MARCH 2006

MCAD

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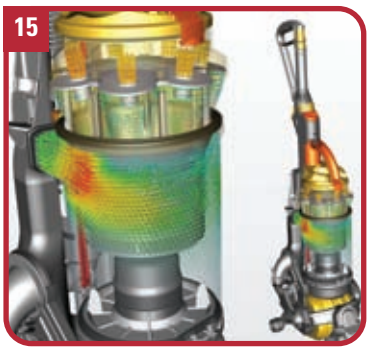
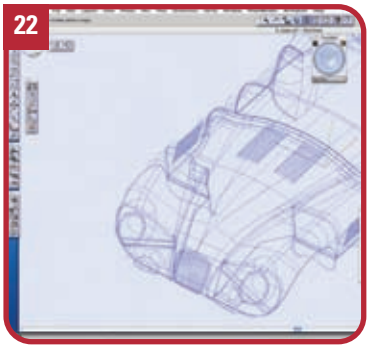




3Dlabs pulls out of workstation graphics

CREATIVE TECHNOLOGY'S 3Dlabs subsidiary is to pull out of the professional workstation graphics business and refocus its 3D graphics business on the portable handheld device market, the company announced this month. 3Dlabs had been at the forefront of professional graphics for many years with its Wildcat product family. However, fierce competition from ATI and Nvidia in recent years had made it increasingly hard for 3Dlabs to compete on performance and price.

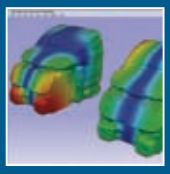
www.3dlabs.com

Flo/PCB solves lead-free manufacturing problems

FLOMERICS has announced a new version of its Flo/PCB thermal simulation software that is designed to help solve thermal problems in solder reflow processing associated with the use of lead-free solders.

www.flomerics.com

LMS kickstarts Dassault's simulation partner program



LMS has become the first company to join Dassault Systèmes' new Simulia Partner Program. Simulia, launched by Dassault Systèmes simultaneously with the DS acquisition of Abaqus in October 2005, provides an open platform for enabling the integration of all types of simulation applications.

www.lmsintl.com / www.3ds.com

Cimatron releases new 5-Axis NC package

CIMATRON has announced the availability of a new 5-Axis NC package which is designed to machine complex parts in demanding industries, such as aerospace, defense, and heavy machinery.

www.cimatron.com

PTC unveils Pro/Engineer Wildfire 3

PTC has announced the availability of Pro/Engineer Wildfire 3.0, the third major release of its MCAD/CAM/CAE software. For the new version, productivity seems to be high on the agenda, and the PTC marketing guys have got their teeth into the new functionality and branded them 'Fast'.

'Fast Sketcher' sees a reduction in the number of menu picks required to use and exit the sketch environment; 'Fast Assembly' features a modernised user interface and optimised assembly workflow which is designed to dramatically increase the speed of assembly, while support for Window XP-64 bit systems enables retrieval of very large assemblies. Finally, 'Fast Drawings' includes the ability to add shaded views to traditional 2D drawings to help clarify design concepts faster and remove ambiguity.

Elsewhere in the new feature set, 'Fast Sheetmetal' is claimed to enable the creation of sheetmetal features by up to 90%, while also reducing the number of features by up to 90% and Fast CAM, which includes enhancements to the manufacturing user interface, is claimed to speed the creation of manufacturing geometry by up to three times.

Work has also been carried out in the area of Process productivity, and a range of new 'Smart' features include: Smart Process Wizard, a new, customisable Process Wizard which allows companies to capture knowledge and utilise their best practices and recommended approaches for different processes; and Smart Model, which features the ability to embed manufacturing process information into the model with a view to making it easier to design for manufacturability and help promote best practices.

Smart Sharing introduces a portable workspaces that can track all changed, new and unchanged files and facilitate offline access to CAD data to help improve collaboration with external parties. Finally, Smart Interoperability with Windchill and Pro/Intralink enables automated reporting of bulk items, item check out on the fly only when changes are made, and the addition of a status column in the model tree to report the database status of an item provide a streamlined process for accessing information.

Look out for a full review next month.

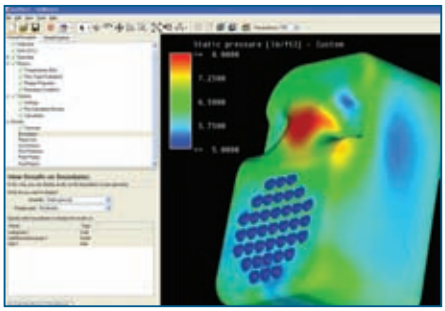
www.ptc.com

Ansys to acquire CFD specialist for $565m

SIMULATION software giant, Ansys, has announced plans to acquire Fluent, a CAE vendor that specialises in computational fluid dynamics (CFD) for approximately $565 million. The deal, the biggest of its kind in the CAE sector, will enable Ansys to broaden its already extensive analysis and simulation portfolio by adding technology from one of the most respected players in the CFD market.

Fluent's products utilise CFD principles and techniques to enable engineers and designers to simulate fluid flow, heat and mass transfer, and related phenomena involving turbulent, reacting, and multiphase flow. Today, CFD simulation technology is used in almost every industry sector and manufactured product, with an annual growth rate of 18% through 2009 according to marketing research firm Daratech.

"The combination of Fluent's extensive portfolio of analysis, engineering design, preprocessing and



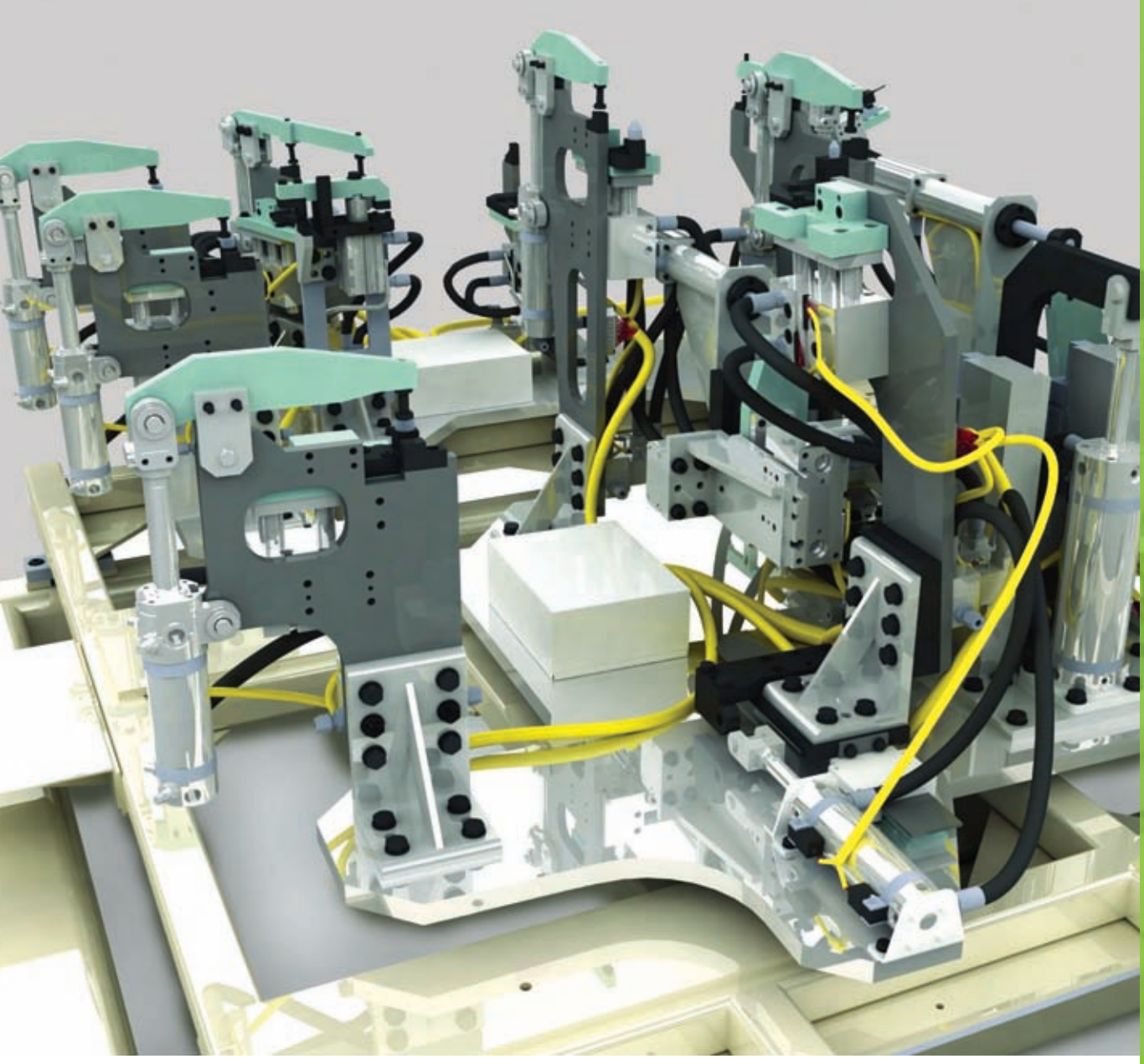
simulation solutions with Ansys' existing simulation capabilities creates a "best of breed" company that will continue to lead the evolution and innovation of engineering simulation," said Dr. Ferit Boysan, President and COO of Fluent.

www.ansys.com / www.fluent.com

Dassault Systemes to buy MatrixOne for $408m

DASSAULT SYSTEMES' proposed acquisition of MatrixOne for approximately $408 million has caused quite a stir within the PLM industry. The deal, which according to CEO Bernard Charles, will enable Dassault Systemes to target a broader range of industries with its PLM offerings, was openly criticised by PLM rival UGS in a statement this month. In an unprecedented move UGS said that the 'premium that Dassault is willing to pay for MatrixOne is well beyond the point of MatrixOne's value', and detailed that 'MatrixOne has been an unprofitable business for 16 consecutive quarters and will be immediately dilutive to current quarter Dassault earnings.' While the exact motives behind this statement are unclear, UGS, who passed over the opportunity to buy MatrixOne, is sure to be feeling additional pressure from Dassault who with the MatrixOne acquisition will clearly boost its standing in the PLM space.

www.3ds.com / www.matrixone.com



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Seymourpowell looks to Pro/E for Hydrogen Fuel Cell Motorbike design

THE AWARD-WINNING product design and strategy agency Seymourpowell used Pro/Engineer exclusively to design the world's first hydrogen powered motorcycle - ENV (Emissions Neutral Vehicle). The design project was commissioned by Intelligent Energy, a fuel cell development company that focuses on the development of new energy technologies. Seymourpowell used Pro/Engineer in conjunction with the Interactive Surface Design Extension (ISDX), PTC's surfacing and styling module, and Pro/Intralink, PTC's Pro/Engineer workgroup data manager, for the entire design process of ENV.

"Pro/Engineer and ISDX allowed us to design and engineer the motorcycle in a fluid and intuitive way," said Nick Talbot, Seymourpowell director. "We were able to style and engineer parts like the chassis and the swinging arm back suspension within one system. These are functional engineering components, but at the same time they have to look good - PTC solutions allowed us to meet both key objectives."

Collaboration on the project was achieved with Pro/Intralink 8.0 "We use the latest version of Pro/Intralink which manages all the master models for us and allows many users work concurrently," said Talbot. "It was also critical for us to share native Pro/Engineer model files with a significant number of our manufacturers and suppliers. We worked with one supplier who found it much easier to do pre-analysis on some of the cast components because it came in the native Pro/Engineer format."

ENV has been engineered and purpose-built from the ground up, to demonstrate the everyday applicability of fuel cell technology. The Intelligent Energy fuel cell is completely detachable from the bike, is radically compact and efficient, and is capable of powering anything from a motorboat to the electricity for small home. The ENV motorcycle is lightweight, streamlined and aerodynamic. It it claimed to be able to outperform any existing electrical bike and in an urban or off-road environment, it can reach speeds of 50 mph. It is also virtually silent and its emissions are almost completely clean. On a full tank, the ENV can be used continuously for up to four hours without re-fuelling.

www.ptc.com / www.envbike.com

AutoCAD 2007 to be given new 3D front end

AUTOCAD 2007 is coming your way, and will be officially announced by the time you read this. In the meantime information about the new product has come to light on various websites and blogs around the world. From what MCAD had seen and heard AutoCAD 2007 will all be about 3D, conceptual design and presentation.

The new release introduces a design dashboard, which includes a range of new solid and surface modelling tools which feature grip based editing. New section and flatten tools can be used to extract drawing information from conceptual models and animation and rendering will also play a key role in the new release.

Elsewhere, model navigation has been enhanced, as have the dynamic blocks and much improved tables functions that were introduced with AutoCAD 2006. Many users will also be pleased to learn that Autodesk has finally introduced the ability to publish to Adobe's PDF file format.

www.autodesk.co.uk

Moldflow extends reach of plastics simulation

MOLDFLOW has release a new version of its plastics design analysis software, Moldflow Plastics Insight 6.0. MPI 6.0 delivers new technologies and key enhancements that are designed to enable users to work more efficiently, significantly reduce solution time, interact better with CAD, structural analysis and other Moldflow applications, and better understand and communicate analysis results.

At the same time, Moldflow has concentrated on making its data available to distributed product teams with the release of a new product called Moldflow Communicator 1.0. This free product enables users to visualise, quantify and compare Moldflow analysis results.

www.moldflow.com

VX adds realism to real time modelling environment

VX has added a face attributes library to its modelling environment, which is designed to give users a real-time, photo-realistic view of products while they're being modelled. Attributes such as metals, paint finishes and plastics can be instantly applied to a model.

www.vx.com

ACERI unveils Electrical Designer 2006

ACERI has announced the launch of Electrical Designer 2006, an AutoCAD compatible electrical CAD solution that is designed to make electrical project design faster and easier and produce all associated supporting documentation automatically.

www.aceri.com

DP Technology announces new CAM product

DP TECHNOLOGY has released Esprit Mold, a new product which automatically manages the in-process stock model, allowing the user to combine milling strategies from 2.5axis to 5-axis for optimised tool paths. Esprit Mold is a member of the Esprit family of CAM software which also includes Esprit SolidMill, Esprit SolidTurn, Esprit SolidMillTurn and Esprit SolidWire.

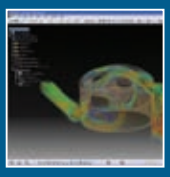
www.somatech.co.uk

Cyco to connect SolidWorks to Enterprise

ENGINEERING Data Management (EDM) specialist, Cyco, has released AutoManager Meridian Enterprise Connector for SolidWorks PDMWorks. Cyco's Enterprise Connector integrates with corporate IT systems to connect engineering groups using PDMWorks to the entire organisation.

www.cyco.com

Fluent delivers CFD inside Catia V5 environment



COMPUTATIONAL Fluid Dynamics (CFD) specialist, Fluent, has announced the release of Fluent for Catia V5. With this new product, Fluent is placing its flow modelling technology inside Dassault Systèmes' Catia V5 PLM environment.

www.fluent.com

CAD 2 releases certified mobile workstation

CAD2 has announced the release of its eagerly awaited certified mobile laptop workstation. Packed with features and powered by the latest Intel Pentium M Processors (up to 2.26GHz) the high performance mobile CAD/CAM workstation features Nvidia's Quadro FX Go 1400 256MB Graphics Card, up to 2GB DDR-2 memory and a 17" Widescreen LCD Display.

www.cad2.com

ATI breaks the 1GB barrier with new graphics card

ATI has upped the ante in professional graphics by introducing a card which features 1GB of memory. The 1GB FireGL V7350 is joined by the 512MB FireGL V7300 to spearhead the company's second wave of PCI Express professional graphics cards. Turn to page 49 for a full review.

www.ati.com

HP unveils multifunctional device at HOK architects

HP recently launched its new large format HP DesignjJet 4500mfp with stacker at the London headquarters of international architects, HOK. The multifunctional machine features the HP Designjet 4500 printer, two integrated media rolls, and ink supplies of up to 400ml for CMY and 775ml for Black. It also includes an embedded RIP, sports the HP Designjet 4500 Scanner, and a 15" LCD touch-screen display.

www.hp.com/designjet

The future is bright for engineering software says new Cambashi report

CAMBASHI, the engineering IT industry analysis and market research consultancy, has published the results of its annual survey of the worldwide engineering software market. It shows investments in new engineering applications software by engineering and manufacturing firms worldwide increasing by some 7% in 2006 compared with 2005.

The report, which covers the North America, Europe/Middle East/Africa (EMEA) and Asia/Pacific regions, describes the survey's findings on past and future investments in the two main categories of engineering software that it tracks, i.e. MCAD/PLM software and Architecture/Engineering/Construction (AEC) software. According to Cambashi's findings, investment in engineering applications software across all sectors has been on an upward trend since 2002. This trend looks as if it will continue throughout 2006.

In 2002, total worldwide investments in engineering software, as measured by vendor revenues and expressed in $US, was $5 billion. With an approximate 14% increase in investments in each of the following two years, this investment figure grew to an estimated $6.8 billion in 2005. Cambashi's forecast for 2006 shows a further increase, albeit at a lower overall rate of 7%, to $7.4 billion.

The report also shows that while increases in investments were fairly uniform across the three regions in 2004, clear differences had begun to emerge by 2005. These differences look set to continue in 2006, with an 11% increase forecast for the Asia/Pacific region, compared with a 7% increase in EMEA and 6% in North America. At the same time, while the Asia/Pacific region currently accounts for just 21% of the worldwide engineering applications software market, this proportion has increased by 2% over the past five years and looks set to continue increasing in the near to mid-term future.

A full copy of the Cambashi World-Wide Engineering Applications Market Summary is available, free of charge on Cambashi's Web site

www.cambashi.co.uk.

Acrobat 3D to star at Product Development '06

ADOBE has been confirmed as a headline sponsor of Product Development 2006, which takes place this year at the NEC Pavilion on May 17 and 18. The recently launched Acrobat 3D is set to feature prominently as Adobe runs rolling demos and hourly training sessions of its dramatically expanded flagship review and collaboration platform. Separate sessions on IP protection and real-time manufacturing collaboration will complete the Adobe picture.

Elsewhere, PTC has confirmed its attendance, reinforcing the show's mainstream PLM focus, while the signing of rendering and animation software specialist Maxon underlines a commitment to end-to-end creative product development. PTC will be attending in conjunction with Root Solutions and will be showing its full range of solutions including the newly launched Wildfire 3.0 and PLM on Demand.

"When we decided the time had come to move on from the Solid Modelling and Prototype shows and launch a more general product development event it was vital that we attracted the right kind of visitors and exhibitors," said show director Andrew Porter. "While the likes of PTC and Autodesk will please our traditional visitor base, it's great that companies like Maxon and Adobe have come on board to demonstrate the creative breadth of what promises to be a fantastic event."

www.pd06.com

UGS terminates OEM agreement with MSC.Software

UGS has terminated its agreement with MSC.Software due to MSC's consistent failure to deliver upgrades to customers on a timely basis, the company announced this month. The OEM agreement allowed MSC.Software to bundle Femap with MSC.Nastran and as a result of the decision MSC can no longer provide Femap inside MSC.Nastran for Windows nor offer upgrades.

In line with this announcement UGS has introduced a free software upgrade for all current MSC.Nastran for Windows (a product based on UGS' Femap product and previously sold by MSC) users to UGS' own Femap with NX Nastran analysis solution. Users will receive Femap 9.1 and NX Nastran 4.0 immediately, and all future. Femap 9.1 contains significant enhancements in automation and solution accuracy. NX Nastran 4.0 offers what the company describes as new and unique analysis capabilities such as linear contact and a fast iterative solver.

The offer includes immediate support but is subject to the purchase of a 12-month maintenance agreement, which would commence after the expiration or termination of any current maintenance agreements.

www.femap.co.uk / www.ugs.com

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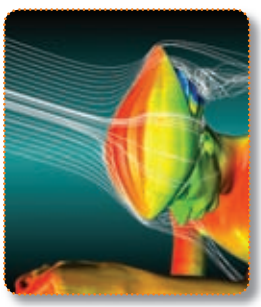
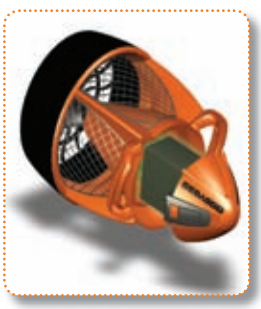
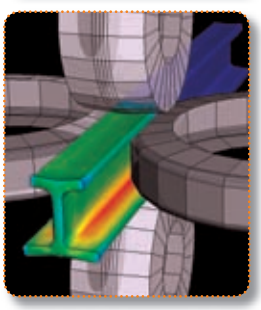
product development 2006

Product development from concept to production







Product Development 2006 will replace and expand on the Solid Modelling and Prototype events that have run for the past 8 years with a fresh and dynamic showcase for the complete spectrum of design and production technologies: from 3D conceptual modelling to prototyping for first-batch manufacture and all points in between.

Product Development 2006 is proud to take place alongside Mach, Subcon and several other vertical market events for industrial engineers. EDA Exhibitions will work with the other organisers to create a seamless experience for attendees to maximise the productivity of their visit. Joint marketing efforts will give exhibitors the greatest amount of visibility and contact within the various target groups.

NEW FORMATS FOR VENDORS

Exhibition Stands –
To exhibit at Product Development is easier and more economical than ever before, helping vendors to control budget and resources. Stands are offered as pre-packaged booths to save time on planning, and include walls, carpet and furniture at cost price to save on budget. With **an entry-level investment of £1495** the show is cheaper than many table-top events but with many times the return for exhibitors.

Design Workshops & Live Technology Zones –
Drop-in sessions for show attendees to get comparative demos of application-specific features in market leading tools and solutions. Vendors have the possibility to book several presentations per day on different topics. Breakout areas for face-to-face discussions and advisory round-tables will offer a greater depth of information to attendees and more valuable customer contact for the presenters.

To speak to us about taking part in **PD '06** as an exhibitor or speaker please contact: **Daljeet** or **Andrew** on **+44 (0) 20 7681 1000** or email **pd@edaltd.co.uk.**

Exhibitors:

3Dconnexion, Adobe Systems, AME Prototype Solutions, Art Systems, ATI Technologies, Autodesk, Cadpo, Cadtek Systems, CD-adapco, Epsilon Structural Analysis, Gemini Prototyping, H2, Konica Minolta Photo Imaging, Laser Lines, Maxon Computer, Moldflow, MSC Software, Objet Geometries, PNY Technologies, Product Design Lab (UEL), Protomold (The) Company, PTC, Rapra Technology, Solid Applications, SolidWorks*, Strand 7, TranscenData, UGS*, Unimatic Engineers, Z Corporation

* - company represented

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solutions showcase for

Visualisation • Data Management • IT Hardware

www.pd06.com

New learning experiences

Alongside the core exhibition, **Product Development 2006** will feature a range of visitor resources to assist in gaining an understanding of the technologies and processes involved and the benefits that can be derived from their adoption.

Drop-in sessions for visitors to get comparative demos of application-specific features in market leading tools and solutions. Breakout areas for face-to-face discussions and advisory round-tables will offer a greater depth of information to attendees and more valuable customer contact for the presenters.

Visitors will also be able to take advantage of open technology demonstrations and user contact areas will focus on enabling technologies for designers and engineers. Likely areas of interest are expected to be compute-intensive design and novel applications for emerging uses of design technologies. Innovations and success stories illustrated in a live format will create a strong visual impact and a higher degree of interactivity for show attendees.

To find out more information about how your company can participate at Product Development 2006, please go online.

www.pd06.com

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Exhibition Workshop Topics

Product development:

- Rapid conceptualisation
- Surfacing techniques for solid modelling users
- Advanced surface modelling master class
- Visualisation & virtual product presentation
- Innovation management
- Selecting hardware for product development
- Handling large assemblies
- Knowledge-based design
- Analysis for the engineer
- Stress analysis of design
- Integrating fluid flow simulation into design
- Integrated Electrical design & analysis
- Integrated Electronic design & analysis
- Integrated Electro-mechanical design

Prototyping:

- Increasing prototype functionality
- Improving prototyping quality
- Optimising prototyping processes
- Prototyping technologies for tooling
- Prototyping technologies for end use components

Process and manufacturing:

- Plastics design for manufacture
- Sheet metal design
- Piping and plant design
- Mould and die design
- Machining simulation & verification
- Injection moulding analysis and simulation
- Manufacturing process analysis
- Process simulation
- The Digital factory

If your company would like to be involved in the speaking opportunities at **Product Development 2006,** please contact **Andrew Porter, Event Director, EDA Exhibitions Ltd**
Tel: 020 7681 1000.
Email: andrew@edaltd.co.uk

UGS NX 4

Following on from February's look at the new 3D design tools, this month we shift our attention to the two other core areas of NX4 – simulation/analysis and the managed development environment.

Written by Al Dean

TEAMCENTER is the jewel in the crown of UGS' product arsenal and in the world of PLM it's one of the few systems out there that supports full production environments. As a result, it's typical to find NX being used alongside Teamcenter. After all, if you've got to the point where a system like NX comes into consideration, then data management is pretty much a must (and I'm not simply talking about cost related issues).

This release sees a lot of work done to improve the support provided by Teamcenter for the more advanced NX assembly related functions that handle product variants and configurations. Here, we're talking about direct management and control (in terms of version and revision control) of assemblies that feature arrangements, variable component positioning and deformable components. There's also been work done to improve Teamcenter's handling of both partial assemblies and those which mix and match CAD formats, where critical components can only be represented by third party or even JT data. Alongside this, there have also been some developments to help ease the implementation and deployment process, which is always troublesome in anything than the most basic, small scale roll-out.

In addition to the core data management updates, there's also been concentration on the collaboration tools within the NX product set. Firstly, XpresReview has been fully integrated into the system, allowing you to pack-up models with PMI, drawings, and any other files (Word, Excel, graphics) into a single PCF file that is viewable by anyone with the freely distributable XpresViewer application. On top of this, the new NX Viewer allows you to not only view native NX files, but any other file type which can currently be opened by NX. It provides file and object properties and measurements, assembly loading and filtering and follows the NX look and feel guidelines.

Simulation and analysis

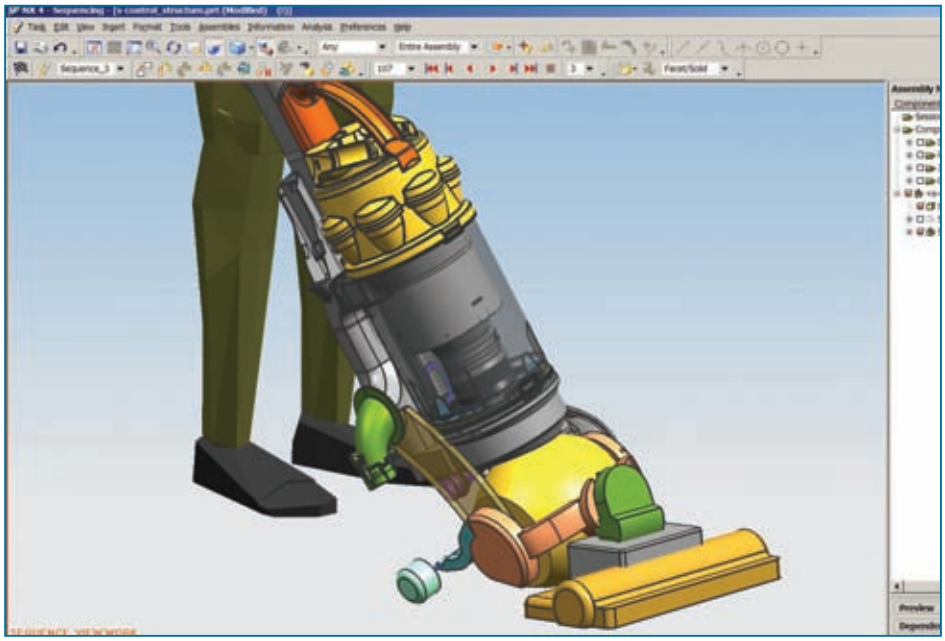
When the UGS/SDRC merger was announced it was clear that analysis was going to be a particularly strong result of what emerged from the development labs and the moves since show that UGS is a company with simulation close to its heart. With this release, there are two key methods of simulation being introduced and established. Firstly, there has been a lot of work done to introduce advanced multi-physics on top of the core NX Nastran solution set. In specifics, this includes the ability to conduct flow and thermal studies, as well as use the linear and non-linear tools in NX Nastran. Interestingly, this isn't restricted to the NX Nastran users and you can also use these tools within NX 4 in conjunction with your preferred solver technology (such as Abaqus or Ansys).

Alongside this there has been a shift in the way that the whole NX platform handles analysis and simulation – with the introduction of the CAE topology layer. Without getting too bogged down in detail, this is an intermediary step between your native or third party CAD geometry and the geometry used as the basis for analysis. What the topology layer does is to create an overlay on top of the explicit surface CAD geometry – and it's this that the analysis and simulation process uses as the basis for all subsequent work.

The really clever bit is that built into the process is a series of smart abstraction tools that use rules to carry out the abstraction process. This rather wonderful phrase describes the process of preparing 3D data for the analysis process. This includes the new tools to remove features considered to be problematic to the analysis workflow, such as sliver surfaces and small features. NX 4 also sees the team introduce tools which allow you to detect and control how fillets are handled. The user has full control over the process, whether that's to remove such geometry or how to mesh those features should they be required. This process is equally beneficial for the generation of shell element meshes, where a solid isn't required or appropriate.

The benefits this gives is that instead of the analyst opening up the CAD geometry and having to go through a manual abstraction process (the removal of features and entities that would cause

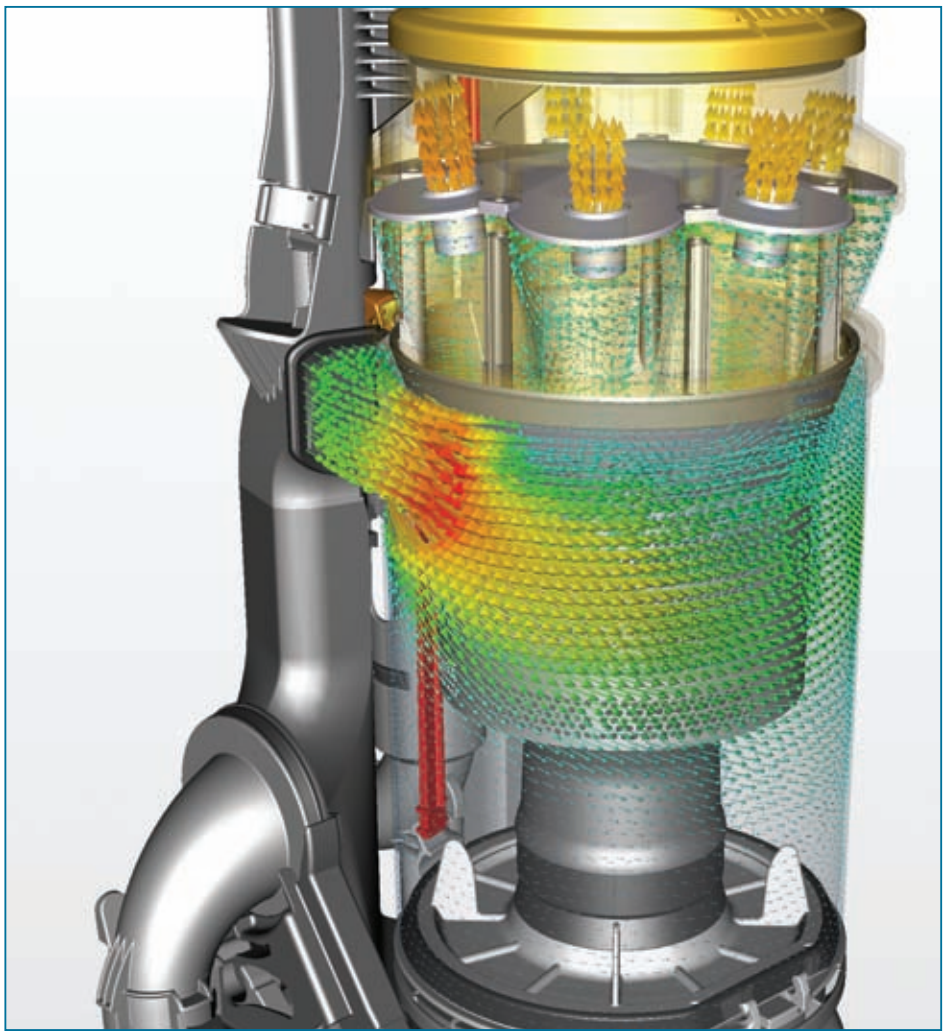
The benefits of simulation and analysis have a direct impact on perhaps the most important thing in the whole development process – the product



meshing problems downstream) the system is able to handle the abstraction process automatically. If required, the system also provides manual tools should you need to dive in and work with serious problems, or provide more control over the mesh distribution. What this means is that the analyst doesn't spend all of their time adapting an overly detailed CAD model for their own purposes – they're just working on abstracted data ready for the analysis and simulation process.

The real benefits are three fold. Firstly, because a large bottleneck is removed, the analyst can carry out more design validation and iterations – making your products better suited to their purpose. Secondly, the CAE Topology layer and the abstractions enable the mesh generators to create a significantly higher quality mesh in a much shorter time. And thirdly, should the underlying data change, the system runs the rules-based abstraction again and the analyst can quickly handle those design changes and continue their work.

Following the simulation workflow, another key



area is the ability to accurately and efficiently recreate the operating conditions for your products – so you can achieve the best results you can. In NX 4 users now have the ability to model contact and nonlinear solutions. The system can handle linear static surface-surface as well as large displacement and surface-surface contact via NX Nastran, transient loads and limited follower force capabilities. It also includes a range of predefined loads and boundary conditions that support the new areas of functionality, such as fluid flow.

Alongside the core technology updates, UGS has concentrated on bringing the benefits of simulation to a much wider audience on two fronts – the first of which is the new Design Engineer CAE product. This new product is aimed at making analysis easier to use for the general NX user, rather than someone with a background and working knowledge of FEA. It uses a neutral, engineering-based language when defining studies, rather than the often cryptic terminology used in traditional FEA. It's based on pure geometry and allows you to conduct linear static and steady state thermal simulations directly. As you might expect, it's built on the NX Nastran solver code, but much of the work is hidden from the user (such as abstraction, mesh definition and control etc) – and that Nastran-based backbone means that work can be passed over to the specialised staff without translation or conversion problems.

The NX 3 release saw the introduction of the Simulation Process Studio, but this has been enhanced for this new version, with the introduction of the strength wizard which steps the user through the stress analysis process and assists in ensuring best practices are adhered to. This kind of work can also be taken further with the Simulation Process Studio, which allows you to create your own formalised analysis and simulation processes in Wizard form, which can then be deployed to other designers.

Conclusion

So, there we have it, the last major updates to this release of NX 4 and both management of the product development process and simulation can provide tangible benefits. The improvements to your business as a result of adopting data management has as much to do with reducing waste, whether that's time, cash, stock, or reduction of duplication, as it has to improving communication between the often disparate entities that are involved in new production introduction and manufacturing.

The benefits of simulation and analysis, particularly when used upfront, have a direct impact on perhaps the most important thing in the whole development process – the product. This can manifest itself in many ways. It's often seen as a way of improving the suitability of a product for its intended purpose – if you can simulate a product in near real-world conditions, then you've got a good idea that it's going to succeed or at least, meet customers requirements. This can range from reduced cost of manufacturing (through a reduction in over-engineering) but perhaps more importantly improved quality of your products, whether that's to raise perceived cost (and improve your bottom line), suitability for purpose or simply to differentiate your products from their competition.

It's these two factors of making your business more efficient and improving your products that are exactly the reason to adopt a system like NX and the process management technology within TeamCenter. That's the real driving force for technology adoption within the design and manufacturing market – to make better products, cheaper and of higher quality. As I said last month, UGS' game plan seems to be working out very nicely and when you step back and look at NX 4, it's clear that the system can assist any business that chooses to adopt it. ■

Product	NX4
Supplier	UGS ***www.ugs.com***
Price	On application

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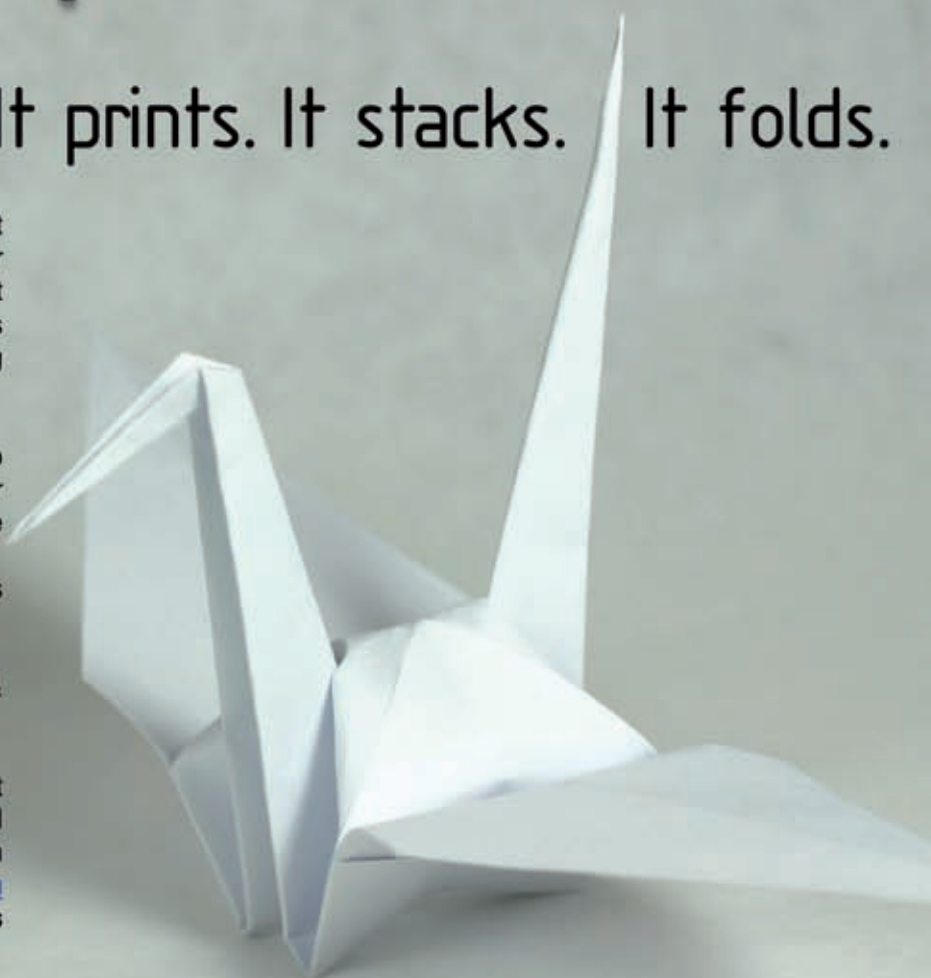

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Transformation engineering

Chuck Hoberman is an unusual mix of inventor, artist and mechanical engineer. He has become internationally renowned for his innovative folding structures, art installations, medical tools and toys. Written by Martyn Day

EARLIER THIS YEAR, I attended the SmartGeometry Forum in London. This group of predominantly architectural designers and computer technologists have formed a research group that is exploring new ways to design and interact with CAD models based on parametric design principles. So what has this got to do with Mechanical CAD, I hear you ask? The answer is that the technology being explored here is applicable to all form-based design and one speaker in particular had a very interesting multi-disciplinary approach to introducing mechanisms to structural design.

Chuck Hoberman is a New York-based inventor, artist and mechanical engineer. He designs products, toys, art installations and structures that all offer, what he terms 'transformability'. Hoberman's designs change shape, size and form, such as a geodesic sphere structure that folds into a 16 inch space, or something the size of a hatbox that deploys as a 5ft tall, two person tent. It's not just about space saving design, it's the ability for a design to move and change states, perhaps adapting to climactic conditions or morph through a number of positions as an art installation. The images here give a taste for the kinds of things Hoberman creates but as they all move in some way, a visit to the company website and a look at some of the videos is well worth the time (**www.hoberman.com**).

On examination, the designs all use an exquisite understanding of geometry, together with standard and unique mechanical components and manufacturing techniques. Hoberman holds both Art and Science degrees and even worked at a Robotics company prior to setting up his design studio to apply his fascination with moving mechanisms within many fields. Hoberman Associates has worked on projects covering military applications, home and office products to stadium and museum installations – in fact wherever Hoberman sees his theories and many patents on transformable designs can be applied. Talking at the SmartGeometry forum, it's obvious that he sees many applications of his principles to modern architectural design, providing retractable coverings and adaptable façades – perhaps building on the concept of the building as a machine for living in, adapting and changing to the environment or usage. It's also typical of today's 'signature' architects, like Sir Norman Foster and Lord Richard Rogers, pushing structures of steel and glass to their limits, only made viable from using tools such as Catia to drive the manufacturing process and make technically complex, custom buildings financially possible.

I caught up with Chuck Hoberman on the phone in his New York workshop to find out more about he designs and manufactures his transformable structures.

Martyn Day: You have qualifications spanning art and science, together with applied experience of both. What interests you about design?

Chuck Hoberman: The starting point of my whole career was looking at this transformability from the most general perspective. What I was interested in from the onset was working at a systems level, that is to say, working with the fundamental geometry and really trying to elucidate mechanical and structural principles, where all these areas come together. It's really an outcome of my education which is in the arts and sciences. It's an inherently multi-disciplinary role.

I didn't start out as, let's say, an expert in tent design, looking to improve the design of tents. It was more from a general design perspective and I've been going from general to specific application through the course of my career. I think one would come up with a different solution to the problem if I were to approach the design from a specialist point of view.

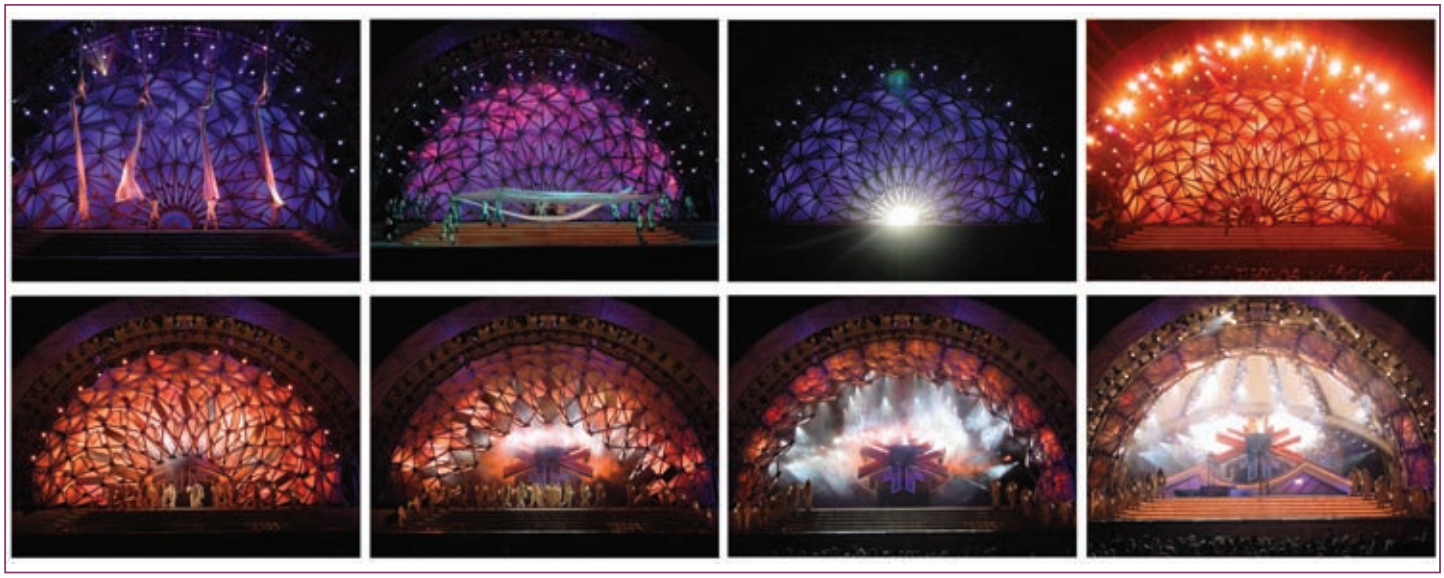
MD: I guess you have come up with a range of ways to transform structures through the years. Is this knowledge always the starting point for your designs?

CH: It's a combination of these principles that form part of the 18 or so patents pending that I have. It's a library of geometric techniques. Certainly when a client comes to us for a design, I dig into those techniques. On the other hand it's also about a highly rationalised, engineering-based approach but at the same time open to new creative directions and inspiration. In many cases while my team and I are always drawing on the core principles that we share, often when a client comes to us with a problem, we only have part of the solution at hand, so we have to develop something new. It's a combination of the two.

MD: Typically, what kind of customer comes to you for a 'Transformable' solution?

CH: The critical factor is that there is a need and enthusiasm and a requirement that our technology can address. In the case of the rapidly deployable military tent, the requirements were very stringent but we felt from the onset of that project we could meet those requirements and the result is now a product on the market has raised the bar.

Chuck Hoberman and his transformable geodesic dome showing stages of transformation from 16 inches to 6 foot wide.



The transformable stage used throughout the 2002 Olympics held at Salt Lake city. Constructed of sand-blasted structural aluminium, fibre-reinforced polycarbonate sheets and more than 13,000 stainless steel connecting pins, the arch retracted in a transforming motion, like the iris of an eye. It stands 36 feet high and 72 feet wide, with 96 structural panels, each 9 feet by 5 feet, and more than 4,000 individually machined pieces. The arch was operated by two 30-horsepower motors controlling eight separate cables.

MD: Your solutions are unique. How do you work with clients and manufacturers?

CH: It's a process that parallels other types of design. We set up a team with a client, a small group to really understand the aspects of the brief in-depth. We then go back and work with my team, develop two or three preliminary approaches to the problem and then the challenge for us is to find the intersection between the brief, the programmatic requirements, the pools of solutions and technology that we already have to bring. We will usually develop lots of tools to convey our ideas, which could be some rapid prototypes, CAD designs/models, renderings, or flythroughs.

We are small company and we are very hands on. Our approach is very grounded; we get a lot of mileage out of standard software, and standard techniques. Once we have what all sides consider is a suitable direction then we will always play a significant role in subsequent design and engineering of the product. Primarily we will handle the engineering from a design and mechanical standpoint and from a structural view we will work with one of the many structural engineering firms out there, like Buro Happold, Ove Arup or local firms in and around New York.

We have a number of fabrication houses that we work with, some are large, some are small. Very often they are firms working for the Aerospace industry or maybe theatrical, working on theme parks.

MD: You mention working with Aerospace manufacturers, is that due to tolerancing of your designs?

CH: From a construction point we are working with very close tolerances. In the manufacturing world, many fabricators are used to working to the tolerances we need. There are process issues and there is an equilibrium to be found with the tolerance and scale of the project. Very often if you are building large structures you have to be aware of the economic costs of over-tolerancing a design.

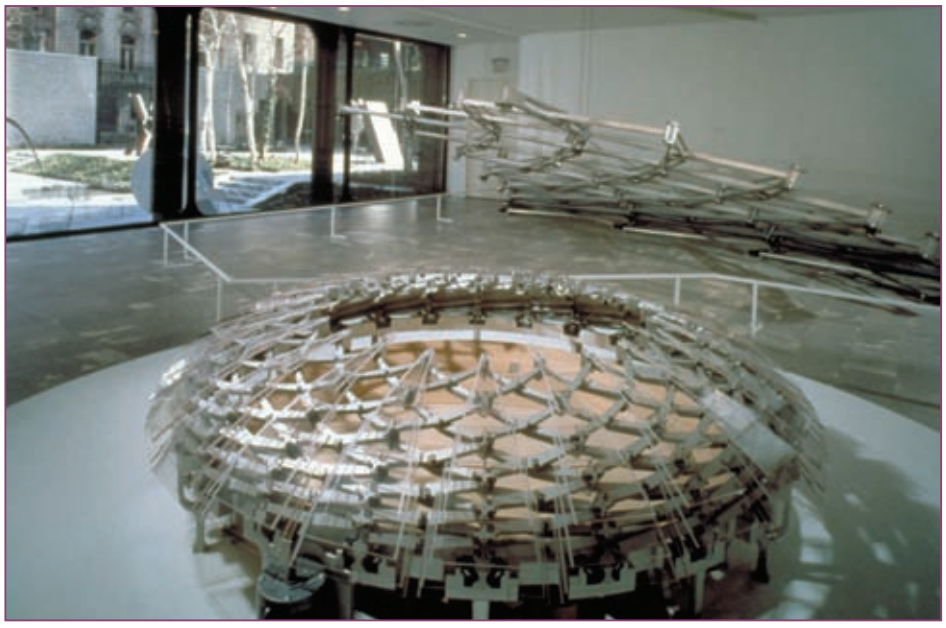
We mainly get our projects machined, with some casting. Our toys are injection moulded, of course. Sometimes we can use surprising low-tech solutions for fabrication. For the piece we did for the Utah Winter Olympics, we needed a big arch to support our mechanical curtain and that was a series of large welded trapezoidal frames that bolted together. These had slides on them, which had to be oriented carefully to keep the mechanism aligned. The actual layout was done on the factory floor, they laid out a grid, 4ft by 8ft, which is the size of sheet of plywood. They took these sheets of plywood onto the CNC machine and etched the outlines of these trapezoidal shapes and laid them out across the grid, so there was a big one to one image of this arch on the floor (around 80ft long). They used this as their template and it gave perfectly adequate tolerancing for what we were looking for and the cost was minimal. Our fabricator came up with that, it was a smart practical solution.

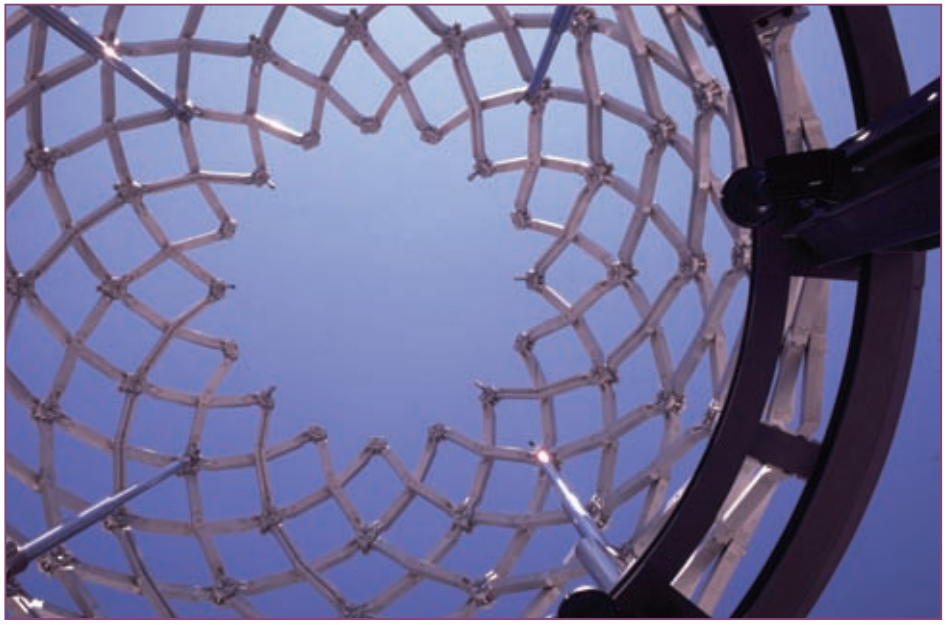
MD: Many of your designs use hinges and joints, are these bespoke or standard parts?

CH: We really don't need to develop components; most have been pre-manufactured for us. It's all out there - they aren't all that 'standard' but they are out there. I am happy that we don't need to innovate at the detail level! We are about the global integration of all these components, at a systems level, to get something that performs.

MD: You use Autodesk Inventor as your modelling tool. How do you use 3D CAD?

CH: I'm not an advanced CAD user but I have been using CAD for 20 years and when I started designing my structures I had no access to any 3D software at all, so I just wrote code to create the geometric representation, as well as render the output. This was on a Macintosh. I had to do the transforms to project the geometry onto a picture plane and come up with my own shading and





hidden line algorithms. It was ridiculous, but it was out of necessity. If I wanted to show someone a picture, I'd print this stuff out on a dot matrix printed and tile the plots out! But it was a good experience as I got to know what all these tools are about.

The use of Inventor is a legacy as we grew up with AutoCAD - it's a natural follow on. We take advantage of the parametric capabilities at a component level, which means we can adapt the design easily and most of our structures use families of parts, or parts that have similar features but are geometrically different, so that's useful.

We build assemblies with mechanical constraints so we can simulate the kinematics, the mechanical action of our structures. However, we don't include the forces or do force analysis in Inventor. Instead we do a fair amount of paper, pencil and spreadsheet calculations!

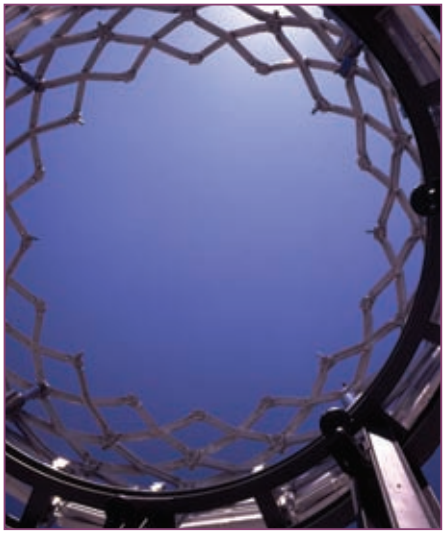
As the project is being finalised, that's when we go outside to a structural house and generally speaking, even then, they are not doing a full-motion dynamic calculation, they will do a static analysis. If, for instance, we have a cable driven structure, they will pin the structure into one position, by 'fixing' the cables, then run the analysis, get the forces and repeat that in a series of positions. It's actually going into a fairly standard analysis package from their point of view.

Internally, we have a prototyping shop where we will use laser cutting, STL, machine parts, any technique that's useful for a given project. To be honest on the software side of what we do, we tend to stay with fairly standard packages.

MD: Do you send 3D CAD data to the fabricators or 2D drawings?

CH: It still depends on the fabricator but things have certainly improved over the last five or six years. We can hand them the 3D file and most have the software to generate all the tool paths. I am of the mind that if we understand the manufacturing technique we can have a meaningful dialogue with manufacture and work out how to do it economically.

We don't just do the mechanisms, we also produce



The Iris roof: a prime example of Hoberman's transformable structures

the electrical wiring controls, and the flow chart for integrated programming for lighting and motion. I am a mechanical engineer, I worked for six years in industrial robotics. There is so much of what we do that is similar to that industry, we are working with the same firms that do motion controls systems, robotics systems but putting it into a different context.

MD: SmartGeometry appears to be about complex form and shape development. What is it that is applicable to transformability?

CH: The reason we are interested in SmartGeometry is to push parametric design to a much earlier part of the design process. So, instead of using our specialised techniques for form finding and creating geometry, we can automate that process and hopefully get to design solutions a lot quicker and in an easier way.

I've been aware of smart geometry for about a year, from some of the engineering firms here in New York. There could be enormous value for us, as we work with highly defined rule-base systems for developing designs. Since we know our rules really well, they may not be that simple and have many steps but it could be possible to develop algorithms for these. If what you can do is find a free form for a building shape by easily adjusting that form, and have the computer take care of the geometry and connections, then our approach is a poster child for that. We have been doing that in a more low-tech way because that's where the current technology is at.

SmartGeometry is a different mindset for design. If you are starting with an algorithmic approach to design, where the first thing you set up are the rules, then you are in a different place than a paper and pencil sketch. I think it's a matter of time, until people become accustomed to the techniques. The other area where this whole highly-parametric approach interfaces with the transformability of designs, is the time component. When we design a structure, it has an infinite number of states, which in a sense in just one more parameter, but you can bring that transformable shape parameter into direct relations with any other design parameter that you may be looking at. It's a powerful idea for us. For instance, if you see people working in these parametric programs, they generate a field of variable design possibilities. Within each of these possibilities there's this time component, where any one of those designs can be set into motion, going through all its changes in configuration. What this does, is takes what is inherently complex and breaks it into a very rich experiential design process giving many different possibilities and automatically optimising for all the different constraints in the project. Everyone here in the office is intellectually engaged with the concept.

MD: So do you think this highly-parametric and algorithmic approach will impact your designs?

CH: When I present to designers, they say 'Your stuff looks pretty symmetrical. What can you do that's asymmetric, that has more complexity or more interesting forms?" I think certainly, there would be a benefit from deploying these kinds of extremely parametric systems. Our transformable design techniques are adaptable to asymmetric systems but the time to design is higher and there's a cost penalty for going in that direction. However as designers our job is to respond to the vision of the architect. Transformable design is not about a particular look or feel or design, it's a flexible design approach that will fit with many types of designs. If the architect is looking for blobby, we can do blobby, if the architect is looking for something curved, our techniques are adaptable and that's what interests me.

MD: So what do you hope for transformable design in the future?

CH: With regard to Hoberman as an entity, we are technologists and technology holders. The future is to move it more towards a design tool, approach and philosophy that is accessible for advanced designers and forward looking designers. I'd like it to have a much broader base. ■

www.hoberman.com

Ashlar Vellum Cobalt 7.0

Ashlar Vellum is one of the few developers to create a professional grade system that's available on both the Windows and Macintosh platforms. Al Dean looks at Cobalt 7.0.

Written by Al Dean

IN THE WORLD of CAD systems, there are those that grab the headlines and count their user community in the hundreds of thousands and then there are those systems that seem to slip off the radar, but have a loyal and active user base. One of these systems is Ashlar Vellum's range of 3D design systems, of which Cobalt is the higher-end offering. MCAD visited a longstanding user, Kevin Quigley of Quigley Designs to take a look at what the system offers to potential users out there and how you can derive benefit from its use.

Cobalt is one of the few workhorse CAD systems that can be used on both the Windows and Apple Macintosh platforms. As such, the interface is a derivative of the two while remaining pretty independent of each, and is very clean with the vast majority of it devoted to the modelling area. Operations are accessed through the ubiquitous strip of pull-down menus, or perhaps more commonly, through a series of discreet toolbars that line the left hand strip of the interface. 3D model control and view manipulation is achieved either using the trackball dialog that allows you to grab a sphere and rotate the model to your required view, or through keyboard and mouse button combinations.

Taking a look at the two sketching tools first, the system includes all the options you'd expect: lines, arcs, circles, splines (with a variety of control and definition methods – control points, Beziers etc) polygons and such. Also on the subject of splines, Cobalt includes the curvature combs and other standard methods of curvature and tangency analysis. One thing to note is that Cobalt isn't quite as prescriptive as some systems with regards geometry creation and feature build. You can pretty much sketch profiles and curve networks on an ad-hoc basis and create the features using references. This is made possible by the ultra-intelligent cursor and feedback system build into the application – which many CAD vendors have licensed.

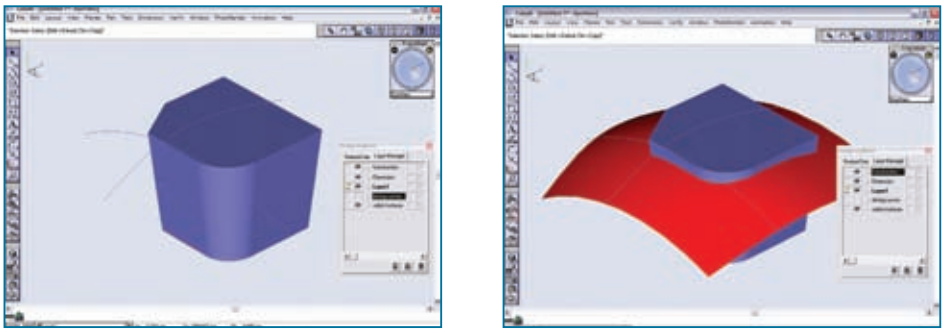
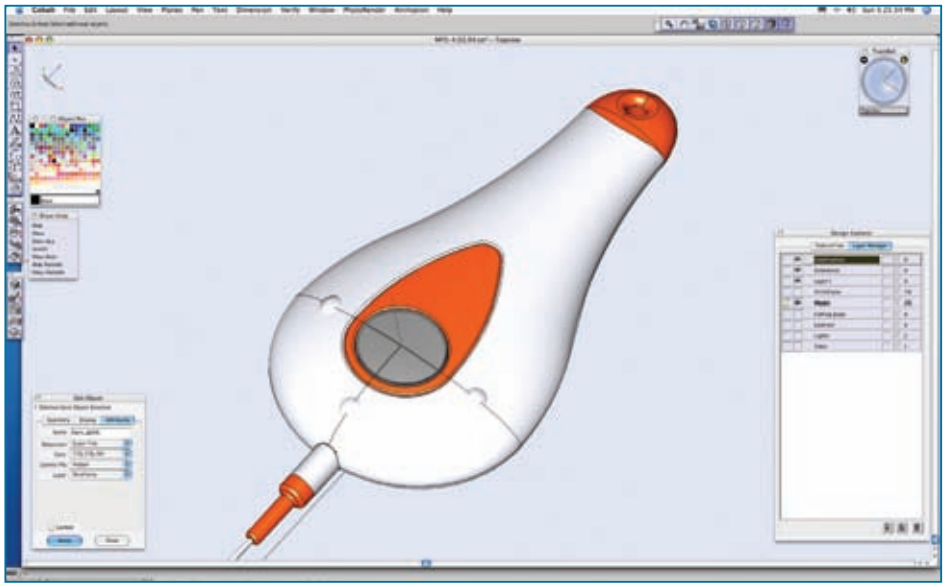


Figure 1: The system is easy to use and doesn't restrict the modelling process. Here, a profile is created in position, and an arc is added that describes the sweep rail. That arc didn't need to intersect or even be in the correct position - the system works on the intent you provide and infers a great deal automatically.

We're all pretty used to intelligent cursors that allow us to make inferences and references within our 3D systems, but it was Ashlar that created the technology in the first place. It allows you to create the geometry you need quickly, without a lot of messing around with workplaces and such. The example in Figure 1 shows how I created a surface that crosses through the drafted extrude. I just created the profile in position, and then added an arc that described the sweep rail. It didn't need to intersect or even be in the correct position - it works on the intent you provide and unlike other systems, infers a great deal automatically.

In terms of 3D geometry tools, the system has the full spectrum pretty much covered. The basic tools allow you to create primitives and simple solid entities such as extrudes, lofts, sweeps, revolves and such. Alongside the standard solid modelling tools, the system is well versed in surface-based modelling.

> *Cobalt is an impressively specified system and while the CAD industry at large is talking commoditisation and reducing margins, Cobalt actually delivers something still quite rare – excellent value for money.*

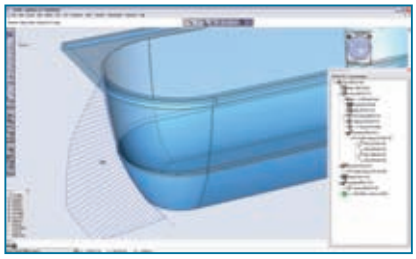


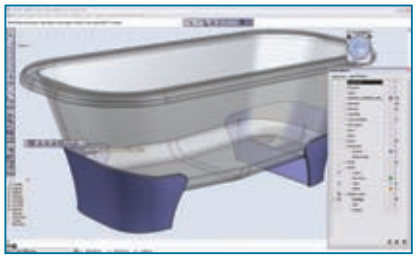
It includes all the usual suspects in terms of features (extrudes, lofts, sweeps, skinning) as well as some tools to assist patching in those awkward areas. Interestingly, Cobalt also includes things like the Tube surface, which allows you to create a simple lofted tube based on a curve or iso-line – making light work of feature lines and other typically complex features often used in industrial design. Of course, the surface creation tools are useful, but the real power of such systems is the ability to work with that surface data to achieve the exact form you want. Cobalt includes all the usual things like trimming, extending and joining, but adds more advanced operations like freeform deformation (which allows you to push and pull surfaces directly), G1 and G2 tangency matching, and surface rebuilding.

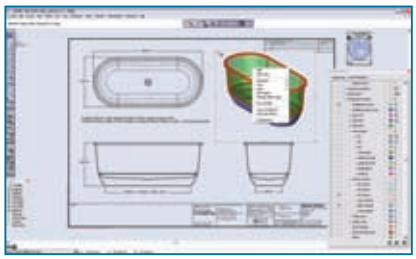
What's interesting to note is that despite the freeform nature of the way you define the profiles and such, the system retains the links between those sketches and the resultant feature – so updates are

Bath time

Victoria and Albert Baths is a Telford based manufacturer of QuarryCast freestanding bathtubs (**www.vandabaths.com**). At the recent KBB show in January the company launched four new bathtubs: the Como, a contemporary one piece freestanding tub, and the Freedom range (Antibes, Nice and Cannes) which are all based on the same form but with different rim options to suit different installation needs. The bathtubs are manufactured in South Africa and distributed worldwide.





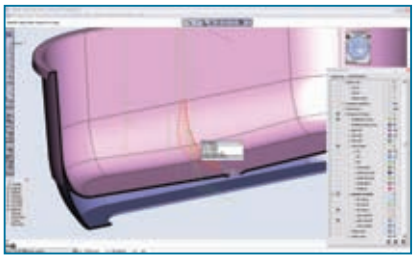


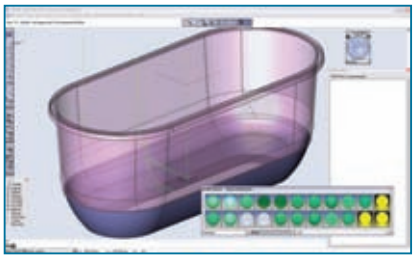
Since 2003 Quigley Design has designed all new bathtubs for V and A using Ashlar-Vellum Cobalt software for the entire process. Owing to the nature of the software it allows very rapid development of concepts which can be developed into prototypes (using scaled SLAs) or drawings for assessment by the factory. The built in rendering allows preliminary visuals to be done as part of the development process without having to move to rendering specific software. Generally, the quality from Cobalt's rendering is more than enough to allow design decisions to be made.

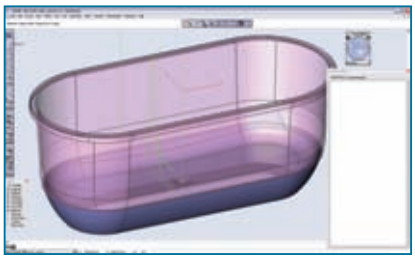
An important element of the early design phase is the weight and volume calculation for the tub to allow V and A to evaluate production costs and shipping costs. Using Cobalt's verification tools, the weight can be supplied throughout the design process, and the hybrid modelling allows the interior surfaces to be extracted and stitched into a solid to allow water volumes to be continually evaluated.

Where high end visuals are needed for marketing use, Quigley Design tends to move to more rendering specific systems such as FormZ or Cinema4D where its designers can place tubs into room scenes and use effects like Radiosity to achieve true photorealistic visuals. But during the design phase this level of visual is rarely needed. The screenshots show various views of the Freedom range tubs, showing the use of dynamic sectioning to analyse wall thickness issues, curvature on NURBS splines used to drive the solid forms, and adjustable object level transparency to show hidden features more easily during design.

Once the designs are approved, the tub models are adjusted following factory feedback, before producing detailed production drawings using Cobalt's built in drawing system. These are then issued as PDFs for reference, and surfaces and







curves are extracted as IGES and DWG files and sent to the factory for manufacture. The flexibility of the export process allows specific entities to be extracted as needed, for example, the inside surfaces only.

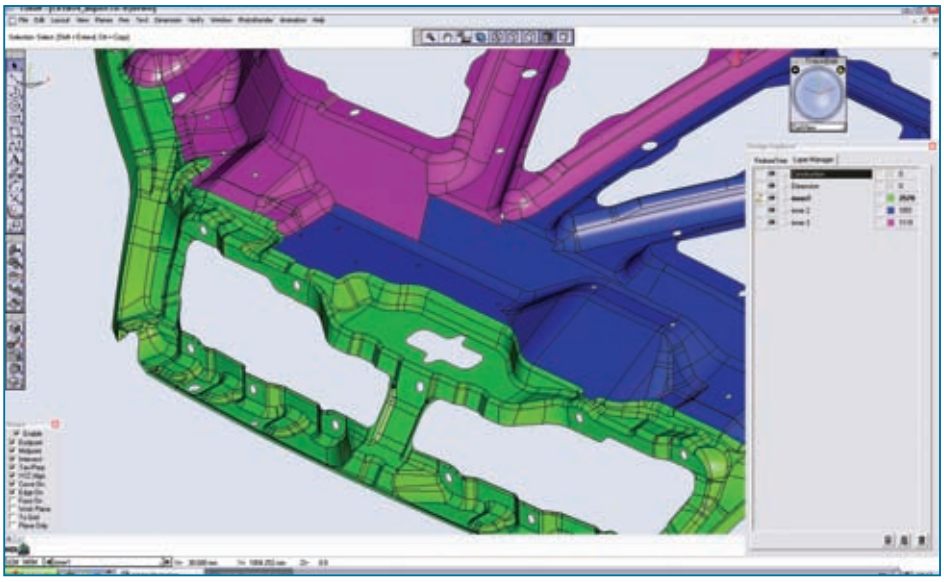
All screenshots are courtesy of courtesy Victoria and Albert Baths, ***www.vandabaths.com*** *and Kevin Quigley*

Quigley Design:
kevin.quigley@kqd.co.uk / www.kqd.co.uk

handled efficiently.

When it comes to data compatibility, the system includes a good list of import and export format options. Featuring the usual IGES, STEP, DXF, VRML, STL it also includes a number of native formats such as DWG, Catia V4, 3D studio, Rhino, and Illustrator. It also features an ACIS import/export option (as the system is ACIS based) and Parasolid is also catered for, though this is currently only available on the Windows platform.

Alongside the core modelling tools, Cobalt also includes some functions that aren't so common, even in this mature 3D market. For example, there are a number of tools that allow you to create feature lines and lips that are commonly found in injection mould parts and consumer products, but are typically rather difficult to model in most systems. There are also a number of operations that allow you to do some extensive work with both native and imported data, including face moving and matching tools, deformation and replacing of faces and the like.



Cobalt includes a good list of import and export format options including native formats such as Catia V4.

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Rendering

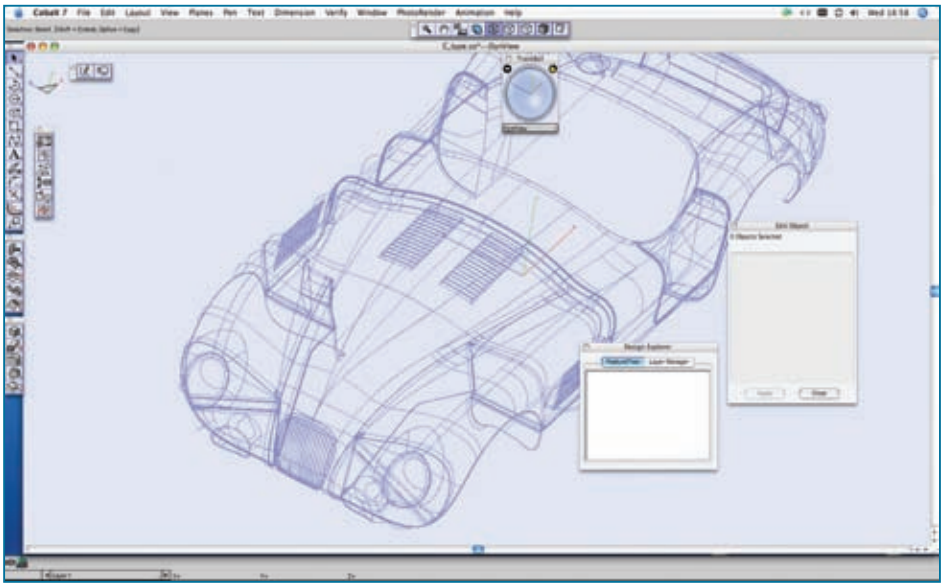
Like the other products in the range Cobalt includes its own rendering capabilities, which can be seen from the images that accompany this review. Being LightWorks-based, it comes with a base level of materials that can be dragged and dropped onto the various parts within your product model. This includes a decent range of materials for textures such as plastic, leather, plastic, glass, metal, brushed metal and automotive paint. It also includes woods and marbles - though I'm not convinced anyone actually uses them. Of course, you can define your own materials with full control over the usual parameters (colour, texture, bump maps, reflectance, specular/diffuse/ambient light handling etc).

The system also comes with a number of predefined scenes in which to place your product models, but again these can be adapted with control over lighting (including hard and soft shadowing) and scenery. Images can be rendered out to static image files or as QuickTime VR files, to allow for clients to interact to some degree with a design variant. Interestingly, Ashlar Vellum also offers a number of accessories to the product line.

Amongst these are a CD of 15 'virtual photography' studios, into which you can place your product, and two collections of materials – one which gives a greater choice of textures and another which covers decals.

Draughting

Of course, draughting is something that most people still need, so it's good to know that Cobalt has some decent drawing production tools. As with all things these days, the drawing view creation process is based on 3D geometry and you can automatically generate detail and section views again associatively based on 3D geometry. The detailing and annotation tools are similarly efficient and are again model driven, meaning that you get accurate dimensions based on your 3D part. All the usual bases are covered in terms of standards support (including ANSI, DIN, ISO, JIS) and the associated Geometric Dimensioning and Tolerancing.



Jaguar C Type image courtesy of Enduro Cars **(www.enduro cars.com)**

Bills of materials and the relevant ballooning and call-outs are also intelligent, so you can create the documentation you need without too much effort.

Conclusion

As I said at the outset, Cobalt is the highest end package in the Ashlar Vellum range. The other options available are Xenon and Argon. The differences between these are the amount of intelligence you can build into your model. They all include the same base modelling and rendering tools, but they don't get things like dimension and equation driven design, draughting, assembly modelling and such. In comparison to other systems out there, this might seem strange, but the price reflects the reduced functionality. UK distributor, Computers Unlimited, currently quotes Cobalt at £2,511 (maintenance is around £500 p/a) while the Xenon and Argon products will set you back £1,882 and £625 respectively – although these prices vary due to the fluctuating exchange rates as it's a direct conversion from US dollars.

But, despite being a very persuasive argument, cost alone can't justify a purchase, and there are two core areas of functionality that stand out. The system is very easy to use and doesn't restrict the modelling process, unlike more regimented applications. Indeed, you don't really need to consider the order or manner in which you define features – it's a lot more fluid than that. Yes, you'll still have to think about the modelling process, but not quite as much as you would in 'other' systems. Cobalt's data translation capabilities also stand out and the system has a number of translators built into it (including Catia V4) as well as a raft of surface modelling tools to fix any problems that arise from the process.

Of course, Cobalt isn't going to be suitable for every MCAD reader. While it can handle routine 3D CAD work such as prismatic parts, its real strength is in areas where complex geometry is required but assemblies are less complex. Yes, you can model a complete product model down to the exact detail you need, but it's never going to handle a 100,000 part packaging machine design – it simply hasn't been built for carrying out and, perhaps more importantly, managing that sort of work.

Where I can see Cobalt being adopted is either as a standalone application to take parts from concept through to draughting (particularly considering the price), or perhaps to supplement a more mainstream 3D design package - either as a surface modelling and manipulation tool, for geometry import and repair, or for rendering. Of course, there's also the fact that it's one of the only professional 3D product design and development tools available for the Apple platform – which if you're a Mac bunny makes it a pretty simple choice.

In short, Cobalt is an impressively specified system and while the CAD industry at large is talking commoditisation and reducing margins, Cobalt actually delivers something still quite rare – excellent value for money. ■

Product	Cobalt
Supplier	Ashlar Vellum / Computers Unlimited ***www.ashlar.com / www.computersunlimited.co.uk***
Price	£2,511 (see text)

SolidCAM for SolidWorks

In the world of CAM, there are the big standalone players and those that serve a more integrated way of working. One of those latter groups is SolidCAM with its eponymously titled CAM system for SolidWorks. Written by Al Dean

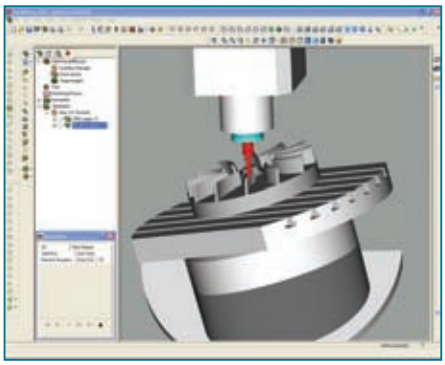
SOLIDCAM has been developing its core product for the last 20 years or so. Some time ago, the organisation analysed its strategy and took the decision to step away from CAD development and concentrate specifically on the CAM portion of its business. But to ensure that it could compete in a global market place, it decided that its users would still require some form of 3D modelling backbone – so it looked at the market and went for SolidWorks. Since that time, the company has built a business based on the SolidWorks community and the sales of its systems into a wide range of organisations. Interestingly, particularly for those who've already adopted SolidWorks, it's often the requirement for CAM that drives the SolidWorks 3D CAD sale. Users are looking for an easy to use CAM System – after all, you need to have a method of getting your data into the CAM system don't you? …but more on that later on.

So, what we're gong to do this month is take a look at how SolidCAM functions in a generic manner, then talk about business benefits and how it can help your organisation.

The first stage, in any CAM-related workflow is to import the part that you're looking to manufacture. Here, the manner in which SolidCAM has integrated its tools into SolidWorks immediately pays benefits, as the CAD product has a much wider range of data import and perhaps more importantly, data repair and modification tools. It also means that you can use SolidWorks to model up jigs and fixtures and should you be looking to do it, the whole machine tool for simulation purposes (this is particularly useful for simultaneous 5-axis Machine Tools, where much more machine and tool movement is involved).

Once your 3D data is imported or designed in SolidWorks and ready to go, you can start to define the CAM operations that will manufacture that part. SolidCAM operates from within SolidWorks, using the Property Manager Feature Tree panel. Machining jobs are added to the panel and can be edited using the same easy to use methodology employed in SolidWorks (drag and drop etc)

The SolidCAM process is built up of several standard stages and these are defined in a pretty simple workflow. You start by defining the CAM part – this is the geometry of the components you want to machine. Once it's selected and ready, the first stage is to define the home position on the model. Whereas in many systems, the part geometry is loaded at zero position in 3D space, when you're working with an integrated system, it may be the case that the part (or indeed, assembly if you're including fixtures) is elsewhere. SolidCAM handles this easily, moving the 3D workspace to the part,

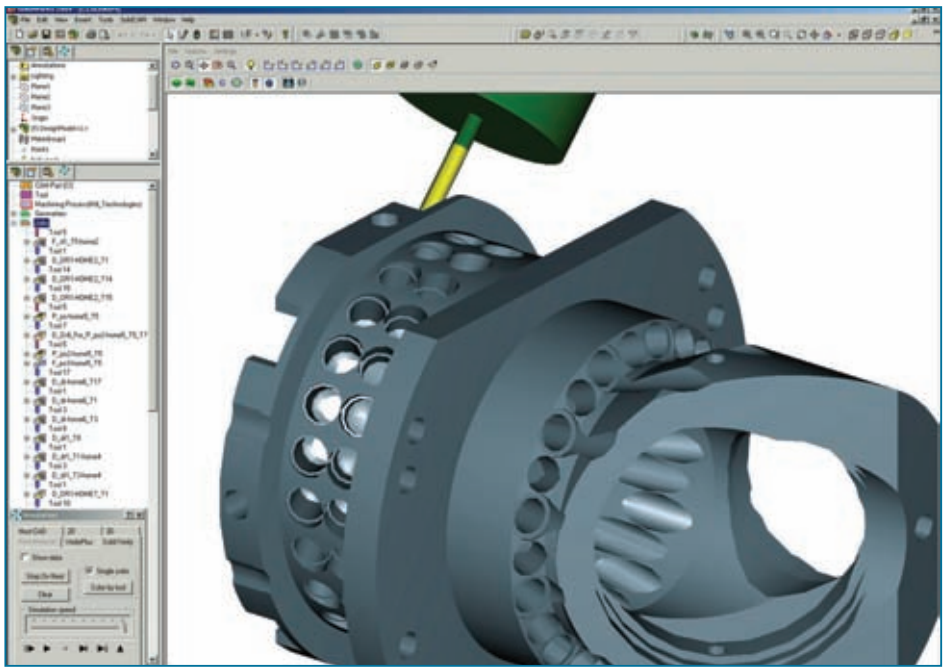


thus maintaining full associativity.

If you're working with more advanced multi-axis machines, then you can also define multiple sets of home positions if required. Of course, at this stage, you also need to define the target CNC Machine controller, axis type, material and of course, a stock model. This allows you to use a basic billet, an adapted CAD file from a separate configuration (which includes an 'as cast' representation for example), or an imported STL of a casting etc.

Once the basics are defined, the fun stuff starts with the definition of the machining operations. The system includes a decent array of operations, but the manner in which you define them is very simple and doesn't really change – just the various parameters

> *Looking at the CAM functionality, it is clear that SolidCAM is easy to use, which may conceal the more advanced areas of functionality that the system can handle.*

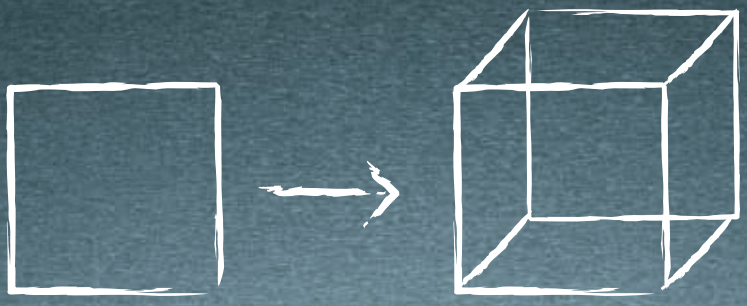


for each individual strategy. Essentially, it's all done in one or two dialogs. Using the 3D model operation, you define all of the parameters for each operation, such as rough, semi-finish and finishing, in a single page. Here, you can define the cutter for each operation or perhaps more likely, select the required tool from a library of those tools you use most commonly. You then define the parameters for each sub-process, such as speeds, feeds, levels, approach and retract strategies and such.

Once the operation is complete, you can then use the built in, LightWorks-based simulation tools to verify the operation. This ranges in capability from basic part and material removal simulation, but can also be expanded to include full machine simulation, which is particularly critical to those working with 4- or 5-axis or mill-turn machines.

CAD integration

One area I wanted to cover was the integration with SolidWorks . The benefit of a tightly integrated system such as this is that those inevitable



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design changes can be handled very efficiently. When you update the underlying geometry, whether that's SolidWorks native or imported data, the system recognises the change and allows you to quickly recalculate the options. If there are major topological changes, the system may break some level references or boundaries, so there might be some manual intervention, but it's a pretty trivial task to reassign these references. Once done, you are ready to re-output the G code for the machine.

Machining technologies

These days, I'm of the opinion that it's not wise to delve into the in's and out's of machining technology and each individual operation – the days of shoddy software being sold are hopefully long gone – Darwinian theories have taken care of the weak and injured and pretty much everything can 'dot he job'. That said, there are two particular areas that I was particularly impressed with when working with the SolidCAM team in the UK – and those are Hole Recognition and the use of Machining process Template.

Hole Recognition is along the lines of automatic feature recognition technology built into many CAD and CAM systems these days, but with a couple of differences. While other systems look at the feature history of a part and extract that machining hole data from that information, the Hole Recognition tools in SolidCAM differ as they inspect the actual geometry as well as the history tree. What this means is that it can handle much more complex hole forms, such as counter-bored, countersunk and other types that require multi-stage processes. It also means that it can handle native SolidWorks parts as well as imported data.

Moving on to the Machining Process Templates, these allow the user to take an already defined machining job and formalise it into a template which can be applied to any other part. If you're a jobbing machine shop, this could allow you to define standardised machining processes that are applied to pretty much every part that comes in for work. If you're in the game of producing part families or variants, then this also allows you to do the same, to create a template which can handle every instance, safely and efficiently without too much hassle.

Modular system

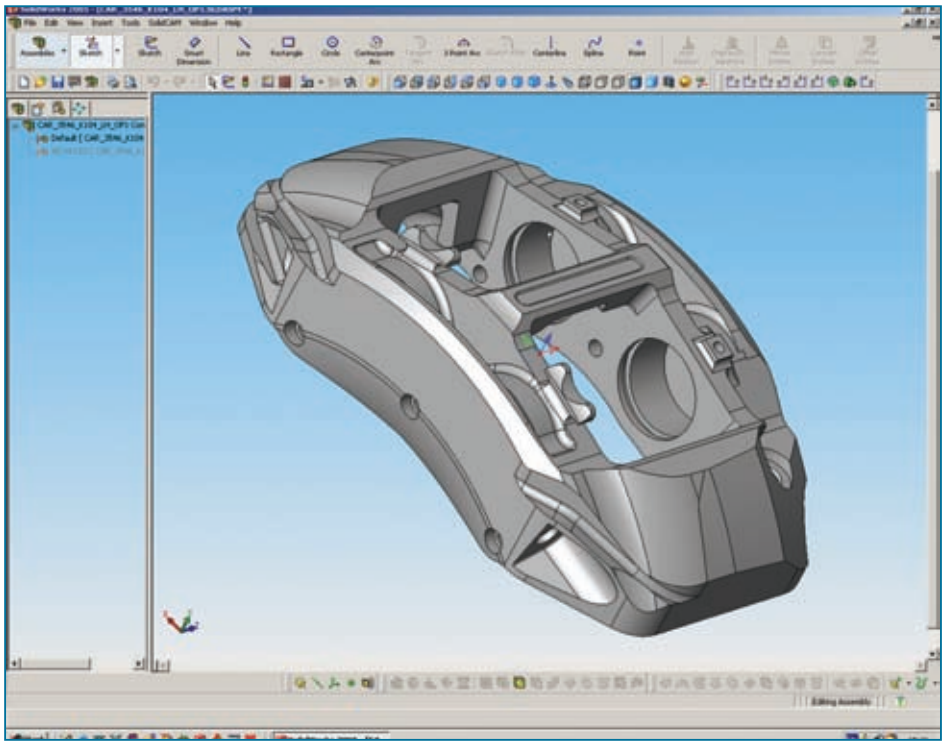
As with most CAM systems, SolidCAM is modular. While in terms of 3D CAD software, this is usually a method of the vendor extracting as much cash from their users as possible, in the CAM world it makes much more sense. After all, if you're running 3-axis high-speed machines, then you don't want to pay for 4- and 5-axis functionality – it's just good to know that your system can be scaled up if needs be. At present, SolidCAM covers pretty much all of the current bases. It handles basic 2.5D machining work, 3-axis work (including all the high-speed machining tips and tricks you'd expect these days), then moves into 4- and 5-axis - both positional and simultaneous. It is also gaining a lot of traction in the Turn/Mill market, which is gaining adoption at an incredible rate; so increased support for this ultra complex machining method has been recently added. To complete the offerings from SolidCAM, Wire EDM modules are available in 2- and 4-axis

Conclusion

For want of a better way of putting it, SolidCAM is a solid CAM programming application and one that takes the benefits of CAD integration to heart. It's been developed with the same concepts as today's mainstream modelling tools, such as ease of use, reduction of complexity and improvements in data and process reuse. As such, the fact that it's built directly into SolidWorks means that potential users are much more wide spread across industry.

Looking at the CAM functionality, it should be clear that SolidCAM is very easy to use and that fact may conceal the more advanced areas of functionality that the system can handle. Whatever machining process you're engaged in, be it 3-, 4- or 5-axis the workflow is much the same – which means less training and implementation problems. When you factor in the hole recognition tools that make light work of more complex drilling operations and the ability to wrap up your knowledge and experience into a process template, it's clear that the system is very efficient.

Unlike CAD software, CAM tools are very easy to quantify in terms of benefits. Firstly, the time taken from receipt of customer data to the final output of G-code is critical – the quicker it gets done, the quicker your machines can start cutting. Looked at from operation optimisation, the ability to create, simulate and, should needs be, modify your toolpaths means that when your machines are running, they are cutting efficiently using the most up-to-date methods available. What this all boils down to is that in the machining world, getting a part, programming it, machining them to the required quality and getting those parts out of the door to the customer as quickly as possible is a very tangible business benefit and anything that can improve that workflow is going to prove a valuable commodity. Whether you're an existing SolidWorks house, or are simply looking to update your CAM technology, there's something for everyone and current technology can be adopted as a scaleable solution without the many of the implications of capital costs, training and implementation traditionally associated with such moves. ■



Integration cost benefits

One thing I wanted to look at was the manner in which SolidCAM is sold, particularly in the SolidWorks channel. SolidCAM have a "Bundle" agreement with SolidWorks, at competitive pricing, which means that they can sell the SolidWorks system as the 3D CAD front end to their machining technology, thus offering a fully Integrated CAD/CAM package using superior mainstream CAD tools. As I've already said, this has proven very popular with many users, particularly those that are looking at its from a very CAM specific angle, rather than an extension to their design process.

Product	SolidCAM for SolidWorks
Supplier	SolidCAM ***www.solidcamuk.com***
Price	On application

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EON Reality

From immersive design environments to interactive Web-based sales tools, EON Reality provides the means to take 3D data way beyond the realms of traditional design and manufacture.

Written by Al Dean

IF YOU LOOK at today's advanced 3D design tools, the amount of product-related information that's held within the 3D model is incredible. We're talking about a micron perfect definition of the geometry of each part, how those parts interact, their material definitions, manufacturing information and functional requirements. But aside from using this data for digital mock-up and interference detection, simulation and analysis and for the basis for engineering and manufacturing drawings, how many organisations take the re-use of that data further down the line?

Surely something as valuable as a complete product definition should be reused as many times as possible through the lifecycle of that product? Well this is the concept behind EON Reality's Interactive 3D software applications. At a very high level, EON's offerings allow you to take raw 3D CAD data and repurpose it for four major application areas – Product Development; Purchasing; Sales and Marketing and Maintenance; and Support and Training.

"EON's offerings allow you to repurpose raw 3D CAD data for Product Development, Purchasing, Sales, Marketing and Maintenance, Support and Training."

But before we get on to that, let's take a quick look at the basic workings of the system, how you go about repurposing your CAD data, and then look at how the technology benefits each of the four key areas.

CAD data optimisation

EON's offering is split into several products and your selection of them depends on where you wish to take your 3D data. Whichever way you go, at the core is the EON Studio application. It's here that your core CAD geometry is imported and adapted for efficient visualisation. In terms of pure data import, the system includes a number of intelligent translators that connect to a range of different systems, either through standard style formats (such as VRML, STL, IGES, STEP, or ZGL/XGL) or though direct connections with the host CAD system, such as Inventor, SolidWorks, Pro/Engineer (via the SLP format) and Catia. The import process also covers how that data is handled. As you'd expect, EON uses tessellated data to achieve the efficient handling of often complex CAD geometry. What the system allows you to do is control how the tessellation process is carried out, so you can achieve a workable trade off between surface accuracy and efficient manipulation, which depends on your end use requirements.

For example, for high-end visualisation a higher polygon count is desirable, as you'll be conducting design reviews, but for Web-based sales and marketing activities, the need for smaller file sizes will dictate that the polygon counts is lowered.

Aside from geometry, the real power of the EON tools is the ability to add a huge range of actions, capabilities, and visual characteristics to that base geometry. Here we're talking about texture and material maps of a very high order, kinematic, motion and animation controls, as well as all manner of interactivity. It's really a case of what you want to do with your model. If you just want it to look photorealistic, this can be achieved relatively easily once you have applied the appropriate textures. You can also take advantage of cutting-edge technologies like HDRI light maps to ensure that the way the light interacts with your product is simulated correctly.

If you want to take things further, the system provides you with a massive arsenal of tools to add the details that you require. If you want to have a door or roof fold back when you click it, for example, then this can be done, without a massive amount of re-engineering.

When used for visualisation, EON's tools allow you to takes advantage of all of the current technologies for photo realistic simulation, such as HDRI mapping to achieve realistic lighting conditions.

A virtual sales tool

For those looking to adopt this technology for sales/marketing or training purposes, then you're looking at a little more work to be able to create the required levels of animation and interactivity. For point of sale solutions some custom programming is going to be required to link together the 3D model with a manageable application that fulfils the sales role requirements. A good implementation example is the work that EON does with Suzuki in the US to create a store-based interactive display, which allows the sales staff and customers to interact with virtual products, inspect them from whatever angle they desire and add accessories.

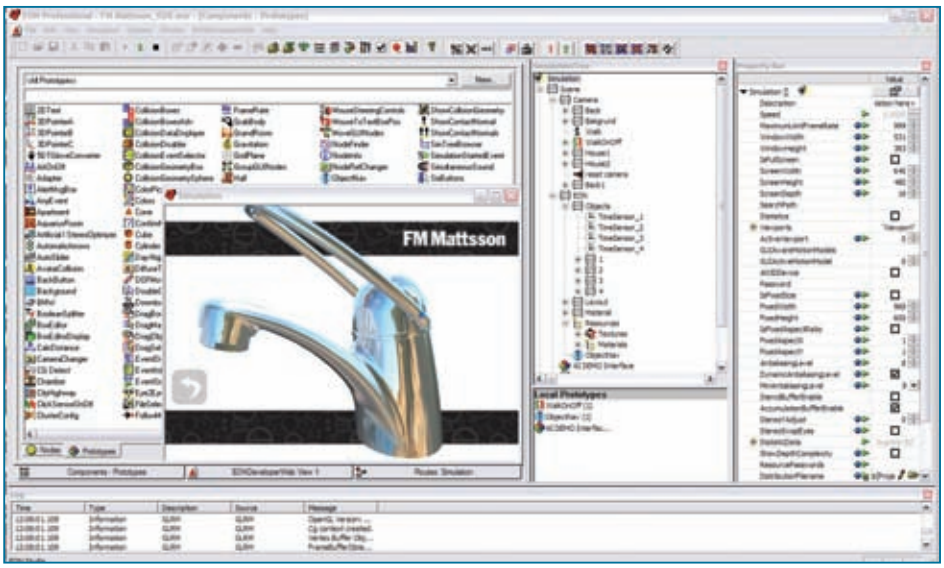
According to Suzuki, the process is very simple. Once the customer has selected the vehicle of their choice, they use the electronic kiosk assisted by the sales person to "facilitate and enhance the entire purchasing experience." They can view, rotate and zoom in and out of the motorcycle from any angle, select any available colour, and add and view accessories such as chrome details, bags, lights etc.

Furthermore, the customer can view vehicle features and receive more detailed information by simple hovering the mouse over a part. Once the customer is satisfied with the selections, they can experience the configured bike in full screen mode; receive a monthly cost estimate including extended protection guarantee as well as a customised brochure with detailed pictures and information for the motorcycle of their choice.

Finally, EON's tracking tools allow owners and managers to better understand customers' preferences and thereby increase the performance of their salesforce and increase profits.

Another organisation that's adopted EON's tools for consumer communication is the manufacturer of Liftgate products, Interlift. The company has implemented EON's technology within its Website and on CD-ROM to assist with the sales process. If you take a look at Interlift's web site (**www.interlift.net/htm/products/index.htm**) customers are able to select a product and explore it in 3D as well as get a clear understanding of how the products are connected to the trucks. In addition, the customer can receive a step-by-step demonstration how the lift-gate loads and unloads in different conditions with the truck on level ground, on angled ground and at dock.

According to Interlift's president, Hakan Peterson, the company's products previously required physical demonstrations and face to face meetings in order to sell. Now, by adopting EON's online demo tools, Interlift has been able to close sales over the phone as features that were traditionally difficult to explain over the phone can now be demonstrated online in a few seconds.



EON Reality's Studio application handles everything from data import and preparation to adding behaviours and visual properties and interactions to your models.

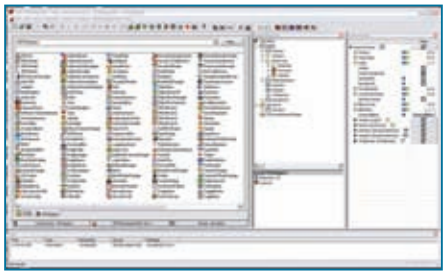
In conclusion

You might have noticed that I haven't used the term Virtual Reality anywhere is this feature… well, until now. The reason is that I really object to it. For years, we've been led to believe that VR is the next big thing and many organisations have been there and tried it and abandoned it. It's a bit like calling the Internet, the Information Super-Highway – very 1990s.

What we're talking about here is the emergence of converging solutions, the bringing together of all manner of developments, both current and in the near future – and it goes way beyond many people's preconceptions of Virtual Reality. Graphics hardware is getting faster, cheaper and more powerful because it's being driven by the cutting edge 3D gaming market. Hand held devices are getting more and more powerful and I'm sure there's a break through in human-machine interaction just around the corner (and again, this will be driven by the gaming market).

What this adds up to is that we have a more than capable IT environment in which the design and manufacturing industry can prosper beyond the realms of traditional design and manufacture. This might be sales staff interacting with customers on a hand held PC to configure a custom product on the fly, or using 3D display technology as the basis for communication. It might even be a web-based sales process for potential customers to sit down and configure the product of their dreams from a range of standardised items – making the customer more engaged in the process and hopefully encouraging them to click the 'Buy Now', rather than the 'Cancel' button.

Display technology has also moved on, and immersive walls and 3D stereoscopic display technologies give an impressive sense of realism, rather than just a headache. Indeed, the display set-up that UK EON Reality reseller, Design Academy, has installed at the Digital Knowledge Exchange at Doncaster College illustrates this perfectly. Walk in, slip on a simple pair of polarised glasses and prepare to be gob-smacked. The display is precise, the 3D image amazing (particularly when you consider that it's run from one of those small form factor Shuttle PCs) and when the tools in the EON Reality range are taken to the highest level, design reviews can be conducted in the environment they should be – one where ultra realism comes as standard. ■



Product	EON Reality software
Supplier	EON ***www.eonreality.com / www.design-academy.co.uk***
Price	On Application

At the controls

In order to meet increasing electronics packaging design challenges, Otis implemented an integrated Thermal/EMC Simulation process for its Elevator Controls.

Written by Randy Dube

THE ELECTRONICS packaging challenges facing the designers of lift control equipment have significantly increased over the past decade. The market demands for reduced space utilisation within the building by the lift system has driven the design of smaller sized controls, making it possible to place them in the hoistway rather than a separate machine room. Eliminating the machine room benefits building owners by increasing rentable space, but making the controls smaller has substantially increased power density, which makes thermal management more difficult than in the past.

At the same time, electromagnetic compatibility (EMC) design for lift control equipment has become more challenging than in the past, largely due to stricter requirements that have been issued by the European Community. In Europe, lift controls must meet the requirements of EN 12015 (emissions) and EN 12016 (susceptibility). Otis products are used around the world so they are generally designed to meet the toughest global standards. Finally, electromagnetic interference (EMI) has become a more important consideration than ever before because emissions generated by the control equipment can interfere with the increasing number of wireless communication systems distributed within buildings. In addition, better EMC design improves immunity of the lift controls from emissions of licensed transmitters such as mobile phone services, commercial broadcasters, and emergency communications.

Designing new motor drive

All of these issues came to the fore in the design of a new regenerative variable frequency drive for AC motors used to drive Otis lifts. Regenerative drives are attractive to building owners and managers because of their improved energy efficiency and consistency with "green" building initiatives. The advantage of regenerative drives stems from the fact that instead of the motor doing the work to move the lift car, under certain load conditions such as empty car up or full car down, the weight of the car or counterweight drives the motor, generating electricity that is put back into the grid, reducing energy costs. In addition, regenerative drives offer greater line voltage flexibility, low harmonic distortion, and high power factor.

The new drive has three major sections. The input section includes EMC filtering, inductive line coupling, precharge circuitry and AC-to-DC conversion. The power section includes the power semiconductors used to drive the motor, control circuitry for these semiconductors, and the capacitors used for DC bus energy storage. The control section uses digital signal processors to perform the conversion from DC-to-variable frequency AC and contains the proprietary algorithms to efficiently control the torque and speed of the motor by dictating appropriate vectors.

Otis engineers recognised from the start that a well executed electronics packaging design of the new motor drive would present a formidable challenge. Thermal management, EMC, and acoustic noise requirements had all increased over previous generations of controls. Just as important, all three of these factors interact with each other to further increase the difficulty of simultaneously meeting all the requirements. For example, increasing the openings in the enclosure to improve thermal performance will at the same time have a negative impact on EMC and acoustic noise.

Solid model image from Otis Elevator's CAD software, Pro/Engineer.

Integrated thermal analysis

Otis has used Flomerics' Flotherm thermal simulation software since 1994 and the company's FLO/EMC simulation software since 2000 in order to identify problems early in the design process when they can be inexpensively corrected. Simulation can significantly reduce time to market by making it possible to specify critical custom components such as large heatsinks that are required in motor control drives much earlier than was possible in the past. In their traditional design methodology, Otis engineers separately simulate the design from a thermal and an EMC standpoint. In the design of this drive, it was important early in the project to achieve greater collaboration between what are traditionally discrete engineering specialties to reduce risk and avoid substantial delays from iterative design changes. A major concern was that thermal design often conflicts with EMC design so fixes that are implemented to address thermal concerns often exacerbate or create EMC problems.

The most obvious example is that thermal performance often is improved by using large openings to enable adequate airflow while EMC design requires small openings to attenuate high frequency emissions. Another example is that heatsinks are often added to dissipate heat away from hot components. Switching currents can then couple to the finned surfaces causing them to radiate like an antenna.

Otis worked on thermal and EMC design in parallel so these types of tradeoffs could be optimised simultaneously. Flomerics has introduced an integrated analysis environment that makes it practical to address thermal and EMC design in a collaborative manner from the earliest design stages.

Hand calcs and rough models

The first step in the process was to use lift system simulation results to develop a spreadsheet to track power dissipations and estimate airflow requirements. Hand calculations and experience with previous designs indicated that it should be possible to cool the motor drive with a combination of natural convection for the input and control sections, but forced air convection would be required for the power section. Then engineers created a series of very basic thermal models of the design using Flotherm software in conjunction with PTC's Pro/Engineer for creating geometry. These coarse models were used primarily for preliminary power section heatsink design, placement of high-dissipation components in the power section, selection of air movers, and optimisation of air mover location.

At the same time the thermal design was being addressed, other members of the engineering team were looking at EMC issues. A subset of the geometry used to create the thermal model was also used to create an EMC model in FLO/EMC simulation software. Engineers considered the effect of the location, number, size, and type of openings on radiated emissions. They addressed conductive emissions by simulating the major sources and evaluating changing their position.

Otis engineers considered several major aspects of EMC design as submodels in order to efficiently use FLO/EMC to evaluate emissions from major sources. Examples are how to mate the cover with the enclosure to avoid gaps, the best way to integrate drip proof ventilation openings, and the analysis of cable routing effects in more detail. As they considered various design alternatives from an EMC standpoint, Otis engineers also looked at impact on thermal management, ensuring that each decision made at this early stage took effects on both thermal and EMC into account.

Refining thermal/EMC models

The next stage of the design process involved refining both the thermal and EMC models in order in order to incorporate PCB layout changes and implement design changes requested by field and manufacturing groups obtained through periodic design reviews. The simulation models were also expanded beyond the power section to incorporate more parts and to include appropriate component physical attributes deemed important to the simulation accuracy. Component selections were stable, but other aspects of the design such as cable routing and improving overall performance were refined. The new motor drive uses an enclosure 650mm high by 420mm wide by 210mm deep, which results in a power density considerably greater than previous designs.

At this stage, ideas for improvement were rapidly analysed from both a thermal and EMC standpoint. For example, small changes were made to the location of openings in the enclosure to simultaneously determine their impact on thermal and EMC. The refinements that were added to the simulation made it possible to start looking at the effect of physical layout on radiated emissions. At this point, engineers also began to consider the effects of barriers required in the control system to prevent contact with dangerous high-voltage components by field personnel. These barriers impact airflow so Otis engineers simulated their effect on thermal performance.

The more detailed system-level model helped engineers quickly assess problems areas such as a heatsinks that acted as antennas and how the structure of the box resonated and contributed to electromagnetic interference. At this point, engineers also made several modifications to the enclosure, internal bracketry, and cover to improve the design for manufacturability and ease of assembly again considering the impact on both thermal and EMC. Robust design of the interface between the cover and the enclosure was needed to prevent radiated emission leaks. Integrating this functionality into the sheet metal itself reduced the cost of the design as opposed to the alternative approach, used in the past, of adding components such a wire mesh or wire impregnated elastomer gaskets to provide these capabilities.

Works as predicted

The effectiveness of Otis' improved engineering methodology is illustrated by the fact that when components finally became available to build the first prototype of the design, temperatures and EMC performance were as predicted within the expectations requested of the simulation tools. All thermal and nearly all EMC requirements were met from the very first iteration. Minimal modifications were required to the enclosure and the cooling system from the first prototype through to the final release.

All in all, this project demonstrates that the integrated approach to thermal and EMC design is ideally suited to meeting increasing electronics packaging design challenges that are caused by higher power density and more stringent EMC regulations. The ability to evaluate design alternatives from both a thermal and EMC standpoint prior to the prototyping stage made it possible to order prototype components and build the first prototype earlier than would have otherwise been possible. Integrated thermal/EMC simulation also helped to ensure that the first prototype worked as predicted from a thermal and EMC standpoint, which reduced prototyping expenses and helped to get the product to market earlier. ■

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DBR9
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Tunnel vision

For the design of its DBR9 GT-class racer, Aston Martin Racing enlisted the help of Advantage CFD to implement a pure CFD-based aerodynamic development process.

THE ASTON MARTIN Racing DBR9 was designed as a GT-class racer for competition in a number of different series including the American Le Mans Series, the FIA GT Series and the Le Mans 24hr. When Aston Martin Racing commenced development of its racing DBR9, it was considered to be a bold move not to follow the traditional route of wind tunnel design development, opting instead to go straight from a Computational Fluid Dynamics (CFD) development program to put the DBR9 on the track.

Traditionally, racecar aerodynamic development is driven by a combination of track-tests and wind-tunnel development. Until very recently CFD has not been able to sustain the rate of development possible using these methods leaving CFD as an interesting tool but often non-essential. Advances in computer technology and CFD techniques have started to challenge this established process in earnest and it is believed that this is the first time an aero package has been designed for a race car, at this level of competition, primarily using CFD. Specialist consultancy, Advantage CFD, was chosen as the partner for this ground-breaking approach.

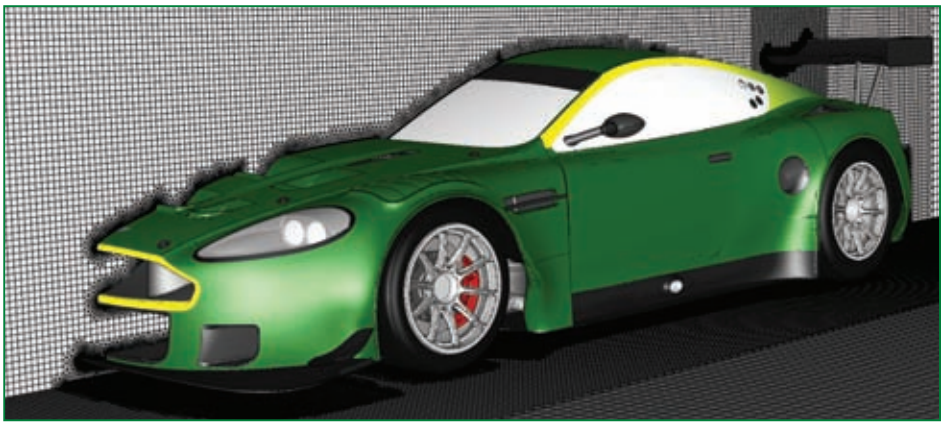
Rob Lewis, Chief Engineer at Advantage CFD explains, "This project was a unique opportunity for us to demonstrate that CFD really has come of age. Aston Martin Racing's decision to bypass the scale-model wind tunnel and focus on going from CFD straight to track is a major turning point for us. It demonstrates that we can offer a practical alternative to the wind tunnel for aerodynamic development."

The CFD Advantage

CFD offers a number of key advantages over physical testing. As well as providing the aerodynamicist with more information and understanding than a wind tunnel test, CFD allows engineers to evaluate the aerodynamic performance of new designs without requiring the time and cost associated with building prototype or model parts.

Aspects of the vehicle which are notoriously difficult to study and develop in physical tests such as managing and monitoring the air flow in the engine bay require little additional effort in CFD as the engineer has access to the air pressure and velocity both inside and outside the vehicle. Detailed visualisation can also improve the engineer's understanding of the flow and dramatically reduce the number of different options that must be tried before a tangible gain in performance is found. In addition, avoiding the wind tunnel and modelling the on-track conditions in CFD can account for the effect of engine intake and exhaust flow throughout the design process.

Aston Martin Racing asked Advantage CFD to consider a number of different goals when developing the aerodynamics. The aim was to increase downforce and minimise drag with a suitable aerodynamic balance and maintain a required level of cooling for the car whilst being predictable and consistent for the drivers. Furthermore, all of this had to be achieved within a short timescale and fixed budget.



The first stage in the process was to develop a CAD model with adequate detail to assess the aerodynamic performance of the vehicle. This CAD model provided a basis for the initial CFD model. A combination of commercially-available and in-house codes was used to rapidly generate a high quality volume mesh around the vehicle. In order to meet the tight schedule set by Aston Martin Racing, a meshing strategy was employed that would allow new geometries to be analysed quickly whilst providing reliable assessment of the aerodynamic performance of the vehicle. Advantage CFD's experience in Formula One and other industries was key in making this possible.

The baseline specification model was assessed at a variety of different conditions and included flow through the engine bay, rotating wheels and a moving ground plane. By understanding the issues on the baseline model it was possible to plan the development process, which would hopefully allow Advantage CFD to extract the maximum increase in performance within the timeframe and constraints allowed.

Key features of the aerodynamic package were studied in detail including the rear wing, splitter and underfloor. These components were known to contribute a large proportion of the downforce of the vehicle and had to be tailored to suit the characteristics of the Aston Martin DB9, from which the car was derived.

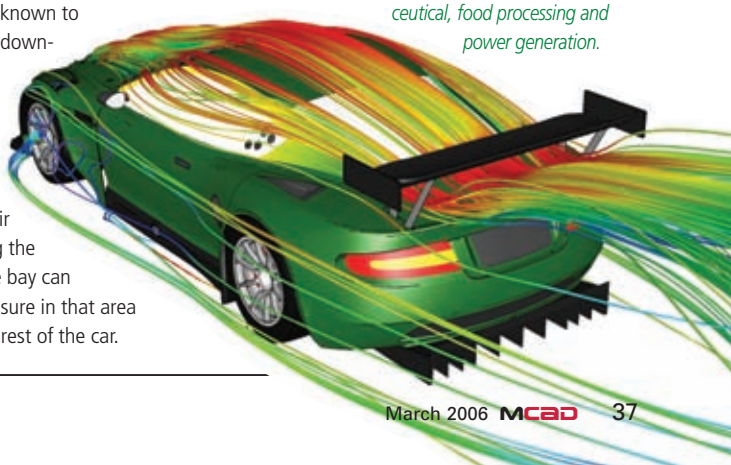
In addition, significant work was carried out to manage the cooling air and the underhood flow. Controlling the path that air takes out of the engine bay can have considerable effect on the pressure in that area and also minimise its impact on the rest of the car.

For some changes to the vehicle, new mesh-deformation software, Sculptor, was used to make large modifications to the geometry rapidly. Sculptor was often found to reduce the time taken to assess some changes from days to hours. By using parametric variations to an existing CFD model it was also possible to use optimisation techniques to try to improve performance.

Early track tests carried out at the end of the CFD development phase indicated that there was good correlation between the CFD predictions and the measured data and the aerodynamic performance of the DBR9 was promising.

The all-new DBR9 took an extraordinary class-victory in its debut race, despite some tough opposition. Later in 2005, the car managed a brave third in class for its debut at the world-famous Le Mans 24hr race after leading for 22hrs. This confirmed the performance of the car and validated the decision made by Aston Martin Racing to use CFD as the principal aerodynamic development tool. **www.advantage-cfd.co.uk**

Advantage CFD is a consultancy that specialises in applying Computational Fluid Dynamics to a vast array of problems, from Formula One cars to bicycles. Reynard Motorsport set it up in 1997, with the target of being the best CFD resource in motorsport. Now as part of the Honda F1 Racing team, Advantage CFD continues to provide consultancy to clients in motorsport and the automotive sectors as well as engineers in other industries such as pharmaceutical, food processing and power generation.



Drive time

For the BMW X3 rally car project, engineering and manufacturing partner Magna Steyr enlisted the help of Surrey-based design studio, Drive Inc.

YOU HAVE A DEADLINE – it is for one of the most exciting rallies in the world – the Paris-Dakar. Your brief is to design and construct a rally car which is capable of making it to the finishing line of this gruelling event in one piece ... as quickly as possible. Yet just getting it to the start line in record time will be a challenge in itself. Magna Steyr, the global, brand-independent engineering and manufacturing partner to OEMs was asked to do just this for the 2006 event by the x-raid team.

The car, which was to be based on the BMW X3, would need to be extensively re-engineered and adapted for the extreme conditions and unique challenges this rally demands, whilst having to remain instantly identifiable as a BMW X3. Magna Steyr is a partner to BMW who assembles the BMW X3 SAV, making the company the obvious choice for this development. With Magna Steyr's designers already working to capacity on existing client projects, they needed to bring in the support of a company who could work with minimal input from them, whilst delivering the specified design they required. That meant a company which not only understands how to operate its chosen in-house surfacing software, Alias Studio tools, but which also has the creative capacities and design understanding to ensure that the original intent of Magna Steyr's design could be maintained, whilst engineering requirements were accommodated, through to production.

Surrey-based design studio Drive Inc. was selected from a group of potential suppliers for their ability to demonstrate that they could deliver both Magna's technical and design requirements. In addition, Drive's in-house capabilities meant they had the flexibility to accommodate an immediate start and additional resource as required to ensure Magna's manufacturing team received the data within the allocated six week exterior surfacing stage. This gave the project team a time advantage right from the word go.

Magna's senior designer, Tim Doherty, was responsible for the exterior appearance of the BMW X3 rally car project. Drive worked from Tim Doherty's 2D sketches, renderings and concept Alias models, plus the original 3D data of the X3 production car, and technical data from the engineers to provide Magna with digital surfaces for the rally car. Andrew Jones, Drive's designer and project contact, worked with both Magna's designer and engineers to ensure the new body surfaces accommodated solutions that satisfied their very specific needs throughout the surface development stage. Magna benefited from the fact that Drive's Alias surface modellers all have a design background. This allowed quality surfacing to be created while remaining true to the designer's concept.

Data re-use

At the project start up meeting at Magna Steyr's design centre in Graz, Austria, Drive was provided with the exterior 3D digital surface data for the existing BMW X3 on which the rally car is based. This data was imported from the engineer's Catia system into Alias using the direct connect interface. The data was stripped down to leave only the essential information required to create the surfaces of the rally car body. Working from the stringent specification documents, carry over parts such as headlamps, tail-lamps, grills and front

doors were then repositioned to fit correctly with the recently engineered spaceframe chassis provided by the engineering team. Carrying over parts meant that the rally car would retain a close resemblance to the original X3 – a project requirement.

The main body of the rally car was to be 40mm wider than the original so carry over panels such as the front doors were moved outboard and all the central panels such as the roof and bonnet widened whilst maintaining design and surface continuity. As well as surfacing, every new part position required checking for clash conditions with the under the skin engineering developments.

A new driving position, combined with these new body dimensions, required checks on visibility angles and ergonomics to ensure the drivers could comfortably maintain maximum concentration and speed.

Design evolution

Design direction based upon styling and engineering requirements came from Tim Doherty in the form of detailed 2D sketches and renderings and 3D guide surfaces, which gave Drive the necessary guidance. Combining this with engineering hard points such as ride height, track, wheel clearances and overall extremities of the new vehicle, the new BMW X3 rally car package was compiled.

With this information prepared and agreed, Drive began to build the new surfaces. With their team approach ensuring quality, continuity of design and process, work on the front and rear was able to be carried out concurrently, creating time savings to keep the off road project on track.

The extended wheel arches were a strong feature of the design and drove development of the front wing and rear 3/4 panel. The new front bumper was stronger in appearance and widened to accommodate the repositioned front lamps. The front grill position remained unchanged. The rear bumper was also made wider and stronger in appearance. The rear screen was removed and the tailgate remodelled with an additional rear spoiler incorporating two high level brake lamps. The new sills were increased in size, to accommodate the space frame chassis, a feature line added and at each end it was blended into the new wheel arches.

Ventilation and airflow is a serious issue for any rally car design, and for the extreme desert conditions it was important to provide adequate ventilation for both engine and cabin. Drive received very precise design direction in this area of the development, and Magna's engineers were able to take the new digital data and do simulated flow analysis to check the correct volumes were achieved.

At every point in the development process Drive's additional resources allowed Magna's designers and engineers to explore a number of design solutions to particular areas of the model before selecting the most appropriate.

New surfaces were kept clean, strong and taut to ensure that the new design remained in keeping with the original vehicle and BMW's very strong design identity – during construction the surfaces were carefully analysed to check their quality of continuity and highlighting. The dimension of shut gaps was kept to a minimum to ensure that panels fitted closely giving airflow efficiency. Careful consideration was given to the position of splitlines to enable ease of production and speed of repair once fitted – essential when

competing at the highest level where minutes can be the difference between winning and losing.

Down the line ease of manufacture of body panels was an important consideration and Drive adhered rigidly to the draft angle requirements laid down by the designer. Once all the major surfaces had been signed off, all that remained was to add radii and fillets to the required manufacturing specifications. During the development period, Drive worked consistently to accommodate both design and engineering changes with minimum disruption to the project. The final surface data was exported and sent to Magna for final approval, before the panel tools were created.

Throughout the project, clear communication was essential between Magna in Austria and Drive in the UK. All of drive's surfacing work was done at their studio and apart from an initial meeting in Austria at Magna's offices, the project was coordinated 100% remotely from start to finish. This clearly implied a huge level of trust and understanding between the two companies right from the word go.

Magna staff needed to be able to follow the process as and when required, so, in addition to telephone calls and e-mails, data and visual information was exchanged on a daily basis via Drive's secure

> *drive's modellers have a keen understanding of the design process and this helped us enormously when communicating remotely* – Andreas Wolfsgruber, Head of Design, Magna Steyr

The rally car, which was based on the BMW X3, needed to be extensively re-engineered and adapted for the extreme conditions and unique challenges of the Paris-Dakar rally

data transfer FTP site. At any stage throughout the project, changes and enhancements could be made and approved at the push of a button.

"We were very pleased with the cooperation with drive at a time when our in-house resources were pushed to the limit. With their design background, drive's modellers have a keen understanding of the design process and this helped us enormously when communicating remotely," explains Magna Steyr's Head of Design, Andreas Wolfsgruber.

Magna Steyr delivered the car to the x-raid team in time for their gruelling testing schedule in preparation for the 2006 Paris Dakar event. The fact that the car finished in the top 10 after 62 hours 12 minutes and 45 seconds of flat out punishment, was proof that the Magna Steyr and Drive collaboration was an overriding success.

"Our main aim in producing the BMW X3 rally car was to retain the original design intent and this is exactly what happened. We have since worked with drive on other design surfacing projects and look forward to a continued successful relationship," concludes Andreas.

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Carrying design forward

From initial concept design to final testing and production, a Northampton-based manufacturer of conveyors has deployed Autodesk Inventor at the heart of its bespoke manufacturing environment to great effect.

FOUNDED IN the early 1980s, Northampton-based Conveyor Lines is a leading manufacturer of conveyors and conveyor systems to food manufacturers and, more recently, the laundry industry. Today its products are in use both in the UK and Europe and as far afield as South Africa, China and Australia.

In 2003, the company recognised the need to take its manufacturing design capability to the next level by moving to 3D. "In order to maintain our strong position in the market, it was essential that we continued to design high quality products at a competitive price," confirms managing director, Ian Goosey. "In short, it was a natural progression for us."

After looking closely at what the market had to offer, Conveyor Lines selected Inventor Series from Autodesk and Training Provider, Micro Concepts as best-suited to Conveyor Lines' requirements.

"We already had a very positive experience of AutoCAD LT," says Goosey, "and, most importantly, Inventor also offered the 2D capability which would enable a smooth transition at a pace which suited us – in effect, giving us the best of both 2D and 3D worlds. In addition, we were impressed with Micro Concepts' ability to understand our business needs and provide a solution with the right 'fit'."

certain knowledge that the parts will fit, speeding up the manufacturing process considerably. "Put simply, we know that if it fits in the 3D model, it will fit on the shop floor," confirms Peter Roberts.

Similarly, the designer's job has been made much easier. "The use of 3D modelling has also reduced the number of errors at assembly stage," he continues, "as we are able to see clearly from the start what we are making and see collisions and examples of poor fit and correct them straight away."

The company and its suppliers also benefit from the ability to create a sheet metal design as a 3D model including folding dimensions, so minimising the previously labour-intensive need for dimensioning and drawing in details such as the positioning of holes, as these are automatically done in the model.

In making to order, Conveyor Lines is also able to involve the customer much earlier in the design process. "The quality of the 3D image, together with the ability to make changes instantly, means that clients with little or no design expertise can visualise the product and make an effective contribution to the design process," says Micro Concepts' sales manager, Mark Mills.

Two years on, and Autodesk's 3D modelling software has delivered the major step forward in design for which Conveyor Lines was looking. "In effect, by 'giving us back' design time, Inventor has undoubtedly helped us create better products," confirms Ian Goosey.

company automatically receives all new releases of Inventor, full telephone and email support and can attend update technical training – in the form of Subscription Support Update (SSU) – seminars in order to realise the potential of the new release's functionality.

Standardisation

Historically Conveyor Lines used 2D to design each new conveyor from scratch. Since the introduction of Inventor however, it has been able to design and build a library of standard parts common to a range of conveyors. This not only saves time, avoiding the need to constantly 're-invent the wheel', but also reduces cost, through the ability to purchase common components in bulk rather than as a series of 'one-offs'.

Looking ahead, Conveyor Lines plans to extend this to the development of a series of standard conveyor designs, which can then be adapted to meet individual customer requirements. "The opportunity to maintain design quality at a more competitive price in this way would not be a realistic option without Inventor," believes Ian Goosey.

"Right first time, so avoiding costly mistakes further down the line, is no longer a holy grail - an ideal which is tantalisingly out of reach," he concludes. "Backed by Micro Concepts' first class support and with Inventor underpinning the design and manufacture of top quality conveyor products, for us it is now a fact of everyday life." ■

> *"Production times have almost halved and, in a bespoke manufacturing environment in which we design and manufacture to order, customers have recognised – and remarked on - the improvement in the end product which we are able to deliver."*
>
> *Ian Goosey, managing director, Conveyor Lines*

Key design tool

At the outset, Micro Concepts provided four days' intensive training, "which we found to be highly practical, hands-on and relevant to our needs," recalls design engineer, Peter Roberts. The design team has subsequently found Inventor to be highly intuitive and easy to use, delivering substantial benefits almost immediately.

Now in use in full production for more than 12 months, today Inventor sits at the centre of Conveyor Lines' complete development life-cycle, from initial concept design to final testing and production and has proved to be the ideal choice in a sheet metal environment.

For example, the basis of the construction of many build-to-order conveyors is a large box framework, for which Conveyor Lines typically buys in a number of machined metal components. Historically the company has had to await delivery of all the specially-produced parts before final welding of the frame.

With the arrival of Inventor, by contrast, the complete frame can be welded in advance, in the

"Production times have almost halved and, in a bespoke manufacturing environment in which we design and manufacture to order, customers have recognised – and remarked on - the improvement in the end product which we are able to deliver."

Goosey has also been impressed with the quality of consultancy advice and support provided by Micro Concepts. "As with all clients, our objective has been to maximise both productivity and the return on Conveyor Lines' investment," confirms Micro Concepts' Mills. "As a result, we take a multi-faceted development approach, including careful consideration of both the software and supporting hardware platform, together with a tailored training and support programme."

Conveyor Lines has taken advantage of the Inventor Support package, Micro Concepts' subscription programme for Inventor: As a result, the

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Emotions have been known to run high in the stands at football matches. That is exactly why the first-ever all plastic stadium seat was designed to withstand the stresses exerted by so called 'fans'.

STADIUM SEATING LIMITED had the idea of taking stadium seating to a new level of style and economy by creating the world's first all-plastic stadium seat. The company asked the Radar design consultancy for their input and Radar responded by providing a futuristic design with contoured plastic stanchions, which replaced the boxy metal stanchions that have been used on nearly every seat up to now. Next, Radar turned to Optima Design Services and asked them to make the seat tough enough to stand up in the stadium environment.

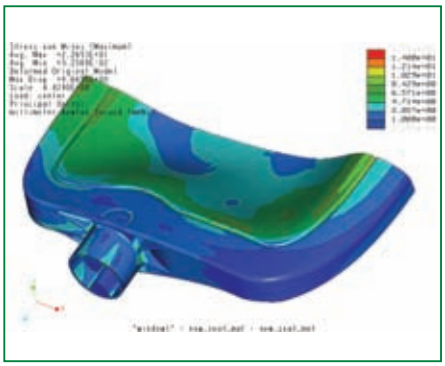
Radar provided Optima with a number of different structural requirements for the Eventa seat. The most difficult challenge was for the seat to withstand large football hooligans jumping in the air and landing on it in an attempt to break it off. This challenge proved particularly difficult for an all-plastic seat because dynamic loads applied by so-called 'fan' are all directed toward the small plastic mechanism that connects the seat with the stanchion.

This mechanism was primarily designed for raising or lowering the seat, making it easy for fans to pass by when the seat is not occupied.

From clay to surface model

Radar supplied Optima engineers with point cloud data generated by scanning the clay model they created while developing the conceptual design. Using conventional methods, engineers would have had to go through the tedious process of manually defining splines and surfaces by eye to match the point cloud data. Not only is this time consuming, but it requires a considerable amount of judgment on the part of engineers, running the risk of compromising the design intent.

In this case, however, Optima engineers took advantage of the Scantools functionality of Pro/Engineer Interactive Surface Design Extension (ISDX) to automatically fit surfaces to point cloud data. The surfaces that were generated by Scantools represented the design intent so well that only a few manual tweaks were needed. "The new automated approach saved 60 to 70% of the time that would have been required with the conventional methods," says Darren Forrest, Director, Optima Design Services. "This helped to substantially reduce the cost of completing the project."



Pro/E graphic showing the amount of stress in the seat when simulating a person jumping on the end of the seat.

The use of Pro/E Structural and Thermal simulation enabled the evaluation of more iterations, resulting in a better quality product designed in less time and at less cost.

With Pro/E, Optima Design was able to design a durable, all-plastic seat that could withstand the stress of football hooligans jumping on it.

Mechanical design concept

The next step was to design the mechanism in the stanchion that allows the seat to swivel up and down. The stanchion is designed as a space frame with ribs strategically located to distribute stresses efficiently through the structure. The stanchion part of the mechanism, which consists of two male slots shaped like pie slices with a small cylinder between them, is designed to mate with the seat.

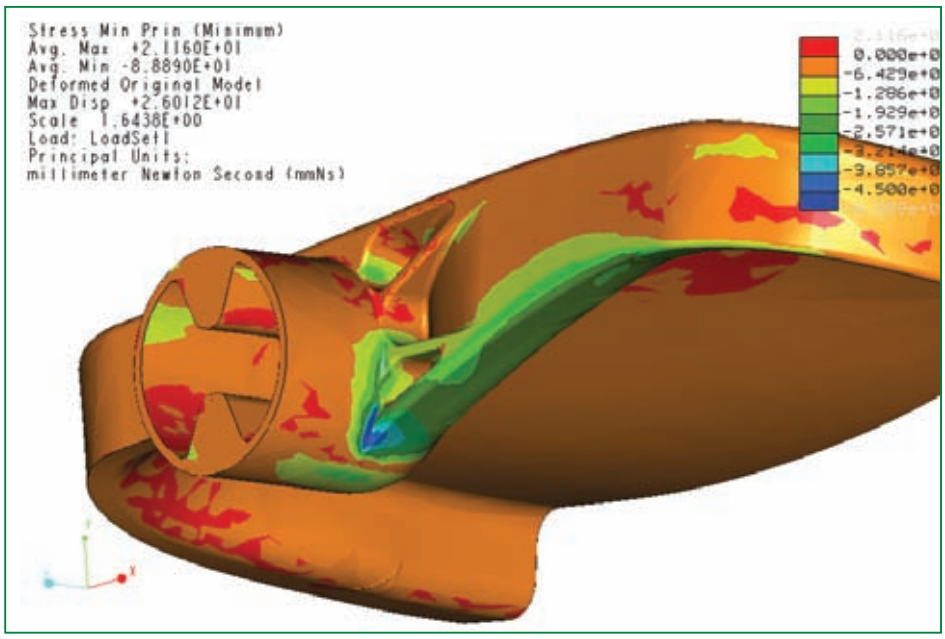
The seat part of the mechanism incorporates two female pie-slice-shaped pieces with space between them to provide room for the cylinder. A bolt that passes through the centre of this mechanism provides the physical connection. The male and female pie-slices interface with each other to provide positive stops that limit rotation and deliver strength to resist bending moments applied to the seat.

The backrest is fixed to the stanchion, and the seat is weighted by a metal bar, so it automatically flips up when it is not in use. The use of gas injection moulding makes it possible to use hollow sections in the seat, which is gas injected and improves the seat to backrest strength-to weight ratio. The seat and backrest are made of polypropylene while, the stanchion and other components are made of 30% glass-filled nylon.

Software prototyping

In the past, after defining the initial design concept, Optima engineers would build and break a series of prototypes in order to detect and correct structural deficiencies. Five or six prototypes would generally be required to get a design of this complexity right - a process that would take nearly a year. Engineers estimated that this design would have taken 18 months without Pro/Engineer; using Pro/Engineer it took only nine months of work from concept to manufacture, and reduced prototyping expenses substantially. Even better, with the integration between Pro/Engineer and Pro/Engineer Structural and Thermal Simulation, Optima has been able to replace its old process with a new, much faster process based on software prototyping.

On the Eventa project, Optima engineers worked in the familiar Pro/Engineer environment to define the additional information required to convert it to a virtual prototype. Engineers first applied shell elements to the surface model because shells can be analysed very quickly. After running through enough design iterations to get the design close to finalised, they converted the surface model to a solid model to achieve the highest possible analysis accuracy.



This analysis shows the seat under compression whilst simulating a person jumping on the end. The values here can be higher as the material is under compression.

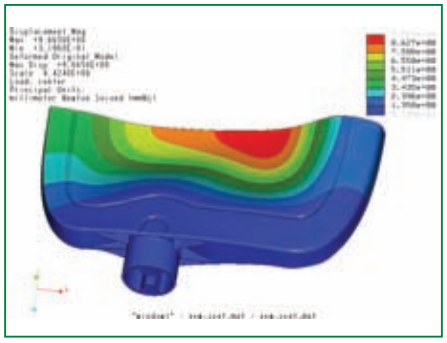
> *The very first prototype passed all the demanding physical tests required of a stadium seat, including first and foremost the 'football hooligan' test*

The Pro/Engineer Mechanism Design Option was also used to define the mechanism, primarily by defining joints and contact points that come into play as the mechanism operates. A variety of load cases were also defined, such as applying a downward force to the seat to represent a person jumping on it.

Integrated analysis

With the mechanism conditions and boundary conditions complete, Optima engineers simply pushed a button to perform the analysis in Pro/Engineer Structural and Thermal Simulation. And because this simulation software is completely integrated with Pro/Engineer, engineers never had to leave Pro/Engineer to conduct the analysis.

"It is essential to have an integrated solution for CAD/CAE," Forrest said. "It allows for better collaboration, higher quality products, and a faster design process." Within a few hours of starting the process, the engineers received their first results.



Checking the displacement (movement) of the seat by simulating someone sitting on the seat using Pro/Engineer simulation tools.

As expected, the analysis results highlighted a number of weaknesses in the initial design. The results showed high stresses in the male and female pie-slice-shaped segments, so engineers reinforced the areas highlighted by the analysis. The analysis also showed weaknesses in the body of the stanchions, seat, and backrest that were addressed by adding and re-positioning ribs. On the other hand, the analysis showed that some areas of these components faced very low stresses, so, in these areas, material was removed in order to reduce manufacturing costs. The use of Pro/Engineer Structural and Thermal simulation enabled Optima to evaluate more design iterations, which resulted in a better quality product designed in less time and at less cost.

The optimised design

Optima engineers performed 15 design iterations on the mechanism, and nearly five more on each of the major components. Their goal was to optimise the design by meeting all of the client's mechanical requirements, while minimizing material costs. Engineers showed their customer the final design, which required only a few tweaks.

At about this time, the materials suppliers said they couldn't meet the original ultimate tensile strength specification, so Optima engineers went back to the Pro/Engineer model, entered the new material specifications, and made a few tweaks to get it working with the new material specifications. In the past, this would have required at least one, possibly two iterations of building and testing prototypes, which would have taken much longer. Not only was it easy to rerun the analysis, but the associative nature of Pro/Engineer made it extremely easy to implement the engineering changes. After making the modifications to the design, all downstream deliverables were updated automatically, saving time and reducing errors.

Right first time

The very first prototype passed all the demanding physical tests required of a stadium seat, including first and foremost the 'football hooligan' test described above. Getting the design right the first time made it possible to complete the design process in only six months, half the time of conventional design methods. Without Pro/Engineer, such a design would have required at least four or five physical prototypes, which are not only time consuming, but also expensive.

Ultimately, Optima engineers created a better-performing design than was possible in the past because the speed of the virtual prototyping process - enabled by the integration between Pro/Engineer and Pro/Engineer Structural and Thermal Simulation - made it possible to consider more than twice as many iterations.

The new seat is already being used in the UK at Lord's cricket ground and Sheffield Arena, and is being installed at Wembley Stadium. "Our customer was very impressed that we were able to meet their demanding specifications with the very first prototype," Forrest concluded. ■

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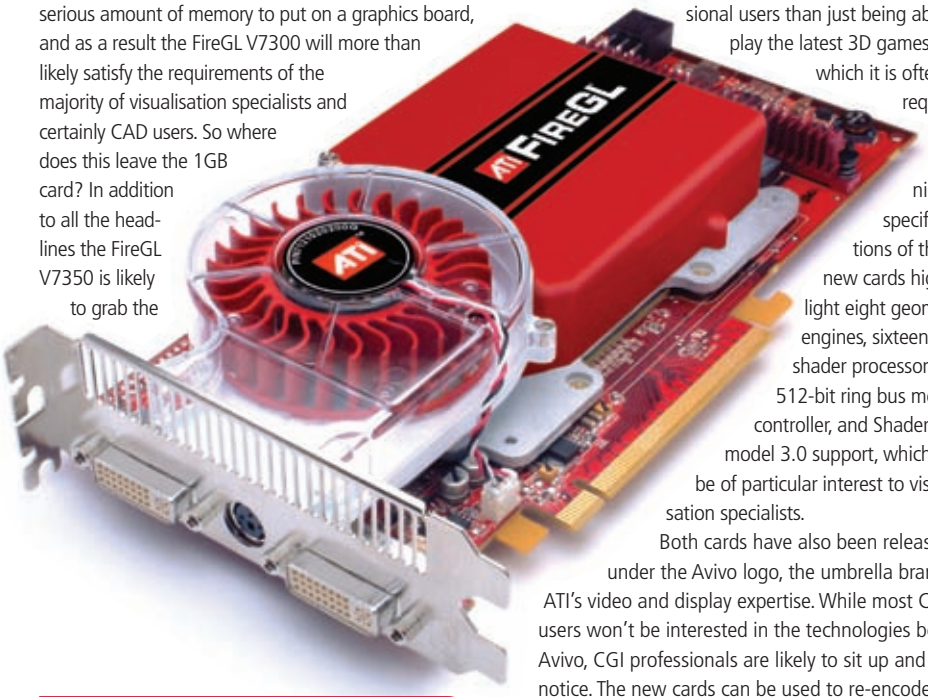
ATI FireGL V7300/V7350

ATI's new flagship FireGL graphics card features a whopping 1GB RAM. With even bigger models being encouraged with 64-bit Windows could this be the future of professional graphics? Written by Greg Corke

ONLY A COUPLE of years ago graphics giant ATI said it wasn't interested in the ultra high-end professional graphics market. However, a lot can change in two years and this month the Canadian company unveiled a new professional graphics card, which with 1GB of on-board GDDR3 memory can be described as nothing other than ultra high end.

The FireGL V7350 is the first FireGL card built with ATI's new 90 nanometer semiconductor fabrication technology, and gives us a glimpse of the company's second wave of professional PCI Express graphics cards. At the same time ATI also announced the FireGL V7300, which features exactly the same core technology, but only, and I say only with a pinch of salt, 512MB of GDDR 3 memory. Indeed, 512MB is still a serious amount of memory to put on a graphics board, and as a result the FireGL V7300 will more than likely satisfy the requirements of the majority of visualisation specialists and certainly CAD users. So where does this leave the 1GB card? In addition to all the headlines the FireGL V7350 is likely to grab the attention of the medical and oil and gas industries where excessively large datasets are commonplace. But this doesn't mean to say that it will not find a footing in the design arena. The move to 64-bit CAD and even more complex models is also likely to drive the adoption of this beast of a card. But in addition to huge amounts of memory, what other technologies do the new FireGL cards bring to the table?



The technology

As you'd expect, both cards support OpenGL and DirectX graphics libraries. With CAD vendors such as Autodesk continuing the transition to DirectX, this will become much more important to professional users than just being able to play the latest 3D games, for which it is often required. The technical specifications of the new cards highlight eight geometry engines, sixteen pixel shader processors, a 512-bit ring bus memory controller, and Shader model 3.0 support, which will be of particular interest to visualisation specialists.

Both cards have also been released under the Avivo logo, the umbrella brand for ATI's video and display expertise. While most CAD users won't be interested in the technologies behind Avivo, CGI professionals are likely to sit up and take notice. The new cards can be used to re-encode video very quickly, by taking the computational load off the CPU and onto the GPU, and image quality has also been addressed with the option of 10-bit processing for more realistic colour definition - though this is more of a technology for tomorrow as most monitors do not support this yet.

On the subject of monitors, with two dual link outputs, both cards are able to drive two nine megapixel (3,840 x 2,400) displays or four 2,560 x 1,600 displays, like the impressive Apple Cinema.

Results and conclusions

We tested the flagship FireGL V7350 inside an Armari Gravistar SR workstation (more on this next month) featuring the latest dual core processor from AMD, the 2.6GHz Opteron 185. If our results confirmed one thing, it's that there's little point in investing in one of these cards if you use Autodesk Inventor, as you won't get any more performance than you would out of a £200 Quadro FX 540 from Nvidia. It will, however, be interesting to see if this changes with the imminent arrival of Inventor 11. This new release will be able to use DirectX instead of OpenGL, and we expect it to significantly boost 3D performance in Autodesk's flagship MCAD application, which is currently bottlenecked by the speed of the CPU.

As you'd expect from a card of this positioning the FireGL V7350 showed its true potential under 3ds Max, Autodesk's key visualisation and animation application, where the results were the highest we've seen in the MCAD labs. At this moment it's also worth commenting on the performance under Windows XP x64 Edition, where there was around a 5% drop from 32-bit Windows XP. This, according to ATI, is due to the CPU overhead imposed by Microsoft's 64-bit Operating System.

However, the real worth of the new cards go beyond benchmark figures. 2006 is set to be the year when many CAD applications and users make the move to Windows XP x64 Edition. With model size and complexity driving this change, we're expecting a quantum shift in the loads that will be put on graphics cards. Kitted out with 512MB and 1GB respectively the FireGL V7300 and FireGL V7350 look perfectively positioned to support this next generation of ultra-high-end users, and with 3Dlabs just announcing its departure from the professional workstation graphics sector, ATI can now take the battle to one front, where it will start to fight Nvidia at all levels of the workstation market. ■

Results

(* indicates performance under Windows x64 Edition)

SolidWorks 2005 APC benchmark (bigger is better)	
Graphics	2.13
Inventor 10.0 frame rate test (bigger is better)	
Medium Assembly	25.00
Large Assembly	2.33
3ds max 7.0 frame rate test (bigger is better)	
OpenGL	72.04 (71.38*)
DirectX	166.84 (160.92*)

Product	FireGL V7300/V7350
Supplier	ATI *www.ati.com*
Price	£949 / £1,175

Test machine

Armari Gravistar SR

- 2.6GHz AMD Opteron 185 Dual Core Processor
- 4GB DDR400 (PC3200) DDR SDRAM
- ATI FireGL V7350 (1GB)
- 150GB Western Digital Raptor SATA 10K
- Tyan (S2865) Tomcat K8E motherboard
- Sony Dual Layer DVD+-R/-R/W drive
- Mitsumi 7 in1 Multiple format Flash memory Internal reader/writer
- Windows XP or Windows XP x64 Edition
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www.armari.co.uk

The state of workstation graphics

This month Rob Jamieson heads back to home turf to look at the current state of the workstation graphics market and what the future holds.

IT'S BEEN an interesting last month in workstation graphics. With my company (ATI) introducing a new top end workstation card and 3Dlabs stating its withdrawal from the workstation graphics market place. Although not directly related I'm going to give my perspective on the factors that make these things happen in our industry.

As with any industry there are lots of companies vying for control of the market. As technology develops production costs increase and you end up with a small group of larger players.

If not by direct mergers the people in the graphics industry have all worked for different players. 3Dlabs had the Intergraph Wildcat team and is now owned by Creative Technology famous for its soundcards and now its MP3 players. Creative wanted to get into general performance graphics to compete with ATI and Nvidia and purchased the high end player 3Dlabs so that it could develop chips that could also be used in "consumer" graphics. The problem was 3Dlabs made high end performance cards for ultimate OpenGL performance using limited production runs GPUs (Graphic Processing Units) on physically large cards. But designing and making a GPU for mass production is a very different game and even in the interim Creative purchased GPUs from ATI and Nvidia to sell to consumer graphics customers. I guess this just didn't help the bottom line for 3Dlabs.

The cost of drivers

There are a few areas that make a big difference to why there is a higher cost for workstation graphics cards. The driver has to be tested by the ISV (Independent Software Vendors, such as Autodesk, Dassault etc) to prove it works to their standards and ensure any bugs are fixed. These drivers optimise the performance so that the card is faster in the application and because of the testing they are more reliable. The ongoing support costs for workstation cards are quite high in terms of manpower as workstation graphics card vendors also have to develop drivers for future applications not yet written. Inventor 12 and Solidworks 2008 are currently only a twinkle in their developers' eyes but when they come out they will have to be supported on graphics cards that were shipped long ago.

Graphic interfaces and content is constantly changing in CAD so this is not an easy task. With ATI and Nvidia having a larger market share we have contact with more customers and therefore fix more bugs. This translates to reliable performing drivers. This generally means good customer experience (there will always be an exception) which is important for repeat business. This is something that reduces as your user base shrinks.

The extra money a larger user base brings in means you can spend more on driver development. Take our new cards, for example. The performance is good now but six months down the line it will be better as we invest time and money to improve this with optimisations for each application.

As the gap widened between high price and limited performance gain of 3Dlabs over ATI and Nvidia the sales slumped making it hard for 3Dlabs to develop new GPUs. This was made harder as DirectX become more popular in use in workstation applications (and continues to today). The 3Dlabs cards have a lot less performance in this area and so excluded them from vast segments of the market. The next Microsoft operating system, Windows Vista, is heavily focused on DirectX and needs a high performance DirectX card to get the enhanced functionality of the interface - never mind the requirements of CAD applications.

Because the two main players ATI and Nvidia are going head to head, users are safe. Constant competition guarantees good value and repeated innovation.

The new generation

The workstation market grew quite a bit last year, not only in this country, but worldwide as more people recognise the advantages of good performance and the benefits of supported graphics. Now, the two main players in volume are ATI and Nvidia and because there are two companies going head to head the users are safe. Constant competition guarantees good value and repeated innovation. Once one comes out with a new better solution, currently ATI's FireGL V7350 with 1GB of frame buffer, you can guarantee the competition will try and come out with something to compete with it sometime soon.

So why do we need all this RAM on a graphics card? I am not saying a card like the V7350 will give improvements to all CAD and visualisation applications today but for certain high-end requirements, such as in medical imaging, this is a requirement. Also DCC (Digital Content Creation) applications like 3ds Max can cache large datasets into this frame buffer (or by default when using DirectX mode) so that it improves the frame rate (rotational performance). This is also linked to the time it takes to zoom in and out. On a large model do you really want to waste time waiting for this? With the other CAD vendors implementing this functionality to exactly get these benefits. I imagine cards with more RAM will become increasing popular once the memory limits have gone when 64-bit computing becomes the norm. For people on a tighter budget the V7300 has "only" 512Mb which is easier on the pocket but gives the same base performance.

The future

I have talked recently about more computing functions being placed on GPUs as the current GPUs are an array of little processors. Once applications become available which support these functions more directly and Operating Systems like Vista have this functionality built in, GPU choice will become as important as CPU choice.

Microsoft Windows has produced a document on the minimum requirements for "Premium" Windows Vista to support the Aero interface. The main crux of this is that you need a dedicated graphics card with at least 128MB of RAM (not shared memory) to run at a resolution of 1,600 x 1,200 with 32-bit per pixel. DirectX 9 support with Shader Model 2 and a texture bandwith of 2GB/second. All FireGL cards from the last two years, with the exception of the FireGL T2s (half height) support this requirement.

In summary, this is likely to be a good year for graphic card vendors with the increasing reliance on 3D applications, not only in CAD, but for file viewers. Windows Vista and the competing Operating Systems with 3D interfaces will also play a major role. ■

Robert Jamieson works for workstation graphics specialist, ATI.

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