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*RAPID DESIGN
CUSTOMIZATION!*

Tailoring product designs to customers' needs

TAILOR your DESIGNS to your Customer Needs

A customer walks into an auto dealer's showroom and spots a car that almost matches his wish list. "Make the transmission standard, the color red, put Michelin tires on it, add a sunroof and I'll buy it," he says. Another customer comes in later, checks out the same model, orders it in green, with a trailer-towing package. Both get what they want.

It's a fairly common scenario today for car buyers. Now, the rest of the manufacturing world is striving to achieve the same kind of rapid customization for their customers. And those who succeed will win hearts, minds, and dollars, and position themselves for tremendous future growth.

That's because technology has not only made the world smaller, it's made customers more sophisticated. They want—indeed, expect—"personalized" products, and they'll give their loyalty to the manufacturers who respond fastest.

"Manufacturers can't let themselves fall behind in their ability to rapidly customize their designs," says Tom Salomone, Worldwide CAD/CAM Segment Marketing Manager for Compaq Computer Corporation. "If they do, they'll lose out to companies that can modify rapidly."

'Customers want uniqueness in design.'

It's true in virtually every industry, from appliances to power tools to office furniture and beyond. Even with such seemingly standard products like elevators, customers want what they want, not necessarily what the manufacturer has as a standard offering. Just as Otis Elevator recognizes that each building requires a unique elevator system, manufacturers of all types know they must tune in to the individual needs of their customers, or be tuned out.

Uniqueness in product design is what more companies



Car designers are catering more today to customers' unique needs. This Land Rover Freelander was built using PTC MCAD solutions. Photo courtesy of the Rover Group.

want, says Alan Mendel, Director of North America Consulting Operations for CIMdata, a consulting and market research firm headquartered in Ann Arbor, Michigan.

"A growing trend among many industries is the move to offer more engineer-to-order products," he says. "Discrete manufacturers from automotive to telecommunications see the ability to provide customized products with short delivery times as key objectives to differentiate their companies in the growing global economy."

One force that is driving the demand for engineer to order is the general trend of globalization, which is pressuring companies to get their products to market faster than ever before. For the growing numbers of discrete manufacturers that are going through a consolidation process, it is particularly important to differentiate their products in the global marketplace.

Companies that are customizing products need the software

solutions that allow them to do it in a cost-effective way. They need the ability to conduct rapid customization.

The Importance of Custom Designs

“Whether a company is customizing a product for a specific customer, a particular region of the world, or for a variation within a brand, the benefit of rapid design customization for any company is profitability,” says Brian Shepherd, Senior Vice President, Technical Product Marketing, PTC.

“How do you build customer loyalty? You tailor the product to the customer. By offering that service, you can become a premium supplier. The trick is to offer that service to your customers at the least cost to you. Pro/ENGINEER® is the key to that,” he adds.

Manufacturers can tailor a product for a particular market while reducing costs and cutting time to market. But in order to do this, they need to establish flexible, controllable platforms that enable modular, top-down design. They also need flexible designs that let engineers change a CAD model easily. Companies today want to be able to reuse 80% of their existing design and easily modify the remaining 20%, Shepherd says.

Take, for example, bearings manufacturers. Engineers at two leading companies need to build new bearings for customers on a daily basis. They are creating new models of a bearing and showing them to the customer so they can see what they



Rapid customization and PTC software help Cannondale design bikes to fit customers' body sizes.

will get—before they get it.

The key for companies to accomplish this goal is, not surprisingly, automation. And automation requires the right hardware and software.

Now, using the Internet and PTC's Windchill®, engineers in any company can enter the information on a new design from a customer and with Pro/ENGINEER can build the model using

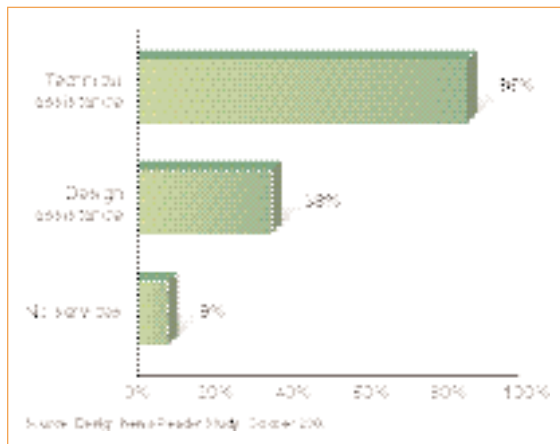
80% of the existing design.

A case in point: The bicycle division of Cannondale, Bethel, Connecticut. Last year, the company began offering custom frames through its Web site. The “Custom Cannondale” CAAD4 Road Frame Program allows a customer to order a customized road bike that will fit his or her unique body size, explains Dan Connors, Senior Project Engineer.

“Once they fill in the parameters that will fit their own body size, those parameters go to a Pro/ENGINEER model that will regenerate and create all of the laser cutting paths and profile so we can make that bike,” he asserts. “No one else in the industry can do that.”

He adds that it generally takes four to six weeks for a customer to receive his or her custom bike after placing the order because the company collects several custom orders and processes them together. If Cannondale didn't use

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Rapid design customization often entails providing assistance to customers. Here's what customers expect from manufacturers when they deal with them over the Internet.

Factors Driving Customized Design

- Business Globalization
- Customer Demand
- Fierce Competition
- Product Price Pressure
- Product Differentiation
- Technology Drives Customer Expectation

Key Elements in Custom Design

- Common Product Platform
 - Modular Design
 - Interface Design
- Rapid Customization System
 - Rule Based
 - Automated
 - Product Option Sets
- Integrated Product Decision Making
- Cross-Functional Teaming

Transformers Made to Order

It might seem on the surface that the concept of rapid design customization and the design of a 350-ton power transformer with up to 3,000 unique components would not go together.

But they do. The 300 engineers at ABB Power Transformers, a global company with 25 design and manufacturing facilities around the world, certainly prove that every day as they collaboratively design transformers for customers worldwide.

The designs are complex—a transformer assembly may have 3,000 different parts and that doesn't include the quantity of each part. Yet despite the complexity, ABB customers want their transformers as quickly as possible.

"We design to order, so we need to have a good, rapid design capability," explains Julian Guild, Mechanical Design Coordinator, ABB, based in Germany, where the mechanical design and CAD functions are done. "Some of our facilities are making upwards of forty transformers a year," he adds.

"A fast response is everything in the transformer industry because customers are demanding much shorter delivery times," Guild explains. "Our customers in China want their transformer three months after they place an order. That means that we need to be thinking ahead all the time—standardizing and modularizing our concepts so that any long lead time components are already booked with our sub-suppliers. More importantly, we need to get

manufacturing data into our factories as soon as possible."

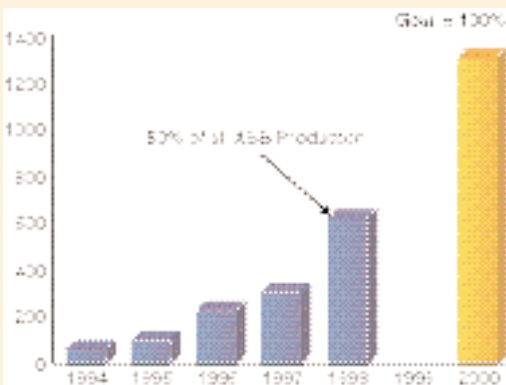
Engineers faced a particularly challenging request recently when they had to develop a new design for a cooling mechanism that would be placed inside a transformer assembly. Not only did ABB have to design the new product, it also had to build it and make sure it worked properly the first time. The design work was done collaboratively between engineers in Australia and Germany.

Guild says that the open architecture of Pro/ENGINEER allows the company to write its own applications, which is vital since engineers are creating design modules driven by parameters and then writing their own programs.

To help expedite a faster rapid customization design process, ABB engineers built a methodology called "pick and place." Now when the company needs to create a new design module, a design engineer using PTC's Pro/ENGINEER "can do a mouse click on the outside of a transformer and the part will be placed," Guild says.

"Now when we do 'design to order', the detailed drawings are already defined behind the system, which produces a very productive design-to-order environment," he adds.

Using a combination of Pro/ENGINEER and internally designed software has increased engineering productivity at ABB. What used to take more than 1,000 hours now takes 500 hours. "And we're heading toward a target of 200 hours," he adds.



To enable rapid customization, ABB has created a common product platform for design of all products worldwide. Half of all the company's products were created in that platform in 1998. The goal is 100%.

Common Product-Platform Strategy is Vital

Another challenge Guild and his team recently faced—and one that is critical to achieving the rapid design customization process they need—was creating a global common product-platform strategy for all of ABB's 25 locations over an 18-month period.

"We created a common product platform by looking at all of the technologies we had and developed a system that would be a common design technology for all of ABB," he explains. "Having a common technology means we can be very efficient in our operation. We can move people around and cross-fertilize. We can also provide a lot of support," he says.

"Having this design capability supported with trained people with good integrated systems and pre-defined modules is absolutely vital to success," he concludes.

Pro/ENGINEER, he adds, the process would take three times as long. Connors adds that the company has manufactured several hundred customized frames since the program began.

In the highly competitive bicycle industry, Connors says that the challenge is to make custom products quickly and affordably.

"Since our design and manufacturing departments are linked through Pro/ENGINEER, we can easily CNC (Computerized Numerical Control) a part and build that into a bike very quickly," Connors says. "Flexible engineering and manufacturing allow the company to customize a bike easily and cost effectively."

Integrated Processes are Crucial

"In order for an engineering environment to respond to customization, they have to develop best practices," Mendel says. "They need to have an information infrastructure in place that provides them with the information they need in order to take advantage of the state-of-the-art 3-D modeling environment."

Mendel says that for collaborative design and rapid design customization to work successfully, companies need to ensure that they have an infrastructure that enables them to manage change throughout the supply chain. This is particularly important for companies that deal with outsourcers.

Software is critical, and so is the hardware it runs on. "The

more powerful the workstation, the quicker the engineers can go through design iterations," says Compaq's Salomone.

The companies establishing processes for rapid design customization know the necessity of having a common product platform in place. It is far more efficient. But while the whole movement of common platforms and homogeneous products within those platforms is hardly new—it began about 30 years ago in the automotive industry—manufacturers are realizing that another challenge is standardizing all of the elements that come into play in the total manufacturing cycle.

The solution is instituting an integrated product development team, which in itself is a great challenge to most companies. "The challenge, in fact, goes well beyond the design engineer's role and involves total cross-functional disciplines," says Mendel.

Similarly, it is critical that product development software provides a complete and integrated process coverage. Unless the product performance can be validated virtually, manufacturing deliverables automatically updated, and production processes digitally simulated, true rapid customization will be a dream.

Pro/ENGINEER provides an integrated suite of applications that enable automation of the entire product development process. Behavioral modeling technology provides extensive abilities to measure and drive product performance, within the Pro/ENGINEER environment.

Change and Reuse Existing Designs Easily

One key to getting products to market faster is to rapidly change designs that already exist. Certainly, no one wants to spend time reinventing a complicated design if a customer wants only one dimension changed.

"Companies want and need to reuse parts and assemblies across their product lines," says Alan Mendel of CIMdata. "They want to know, 'How can we make our products more modular and support customization?'"

In order to reuse information and reuse it productively, engineers must be able to easily access it, and easily change it. They also need to be able to share information easily with different members of the development team. And, they need a common hardware platform to make information sharing and reuse easier.

That sharing and the collaboration it enables can be done over the Internet or in face-to-face meetings. And, engineers no longer have to lug heavy workstations to those meetings. Coupling a Compaq laptop with Compaq's MP2800 projector, engineers can call up design models and project them on meeting-room screens so several members of a team can view and suggest changes to the model on the spot.

The speed such capability provides is essential for the flexibility engineers need for rapid design customization. And flexible design processes are important to all companies. Just

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PTC's Windchill system simplifies design collaboration, as is the case here with a video system and seat supplier and an auto company.

Dorner Cuts Cycle Time

When Dorner Mfg. Corp., Hartland, Wisconsin, began development of its new 2200 product line of low-profile extruded alloy conveyors, company officials decided it was time to implement a new flexible process for product development.

The decision was an important one for the company, which is a leader in the design, manufacturing, and distribution of high quality, low-profile conveyors and related equipment. The 2200 series would be the company's first product line to be designed and manufactured in a 3-D concurrent engineering format. This was important for the new product series since it is a modular product that offers customers a high degree of configuration. In fact, the possible number of configurations is in the hundreds of thousands when you take into consideration length, width, belt, motor, stand, and accessory combinations. In addition, the company also services custom requests from customers that are outside of Dorner's range of combinations.

Basically, the 2200 series, which was introduced in November 2000, consists of a number of standard modules that customers can "select" to meet their specific needs. It was important that the entire design to manufacture process for this product launch be integrated and standardized throughout the enterprise.

The low-profile conveyors are used in industries that range from electronics to medical equipment, and in applications that include automated and manual assembly, and testing and inspection.

John Nobsch, Director of Information Systems at Dorner, and his team, standardized their technology and implemented significant process change all within one year. They say that Pro/ENGINEER® was key to their success.

"We were able to cut months out of the development cycle," says Nobsch, who is also the corporate Pro/ENGINEER project leader for enterprise implementation.

Nobsch and Standard Products Division Engineering Manager Mike Hosch partnered to develop a flexible product platform for the company's 14 engineers in the Standard Products Division. Of course, a flexible process for product customization requires standards followed by the entire enterprise.

"Processes typically work well and run efficiently if they are standardized and well understood throughout the enterprise," Nobsch says.

Early in the implementation process, Dorner focused on developing modeling and process standards, making both easily accessible on its Intranet. The company also translated key modeling standards into rules, which were entered into Pro/ENGINEER's ModelCHECK™ product that scans the models for compliance and highlights deviations from those standards. Dorner put this process in place to enforce key quality steps.

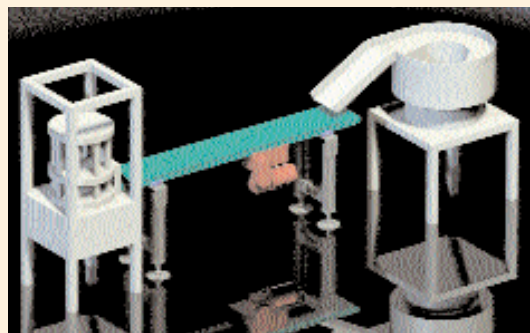
Consequently, when it came to developing the new product line, the engineers had the tools they needed, and they got the product to market faster.

"We used finite element analysis in several applications for the design of the product," Hosch explains. "The most dramatic was offering product selection in terms of width and sizes of the conveyor that weren't previously available."

"Using the power of Pro/ENGINEER's flexible product models has let us cut the design time," Hosch adds. "It has simplified design tasks and freed engineers to concentrate on innovations."

Dorner engineers are currently developing other new products using Pro/ENGINEER.

"Pro/ENGINEER has helped get more people involved in the product development process—including manufacturing," Nobsch says. "We've gone to cellular manufacturing and each cell engineer has a Pro/ENGINEER station. As a result, we have a much tighter relationship between manufacturing and engineering."



Because Dorner's business strategy embraces rapid design customization, standard conveyors can be easily tailored to meet specific customer needs.

Western Star Leads the Pack in Customized Trucks

When it comes to custom-designed and hand-assembled Class Eight heavy-duty trucks, Western Star, Kelowna, British Columbia, is in a league of its own.

The company's customers can choose from thousands of custom options that cover all aspects of the vehicle, from the engine to the sleeper cabin. What enables Western Star engineers to do this is an integrated production development process driven by leading hardware and software technology.

The situation was different in the 1990s when the company realized its survival depended on improving product development and manufacturing capabilities. That's when Western Star tapped into the power of computers — in particular, mechanical design automation.

As a result, the company can now produce about 31 trucks a day versus six a day before using Pro/ENGINEER®.

'Our customers benefit... from quick response.'

The engineer intuitively designs a product and the software automatically generates a product definition for use in downstream applications. Pro/ENGINEER, powered by Compaq Computer workstations, allows Western Star to bring its mission of customization to a new level in the niche transportation market.

"The performance of the Compaq Professional Workstation SP700, along with its high performance graphics, allows our engineers to design and visualize our concepts from initial stages of development to final production in a very rapid fashion," says Lee Johnson, CAD Support Specialist at Western Star. "Our customers benefit greatly from our ability to respond quickly."

For Western Star, the Compaq Professional Workstation SP700 was a natural choice to power Pro/ENGINEER. Western Star needed a workstation that was both certified by PTC and compatible with their 37 Digital Alpha workstations running Windows® NT.

Productivity Increased

Pro/ENGINEER allows Western Star to reduce design time through automation. Today, the frame layout team works three 12-hour shifts and produces five times as many layouts as they could by hand in a 40-hour week. Now frame layout engineers spend their time focusing on tasks that require their expertise rather than the tedious and repetitive aspects of design. This focus changes the very nature of Western Star's design-based competitive advantage.

Pro/ENGINEER's virtual design environment permits continuous change and exploration of alternatives. This flexibility in the design process is invaluable to Western Star as it strives to meet its customers' needs. A virtual design environment also facilitates collaborative efforts among frame layout engineers, regardless of their physical location. Western Star engineers in the United States and Canada can share ideas and work collaboratively on a single design.

Western Star also relies on Compaq technology to enhance Pro/ENGINEER's efficiency through access to increasingly faster processing power as it becomes available. And the Compaq Professional Workstation SP700 has proven to be well suited for Western Star's virtual team approach.

Plans for Future Growth

Western Star is pursuing an aggressive growth strategy that envisions a frame-layout design capacity of 80 trucks per day by 2001. Over the next year, technology from Compaq and PTC, coupled with plant expansions, will fuel even more growth.

When Western Star's new manufacturing facility in North Charleston, South Carolina is operational, it will support twice the current production capacity. Western Star's Orion Bus division will also fuel this expansion, as will the addition of Class Seven vehicles.

As a manufacturer of both right and left drive vehicles, Western Star is poised for global expansion.

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ask Cannondale engineers, who design about 100 different bicycle models on an annual to bi-annual basis.

"When we make changes to a bike, the parts are cut and put in welding in days," says Dan Connors, Senior Project Engineer, Cannondale. "Our Pro/ENGINEER models are used by our manufacturing engineers. We use ProENGINEER Production Solutions (CAM), that are driv-

en right off the Pro/ENGINEER model, so all of the manufacturing programs are linked to the files. We never have to go outside the Pro/ENGINEER environment to create a part. And since we are all on the same network, it never has to leave the network."

Pro/ENGINEER also lets a user organize information in a way that the engineer can go back and access the data that's important—and change it. This allows for a very intelligent design.

Driving Unique Product Variations

The key to creating flexible, reusable models is the ability to capture and organize critical design criteria. Information such as parameters, engineering rules, space claims, motion envelope, and system interface information needs to be readily accessible for modification and sharing. Pro/ENGINEER has industry-proven top-down

design capabilities that encourage distribution of this key product information among the members of the design team, and enables engineers to make broad, sweeping changes. This simplifies the process of design iteration, and the creation of product variants.

Changes to the design are reflected in associated deliver-

Compaq Designs Leading-Edge Products with Compaq, PTC Technologies

Every designer wants more capacity and portability when it comes to their technology tools. Engineers at Compaq Computer Corporation have answered that request with award-winning products that break new ground in terms of mobility, speed, and power.

One of the products, Compaq's Armada M700 notebook computer, weighs only five pounds and was recently certified to run Pro/ENGINEER. Another of the company's new breakthrough products, the three-pound MP2800, is the world's smallest projector. When the two products are used together, they give engineers the power and mobility to show complex product designs "on the road," which empowers engineers with a new level of mobility that hasn't existed before.

The microportable projector received a "Best of Show Award" honoring new and innovative technology products at COMDEX Fall 2000, a leading technology trade show.

Compaq's iPAQ Pocket PC, which weighs a mere 6.3 ounces and boasts the power of a 200 mhz chip, received ZDNet's first-ever "Tech Trendsetter Award" honoring new and innovative technology products. The iPAQ added that to its list of awards that already included accolades from Popular Science and PC magazine.

What has helped Compaq engineers in developing these leading products is the capabilities of Pro/ENGINEER, says Phillip Prestigomo, Industrial Design Manager for Mobile Products, Compaq Computer Corporation, CPCG Design Center, Houston, Texas.

Prestigomo, who led the design effort for the MP2800 microportable projector, says that all aspects of the design for the product were done using Pro/ENGINEER.

"We shared data from engineering to design via Pro/ENGINEER," he recalls.

Prestigomo says that one advantage to using Pro/ENGINEER technology is that the designers from industrial

design and engineers could look at rough conceptual sketch models and ask, "Is this the right design and direction? How does this fit into the family line of portables that we make?"

"It was a very collaborative process. We could get two days worth of work done in a 24-hour period," he says.

"The technology makes everyone more proficient and makes everyone more productive," Prestigomo adds. "Using parametrics to be able to tweak a surface helped me out greatly. From an industrial design standpoint, I don't have to rebuild an entire surface. I can just tweak dimensions."

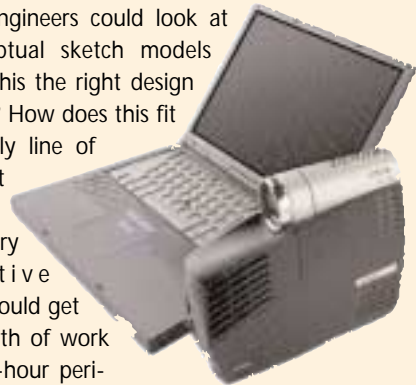
Design appearance is everything in this consumer market, and PTC has introduced a new freeform surfacing product called Interactive Surfacing Design Extension (ISDX).

Some of the design challenges the team faced were keeping the projector's total weight at three pounds.

"The success of the MP1800—the first version of this projector—was done in similar fashion. We were able to quickly solve the thermal issues. We wanted to make it cooler and quieter. We used Finite Element Analysis (FEA), modeled with the Pro/ENGINEER data base," he explains.

Prestigomo says that one of the most unique design aspects of the projector is its "tower configuration."

"The shape makes it easier to set up. You are getting the lens off the table further than the traditional projector, and it doesn't get in the way of coffee cups or soda cans. The MP2800 gives you an image in the marketplace that no one else has. We're able to be unique in the marketplace," Prestigomo says.



Compaq's Armada M700 notebook computer and MP2800 projector work together to help engineers share design ideas



The iPAQ pocket PC won a "trend setter" award from ZDNet.

ables such as assembly processes, bills of material, piping and cabling routing, manufacturing drawings, and Numerical Control (NC) tool paths.

The parametric associativity feature of Pro/ENGINEER allows this to happen quickly and without any time commitment from the designer. If one dimension needs to be changed in an existing design, then all of the other parameters will change accordingly to make that design work.

This kind of flexibility and speed is important in all industries. But one industry that is particularly competitive and needs to react quickly is the toy industry, where the popularity of a toy is determined by the whims of the market. One company that knows this first hand is K'NEX Industries, Inc., Hatfield, Pennsylvania, which is a well-known construction toy manufacturer.

"We chose Pro/ENGINEER because it is fully customizable to our specific needs and the parametric nature allows seamless integration of any part changes into our full model assemblies," says Glenn Giddings, Design Manager. "Speed and simplicity are essential. For example, we can now call up any part in just three keystrokes or assemble two parts together with just two clicks of a mouse. Instead of two days of assembly, we can now achieve the same results in hours."

An engineer can make changes easily with Pro/ENGINEER because of the user interface that lets a user fill in the changes on a table that is on-screen. The program then figures out the rules that are applied to the interface, which changes the product model. An automatic generation of new deliverables is computed instantaneously, and without taking up important time from the engineer.

A Custom-Made World

One of the challenges that manufacturers face—now that they are working to get their products to market as fast as possible—is managing the tremendous amount of changes to their product that occur both during the design phase and throughout the lifecycle of the product.

'Build to order' is already a way of life for many products, and "engineer to order" is coming up fast behind. General Motors, for example, hopes to have custom cars in a customer's driveway in as little as three days—in this decade.

Engineers are also finding themselves in the flow of fulfilling an order, which adds new challenges to their duties.

"Today, there is a lot of focus on the 'order-to-cash' process," says Brian Shepherd, PTC. "Making sure that engineering, design, and manufacturing are as rapid and flexible as possible is important. You want engineering in the loop, but you want them to be super quick because you don't want them to delay the order metric," he adds.

All of these factors add up to the importance for manufacturers to have the appropriate communications infrastruc-

ture to manage the vast amount of change they are continually dealing with.

"The concept of 'design anywhere' requires you to be very agile in moving the correct product definition information from one place to the next and moving it in a way that people have access to it," says Alan Mendel of CIMdata. "If you need to make a change across a distributed engineering environment or design supply chain, you need a collaborative product definition management infrastructure to do that," he adds.

All of this means that manufacturers need to have the technology to deliver these requests. Now, companies can choose technology that designs products faster in a more customized manner and in a collaborative design environment.

The PTC Solution

PTC provides solutions to address customer business problems through establishing common product platform and rapid design customization systems. These solutions combine the best of PTC software suite functionality with the service competencies of PTC's Global Services and its extended service partner network.

PTC Global Services Organization (GSO) typically supports the technology aspect of customer initiatives, while consulting partner Accenture, formerly Andersen Consulting, focuses on crucial strategic services to align PTC technology implementation with the customer business strategy.

In that fashion PTC helps its customers to orchestrate a complex business change that holistically encompasses product strategy issues, product portfolio management, integration of key processes, organizational change, and common technology infrastructure.

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Special Webcast Explains the Basics

On Wednesday, March 7, Design News, PTC, and Compaq will sponsor a special Webcast on rapid design customization, directly from the National Design Engineering Show (NDES) in Chicago. Register today to learn more about the basics of this critical design trend.

The time will be 11am Eastern Standard Time (10am CST).

To register, visit www.designnews.com.

Attend the Webcast to learn more about how PTC technology can help you and your engineers rapidly customize a design to suit your customers' needs.

Register now!