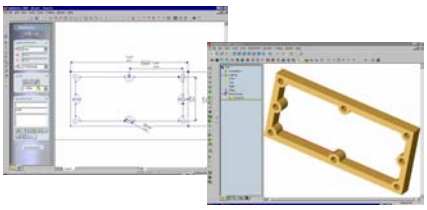
SolidWorks

The Standard in 3D

**This guide addresses the following topics:**

- Leveraging legacy design data to speed projects
- 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, CAD 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 Electronic Product Designers

3D CAD solutions are revolutionizing the electronic product design industry by speeding development of innovative products that can be easily customized to meet specialized requirements.

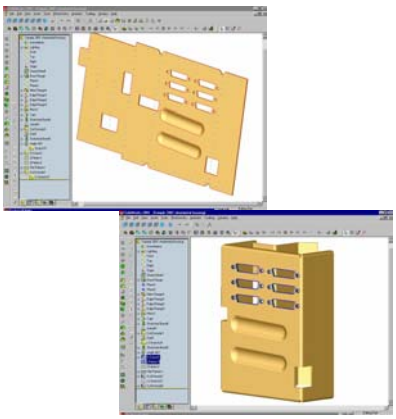
Your choice of 3D CAD tools is critical to your organization's ability to compete effectively in this challenging business environment. This guide identifies key issues and explains advantages of SolidWorks® 3D modeling software for electronic product designers.

## Leveraging Legacy Data

- Electronic 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.
- SolidWorks 3D CAD software offers the widest number of data translation formats of any CAD solution. Supported formats include DWG, DXF™, IGES®, STEP, SAT (ACIS™), STL, Parasolid®, Pro/ENGINEER®, Unigraphics®, PAR (Solid Edge™), VDAFS (VDA), Mechanical Desktop®, IPT (Autodesk Inventor®), CGR (Catia®), HCG (highly compressed graphics), Viewpoint, RealityWave, TIFF, and JPG.
- Designers migrating to SolidWorks from 2D AutoCAD® will greatly benefit from new functionality including powerful view folding, which enables legacy 2D drawing views to be used 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) further speeds design work by searching the incoming file data for features, such as bosses, holes, ribs, sheetmetal features, and fillets. These features are then inserted in the SolidWorks FeatureManager® design tree, as native SolidWorks features, for easy modification, reordering, and other standard SolidWorks operations. (Please refer to the *SolidWorks Integrated Solutions* section for more details on SolidWorks Office and FeatureWorks.)
- The ability to use these data formats helps designers leverage legacy data, work side-by-side with designers who use other CAD systems, speed development, and increase financial returns. Access to many sources of legacy data gives the product designer greater flexibility in responding to market needs and customer requirements.

## Enclosure Design Tools

- Designers responsible for packaging all types of electronics 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-



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

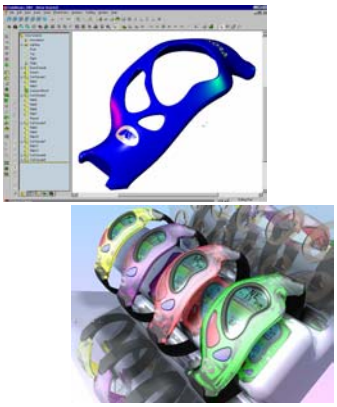
molded parts and molds. Package designs can also require integration with existing parts and assemblies.

- 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 general 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.

- Designers can now run initial stress analysis checks on their part designs up-front using COSMOSXpress™ FEA software from COSMOS™ that is included with every license of SolidWorks. Optional COSMOSWorks™ analysis software products enable additional analysis including thermal, buckling, non-linear, and electromagnetic.



**Surfacing, sophisticated filleting, and other design tools in SolidWorks enable fast development of sculpted shapes, which are often used in consumer products.**

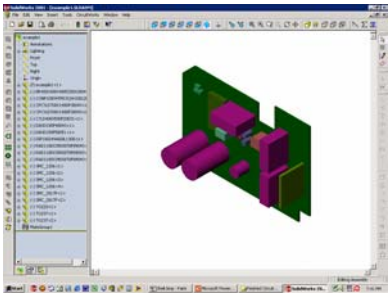
## Configuration Management

- 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.

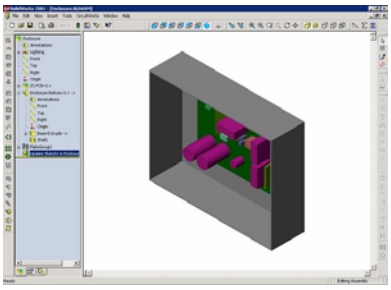
- Configuration Management enables the generation of multiple versions of parts, assemblies, and drawings in a single document with a minimal amount of time and effort. Configurations make use of design tables, derived design data, component properties, relationships, viewing states, and other attributes, storing part and assembly information in one area for greater efficiency. SolidWorks offers multi-level 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 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.



**An example of configurations within SolidWorks is the generation of multiple versions of a PCB assembly using design tables. Each PCB version is an entry in the table (row), and the choice of part, part location, or other parameter for the version is an entry in each column of the row. With this approach, all required PCB variations are created from a single design.**



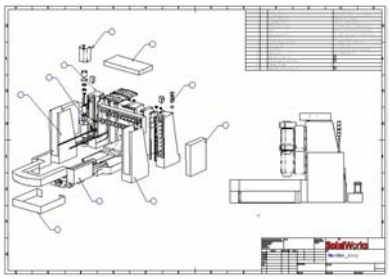
**Top-down assembly enables parts to be developed within the context of an assembly. In this case, a simple enclosure is generated around a PCB assembly with a specified 1" offset from the edges of the board. Any changes to the PCB in the future will result in this enclosure changing so this 1" offset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

- "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.

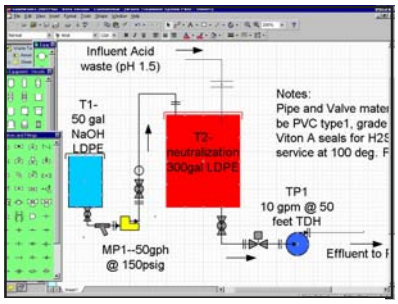
## Fully Associative Assemblies: Top-down and Bottom-up Design Techniques

- For electronic package 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.
- SolidWorks software provides powerful top-down capabilities that allow designers to build in design intent automatically and painlessly.
- 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 har-

**Designed by Bucyrus International, Inc. using SolidWorks software, the Bucyrus® Model 795B Electric Rope Shovel has more than 60,000 parts, including extensive wiring and controls.**



**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.**




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

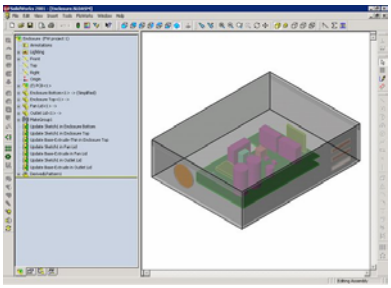
ness to link key components that fits between other components. Configuration Management enables these new parts to be linked and related to ensure that the new parts will always fit the necessary requirements of the design which helps prevent design problems. (also see *Configuration Management*).

## Large Assembly Performance

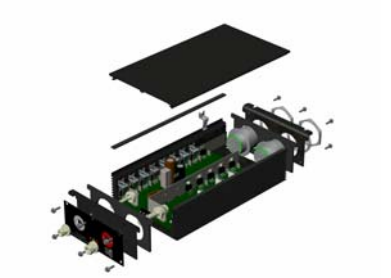
- The ability to handle assemblies comprising thousands of parts without compromising performance is a requirement of 3D CAD solutions for designing large electronic products, such as computers and network switching panels.
- The capacity to manage large assemblies easily allows product designers to take on a broader range of projects and gain greater flexibility in solving design problems.
- The challenges associated with large-assembly electronic 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 an assembly's motion. 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 support Configuration Management, top-down design techniques, and design collaboration.

## Production-level Drawings

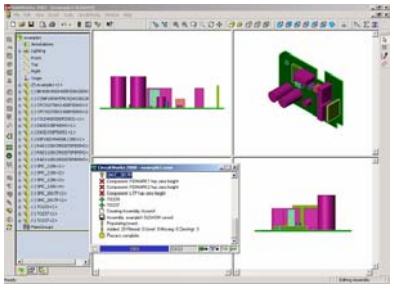
- Production-level drawings communicate detailed design information, such as varied design views, dimensions, surface finish requirements, assembly instructions, and other pertinent design information required for manufacturing.
- Accurate and efficient creation and modification of drawing information is paramount for product designers. Many electronic 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.



**SolidWorks enables outside enclosures to be made transparent or hidden to visualize internal details of a design as a first-level check of design intent.**



**SolidWorks assemblies can be exploded to show all parts and assembly orientation. SolidWorks Animator can be used to create quick, high-quality animations of product operation and assembly for presentations or employee training purposes. (Design data courtesy of Soft Switching Technology, Inc.)**



**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.

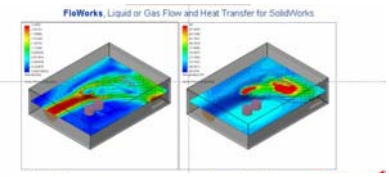
- SolidWorks enables checks for interferences or specific clearances between components using Dynamic Assembly Motion and Collision Detection. Any interference will stop motion between parts that contact and the point of interference will be highlighted by changing color. Exploded assemblies support 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 and full-motion animation 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.

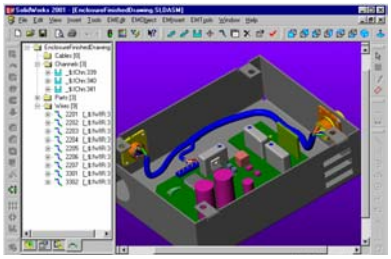
## Integrated Solution Partner Products

- Available best-in-class partner solutions are fully integrated into the core SolidWorks 3D CAD software to offer a complete, single-window approach to electronic product design.

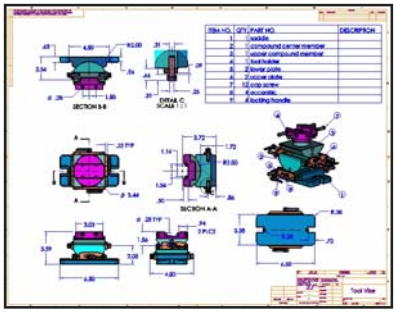
- SolidWorks software development focuses solely on 3D design tools to ensure continuous innovation. CAD companies that build strong ties to Solution Partners for best-in-class, extended solutions — such as finite element analysis (FEA), computer-aided manufacturing (CAM), product data management (PDM), and kinematics — make sure that development is done by the




**Only SolidWorks Gold Certification ensures single-window, fully associative integration with best-in-class add-on solutions. For example, COSMOSFloWorks™ CFD analysis software solution, provides color-coded output, highlighting hot spots in a circuit design and helping designers address potential problems.**



**EmbassyWorks from Linius Technologies, Inc. provides advanced wire harness design for electronic packaging designers.**



**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.**

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: 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.

  Wiring harness design tools: EmbassyWorks from Linius Technologies, Inc. provides the capability to design a wiring harness for a product automatically from interconnection data. It also enables manual harness design by routing from point to point.

  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 CADCAM Systems offering their Certified Gold Product CAMWorks™.

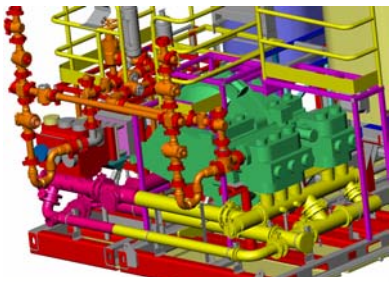
  PDM (product data management) solutions: These products provide complete document and file control for the entire development project and are available from a number of Gold and Solution Partners.

  For a complete listing of SolidWorks Solution Partner products, see the "Partner" section of the SolidWorks web site at www.solidworks.com.

## 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

**3D Instant Website enables design communication world-wide. You can publish to a hosted web site instantly.**



**The SolidWorks Piping add-on solution enables faster design of assemblies with piping components, such as pump skid systems. (Image courtesy of Halliburton Energy Services)**

**PhotoWorks enables a wide range of surface reflections, lighting sources, backgrounds, textures, decals, and other photorealistic effects. (Product design data courtesy of Product Resolutions, Ltd.)**

product designers, from independent consultants to engineers in large multinational corporations.

- SolidWorks provides innovative collaboration tools that enable the product designer to convey 2D and 3D product design information to colleagues, customers, and suppliers easily and efficiently. SolidWorks collaboration tools are part of SolidWorks Office Professional including 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, 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 engineering, manufacturing, marketing, purchasing, 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/

- This entire group of tools is unmatched in the CAD industry and integrated with SolidWorks products to greatly increase speed of communication and development of electronic products.

## SolidWorks Design, Productivity and PDM Solutions

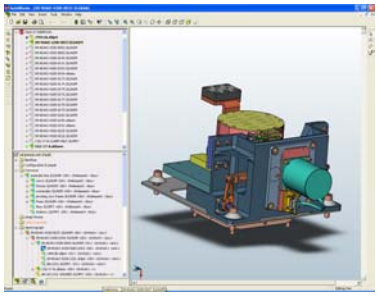
SolidWorks offers a unique degree of integration with add-on solutions, supplying valuable functionality beyond that found in the core CAD product. These solutions operate from within SolidWorks and can be added at any time to meet new or existing needs.

- **SolidWorks Office Professional** combines the full functionality of SolidWorks 3D modeling software with the following design communication, CAD productivity tools, and data management tools:

  **Design Communication Tools**

  Demonstrate more effectively how products look and perform with SolidWorks design communication tools:
  **eDrawings Professional**— tools necessary to view, interpret, mark up, measure, and expedite and review 2D and 3D product design data across your extended design team
  **SolidWorks Animator**— animation software for creating compelling AVI files from SolidWorks parts and assemblies
  **PhotoWorks—** tools for creating photorealistic images
  **3D Instant Website—** an easy-to-use tool for creating and publishing live web pages with 3D interactive content

**SolidWorks Toolbox add-on product offers a time saving library of standard fasteners, bearings, structural steel shapes and cam design tools. 3D Content Central is a free service from SolidWorks, that complements Toolbox by offering 2D & 3D CAD models from users and manufacturers.**



**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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**CAD Productivity Tools**

Reduce design steps with SolidWorks CAD productivity tools:
**SolidWorks Toolbox—** automate assembly tasks with a library of standard parts using SolidWorks Smart Part Technology
**FeatureWorks—** feature recognition software for simplifying the reuse of 3D CAD data created in various file formats
**SolidWorks Utilities—** productivity tools for finding and displaying differences between product designs

**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.

- **SMARTEAM® Enterprise PDM** ***(optional with SolidWorks)***
  SMARTEAM provides a product information collaboration solution specifically designed for the Electrical and Electronics business environment. SMARTEAM for Electronics is for manufacturers who combine electronic components into their mechanical assemblies along with multiple MCAD and ECAD applications. SMARTEAM manages and automates the engineering design workflow and BOM for mechanical design, electrical design, and product software.
  http://www.solidworks.com/html.smarteam.cfm

- **Specialty Productivity Tools**
  **(*optional with SolidWorks Office Professional*)**
  **SolidWorks Piping** – a fast routing tool and part library for designs involving piping and tubing 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)** |