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> Special Section

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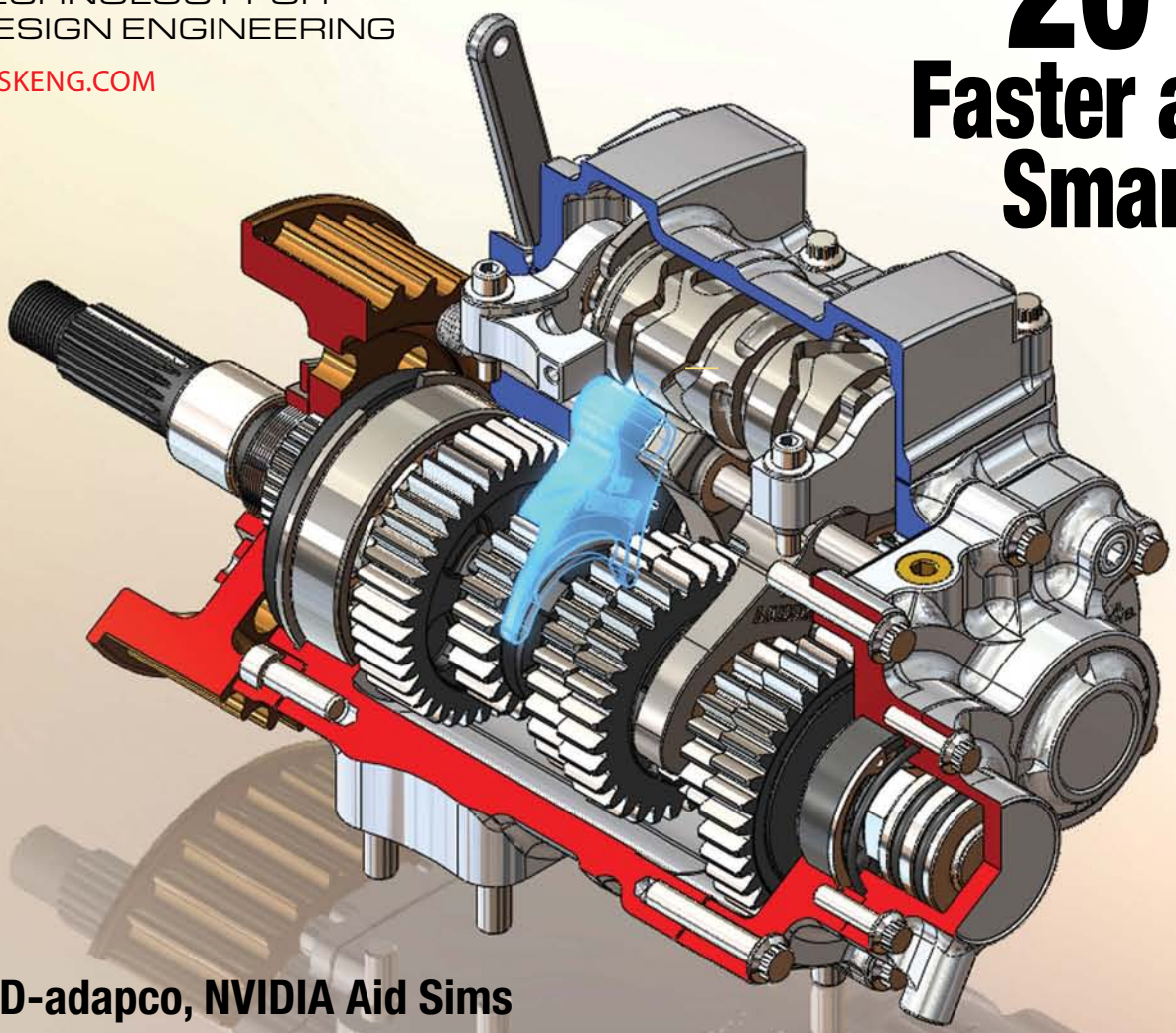
Faster and Smarter



> CD-adapco, NVIDIA Aid Sims
> Visualization with aesthetica
> Aras Innovator on a Shoestring
> Sculpting with Autodesk Mudbox
> Dassault Systèmes' PLM Strategies
> HP's Z800: Redesigned & Reinvented

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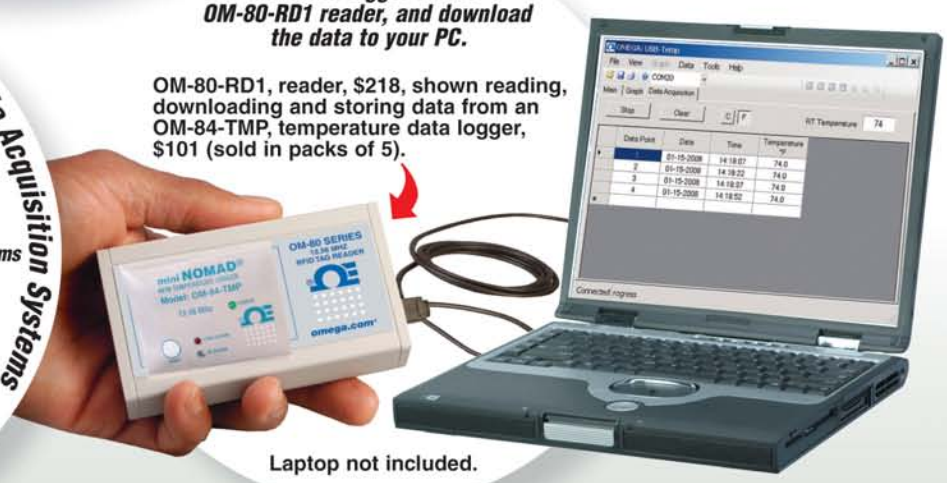

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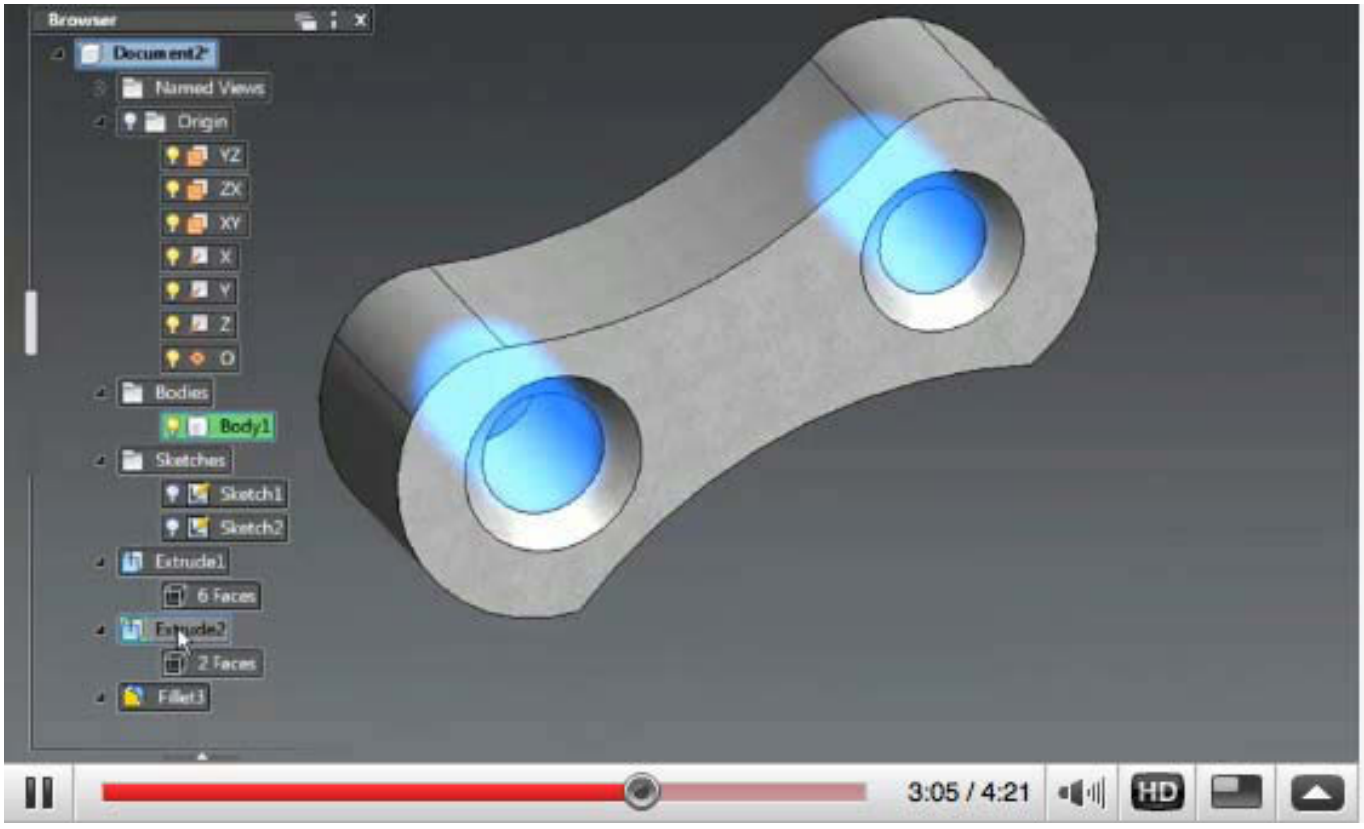
The Changing Face of Parametric Modeling

KENNETH WONG
kennethwongsf@earthlink.net

Push-pull editing, commonly found in direct modeling programs like SpaceClaim and CoCreate, has now been embraced by many leading parametric CAD brands. Despite having Parametric for its first name, PTC or Parametric Technology Corp becomes the latest to implement push-pull functions. This appears in the company's flagship Pro/ENGINEER Wildfire 5.0 software under the name Dynamic Editing..

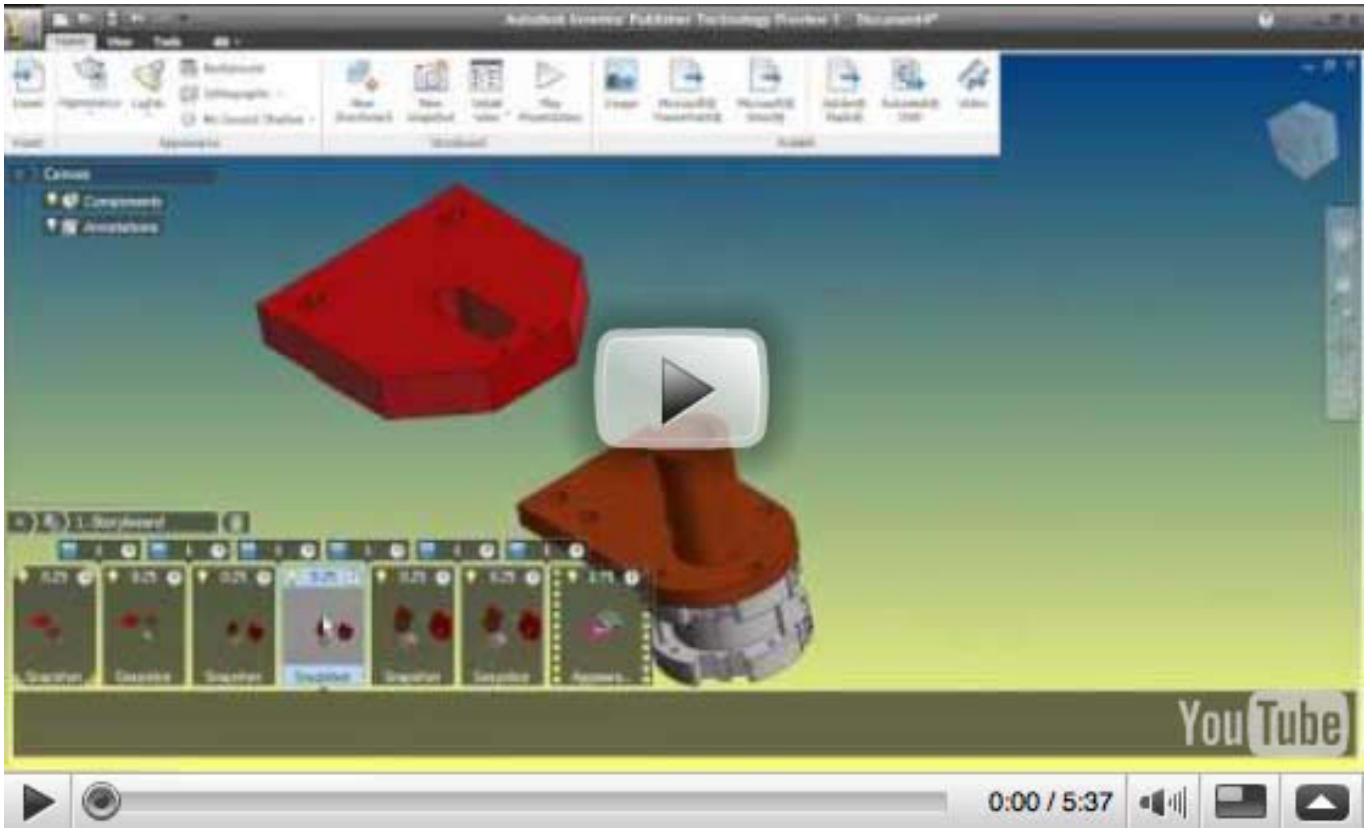
Click here to learn more and watch a video of it in action. ■



Inventor Publisher Technology Preview

Released in the midst of Autodesk University 2009, Autodesk Inventor Publisher is a technology preview of a 3D documentation publishing application, aimed as those who might wish to create assembly instructions, repair manuals, and other CAD-based documentsat. The program can read both native Inventor parts (.ipt) and DWF files, but the light DWF file format might be easier to handle, especially in creating animations involving large assemblies

Read more and see the video. ■



Delivering on the Potential of Multiple Cores for HPC

PETER VARHOL
pvarhol@deskeng.com

Two dual-core Intel processor systems sit on my work table. Yet for the vast majority of applications available today, this kind of computing power is not nearly as efficient as it could be because almost no commercial applications can divide up their workloads to execute in parallel.

One of the most difficult problems faced by the computing industry is writing software that can effectively use multiple processor cores. You must understand the application intimately to know where the opportunities for separate code streams to run independently exist and to make detailed changes to the code in those areas so it will run on different cores without causing synchronization problems. And even then the code can only be run on that specific processor architecture.

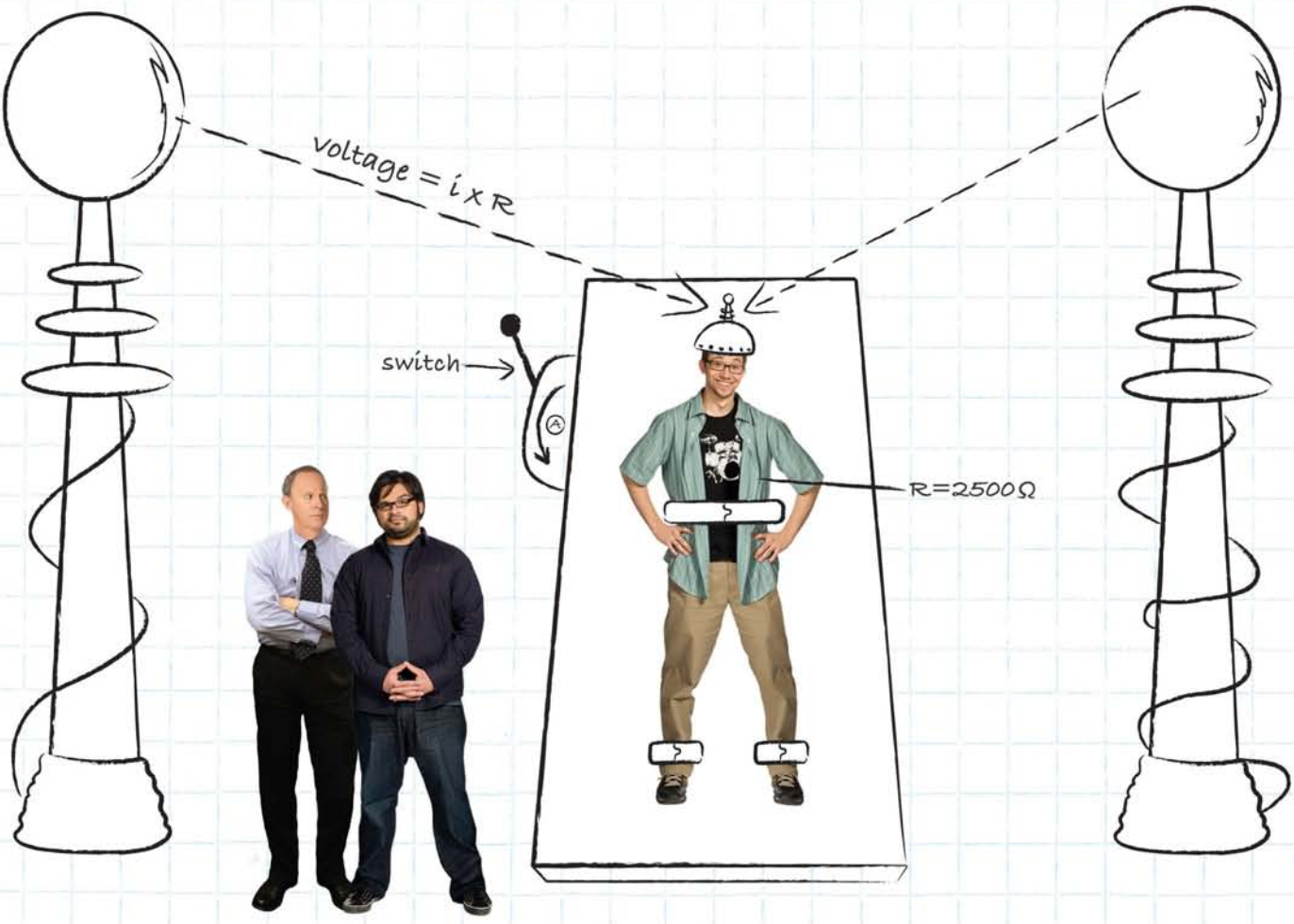
Mitrionics AB (mitrionics.com) of Sweden has a piece of the answer to this puzzle. While it doesn't by itself parallelize code, the company's Mitrion-C is a language that enables developers to easily parallelize code, and to port that code to other processors.

> Mitrion-C is a portable language designed for writing parallel code.

According to Mitrionics' Co-Founder and Stefan Möhl, the inability to fully use more than a single core has dire implications for our information society. "Our computing practices are built upon the foundation provided by Moore's Law," he explains. "If Moore's Law no longer holds, because software can't take advantage of increased computing power, our information society will no longer be able to advance at the rate of the past."

Technology—and the universe it serves—takes advantage of Intel Cofounder Gordon Moore's famous observation that computing power doubles every 18 months, by building faster computers and designing more complex software.

Möhl says that Mitrion-C is not an ANSI C, but rather a completely new language optimized for parallel compilation and execution. He says it uses C syntax, but is as different from C as is Java. Mitrion-C was originally



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developed to run on processors encoded into field-programmable gate arrays (FPGA) to be able to get the most out of these embedded processors.

More recently, Mitrionics has branched out. At Supercomputing '09 in November, the company announced a proof-of-concept compiler to demonstrate that a Mitrion-C program will automatically scale through parallel execution, not only on FPGAs, but also on multicore systems and clusters, without changing the source code between theses very diverse architectures.

In particular, the company has tested Mitrion-C with multicore systems and clusters, and has determined that no code changes are needed to achieve parallel operation. Möhl anticipates that the same will be true with graphics processing units (GPUs). He notes that these processors and architectures are actually less highly parallel than FPGAs, and require that the compiler sequentialize. "To run Mitrion-C code on other less parallel platforms, you need to sequentialize the code, rather than parallelize it. The problem of automatic parallelization has turned out to be very hard. In comparison, sequentialization is quite easy."

To take advantage of the capabilities of Mitrion-C, developers first have to learn and practice the language. The similarity to the C language makes it relatively easy to learn, and once developers get the hang of it, they can write applications that are both highly parallel and are portable to several different parallel architectures. Engineers benefit by having design and simulation applications run more quickly, and across more computing platforms. ■

*Contributing Editor **Peter Varhol** covers the HPC and IT beat for DE. His expertise is software development, math systems, and systems management. You can reach him at DE-Editors@deskeng.com.*

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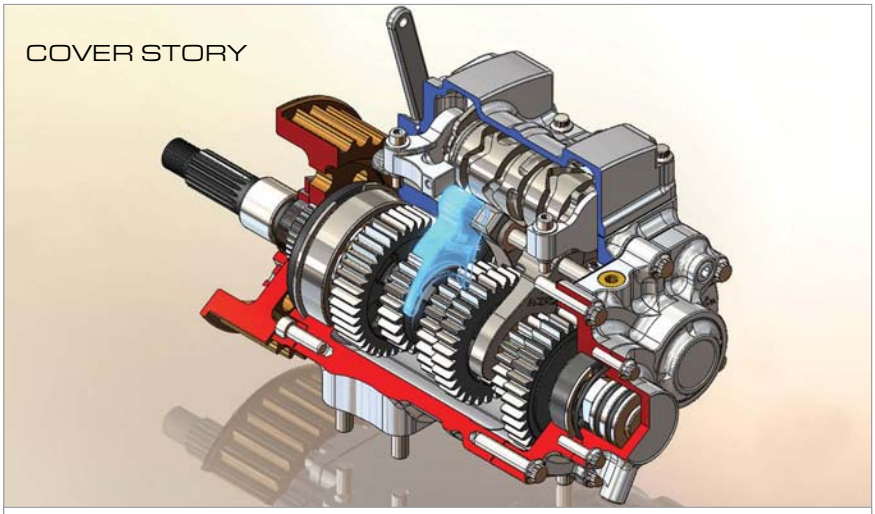
"To err is human – and to blame it on a computer is even more so."
> Robert Orben



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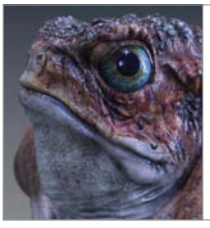

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> *Newslink; Editor's Pick of the Week; Check It Out (Videos, White Papers and Webinars); Virtual Desktop; Elements of Analysis and Simulation; Elements of Engineering IT & Computing; Elements of MCAD; and Elements of Rapid Technologies.*

ON THE COVER >This is a model of a left-side drive five-speed motorcycle transmission design by Baker Drivetrain (bakerdrivetrain.com) of Lansing, MI. Baker has been using SolidWorks for the last four years to design transmissions for Harley Davidson and custom motorcycle builders. The light-blue section indicates a gear fork has been selected for editing. *To read Kenneth Wong's review of SolidWorks 2010*, turn to page18.

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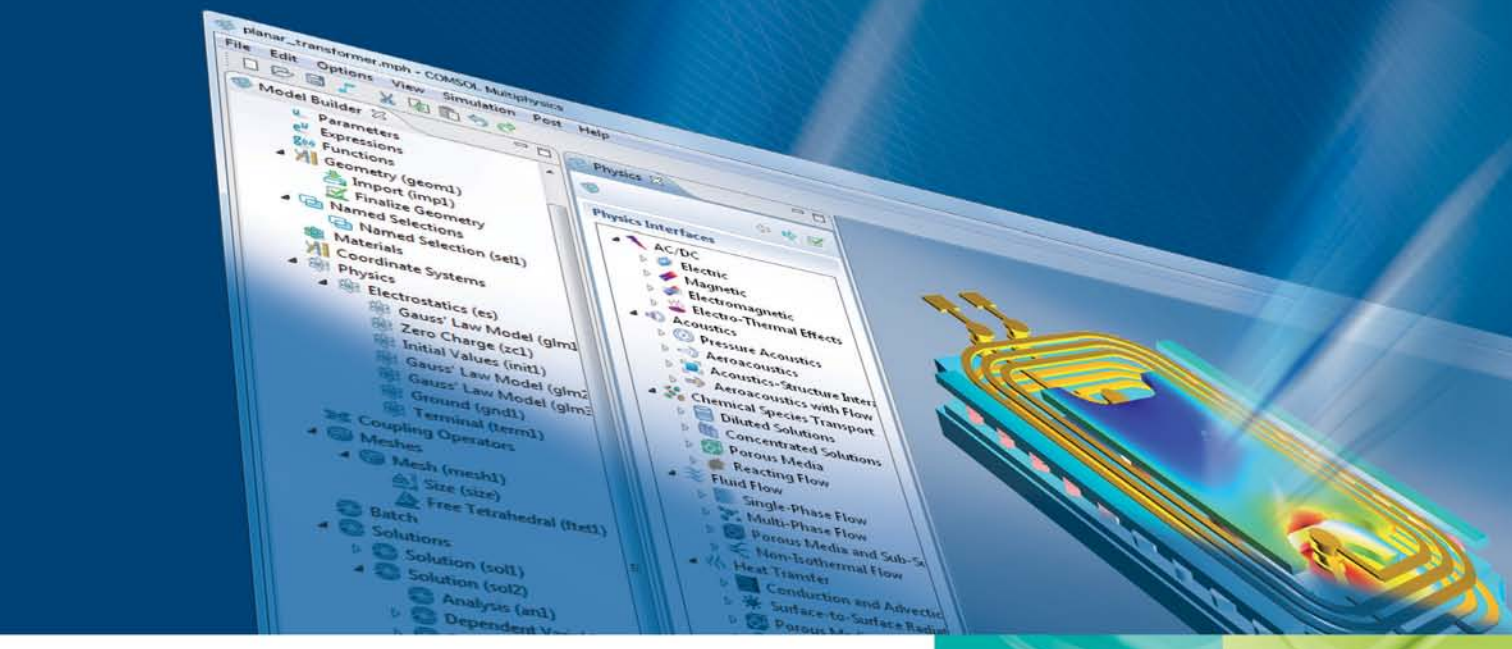

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NAG Enables Multicore Performance Improvements on HECToR

The Numerical Algorithms Group (NAG) has announced new HPC performance milestones including up to four times better performance with multicore optimization for materials science and quantum Monte Carlo applications, and reductions of up to 25 percent in runtimes with I/O tuning for an ocean modeling application. These are the early results of NAG's distributed Computational Science and Engineering (dCSE) support program for HECToR, the UK's national supercomputing facility.

In the first project to complete, CASTEP was enhanced with band-parallelism to allow the code to scale to more than 1,000 cores. The speed of CASTEP on a fixed number of cores was also improved by up to four times on the original, according to the company. The CASTEP project showed the collaborative nature of the dCSE program, with the University of York undertaking the core development in conjunction with NAG HPC staff and the Science and Technology Facilities Council.

In another project, an ocean modeling application known as NEMO (Nucleus for European Modelling of the Ocean) underwent optimization including I/O techniques and variable resolution approaches to run 25 percent faster on relevant use cases. This represents a $600,000 saving in computing resources for that project with potentially multi-million dollar savings across all NEMO users, according to NAG.

A third project optimized a quantum Monte Carlo code (CASINO) for better performance on multicore nodes by introducing shared memory techniques and hierarchical parallelism. This resulted in performance gains of up to four times on quad-core nodes and further performance gains from I/O optimizations for simulations using more than 10,000 cores. Following NAG's work, the scientists were able to run on 40,000 cores of the Jaguar Petaflops supercomputer at Oak Ridge National Laboratory.

FOR MORE INFO:

> Numerical Algorithms Group

Metris Changes Name to Nikon Metrology

The corporate name of Metris has been changed to Nikon Metrology NV.

Nikon Metrology blends Metris' experience in micrometrology with a globally recognized brand. The new organization includes the Nikon 2.5D vision measuring systems that complement optical and mechanical Metris 3D metrology solutions.

Bart Van Coppenolle, founder of Metris and now CEO of Nikon Metrology, said the ability to trade under the Nikon brand meant further investment in future product development.

FOR MORE INFO:

> Nikon Metrology

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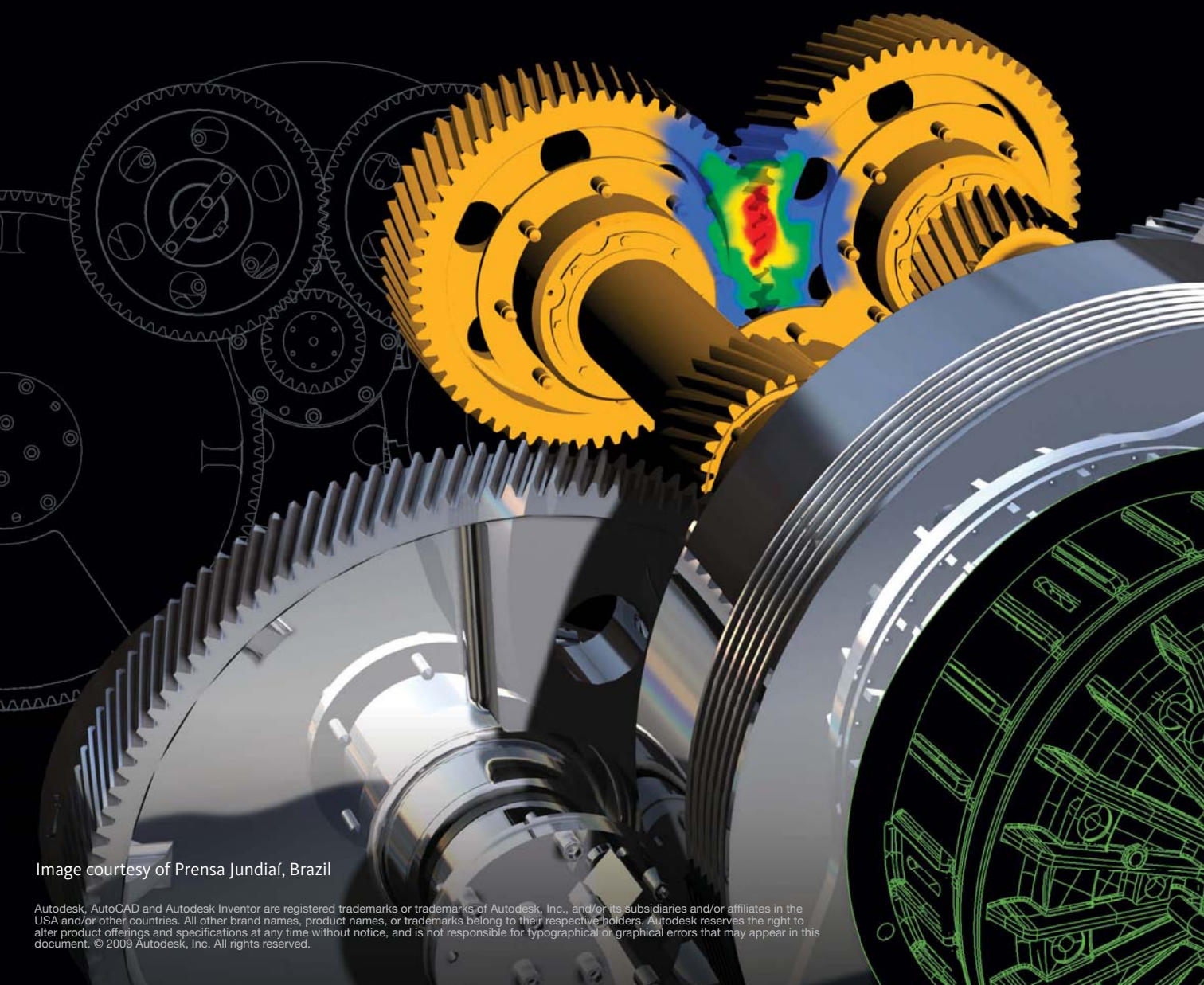


Image courtesy of Prensa Jundiaí, Brazil

Cray XT5 Supercomputer Named World's Fastest Supercomputer

Cray's XT5 supercomputer, nicknamed "Jaguar," located at the Department of Energy's Oak Ridge National Laboratory (ORNL) has been recognized by the Top 500 list as the world's fastest supercomputer.

"We are pleased that the upgraded Cray XT5 system at ORNL has added this new honor to its growing list of achievements," said Peter Ungaro, president and CEO of Cray. "We are most proud of the fact that Jaguar is used day-in and day-out to solve real-world scientific problems..."

In 2008, Jaguar became the first HPC system to set a new world record for computer speed with sustained performance of over one petaflops (quadrillion mathematical calculations per second) on two scientific applications. This fall, the Jaguar system was upgraded with Six-Core AMD Opteron processors, increasing the number of its processing cores to more than 224,000 and advancing its peak performance to more than two petaflops of compute power.

FOR MORE INFO:

> Cray, Inc.

NVIDIA and Partners Form Parallel Computing Development Ecosystem

Standards-based tools and libraries develop around CUDA architecture.

NVIDIA and its ecosystem partners will deliver, over the next few months, a set of software releases to developers using GPU Computing in their work.

These updates feature releases across a spectrum of GPU Computing development languages, tools, and libraries. Included are updates from NVIDIA for its CUDA C compiler, with additional support for C++ and its upcoming GPU codenamed "Fermi." NVIDIA is also releasing its R195 driver that includes new extensions to its OpenCL 1.0 conformant driver and toolkit, and a beta release of Nexus, a development environment for massively parallel computing, which is integrated into Microsoft Visual Studio.

Alongside NVIDIA's own updates, several partner releases are available now, including The Portland Group's CUDA Fortran solution, Allinea's Distributed Debugging Tool (DDT), and the TotalView debugger.

"The only effective way to scale performance in demanding applications is to move to a parallel computing model," said Sanford Russell, general manager, GPU Computing software at NVIDIA. "The NVIDIA CUDA architecture facilitates this critical transition with its broad industry support and network of software consultants and training resources for massively parallel computing."

FOR MORE INFO:

> NVIDIA

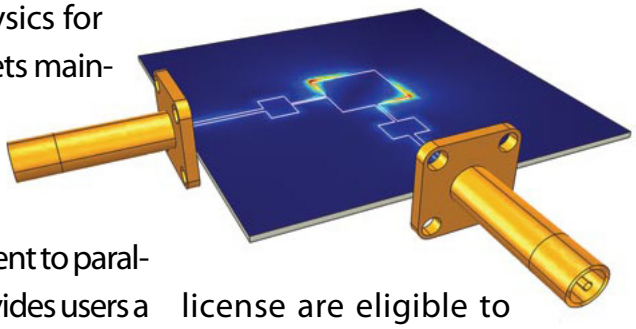
COMSOL to Offer Free Cluster Support for Multiphysics Simulations with Windows HPC Server

COMSOL Inc. has announced that, with the release of COMSOL Multiphysics version 4.0 for Windows HPC Server 2008 (HPCS), current users of a COMSOL Multiphysics floating network license will have free and unlimited access to cluster compute power.

The new COMSOL support for cluster computing means that any simulation job can be deployed to any number of clustered computers at no additional cost to the user.

"COMSOL is the first developer of multiphysics software to take this step toward removing the financial barrier to large-scale simulation on cluster computing systems," said Bernt Nilsson, senior vice president of Marketing with COMSOL, Inc.

COMSOL Multiphysics for Windows HPCS targets mainstream computing. Version 4.0 ports a flexible and intuitive simulation environment to parallel platforms that provides users a scalable cluster solution for virtual prototyping. All controls needed for configuring a cluster job with Windows HPC Server 2008 are available in the COMSOL graphical user interface.



For maximum performance, the COMSOL cluster implementation can use shared memory multicore processors on each computer or node in combination with the cluster distributed memory system.

All current users of a COMSOL Multiphysics floating network license are eligible to run their simulations on a cluster system with an unlimited number of nodes without an additional charge. New users who purchase a floating network license will also be able run their simulations on a cluster system with unlimited number of nodes free of charge. COMSOL Multiphysics platforms support clusters on Windows Compute Cluster Server 2003, Windows HPC Server 2008, and Linux.

FOR MORE INFO:

> COMSOL

Extensible Joins PTC Partner Advantag Program

Extensible CAD Technologies announced it has joined the PTC PartnerAdvantage Program at the Silver tier in a strategic move to integrate the InspectionXpert productlink with PTC's Pro/ENGINEER. InspectionXpert is inspection report automation and ballooning software that helps manufacturers generate inspection report forms and ballooned inspection drawings quickly and accurately directly from CAD drawings, PDFs, TIFs and many other formats.

InspectionXpert now has products with direct integration into Pro/E, AutoCAD, SolidEdge and SolidWorks.

FOR MORE INFO:

> Extensible CAD Technologies

> PTC

NVIDIA Tesla GPUs to Communicate Faster Over Mellanox InfiniBand Networks

NVIDIA and Mellanox Technologies Ltd. have introduced new software that will increase cluster application performance by as much as 30 percent by reducing the latency that occurs when communicating over Mellanox InfiniBand to servers equipped with NVIDIA Tesla GPUs.

The system architecture of a GPU-CPU server requires the CPU to initiate and manage memory transfers between the GPU and the InfiniBand network. The new software solution will enable Tesla GPUs to transfer data to pinned system memory that a Mellanox InfiniBand solution is able to read and transmit over the network. The result is increased overall system performance and efficiency.

"In GPU-based clusters, most of the compute intensive processing is running on the GPUs," said Gilad Shainer, director of HPC and technical marketing at Mellanox Technologies. "It's a natural evolution of the system architecture to enable GPUs to communicate more intelligently over InfiniBand. This ... will enable future Exascale computing and dramatically increase performance...."

The capability will be available in the NVIDIA CUDAT architecture toolkit beginning in the second quarter of 2010 and will work on existing Tesla S1070 1U computing systems and Tesla M1060 module-based clusters.

FOR MORE INFO:

> NVIDIA

> Mellanox Technologies

VISTAGY and BETA CAE Systems Partner to Integrate Composite Analysis and Design

VISTAGY, Inc., a provider of engineering software and services, and BETA CAE Systems S.A., which specializes in computer aided engineering (CAE) pre- and post-processing software systems, have announced a technology partnership.

The companies will integrate VISTAGY's FiberSIM composites engineering software and BETA CAE Systems' ANSA CAE pre-processing software. The FiberSIM suite of software supports design and manufacturing methodologies necessary to engineer composite products and parts. ANSA is a multidisciplinary CAE pre-processing tool that provides the necessary functionality for full-model build up, from CAD data to ready-to-run solver input files, in an integrated environment.

"BETA CAE Systems is one of the world's leading analysis firms and a true force in the automotive industry," said Ed Bernardon, vice president of business development for VISTAGY.

The integrated product solution will be available in the first quarter of 2010.

FOR MORE INFO:

> VISTAGY, Inc.

> BETA CAE Systems

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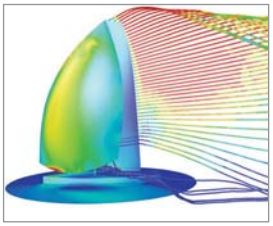
EDITOR'S PICK OF THE WEEK

FROM THE DESK OF **ANTHONY J. LOCKWOOD**, EDITOR AT LARGE, *DESKTOP ENGINEERING*

WOULD YOU TRUST THIS GUY? Well that question has already been answered by thousands of readers who have indicated they already do, implicitly. So here are Lockwood's most recent musings about the products that have really grabbed his attention, and deserve yours.

New ANSYS HPC to Boost Productivity for Simulation-driven Product Development

>New HPC solutions promise to deliver expanded engineering simulation value.



I've made no bones about it in the past. I think HPC (high-performance computing) and simulation are a match made in heaven. Bob Eubanks should get the two of them on the "Newlywed Game" so that everyone can see it as far as I am concerned. And ANSYS just one upped the relationship with what they call ANSYS HPC software.

Basically, ANSYS HPC is a scalable HPC solution that supports the full ANSYS portfolio and enables you to do multiple physics simulations on your workstation or your cluster. And that means that ANSYS HPC makes accessible larger-scale parallel processing for simulation for companies large and small. It does so two ways: scalability and multiphysics.

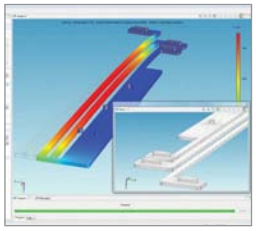
And that's the deal in a nutshell. If you're a small outfit and you have workstations with, say, 16 or 32 cores, ANSYS HPC gets you high-end multiple physics simulations.

READ MY COMPLETE REVIEW:

>ANSYS

Multiphysics Simulations from More Users

> Graphical programming in COMSOL Multiphysics 4 guides users to simulation.



In my foot-loose life as an independent pen and portly presence—Have Keyboard Will Click for Checks and Food—I have done work for COMSOL. They put me up and put up with me at their recent conference in Boston.

Nonetheless, at that conference, the company released a beta version of its upcoming 4.0 version of COMSOL Multiphysics and I've seen it and it's cool. It is especially cool for you people who design more than you analyze, small organizations with a need to leverage all that you've got, and any organization that needs to maximize efficiency.

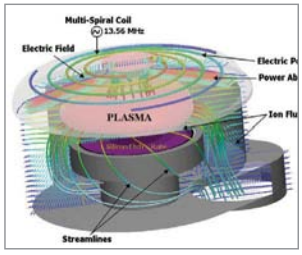
The heart of Version 4.0 is a new graphical user interface they call the COMSOL Desktop. Basically, what the COMSOL Desktop does is make the high-end analytical functions in COMSOL accessible to people who do not read PDE equations for leisure. (For those of you who have been using COMSOL for years and love the equations, they're still there for you to work with at the touch of a button.)

READ MY COMPLETE REVIEW:

>COMSOL

ESI Releases Update to CFD Simulation Suite

> Enhancements target automotive, aerospace, fuel cell, and electronics.



ESI Group has been a leading developer of simulation software for prototyping and manufacturing processes for a number of years now. Its applications suites for such diverse areas of interest as casting, composites and plastics, NVH, vibro-acoustics, welding, and crash, impact, and safety are widely recognized as the gold standards in their class. A few weeks ago, ESI announced the Version 2009.2 release of its ACE+ suite of CFD and multiphysics simulation software. I've been wanting to tell you about it since.

CFD-ACE+, as ESI refers to it, actually is a base package with a multiphysics solver at its core that provides you with flow, heat transfer, and turbulence analysis capabilities. You then add the industry-specific analysis capabilities that you require—say, aerospace, biotechnology, or semiconductor. And that combination is what's important here.

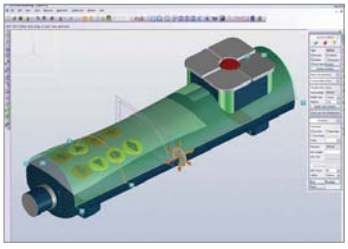
Everyone supports multiple physics operations these days. It's part of the march toward simulation-driven design. However, not everyone launches their multiphysics capabilities from the same base. Some are really applying an application layer above individual applications and passing data between these discrete applications.

READ MY COMPLETE REVIEW:

>ESI Group

CoCreate Integrates with PTC Product Development System

> Standalone advanced simulation solution also unveiled.



Right about this time a couple of years ago PTC announced that it planned to acquire CoCreate. Smart guys everywhere wondered what PTC was up to. But, you know people have consistently misunderestimated PTC. With the announcement of CoCreate 16.5, it's becoming clear that not only will PTC continue to support and enhance CoCreate but PTC intends to offer manufacturers a full plate of tacos.

A key innovation in version 16.5 is integration between the CoCreate family and major applications in PTC's Product Development System (PDS) like ProductView, Arbortext, and Mathcad as well as Pro/ENGINEER. A key addition to the family is CoCreate Advanced Mechanica, which offers much higher level simulation capabilities than does CoCreate FE Analysis.

ProductView allows viewing, visualization, mark-up, and interaction with CoCreate data by anyone in your workgroup. Arbortext lets you create and update technical illustrations and animations directly from CoCreate models, while Mathcad helps you create, document, and capture your engineering calculations.

READ MY COMPLETE REVIEW:

>CoCreate

FASTApps

> FOR COMPLETE APPLICATION STORIES CLICK HERE

AVEVA's Plant Suite Empowers AREVA's Design of Next-Gen Nuclear Facilities

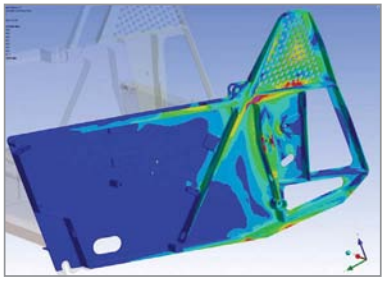
> After decades of dormancy, nuclear power plant design and construction is undergoing a resurgence. The renaissance has been marked by a wave of companies seeking the latest engineering and design systems to create the next generation of nuclear power generating facilities.

Among the companies involved in the new plant construction is AREVA, one of the world's leading builders of nuclear plants. To meet the demand for enhanced facilities, the company had to overhaul its engineering IT systems. AREVA looked to AVEVA to help build a sound IT foundation for future projects. AVEVA has a long history of leadership in the global energy industry.

AREVA adopted AVEVA's Plant suite, a set of integrated applications that enable the engineering, design, fabrication, and revamping of plants of any size and complexity. These software tools promote efficient project workflows, consistent change management, and reduced development cycles and costs.

> More info

ANSYS Workbench Delivers Concurrent Design and Analysis While Meeting Aggressive Schedule



> Goodrich Aircraft Interiors and Concurrent Technologies Corp. developed the next-generation ACES 5 ejection seat for the F-35 Joint Strike Fighter. The new seat was designed to enhance aircrew safety, reduce maintenance downtime and weight, and integrate with the F-35 cockpit. The biggest challenge was developing a new seat structure quickly. The design team used ANSYS Workbench extensively, and the parametric link between the ANSYS Workbench platform and Pro/E Wildfire software was a critical factor in successfully developing a design that met all requirements while maintaining the aggressive schedule. CTC's engineers were able to quickly update simulations for multiple design iterations. This concurrent design and analysis approach enabled the team to optimize the seat for both function and weight from the earliest stage.

The first test of the ejection seat occurred after 14 months. It performed flawlessly the first time out.

> More info

Thermal Dynamics Uses Stratasys' Direct Digital Manufacturing Tool to Optimize the Building of Assembly Tools

> Thermal Dynamics is one of the largest suppliers of manual and automated advanced plasma-cutting equipment. The company's R&D department purchased Stratasys' FDM-based Fortus 3D Production System for rapid prototyping of injection-molded parts. The department's goal was to perfect designs before they reached tooling, reducing the need for mold rework.

The Fortus system was put to work building prototypes. The engineers, however, quickly realized its potential for direct digital manufacturing when they used it to build a production fixture to enhance the plasma-cutting equipment assembly process.

Manufacturing engineers were able to build the fixture, using direct digital manufacturing, at a significantly reduced cost, in a much shorter timeframe. The new fixture speeds up the plasma-cutting equipment assembly process, reduces material costs, and makes the assemblers' job easier.

> More info

Appro Assists Lawrence Livermore National Laboratory with a New Cluster Designed for Extreme-Scale Visualization

> The high-performance computers of Lawrence Livermore National Laboratory (LLNL) generate multi-terabyte data sets. To perform the interactive data analysis inherent in many of its research projects, the laboratory needed a supercomputing cluster capable of visualizing quantities of data on this scale. To meet this need, LLNL requested an Appro Hyper cluster.

The Appro Hyper cluster deployed at the laboratory uses four Scalable Units and delivers measured performance of 110 TFLOPS. The cluster is based on a combination of Appro AMD Opteron–based servers, InfiniBand interconnect, and a shared software stack, developed by the Tri-Labs Project.

The cluster provides high-speed connections, a memory-rich environment, and sufficient I/O to support the performance required. Researchers can now complete multi-day visualization problems more quickly and maintain a high level of interactivity.

> More info

SolidWorks 2010: Faster & Smarter

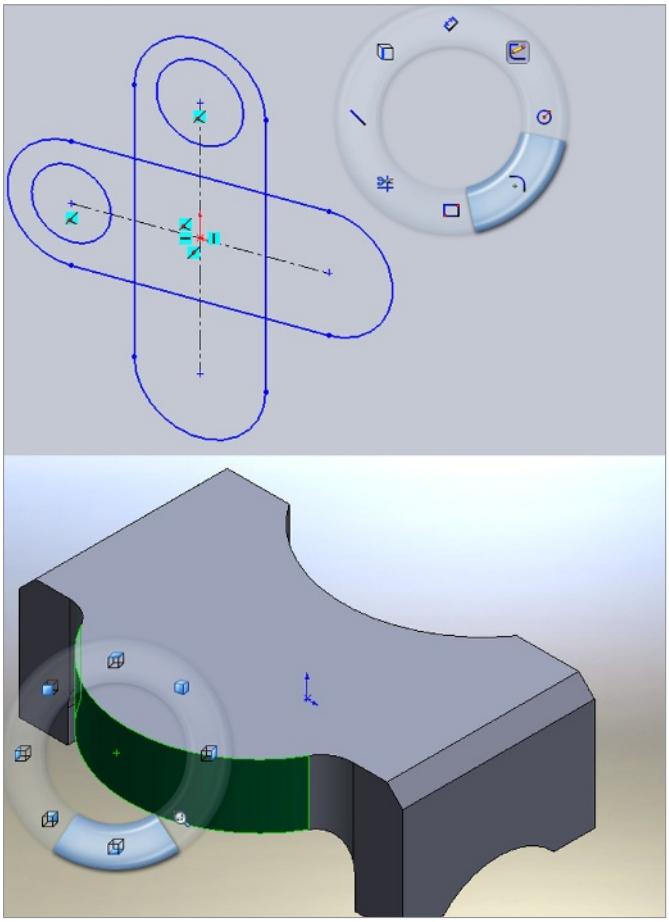
> In this latest release of the workhorse design solution, productivity and sustainability take center stage over an array of dazzling new tools.

BY KENNETH WONG

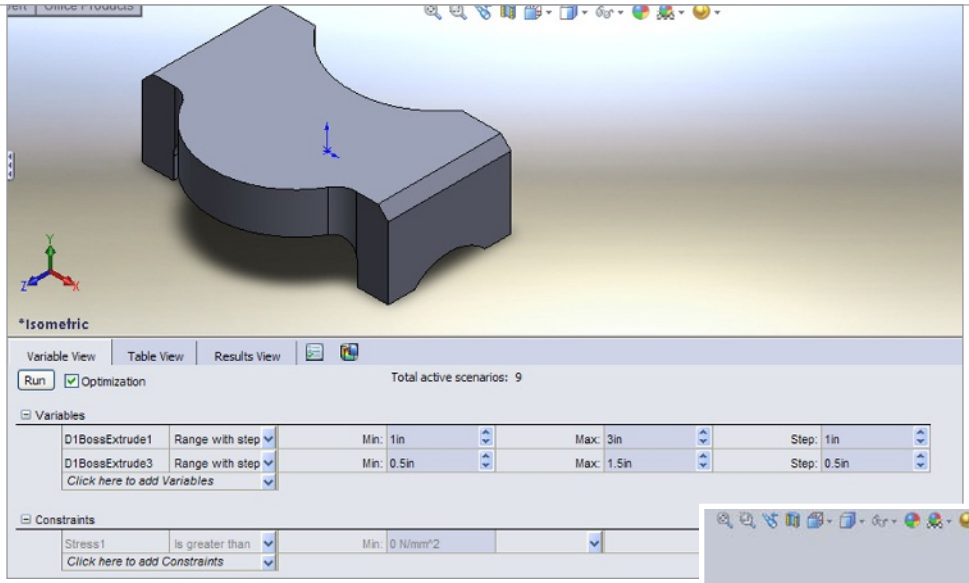
It's difficult to single out certain features of SolidWorks 2010 as revolutionary steps. As the company has stated, this release focuses on productivity (a "faster, smarter, rock solid" release, according to the launch site) instead of dazzling new tools. And, since most Desktop Engineering readers are familiar with how leading midrange CAD programs work—offering 2D sketching, 3D modeling, and dimensioning functions—this article is devoted to exploring some of the new tools debuting in 2010 release of this respected solution.

Interface Improvement

One of the most notable enhancements to the SolidWorks interface is the introduction of gesture-based sketching and modeling. To activate this feature, you need to go to Tools > Customize > Mouse Gestures, then select either 4 or 8 gestures. With gestures turned on in sketch mode, you can simply right-click and drag your mouse down (as though you were drawing a straight line from top to bottom) to launch the multiple-choice wheel. Depending on whether you've selected 4 or 8



In SolidWorks 2010, you can use mouse gestures to activate the multiple-choice wheel. In sketch mode, the wheel gives you quick access to commonly used sketching tools; in 3D mode, the wheel lets you switch from one perspective to another without having to rotate the model manually.



The Design Study feature in SolidWorks 2010 lets you automatically generate various configurations of your part, with certain goals in mind. Afterward, you may pick the option configuration recommended by the software.

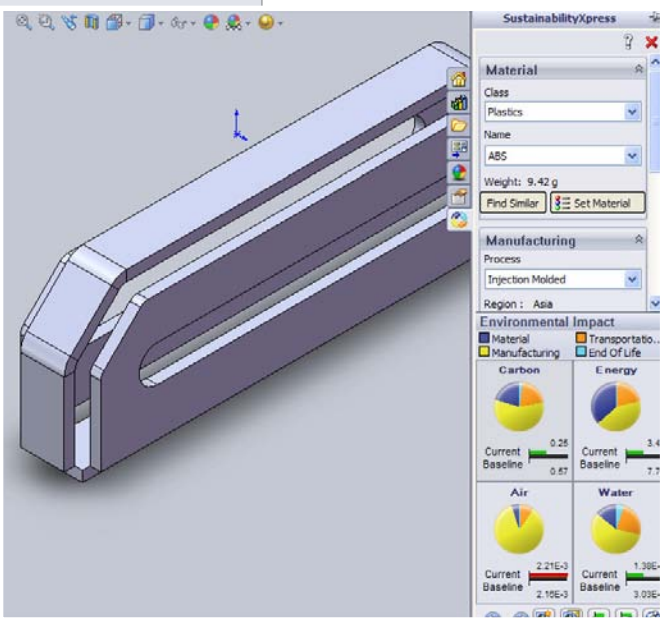
gestures, the wheel gives you a series of sketching options: for example, the ability to directly select a circle or square, then dimension it.

In 3D mode, when you right-click and drag your cursor down, you launch a multiple-choice wheel that presents you with a series of perspectives. You can then easily move from front to back plane, or return to orthographic views, making it easier to pick certain hard-to-reach surfaces without rotating the model.

Placing the cursor directly on the wheel will automatically select the nearest feature, be it a square or a circle. Long-time SolidWorks users accustomed to selecting the desired sketch or modeling features from the ribbon bar menu might need to invest some time and effort in the new approach. But you can become more productive, as the gesture wheel places some of the most commonly used commands at the tips of your fingers (or mouse cursor).

Focus on Sustainability

Sustainability Xpress, a new plug-in that ships with every copy of SolidWorks 2010, was developed in conjunction with PE International, a sustainability



Sustainability Xpress, debuting in SolidWorks 2010, uses a series of simple input parameters and dropdown windows that let you predict environmental impacts.

consultant and solutions provider. Using a series of simple input parameters and dropdown windows, the tool lets you predict the environmental consequences of your manufacturing decisions with regard to choice of material, manufacturing method, production site, and sales location.

Based on your CAD part's 3D geometry, the software can deduce how much material is required to produce the part. Using some known facts about material properties, manufacturing

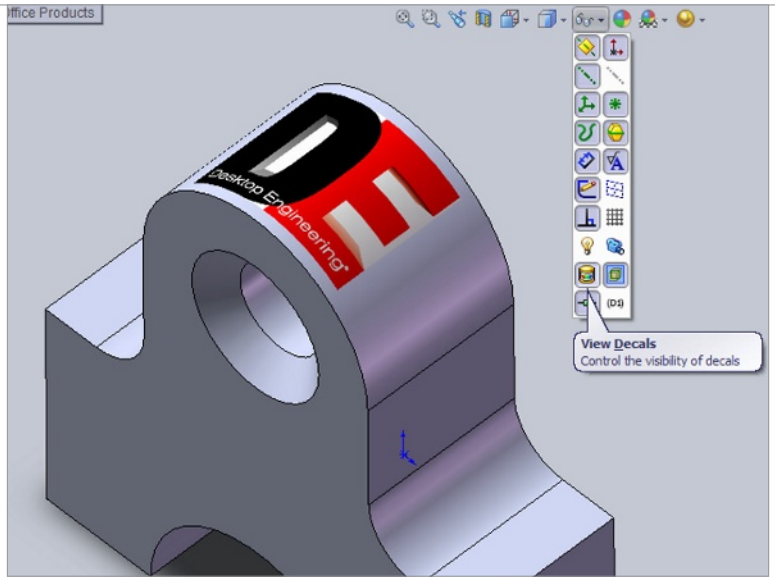
practices, and transportation procedures, the software estimates your parts' environmental impacts, revealed as air pollution, water pollution, carbon emission, and energy consumption.

For example, a part that's meant to be used in North America but produced in Asia increases energy use because of the fuel required to transport the part from its production site to deployment site. By contrast, choosing plastic instead of steel might decrease carbon emissions because of the energy-intense process of making steel.

The software doesn't give you preset targets, such as a specific volume of energy consumption or a recommended level of carbon emission. Instead, it lets you use a manufacturing scenario—say, producing a 0.16-lb. sheet-metal part in Asia, to be sold in the U.S.—as your baseline. Subsequent scenarios using a different material, production method, or manufacturing site are judged against the baseline.

Even if you're unconcerned about environmental impacts, you will find the software's Find Similar feature a handy tool. It enables you to identify alternative materials with similar, greater, or lower tensile strength, thermal properties, mass densities, and shear values.

Sustainability Xpress currently works only on parts, not assemblies. It's also available to SolidWorks 2009 users as a free download from SolidWorks Labs. If you install it in SolidWorks 2009, you'll find the application under the Tools menu. In 2010, Sustainability Xpress lives under the Evaluate tab, alongside your analysis tools.



In SolidWorks 2010, you can view the decals applied to a part right inside SolidWorks' modeling environment to figure out the right logo placement or detailing in fabrication.

Goal-Driven Parameters

In SolidWorks 2010, after running Simulation Xpress (the FEA analysis wizard), you'll be asked if you wish to optimize the design. If you choose "Yes," you'll find yourself in the Design Study environment. (You may also initiate a Design Study session by clicking on its tab under the Evaluate tab, but you'll probably need simulation data to use as input parameters.)

In the Design Study environment, you can select some of your part's parameters—such as an extrusion height and a bend angle—as Variables. Then you can pick certain constraints: for example, a Factor of Safety greater than 1 (determined by the previous simulation data). Next, you set a goal, such as reduction of mass or surface area. Then run the session, allowing the software to regenerate the part by incrementally altering your part's variable dimensions.

From all possible permutations, the software presents one as optimal. If you agree with the recommended option, you can apply the edits.

This could be valuable if you know the maximum load or deformation your part is meant to endure and you wish to find the best geometry. You can experiment with your part manually, one parameter at a time, or run a Design Study to let SolidWorks identify the best configuratio

Multi-body Parts

In SolidWorks 2009, the software introduced a feature called Convert to Sheet Metal that automatically transformed a solid part into a sheet metal part. In 2010, you have the option to create multibody sheet metal parts.

When adding a new sheet metal feature, a crucial checkmark under the Sheet Metal Property Manager window lets you specify whether you want the new feature (for instance, a boss flange) to merge with the existing part. If you uncheck the Merge Results option, you get a sheet metal part with two separate bodies. Similarly, in part creation, you also have the option to merge a subsequent extrusion or sweep with the existing geometry. If unchecked, the outcome creates a multibody part. These multibody sheet metal and solid parts let you treat each body separately (as you would your assembly components). You could, for example, unfold a portion of the sheet metal part as a separate flat pattern or conduct stress analysis on a single body. Bear in mind, however, that some of the tools under Evaluation

Tab (Simulation Xpress and Sustainability Xpress, to name but two) don't support multibody parts.

Event-Based Motion Study

In 2010, SolidWorks introduces Event-Based Motion simulation (requires SolidWorks Simulation Professional). With this feature, you can define your assembly components' contacts and behaviors as Triggers, which set in motion another event, to be completed within a certain time. Industrial machine designers stand to benefit from this tool tremendously; they might use it to refine and adjust the cycle time of each machine operation to improve efficiency.

Decals and Depth of Field

In PhotoWorks, the rendering plug-in that comes with SolidWorks, you have the option to project 2D images on your 3D models, a handy tool for consumer goods designers who need to figure out the right logo placement or detailing in fabrication. In 2010, you can toggle previously applied decals on and off, allowing you to view the superimposed 2D images within SolidWorks environment, before entering PhotoWorks' rendering environment.

Another feature of PhotoWorks that adds realism to the rendered images is simulated depth of field, which lets you deliberately blur background objects in your rendering. In 2010, you have the option to adjust the depth of field by controlling the blur rate. (Note: To access the Depth of Field dialog box, you need to be in a camera view.)

As always, SolidWorks remains a stellar mid-range CAD program, complete with basic stress analysis (Simulation Xpress), data management (PDMWorks), and rendering (PhotoWorks). By introducing Sustainability Xpress in 2010, SolidWorks paves the way for other CAD vendors to consider adding green manufacturing tools. Its simplicity and ease of use make the feature easily understandable. The Design study and event-based simulation also set it apart from its rivals, but both tools require time and patience to master. ■

> SolidWorks

SolidWorks Premium
Price: $7,995

SolidWorks Professional
Price: $5,495

SolidWorks Standard
Price: $3,995

Video demonstrations of many of the features discussed above can be found at *DE*'s Virtual Desktop blog at **deskeng.com**.

Search for the following posts:

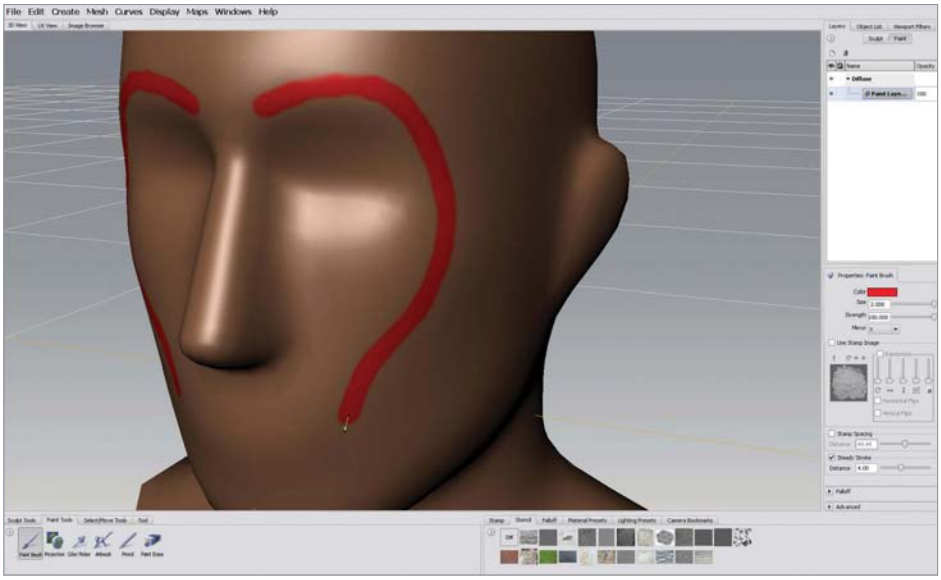
- *A Look at SolidWorks Sustainability Xpress*, September 3
- *A Look at Multibody Sheet Metal in SolidWorks 2010*, September 29
- *Design Study in SolidWorks 2010*, October 6
- *A Look at PhotoWorks 2010's Decal and Depth of Field Simulations*, October 8

Kenneth Wong *writes about technology, its innovative use, and its implications. One of DE's MCAD/PLM experts, he has written for numerous technology magazines and is the author of DE's Virtual Desktop blog at deskeng.com/virtual_desktop/. You can follow him on Twitter at KennethWongCAD, or send e-mail to DE-Editors@deskeng.com.*

Autodesk Mudbox: Sculpting in Digital Clay

> While some 3D applications provide organic sculpting as an adjunct, Autodesk's Mudbox places sculpting front and center.

BY MARK CLARKSON



Mudbox's Steady Stroke averages and smooths out your brush strokes, eliminating jitters.

Mudbox's working metaphor is sculpting with digital clay, and it's almost as intuitive and practically as easy to use. My 10-year-old son had no trouble sculpting a low-resolution head into a hideous monster after about 15 seconds of instruction.

Mudbox's very clean default workspace consists of a single, large camera view with tool palettes below and to the side. There's no way to create a split view (e.g., Front/Side) Mudbox does, however, permit using camera bookmarks or separate cameras to switch between different views of a model.

To get to work, just plop down your lump of clay and start sculpting. You work by adding clay and scraping it off, or by pushing and pulling on it. If you're using a tablet (e.g., a Wacom), Mudbox's brushes are pressure sensitive.

The Tools

Mudbox gives you 19 sculpting tools including Sculpt, Smooth, Pinch, Scrape, Fill, Flatten, which, for the most part, do exactly what you think they will.

All brushes allow you to mirror your strokes across any axis to easily model symmetrically. Pressing Ctrl (or checking Invert in the brush's properties) inverts the direction of most brushes—Bulge creates cavities instead of bulges, for example. Pressing Shift temporarily changes any brush to

the Smooth tool to blend features together.

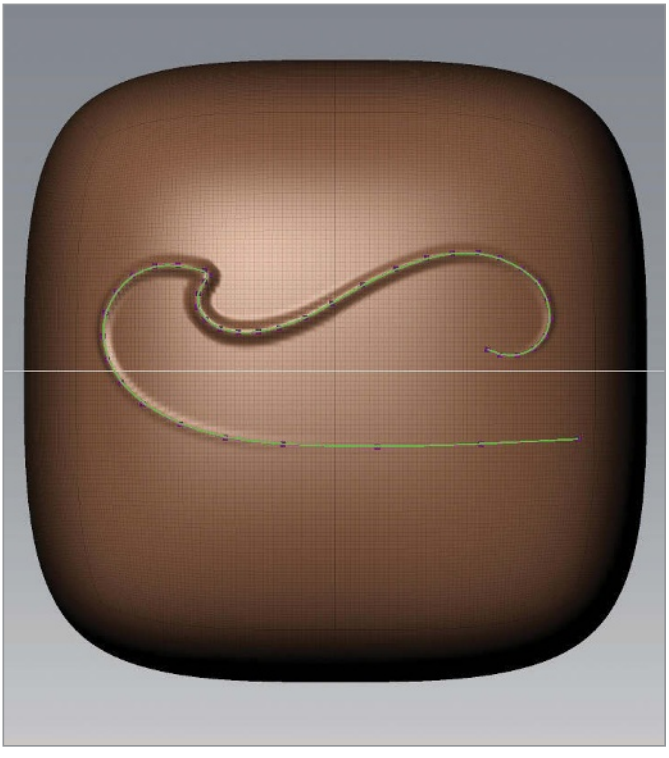
You can change the shape of a brush by modifying its falloff, or by adding a bitmap "stamp." The stamp's grayscale values control the strength of the tool, making it easy to apply lumps, bumps, and other textures.

Paint on your meshes with paintbrush, pencil, or airbrush to create color maps, bump maps, specular maps, etc. You can export these maps for use in other applications, or for fine-tuning in Photoshop.

You can also paint masks, which constrain the area of effect for the sculpting and painting tools.

Smoothing Out the Strokes

In case your hand isn't especially steady—and mine isn't—Mudbox gives you a couple of aids.



Mudbox lets you sculpt and paint along curves to accurately trace shapes.

The first is Smooth Stroke, which averages your mouse or pen movements to remove inadvertent jitters. You can adjust the amount of smoothing applied, or turn the feature off entirely.

Mudbox also lets you sculpt and paint along curves that can be simple circles, squares, or lines, or they can be custom curlicues drawn with Mudbox's pen tool. Brush strokes will snap to the curves, so you can trace and re-trace particular shapes.

Even with these aids, there's a limit to how accurately you can carve things; you're never going to get Class-A curves, or anything like them, out of Mudbox.

Levels and Layers

You can change the resolution of a mesh, either up or down, with a keystroke. Even very dense meshes, with tens of millions of polygons, transformed and displayed smoothly on my system.

Mudbox sports layers, similar to Photoshop's. When you sculpt or paint, your strokes are applied to the active layer. (The meshes themselves are not tied to any particular layers.)

Let's say I sculpt grooves into my toothbrush model on Layer 2. I can hide Layer 2 to eliminate the grooves, or lower the opacity of Layer 2 to reduce the grooves, or even invert Layer 2 to turn the grooves into ridges. All this is independent of other features, which are sculpted on other layers.

Issues of Scale

Mudbox provides a very few simple starting shapes: cube, sphere, head, tree stump. If that doesn't suffice—and it probably won't—you can import objects in .OBJ format, which is supported in most

Mudbox's impressive real-time renderer supports HDRI image-based lighting, ambient occlusion, and depth of field (if your card is new enough).

modern modeling applications.

There's some by-guess-and-by-gosh involved, both in importing objects and in getting the right settings for brush strength and size. Part of it is that there's no indication of just what scale I'm working in. Is that head a meter long? A kilometer? My brush size is set to 3.75, but 3.75 what? The UI gives you no indication. There is no measurement tool. You can set the linear units to, say, centimeters and then you'll have to remember that 3.75 means 3.75 cm, but it would be nice to have onscreen feedback.

This may seem irrelevant, and it might be, except that Mudbox is obsessed with scale. If you import an item at too small a scale, for example, you simply can't work with it; the range of brush size and strength are inappropriate. Worse, Mudbox seems

to become confused about surface normals. No problem, just scale the mesh up. And you can, but for some reason that doesn't resolve things. To actually fix it, I had to re-export my models at a different scale. What scale? Exactly. We're right back where we started.

An actual-size object might be too large (a truck) or too small (an MP3 player) for Mudbox to accommodate. It will take a little experimentation to find the best workflow.

Rendering

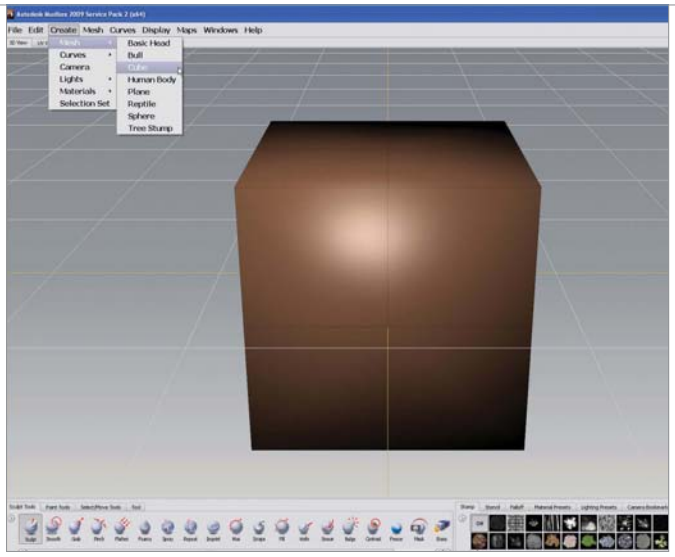
Mudbox's real-time renderer is impressive; it supports HDRI image-based lighting, ambient occlusion, and depth of field (if your card is new enough).

Still, the application has no "beauty" renderer, and no animation. If you need print-quality final art, you'll have to use another package such as Maya or Max to do the rendering. You can export your sculpted meshes either as high-resolution poly meshes (.OBJ), or as displacement maps to be applied to low-resolution meshes in another package.

Limited to Concepts

Yes, I have quibbles. Mudbox is for sketching, playing around, and trying out crazy ideas. Personally, I don't foresee many Mudbox designs going straight to manufacturing. I expect you'll have to rebuild the geometry from scratch in another package.

Those of us accustomed to more full-featured 3D or CAD applications will run into lots of unexpected limitations. You can have multiple meshes in a scene, for example, but I can find no way to duplicate a mesh. And copying attributes—say, scale and rotation—from one mesh to another is problematic. So creating multiple buttons on an MP3 player, or two identical eyes in a human head, is much, much harder than it should be.



The Mudbox UI is simple and relatively intuitive, with plenty of elbow room.

Mudbox's $745 price tag, and its sheer fun and ease-of-use, though, go a long way toward making up for its shortcomings. ■

*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 markclarkson.com or send e-mail about this article to DE-Editors@deskeng.com.*

> **Autodesk**

Mudbox 2009
Price: $745

Does clay sculpting have a place in your workflow? That's up to you to decide. **Download a trial version**.

FOR MORE INFO:

> **Deskeng.com**

HP Z800 Workstation: Redesigned & Reinvented

> HP's new Nehalem processor-based workstation gets a completely new design and yields record-setting performance.

BY DAVID COHN

HP recently unveiled its new Z-series workstations, featuring a new design that the company calls "a reinvention of the product category from the core outward." As part of that launch, HP shipped us its flagship Z800 workstation, the first system we've received from HP based on Intel's new processor microarchitecture, code named "Nehalem." With a design from BMW Designworks USA and more than 20 HP design innovations, the new HP Z800 is nothing short of stunning and, as we quickly discovered, the new Intel CPU helps make this one of the fastest systems we've ever tested.

The new HP Z800 workstation comes in an all new case with brushed aluminum side panels and integrated handles. A single slot-loading DVD drive is the only break in the vertical front panel air intake fins.

The HP Z800 is housed in an all-new case with brushed aluminum side panels and integrated handles. Vertical fins give the front panel a clean, new aesthetic while at the same time providing abundant airflow to the interior. A single slot-loading DVD+/-RW drive marks the only break in these vertical lines. A power button, three USB ports, headphone and microphone jacks, and an IEEE 1394a FireWire connector occupy a narrow vertical panel along the right side of the case. The rear panel adds six more USB 2.0 ports and a second FireWire connector as well as one 9-pin serial port, PS/2 keyboard and mouse connectors, a pair of RJ-45 jacks for the integrated Gigabit LAN, and audio-in, audio-out, and microphone jacks.

While the exterior design is strikingly new, noth-

ing prepared us for what we found when we opened the new tool-less case. Removing the large aluminum side access panel reveals the most unique system interior we've ever seen. Instead of an exposed motherboard, sharp-edged metal drive cages, and a rectangular power supply, HP has created a completely modular interior. Each component, including the motherboard itself, can be removed by the user without any tools, guided by numerous green "touch points." At the top of the case is the first-ever customer-serviceable power supply module. By spanning the entire depth of the case, the power supply is assured a ready supply of cool air, and can be removed in seconds by simply pulling on an integrated handle. Our system came with an 1110-watt 89-percent efficient Energy Star Silver power supply. An 850-watt power supply is also available.

Components inside the Z800 are concealed by airflow guides. Each modular component, including the power supply, can be easily removed, guided by green "touch points."

Below the power supply, the optical drive bay occupies the front portion of the case with the memory and CPU sockets toward the rear. A sculpted airflow guide covers these sockets and assures that cool air is routed from the front of the system directly to each CPU and memory module to avoid their receiving air that has already been heated by components in front of them. The airflow guide easily snaps out to reveal a pair of fans over the memory sockets and additional ducts around the processor heatsinks, each of which has its own cooling fan. Again, green touch points immediately indicate where to grasp this component. The memory fan module snaps out to reveal 12 memory sockets, while another touch point releases the entire optical drive cage.

A similar cover conceals the expansion card area in the lower portion of the case. This cover serves the dual purpose of directing airflow over I/O cards and providing small springs to help hold expansion cards in place. Four 3.5-in. drive bays located in front of the expansion card area feature special drive carriers with spring-loaded, acoustically isolated clips that hold each drive in place while at the same time ensuring that vibration from spinning drives is not transmitted to the case. Once mounted in the carrier, each hard drive simply slides into the cage; there are no cables to connect.

New Intel Nehalem Processor

Our evaluation unit came equipped with two new 3.2GHz Intel Xeon W5580 CPUs. Unlike the

HP Z800 Workstation Benchmark

		HP Z800 workstation (two 3.2GHz Intel Xeon X5580 quad core CPUs, NVIDIA Quadro FX 4800, 12GB RAM)		**Lenovo S20** workstation (one 2.93GHz Intel Xeon W3540 quad core CPU, NVIDIA Quadro FX 4800, 4GB RAM)		**HP xw8600** workstation (two 3.4GHz Intel Xeon X5492 quad core CPUs, NVIDIA Quadro FX 4800, 4GB RAM)		**Lenovo Thinkstation S10** workstation (2.66GHz Intel Core 2 Q6700 quad core CPU, NVIDIA Quadro FX 4600, 2 GB RAM)	**Alienware Area-51 ALX Crossfire** workstation (Intel Core 2 Extreme 9650 quad core 3.0GHz CPU overclocked to 4.0 GHz, two ATI Radeon HD 3870, 4GB RAM	**HP xw8600** workstation (two 3.16GHz Intel quad core CPUs, NVIDIA Quadro FX 4600, 4GB RAM)	**HP xw6600** workstation (two 3.0GHz Intel quad core CPUs, NVIDIA Quadro FX 1700, 2GB RAM)	**HP xw4600** workstation (3.0GHz Intel dual-core CPU, NVIDIA Quadro FX 1700, 2GB RAM)	**Appro Xtreme WH 5548** workstation (four 1.9GHz AMD Opteron quad-core CPUs, NVIDIA Quadro FX 5600, 32GB RAM)
Price as tested		$10,604		$3,885		$9,307		$2,589	$6,163	$6,915	$4,611	$2,319	$9,217
Date tested		4/24/09		7/29/09		12/22/08		6/30/08	3/24/08	12/24/07	12/21/07	12/20/07	12/27/07
Operating System		Windows XP 64	Windows Vista 64	Windows XP	Windows Vista	Windows XP	Windows Vista	Windows XP	Windows Vista	Windows XP	Windows XP	Windows XP	Windows XP
SPECviewperf	higher												
3dsmax-04		50.55	51.51	48.43	52.59	52.24	**54.61**	37.88	19.61	35.26	33.16	37.37	**19.23**
catia-02		62.10	61.66	60.40	60.61	**63.17**	62.48	48.25	**17.06**	46.11	43.01	46.98	25.30
ensight-03		53.99	53.62	51.74	**55.33**	54.44	50.82	43.33	**24.88**	41.89	31.03	30.01	38.74
maya-02		213.80	209.74	232.92	207.87	**234.50**	193.15	191.10	**32.16**	175.60	111.20	111.40	128.50
proe-04		63.59	61.48	61.56	**64.49**	52.73	57.15	48.86	**13.04**	40.46	38.27	43.98	21.82
SW-01		135.24	128.08	136.81	**139.54**	109.91	119.29	90.90	**28.64**	74.28	55.44	62.12	40.32
tcvis-01		28.93	28.29	29.17	**38.76**	29.84	27.58	24.46	**6.26**	23.57	15.34	15.06	24.24
ugnx-01		33.34	32.38	33.41	33.19	**34.17**	31.14	27.04	**12.75**	25.25	14.90	14.29	31.80
SPECapc SolidWorks	lower												
Score	seconds	145.17	n/a	**140.42**	n/a	164.71	n/a	188.01	n/a	174.62	184.36	167.24	**282.78**
Graphics	seconds	**41.31**	n/a	47.33	n/a	54.18	n/a	60.13	n/a	57.97	61.52	57.46	**89.03**
CPU	seconds	32.68	n/a	**31.01**	n/a	44.36	n/a	41.48	n/a	50.52	50.03	40.40	**69.12**
I/O	seconds	71.94	n/a	**65.86**	n/a	69.96	n/a	90.18	n/a	69.96	77.04	73.43	**125.34**
SPECapc SolidWorks	higher												
Score	ratio	**6.38**	n/a	5.91	n/a	4.84	n/a	4.56	n/a	4.46	4.28	4.82	**2.98**
Graphics	ratio	**4.85**	n/a	3.92	n/a	3.55	n/a	3.15	n/a	3.33	3.11	3.29	**2.15**
CPU	ratio	9.87	n/a	**10.41**	n/a	7.27	n/a	7.72	n/a	6.39	6.45	7.99	**4.67**
I/O	ratio	4.40	n/a	**4.81**	n/a	4.52	n/a	3.51	n/a	4.52	4.11	4.31	**2.53**

Numbers in **blue** indicate best recorded results. Numbers in **orange** indicate worst recorded results. Results are shown separately for portable and desktop workstations.

"Harpertown" CPU before it (which was basically a pair of dual-core chips in a single package), Nehalem is a true quad-core processor based on Intel's 45nm high-k metal gate technology. Nehalem has approximately 751 million transistors compared to 410 million in Harpertown. Each core has a relatively small 256K L2 cache and an 8MB L3 cache shared by all four cores. And that's just the beginning. The chip also includes an integrated memory controller and a high-speed interconnect. That's right—there is no front-side bus.

Intel calls this new shared-memory architecture QuickPath, and claims up to a 3.5X bandwidth improvement for dual-processor workstations. The new design also supports both registered and unbuffered DIMM types as well as ECC memory modules. Our evaluation unit came equipped with 12GB of memory, installed as six 2GB DDR3 1333MHz ECC modules. The Z800 will be able to support up to 192GB once 16GB DIMMs become available later this year.

In a dual-socket system like ours, Nehalem provides six channels of DDR31333MHz memory, with a theoretical peak throughput of 64GBps. The use of DDR3 memory results in higher operating frequencies and lower voltage requirements than the DDR2 memory in last year's xw8600 and less power draw and lower latency than the fully buffered memory used in the xw8400. The W5580, the fastest of the new W5500-series CPUs, has a thermal design power value of 130 watts, compared to 150 watts for the X5492 processor in the HP xw8600.

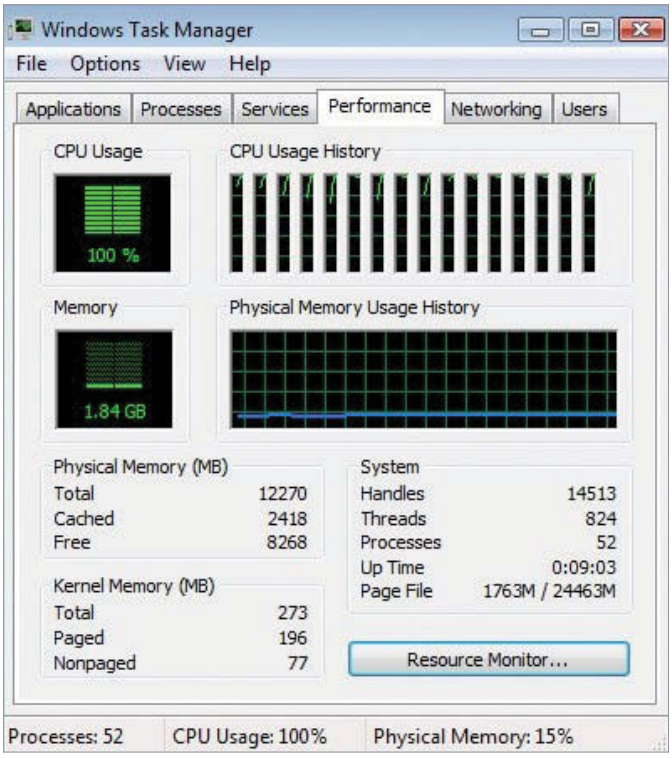
Intel has also reinstituted simultaneous multi-threading, which it now calls "hyper-threading." When enabled in the BIOS, each Nehalem core can execute two threads, for a total of 16 threads on our two-socket system. While hyper-threading enables better performance for complex simulation and rendering applications, Intel Turbo Boost Technology promises to improve performance when running lightly threaded applications. When the CPU is only partially used, it can shut down idle cores to near zero power consumption while dynamically raising the clock speed of the cores that are busy by up to 400MHz.

Thanks to Nehalem's new technologies, HP claims that the Z800 consumes 35 percent less power than its previous generation workstation. The Z800 uses approximately 102 watts in normal use, 60 watts in reduced power mode, and as little as 0.8 watts when hibernating.

Lots of expansion

In addition to the 12GB of memory, our evaluation unit came with a 146GB HP 15,000-rpm SAS drive for the operating system and a 1-terabyte (TB) Seagate Barracuda 7,200-rpm SATA drive for data. The HP-designed motherboard provides an integrated 3Gbps SATA controller with support for RAID 0, 1, 5, and 10 as well as an integrated 8-channel SAS controller with RAID 0, 1, and 10 support. You can equip a Z800 with up to 7.8TB of internal storage.

The HP-motherboard also takes ample advantage of the new Intel 5520 I/O hub chipset, code named "Tylersburg." With two Tylersburg chips, the Z800 provides 72 PCI Express Gen2 lanes plus six Gen1 lanes. As a result, the motherboard has



With hyper-threading enabled via the BIOS, Windows can see the equivalent of 16 processor cores.

seven expansion slots: two PCIe Gen2 x16 graphics slots, two PCIe Gen2 x16 slots (x8 electrically), one PCIe Gen2 x8 slot (x4 electrically), a PCIe Gen1 x8 slot (x4 electrically), and a single PCI slot. One of the graphics slots was filled with an NVIDIA Quadro FX 4800 graphics accelerator with 1.5GB of memory.

Record-setting performance

We previously tested this graphics board in the HP xw8600 we reviewed (see DE July 2009), so we were quite anxious to see the results of our graphics benchmarks with the FX 4800 installed in the Z800. Like other high-end boards, the FX 4800 requires an auxiliary connection to the computer's power supply, making it one of the few cables visible within the Z800's interior. The large cooling fan and plastic cowl blocked access to the adjacent PCIe x8 slot. In spite of all the fans—there's a total of nine—the Z800 is the quietest system we've ever encountered.

While we already noted that the Z800 proved itself as one of the fastest workstations we've ever tested, that doesn't even begin to tell the whole story. After watching the HP xw8600 break all previous records, we were totally unprepared for the margin with which the Z800 surpassed even that system.

Once again, HP graciously provided a second identical 146GB SAS hard drive with Windows Vista loaded, enabling us to perform our benchmark tests under both Windows XP and Windows Vista. Since our system came with 12GB of memory, this time around we used the 64-bit versions of those operating systems. On the SPECopc Viewperf graphics benchmark, the HP Z800 equipped with the same NVIDIA Quadro FX 4800 matched the similarly equipped xw8600 on six of the datasets and beat it by a considerable margin on the other two.

On the SPECapc SolidWorks test, which is more of a real-world test (and breaks out graphics, CPU, and I/O performance separately from the overall score), the Z800 outperformed the xw8600 on all the tests under XP with the exception of I/O, which fell just slightly behind the xw8600. Because the current SPECapc SolidWorks benchmark only runs under Windows XP, we are not publishing Vista results for this test.

The AutoCAD rendering test results were nothing short of incredible. Under 64-bit Vista, with

hyper-threading enabled, the Z800 completed the rendering in 52 seconds, eclipsing the Appro Xtreme WH5548, which was equipped with four quad-core CPUs.

As usual, HP rounds out the Z800 with its excellent 104-key USB keyboard and a two-button optical mouse and backs the system with a limited three-year warranty on parts and labor. While Z800 prices start at $1,815, that buys you a fairly sedate system with a single CPU, 2GB of memory, a modest hard drive, and a midrange graphics card. A more upscale system with one W5580 CPU and 4GB of RAM would set you back around $5,200. But why scrimp? As equipped, our evaluation unit costs a staggering $10,619, making our Z800 not only one of the fastest, but also the most expensive system we've ever tested.

As realists, we know that this is much more computer than many MCAD users need or can afford. But if you run high-end CAD, CFD, CAE, or EDA applications or are involved with high-end digital content creation, the performance improvement is likely to make the Z800 extremely attractive. ■

*Contributing Editor **David Cohn** is DE's MCAD and workstation expert. A computer consultant and technical writer based in Bellingham, WA, he has been benchmarking PCs since 1984. He's the former editor-in-chief of Engineering Automation Report and CADCAMNet, and the author of more than a dozen books. Please send comments about this article to DE-Editors@deskeng.com. You can also contact David at david@dscohn.com.*

> HP

HP Workstation Z800

Price: $10,619 as tested ($1,815 base price)

Size: 8.0 in. x 20.7 in. x17.5 in. (WxDxH) tower

Weight: 51.5 pounds

CPU: two Intel Xeon W5580 3.2GHz quad-core with 8MB L2 cache

Memory: 12GB (192GB max) DDR3 1333MHz

Graphics: NVIDIA Quadro FX 4800

Hard Disk: HP 146GB 15,000 rpm SAS

Hard Disk: Seagate 1TB 7,200 rpm SATA

Floppy: none

Optical: DVD+/-RW slot load

Audio: High-definition integrated Realtek ALC262 audio

Network: dual integrated Broadcom 5764 Gigabit LAN

Modem: none

Drive bays: three external 5.25 in. bays, four internal 3.5 in. bays

Ports (front): three USB 2.0, one IEEE 1394a (FireWire), one microphone in, one headphone out

Ports (rear): six USB 2.0, one IEEE 1394a (FireWire), one audio out, one microphone in, two PS/2, two RJ-45 to integrated Gb LAN, one 9-pin serial

Ports (internal): three USB 2.0

Keyboard: 104-key HP keyboard

Pointing device: two-button optical HP scroll mouse

For more information on this topic, please visit deskeng.com.

Force10 Taps SigmaQuest for Timely Quality Control

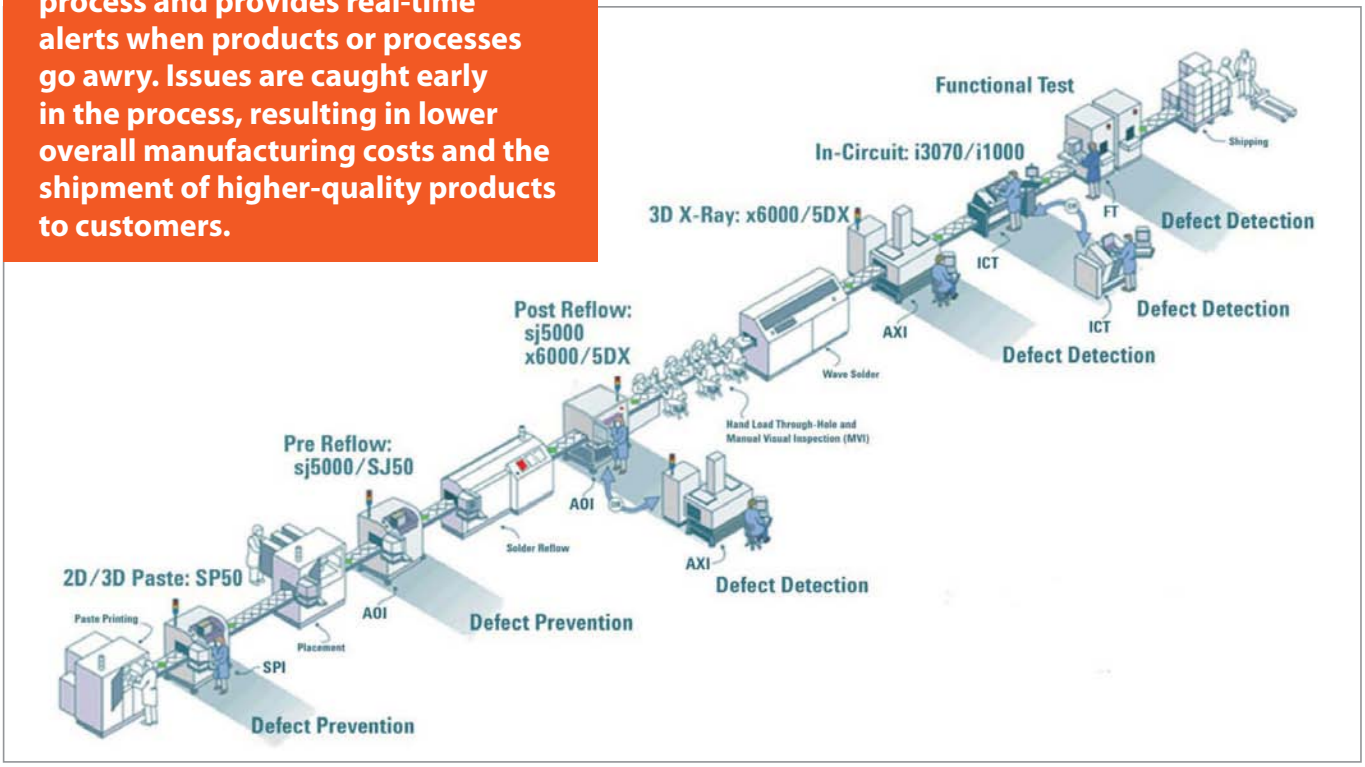
> Product failure is not an option at this manufacturer of routing and security networks.

BY VICTOR NELSON

Quality assurance at Force10 Networks, a pioneer of high-performance data and communications networks, is an imperative. The company's customers count on their high-density 10-gigabit ethernet switching, routing, and security networks solutions, with up to 5,000 components on a board, to be fail-proof and cost effective.

To ensure its products were consistently of the highest quality, the company sought a solution to get real-time quality insight during and after product manufacturing. The quality management team couldn't afford to wait weeks to get reports

SigmaQuest pulls data from each phase of the manufacturing process and provides real-time alerts when products or processes go awry. Issues are caught early in the process, resulting in lower overall manufacturing costs and the shipment of higher-quality products to customers.



containing only summary data (e.g., statistics on how many devices passed). It required real-time insight into the manufacturing process without having to wade through long, hard-to-interpret reports. In particular, Force10 wanted faster access to valuable parametric data, in-circuit testing, and X-ray data. The company also sought more in-depth test station information such as pass-fail rates, numbers of tests completed, and a listing of tests that were skipped including how often, when, and why.

Essentially, Force10 wanted at-a-glance, easy-to-understand feedback, with drilldown capabilities on its products that have more than 1500 test points each. To get there, Force10 turned to SigmaQuest, a provider of on-demand product quality management software for meaningful data, real-time reports, and its easy-to-use dashboard.

Improving Yields

Accurate yield information is another imperative at Force10. The company had experienced a not-too-uncommon scenario whereby its contract manufacturers' (CMs) data didn't seem reliable. The CM previously claimed 90+ percent pass rates of boards following in-circuit test (ICT) and 5DX (automated X-ray inspection). The CM only provided pass-fail data, leading to operator interpretation and guessing.

Rather than analyze the CM's pass-fail data feed,

Force10 leveraged SigmaQuest's SigmaSure suite of software with automatic data collection, powerful root-cause analysis, and the means to quickly find, fix, and avoid quality issues. The On-Demand software pulls data directly from any automatic tester source, providing its own pass-fail data along with parametric data.

SigmaSure indicated that a significantly higher percentage of the boards had actually failed. It also provided limit information on components in the board that failed. For example, if a particular resistor is expected to operate at 7 ohms, SigmaSure shows the number of resistors below the lower specification limit of 4 ohms and above the upper specification limit of 10 ohms. From there, the serial numbers of the boards with failing resistance values can be pulled and the defective resistors can be easily replaced.

SigmaSure automatically generates e-mail and pager alerts, flagging issues that need investigation. The alerts go out when the process-indicator limits or thresholds have been violated.

SigmaSure automatically generates e-mail and pager alerts, flagging issues that need investigation. The alerts go out when the process-indicator limits or thresholds have been violated. For ex-

ample, when target yields are outside of acceptably determined limits (e.g., below 95 percent) an alert is activated. Since this information is presented in real time—as opposed to several weeks later—plant managers can solve problems quickly, significantly reducing rework and remanufacturing time as well as cost.

Improving Quality & Product Cost

At one time, a certain percentage of Force10's line cards were failing. With SigmaSure, Force10 found that a component was being placed in the wrong location. Measurement data showed a different performance characteristic as compared to data from a properly installed component. From here, Force10 quickly tracked the lot of products that weren't assembled correctly and revised them prior to shipment to customers.

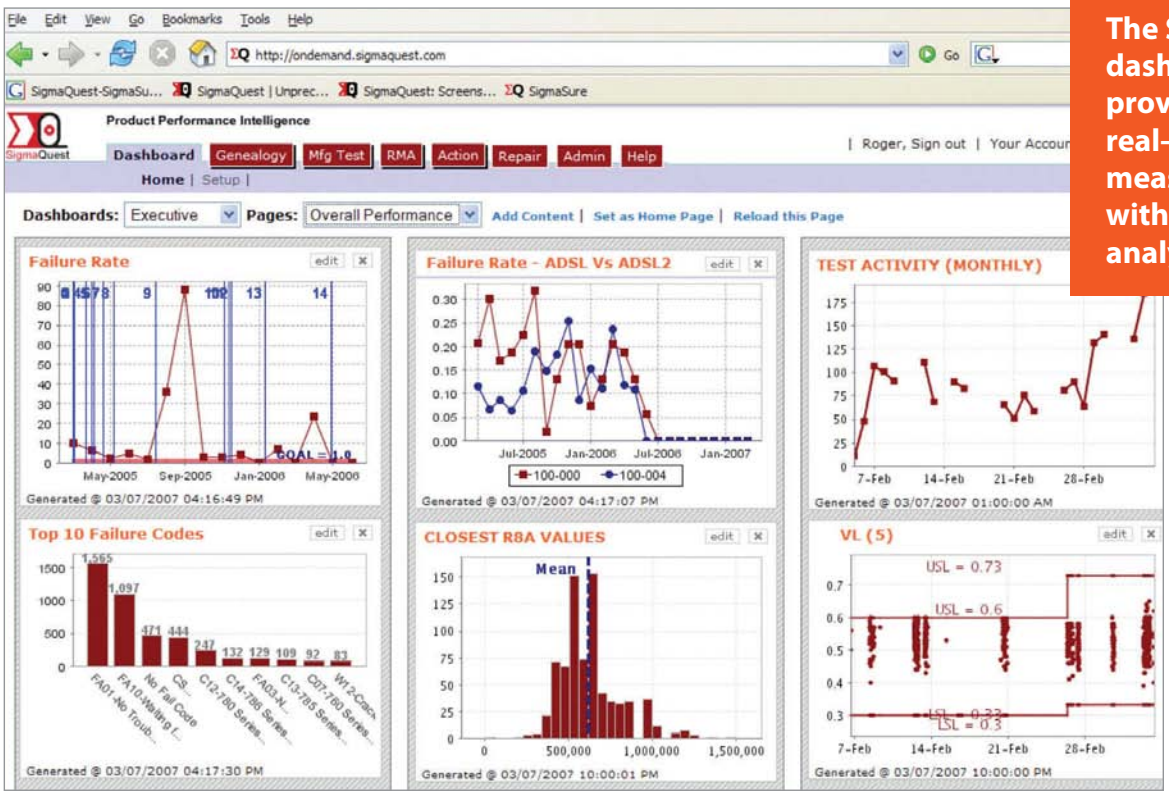
In another situation, the plant team was reporting excessive "false calls" amounting to more than several thousand a month. (Operators often visually inspect boards after test and can assume an issue is actually a "false call.") SigmaQuest's failure Pareto charts and drill-down capability depicts relationships between failures at particular locations on the boards to defects reported at X-ray. As it turned out, a percentage of the defects were real and shouldn't have been characterized as a "false call." As the software pinpoints the root cause, these issues can then be resolved prior to shipping products to customers.

The software identifies key product failure stats such as 30 percent of components installed into slot 45 failed. From there, it shows the percentage of components, in the slot, that are indeed defective as a result of being soldered incorrectly, placed sideways, etc. When defects can be identified at X-ray, this results in savings of tens to hundreds of thousands of dollars.

Another intriguing issue arose as a result of an oscillator placement on boards. The issue was tricky to diagnose as three oscillators were being used in each printed circuit board. They worked initially, but started to fail within a week of use in the field. The high failure rates were an unusual circumstance as the supplier had been delivering high-quality products for years. Force10 learned that the oscillators' crystal blanks were not properly etched. By reviewing the underlying data via SigmaSure, the team quickly found other boards showing the same characteristics as the defective products that had initially passed ICT. From there, the software quickly located the serial numbers of the boards that had the defective oscillators. The components were replaced with good parts and retested prior to shipping additional products. Also, Force10 was able to identify the units that had been shipped and fixed them quickly.

By leveraging SigmaQuest's SigmaSure On-Demand software, Force10 has improved its quality operations and significantly reduced scrap.

As companies strive to manage costs, they want to avoid bringing on more test stations, particularly as fixtures can cost more than $100,000 each. As SigmaQuest identifies how many hours each station is used each day and tracks the amount



The SigmaSure dashboard provides real-time measurements with drill-down analytics.

of time it takes the station to test each product, Force10 determined it had unused capacity and that it could run its existing test stations for more hours, saving on costs.

Quality Tracking for the Entire Team

SigmaQuest's SigmaSure gives CXOs to plant engineers and CMs real-time access to manufacturing, return material authorization, and test data. Information is presented via a dashboard with drill-down analytic capabilities. Teams are then notified if, when, and where products and processes go awry.

By leveraging SigmaQuest's SigmaSure On-Demand software, Force10 has improved its quality operations and significantly reduced scrap. Moreover, customers are satisfied when returns are kept to a minimum. Better yet, Force10 has cut manufacturing costs by 20 percent, reduced customer returns by 40 percent, and eliminated $5,000,000 in service repair costs over the past four years. ■

Victor Nelson *served as head of quality and manufacturing operations at Force10. He is currently managing partner at Axiom Associates. Send comments about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Force10 Networks

> SigmaQuest

For more information on this topic, please visit deskeng.com.

Dassault Systèmes and Michael Waltrip Racing

> The racing team's design process looks for small advantages to get big improvements using 3DVia.

BY JIM ROMEO

Kendall Pond, Dassault Systèmes

Kendall Pond is a vice president with Dassault Systèmes Americas and is focused on its newest brand, 3DVIA. With more than 28 years of experience in product lifecycle management (PLM), Pond has had hands-on experience helping companies in various industries make key, process re-engineering transformations. We spoke to Pond to find out about the product's use in designing for Michael Waltrip Racing.

Can you tell us a bit about Michael Waltrip Racing and the team's design process for developing racing cars?

Pond: Michael Waltrip Racing designs, builds, analyzes, and tests their race cars with the end goal to have the fastest car and to win races and championships. NASCAR has a very comprehensive set of rules and guidelines, and teams like Michael Waltrip Racing will seek to build the fastest cars while adhering to the NASCAR-mandated rules and specifications. The smallest of advantages can yield big improvements in speed and lap times, so building the right car for the right track is also a race of sorts.

Can you give us an overview of any challenges Michael Waltrip Racing faced that motivated them to turn to Dassault Systèmes PLM products?

Pond: Perhaps the cornerstone of the Dassault Systèmes PLM strategy is the ability to fully leverage the virtual world in order to predict outcomes in the physical world. In other words, DS technology allows companies to conceive, design, analyze, build, and test a product before any physical part of that product is made. Let's consider the front suspension of a racecar as an example. With Dassault Systèmes PLM solutions, Michael Waltrip Racing has the ability to conceive of a new, improved suspension design. They can model that new design with our software. They can analyze the design for function and strength. They can conduct computational fluid dynamic

(CFD) studies to optimize airflow over the new suspension. They can design and simulate the manufacturing process for the new suspension. All of this can be done virtually. In doing so, the costs are much lower than in the physical world but perhaps more importantly, significantly more designs and iterations can be considered in order to arrive at the best solution.

What was the process for adopting and implementing Dassault's product? Was implementation very involved?

Pond: Michael Waltrip Racing had familiarity with CAD tools and they were realizing some benefits from CAD. Michael Waltrip Racing replaced its CAD with the Dassault Systèmes flagship authoring tool, CATIA V5. Simultaneously, Michael Waltrip Racing implemented and deployed ENOVIA SmarTeam. ENOVIA has helped Michael Waltrip Racing not only to manage their design process but to also integrate significant amounts of other data directly related to the race car that existed in pockets throughout the company. Like most companies, Michael Waltrip Racing cannot stop the operation of its business to enable this adoption, so it has been important to have an iterative, pragmatic implementation plan with ROI "proofs" along the way.

What role did intellectual property play in the efficacy of Dassault's product and how it adds value to the design process?

Pond: Intellectual property (IP) in a company can be considered in two classes. First, there is the IP that is easily recognized as IP—the techniques, processes, or practices that differentiate their company from another. Secondly, there is a much broader collection of IP within companies that is more subtle. It is the know-how of typically senior people regarding process, procedures, techniques, and most importantly, a knowledge of history. Sometime this may be referred to as "tribal knowledge." Perhaps it is not at the forefront when you think of IP explicitly, but it is IP and it should be captured, cultivated, and protected. "Knowledgeware" is another tenant of Dassault Systèmes PLM solutions. The capturing, re-use, and optimization of knowledge is both easy and straightforward in Dassault Systèmes' PLM implementations.

Does Michael Waltrip Racing's process involve a distributed design team?

Pond: Multiple design teams are involved across many disciplines. At Michael Waltrip Racing, you have design teams specializing in suspension, chassis, body, and drive train. All of these various design teams must work in concert.

Who is on the distributed team and where are they located?

Pond: In the case of Michael Waltrip Racing, the teams are physically close to one another in Charlotte, NC. But, as it is easy to imagine, the design teams must work simultaneously on the same car and all of their changes must recognize and optimize the changes occurring simultaneously

by other design teams. All of this is orchestrated with the use of ENOVIA—ensuring that there is both awareness and collaboration around multiple, simultaneous changes ongoing to the same racecar. Michael Waltrip Racing achieves this level of productive collaboration using a local area network (LAN), but the same ENOVIA collaboration tools work identically in wide area networks (WANs) where the design teams are frequently separated by thousands of miles.

In general, what are the major benefits of this type of software for the design engineering community nowadays?

Pond: The benefits of PLM over CAD are much broader and significant than the benefits that CAD brought over drafting tables. Both the computational performance and graphics performance of PCs has evolved tremendously over the past several years. The PC evolution has been a key enabler. The real evolution has been in the PLM software. Dassault Systèmes has always placed a high emphasis on "3D for all" and today it is true more than ever. Across companies in many different industries, we have people from procurement, accounting, finance, sales, etc. all accessing "the" 3D data. Communication and collaboration is profoundly improved. The key reason is that we are so visually oriented. For example, using a Dassault Systèmes technology product called 3DVIA Composer, one of our customers was quoted, "We replaced a 4,500-word assembly procedure with a 3D animation of the whole process." The efficiency and cost savings are enormous. Imagine the last time you were trying to follow a complex set of instructions. Perhaps it was about assembling a BBQ or a child's toy or play set. A 3D animation would have greatly reduced the amount of time for assembly, would have mitigated errors, improved satisfaction, and eliminated ambiguity. The ability for companies to communicate in 3D is profound.

How has software for the supply chain and the design community changed over the past 10 years?

Pond: The changes have been absolutely enormous, and the challenge is that we too frequently see the supply chain and design communities using antiquated solutions and processes. Mind you, that "antiquated" in a PLM context means that a company has not exploited new tools or technologies in the last five to seven years. In the last decade, we have seen supply chains become much narrower but simultaneously we have seen the OEM [and/or] supply chain relationship become much closer in the way that they must work together. PLM environments with robust design tools that foster rich, meaningful, collaboration are imperative.

Where would you say software for the engineering community is going over the next three to five years?

Pond: For design and manufacturing, it will continue to be a fun and rewarding journey for those people working in these disciplines. We will continue to see the strong trend of leveraging the

Dassault Systèmes has always placed a high emphasis on "3D for all" and today it is true more than ever.

virtual world. The virtual world will be used to conceive and design innovative new products. We will see more collaboration across multiple disciplines (sales, marketing, procurement, financing) in the virtual world to validate all aspects of the new product. More and more new products can be analyzed and tested in the virtual world and, finally, the entire fabrication and assembly processes will increasingly be performed and optimized virtually. This continued "virtual world first" shift will not only yield better products delivered to market faster and with higher quality, but it will also help companies across the world to be much greener and eliminate waste associated with failed experimentation in the physical world.

What are some of the most important, but overlooked, attributes in selecting and using collaborative software for knowledge workers in engineering design?

Pond: Unlike almost any other purchase, software purchases must be analyzed in a very important additional dimension—especially when that software is or is planned to be mission critical. Undoubtedly, the software needs to meet or exceed the needs and demands of the selection criteria. As important, if not more important, is the alignment of the company's future design vision and comprehensiveness with the vision and investment of the software provider. Strong, visionary software providers can be a trusted partner. In implementations where there is not an alignment of vision and investment, a company risks costs associated with failure to meet current and future growth expectations. The weighting in the selection process of these forward-looking alignments with the software provider is relatively unique to mission critical software acquisitions. ■

Jim Romeo *is a freelance writer specializing in industrial technology topics and can be reached at jimromeo.net. To comment on this interview, send e-mail to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Dassault Systèmes

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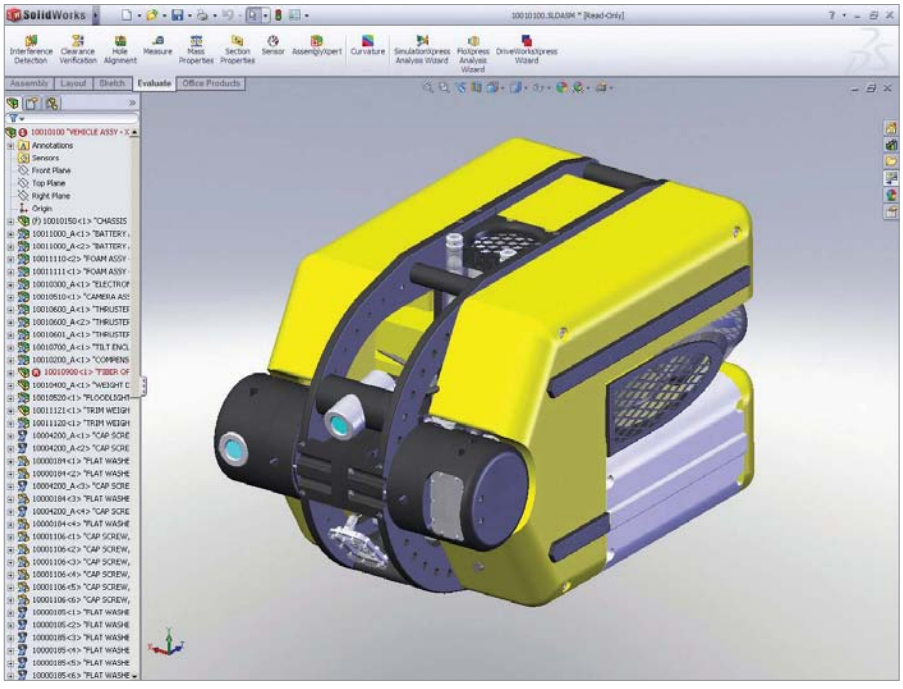
Aras Innovator: PLM on a Shoestring

> Part I: When Phoenix International Holdings needed to implement a PLM system and essentially had no budget, choosing Innovator was easy.

BY BRENT EVERS

Aras Corporation and its PLM system, Innovator, have received considerable attention since announcing its business and licensing model change to open source. As expected, this new approach has spawned both skepticism and praise from users, competitors, and the press.



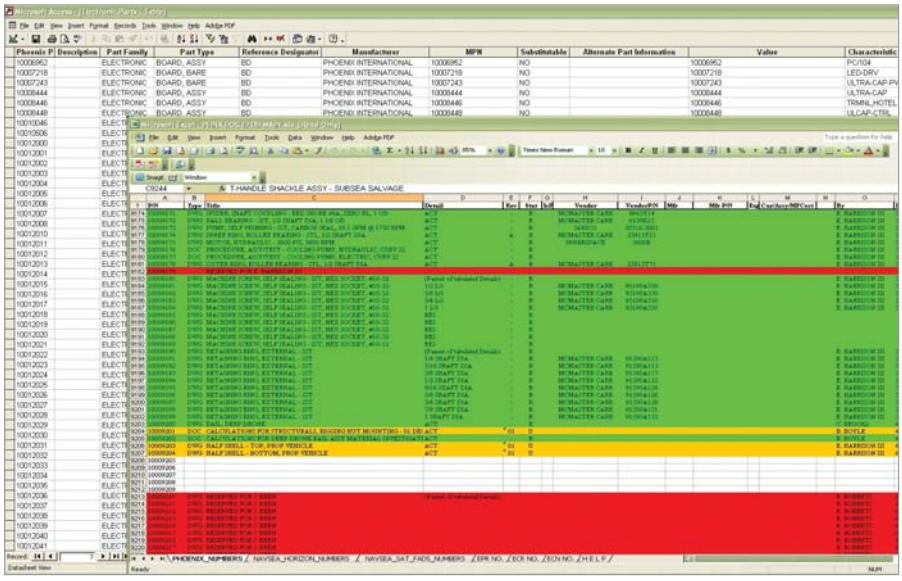
Phoenix International Holdings designs, builds, and operates robotic vehicles and tools for use in the subsea oil and gas, scientific, and government markets.

At Phoenix International Holdings, which specializes in the design, manufacture, and operation of deepwater (up to 6000 meter operating depth) remotely operated vehicles (ROV), autonomous underwater vehicles (AUV), and other subsea systems, we implemented the open source Innovator application in house with no outside support.

Phoenix is a 12-year-old employee-owned company. Readers might be familiar with the Navy's advanced Towed Pinger Locator system—designed, built, and operated by Phoenix—that was most recently used in the search operation following last May's Air France tragedy off the Brazilian coast.

Phoenix's history is based in the operation of ROVs. Engineering grew out of a support role, and over time has evolved into a business unit primarily focused on the development of specialized, one-off subsea tools and vehicle systems. Many of our engineers have significant offshore and operations

experience, and while some have new product development and manufacturing backgrounds, we do not have a strong foundation of experience with engineering systems to provide product data management (PDM), product lifecycle management (PLM), or configuration management (CM).



Phoenix previously managed engineering data via an array of spreadsheets and directories.

Learning PLM

Despite minimal experience with PLM systems, it became clear to those of us who were managing product structures and system development on a day-to-day basis that we had to improve processes and systems within our engineering organization.

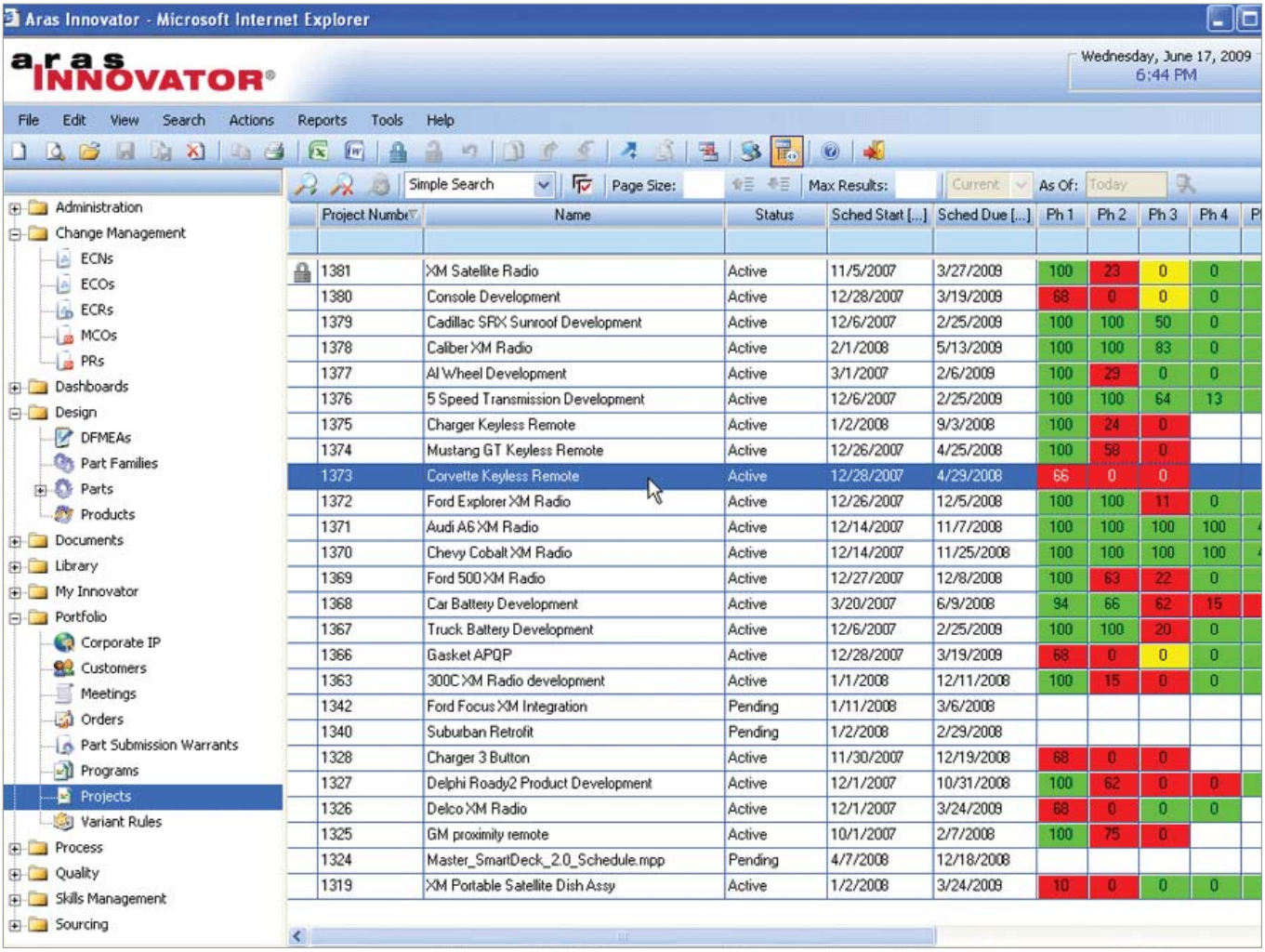
As Phoenix approached the completion of several large engineering development programs in the early fall of 2008, the timing was right to revise our internal processes to reflect lessons learned and move closer to our end goal of corporate ISO 9000 certification. We also began investigating tools to support the implementation of our improved internal processes, and "Web-demoed" several PLM systems.

Our initial review of PLM tools was driven from the integration needs of our CAD tools. Phoenix uses OrCAD from Cadence for schematic capture, PADs from Mentor Graphics for PCB layout, and primarily SolidWorks for mechanical design. Several of the PLM systems we reviewed were biased toward one type of CAD system or another. And while few seemed to be able to demonstrate a solid existing integration with all of the platforms that we wanted to integrate, each company assured us that they could do anything for a price. This happened in September of 2008 as the economic sky was falling, making the prospect of asking for new funding less than prudent, if not outright foolish.

Cost Realities in a Financial Crisis

Because of our cost limitations, the larger vendors weren't even up for consideration. We were focused on a solution for our team of 35 engineers and draftsmen that would require an initial outlay under $50,000. Several options fell within that realm, but most seemed to bring a distinct possibility of significant cost creep that might have embarked the company on a never-ending spending spree in support of the elusive "complete PLM solution."

In our initial investigation, one theme became more and more apparent: The more we learned about PLM systems and the processes that they



Aras Innovator provides a complete PLM solution with no cost barriers to entry.

are designed to support, the more we realized how little we knew. This compounded the investment problem. With financial resources already tight and getting tighter, what if we made the wrong choice?

There was one system that was different: Aras Innovator. It was free. We were very dubious, which was further reinforced by competitive vendors who were rightly worried about this new potential competitor. "Aras—yeah, I've heard of it—it's like some shareware utility sort of thing." Our IT department was especially skeptical, having been burned on other occasions with the lure of open source applications that turned out to be untested, undocumented, and a resource burden.

We put some of those questions to the folks at Aras. We asked them, "How do you configure this? How does it handle SolidWorks data?" The usual response was, "Well, Aras can configure that for you or you can configure that yourself."

In the end, because we were gun shy to commit funds to an effort for which we had so little understanding, we punted. We decided to download and install Innovator and experiment, using the

talents of our software engineers. We figured, if nothing else, we'd learn enough to make a better-informed decision later.

Phoenix Requirements

As engineers, we (ideally) develop systems through a systematic approach with its foundation in requirements definition. Unfortunately, when it came to our own PLM implementation, we didn't know enough to even know what to require. But we had some ideas about what we wanted to achieve with its implementation. They included:

- A single process for development and documentation of all engineering projects
- A single repository (vault) for all project data
- The ability to establish and revise a product structure
- The ability to control all documentation
- A formal document (drawing) release and change process
- The ability to pack and go with all project data so that vehicle operators could pull all project documentation prior to a job and take it to an offshore environment where communications might be impossible to establish.

Gaining Confidence

As we began to work with the Aras Innovator software, we generated more questions about our own processes and we slowly but surely began a spiral refinement process of our own requirements, even if we never formalized them. We learned some things about PLM systems, about our own (lack of) processes, and that we needed to put a lot more effort into figuring out how it would all fit together. Most importantly, we wanted to implement it without it becoming an overburdening beast to our lithe but out-of-control ability to get a functional prototype design operating in the water quickly.

Eventually we began to validate for ourselves Innovator's strengths—primarily, its flexibility. We saw the product in the press more and more, and saw first-person implementers' reactions to it in forums. It became clear that Innovator was for real. It was a fully developed product that the developer had elected to move to open source to gain market share and change the PLM marketplace's "put another dollar in" mentality.

In the next installment of this series, we'll discuss the process of implementing a PLM system without outside assistance and on a minimal budget. We'll talk about the advantages of that learning process and how it has helped Phoenix better define the processes that it needs to be successful. ■

Brent Evers *is the engineering manager at Phoenix International Holdings, Inc. Send comments about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

- Aras Corporation
- Cadence
- Mentor Graphics, Inc.
- SolidWorks Corp.
- Phoenix International Holdings

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3D Printing Researchers Use Glass to Open a Window into the Future

> Glass is a bio-friendly, bioresorbable, and low-cost alternative to other materials.

BY SUSAN SMITH

Glass is a tantalizing substance in the realm of materials—one that researchers have often wanted to use for various applications. But no one has come up with a way to print glass in 3D. Until now.

Geometry researchers at the University of Washington's (UW) Solheim Rapid Manufacturing Laboratory on the university's Seattle campus have developed a process by which they can print glass in 3D. The "vitraglyphic process" is a follow-up to the Solheim Lab's success last winter printing with ceramics.

The "salt" grains on this organic shape are white industrial sapphires (Al203 corundum) and are used as a high-temperature sintering bed. Depending on the kiln firing process, they will either stick to the parts or not.
Image courtesy of Mark Ganter

Mark Ganter and Duane Storti, both UW professors of mechanical engineering and co-directors of the Solheim Lab, have spent 10-15 years developing math, methods, and algorithms to represent geometry within computers. The next step, then, was to create physical models of geometry.

"We first developed the ability to be able to represent objects that were not easy to make," says Ganter. They tried equipment from a firm called Ballistic Particle (which went bankrupt), followed by an attempt to use an early manually

Three SW pots in a new glass using Vitraglyphic process.
Image courtesy of Mark Ganter

layered object-manufacturing machine. Ganter says eventually they gave up their summer salaries to buy one of the earliest Z Corporation machines developed, a model 402.

There were two big reasons for going with the Z Corp equipment. According to Ganter, it used materials that were "less costly" and "we didn't like the toxicity of the SLA approach." Also, the printer was among the fastest then on the market.

"Once we got the technology we saw how much excitement it created in students and in other researchers," says Ganter. "Nevertheless, we weren't as interested in being involved in that as in our research area. We partnered with what is now ExOne Corp." ExOne, a subsidiary of ProMetal, had a Z Corp-style machine. As part of the partnership, Solheim began to experiment with how to print aluminum mixtures, silicon carbides, and silicon nitrites.

One of UW's grad students, Ben Utilla, wrote a thesis called "How to Print Anything with a 3D Printing Process," describing approaches to 3D printing in a wide range of materials. The common element, according to Ganter, is working with particles around 20 microns. Then it is a matter of finding binders and fillers to create the reactions that allow the particles to adhere during the build phase and to display desired performance characteristics after post-build processing, such as sintering or infusion with other materials.

UW now has four machines in its lab—each running a different material. The lab continues to develop new materials; they have 25 currently. "I tell people jokingly I'll stop this quest when I have 1,000 new materials," says Ganter. "Anything that works for ceramics we can print with. Commonly you can get 20-25 different kinds. I'm pretty sure any glass you can get would be printable. It's simply a question of my being able to get a firing protocol for it."

Getting into Glass

Ganter blows glass as a hobby and he's passionate about its properties and possibilities. "It is a fundamental material type … if you think of materials, there are metals, ceramics, glass materials, plastics, polymers … so there is only a set number of materials, broadly speaking. Glass is a category with which people in mechanical engineering don't much work."

Glass can be transparent or opaque. It is distinguished as an inorganic material that solidifies from a molten state without the molecules forming an ordered crystalline structure. Because its molecules remain in a disordered state, glass is

technically a super-cooled liquid rather than a true solid.

Ganter likened 3D printed glass to pate de verre, a 400-year-old technique for creating glassware that is basically a "paste of glass." In pate de verre, glass powder is mixed with a binding material such as egg white or enamel, placed in a mold and fired. Dating from early Egyptian times, the technique is revived with 3D printing.

Because glass powder doesn't absorb liquid easily like ceramics, the 3D printing approach had to be altered.

"When we used glass powders, our normal process to print objects resulted in gelatin-like parts," says mechanical engineering graduate student Grant Marchelli, who led the experimentation. "We had to reformulate our approach for both powder and binder."

By adjusting the ratio of powder to liquid, the team found a way to build solid parts out of powdered glass (purchased from Spectrum Glass in Woodinville, Wash). Their successful formulation held together and fused when heated to the required temperature.

"We also know that making porous glass objects with these holes that are 20-80 microns in diameter is in the right range for growing biological objects that are implantable, because cells will grow in them," says Ganter. Indeed, another UW bioengineering researcher is working on that application.

Bio-Friendly

Glass is a highly appealing research domain because there is an entire spectrum of glasses that are "bio-friendly."

"Valve 43" is a sculpture created by Meghan Trainor, a graduate student in the UW's Center for Digital Arts and Experimental Media. She designed the piece in Rhino 3D and was the first to use the new Vitraglyphic process to produce objects other than test shapes.
Image courtesy of Meghan Trainor

"I could take a piece of sterilized glass and implant it under your skin and it would be fine. The human body just isn't bothered by glass at all," says Ganter, adding that researchers have placed a glass heart in the middle of the chest, the skin stretching to accommodate it, without the body rejecting it. "There are some glasses that are actually bio-absorbed," says Ganter, "dissolving over a period of months in the human body. I know they exist, and I'm very confident we'll be able to print them as soon as we can find a supplier."

Although 3D printing with cells to produce replacement body tissues is still highly experimental, the development of 3D printing with

glass opens up new directions for interactions between cells and glass.

Low Cost Materials

Ganter says using glass and ceramics is very inexpensive. Powdered recycled glass is available in most large cities and all that is necessary is to mix the powder, pour it in the machine, and see how it works. The glass is pink in pre-firing and gray in the post-firing stage.

Using his own binders formulated at UW, Ganter can make color products using the Z Corp monochrome machines. The recycled supplies sell for $1 per pound; specially formulated binders for most rapid prototyping machines would cost around $30-$50 per lb.

Applications

Custom glass formulations are used extensively in semiconductor manufacturing, as well as in building supplies. Possible applications include: art, architecture, medical, and dental.

Howard Kuhn (former director of research for the Ex One Company) says that while infiltrations have worked with a number of glass and porcelain systems, nothing has been refined to the point of being commercially viable.

Joe Titlow, director of product management for Z Corporation, says his company has done a lot of research in the area of 3D printing of glass in the past. "Our experience to date has been that it is pretty easy to get something that kind of works

that will piece together glass particles," he says. "What is difficult, and what we haven't yet found a solution for, is making what we think would be a viable product in this space, something that would actually be able to perform like glass and look like glass."

EOS laser-sintering systems do not create glass parts at present, according to the company. The closest they have come is their material PA 3200 GF, a glass-filled fine polyamide that is used for applications such as housings and thermally stressed parts.

Assistant professor of architecture at the University of California, Berkeley, Ronald Rael, is working on new kinds of ceramic bricks that can be used for evaporative cooling systems. "3D printing in glass has huge potential for changing the thinking about applications of glass in architecture," Rael says. "Before now, there was no good method of rapid prototyping in glass, so testing designs is an expensive, time-consuming process."

With 3D printing, one can insert different forms of glass to alter the performance at positions specified by the design.

Properties

The challenge now is to do the engineering work to characterize the properties of new materials for 3D printing. What the glass might be used for depends upon its strength and porosity.

Solheim Lab researchers are still working to get a handle on porosity and will begin strength testing within three months. "We print a 10 ml x 10 ml x 100 ml bar and the first thing people want to do is try to break it," Ganter says. "The last run we did, the grad student who made it couldn't break it in his hands."

The Solheim Lab at the University of Washington uses early Z Corporation 3D printers in its experiments with materials. *Image courtesy of Mark Ganter*

At the Lab, they print cylinders similar to two stacked hockey pucks, then test their resistance to crushing. Those that pass the test can be used as building materials.

The finished glass material looks "more like sugar," and is porous. "You're looking at mostly glass-air boundaries," says Ganter. "If you take a glass and crush or break it, the powdery stuff looks pretty white."

Possibilities Ganter sees for the porous materials include filters or liners for containers that should not slosh. Tanks that might be filled with a glass foam chemically neutral to whatever else you fill it with would be ideal. You can soak the glass with

gasoline, for example, and the gas won't drip out. In chemical engineering, porous glass is used for filter or reactor applications, where there may be a chemical reaction within a vessel.

Glass holds a lot of promise as a low-cost material for use in many different capacities. The ability to repurpose used glass in 3D printing for new products, and the bio-friendliness of glass, make it appealing to a manufacturing industry that is charged with finding ways to recycle, repurpose, and use non-toxic and dissolvable materials.

As designers, artists, and manufacturers become increasingly aware of the breadth of uses for glass and 3D, it should find its way into more applications as a low-cost alternative. ■

*Contributing Editor **Susan Smith** is DE's expert in rapid technologies and has been immersed in the tech industry for more than 17 years. Send e-mail about this article to DE-Editors@deskeng.com.*

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> Solheim Rapid Manufacturing Laboratory University of Washington

> Z Corporation

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Sorting Out the Need for Personal Supercomputers

> The power on your desktop can drive the most demanding applications.

BY PETER VARHOL

The history of personal computing is a very short one—it was only in the latter part of the 1960s that professionals could hope to have a time-sharing terminal on their desks. In the 1970s and 1980s, Unix workstations were relegated to the most demanding engineering tasks, with X-Windows servers dividing the computational horsepower among multiple users.

The Dell Precision line is a capable model for high-end engineering design work. It is shown here running DASSAULT Systemes Catix.

Supercomputers were an entirely different type of beast. Born in the 1960s out of Control Data Corporation, they were simply the fastest computers money could buy. They used specially designed processors and were particularly quick at math computations. In the 1970s and 1980s, they were designed and manufactured by the likes of Cray (two separate companies bore the name of Seymour Cray), SGI, Pyramid, Thinking Machines, and IBM.

Today supercomputers are custom-designed parallel processing machines that are built to the needs and specifications of individual buyers. They use industry-standard processors, but hundreds or even thousands of them, and typically cost millions of dollars.

But it is possible for individual engineers to have 80 or even 90 percent of the performance of a custom-designed supercomputer right on their desk; or more likely, under their desk in a standard PC tower configuration. It might cost a few thousand dollars, or at the top end a few tens of thousands, but you can have more power on your desk than was available in any research lab only a few years ago.

How? Mostly it's thanks to faster industry-standard processors, the PC architecture, and the race to the bottom on prices. But there is also help, through the use of other processors that are better at computation than the industry-standard Intel processors.

The Different Levels of Supercomputer

There are three levels of personal supercomputer. The first is the faster Intel-processor computer. It might be a quad-core Xeon desktop, with up to 192GB of memory. It could be a Xeon or Itanium with two or four processors, perhaps each with multiple cores.

By any measure, this is a fast computer. According to the popular SPEC benchmark, a Dell Precision with the Intel Xeon X5470 processor reached a peak SPECmark of 36.7, one of the top values recorded on a standard PC configuration.

The second level starts with the same level of computational power as the first, and then incorporates one or more high-performance coprocessors. The coprocessor, such as the NVIDIA Tesla, might be designed for superior floating point performance. Because of the low cost of such graphics processing units (GPUs), you could run a number of them in parallel and still put a supercomputer on your desk. The problem with this configuration is that you need code that can take advantage of both that processor and any unique architecture being used.

The third level includes specialized memory and processor architectures. While the processors will be off the shelf, how they are configured, and how they access memory, are likely proprietary, optimized for high performance. These are typically designed for specific uses, or are laboratory projects. Depending on the configuration and purpose, such a system can cost anywhere from low five figures to well up into six figures.

At the Low End

You can move into the lower end of the personal supercomputing range with high-end off-the-shelf systems for under $2,000. It starts with Intel's Nehalem architecture, which is revolutionary in a number of ways that will benefit users such as engineers who require very high-performance systems on a budget.

One significant innovation in Nehalem (now incorporated as a part of the Xeon chip line) is its so-called Turbo Boost Technology, which automatically delivers additional performance when needed by taking advantage of the processor's power and thermal headroom. It does so via overclocking, a technique well known to anyone who built his or her own PCs 15 or 20 years ago. Because Intel processors were capable of running faster than their rated clock speeds, replacing the clock crystal with a faster one was an easy way of getting a computer to run faster with a slower, less-expensive processor.

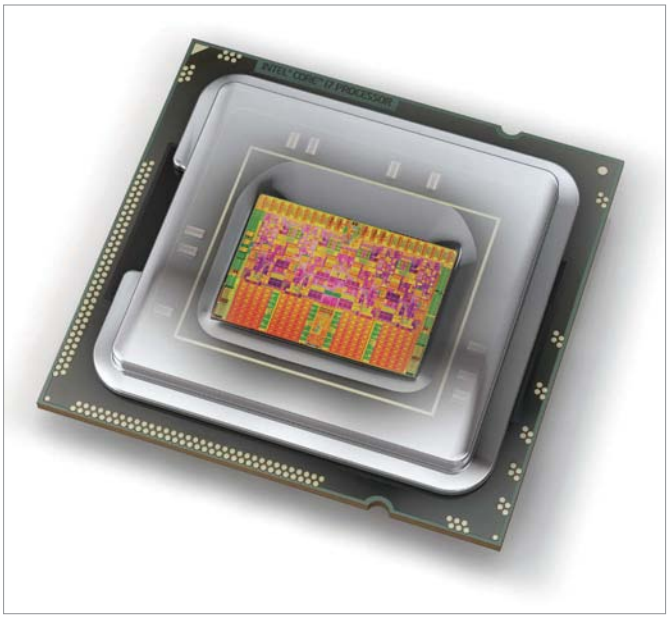
One significant innovation in Nehalem is its so-called Turbo Boost Technology, which automatically delivers additional performance when needed by taking advantage of the processor's power and thermal headroom.

Nehalem does it in a different way. It detects

when a processor core is running at close to capacity, then overclocks itself one step at a time to be able to run its workload more easily. As the workload diminishes, it clocks back down to its normal speed.

The processor also incorporates scalable shared memory with memory distributed to each processor with integrated memory controllers and high-speed point-to-point interconnects. Specifically, it has the memory controller on-chip, rather than across the memory bus on a separate chip. This enables the controller to understand what is happening in the processing pipeline and make fetch decisions based on that tight coupling. This approach has the potential to improve performance by ensuring that data and instructions are ready to go so that pipeline stalls become less common.

HP uses the Nehalem processor primarily for servers. If engineers are willing to invest in a system configured as a server, such a configuration will be comparable to the Dell in memory capacity and bus speeds.



The Nehalem processor from Intel is capable of powering demanding applications that require Intel compatibility.

More Power for More Money, Tradeoffs

The next level of personal supercomputer will typically run a standard operating system that lets you get your routine work done, but has the ability to dispatch specific parts of the application to one or more graphics processors, such as those produced by the likes of NVIDIA and ATI (a part of AMD). NVIDIA, in particular, has gone a long way in this direction. Using the Tesla processor and CUDA architecture, it has created a processing architecture that lets you run heavy floating point code on multiple graphics CPUs. In September of this year NVIDIA announced its new architecture,

OS FAMILIES OF THE TOP 500 SUPERCOMPUTERS

Operating System Family	Count	Share Percentage
Linux	443	88.60
Windows	5	1.00
Unix	22	4.40
BSD	1	.20
Mixed	29	5.80
Totals	**500**	**100**

Fermi, which overcomes some of the limitations.

At the high end, Intel is once again getting into the picture. The company is scheduled to reveal details of its new Larrabee family, Intel's first multicore architecture designed for high throughput applications featuring a programmable graphics pipeline. It uses multiple X66 processor cores rather than some exotic processor that may be more suited for the task.

The compelling thing about Larrabee is that far fewer code changes will be necessary in order to use existing applications. In fact, all existing applications should be able to use it, albeit not nearly to its potential. Rewriting code to make it more parallel where appropriate will offer occasional dramatic performance gains, but that requires additional development effort.

Do Operating Systems Matter?

According to a list of the top 500 supercomputers on the planet today (500.org/list/2009/06/100), 443 are running Linux. Does that mean Linux is the fastest OS? Well, no. And there is no question that an operating system that can have an influence, depending on your application.

Microsoft, for example was happy to note last year at the Supercomputing Conference that Windows Server 2008 was used with the fastest computer on the top 500 list. But it is likely such a minor role that being able to easily run the applications you need is more important. If your application consists of many threads, you may want to look at an OS that does fast context-switching. Of course, you'll also want to make sure that your applications are available on the OS that you choose.

In the Market?

If you're looking to buy a desktop supercomputer, you must first assess your needs. If your primary need is to run standard design applications, the lowest level of desktop power is probably fine.

If you have the money, and need the power, look for solutions that can run on, or be rewritten to run on a graphics processor, or processor array, such as the NVIDIA Tesla. You should be able to run the compute-intensive parts of your application much more quickly than with standard processors.

If you need still more, or if you don't have source code that can easily be rewritten and recompiled, look toward a new architecture like Intel's Larrabee. It will take a little longer to get there, and cost a bit more, but you will get the power of a true personal supercomputer. ■

*Contributing Editor **Peter Varhol** covers the HPC and Engineering IT beat for DE. His expertise is software development, systems management, and math systems. Send comments about this column to DE-Editors@deskeng.com.*

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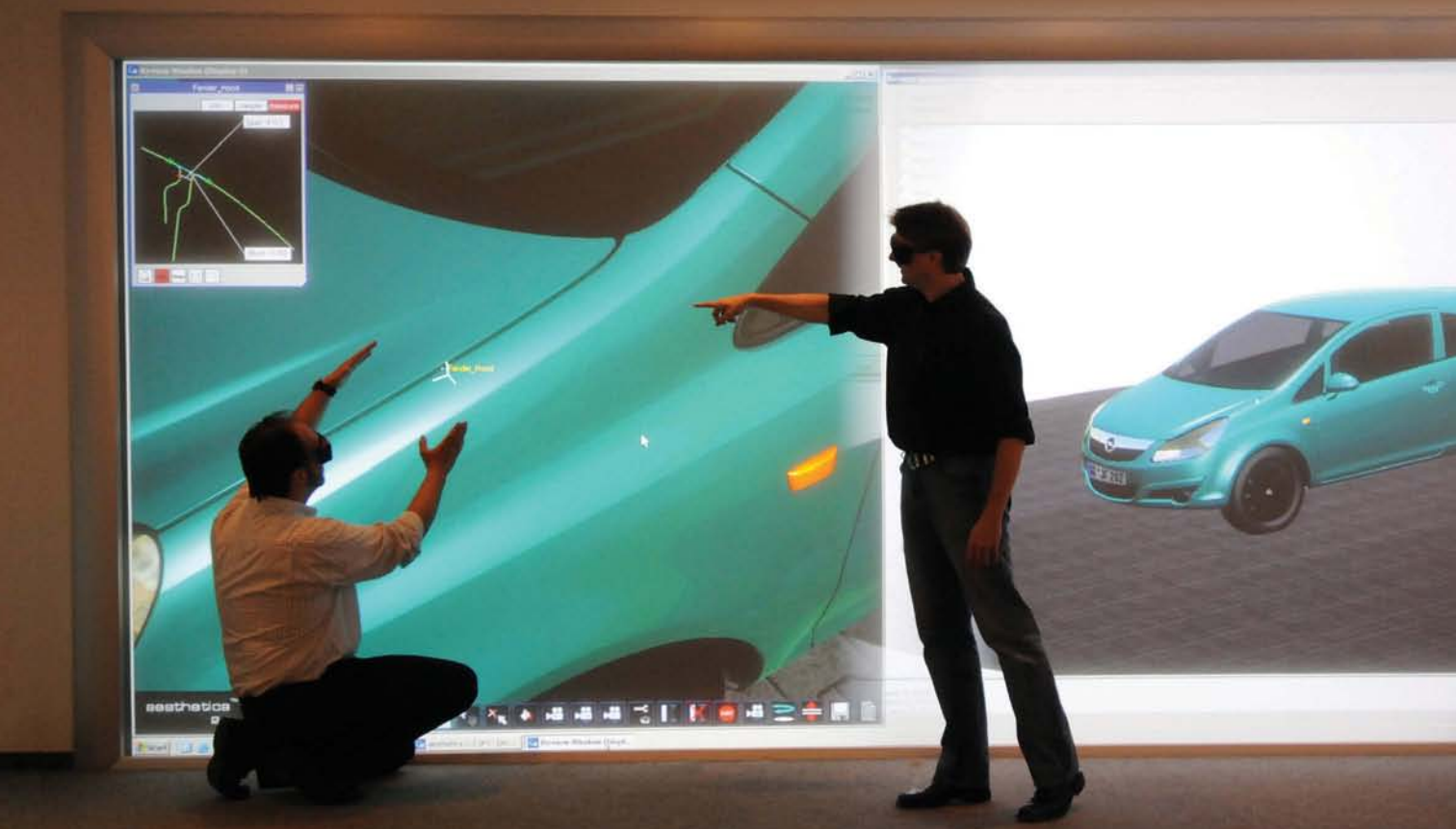

58 aesthetica Speeds New Opel to Car of the Year

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65 NVIDIA Quadro Makes the Virtual Real

Design review meetings are routinely carried out in virtual reality rooms at Opel so all meeting participants can view a 3D model without the need for any physical models.

Image courtesy GM Europe

By Neil McLeod

aesthetica Speeds New Opel to Car of the Year

> GM Europe used Icona Solutions' manufacturing variation visualization solution to fine-tune Insignia while saving time & costs.

When the new Opel/Vauxhall Insignia from GM Europe won the 2009 European Car of the Year (COTY) award from among a field of 37 contenders, judges agreed that an important contributor to their decision was the "high perceived quality" of the automobile. Perceived quality describes the first impression a customer has of the look and feel of a product, without regard to its functionality. This visible high quality is an important differentiating factor among potential customers for deciding which products and brands they will consider purchasing, and it is a key component of brand identity.

Key to GM Europe's success with the Insignia was its use of advanced manufacturing variation simulation and visualization software during the car's development. Known as aesthetica and de-

This illustrates a typical example of how aesthetica is used to decide whether gap and flush conditions are acceptable and will provide high perceived quality in the finished product.

veloped in the UK by Icona Solutions, the software was used during the early concept design stages of the project—enabling the design, engineering, and manufacturing teams to understand manufacturing constraints and agree on gap and flush conditions, as well as manufacturing tolerances, as early as possible. This made it possible to achieve the highest possible perceived quality in the final vehicle without impacting development and manufacturing costs.

Dimensional Management

Ten years ago, GM Europe created the dimensional management department at its International Technical Development Center in Rüsselsheim, Germany to accurately manage tolerances over the entire vehicle development cycle. The department is led by Edgar Lossnitzer, who has defined the new perceived quality processes by instituting a tracking schedule known as the dimensional technical specification (DTS) that specifies all gaps and offsets visible to the customer (along with their nominal values and allowable deviations) and tracks them all the way to production.

The problem GM Europe encountered was that too many gaps were falsely interpreted through tolerance simulation. This often led to controversial discussions in the DTS setting meetings, as well as in follow-up meetings. This costly and time-intensive process resulted in late decisions and additional costs involved in implementing the required design changes.

With a view to overcoming this problem, Lossnitzer and his team set out to fully investigate whether 3D visualization software could help in the dimensional management process during development of the Insignia. The team then chose to investigate aesthetica from Icona Solutions.

The software is unique in that it applies tolerances and component deformations directly to the product's 3D CAD geometry. These 3D models can then be visualized, in real time, using different light sources, colors, and materials, and its components and assemblies can be distorted, buckled, and moved in 3D space and visualized in real time. (This is unlike traditional visualization software, which can only visualize a virtual product in its perfect, as-designed nominal condition.) With aesthetica, a realistic representation can be produced at any stage of development so perceived quality reviews can be undertaken, and fit and finish problems can be solved immediately.

Perceived Quality Studies

Opel implemented aesthetica at the early stage of the development of the Insignia. Superior design, vehicle dynamics, safety, and comfort, as well as superior aerodynamics and appearance (gap and flush) were all expected from this vehicle; models for the interior and exterior were generated from the first available styling data.

The parameters used for the aesthetica simulations were based on design and manufacturing data, including the material, fastening scheme, and tolerances. Complex deformation effects such as arching, bending, and distorting were represented, enabling identification of the root cause of problem areas. In fact, these parameters can be changed freely to test all possible solutions in order to achieve the highest possible quality in

the final product. The digital model was continuously updated to accommodate styling changes, and the process continued beyond validation up to the final confirmation and improvement phase.

GM Europe/Opel uses NX from Siemens PLM Software for CAD and ICEM Surf from Dassault Systemes for surface modeling. Its tolerance stack-up and analysis of the chassis, body-in-white, and powertrain are completed in Vis VSA from Siemens PLM Software. Using aesthetica, design review meetings were routinely carried out in a virtual reality (VR) room so all meeting participants could easily view a 3D model without the need for any physical models.

In these meetings, all key stakeholders were able to review all tolerances, their effects, and any effects of changes. Target specifications could be

Since introducing aesthetica into Opel, there have been no more long-winded and time-consuming discussions regarding a few tenths of a millimeter.

defined based on realistic images early in the process and decisions could be released for product development simultaneously, thereby avoiding future surprises.

In order for discussions in the VR rooms to be completed as efficiently as possible, a typescript was generated beforehand. With this, the area of the vehicle, perspective, material combination, and light sources for the visualization were defined and stored in aesthetica. As a result, every condition

Target specifications for gaps and tolerances can be defined early in the process and decisions can be released for product development simultaneously using aesthetica. Effects of changes can be seen in real time.

could be quickly reconstructed. The new points and desired notes from the meeting could also be directly entered and stored in the same manner. This allowed new ideas to be discussed immediately and either pursued or rejected, partially eliminating the need for physical models and resulting in cost and—above all—time savings.

Depending on the phase of vehicle development, different goals were pursued and aesthetica's 3D visualization capabilities proved indispensable because, in the absence of a physical vehicle, no conclusions could have otherwise been reached. This was especially true in areas where many components interface with each other (e.g., the boot [trunk] lid, meeting of dashboard and door trim). In the development of the Insignia Sports Tourer, these areas were investigated with aesthetica and its Gap/Flush Fitting tools. With these, different possibilities for gap and flush could be judged until an optimal combination was found.

As a rule, only partial models were generated for the interior. These models included the front

For the Insignia's interior, the area visible to the driver and passenger was the priority. This enabled engineers to use out-of-sight areas for compensating the build tolerances.

door trim, instrument panel, and the center console. To observe these areas from the viewpoint of the driver and passenger, the 3D CAD manikin RAMSIS from Human Solutions was used to collect data. Additionally, within the aesthetica model, rotation points were set at the manikin's eyes to evaluate the view in all directions. Moreover, this avoided identifying problems as a result of being evaluated from unrealistic views.

Enabling Good Decisions

As the models became more advanced, more attention could be applied to elements like screws, rivets, or ribs within gaps, clip connections of components within the visible area, visible submaterials such as sealing foam or glue, and elements visible through transparent components such as headlamps. This all helped to improve the overall visual appearance, or perceived quality, of the final vehicle.

Icona Solutions' aesthetica software was developed as a visualization tool that enables vehicles to be developed in a cost-efficient and effective way. Although some people at Opel were initially critical of the high investment needed for the software and 3D visualization on a Powerwall, once it became clear how easily decisions could be made, they were convinced of the value.

Since introducing aesthetica into Opel, there have been no more long-winded and time-consuming discussions regarding a few tenths of a millimeter. Considerable resources have been saved by eliminating the need for physical validation models, and when considered with improved communication of necessary changes, faster decisions, and trimmed development costs, it's clear to see why Opel feels aesthetica was a worthwhile investment. ■

Neil D. McLeod *is a UK-based marketing communications and PR consultant who specializes in the CAD/CAM/CAE and PLM software and systems marketplace. To comment, send e-mail to DE-Editors@deskeng.com.*

FOR MORE INFO:

- > **Dassault Systèmes**
- > **GM Europe/Opel**
- > **Human Solutions**
- > **ICEM Ltd.**
- > **Icona Solutions**
- > **Siemens PLM Software**

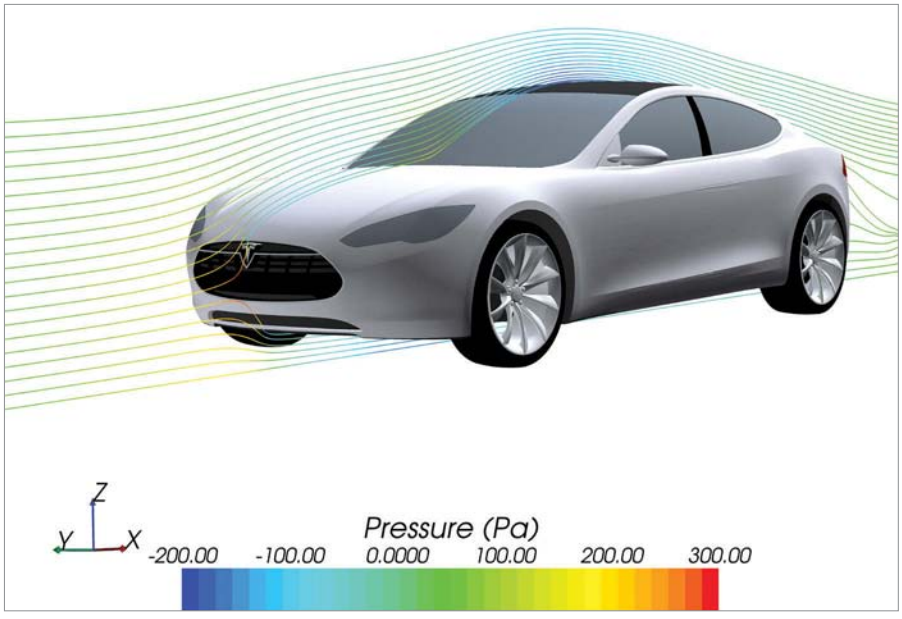
For more information on this topic, please visit **deskeng.com**.

By Vince Johnston

STAR-CCM+ Solves Aerodynamics and Heat in Tesla Model S

> CFD simulation of an all-electric sedan enables engineers to see where aerodynamic drag and thermal energy needs to be reduced.

At Tesla Motors we run lean and go fast. This is true of our vehicles and of our engineering and analysis teams, who have developed today's all-electric Roadster, the only highway-capable electric vehicle currently in production, with a 240+ mile range and a 0-60 mph time of 3.9 seconds.



STAR-CCM+ computational fluid dynamics software from CD-adapco helped Tesla engineers address a broad range of electric vehicle engineering challenges quickly and accurately.

When Tesla decided to bring the aerodynamics development and thermal engineering of its new Model S sedan in house, it chose the STAR-CCM+ computational fluid dynamics software from CD-adapco to help address a broad range of electric vehicle engineering challenges quickly and accurately.

STAR-CCM+ is deployed among several groups at Tesla Motors including Aerodynamics, HVAC Systems, and Powertrain Engineering. A key to its successful deployment is the ability to go from a CAD model to a CFD solution within one tool, al-

lowing expertise in CAD correction, computational mesh generation, and physics modeling to develop within a single platform across a broad range of users. Within STAR-CCM+, it's a straightforward process to add, remove, or modify geometry and physics models, allowing engineers to quickly see the results of modifications on quantities like drag, lift, pressure loss, temperature, and mass flow.

Our goal in this project was to achieve exceptional range without compromising the performance of the Model S. To do that, we analyzed every aspect of the vehicle to conserve energy.

In the simplest terms, range is the net result of the on-board energy carrying capacity of the vehicle and the efficiency in applying that energy to accelerate and propel the vehicle's mass—minus all the opposing forces. These include rolling resistance, gravity on grade, and aerodynamic drag. At highway speeds, aerodynamic forces dominate the opposing forces, so it's easy to see that to achieve increases in range the most effective means are to reduce the aerodynamic drag of the vehicle and add more on-board energy capacity. But increasing battery-energy capacity typically increases the cost, weight, and battery size, and is also likely to increase the amount of thermal energy that has to be removed from the vehicle. Heat transfer devices such as radiators and condensers work well in removing heat, but often at the cost of aerodynamic performance and

Borrowing from Yesterday for Tomorrow

Tesla Motors was named for Nikola Tesla, inventor, electrical engineer, scientist, genius. Among his many inventions (and more than 700 patents) are the induction motor and alternating-current (AC) power transmission. Without Tesla's vision and brilliance, the wheels of industry would cease to turn and Tesla Motors' cars wouldn't be possible.

While Tesla Motors is carrying the inventor's name forward in the advancement of electrical science, it is hoping to reduce its impact on the environment. That is why the tires and the battery of every Tesla Motors vehicle are recyclable. Reuse is such a key part of Tesla Motors' philosophy that it arranged to have its car batteries safely recycled before the first Tesla car was sold. The cost of recycling is built into the purchase price of the car, so there is never reason not to recycle.

further energy losses through the use of electric fans coupled to the heat exchangers.

CD-adapco's STAR-CCM+ software provided Tesla Motors with a tool to simulate and evaluate all of the aerothermal components and interactions to optimize range performance and minimize vehicle energy consumption. As a result, the Model S Sedan (which is due to hit the streets in 2011) has a range of up to 300 miles. Compared to competitors whose typical electrically powered range ventures up to 60 miles, this represents a huge advantage. Its batteries can be charged from any electrical outlet and only takes about 3.5 hours to reach a full recharge. Additional features like regenerative braking, which recovers and stores the energy usually lost when the car slows, extends the charge even further, delivering higher miles-per-charge on in-town driving. All of these features enable Tesla Motors' cars to run as cheaply as 1 cent per mile.

All of this is delivered without compromise to performance. The S sedan's peak torque starts at 0 rpm and stays powerful at 14,000 rpm. This is the opposite of the performance of gasoline engines, which have very little torque at low rpm and only reach peak torque in a narrow range of rpm. The nearly constant torque of Tesla Motors' cars results in great acceleration with high energy efficiency at the same time. ■

Vince Johnston *is the engineering manager at Tesla Motors. To comment, send e-mail to DE-Editors@deskeng.com.*

FOR MORE INFO:

> **CD-adapco**

> **Tesla Motors**

For more information on this topic, please visit **deskeng.com**.

By Shawn Hempel

NVIDIA Quadro Makes the Virtual Real

> Real-time interactive visualization enables analysis of digital models.

Designing products that are safer, more aerodynamic and ultimately attractive is paramount for companies like adidas, Audi, Porsche, and Airbus. One increasingly popular product design trend that these companies are using is virtual prototyping.

Virtual prototypes allow designers to evaluate every inch of a product, starting by converting original computer-aided design (CAD) data into usable, photorealistic models that can be manipulated in real time. With virtual prototyping, designers can instantaneously view different configurations, thereby reducing the need for expensive physical prototypes and streamlining the design and production process, all while giving them greater design flexibility and saving companies millions of dollars.

The challenge? With virtual prototyping, a high degree of realism and visual quality are crucial.

Visualization is by nature an estimation of reality, albeit with today's technology, a very convincingly realistic one. In contrast, simulation is a physically correct representation of reality. In the absence of physical prototypes, designers require precise simulation, consistent and repeatable physical-based model rendering, the ability to easily modify light and materials, and the option of switching between design alternatives for effective comparison.

Real-time raytracing has quickly gained recognition for its value in the design areas of lights and panes, making it particularly useful in designing complex tail lights and analyzing window reflections.

RTT RealTrace enables physically correct simulation of light refracting and reflecting in real time, even for dynamic 3D scenes. Here you see light and shadows displayed in real time and with considerable accuracy. Note the shadows cast by the side mirror and the reflections shown on the door.

Ray tracing is undoubtedly one of the most realistic methods of rendering images created in 3D computer environments. Ray tracing tools allow reflections, refractions, and the absorption behavior of surface materials to be simulated precisely, making this technique essential in the powerful and realistic representation of 3D models. However, ray-tracing calculations are considered to be extremely time-consuming, and until now it has taken users hours to process ray tracing effects of a single image.

The main principle of ray tracing is based on the lengthy backward tracing of rays—starting from the eye of the viewer through each pixel of the image until it hits a part of the scene intended to be displayed. The pixel contains both the color and intensity of the surface element it has hit. From a scientific viewpoint, it's a technical challenge to simulate the accurate distribution of rays.

Munich-based virtual reality specialist RTT AG has revolutionized the market and provided a solution to previous ray-tracing challenges with its pioneering module, RTT RealTrace. RTT RealTrace is a component of RTT DeltaGen 9.0, a design and engineering software application that allows designers to build hyper-realistic 3D models and interact with those models in real time. RTT RealTrace is the world's first real-time raytracer, producing physically correct simulation of light refracting and reflecting in real time, even for dynamic 3D scenes.

With RTT RealTrace, designers now benefit from a technology that visualizes global illumination effects rapidly, allows for changes anytime during

the presentation, and eliminates long preparation and pre-calculation steps. RTT RealTrace enables exact visualization of materials, including complex effects and surface structures.

RTT RealTrace is based on the NVIDIA Quadro technology and enables real time, interactive visualization and analysis of digital models. It is fully integrated, runs on a desktop machine, and can run on an NVIDIA Quadro cluster. RTT RealTrace is 10 times faster than existing CPU-based products.

This new technology allows physically accurate reflections, refractions, and absorption behavior of surface materials to be calculated and displayed in real time. In addition, RTT RealTrace enables a smooth integration into OpenGL, allowing the user to ray trace only specific parts. Through full integration, designers can use existing virtual models and hardware setups, which allows for a high degree of usability and workflow flexibility.

"The combination of RTT DeltaGen 9.0 with the NVIDIA Quadro platform gives our customers the best visualization and performance available," explained Ludwig Fuchs, RTT co-founder and board member. "Together, we are challenging reality with unprecedented 3D visual quality. The NVIDIA Quadro solutions ultimately allow us to offer our customers flexibility, which in turn saves them time and money."

"The breakthrough is in its ability to address speed like never before," Fuchs added.

The unique advantage of RTT RealTrace is speed, which remains most critical to virtual reality users and designers. The result of RTT RealTrace and NVIDIA Quadro platform is high-end simulation in real time. This allows designers to rebuild virtual prototypes every night whereas competitors' software would take several days. The ability to compress the product development timeline has unmatched value.

RTT's is the only technology solution that uses new software techniques like meta programming on the GPU instead of the CPU. The tool generates more than convincing results with a single high-end NVIDIA Quadro solution. To add flexibility, RTT RealTrace is cluster-compatible and optimally distributes the data via dynamic load balancing.

RTT RealTrace and NVIDIA Quadro solutions provide the flexibility of changing the look and materials while modifying light sources.

RTT RealTrace and NVIDIA Quadro solutions provide the flexibility of changing the look and materials while modifying light sources. Since the calculation algorithms of RTT RealTrace are based on real optical facts, the visualization is physically accurate. The effect is that designers see exactly how light will travel—not an approximation thereof. RTT RealTrace provides insight into dysfunctions caused by lighting, such as when glare from dashboard material, due to its angle onto the windscreen, impairs viewing. The advantage of a virtual prototype enhanced with RTT RealTrace is that dysfunctions are identified early in the process, not after a company spends millions to build a physical prototype.

Real time ray tracing has quickly gained recogni-

tion for its value, particularly in the design areas of lights and panes, making it particularly useful in designing headlamps and analyzing windshield reflections. Customers like Porsche, Airbus, Audi, Volkswagen, BMW, and General Motors have taken advantage of RTT RealTrace. In reference to tolerance analysis, it is crucial to interactively visualize global illumination effects, such as specular and glossy refraction and reflection, ambient occlusion, hard and soft shadows, indirect illumination, color bleeding, or light emitting objects. Doing so, designers can now discover problematic reflections earlier and adjust design aspects more effectively due to RTT RealTrace's ability to portray an accurate reflection in the panes. Even complex headlights, where accurate representation caused significant problems in the past, can now be visualized easily and correctly to provide a reliable impression of the final product.

Not only are subtle design details easier to assess, but RTT DeltaGen 9.0 powered by the NVIDIA Quadro platform is shortening a product's time-to-market.

The visual computing power of NVIDIA Quadro's graphics solutions provides cost-saving solutions and enables RTT's customers to affordably integrate visual prototyping into all areas of design, where it was previously cost-prohibitive. Not only are subtle design details easier to assess, but RTT DeltaGen 9.0 powered by the NVIDIA Quadro platform is shortening a product's time-to-market. From cars to aircraft, new products designed with these two technologies incorporate better ergonomics, higher safety standards and superior design aesthetics.

With continuous improvements in hardware performance, even the most complex designs can be interactively visualized in the future. Phenomena that today cannot be visualized in real time—such as dispersion, diffuse reflections, refractions, and caustics—will soon be a standard request. ■

***Shawn Hempel**, director of research and development, joined RTT USA in 2008 and is responsible for all R&D activities in North America. Hempel has led RTT's real-time raytracing and lighting technology advancements. To comment, send e-mail to DE-Editors@deskeng.com.*

FOR MORE INFO:

> **NVIDIA**

> **RTT AG**

For more information on this topic, please visit **deskeng.com**.

Open Design Alliance Announces Release of DGNdirect and DWGdirect

> The **Open Design Alliance** (ODA; opendesign.com) has announced the first production release of DGNdirect available to ODA members globally. DGNdirect includes the ability to load V7 and V8 files, convert V7 to V8 files, save V8 files, access, edit, and render data, and export to PDF and SVG file formats.

The ODA has also announced the production release of DWGdirect version 3.2, which includes support for the DWG 2010 file format.

In addition to reading, writing, and editing DWG 2010 files, version 3.2 of the ODA platform includes overruling and subdivision mesh surfaces, support for ADT 2010 objects, and advancements in the technology accessed by .NET and ActiveX developers.

Matrox Launches Single-Slot PCIe x16 Octal Graphics Card

> **Matrox Graphics** (matrox.com) has launched the Matrox M9188 PCIe x16 Octal graphics card, capable of supporting eight DisplayPort or DVI

PTC Takes Aim at Barriers to Productivity with Pro/ENGINEER Wildfire 5.0

> **PTC** described Pro/ENGINEER Wildfire 5.0, the latest release of its CAD/CAM/CAE product, as a technology to "help customers eliminate traditional design barriers to achieve faster, more efficient and more innovative product development."

In the announcement, PTC identifies present day manufacturing challenges as "the difficulty of making design changes, the length of time to productivity, dealing with heterogeneous CAD data, working with a multitude of disconnected point solutions, and identifying resources and leveraging collective knowledge when needed."

In Pro/ENGINEER Wildfire 5.0, PTC says it's introducing more than 330 enhancements, aimed at productivity and better user experience. "Real-time, dynamic editing and disruption-free design will help users overcome the traditional barriers to design modification" and "accelerate time to productivity by up to 10X," the company predicts.

Other R&D initiatives to deliver design efficiency and reduce time-to-market include simplified subassemblies and mold part creation, up to 80% faster in the company's estimate. For design visualization, PTC offers an Advanced Rendering Extension, based on the rendering technology from Mental Images.

To facilitate better communication between mechanical engineers and electrical engineers, Pro/ENGINEER Wildfire offers an ECAD-MCAD collaboration module. The new manikin, a digital human model, enables users to verify plant safety and improve field ergonomics digitally.

Brian Shepherd, executive vice president, product development, PTC, said, "Pro/ENGINEER Wildfire 5.0 demonstrates PTC's ongoing emphasis on quality and commitment to deliver capabilities that enable our customers to develop winning products and bring them to market faster and at lower costs."

Wildfire 5.0 received the most visits from readers in the month of November.

Single-Link outputs from a single workstation. The Matrox M9188 PCIe x16 offers 2GB of memory, resolutions up to 2560x1600 per output, and desktop management features—such as independent or stretched desktop modes.

The Matrox M9188 offers support for Microsoft Windows XP, as well as for Linux.

Matrox also announced the Matrox M9128 LP PCIe x16, DualHead DisplayPort graphics card that drives business, industrial, and government applications across two displays at resolutions up to 2560x1600.

Infrared Thermometer with Circle/ Dot Laser Sighting, Wireless USB

> The high-performance, handheld OS-DT8855W infrared thermometer from **Omega Engineering** (omega.com) is a non-contact temperature measurement instrument that features a laser circle/ dot sight. The patented laser sighting system defines the target for point and shoot measurement of temperatures from -50 to 1370°C (-58 to 2498°F) and reads surface temperature in less than a second. Comes with hard carrying case, mini-tripod, power supply, one type K thermocouple, USB wireless data receiver, software and probe lead adaptors. Price starts at $279.

Planit Releases of Radan 2010 R1

> **Planit's Radan** (planit.com) offers sheet metal software for design, manufacture, and production control. Radan is capable of 2D and 3D CAD design, nesting, tool path optimization, and allowing programmers to automate the design to manufacturing process.

In this latest release, there are enhancements to the 2D CAD module, including an improved DXF interface. In 3D, the introduction of the latest ACIS kernel offers greater stability and performance when loading Catia and Parasolid files. At the core of Radan 2010 R1's nesting is the new Nest Projects enhancement, which accommodates production changes by allowing customers to visualize multiple nests, change priorities, and automatically or manually control nesting functions. Radan users will also see an increase in material use.

Data Logger Selection Guide Now Available from Dickson

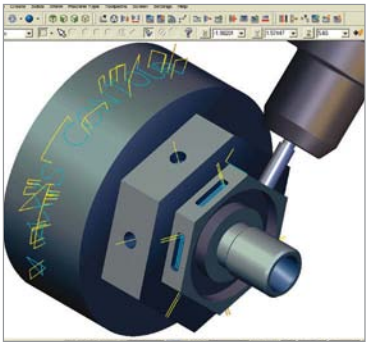
> Engineers looking for technology for monitoring temperature, humidity, pressure, or electronic signal events can now use the Dickson Data Logger Selection Guide, online step-by-step resource guide available from **Dickson Company** (dicksondata.com).

Multiple selection factors are provided, including instrument displays, remote probe availability, alarm options, wireless/Ethernet/ battery-operated or outlet-powered, operating ranges, and cost. Users are able to drill down and mix and match various features until they identify the range of instruments that match their specifications.

MASTERCAM release CNC Software Releases Mastercam X4 Lathe

> Mastercam X4 Lathe from **CNC Software, Inc.** (mastercam.com)is a new suite of CAD/CAM tools focused on delivering efficiency to machining jobs.

From roughing and finishing to easy grooving and threading, Mastercam Lathe has been designed to reduce programmer interaction and increase machining flexibility. Mastercam's streamlined CAD engine makes each piece of created geometry "live," letting users modify it.



Mastercam X4 Lathe delivers a set of programming tools, including: Quick Toolpaths for programming parts with just a few clicks; Optimized facing including roughing and finishing; Complete threading with multiple starts, diameter calculation, and user customizable thread tables; In addition to turning, full 3- to 5-axis milling, including machines with B-axis tooling arms; Grooving with multiple depth cuts and pecking; Stock recognition for optimized turning toolpaths with minimal user interaction; Lead-in/lead-out controls that minimize the need to modify the CAD model to control tool motion; and more.

Mastercam X4 Lathe's associative toolpaths are linked with users' geometry. If a user modifies any element of a job, toolpaths can be updated without starting over, and CAD File Change Recognition tracks files from Mastercam or any other CAD system to show users what's been changed.

Dassault Systèmes Announces New Abaqus FEA from SIMULIA

> **Dassault Systèmes** has announced the availability of Abaqus 6.9 Extended Functionality (6.9-EF), its unified finite element analysis (FEA) product suite from **SIMULIA** (simulia.com).

This latest release delivers new features and enhancements for modeling, advanced mechanics, and performance. These ongoing improvements are enabling customers to consolidate simulation software, which may help to lower costs and increase efficiency.

New features and enhancements in Abaqus 6.9-EF release include: Interactive support for meshing models using cylindrical elements, which can be useful in the analysis of pipelines by oil and gas companies; Geometry repair tools to offer greater flexibility and broader scope for systematically adjusting the geometry of a model in preparation for meshing; An interface for model change definitions to enable the deactivation and reactivation of model regions and contact pairs during an analysis; and more.

There are also new advanced mechanics capabilities, including: modeling viscoelastic behavior with orthotropic/anisotropic elasticity in Abaqus/Explicit; a new and efficient method for analyzing structures subject to air blast loading; continued advancements in fracture and failure; and a breakthrough improvement in the implicit dynamics procedure.

Colortrac's SmartLF Ci 40e Large-Format Scanner Available with a Certified ISIS Driver

> **Colortrac's** (colortrac.com) SmartLF Ci 40e

(enhanced color) technical document scanner is now available with a certified ISIS (image and scanner interface specification) driver.

Created by Pixel Translations (now EMC Corporation) in 1990, ISIS is a software standard for the acquisition, viewing, format conversion, printing, and storage of documents in order to ensure consistent and reliable communication between hardware and software. ISIS is the basis for a public domain standard. More than 300, high-speed small format document scanners are available with this enterprise-level interface that ensures scanned information is quickly and reliably integrated into electronic document management (EDM) and electronic document capture applications for digital distribution, processing, and storage.

Colortrac developed its wide-format ISIS driver in order to give EDM users with small format scanners a quick and cost-effective route up to large format document capture. EDM professionals wanting to scan large format documents simply need to acquire a SmartLF scanner with its ISIS driver, then continue to use the EDM software they already own to capture large-format documents.

Celeritive Technologies and SigmaTEK to Introduce VoluMill to Fabricating Industry

> **SigmaTEK Systems, LLC** (sigmanest.com) will integrate the high-speed machining toolpath engine of Celeritive Technologies' VoluMill (volumill.com) in its SigmaNEST V10 product for woodworking and aluminum fabrication.

Expected to be available in early 2010, SigmaNEST V10 powered by VoluMill will combine SigmaNEST's ability to optimize parts nesting for minimum waste and minimum machine movement with VoluMill's technology that generates toolpaths with smooth radial motions and minimum force on the spindle and cutting tool. VoluMill toolpaths reduce cycle times and extend the life of cutting tools.

"The combined system, although primarily targeted for wood routing, will work just as effectively for aluminum part routing," said Glenn Binder, SigmaTEK's vice president of sales. "The inclusion of VoluMill further enhances SigmaNEST's pocket-milling capability. Furthermore, the software programming is intuitive, making it easy to produce programs for production."

Microsoft Broadens Supercomputing Reach through New Offerings

> **Microsoft Corp.** (microsoft.com) has announced the availability of betas for Windows HPC Server 2008 R2 and distributed Microsoft Office Excel 2010 for the cluster. Together with the recently announced Microsoft Visual Studio 2010 Beta, which helps simplify parallel programming, these advances make it possible for more users to access supercomputing power through Microsoft Office Excel, Windows Server, and Visual Studio.

Visual Studio 2010 Beta 2 will help make parallel programming simpler and more efficient for a broad base of developers across both client and cluster workloads, according to the company. In addition, by moving Microsoft Office Excel 2010 to the cluster, customers are seeing linear performance scaling of complex spreadsheets—spreadsheets that before would take weeks to

complete, and which are now completing their calculations in a few hours.

Sescoi Releases Version 3 of WorkPLAN Enterprise and MyWorkPLAN

> **Sescoi** (sescoi.com) is pleased to announce the release of Version 3 of its custom manufacturing solutions, WorkPLAN Enterprise for full enterprise resource planning (ERP) and MyWorkPLAN for efficient job management. Version 3 brings new advanced integration options and numerous additional capabilities.

The openness and interoperability now provided by WorkPLAN Enterprise V3 and MyWorkPLAN V3 will enable users to control costs and prepare quotations with unprecedented accuracy, bring better products to market more quickly, maximize return on investment for their existing software, and make the best use of the expertise within their companies.

Microway Announces OctoPuter with 8 Nvidia Tesla Processors

> **Microway** (microway.com) announces its most powerful Tesla GPU-based platform to date. The OctoPuter compute engine includes 2x quad-core Intel Nehalem or 2x six-core AMD Opteron processors. The 8 PCI-Express Gen 2.0 x16 slots support up to 8 Tesla C1060s each with 4GB in a chassis specifically designed for multi-GPU applications. Memory capacity of up to 144GB and high-efficiency, 2+1 redundant power supply complete the package. This platform is well suited for HPC applications and virtualization, and can be used as a building block with high-speed InfiniBand interconnect for dense GPU/CPU computing.

Microway offers several rack mounted and desktop Tesla solutions. Tesla S1070 servers and 1U racks with dual CPUs and dual GPUs are available.

InspectionXpert Adds Support for SolidWorks 2010

> **Extensible CAD Technologies'** (extensiblecad.com) InspectionXpert for SolidWorks now supports SolidWorks 2010. The InspectionXpert product line, which includes InspectionXpert for SolidWorks, is a quality control oriented platform used to generate inspection report forms and ballooned inspection drawings directly from SolidWorks.

InspectionXpert for SolidWorks can extract nominal dimensions, plus/minus tolerances, units, geometric tolerances, hole callouts, surface finishes, weld symbols, and notes directly from inside of SolidWorks and then export them to Microsoft Excel. Uniquely numbered inspection balloons are added next to each extracted inspection characteristic (e.g. dimension, geometric tolerance, etc.) for easy navigation between the drawing and the inspection report form.

ANSYS Releases FLUENT for Dassault Systemes' CATIA V5 5.0

> ANSYS' FLUENT for CATIA V5 software integrates computational fluid dynamics into PLM. It's technology is based on Dassault Systemes' open SIMULIA scientific platform and the underlying CAA V5 architecture.

ANSYS (ansys.com) has created a PLM-integrated CFD solution that reveals the effects of fluid

dynamics during product design. According to the company, it generates files that are 100 percent compatible with ANSYS' CFD software, FLUENT, allowing users to move back and forth between FLUENT for CATIA V5 software.

The volume of fluid (VOF) model has been introduced in FLUENT for CATIA V5 5.0. The VOF model is useful for modeling two-phase flows with a long free surface. This model is useful for applications where two different fluids, typically a gas and a liquid, are interacting with each other.

Other enhancements include more robust flow volume creation, user defined coloring of inlets and outlets, total heat flux specification for walls, periodic specification icon for periodic boundary conditions, and appropriate error messages when meshing volumes using the Tgrid filler. Several enhancements have been made for large model handling, such as consistent numbering and highlighting of solid and fluid sides of walls.

Several changes have been made to the post-processing capabilities. The icon groups have been reorganized and new capabilities have been added. A new icon group has been added for vector plots and the post-processing icons for contour, vector, and pathline plots have been grouped together to make them more compact and accessible. It is now possible to create cut planes easily to create slices through 3-D geometry for plotting. Turbulence at walls can now be plotted. ■

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Technology for Design Engineering

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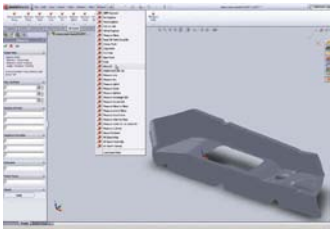
***ReSpect*™, the Inspection Software Plug-in from ReverseEngineering.com Integrates PCMM Hardware into SolidWorks**



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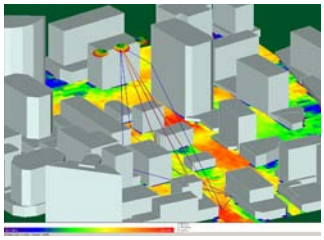

Remcom's Wireless InSite® is site-specific radio propagation software for the analysis and design of wireless communication systems. It provides efficient and accurate predictions of propagation and communication channel characteristics in complex urban, indoor, rural and mixed path environments. Applications range from military defense to commercial communications, including wireless links, antenna coverage optimization, and jammer effectiveness. Visit www.remcom.com/wireless-insite for more information.

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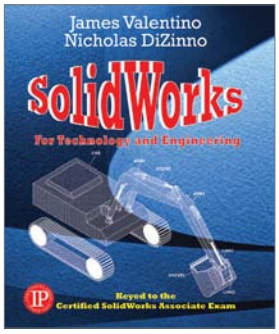

This unique text presents a thorough introduction to the subject for students with little or no prior experience. It can be used in virtually any educational setting and will also serve as a reliable reference for on-the-job use or as a self-study manual. It also contains exercises and materials that are key to preparing students for the Certified SolidWorks Associate (CSWA) exam. To order go to www.industrialpress.com.

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Saving the Planet Starts with Your Design in Mind

JEFF RAY
Dassault Systèmes
SolidWorks Corp.

Climate change. Cap and trade. Reduced carbon footprints. These are just a few of the new terms injected into the product-development lexicon from sustainable-development advocates. More than that, however, they're a bellwether for the new realities of product design. No matter where you stand on the global climate change debate, sustainability-related pressures beyond your control—societal, political, or regulatory—will affect you and the products you design.

While renewable technologies like wind turbines, solar panels, and electric cars grab most of the media attention, the real opportunity for sustainability in product development—with the greatest potential for reducing environmental impacts—rests with the design and manufacture of everyday products.

The next time you're strolling through your favorite store and notice

> The time has come for all of us to make the world a healthier place.

an appealing item—whether it's a lawn chair or a sports car—consider for a moment the product's total environmental impact. Imagine the mining of raw materials, the processing of those materials, and their transportation to the factory. How are those materials manufactured into parts? How much energy will the product consume throughout its useful life? How will the product's eventual disposal affect the environment?

Now, take the collective impact of that one item and multiply it by the thousands, millions, or even billions of identical units available on the market. Then, multiply that number by every type of product that is manufactured and sold. The environmental impact

almost defies comprehension. Next, imagine that design engineers could collectively reduce that impact by some percentage—say, 10 percent or more—across the board.

The thing is, you don't have to imagine. Every product designer and engineer has the power to make a huge difference in the planet's health—right now. Designing sustainable products doesn't require a seismic change in the way designers and engineers do their jobs, just a different awareness when making decisions about considerations like a product's necessary mass and the materials that go into it. Even small changes—such as making sheet metal a little bit thinner or employing a molding process that requires less energy—can make a huge difference in the aggregate.

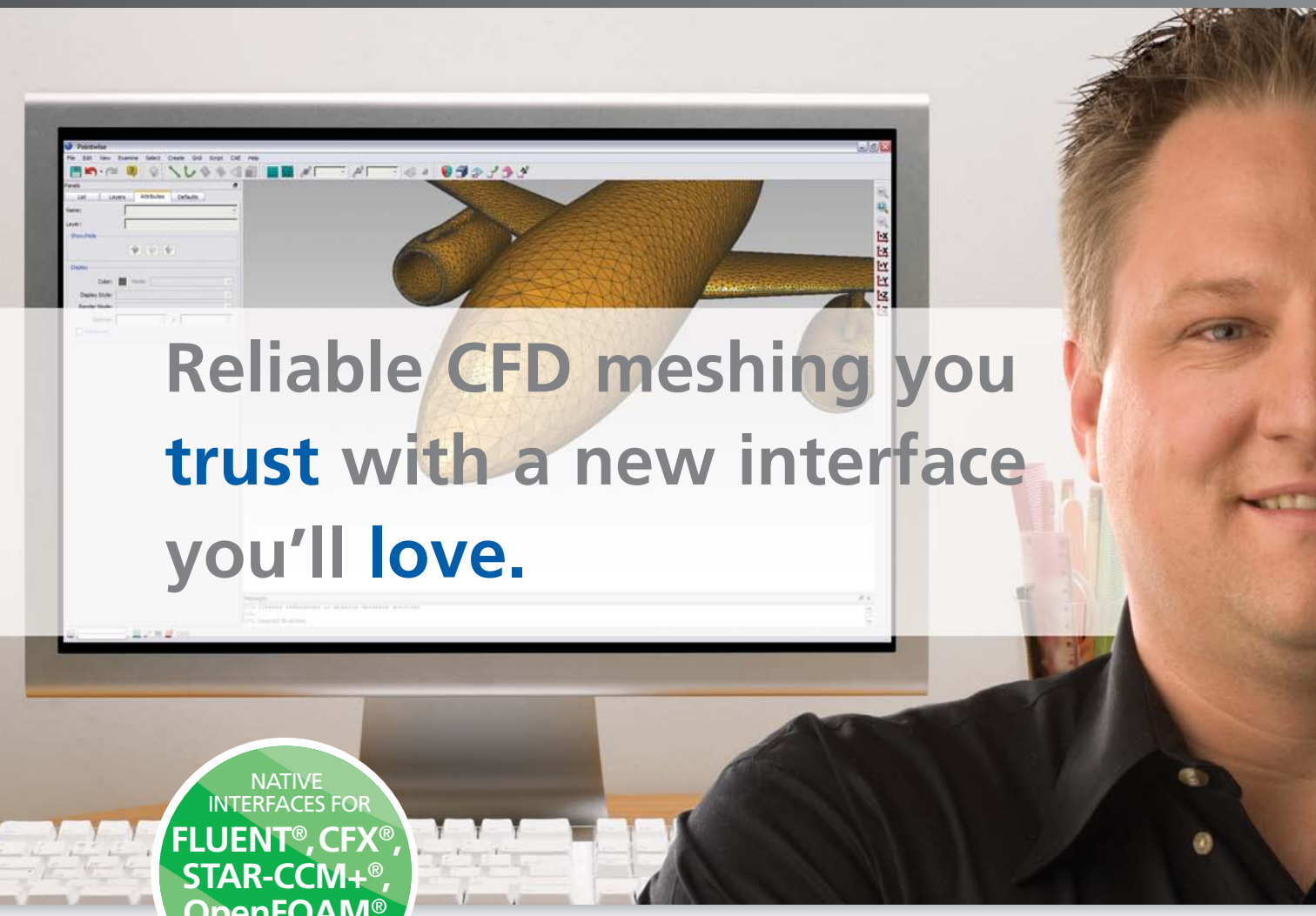
The time has come for all of us to do what we can to make the world a healthier place to live, work, and pursue our dreams. It all starts with the product design in your mind.

A growing number of technology tools on the market today help designers make choices that reduce a design's impact on air, energy, and water, and a product's carbon footprint. The best products on the market will include functionality to:

- evaluate materials for environmental impact
- determine how the manufacturing location and shipping requirements for a product improve or degrade its environmental impact
- assess manufacturing processes to determine what alternatives use less energy and create fewer pollutants.

Using tools like these will help engineers and designers integrate sustainable design principles into their thinking, where it can have immediate impact on environmental factors without sacrificing a product's practicality. The time has come for all of us to do what we can to make the world a healthier place to live, work, and pursue our dreams. It all starts with the product design in your mind. ■

Jeff Ray *is the CEO of Dassault Systèmes SolidWorks Corp. Feedback regarding this commentary can be sent to DE-Editors@deskeng.com.*



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