met, engineering teams can iterate quickly, and more often, so they can confidently launch their product before their competitors.

**Q: How can you help engineering teams cope with those challenges?**

**A:** We are a catalyst when speed to market is crucial. Because Proto Labs is a technology-driven company, engineers

can upload a single 3D CAD model, or many models simultaneously, and they'll receive an automated quote back within hours. Our quotes provide design feedback and real-time pricing so teams can make any needed modifications before actual production begins, or many times as fast as one day if needed. Between our two services, engineers can get from one to 10,000+ parts in less than two weeks. With functional parts made from real materials in their hands quickly, they're able to avoid manufacturing speed bumps on the critical path to launching a product.

**proto labs®**  
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## About Proto Labs

Proto Labs is the world's fastest manufacturer of custom prototype and low-volume parts. Our proprietary computing technology and automated systems allow us to produce real prototype parts in a matter of days for a global base of customers. Whether you're an inventor in the maker movement or an international corporation, we work with you to accelerate innovation.

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For more information visit:

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## Expert Answers /// ETA

### Addressing Multi-Dimensional Product Development Issues

Contradicting requirements require an optimization-based design approach.

**Q: What services do you provide to design engineers, and engineering and IT management?**

**A:** ETA provides engineering services from **Concept** to **Product**, including Product Design & Development Solutions, Full Vehicle Development, CAE/FE Analysis, Design Optimization for Cost & Weight Reduction and On-Site Engineering Support. A long time tier-one supplier to the global automotive industry, ETA offers expertise in all aspects of structural analysis including durability, NVH, metal forming, crashworthiness, occupant safety and optimization.

ETA provides these services for a broad scope of industries including the automotive, heavy truck/bus, aerospace, military, consumer electronic, medical product and appliance industries.

**Q: What are the top challenges being faced by the engineering teams you serve?**

**A:** The transportation industries in particular are facing numerous challenges today. The product design and development process includes multi-dimensional issues, which often contradict each other. A central challenge is the need for cost and mass reduction to compete in the



global market, while continuing to meet all new and existing requirements for quality and performance.

The cost and mass reduction objectives are challenged by a few factors, including aggressive fuel economy and emissions standards. Customer demands also play a large role with the desire to increase miles per gallon (MPG) across the fleet to lower operating costs.

**Q: How can you help engineering teams cope with those challenges?**

**A:** These requirements indicate that new approaches are necessary within the modern product development environment. To address the challenges head-on, ETA has developed a patented design optimi-

zation technique, called the Accelerated Concept to Product (ACP) Process®. The ACP Optimization Process views product development in a completely *holistic* way. It synchronizes the individual facets of the product development process including concept design, material selection, CAE and manufacturing, resulting in an overall reduction in development costs and time to market.

For ETA's clients, the methodology offers four key benefits, including a demonstrated capability to reduce product development costs significantly, reduce product mass by 20 - 40%, improve product performance (durability, stiffness, NVH, crash/safety), as well as increase MPG based on the mass reduction results.



#### About ETA

ETA is committed to the delivery of processes, tools and services of consistently high quality, and to continual improvement. ETA strives to be innovative and excels at providing new technology and multi-disciplinary expertise by developing new processes to help reduce cost and increase quality.

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**Q: What services do you provide to design engineers, and engineering and IT management?**

**A:** ICOMold provides rapid injection molding and production injection molding and is structured to quickly produce low-cost, pre-hardened-steel plastic injection molds for prototypes and production parts. Our pre-hardened steel mold prices are typically lower than aluminum molds, and our standard lead time is within two to five weeks — regardless of the size or complexity of your parts. In addition to our large selection of standard materials and colors to choose from, we also welcome your requirements for engineered specialty resins and/or special colors. Select from our standard surface finishes, or specify your requirement. Our sole purpose is to quickly supply you with inexpensive, high-quality plastic injection molded parts.

**Q: What are the top challenges being faced by the engineering teams you serve?**

**A:** The same problem as always — too many tasks and not enough time. When management seeks budgetary or firm quotes and lead times for projects, engineers, designers and buyers scramble to issue RFQs (request for quotes) then typically must wait several days to receive the numbers due the complex

Item	Part Number/Name	Material	Surface Finish	Color	Cavit...	Sample...	Tooling ...	LeadTime	Tooling Price ...
1	VIION PROTO CASSING_2014-02-28	ABS Sabic Cycloac AS35.Snowy	IM-1 light bea	transparent Color	1	5	100k	3.5 weeks	\$13,118
2	INNER CHANNEL FRONT STEP	PA6/6-25%GF-BASF A30G5.Nat	SPI-A1 Mirror	PALE PINK PM...	1	5	100k	3.5 weeks	\$9,696
3	Striker Hook Back Plate.STEP	PA66-30%GF Zitel 73G30L NC01	SPI-A2 High I	TEXAS ORANG...	1	5	100k	3.0 weeks	\$4,541
4	BASE CAP.STEP	ABS Chems 7770.Natural	IM-1 light bea	FATIGUE GRE...	1	5	100k	3.0 weeks	\$2,970

Item	Part Number/Name	Part Size	Part Weight	Part Quantity	Price without Shipping	Closest Shipping D...	Price with FedEx
1	VIION PROTO CASSING_2014-02-28.STEP	143.2 X 52.4 X 202.7mm	0.2031Kg	500	\$5.47	Greenville,SC	\$16.08
2	INNER CHANNEL FRONT STEP	334.1 X 114.0 X 12.6mm	0.0195Kg	1000	\$1.63	Huntsville,AL	\$4.98
3	Striker Hook Back Plate.STEP	7.5 X 1.0 X 47.5mm	0.0004Kg	200	\$0.99	Houston,TX	\$1.55
4	BASE CAP.STEP	36.0 X 34.6 X 8.5mm	0.0024Kg	2000	\$0.33	Huntsville,AL	\$0.48

calculation of the tooling and part cost. In the meantime, the part design changes or a competing design emerges, further frustrating the situation because the path to the most economical design demands another round of RFQs and the days continue to slip away.

**Q: How can you help engineering teams cope with those challenges?**

**A:** ICOMold has recently developed ICOQuote — software that instantly provides tooling and part quotes by quickly analyzing users' model files — no confusing tooling/part parameters

to enter. It's available at no cost — simply download it from our website: [icomold.com/icoquote](http://icomold.com/icoquote).

ICOQuote is a revolutionary tool for the injection molding industry — providing cost and lead time in less time than it takes to prepare an RFQ. It instantly adjusts for users' selections of desired tooling life, tooling configuration (family molds), surface finishes, and resins, as well as four shipping methods. The speed and easy-to-use features makes this an ideal tool to use during project meetings, enabling the user to provide on the fly what-if cost information of various scenarios.

**ICOMold®**  
Plastic Injection Molding Services

**Contact Information:**

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ICOMold  
6415 Angola Rd., Holland, Ohio 43528  
Phone: 419-867-3900 ext 101  
Fax: 419-867-7200

[www.icomold.com](http://www.icomold.com)

## About ICOMold

ICOMold is the Rapid Injection Molding division of ICO Products, LLC with an office in Toledo, OH, and mold facilities in ShenZhen, China. Our U.S. office provides sales and service to our customers around the world. Our experienced staff members develop quotes, process orders, resolve technical issues and provide support and operational oversight of our staff in China. All projects are prepared, launched and tracked daily by our U.S. office. Our ShenZhen, China facilities are staffed with full range of competent support and technical personnel, including highly skilled Project Managers, Mold Designers, Quality Engineers, Toolmakers and Machine Operators. Our Tool & Die making equipment includes a variety of CNC milling machines, wire & probe EDM machines, etc., capable of producing molds of nearly any size and complexity, and inject using up to 3,500-ton machines.



# Engineering Services Directory

Welcome to *Desktop Engineering's* second annual Engineering Services Directory. We began this directory and its online companion at [deskeng.com/services](http://deskeng.com/services), to help design engineers find the help they need. Whether you need an extra set of hands at peak times, are looking for training to expand into new engineering disciplines, or want to bring in outside expertise on a particular engineering project, the service providers on the following pages are here to help.

We've divided the Directory into seven sections to make it easy to use. The online directory is searchable by company name, location and category.

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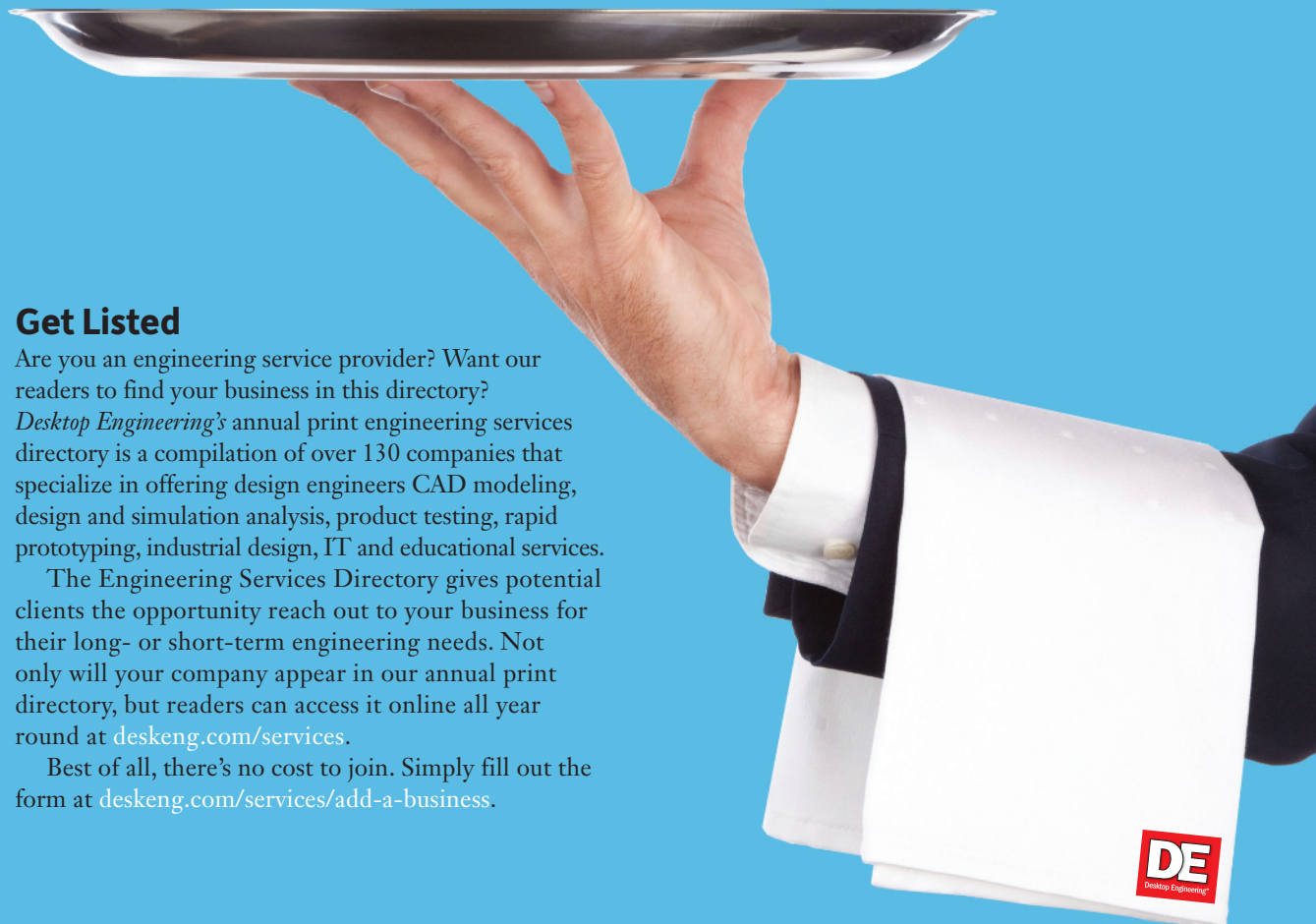
## Get Listed

Are you an engineering service provider? Want our readers to find your business in this directory?

*Desktop Engineering's* annual print engineering services directory is a compilation of over 130 companies that specialize in offering design engineers CAD modeling, design and simulation analysis, product testing, rapid prototyping, industrial design, IT and educational services.

The Engineering Services Directory gives potential clients the opportunity reach out to your business for their long- or short-term engineering needs. Not only will your company appear in our annual print directory, but readers can access it online all year round at [deskeng.com/services](http://deskeng.com/services).

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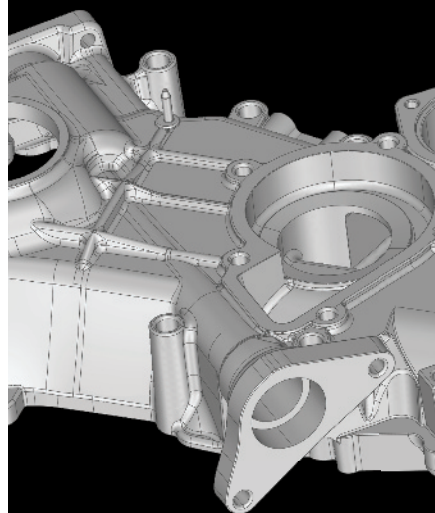
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# Building Bright Ideas

Proto Labs accelerates innovation with its quick-turn manufacturing services for prototypes.

**P**roto Labs manufactures custom parts for product designers and engineers around the world through its Firstcut CNC-machining and Protomold injection-molding services. Its proprietary software and automated manufacturing processes allow for quick-turn prototyping and fast low- to mid-volume production of real plastic, metal and liquid silicone rubber parts in days.

Designers and engineers can upload their 3D CAD model online and receive an interactive quote with free design analysis, full pricing information and quick-turn options within hours. The manufacturability analysis helps customers eliminate problems, like sink or internal undercuts. The design analysis can aid product developers early in the prototyping process and help them get real parts faster. Once a part design is ready and a quote approved, production begins and parts are shipped in one to 15 business days.

## Firstcut CNC Machining

Through a subtractive manufacturing process, Firstcut uses three-axis milling from up to six sides to machine low volumes of parts from plastic and metal materials including ABS, Nylon, PC, Delrin, PEEK, Ultem®, aluminum, magnesium, steel, stainless steel and more. The result is functional parts made from real materials for prototype testing, jigs, fixtures or one-off projects.

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For customers who need low-volume production or bridge tooling, Protomold can injection mold up to 10,000+ parts from hundreds of different stocked resins in three weeks or less. The injection-molding service machines aluminum or steel molds, in a fraction of the time and cost in comparison to traditional mold manufacturers, to produce custom parts for all industries.

## Liquid Silicon Rubber Molding

Proto Labs is now also offering quick-turn liquid silicone rubber (LSR) injection molding through its Protomold service. Liquid silicone rubber is a thermoset engineering material that possesses thermal, chemical and electrical resistance. It can withstand sterilization and is biocompatible, so it works well for products that



Proto Labs is now offering liquid silicon rubber injection molding.

have skin contact. Like plastic injection molding, Protomold can produce as little as 25 parts up to 10,000 or more.

## About Proto Labs

At Proto Labs, speed and innovation are the cornerstones of our success. We are committed to being a solution for getting things done quickly and a catalyst for great ideas. By providing timely design feedback on 3D CAD models followed by quick-turn production of prototypes, modifications can be made fast and often. It's iterative product development that allows designers and engineers to optimize their own processes and ultimately get their product to market faster.

For more information visit our website at [www.protolabs.com](http://www.protolabs.com) or call us at 877-479-3680.

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# Middlemen, Middleware Unlock the Public Cloud

Specialized IaaS, SaaS and mobile apps provide a bridge.

BY KENNETH WONG

Getting into the cloud is simple. It takes you less than five minutes to sign up for an account on Amazon Web Services (AWS). Once within, you'll be confronted with Amazon EC2 for general computing (\$0.07 per hour and up); Amazon S3 for storage (\$0.03 per TB per month and up); Amazon RDS for on-demand database; Amazon Kinesis for massive real-time data streaming; and much more.

But what is the sensible storage capacity and core count that would let you run your computational fluid dynamic (CFD) or rendering job? How do you apply the computing cores or the hours you've purchased to your turbine engine optimization session? Suppose you have chosen to migrate all construction documents to Amazon. How do you let the other 250 people involved in the project access the same documents? Who gets to edit them online? Who gets to delete files? How would the ones without AutoCAD installed on their machines look at the DWG schematics of a plant posted to Amazon?

"Some of our best customers are the ones who've tried [to implement cloud computing] themselves," says Joris Poort, founder and CEO of Rescale. "They understood enough about the potential value to be willing to take the risk, but as soon as they delved into Amazon or Azure, they discovered it was a computer science problem, not an engineering problem."

In 2011, Poort and Adam McKenzie, both former Boeing engineers, founded Rescale to offer on-demand simulation solutions by bundling hardware, software and middleware. But you won't find an air-conditioned room with server racks in Rescale's San Francisco headquarters. Rescale uses a global network of hardware infrastructure providers as the foundation for its own products. The company adds its own software on top of a



The image is a screenshot of the Rescale website. At the top, there's a navigation bar with 'Sign Up' and 'Log In' buttons. Below the navigation bar is a large hero image of an airplane in flight against a sunset sky. Overlaid on the image is a text box that says 'Reduce development time on your new aircraft development program. Explore your engineering design space faster with Rescale.' Below the hero image is a section titled 'CLOUD SIMULATION PLATFORM' with the text 'Engineers and scientists use Rescale to build, compute, and analyze simulations in the cloud'. Below this is a section titled 'Run any simulation instantly with your web browser' which lists several bullet points: 'Run any simulation code on demand - Abaqus, ANSYS, LS-DYNA, Star-CCM+ - we support third-party open source, and custom codes', 'Get access to 10,000 state-of-the-art HPC computing cores with one click', and 'Set up your most complex simulations - multidisciplinary optimizations, designs of experiment, etc. - using Rescale workflow tools'. At the bottom of the screenshot, there's a caption that reads 'Rescale created a software-hardware-middleware combo to run simulation.'

computing hardware cloud to run and monitor simulation jobs. Should the user need additional licenses of simulation software to complete the task, the company also serves as the middleman to negotiate and acquire the necessary software. In essence, Rescale has repackaged cloud hardware infrastructure into a type of service — commonly known as Platform as a Service (PaaS) — for engineering firms that heavily rely on simulation.

The model points to one way engineers and manufacturers could get into the public cloud. Few design engineers have the inclination to figure out how to refashion the public cloud into deployable applications; they'll most likely turn to cloud-powered solutions someone else has developed to tackle their problems.

## Repackaging the Cloud

Barely in its third year, Rescale is still a new kid on the block, compared to established simulation software vendors like ANSYS, CD-adapco, COMSOL or Dassault Systèmes' SIMULIA. Even so, in its relatively young life, it has witnessed manufacturers' changing attitude toward the cloud, Poort states.

"A lot of companies have decided they're definitely going



to do *something*,” he continues. “In our case, the high-end engineering customers realize they cannot just keep adding hardware to their infrastructure and remain competitive. So on-demand hardware’s value is easy for them to understand.”

As simulation jobs grow more complex, so does the need for greater computing power, achievable by investing in additional servers. Whereas large enterprises may have no qualms about the cost of additional hardware, midsize and smaller firms are much more judicious. It’s a need Rescale hopes to fill by offering not just access to the cloud, but cloud-powered storage and computing services tailor-made for simulation-heavy businesses.

Since it launched its business, Rescale has also been gradually expanding its software partner network. It now encompasses household names in simulation, like ANSYS, CD-adapco, MatLab, Convergent Science and MSC Software. For traditional simulation software vendors who’re not ready to offer their own on-demand PaaS or SaaS products, partnership with Rescale serves as the bridge to reach new users they could not reach on their own.

#### A \$500 Answer to a \$200,000 Question

Overland Conveyor Co. (OCC), based on Lakewood, CO, came up with a solver that simulates particle behavior in

bulk handling systems. Its discrete element method (DEM) software “explicitly models the motion and mechanical interactions of each object in the physical problem ... then provides a detailed description of the velocities, positions and the forces acting on each object at different points in time,” according to the company. It proves to be an ideal product for the mining business, for example, which requires routine transportation of materials in bulk using automated systems.

To be effective, OCC’s software has to run on high-performance computing (HPC) hardware. The investment may not be a significant barrier to well-funded mining firms, but could prove prohibitive for others. This presented a dilemma for OCC, which felt its solver could also be marketed to other businesses — for example, agricultural plants using automated systems to process peas.

Clint Hudson, manager of DEM applications at OCC, recalled how the company’s decision to integrate the cloud into its offerings came about. The catalyst was a hypothetical question: How can you reach companies that can’t invest \$30,000 to solve a \$200,000 problem? “What I want is to be able to give these companies the chance to spend about \$400 to \$500 to get the answer they need,” said Hudson. For OCC, the cloud was the answer.

“In the past, [companies] just bought the software,

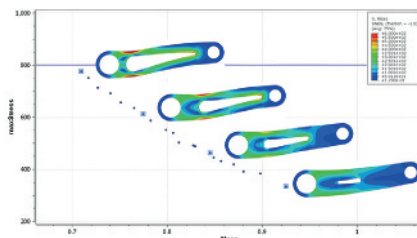
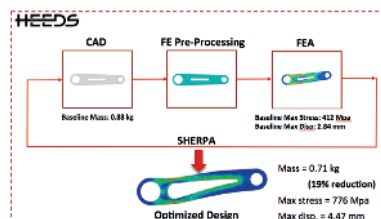
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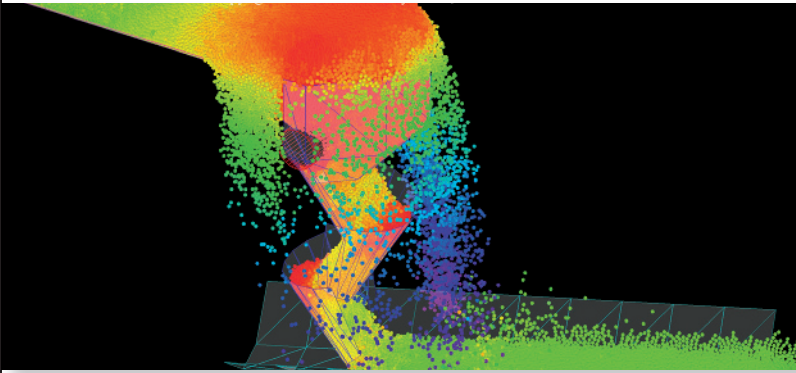
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The particle simulation results here demonstrate a chute of cascading cones unable to handle the flow rate. The particles are colored according to their speed. This simulation was performed on the DEMcloud and cost \$81. No other hardware investment was necessary. *Image courtesy of Overland Conveyor Co.*

bought the hardware, and used them as often as they wanted to,” Hudson reasons. But what if “often” is just once or twice a year? Then the initial cost of hardware and software is no longer justifiable. So OCC repackaged its DEM technology as on-demand offerings, accessible for as little as \$28. (Typical analysis sessions, Hudson estimates, would cost less than \$500 — well within the range affordable to the targeted companies.)

Last December, OCC launched the services as DEMcloud for Bulk Flow Analysis under the Applied DEM division. Users won’t need to purchase the software outright; instead, they can pay for usage. Nor do they need to invest in their own HPC hardware; access to OCC’s 32-core computing server is part of the on-demand product. In case you’re wondering where OCC’s computing infrastructure is located, the company uses AWS to scale as needed.

## Going Mobile

Some businesses fear they might miss the cloud gravy train if they don’t climb aboard quickly. Alex Brown, CEO of 10th Magnitude, has seen more than a few of them. “The issue is, they have not necessarily identified a winning business usage of the cloud,” he says. “When we start asking questions about where they see [the cloud] adding value to their business, sometimes they have a hard time answering.”

Recently, 10th Magnitude began working with a heavy equipment manufacturer to develop a mobile app for maintenance personnel working at customer sites. “The cloud and mobile technologies allow manufacturers to support their staff’s field activities in a way that in the past would have been cost-prohibitive,” Brown notes.

Built on Windows Azure, 10th Magnitude’s mobile

app allows service technicians to remotely call up customer-specific installations of mining equipment right from the site. The pilot project uses Microsoft Surface tablets, but when the app rolls out, the technician should be able to use any type of connected device, running on Android, iOS or Windows operating systems, Brown explains.

“That’s the beauty of the cloud,” he adds. “All data exchanges are quite standardized, so from the device perspective, it doesn’t matter what device you use to consume the data.”

Because the mine could also be “in the middle of nowhere,” in Brown’s words, 10th Magnitude is planning to give the tablet users the option to preload all pertinent documents onto the device itself. That gives the technician a chance to troubleshoot other equipment or check on its health, even if the site offers no connection.

## Let’s Talk Bandwidth

For simulation software powered by the cloud, the data connection still remains a critical factor. In automotive and aerospace, the 3D data that must be viewed, meshed and processed online is often measured in gigabytes.

“We knew from the very beginning that upload and download bandwidth is very important. So we use a custom Rescale JAVA uploader that uses multithreaded uploading,” explains Rescale’s Poort. “That fully saturates the bandwidth available.”

Rescale customers routinely upload 20- to 60GB models without hiccups, he points out: “It certainly isn’t going to take half a day.”

10th Magnitude’s Brown concurs that bandwidth issue was a well-founded concern — “about two to three years ago. The good news is, since then, some very interesting high-speed networking capabilities have come online for large industrial strength cloud providers.”

Brown points to the Express Route in Windows Azure, which allows a direct connection between the cloud and the end user. “Today we’re talking 1GB per sec rate; in the future, it’ll go up to 10GB per sec,” he predicts.

## Let’s Talk Security

Ask cloud skeptics and advocates to create a short list of issues that affect adoption, and security is bound to find its way onto that list. “I would love to say security isn’t an issue, but it is — just a fact of life,” says Brown. “I’m of the opinion that, for 99% of the world out there, the cloud offers a more secure alternative to whatever people are doing [on premises].”

Especially when working with biomedical and high-tech clients, 10th Magnitude has to ensure its cloud solutions are compliant with both PCI and the U.S. Health Insurance Portability and Accountability Act (HIPAA) —

“some of the toughest requirements for security,” according to Brown.

In addition, many customers’ attitude on security has changed, Rescale’s Poort points out: “They’ve gone from assuming [the cloud] is insecure so they shouldn’t do anything with it, to evaluating the security. When our customers look at our end-to-end encryption, (Service Organization Control) SOC 2 compliance, and security protocols, they often find that it’s a lot more secure than what they’re currently doing internally.”

OCC’s Hudson finds that “some companies are reluctant because they feel there’s a possibility their data might not be secure. Then there are those who won’t even look at the cloud because they’ve decided it’s not secure. They just have a policy against it.”

OCC’s software uses 256-bit encryption for every bit of data transferred to and from the cloud, Hudson reports. Besides, in mining and conveyor operations, the risk of IP theft doesn’t make a convincing argument, as many operations are well known and standardized. (It’s a different matter for an automaker, whose competitive advantage comes from the secret design of its next vehicle model.)

“So at least in some industries, I don’t think the fear of cloud is a legitimate fear,” Hudson says.

## Public Cloud, Once Removed

For small and midsize engineering and design firms, the low-cost public cloud offers tantalizing possibilities. It’s a way for them to bypass the need to purchase and maintain hardware that they may not use perpetually. If their aim is to use the cloud for data storage and backup, the setup is relatively simple; however, if they plan to use the cloud as an on-demand computing resource, it’s not so straightforward. The emergence of companies like Rescale, OCC and 10th Magnitude indicates small and midsize engineering businesses will have an easier time reaping the benefit of the public cloud through third-party companies that have developed solutions tailor-made to tackle their problems. **DE**

**Kenneth Wong** is Desktop Engineering’s resident blogger and senior editor. Email him at [kennethwong@deskeng.com](mailto:kennethwong@deskeng.com) or share your thoughts on this article at [deskeng.com/facebook](http://deskeng.com/facebook).

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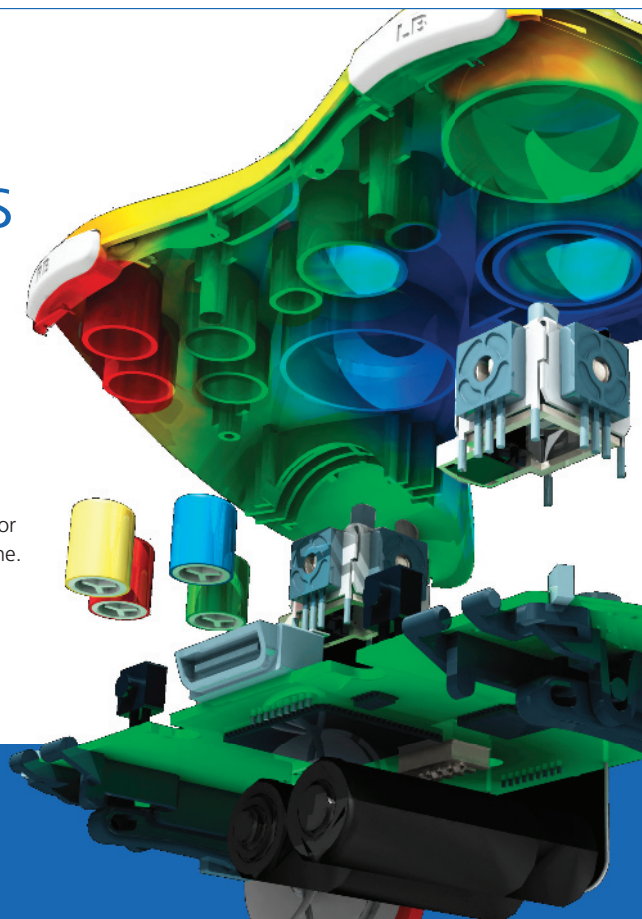
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## TATA TECHNOLOGIES





# 7 Keys to Working with Outside Analysts

Can using simulation services make your project rock? Read on.

BY PAMELA J. WATERMAN

**F**or projects large and small, sometimes the best solutions unfold under the guidance of outside experts. It makes sense to use a consultant instead of investing in rarely needed software, or when a niche task crops up that's beyond your staff's expertise. But how do you really know when it's time to hire engineering services? What do they need to do the job well, and how do you make it all work when those people are across the city — or the continent?

Consultants can be lifesavers, or at least project-savers. The above questions and others form great starting points for successfully partnering with outside help, whether a one-person business or a service with multiple experts and locations. Here are the must-do steps for a great outcome.

## 1. Decide whether you even need a consultant.

Time, resources and experience are at the core of why companies seek outside analysis help, says Nagi Elabbasi, managing engineer at Veryst Engineering, a consultancy with special emphasis on coupled and nonlinear systems.

"The client needs a quick turnaround, the client has a problem requiring expertise and/or equipment that it does not have, and/or the client needs the solution to a complex problem requiring specific expertise," he explains, noting that's when it's clear "that the service provider knows the field better than anyone else."

Sometimes it's just a matter of project scheduling — you own analysis soft-

ware, but you're short on time and simply need someone to get the task done, for example. The in-house team can focus on other areas, or take the time to build up internal experience to do the next job themselves.

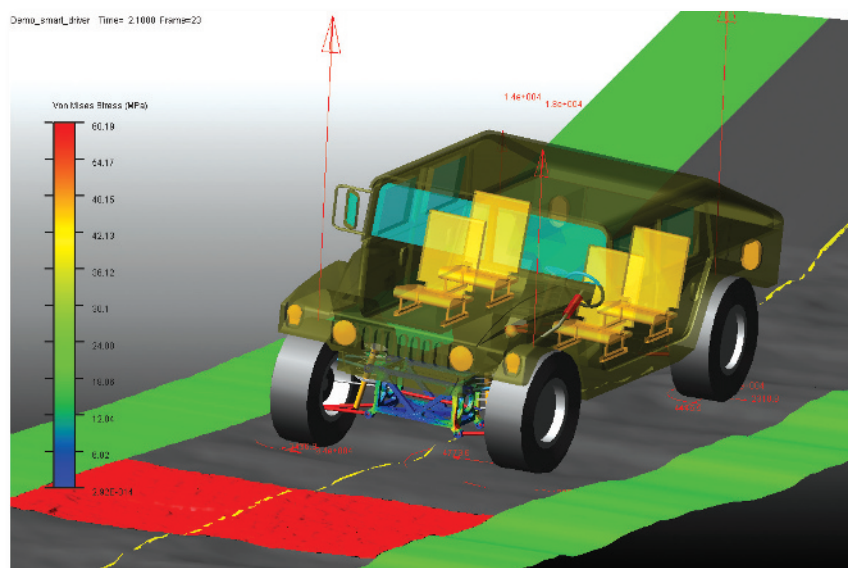
Often a company, regardless of size, does analysis infrequently and can't justify developing in-house capabilities. Derek Barkey, senior manager of consulting for MSC Software, points out that it's not just about the cost of the software.

"You have to consider getting the tools, getting the training, and adding the headcount," he explains. "If it's something they're going to do on a regular basis, maybe it makes sense to make that investment. If they're only going to do analysis

occasionally, then maybe it's more cost-effective to let someone else do it."

Many projects require niche expertise, from understanding the properties of composite materials to predicting the wear effects of water flow on a structure. Consultants generally have more time to focus on details that go beyond your everyday workflow; they know the latest in code compliance and standards, or the tradeoffs that can optimize system-level behavior. Even companies well versed in general structural or fluid dynamics analysis may simply not have the depth to thoroughly perform such specific tasks.

One additional, very good reason exists for looking to outside expertise: creativity.



Including flexibility in some of the critical components in a Humvee suspension system contributes to the accuracy of Road Loads predictions performed with MSC Software mechanical simulation products.  
*Image courtesy MSC Software*

"When people go outside for engineering services," says Tony Norton, executive vice president of Altair's ProductDesign team, "it's often to get 'fresh eyes' on the problem, to get innovation injected into their product development process." The Altair subsidiary specializes in thinking outside of the box, using a simulation-driven design approach to employ CAD and CAE in parallel. Its engineers tackle such jobs as upfront geometry optimization for weight reduction, prior to detailed dimensioning.

## 2. Be confident you're choosing the right company by asking the right questions up front.

Fundamentally, the Top 2 considerations are: can they do what you want, and can you work with them? The information you need to decide yes or no, then, comes from answers to such questions as posed by Nick Veikos, president of CAE Associates, a company that since 1981 has applied ANSYS analysis solutions to finite element analysis (FEA) and computational fluid dynamics (CFD) problems:

- Does the consultant have the level of expertise required to help meet the goals of the engagement?
- Have they successfully worked on similar projects?
- What kind of engineering degrees and how many years of experience does the staff have?
- Have they worked with clients whose names you recognize as industry leaders?
- Is the engagement going to be transactional, or are they in a position to be a long-term partner, learning your processes and practices, with the expertise to help in multiple ways?
- Can they effectively articulate their findings to you in a manner you can understand? Will this include insight into your product or process?
- Are they flexible in how they work, and can they easily accommodate changes in scope — common needs in these types of engagements?
- Do they use the best software tools, and have access to sufficient computer hard-

ware to produce the correct answer to your problem in a timely manner?

Understandably, customers also look for an objective metric, such as hourly rate, to compare to others. But as MSC's Barkey says, in reality, value is more complicated and subjective.

"If we can do things better and faster, and give you a lower total cost," he explains, "then the total cost and its value are what's important."

Added value can take many forms. O'Donnell Consulting, for example, specializes in analyzing designs of vessels,

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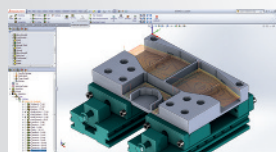


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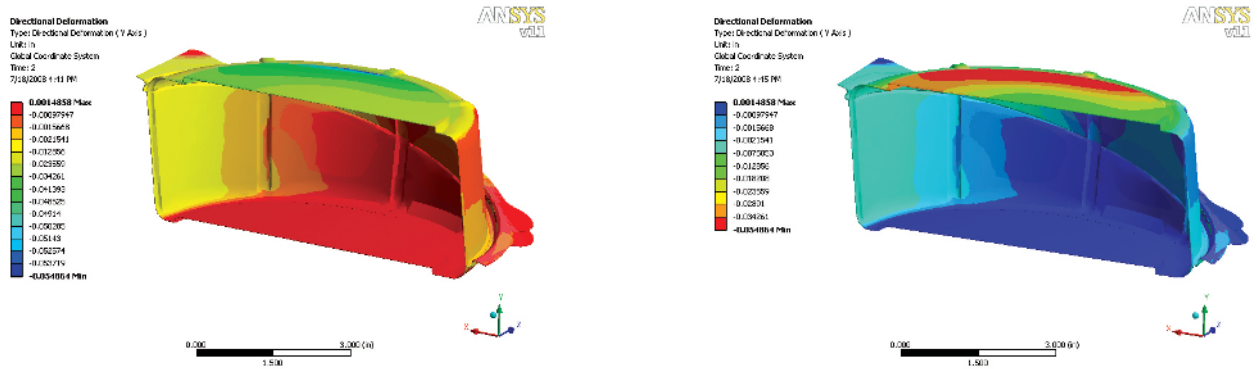


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An analysis project for the improvement of a plastic cake container, done by CAE Associates for Inline Plastics Corporation. The goal was to optimize the cake-container design with respect to material use and product visibility while maintaining sufficient structural stiffness of the container during shipping and handling. CAE Associates used ANSYS Workbench to create the FEA model. Using a statistical approach, the company analyzed hundreds of design scenarios to produce a table of product geometries optimized for various client-driven goals. *Images courtesy CAE Associates*

## Independent Consultant or Vendor Service?

**M**ost analysis software companies offer their own consulting services, so you have choices to make. If you work with the developer, such as ANSYS, the company engineers could readily create customized software to add specific capabilities — or integrate third-party software within ANSYS Workbench.

However, a one-person or small-business consulting service may have greater pricing flexibility, shorter turnaround, and experience with several vendors' tools for a best-match analysis solution.

Some software developers, such as COMSOL, certify independent consultants in the use of their software. According to the company's website: "COMSOL Certified Consultants use their extensive experience with COMSOL Multiphysics and our related products to deliver turnkey solutions for a wide range of modeling projects. They produce ready-to-run models and reports with an in-depth analysis of the simulation results."

Use the seven steps in the main article to help you choose which path to take.

turbines, shafts, ductwork, heat exchangers and turbo machinery. Drawing upon the company's 44 years of engineering experience, Bill O'Donnell, vice president of marketing, says, "Knowledge of fatigue and fracture properties is essential to evaluate structural integrity." His company adds value by offering interdisciplinary expertise in structural, materials, fabrication, welding technology, metallurgy and FEA.

### 3. Determine the path that starts at proposal and ends with results.

Clients come to a consultant because they have a problem that ideally translates into a specific analysis or experiment.

"Our job is to solve their problem and act in their best interest," says Veryst's Elabbasi. "Sometimes we find that a different course of action is more suitable; we must communicate that to the client — even if it means someone else should provide assistance."

Tom Marinaccio is senior vice president, worldwide engineering services, at CD-adapco, a global engineering company with particular expertise in flow/thermal software development and applications. He agrees, saying, "Remember, no one ever just wants 'an analysis'; they need the analysis to answer certain questions or to use as an example to learn how an experienced supplier approaches the simulation." He asks clients, "What do you want to know at the end of the

engagement that you do not know now?" The more we understand the objectives, the better."

A well-defined project must include simulation objectives, a proposed timeline and specific deliverables. If test results are at hand, reports on manufacturing tolerances, failure modes and supplier data should also be provided.

"The more details, the better," says CAE Associates' Veikos. "The relevant geometry, material data, loading and all other data should be made available up front. This way, it will be clear what data is missing, providing the maximum amount of lead time for acquiring it."

### 4. Communication and progress tracking are critical.

Consultants often break a project into one-month sections with defined deliverables, making weekly phone calls to discuss progress. Although face-to-face meetings or site visits are helpful, working with a geographically distant consulting company is comparable to using a local one. Quick emails, easy file transfers, multi-site conference calls, and Skype, Webex or GoToMeeting videoconferencing can all keep the job moving smoothly.

Some projects have crisp statements of work (SOW) and specific milestones; for others, the milestones aren't as clear. Even when deliverables seem well defined, MSC Software's Barkey



says consultants must ask, "How good is good enough?" and put in decision gates — setting a certain amount of time after which to decide, for example, should we now refine one of these four design concepts, or evaluate yet others?

## 5. Ensure that the analysis you receive is valid.

Validation (they're solving the right model) and verification (they're solving that model correctly) are both important aspects of the analysis to monitor. To do so, depending on the size of a project, you may first hire an engineering service to set up a pilot program. Paul Goossen, vice president of engineering solutions at Maplesoft, suggests you could even work in parallel, compare results to your satisfaction, and then have the confidence to turn over the complete program. Or, going in the other direction, the goal could be knowledge transfer so that eventually you'd do analyses yourself.

Either way, you should insist on seeing some type of basic hand calculation to ensure the results are in the ballpark. Goossen says analysts should be able to expose the equations they are using — and even point to relevant papers on the subject so you can see the rigor of their approach. Look, too, for clear definitions of the loading, boundary conditions, material models and simplifying assumptions that went into the analysis.

"You should review some type of numerical confirmation of the results, such as mesh density effects, heat and force balance, etc.," Veikos states. "If the results are counterintuitive, possibly also benchmark the analysis results for a similar component that has already been tested."

## 6. Make sure you're comfortable with how the company estimates and structures billing.

You should find a company that offers comfortable terms for your needs and budget. Some bill a minimum as low as one day's work; others do time-and-materials. Most propose contracts with a fixed/not-to-exceed price, including clear, preset

milestones. To test the waters, you could always start with a small project first.

## 7. Find out how security and intellectual property concerns are handled.

Clients are understandably sensitive about their information, so non-disclosure agreements are standard. Consultants take pains to keep data, procedures and results secure, making sure only the engineers working on the project have access.

At large companies, it's possible that two people may be working on similar projects for two different clients, so keeping firm boundaries is critical. At the same time, if your consultant will be writing custom code for the analysis job, be clear as to who owns the work afterward.

### Your New Best Friend

The simulation consultant should provide you with a sounding board as the voice of experience. Be clear about your goals, but open to suggestions — sometimes an initial conversation steers the project onto a much more efficient path. Ultimately, working with an outside analyst should be a productive and satisfying process for both of you. **DE**

*Contributing Editor Pamela Waterman, DE's simulation expert, is an electrical engineer and freelance technical writer based in Arizona. You can send her e-mail to DE-Editors@deskeng.com.*

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# Prototyping's New Rules of Engagement

With more engineers using their own 3D printers, rapid prototyping service providers evolve to fill a need for speed, volume and expertise.

BY BETH STACKPOLE

**A** CIST Medical Systems, a manufacturer of cardiovascular medical device systems, has a fairly extensive set of prototyping capabilities in-house. It maintains an array of medium- to high-end additive manufacturing (AM)/3D printers from a variety of vendors, along with a computer numerically controlled (CNC) milling machine to produce more functional parts. Yet when the engineering group has a requirement to produce multiple iterations of a part or assembly, it frequently turns to an outside prototyping service provider — a design decision meant to aid in expediency and the optimization of limited engineering resources.

“Typically, we do our first-run iterations in-house, mostly for the sake of time and because we want our engineers to interact with the machine shop in a rapid development process,” notes Dave Scott, product development manager at ACIST. The company enlists the RedEye 3D printing service bureau, a business unit of Stratasys, as its prototyping service provider. “The unwritten rule is once we need multiple versions of something, we engage RedEye. It’s as much of a throughput issue and an investment in skills — we appreciate the technology, but it’s better utilization of our time to have RedEye’s expertise managing the creation of those parts.”

Like ACIST, many manufacturers are following a similar design strategy now that less expensive and more functional 3D printers are becoming common fixtures in mid-size and even smaller engineering shops. These printers give design teams the ability to get a basic feel for a part or to explore multiple iterations of a design concept much earlier in the process, without expending significant budget on producing expensive physical prototypes.

Nevertheless, experts say there are limitations to the technology, especially at the stage in the design workflow where functional form and fit is a major priority and when a more realistic representation of the design is required. In addition, in-house prototyping capabilities are often limited in the number and kinds of supported materials, impeding



**This multi-material prototype, which requires no bonding, is printed as one piece with the skeletal system on the inside (rigid white) and the exterior body printed (rigid amber). Image courtesy of GROWit LLC**

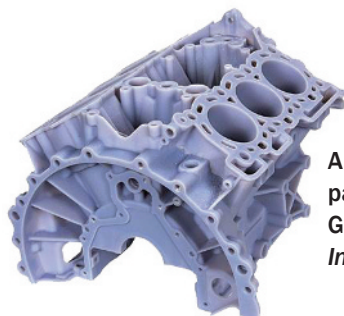
their ability to output a complex part. At the same time, the engineering organization might not have the expertise or the bandwidth to comply with the tight delivery schedules that accompany rapid prototyping.

“With the introduction of lower-cost 3D printers, most of the early concept models and design validation models are being built-in house by the people doing the design work,” notes Terry Wohlers, principal consultant and president at Wohlers Associates, a consultancy specializing in AM, 3D printing and rapid prototyping.

Companies start to seek outside prototyping services



when they get to the point where the design is more mature and there's a need for a full-scale model, an accurate surface finish, or something that needs to be bolted or joined to an assembly, Wohlers explains. "If it's a functional prototype that might require stronger materials or better accuracy and they don't have those capabilities in house, that's typically when they go outside to a provider," he says.



**A single-color, high-resolution part prototype created by GROWit LLC.**

*Image courtesy of GROWit LLC*

### 3D Parts and Beyond

GROWit LLC, which provides rapid prototyping services, built its business on the premise that engineering customers needed two things they couldn't provide on their own: 3D printing of different materials to accommodate increasingly complex prototypes, and consulting services that go beyond a simple transaction of ordering a part online. That's according to Ken Burns, who heads up business development for GROWit LLC.

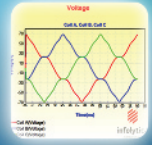
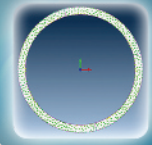
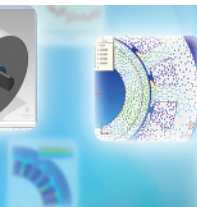
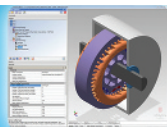
When the Objet Connex multi-material printer was first released in 2007, GROWit LLC decided to be among the first service providers to purchase it and use it as a jumping-off point for differentiation. "So many products in the market are dual-material or require printing of separate components or materials that we saw this as a groundbreaking service," Burns recalls. "Moreover, while half our custom-

ers have 3D printers, even some high-end production ones, they rarely own the full array of technologies that need to be utilized because it just doesn't make sense."

With so many materials and AM technologies from which to choose, GROWit LLC helps each client select the right materials and prototyping processes for a particular job. "If a customer doesn't know what they want in 3D printing or fully understand the capabilities of different materials and the methods for producing those materials, then they are likely to get a bad part and not use us again," he explains, noting that 75% to 80% of GROWit LLC's business is comprised of returning customers because "we help them choose the right process and technology based on their specific project."

RedEye is seeing a similar shift in its business model,

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## Online Marketplace Facilitates Rapid Prototyping Projects

**R**P Marketplace is bringing the concept of an online marketplace and educational resource to the process of professional rapid prototyping practices via its recent launch of a new online platform specifically designed for business-to-business interactions.

RP Marketplace serves three critical functions as part of the rapid prototyping process: It helps facilitate the sourcing of rapid prototyping suppliers, aids in the management of project details, and provides a secured environment for conducting the financial transaction, according to Steven Levy, president and founder of the site.

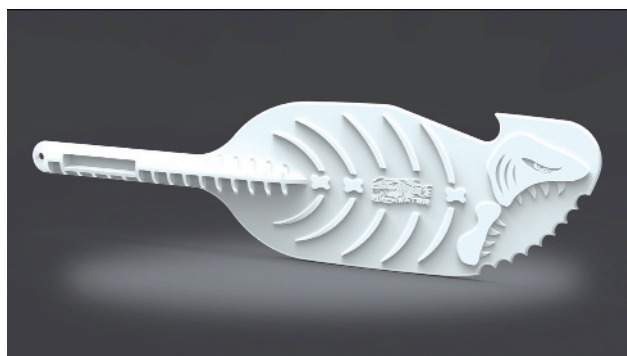
Engineers simply post their prototyping project to the site. Suppliers respond with bids, which can be easily compared. Unlike a Google search or a directory of rapid prototyping providers, RP Marketplace serves up detailed supplier profiles and a rating system, which mimics sites like eBay to allow customers who have transacted with a particular supplier to report on their experience with the service.

Once a customer accepts a bid, the platform aids the payment process via a safe escrow payment system that protects both parties. There are also capabilities for setting up milestone payments so funds are distributed only when specific parts of a job are completed. "In this way, a small business that's new to this type of industry and service feels a little safer entering the market because they don't have to dish out \$5,000 to a supplier they've never worked with before, knowing nothing about their history or past," Levy explains.

Currently, RP Marketplace has 30 premium suppliers on board — and it's just starting to post projects. The site offers a number of resources to educate potential buyers on rapid prototyping processes and technologies, including a database that provides information on most 3D printers and materials offered on the market.

"You can use the database to compare bids," Levy says. "This streamlines the process and makes it much easier to understand when you're seeing an explanation of what a supplier offers."

— B.Stackpole



**The Piranha Paddle was CNC-machined through Proto Labs' Firstcut Machining Service. The actual size is 21.9 x 5.8 x 0.85 in., and was designed for kayaking through gnarly-swampy areas. Image courtesy of Proto Labs**

away from being a pure transactional 3D printing service to more of a consultative engagement in many instances, says Tim Thellin, senior program manager for the firm. Because the service is being used "deeper" in the development process as a way to simulate rubber or project a certain finish, for example, RedEye is spending more time offering consulting services to customers on everything from how to design for AM to how to manipulate CAD files to best fit with Stratasys' Fused Deposition Modeling (FDM) technology, Thellin says.

At the same time, RedEye is also being engaged beyond prototyping to do pre-production or small production runs. "Say a customer has a product that they produce in high volumes that we're not capable of running, but they want to get to market as soon as possible," Thellin explains. "While they're waiting to get the injection-molded tooling done, they use us for some of the components."

While previously, just 1% of RedEye's business was high-quantity orders of more than 25 parts, that figure constitutes about 30% of the company's revenue today, Thellin says.

Proto Labs, which offers injection molding and CNC machining services, also doesn't see the influx of low- and mid-range 3D printers as competition, but rather as a complement to the services it provides. While most on-site 3D printers are great for conceptualizing what a part looks like or to create a prop for early design reviews, they aren't effective for testing function or verifying fit and tolerances.

"We're where you turn to test a part for load capacity or if its gasket material is holding up well," explains Gus Breiland, Proto Labs' customer service engineering manager. "We can put a functioning prototype in the hands of a development team, a user or a small sales team looking to sell the product."

Product development consultancy Bressler Group has plenty of in-house prototyping muscle, yet it still regularly turns to Prototyping Solution Group to provide prototyping

services to its customers, in part because of efficiencies, but mostly because as a dedicated prototyping provider, PSG has a breadth of skills and expertise that Bressler lacks. “We don’t do CNC or SLA (stereolithography) [prototypes] in-house because it’s too much for what we want to handle,” says J.D. Albert, Bressler’s director of engineering. “PSG is an expert at making prototypes, and we do it because we need to. Our core competency is design and engineering and figuring out how to get things working.”

### Relationship Tips

Bressler and PSG have also figured out the secret to making their engineering services relationship work: Responsiveness and effective communication. Unlike prototyping service bureaus where you exchange a few CAD files and emails regarding quotes, Albert and others say it’s important to regularly communicate and have in-depth discussions upfront about the use case for the prototype parts.

Tom Budd, a partner at PSG, says the company makes it a point to drill down into basic prototyping requirements, including budget and timeframe, well before preparing a quote. “Most problems are a result of a breakdown in communications, where the services provider hasn’t asked enough questions about how the part is to be implemented



Barobo’s Mobot-I is a modular robot with body parts injection molded through Protomold, Proto Labs injection-molding service. Image courtesy of Proto Labs

and the client hasn’t taken the time to explain the program,” he explains. “We try to get inside the customer’s head and listen to what they have for budget and timeframe, which helps dictate what technology we’ll use.”

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Responsiveness is another major consideration when choosing a provider, Albert says. "A lot of times, you are counting delivery times by the hour, not day, so that kind of high-level responsiveness is important," he observes. Also, if it's not 100% obvious what process to use or what material to employ, it's critical to be able to talk through those requirements with your service provider, he says: "Deep experience is necessary, along with a combination of responsiveness and openness to trying new things."

Managing customer expectations, especially because much of the 3D printing technology is still relatively new to some engineering shops, is another important aspect to ensuring a prototyping services partnership works optimally for both parties. While most 3D printer vendors do a great job of showcasing their technology and materials, it's not always clear what the end result will look like or how much finishing work is necessary to achieve that desired state, according to Matt Hlavin, CEO of rp+m, an engineering and manufacturing services provider.

Helping customers through the learning curve via education and handholding is what sets a true prototyping services experience apart from using turnkey service bureaus, Hlavin says. "While this is a 35-year industry,

it's still in its infancy and the parts are not perfect and the machines don't run perfectly all the time," he explains. "People have this notion that they can send a file over and it comes back perfectly all the time. They look at it as a transaction vs. a strategic relationship, and that's where a lot of the disconnect happens." **DE**

**Beth Stackpole** is a contributing editor to DE. You can reach her at [beth@deskeng.com](mailto:beth@deskeng.com).

**INFO → ACIST Medical Systems:** [ACIST.com](http://ACIST.com)

→ **Bressler Group:** [BresslerGroup.com](http://BresslerGroup.com)

→ **GROWit LLC:** [GROWit3D.com](http://GROWit3D.com)

→ **Proto Labs:** [ProtoLabs.com](http://ProtoLabs.com)

→ **Prototype Solution Group:** [ProtoSG.com](http://ProtoSG.com)

→ **RedEye:** [RedEyeOnDemand.com](http://RedEyeOnDemand.com)

→ **RP Marketplace:** [RPMarketplace.com](http://RPMarketplace.com)

→ **rp+m:** [RPPlusM.com](http://RPPlusM.com)

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# Scanning the Horizon for Automated Inspection

A miscalculated business launch led to the birth of a new product.

BY KENNETH WONG

About 5 years ago, Bill Greene and his colleagues at Level 3 Inspection (L3I) foresaw the need for precision 3D scanning and inspection in orthopedic implant manufacturing. So they opened an office to offer professional computer-aided inspection services in Warsaw, IN, known as the Orthopedics Capital of the World. The city owes its nickname to Revra DePuy, an early orthopedic appliance manufacturer who left his indelible mark there. Now, other industry leaders like Biomet, Zimmer, Medtronic and their supply chain partners are also part of the city's economic landscape.

L3I is first and foremost a digital inspection service provider. Its bread and butter come from precision manufacturers who need to verify that the parts built conform to the

design specified. To accomplish this, clients usually contract L3I to scan the part produced in the manufacturing facility, then compare the high-resolution digital scan to the original CAD geometry.

For all intents and purposes, L3I's services seem like a perfect match for improving the quality of braces and implants commonly used in the orthopedic profession. Considering how costly a recall is for the manufacturer — and how devastating it is for the patient — the industry could clearly benefit from greater quality assurance.

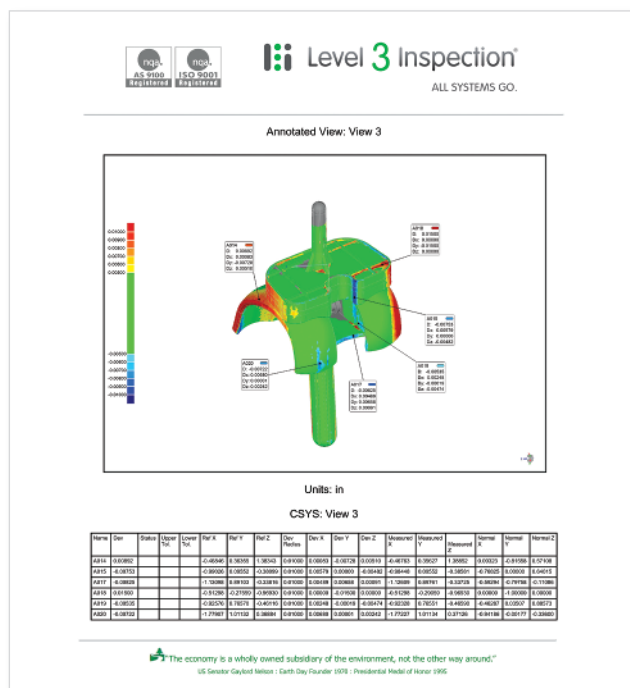
But at the onset, Greene didn't realize there was a fundamental difference that separates aerospace and automotive manufacturers from their orthopedic counterparts. "[Orthopedic manufacturers] love the result, but just aren't comfortable outsourcing the job," he reports. "They'd much rather buy the equipment and bring the operation in-house."

So, instead of combatting the prevalent culture and tradition in orthopedics, Greene decided to adapt. L3I invented and applied for an international patent for an integrated, automated system that would perform the same computerized inspection operations, but could be used by a nontechnical operator. Thus, the Smart Inspection Station (SIS) was born.

## Services vs. Automation

Since it was founded in 2008, L3I has scanned more than 4,000 precision manufactured parts projects, ranging from the unusual to run-of-the-mill mechanical parts. The staff has scanned an actual rose for an artist who wanted to reproduce it at 500 times' scale. They have scanned a house-arrest ankle bracelet for an attorney who needed to prove the device showed no evidence of tampering by his client (the outcome could determine whether the attorney's client would remain in solitary confinement or be sent back to the relative comfort of house arrest). They have certainly scanned more than their fair share of turbine jet engine parts.

L3I's technology is certified to meet ISO's AS9100/ISO9001 Quality Specification standard, and the company recently secured its ISO 17025 accreditation, which includes a proficiency test. To begin the process, Greene and his colleagues scan the part in a high-resolution white light scanner



An annotated page from Level 3 Inspection's report on comparing an as-built orthopedic knee implant and the intended design. Images courtesy of Level 3 Inspection

to within 2-micron accuracy (or within 0.000078 in.). Then they transform the point clouds into a polygonized-mesh (.STL format) file for analysis, inspection and reporting in Geomagic Control (formerly Geomagic Qualify), a metrology software solution. According to Geomagic, the software gives users “the highest accuracy, speed, and comprehensive, automated reporting on the quality of as-built parts for first-article inspection, production inspection, and supplier management using computer measuring machines and 3D scanning tools.”

On a typical contract job, Greene and his colleagues would scan the part, align the scanned results to the CAD data in Geomagic Control to identify the deviations, then proceed to extract all of the dimensions from the blueprint and generate extensive reports in Microsoft Excel and Adobe Acrobat. The analysis results are presented to the customer via secure FTP in a portfolio of PDF and spreadsheet reports. “On complex parts, that report can be 300 to 400 pages — often over 30MBs of information,” Greene says.

In the SIS, the same scanning, inspection and reporting process is completely automated. “We program the super-computer in the SIS to collect the scan file, align the scan file to the CAD model, generate a color plot, extract the di-

mensions from the blueprint, and populate the spreadsheet and PDF reports — all completed automatically,” Greene explains. “It’s really become the Answer Machine for precision parts’ dimensional-quality inspection.”

The SIS, roughly the size of a small refrigerator, consists of a scanner, a robotic controller, Geomagic Control software and proprietary firmware. The system is provided with a support contract, which includes training and technical support. “We actually program the system to inspect the [client’s] part numbers,” says Greene. “We can do that off-line because we have replicate systems in our facility. Once the program is ready for final testing, we download it to the SIS over the Internet.”

With manual scanning equipment (also available from L3I), the user must manually reposition the part several times to expose all surfaces of the part to the 3D camera’s field of view; in SIS’ automated process, however, the part rotation is a computer-controlled robotic operation, yielding speed and throughput.

“Geomagic has been a long-term good partner,” Greene says. “We’ve developed our system using Geomagic Control as the analysis engine. We’re very excited about our partnership, as more precision manufacturers want these fast, reliable results.”

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**The Smart Inspection Station, an automated computer-aided inspection unit from Level 3 Inspection. Image courtesy of Level 3 Inspection**

## Hobbyist vs. Professional Markets

Greene sees the increased consumer use of 3D printing in the hobbyist market, coupled with some pioneering attempts to use mobile phone apps for 3D scanning, not as a threat but as an encouraging sign. The trends point to rising consumer interest in low-res scanning that can raise awareness of the professional market for high-res scanning — L3I's domain.

"Most products and methods in the market are 200 times less accurate [than L3I's technology]," he says. In addition to the accuracy of their process, he says the staff at L3I adds value because they are "master practitioners and can readily recommend how to solve manufacturing problems when they are discovered."

Almost half of L3I's staff is made up of former Pratt & Whitney and other aerospace engineers, according to Greene. Greene is himself a metallurgical engineer with experience in the aerospace industry. That domain expertise allows them to interpret the scanned results correctly and compare them to the designer's intent and reference files, as captured in the CAD geometry and blueprint.

"We know how the scanner and the software work together in our process — in many cases, even better than those who created the scanner and the software," Greene says, noting that anyone can purchase a scanner and the inspection software, but just being able to evaluate the scanner output file and the CAD geometry in the inspection software doesn't give you the answer you need.

"You'll be hundreds or many thousands of button clicks away from getting the dimensional-quality answer you want, and to understand the difference between the measured part and the designer's intent," he points out.

## Ease of Use

The SIS is the encapsulation of L3I's knowledge and processes, so you can get the answer you need in 10 minutes without technical expertise, according to Greene. That ease-of-use is especially important to precision manufacturing professionals, since scanning and running inspection soft-

ware is not their core competency or main responsibility.

There is no limitation to the part size, the material of construction, the surface finish or the shape that can be inspected by L3I's technology — except for line of sight, because the process is stereo digitizing. Greene recalls one of the smallest objects his firm has ever been asked to scan. It was a dental piece made from investment cast ceramic, measuring "smaller than one-third the size of an uncooked grain of rice," he estimates. Greene put up the scanned results in 3D — defined with 800,000 data points — on an oversized monitor so its details could be inspected from every imaginable angle. He was delighted to see the jaw-dropping reaction of his client. **DE**


**Kenneth Wong** is Desktop Engineering's resident blogger and senior editor. Email him at [kennethwong@deskeng.com](mailto:kennethwong@deskeng.com) or share your thoughts on this article at [deskeng.com/facebook](http://deskeng.com/facebook).

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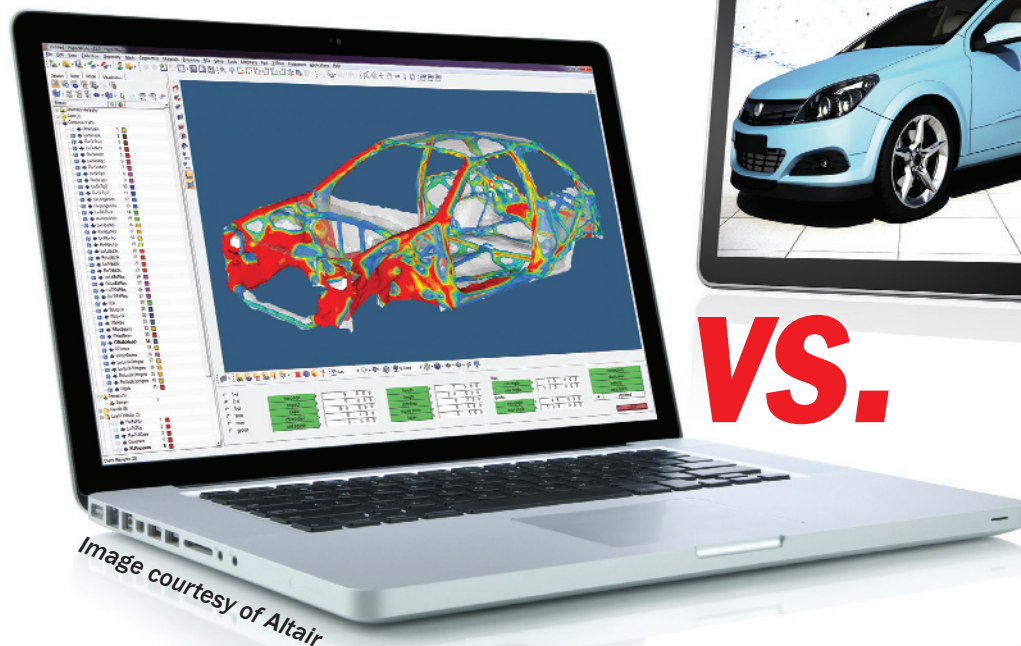
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# Research



VS.

# Innovation

Companies are starting to understand that it's a matter of "innovate or die," but how to drive that innovation?

**BY MARK CLARKSON**

**A**n innovation center's job is to come up with new products, or new and better ways of making the old products. Innovation sounds a bit like research, but it's different, says ETA's Akbar Farahani: "When you are talking about innovation, you are talking about new ideas for solving current problems, or improving the current methodologies. That's a major difference between an innovation center and a research center such as at a university. Research centers can have a lot of abstract ideas that are way, way ahead of their time, whereas an innovation center is looking for the near-term solutions to current problems."

But the difference between the two isn't always easily discernable. Around 15 years ago, ETA pioneered a technology it called the Virtual Proving Ground (VPG).

The idea was to replace very expensive real-world testing of automobiles with much cheaper computer simulation. (Editor's Note: Read more about VPG at [deskeng.com/de/vpg](http://deskeng.com/de/vpg))

"When we came up with the Virtual Proving Ground," says Farahani, "we felt it was a huge, huge breakthrough. We thought we were solving a current problem of product design and development for the auto industry, but we were six or 10 years ahead of everybody else."

In other words, it's only been in the past two or three years that VPG has started gaining serious traction in the automotive industry.

## What's an Innovation Center?

Ask 10 people what an innovation center is or does, and you'll get 10 different answers. An innovation center can

be anything from a cubicle to a building, and comprise anywhere from a single person to dozens of people. Innovation centers are usually focused on a particular product or process, or associated with a particular technology, such as 3D printing, finite element analysis (FEA) or shape optimization.

For example, MakerBot — acquired last year by Stratasys — is opening innovation centers in colleges and universities across the country, from State University of New York to the College of the Ouachitas in Arkansas. The idea is to provide students and, via the school, local businesses with easy access to 3D printing technology and see where it leads.

As you might expect, a MakerBot innovation center features lots of 3D printers, 3D scanners, and the computers to run them, but not all innovation centers are so recognizable. Most look just like any other room or building.

Consider an innovation center working to redesign a structure for weight reduction. “When you look at it, you’re not going to see the innovation,” says Altair’s Royston Jones. “When you look at it, you just see people and desks and machines. But they’re doing different stuff.”

Exactly what that stuff is depends on the group’s goals.

### Outside Expertise

Do you need an outside company or agency, someone like MakerBot or Altair, to help you set up an innovation center? How about just doing it yourself? Commandeer a room, stock it with some engineers and product managers, and give them the freedom to innovate. “You can do that,” says Jones. “Some companies will do that. But I think there’s a lot to be said about trying to get other DNA into your gene pool. OEMs increasingly realize that they don’t have all the answers inside, and can’t always generate innovation from inside.”

The particular expertise you bring into your innovation center will, of course, depend on what you’re trying to accomplish. Are you looking for help with shape optimization, 3D printing, advanced simulation analyses or maybe just basic engineering and design?

### Outside Agendas

Back in the day, before restructuring and downsizing left many large companies somewhat thinned out, they generally carried all the engineering knowledge they needed, says Craig Winn of Applied Technology Integration (ATI). “They had the expertise. They had hundreds — or thousands — of engineers,” he adds. “Today, more and more of these companies’ engineering departments are doing project management as opposed to serious engineering.”

Increasingly, engineering expertise is coming from outside. “Our engagement with the customer has changed quite a bit in the last three to five years,” says Winn.

“We’ve gone from making a few drawings or doing an analysis, to helping them develop concepts for manufacturable designs that meet their parameters.

Of course, outside companies will have their own agendas.

“In automotive,” says Winn, “we used to lean heavily on the supply base to design and develop the hardware. But if you’re a supplier of some kind of large cast part and you’ve got a large casting plant, the concepts you’re going to create are going to help you to fill your capital equipment, to keep your plants running. That limits the solution set.”

The innovation center should typically be neutral to technology and capital, Winn points out.

“When we set up an innovation center with a company, we have no preference for how the part ought to be manufactured, because we have no plant,” he explains. “We’re a service, not a manufacturer.”

### My Place or Yours?

When you’re working with outside companies, where the innovation center is located is key. Winn advocates a physical and psychological break from the everyday.

“We do it both ways,” says Winn, “but more often, we use our facilities. Loading my people into the customer site is doable, but if you’re trying to innovate, you typically



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get better results by taking it outside of your mainstream, whether it's offsite at your building down the street or [an external] innovation center's building. The customer putting his project leader in my building with a team of my people is probably going to get a better result than me putting my people with his project leader in his building.

"If we work at his facility, we become part of his rhythm and routine — including the phones, distractions, trips to the coffeepot, discussions of bowling scores, and all the stuff that goes on in a typical office," he adds. "I think the innovation center really needs to be at a separate site."

The innovation center might even be more of a network, with some people here and others over there. "Ten years ago," says Winn, "customers were bothered if we were 30 miles away. Now we're working with customers on the East and West coasts, in Canada, in Italy. It's not a big deal to the younger managers. It doesn't bother them."

### Paving the Way

Where this innovation gets integrated into your normal design and development process depends on your needs and constraints but, generally speaking, the earlier the better. The greatest potential for change — be it weight savings or shape optimization — occurs early on in the design process.

"All we're doing then is delivering a design," says Altair's Jones. "How we produce the design is generally not that interesting to the program, and the program is generally using a different toolset. All they want is great design input. But the future, going forward, is going to be about getting these programs to use this type of innovation technology themselves. Ultimately, you'd be wanting to have these innovation tools within the existing, established design process."

ETA's Farahani agrees: "For me, an innovation center is [for developing] strategy and problem-solving that we can not only benefit from in the near-term, but which also paves the way to use that technology for the long-term." **DE**

Contributing Editor **Mark Clarkson** is DE's expert in visualization, computer animation, and graphics. His newest book is *Photoshop Elements by Example*. Visit him on the web at [Mark-Clarkson.com](http://Mark-Clarkson.com) or send e-mail about this article to [DE-Editors@deskeng.com](mailto:DE-Editors@deskeng.com)

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## From the Drawing Board to the OR

*Titan Medical teams with Ximedica to bring a novel robotic surgical system to life.*

Robotic surgery has become a widely accepted medical procedure over the past decade. The tele-manipulator and software of robotics restore intuitive movement control to the surgeon, providing the right/left hand synchronicity that standard minimally invasive surgery (MIS) lacks.

Growth of sales in life sciences robotics was in the double digits in 2013, according to the Robotics Industry Association (RIA). Global annual medical robotic revenues are currently about \$4 billion, and are expected to continue to grow at a 12% annual clip, reaching \$19.9 billion by 2019. RIA calls surgical robots “revolutionary tools” for surgeons that help transcend human limitations by providing reduced invasion (less trauma), tremor reduction, repeatability, precision and accuracy.

As a new technology advances, innovative thinking can refine performance. Such was the case for a group of

researchers at Columbia University's College of Physicians and Surgeons. Seeking to overcome the size, cost and dexterity issues of large, multiple-incision robotics systems, they envisioned a smaller, less-expensive, more nimble device



that could perform MIS through a single port of entry into the body, and be moved among operating rooms as needed. The goal was to deliver the advantages of instinctive robotics controls on a compact platform that could be adapted to a wider variety of general surgery operations than is currently available.

Device developers Titan Medical recog-

nized the opportunities presented by the researchers' single-port concept, tested the academic prototype (at Vanderbilt University, where one of the inventors had relocated it) and licensed the intellectual property (IP) from both universities.

To help guide the product into production, Titan chose Ximedica, an ISO-certified, FDA-registered, full-service development firm that focuses exclusively on the medical industry. “We had narrowed our search down to two potential vendors, and ultimately chose Ximedica because of their capabilities, feedback from references, product understanding, communications and management skills, as well as an overall feeling that they could handle all aspects of the project under one roof,” says Titan CEO John Hargrove.

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## Mcor IRIS Brings Tangibility to Customers

*Williams 3D provides manufacturers and industrial companies with colorful, durable and affordable 3D printed prototypes to improve product design.*

To be a great metal fabrication company, you need to be great at design. And to be great at design, you need to make lots of prototypes.

For sheet metal engineering company WH Williams of Sydney, Australia, prototyping means going beyond CAD designs and handcrafting; it means operating one of the most powerful 3D printing services on the continent. Its focus is on high-volume industrial and manufacturing clients.

### Spinning off a Popular Business

The company has made it easy for its customers to see prototypes before final manufacture of the products they have commissioned. In fact, this service has quickly become so popular with clients that the company has spun it off as a new business. That business is Williams 3D, a comprehensive 3D printing service cater-

ing to WH Williams clients — and anyone else who needs 3D models.

Anchoring the Williams 3D printer fleet is the Mcor IRIS 3D printer, billed as a color-capable, affordable and environmentally friendly unit. It's also the only 3D printer using ordinary letter and A4 paper as the build material. Although made of paper, the finished models are essentially wood.

“The Mcor IRIS has been printing non-stop since we bought it,” says Williams 3D General Manager Wojciech Wawrzyniak. “It's by far the most affordable machine we operate because the build material, the paper, is so ubiquitous. A model costs us \$3 to print instead of the \$300 or \$400 it would cost on another machine.

“That's why our strategy is built on using the IRIS to create first-, second- and third-draft physical prototypes,” he continues.

“When the design is close to approval, we

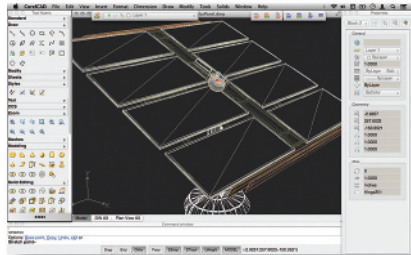


can, in the event it's actually needed, produce a final prototype or the finished part on one of our more expensive machines. It would be foolish and cost-prohibitive to print in plastic from the get-go.”

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Each week, Tony Lockwood combs through dozens of new products to bring you the ones he thinks will help you do your job better, smarter and faster. Here are Lockwood's most recent musings about the products that have really grabbed his attention.



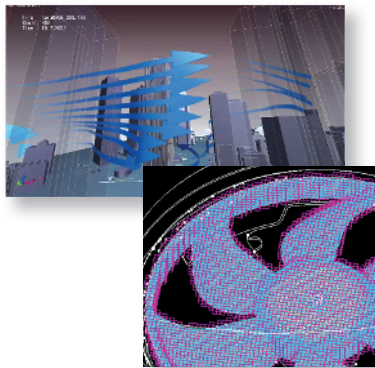
## CorelCAD 2014 Introduces Ribbon User Interface

*New release also incorporates enhanced layer tools and new search capabilities.*

Version 2014 of CorelCAD appears focused on efficiency enhancements. Among these are a new Windows Ribbon user interface, enhanced layer tools and a new 64-bit Mac version. Notable introductions include CAD file standards verification, something called QuickGroups, some new search functions, and a feature called Design Resources.

CAD file standards verification means that beginning with CorelCAD 2014 you can verify a CAD drawing against drawing standards such as those stored in DWS files. The new search functions let you search by keywords to find application settings, preferences, drafting style settings or drawing file properties.

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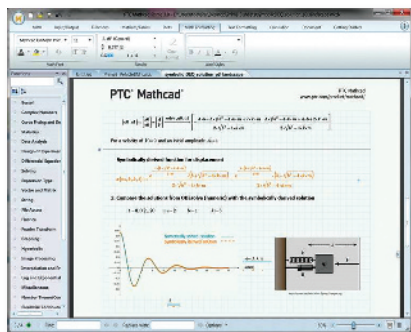
## Software Cradle's CFD Suite Upgraded

*Includes new versions of unstructured and structured grid applications.*

Software Cradle recently released version 11 of its flagship CFD system, SC/Tetra. It has a new liquid film model that, along with its existing particle tracking function, helps you simulate droplets splattering to a wall and turning into a liquid film. It also has a new Moving Arrows function for visualizing 3D flow patterns. The arrows literally move

about your object of interest, providing you insight at the slightest glance. Other new functions in Version 11 include denoising, a new piston analysis function with improved mesh deformation and an evaporation function of free surface calculation (VOF—volume of fluid).

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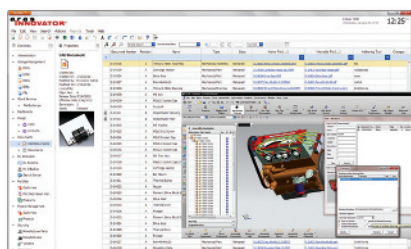
## PTC Introduces PTC Mathcad Prime 3.0

*Also releases new version of its free PTC Mathcad Express.*

Version 3.0 of PTC Mathcad Prime has been enhanced to handle more complex equations faster and now incorporates new functionality like math in text and formatting math regions. Numeric enhancements include new, faster matrix decomposition functions with support for pivoting and complex numbers. Version 3.0 has

what's called a Global Definition Operator that lets you define constants and parameters you can use anywhere in the worksheet. You can also now make a contour plot of a set of unordered 3D points with a PTC Creo design software surface interpolation algorithm.

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## Aras Innovator 10 PLM Platform Released

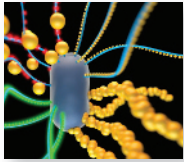
*Latest version introduces browser client and additional PLM platform scalability.*

Aras Innovator has fewer lines of code. That means better efficiency and performance than earlier versions. The company is also pretty certain Aras Innovator is the fastest PLM platform for multi-CAD with Check-in / Check-out. The software's management capabilities streamline and automate the Check-in / Check-out process for entire CAD

assembly structures. Features include a rapid status check for an entire CAD structure and high-performance parallel, asynchronous file check-ins for each level of the CAD structure. Scalability has been enhanced to handle 100 users to more than 100,000 users, according to the company.

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## Living Nanomaterials Made from E.coli



Researchers at MIT may have advanced the development of self-assembling materials by using E.coli bacteria to create a material with properties of both living and non-living substances.

The team says that by adding gold nanoparticles or quantum dots to the bacteria, it is possible to create “living materials” that could self heal or develop complex networks. When gold nanoparticles are added to the fibers, they grab the particles and create a network of nanowires. The team also created curli fibers that could weave quantum dots in the biofilm. The researchers also found that the cells can coordinate with each other to control the composition of the biofilm.

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## Kinect-Capable Rendering Tool

The Altair Partner Alliance has gained its first rendering tool, a 3D solution with tracking capabilities for augmented reality technologies that leverages Microsoft Kinect.

LinceoVR from Seac02 renders 3D models in real time, and allows users to create customized on- and off-line scenarios for interactive product presentations. According to the company, Automotive and consumer goods producers and retailers can take advantage of LinceoVR to present product concepts, along with marketing and sales applications. It can be used in the packaging design phase for visual decision-making support as well.



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## Robonaut Finds its Legs

**N**ASA is adding legs to a robot prototype on the International Space Station. The Robonaut 2 will eventually perform cleaning and maintenance tasks on the ISS. Once the robot can walk in zero gravity, it will be trained to perform maintenance tasks outside the station.

The legs will provide a fully extended span of 9 ft. Each leg has seven joints and an “end effector” on the feet that allows it to take advantage of handrails and sockets on the ISS.

Robonaut 2 can be remotely controlled by a ground crew member via virtual reality or through keyboard commands. The unit’s fingers include pressure sensors, and it is strong enough to move a 20-lb. weight in Earth’s gravity using just one arm.

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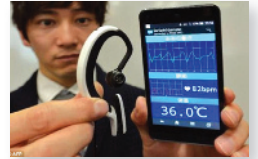


## A PC for Your Ear

Japanese firm NS West has developed a wearable PC for your ear. It looks like a hearing aid, and includes a compass, GPS tracker, gyro sensor, barometer, speaker, and a microphone. It also has infrared sensors that can monitor the movements of your ear as you change facial expressions, allowing hands-free operation. It is battery powered and includes built-in storage, so it could accept software, apps, and files, and includes a pulse monitor and thermometer for health monitoring.

The initial prototype was built at Hiroshima University. The developers expect to have a finished product available by the end of 2015.

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# Plan for the Future Today

**T**wenty years ago, Matt Eggemeyer never dreamed that he would become wedded to manufacturing. Newly minted with a bachelor's degree in history, he thought a desk job in banking awaited him. But when his mother urged him to give his family's custom manufacturing business a try, he honored her wishes — and never looked back.

Today, he is chief operating officer of Keats Manufacturing, outside of Chicago, and his greatest pleasure is engaging young people in the career that has become his passion.

In the decades since Eggemeyer waded into the family business, technology has invigorated his company — and enriched his professional life — in ways he could never have imagined. For example, this year, Keats is investing in a system that can provide 100 different views of the precision metal parts it makes, so production is virtually flawless. This kind of technology not only gives Keats another competitive advantage; it makes every day an exciting learning opportunity for Eggemeyer and his colleagues.

Eggemeyer is far from an isolated example.

**Manufacturers must wear their hearts on their sleeves. America's growth depends on it.**

The 1,200 American manufacturers responding to ThomasNet.com's latest Industry Market Barometer survey on their growth and outlook are effusive in describing how technological advances are improving their companies and invigorating their work life. As a result, they are growing, hiring and increasing their production capacity to meet future demand. These manufacturers say their employees, market leadership, technology, and innovation will help them continue to compete. Nearly seven out of ten (67%) will focus on introducing new or innovative products/services this year.

## Generational Divide

But at a time when innovations like additive manufacturing (AM) and robotics are opening new opportunities for manufacturers, a crack is slowly forming in this positive picture: Our research reveals a lack of talent from new generations that threatens this sector's future.

The companies that we surveyed are representative of today's manufacturing workforce, which is heavily populated

by employees who are 45 and older. With Generation Y (18 to 32 years old) expected to make up 75% of the workforce by 2025, and Baby Boomers retiring in droves, manufacturing's "biological clock" is ticking away.

Indeed, a closer look at our findings reveals a disconnect between the growth of these manufacturers and the lack of young talent to learn the business before older generations exit. Eight out of 10 manufacturers report that Generation Y represents a small fraction of their workforce, and most don't see this changing soon. These findings point to a need for a collective "succession plan" for the manufacturing sector.

## Education and Perceptions Need to Change

Eggemeyer, too, knows that nurturing fresh talent is fundamental to his company's future. He is constantly persuading neighbors and "friends of friends" in career transitions to give Keats Manufacturing a try.

"I don't find trained manufacturers; I make them," he says. His creative approach pays off. Last year, Keats hired and retained 15 new staff members (average age 25), bringing the total number of its employees to 106.

Most of the respondents to our survey (73%) say they believe that young people still have negative perceptions that deter them from considering manufacturing jobs. Many of these manufacturers have developed partnerships with schools to engage their "best and brightest," and they consider educators important for their future. They continue to call on high schools to offer more skills training, and to increase their emphasis on science, technology, engineering and mathematics (STEM).

As a foundation of our economy, the manufacturing sector is strong, and technology continues to give companies more opportunities to grow. For example, manufacturers' websites are their No. 1 business-building tactic, online or offline. For the manufacturing sector to benefit most in this era of innovation, however, those who love the industry need to step up efforts to share their passion with the next generation.

A few words from Matt Eggemeyer's mother changed the course of his life, and made him fall in love with his career. With a similar approach to engaging the next generation, starting at the grassroots level, we can grease the wheels of this \$1.9 trillion sector, carrying it toward an even more vibrant future. **DE**

**Eileen Markowitz** is president of ThomasNet. Contact her via [thomasnet.com](http://thomasnet.com) or [DE-Editors@deskeng.com](mailto:DE-Editors@deskeng.com).

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