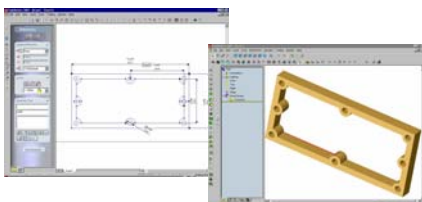




The Standard in 3D

This guide addresses the following topics:

- Leveraging legacy design data to speed projects
- Ease-of-use and power
- Powerful enclosure design tools
- The power of Configuration Management tools
- Top-down and bottom-up assembly design techniques
- Large assembly performance factors
- Creating production-level drawings from 3D design data
- 3D visualization to help refine your design
- Tight integration between SolidWorks and more than 35 best-in-class add-on solutions
- Design communication, productivity, and data management tools



SolidWorks offers easy import and reuse of various types of CAD data, including 2D DWG and DXF. DWG/DXF details, including layers, lines, and formatting, can be maintained in the original drawing.

3D CAD Guide for Medical Product Designers

3D CAD solutions are revolutionizing the medical product design industry by speeding development of a wide range of innovative products including FDA Class 1, Class 2, and Class 3 devices.

Your choice of 3D CAD tools is critical to your organization's ability to compete effectively in this challenging business environment. This guide identifies key issues and explains advantages of SolidWorks® 3D modeling software for medical product designers.



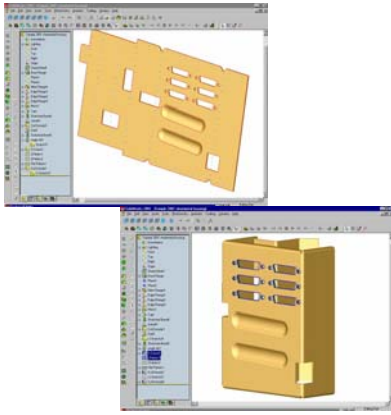
Wheelchair designed by Sunrise Medical using SolidWorks software

Leveraging Legacy Data

- Medical product designers frequently have a large amount of legacy data (data created from previous projects or jobs).
- Legacy data may form a starting point for new designs or can contribute key elements to the development process, including projects based on customer or vendor-supplied CAD data. Unfortunately it is often available in various 2D and 3D formats. The ability to use these varying formats helps designers leverage legacy data, work side-by-side with designers who use other CAD systems, speed development, respond to market needs, and increase financial returns.
- SolidWorks 3D CAD software offers the widest number of data translation formats of any CAD solution. A list of the supported formats is provided on the SolidWorks datasheet. Designers migrating to SolidWorks from 2D CAD will greatly benefit from new functionality including view folding, which enables legacy DWG or DXF™ drawing views to be used more efficiently to create new 3D models. A new import wizard with AutoCAD-oriented help system also streamlines the migration process.
- After 3D legacy data is imported into SolidWorks, the FeatureWorks® feature recognition product (a component of SolidWorks Office Professional) further speeds design work by searching the incoming file data for features, such as bosses, holes, ribs, sheet metal features, and fillets. These features are then converted into native SolidWorks features and inserted in the SolidWorks FeatureManager® design tree for easy modification, reordering, and other standard SolidWorks operations. (Please refer to the *SolidWorks Design, Productivity and PDM Solutions* section for more details on these products.)

Ease-of-Use and Powerful Features

- Medical product designers we have contacted need and want powerful functionality in their choice of 3D CAD software, but it must be easy to learn and use since they are not using it all the time. If the software is powerful yet easy to use then the designer can be productive even with occasional use.



SolidWorks provides sophisticated sheet metal design capabilities, such as those used to develop this networking controller housing.



Surfacing, sophisticated filleting, and other design tools in SolidWorks enable fast development of complex shapes, which are often used in medical products. (Design data courtesy of Siemens Medical Systems, Inc.)

- SolidWorks is used by over 10000 medical product designers worldwide and in use over 50 million hours per year in all industries by people who have the need for design power and ease-of-use.

Enclosure Design Tools

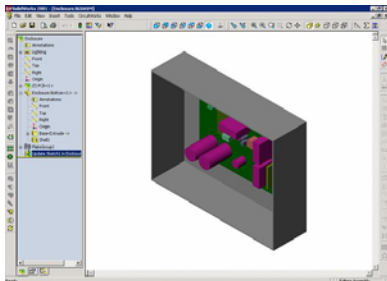
- Designers responsible for packaging all types of devices need flexibility in designing the necessary housings and enclosures.
- Some package design jobs require sheetmetal enclosures while others require surfacing capabilities to create custom injection-molded parts and molds. Package designs can also require integration with existing parts and assemblies.
- SolidWorks offers best-in-class design tools for all types of enclosure development. Key sheetmetal design capabilities include advanced bends, cuts, fold/unfold, hems, jogs, lofted bends and easy sheetmetal part drawing development, to name a few. These give designers the ability to create the necessary chassis products to hold motherboards, rack-mounted devices, and all types of end products.
- SolidWorks powerful surfacing, filleting, variable radius filleting, progressive loft, and advanced surface fill capabilities meet the complex surfacing and filleting needs of plastic enclosure designers.
- SolidWorks is unique in the CAD industry due to its pioneering patented SmartMate Technology, which enables parts to be assembled in place simply by clicking on the mating surfaces of both parts. SolidWorks has expanded this to Smart Fastener technology to enable automatic insertion of fasteners, along with all necessary washers and hex nuts, in a pattern of holes. This innovation, coupled with SolidWorks Toolbox, a comprehensive library of standard parts, saves the designer significant time in the development process.

Configuration Management

- Configuration Management is the ability to control design variations from within a single file or document. This applies to parts and assemblies, with the effects propagating to drawings.
- Configuration Management enables the generation of multiple versions of parts, assemblies, and drawings in a single document with a minimal amount of time and effort. Configurations make use of design tables, derived design data, component properties, relationships, viewing states, and other attributes, storing part and assembly information in one area for greater efficiency. SolidWorks offers multilevel configurations, called nested configurations, to optimize the power, organization, and efficiencies of configurations.
- SolidWorks Configuration Management gives you maximum flexibility in creating multiple design variations covering a wide range of needs. New configurations are easily developed from previously created designs to further speed development and meet market needs for data reuse.
- A simple application of this capability would be to create various versions of sheetmetal rack-mounted enclosures that automatically



SolidWorks configurations were used in the design of this robotic laboratory equipment to create multiple positions of an assembly. This enables multiple position data to be stored in one file. (Design data courtesy of SAGIAN, a Beckman-Coulter company)



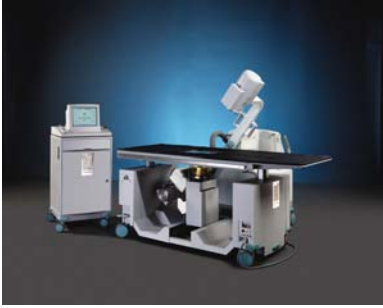
Top-down assembly enables parts to be developed within the context of an assembly. In this case, a simple enclosure is generated around a PCB assembly with a specified 1" offset from the edges of the board. Any changes to the PCB in the future will result in this enclosure changing so this 1" offset is maintained, eliminating the potential for error in the development of new assemblies.

add more cooling air louvers as the dimensions increase. The various versions of this enclosure design can be created within a single SolidWorks model file for simplicity and easy design control. "What if" scenarios for different design requirements such as power supply size and power capacity can be quickly explored by turning on and off various configurations of a part or assembly. Chassis dimensions and sizing of cutouts can be tied to design data for each size of package. As the package requirements change, the necessary chassis dimensions automatically update to reflect the new design.

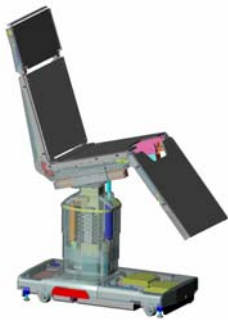
- Components involving multistage processing, such as progressive cavity stampings or the casting and machining of parts, can easily be documented by using multiple configurations of a single part. Configuration Management techniques can generate a discrete version of a part or assembly as necessary to reflect a separate version or in-process state. These versions help you compare designs, track costs, and develop process plans.
- Because change and flexibility are keys to effective design, the importance of configurations to the designer cannot be overstated and SolidWorks is the only product among powerful, easy-to-use 3D CAD products that offers configurations for both parts and assemblies.

Fully Associative Assemblies: Top-down and Bottom-up Design Techniques

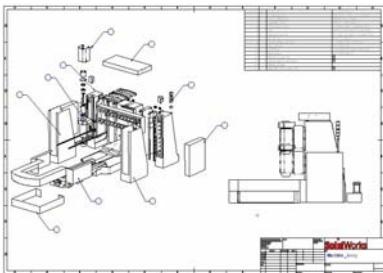
- For medical product design, fully associative assemblies are critical for effectively using bottom-up and top-down assembly design techniques. Associativity guarantees that all elements of a model are electronically associated or connected, including assembly models, components, drawings, details, and bills of materials. This means that when a change is made to any SolidWorks file, that change is automatically made in all associated files.
- Bottom-up associative design encompasses the creation of new components and integration of these with existing components into assemblies. Each of these parts can be edited within the assembly as needed.
- Top-down associative design involves working with an existing assembly to develop new components for use with that assembly. Because new components reference existing parts in the assembly, any changes made to any of the parts are reflected throughout the design. Top-down associative design techniques allow designers to capture design intent easily and automatically, including inter-part relationships. Modifications automatically propagate throughout the assembly and drawings, maintaining design intent.
- Examples of top-down design include developing an enclosure for a PCB assembly that provides a certain clearance around the board, generating a maximum envelope (length, width, and height) for a PCB within a required finished product size to guide board designers in developing necessary controls, and developing a wiring harness to link key components that fits between other components. The ability to perform these types of tasks from within an assembly through continuous relative reference between existing parts and the new parts saves time. Configuration Management enables these new parts to be linked and related to ensure that the new



This shockwave lithotripsy system for noninvasive kidney stone treatment required mechanical and electronic design involving thousands of parts. (Design data courtesy of Medstone International, Inc.)



SolidWorks enables designers of equipment such as this surgical table to evaluate the range of motion of their mechanisms. This often improves product quality and development speed. (Design data courtesy of ALM-Groupe GETINGE)



SolidWorks capabilities provide for standard view drawings (three views or any combination of views — user selectable), which are automatically generated from the model or assembly with bill of materials included. Additional views can be easily added including new breakout section views and unique Alternate Position View Technology (patent pending) that enables documentation of a range of motion.

parts will always fit the necessary requirements of the design (also see *Configuration Management*).

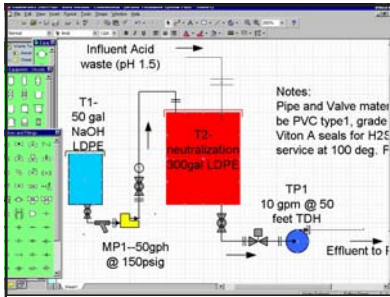
- SolidWorks software provides powerful top-down capabilities that allow designers to build in design intent easily.

Large Assembly Performance

- The ability to handle assemblies with thousands of parts without compromising performance is a requirement of 3D CAD solutions for designing large electronic products, such as MRI and CAT scanning machines.
- The ability to manage large assemblies easily allows product designers to take on a broader range of projects and gain greater flexibility in solving design problems.
- The challenges associated with large-assembly medical product design are often unpredictable and complex. SolidWorks 3D modeling software, with its Large Assembly Mode, offers unparalleled performance for applications involving a large number of parts, allowing product designers to design and assemble tens of thousands of components and evaluate complete assemblies.
- SolidWorks provides built-in tools for evaluating assembly designs, including motion simulation and visualization (Physical Simulation), interference checking, collision detection, clearance information, and creation of envelopes for defining the full range of motion for an assembly. These tools help product designers identify necessary changes in assembly development, which can be easily made using simple drag-and-drop assembly structure reorder operations.
- Many manufacturers accelerate development through concurrent design approaches where several designers or teams work at the same time on separate components or subassemblies of a large assembly. SolidWorks 3D modeling software supports concurrent design, providing powerful capabilities that enable Configuration Management, top-down design techniques, and design collaboration.

Production-level Drawings

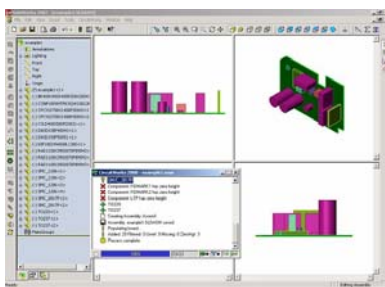
- Production-level drawings communicate detailed design information, such as varied design views, dimensions, surface finish requirements, assembly instructions, and other pertinent design information required for manufacturing.
- Accurate and efficient creation and modification of drawing information is paramount for product designers. Many medical product design organizations rely solely on drawings to provide processing information to production groups, such as machining departments, mold builders, stamping departments, and assembly operations. Accuracy, completeness, and flexibility are essential for meeting the requirements of these groups.
- SolidWorks production-level drawing and detailing capabilities enable faster and more accurate development of drawings, including automatic generation of drawing and section views with breakout section views as well as development of bills of materials.



Create production-level drawings rapidly with SolidWorks software, including wiring, electronic, and functional diagrams using optional Microsoft Visio, which runs inside SolidWorks.



The ability to visualize designs in 3D and catch potential design problems before going into production saves time and money for product developers. (Design data courtesy of Medi-Ject Corporation)



CircuitWorks software from Zeal Solutions enables product designers to generate SolidWorks 3D models of PCB assemblies automatically from industry standard ECAD data. These models can then be used as the basis for product design.

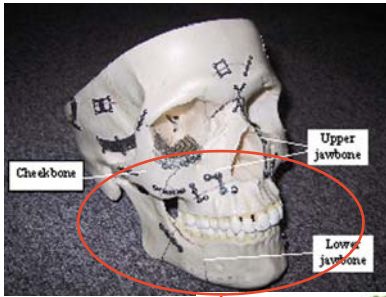
- SolidWorks drawings are fully associative, ensuring that changes made anywhere in the process automatically update all project documentation, including parts, assemblies, and drawings. Integrated links to Microsoft® Visio® 2002 Professional Edition provide for standard technical symbols and best-in-class wiring/hydraulic diagram development. SolidWorks continues to innovate in the area of production drawings with Alternate Position View, which enables a range of assembly motion to be documented in a single drawing view.
- eDrawings is another innovative SolidWorks product that provides the ability to communicate intelligent drawing and model information created in SolidWorks to non-SolidWorks users via email (see *SolidWorks Collaboration Tools* section for more information). www.solidworks.com/edrawings/

3D Visualization

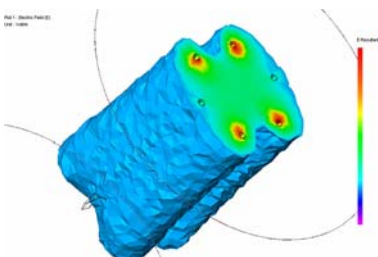
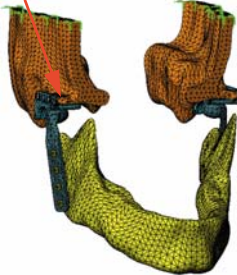
- 3D visualization provides a designer with a first check of design intent, proper operation, and aesthetics as the project develops.
- 3D CAD enables the designer to view a product design from all angles and examine the internal parts of the product throughout the design process. This gives designers a clear and accurate review of parts and assemblies early in the design cycle.
- 3D visualization reduces communication and fabrication errors, saving development time by more effectively conveying design information so that designers can find problems early in the design cycle. Designers can view the product from all sides and look inside by hiding the outer enclosure or other parts.
- SolidWorks enables checks for interferences or specific clearances between components using Dynamic Assembly Motion and Collision Detection. Any interference will stop motion between parts that contact and the point of interference will be highlighted by changing color. Physical Simulation takes motion checking to the next level by presenting meshing parts, such as meshing gears, and showing their operation in the assembly. Exploded assemblies support evaluation of product assembly considerations prior to building parts.
- SolidWorks Office Professional includes PhotoWorks™, SolidWorks Animator, and 3D Instant Website software, that enable even greater visualization capabilities by providing photorealistic rendering, full-motion animation, and web-based presentation of the finished product design. These capabilities help identify potential problems early in the design cycle, when design changes are relatively easy and inexpensive to make.

Integrated Solution Partner Products

- Available best-in-class partner solutions are fully integrated into the core SolidWorks 3D modeling software to offer a complete, single-window approach to medical product design.
- SolidWorks software development focuses solely on 3D design tools to ensure continuous innovation. CAD companies that build strong ties to Solution Partners for best-in-class, extended solutions —



Powerful COSMOS™ analysis tools from COSMOS (the analysis business unit of SolidWorks) help product designers optimize SolidWorks 3D models such as the artificial jaw joints used in this jaw reconstruction. (Design data courtesy of Okayama University)



CosmosEMS™ software provides powerful electric field strength optimization techniques frequently used in medical product design. (Design data courtesy of Genetronics)

such as finite element analysis (FEA), computer-aided manufacturing (CAM), product data management (PDM), and kinematics —

make sure that development is done by the companies best suited for the job. The results are more complete product design and development solutions.

- SolidWorks provides an unmatched selection of Solution Partner products plus the highest level of add-on product integration in the industry. Certified Gold Products offer the look-and-feel of SolidWorks software, simplifying learning and use and extending best-in-class functionality. All Certified Gold Products offer single-window integration with SolidWorks, are fully associative, and undergo a rigorous testing and certification process by SolidWorks to ensure compatibility with every release of SolidWorks.

Electronic-oriented tools: CircuitWorks from Zeal Solutions offers a SolidWorks Certified Gold Product solution that enables the merging of 2D IDF format PCB data and component 3D data to build complete 3D models of PCB assemblies. These exact models result in optimized packaging designs with minimum envelope sizes.

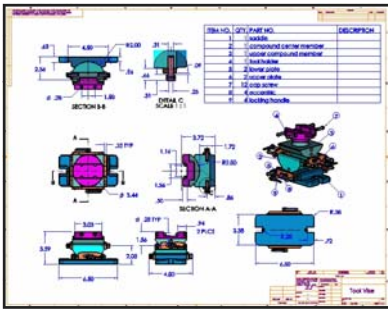
Analysis tools: Designers can now run initial stress analysis checks on their part designs up-front using COSMOSXpress™ FEA software from COSMOS (the analysis business unit of SolidWorks) that is included with every license of SolidWorks. Optional COSMOS products in the COSMOSWorks™ analysis software product line enable thermal, buckling, non-linear, and electromagnetic analysis. Partners such as MSC.Software (MSC.visualNastran FEA for SolidWorks) also provide Certified Gold Product Solution analysis product products for use with SolidWorks. COSMOSFloWorks™ from COSMOS provides CFD (computational flow dynamics) analysis for flow and heat transfer applications.

Kinematics tools: Kinematics analysis is helpful for developing products requiring complex motion including complex packaging access panels requiring easy product maintenance. COSMOS (COSMOSMotion™) and Certified Gold Product Solution Partner Solid Dynamics (MotionWorks) offer these type of analysis tools.

CAM tools: After the design is complete, CAM (computer-aided manufacturing) products provide part checking and machine programming capability for tool path generation with TekSoft CAD/CAM Systems offering their Certified Gold Product CAMWorks™.

PDM (product data management) solutions: These products provide complete document and file control for the entire development project and are available from a number of Gold and Solution Partners.

For a complete listing of SolidWorks Solution Partner products, please refer to the “Partner” section of the SolidWorks web site at www.solidworks.com.



An easy-to-email [eDrawings](#) file offers shaded views, animations, and innovative navigation capabilities that allow recipients to understand 2D drawings and 3D models better.



[3D Instant Website](#) enables design communication worldwide. You can publish to a hosted web site instantly.



[PhotoWorks](#) enables a wide range of surface reflections, lighting sources, backgrounds, textures, decals, and other photorealistic effects. (Product design data courtesy of Life Measurement, Inc.)

SolidWorks Collaboration Tools

- Design collaboration has become an increasingly important part of the product development process, enabling designers to share designs easily with anyone, anywhere.
- Collaboration tools offer new ways for product designers to work more effectively with other members of the development team. The ability to share design resources over the Internet benefits all product designers, from independent consultants to engineers in large multinational corporations.
- SolidWorks provides innovative collaboration tools that enable the machine designer to convey 2D and 3D product design information to colleagues, customers, and suppliers easily and efficiently. SolidWorks collaboration tools include: eDrawings Professional, and 3D Instant Website.

eDrawings Professional is the first email-enabled communication tool that dramatically eases the review of 2D and 3D design information across your extended product development teams. With eDrawings Professional you can generate accurate representations of 2D and 3D models that anyone can view, mark up, and measure without having to purchase their own markup tools. eDrawings files provide an effective means of communicating 2D and 3D design information to customers, vendors, collaborators, production personnel, and everyone else involved in the product development process. www.solidworks.com/edrawings/

3D Instant Website provides the capability to publish product design data to a live web site of interactive 3D design content. A few simple mouse clicks from within SolidWorks allow a designer to publish a SolidWorks model to a web site and communicate the design to the entire work team, including other designers, manufacturing staff, marketing management, purchasing agents, suppliers, and customers. Visitors to the site can easily view, rotate, zoom, and evaluate the design as well as offer comments. www.solidworks.com/3dinstantwebsite/

SolidWorks Design and Productivity Tools

- SolidWorks offers a unique degree of integration with add-on solutions, supplying valuable functionality beyond that found in the core CAD product. These solutions operate from within SolidWorks and can be added at any time to meet new or existing needs.
- [SolidWorks Office Professional](#) combines the full functionality of SolidWorks CAD software with the following design communication, CAD productivity tools, and data management tools:

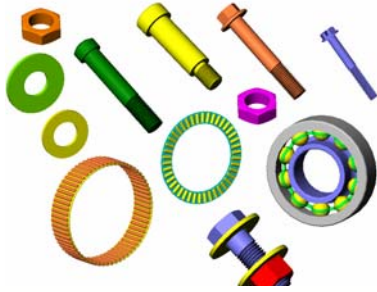
SolidWorks Office Professional Design Communication Tools Demonstrate more effectively how products look and perform with SolidWorks design communication tools:

SolidWorks Animator— animation software for creating compelling AVI files from SolidWorks parts and assemblies.

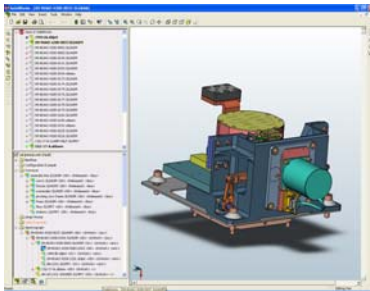
PhotoWorks— rendering software for creating photorealistic images.

3D Instant Website— an easy-to-use tool for publishing live web sites with 3D interactive content.

eDrawings Professional— tools necessary to visualize, interpret, measure, mark up, and expedite the review of 2D and 3D product designs across your extended design team.



The [SolidWorks Toolbox](#) product offers a time-saving library of standard fasteners, bearings, structural steel shapes, and cam design tools.



[PDMWorks](#) provides tools to define and organize projects, easily check documents in and out of a vault, control document ownership and manage revisions. PDMWorks will automatically handle all SW file relationships. Additionally, non-SW documents can easily be managed and linked to relevant documents and projects.

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SolidWorks Office Professional CAD Productivity Tools

Reduce design steps with SolidWorks CAD productivity tools:

SolidWorks Toolbox— a time-saving library of standard parts providing automated assembly through SolidWorks Smart Part Technology

SolidWorks Utilities— productivity enhancement software for working more efficiently in collaborative environments that require multiple design changes

FeatureWorks— feature recognition software for simplifying the reuse of 3D CAD data created in various file formats

SolidWorks Task Scheduler— automation of resource intensive tasks, such as batch printing, running of analyses, and updating of project files during periods when you will be away from your workstation

SolidWorks Office Professional Product Data Management

Organize, vault, and control project data for use by all team members involved with the product

PDMWorks™— offers production proven product data management solution that is uniquely adapted to the requirements of SolidWorks® engineering workgroups. Easy to set up and use, PDMWorks allows your design team to control CAD file revisions and manage all project data more efficiently.

- **Specialty Productivity Tools**

(optional for SolidWorks Office Professional)

SolidWorks Routing – a fast routing tool and part library for designs involving piping, tubing, and cabling systems

SolidWorks MoldBase – a complete library of injection mold base models for use in SolidWorks

For additional information about SolidWorks and its products, checkout the online **SolidWorks Express** newsletter at:

<http://www.solidworks.com/swexpress/index.html>.

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Recent Industry Awards:

CADALYST magazine:	National Design Engineering Show Best-of-Show Award (2002)
CADENCE magazine:	National Design Engineering Show Show Stopper Award (2002)
Design News magazine:	Best Product of 2001 (March 2002)
CIM 2001 Show-UK:	Best-of-Show Award
UPSIDE magazine:	Hot 100 for 2001
START magazine:	Hottest Companies 2001
National Design and Engineering Show:	Best-of-Show (2001)
CADALYST magazine:	NDES Best-of-Show Award (2001)
CADENCE magazine:	NDES Show Stopper Award (2001)