

SELECTING A **3D SOLUTION** THAT HELPS YOU DESIGN BETTER PRODUCTS



THE 2D TO 3D CAD TRANSITION GUIDE





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Opportunity Knocks



In today's competitive manufacturing environment, more and more companies are choosing to replace their traditional 2D design tools with modern 3D product development systems. Although the move to 3D

CAD began more than a decade ago, the pace of the migration from 2D to 3D has accelerated in recent years. Advances in computer hardware and software technologies have resulted in faster, easier-to-use, and more affordable 3D solid modeling platforms. The emergence of a computer-literate workforce has established a labor pool that is more productive using 3D tools. Improving productivity and increasing operational efficiencies have become key competitive advantages that drive success in the global manufacturing economy.

But the most important reason for the trending migration from 2D to 3D design is that the benefits of using 3D for product development have become unquestionably real. 3D CAD software and hardware technologies are faster, more powerful, and have matured to the point at which the advantages of 3D — namely, shorter design cycles, reduced development costs, improved product quality, increased product innovation, and faster times-to-market — are well-documented and no longer topics for debate. 3D CAD is now a proven, market-tested solution, providing a reliable return on investment (ROI) for the product development and manufacturing enterprises of the 21st century.

Industry studies — such as The Aberdeen Group's "The Transition from 2D Drafting to 3D Modeling Benchmark Report (September 2006)" — show that the move from 2D to 3D produces greater efficiency, increased productivity, faster times-to-market, more innovative products, lower development costs, fewer engineering change orders (ECOs), less scrap, and fewer design errors. The key to realizing these benefits and maximizing the ROI of a 3D CAD platform is to carry out a complete assessment of a product development organization's product design and manufacturing requirements in concert with a thorough evaluation of the capabilities of available 3D workstations. This guide is designed to help designers, engineers, and product developers understand the important issues you should consider in choosing the best combination of hardware and 3D CAD software to maximize the benefits and ensure the success of a 2D-to-3D migration.

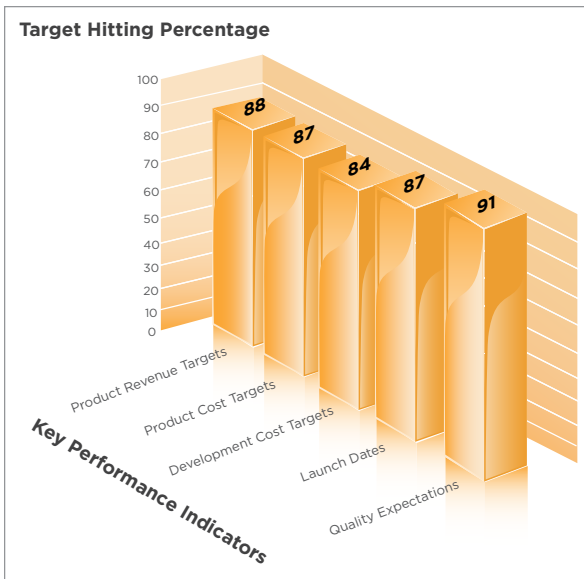
CONSIDERATIONS FOR CHOOSING THE RIGHT 3D SOLUTION

While moving from 2D to 3D CAD can provide important advantages for product development and manufacturing organizations, fully maximizing the benefits of 3D and recovering ROI in a timely manner require a smooth, efficient, and effective transition. If an organization chooses the wrong 3D solution for its needs, runs its 3D CAD software on uncertified hardware, or fails to develop a formal 3D implementation plan, migrating to 3D can actually create the opposite of the intended result.

Conversely, if a manufacturer exercises due diligence in its assessment of its development needs,

evaluates those requirements against the capabilities of available 3D solutions, and develops a transition plan that minimizes operational disruptions, the potential benefits associated with moving to 3D can be truly dramatic. Choosing the right 3D solution, including the appropriate combination of hardware and software, demands a thorough understanding of what an organization's challenges are at every phase of the product development process, of how 3D CAD tools can provide solutions to those challenges, and of how particular hardware configurations can impact performance.

By examining the following topics in the context of your own unique product design and development processes, you can generate the information you need to choose the best 3D CAD software and hardware solution for your particular requirements and facilitate an orderly, rewarding transition from 2D to 3D.



Best-In-Class Manufacturers Hit Performance Targets Using 3D

Source: Aberdeen Group. The Transition from 2D Drafting to 3D Modeling Benchmark Report (September 2006).

SUCCESSFUL 2D TO 3D MIGRATIONS

Team Alinghi

A leading designer and manufacturer of racing yachts for the America's Cup and other professional races, Team Alinghi decided to convert its yacht designs from static 2D AutoCAD® drawings to 3D parametric design data to improve

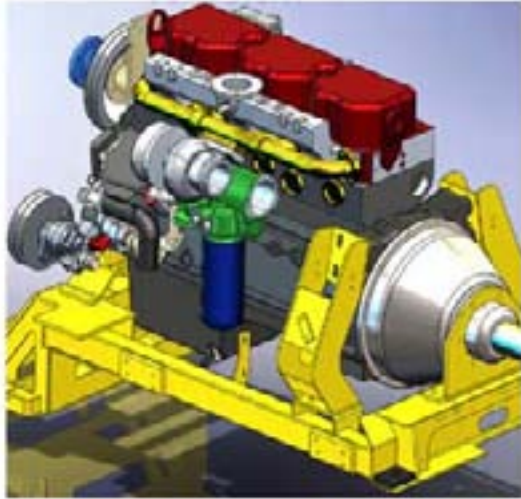


efficiency, work better with suppliers, and streamline component development. The company needed a 3D modeling package that was easy to use and affordable in order to compress development times, minimize errors, and improve quality. Team Alinghi chose SolidWorks® 3D CAD software.

"SolidWorks allows us to collaborate on designs efficiently and accurately with our suppliers, which reduces production times and lets us quickly begin testing the boat on the water," says Designer Aaron Perry. "Loading and saving SolidWorks parts is very fast with the Dell™ Precision™ workstation.

"It's improved the performance of large SolidWorks assembly models."

- **Reduced mold development time**
- **Improved ability to fix tolerance and alignment errors**
- **Enhanced design communications with eDrawings®**
- **Designed the first European yacht to win the America's Cup in 153 years**
- **Uses SolidWorks 3D CAD software on a Dell Precision workstation**



The complexity of modeling designs in 3D, such as these models created with SolidWorks software, can vary greatly. For example, the capabilities required to develop large assemblies comprising numerous individual components are quite different from the surfacing tools necessary for producing rounded organic shapes.

COMPLEXITY OF MODELING TASKS

The first question you should ask yourself is how complex are your company's modeling needs? Do you design simple parts, organic shapes, or sophisticated assemblies? Do the geometries you create require advanced surfacing and modeling capabilities? Do you need to develop molds and tooling in addition to product designs? Do you need to configure product families from a single design?

In order to assess whether a particular 3D CAD workstation is attuned to modeling your products, you should take a snapshot of your current and future modeling needs. It is important not only to assess the *status quo* but also to make sure the platform provides modeling capabilities that will carry you forward, help your organization grow, and sustain efforts

to boost creativity and innovation. The same deliberate approach can help you to assess appropriate computing configurations for running a 3D

CAD workstation. The nature of your modeling needs will dictate the level of computing power you need. Look for workstations that provide the fastest reliable multi-core processors, memory overhead, and advanced OpenGL® 3D graphics. To extend your productivity on complex work it makes sense to buy as much CPU and GPU processing power as you can afford.



The greater the complexity of your modeling tasks, the greater your computational requirements become.

**3D
TIP**

LARGE ASSEMBLY REQUIREMENTS

Are large assemblies a critical part of your product development process? How large are your assemblies: less than a thousand components or well into the several thousands of individual parts?

Can the 3D solution — both hardware and software — handle large, complex assemblies efficiently? Are there dynamic motion tools for assessing fit, tolerance, and interference issues, or evaluating the effects of motion and movement within an assembly?



Sizing large assembly requirements will help you select the right workstation. You should also assess whether your 3D CAD system facilitates design changes in assemblies through the use of parametric design, which updates associated assembly models, component models, drawings, details, and bills of materials (BOMs) whenever you make a change to any part within an assembly. If your designs include assemblies of more than a thousand parts, you should compare how your assemblies run on different platforms

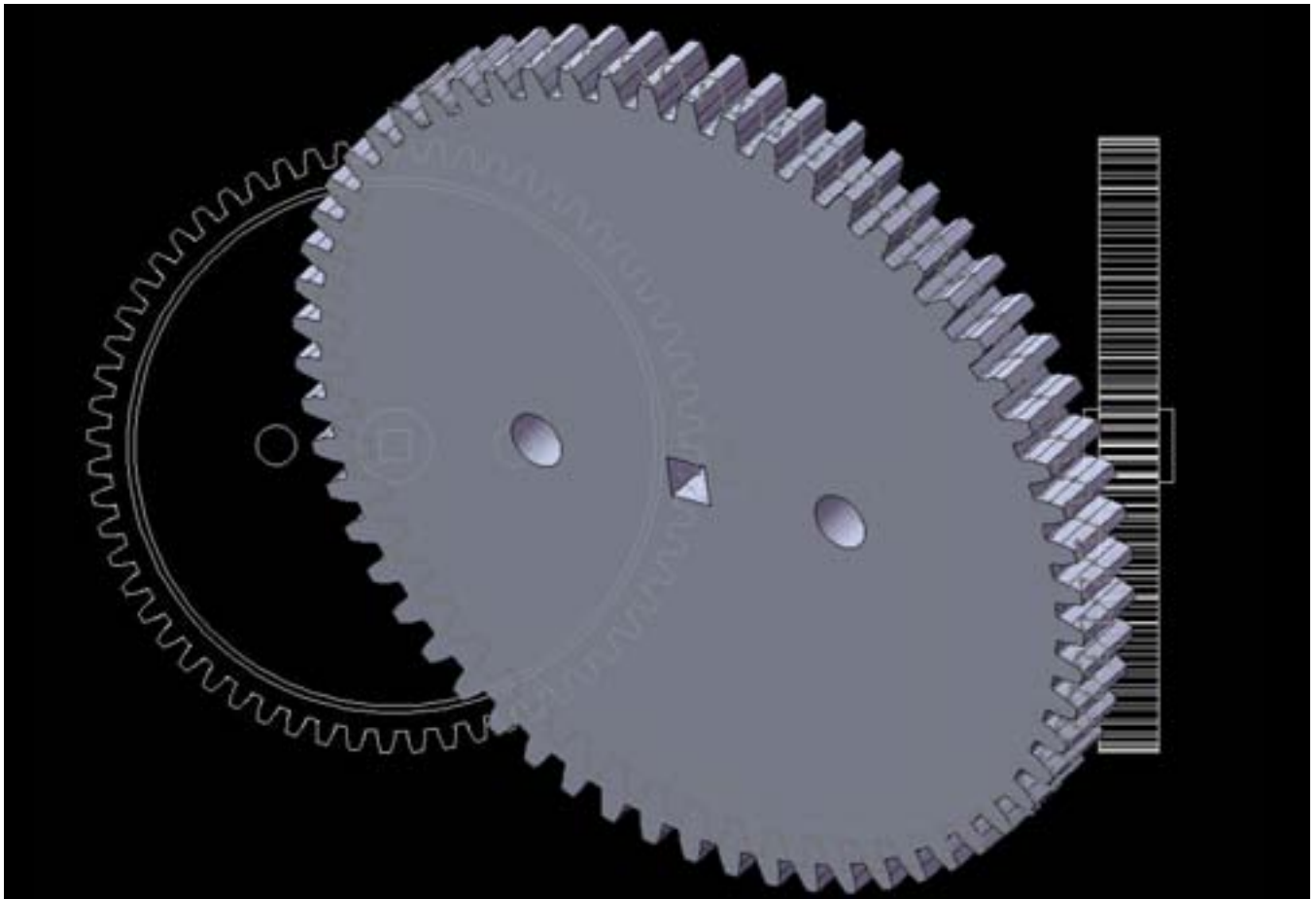
to make sure you do not sell yourself short on functionality. If you plan to open and manipulate large assemblies, make sure to focus on memory (RAM) overhead and OpenGL 3D graphics with plenty of available memory.



The development of large assemblies, such as the SolidWorks models shown here, is not only easier but also more accurate in 3D.

**3D
TIP**

As the part count rises, so do your computing needs.



Tools that support the conversion of 2D legacy drawings into 3D models, such as using DWGeditor® with SolidWorks software, enable manufacturers to continue to tap the expertise contained in existing designs while increasing innovation in future product development.

LEGACY DATA MANAGEMENT

By its very nature, the move from 2D to 3D will leave you with a large amount of 2D drawings files and related data. Do you intend to start completely anew in 3D or will you continue to utilize 2D drawings? Can the 3D solutions import, view, or edit your existing 2D data? Does your 3D CAD workstation provide product data management (PDM) capabilities that allow you to manage legacy 2D data alongside new 3D designs?

Management of 2D legacy data is an important consideration for any manufacturer making the move from 2D to 3D. The years of engineering expertise contained in your 2D drawings represent the very foundation on which your company operates. The ability to access, work with, or convert legacy 2D drawings is critical to your success. Understanding whether a computing platform can run not only 3D applications but also efficiently manage 2D data is vital because many companies continue to use 2D data in some fashion.

Stay flexible: look for workstations that are industry standard because they will give you more software and peripheral choices and are designed to remain backwards and forwards compatible. Also look for solutions that offer reliable, redundant hard drive options to support a production environment.

System scalability and reliability help you to manage 2D legacy data effectively.

**3D
TIP**



The ability to visualize a design on-screen and evaluate design concepts in the 3D virtual world—before incurring the cost of producing prototypes—helps design engineers using SolidWorks software more fully understand the aesthetic appearance and physical behavior of their designs.

DESIGN VISUALIZATION/VIRTUAL PROTOTYPING

Enhanced design visualization/virtual prototyping capabilities can improve the quality of your products and reduce costs as long as you have the integrated tools required to address your unique needs. If you develop assemblies, does the 3D solution provide fit, tolerance, and interference checking tools so you can resolve part collisions and assembly issues before making a single part? Does the 3D system include integrated analysis tools — such as structural, thermal, kinematics, and computational fluid dynamics (CFD) analysis — to validate the performance of your designs? Can the 3D CAD solution create photorealistic renderings and animations for assessing product aesthetics, obtaining customer feedback, or conducting market research?

The ability to fully understand the behavior of part, assembly, or product designs requires a powerful combination of integrated analysis, visualization, and rendering software, as well as an advanced computing platform that can handle the work. Simulation, animation, and rendering applications are computationally and graphically intensive, so you will want to investigate workstations that support fast, multi-core processors; powerful, OpenGL graphics; and large, memory expansion configurations. Make sure to examine how different 3D software and hardware combinations will support your particular design visualization/virtual prototyping needs.

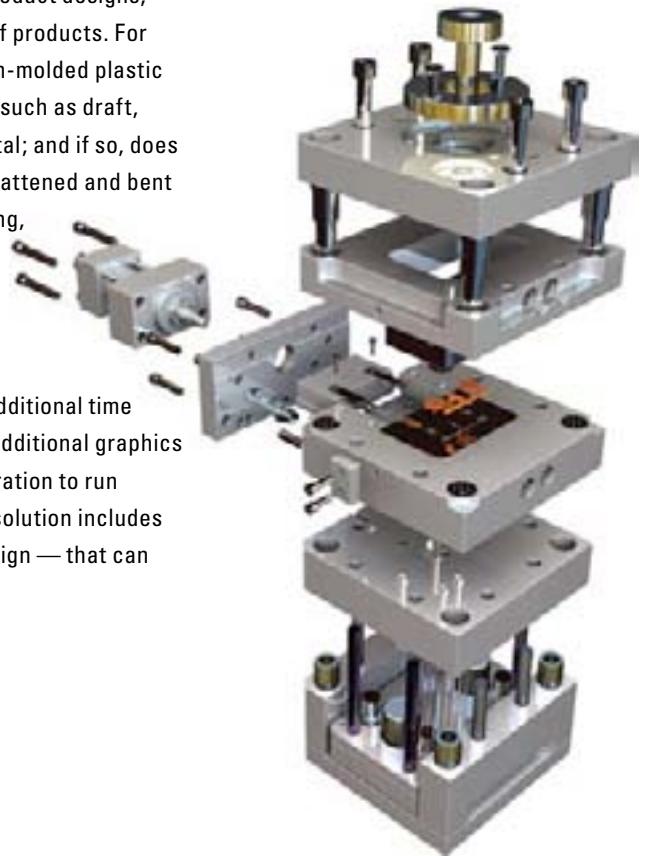
**3D
TIP**

Crunching big numbers and rendering photorealistic models requires real computing power, so do not attempt short cuts or underestimate the requirements for enhanced design visualization and advanced virtual prototyping.

SPECIALIZED DESIGN CAPABILITIES

Although engineers utilize 3D CAD applications to create a myriad of product designs, some packages provide specialized tools for developing certain types of products. For example, most consumer products require molds for producing injection-molded plastic parts. Does the 3D package include dedicated mold development tools, such as draft, mold-flow, or parting-line analysis? Do your products include sheet metal; and if so, does the 3D solution include capabilities for designing sheet-metal parts in flattened and bent states? Do your products include routed systems, such as wiring, cabling, piping, or hydraulic lines, and can the 3D CAD program route these systems quickly and easily?

While general-purpose 3D CAD tools are important, finding a package with the right set of specialized design capabilities can help you save additional time and effort. Many of these specialized design applications also require additional graphics or processing power, so be sure to evaluate the best hardware configuration to run them. Think about some of your product characteristics, and ask if the solution includes specialized tools — such as mold, sheet-metal, and routed systems design — that can help you to automate product design.

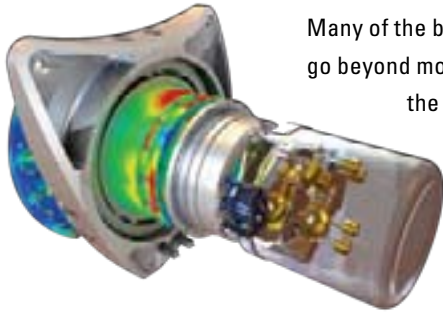


While design engineers can model just about any product using a general-purpose 3D CAD system, specialized capabilities — such as the routed systems, sheet-metal, and mold development tools available with SolidWorks Office Premium software — can provide additional efficiencies.

Specialized design tools often require additional graphics or processing power, so be sure to evaluate the best hardware configuration if you need these tools.

**3D
TIP**

INTEGRATED ENGINEERING/MANUFACTURING/ DESKTOP PRODUCTIVITY TOOLS



With 3D CAD, manufacturers can more easily utilize integrated engineering, manufacturing, and desktop productivity tools, such as the COSMOSWorks® thermal/structural analysis conducted in SolidWorks software shown here.

Many of the benefits of moving from 2D and 3D go beyond modeling geometry and stem from the ability to leverage 3D CAD data to perform other functions, using integrated solutions and desktop productivity tools. Does the 3D solution provide integrated computer-aided engineering (CAE) tools and finite element analysis (FEA) capabilities — such as structural, thermal, kinematics, and CFD analysis — that match your development needs? Is the CAD system fully integrated with computer-aided manufacturing (CAM) software packages? Does the 3D solution include a PDM system for managing, safeguarding, and finding product design data?

In addition to assessing the degree of integration between a CAD system and engineering and manufacturing applications, you should also evaluate the availability of desktop productivity tools, such as automated output of drawings, BOMs, and documentation graphics. Adding capability to your business with the right CAD system need not be complex but make sure to understand the hardware requirements for add-on applications as they may differ from the base modeling packages. You should also investigate your intended 3D hardware's performance capabilities for running 3D CAD software simultaneously and in parallel with integrated engineering and manufacturing applications. It is often easiest to eliminate the guesswork and simply choose hardware that has been tested and optimized for your applications.

**3D
TIP**

Professional CAD application suites require professional workstations to match.

SUCCESSFUL 2D TO 3D MIGRATIONS

Bradford Machine Company

A top precision machine shop specializing in small production runs of complex, high-tolerance parts manufactured from a variety of materials, Bradford Machine Company faced

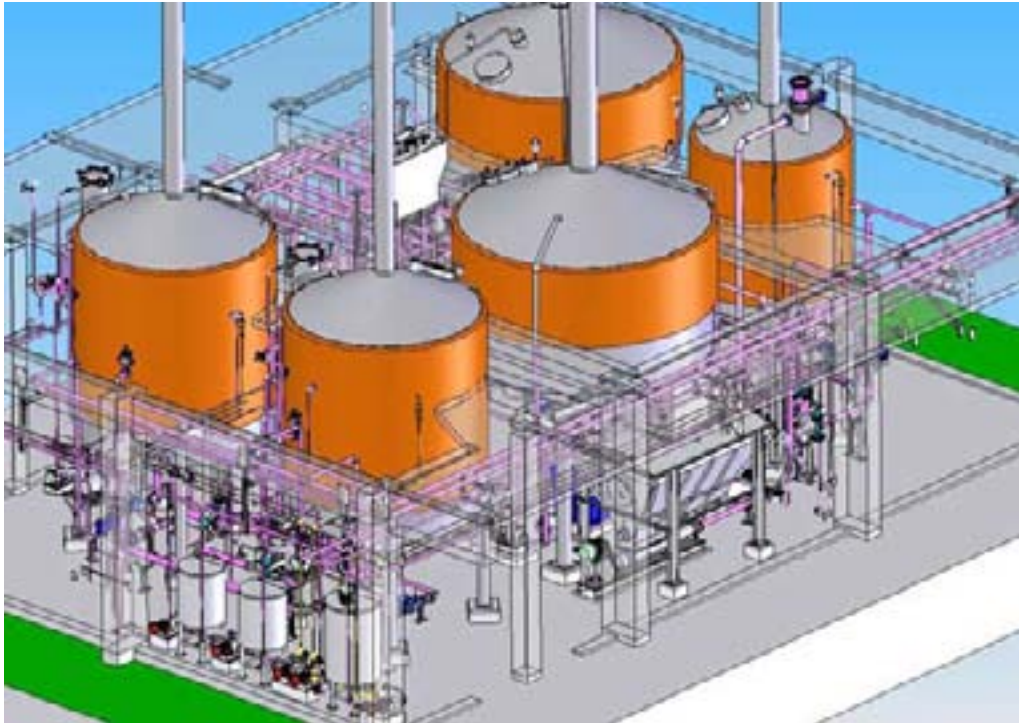


increasing customer demand for 3D CAD capabilities. The company needed to migrate from 2D CAD tools to continue to better meet the needs of its customers. Bradford Machine encouraged more and more of its customers to provide 3D models in order to reduce errors, decrease turnaround time, and improve end-product quality. Bradford Machine migrated to SolidWorks 3D CAD software to take advantage of its broad data compatibility with different kinds of 2D and 3D CAD data.

"We chose SolidWorks for its ability to import and export a variety of file types," stresses

Designer Andy Dunnell. "I run SolidWorks on a Dell Precision mobile computer because we believe it's a good idea to use certified hardware. We have realized dramatic benefits since moving to 3D."

- Shortened product design cycle
- Improved the quality of products
- Reduced prototype fabrications costs
- Substantial scrap reduction through CAM integration
- Uses SolidWorks 3D CAD software on a Dell Precision mobile workstation



The task of designing large-scale assemblies including thousands of individual parts, such as the industrial plant model in SolidWorks shown here, is much faster using 64-bit computing, which provides access to higher amounts of memory and greatly improved large-assembly performance.

32-BIT VERSUS 64-BIT COMPUTING

As this guide indicates the hardware configuration you choose for running your 3D solution is an equally important part of the 3D CAD equation. If you are looking for large amounts of memory and improved performance for tasks that rely on real-number data, such as mechanical design and analysis, a 64-bit operating system is something you might consider.

Generally, the major difference between 32-bit and 64-bit processing is memory support. With more memory, you can run more programs at the same time, and run more memory-intensive programs. As an example, the current 32-bit edition

of Microsoft® Windows® is capable of supporting up to 4 gigabytes (GB) of system memory, whereas Microsoft Windows XP Professional x64 Edition or Windows Vista® Business 64-Bit currently supports up to 128 GB of RAM on select workstations, with the potential to support up to 16 terabytes of virtual memory as hardware capabilities and memory sizes improve.

With large assembly models that total tens of thousands of components CAD users can quickly run up against the 4 GB memory limit on a 32-bit platform. If you are working with assemblies of upwards of 100,000 individual components and with file sizes greater than 10 GB, you might want to consider a 64-bit computing platform, and 64-bit CAD software to match, so your engineers can

tap increased amounts of memory and work efficiently with larger files and assemblies. The other factor to consider in your 2D to 3D transition is legacy applications or dependencies. While many 32-bit applications are designed to work on a 64-bit operating system, you need to verify that an application you plan to use with an x64 operating system is compatible, so contact the specific application provider to verify before you make your decision.

For maximum flexibility, choose a 3D CAD workstation that supports 64-bit applications, operating systems, and memory scalability.

**3D
TIP**



Select Dell Precision workstations and mobile workstations are fully certified for use with SolidWorks 3D CAD software, helping to provide design engineers with the performance, power, and dependability they need to transition effectively to 3D.

CERTIFIED SOLUTIONS

Another important consideration when migrating from 2D to 3D is to make sure the 3D CAD solution is optimized to run on a particular hardware platform and vice versa. General-purpose computers, which are designed for a broad range of tasks and used primarily to run business applications, are typically not configured for the higher performance demands of 3D CAD applications.

You can also help ensure you make the right hardware decisions by using certified hardware. The term “certified,” an industry standard label, is usually granted by CAD software companies to hardware partners that meet their very specific hardware standards. When a hardware or software company certifies a specific partner solution, it means that solution has been tested to help ensure the hardware platform and its individual components work without error. By certifying a particular hardware solution, for example, a software company is attesting to the fact that it has configured and tested a specific workstation platform to run with its CAD software.

Not only does this offer you the best opportunity to purchase a workstation that performs in your environment, it also brings other business benefits. When software and hardware vendors minimize the issue of incompatibility, they help to reduce troubleshooting and issue resolution time, so you can get back to work quickly. That’s a valuable asset when you cannot afford any downtime.

**3D
TIP**

Demand certification, so you do not take chances with a hardware solution that has not been certified or tested with the 3D CAD application you are choosing to run your business.

REMOTE COMPUTING

Unlike the days when designers and engineers resided in a single location, today's manufacturing enterprise is increasingly global in nature with product development offices and engineering talent scattered around the world. When moving from 2D to 3D for product design, it is vital to assess the importance of remote computing needs in terms of both sustaining collaboration among geographically disparate design colleagues and supporting remote workstation needs with customers in the field.

Will your 3D solution enable you to link product development resources around the world by managing access and updates to your 3D product design data? Do you have the right mix of desktop and mobile workstations? This can enable your design and application engineers to run your 3D CAD system in the field when necessary and interact productively with customers. Be sure to evaluate the remote computing aspects of your 3D CAD software as well as your hardware when making this determination.

An effective way to determine what 3D CAD solution will work best for you is to conduct benchmarks of different 3D solutions using your own design data. CAD resellers typically have their own "canned" demos that make the software look impressive and easy to use. But ask your resellers to model one of your actual parts or assemblies and see what happens. If the solution is as powerful and easy to use as they contend, the resellers should be able to model your part in 3D.



More and more design engineers take their work on the road and into the field using SolidWorks 3D CAD software on certified Dell Precision mobile workstations.

Look for a hardware partner that offers both workstation-class desktop and mobile solutions to ensure flexibility and productivity wherever you need it.

**3D
TIP**

SUCCESSFUL 2D TO 3D MIGRATIONS

Rock of Ages Corporation

One of the largest quarriers and producers of granite products in the world, Rock of Ages Corporation used actual hand drawings and 2D AutoCAD design tools before moving to



SolidWorks 3D CAD software running on Dell Precision workstations. Shrinking lead times and demand for faster turnaround on design proposals and projects prompted the company to implement a 3D modeling package in order to produce full production drawings and renderings more efficiently.

"We chose SolidWorks software because it offered an all-in-one modeling, drawing, and rendering solution," recalls CAD Designer Rob Rodriguez. "Our Dell workstations have been good, reliable performers. We count on them to work every day, and they do. Rock

of Ages has standardized on Dell for the entire company."

- **Reduced design time by approximately 40 percent**
- **Realized modeling, drawing, and rendering capabilities in a single solution**
- **Enhanced use of design data as a presentation tool**
- **Increased sales by an estimated 30 percent**
- **Uses SolidWorks 3D CAD software on Dell Precision fixed and mobile workstations**

BENCHMARKS

An even better method to evaluate 3D CAD solutions is to obtain trial, evaluation copies of the CAD software and conduct your own benchmarks internally. Some companies even run two or three CAD systems in parallel on the same project to determine which one works best. In addition to benchmarking different CAD systems against each other, investigate how different hardware configurations affect performance. You can also visit CAD software and computer web sites to access benchmark data for the CAD system itself and various hardware components such as processors and graphics cards.

The only true means for assessing how easy a 3D CAD system is to use is to learn it yourself. But short of investing the time and effort required to do so, you can gain some understanding of an application's ease of use by evaluating the availability and length of the training required, talking with existing users and reference customers, and obtaining and studying the CAD system's tutorials and implementation guide.

**3D
TIP**

While industry standard benchmarks serve as a starting point for choosing a CAD system, testing the software and hardware solution yourself in your actual environment is ideal.

EASE OF USE/TRAINING DEMANDS

How long does it take the average user to become proficient with the system? Are there local training classes available? Does the CAD company offer online training and tutorials? Is there a strong user group community? Is the system used and taught by leading colleges, universities, high schools, and secondary schools? By investigating the training demands and instructional resources available, as well as by communicating with existing users and manufacturers that also made the transition from 2D to 3D, you can develop a strong sense of which 3D CAD system is the easiest to use.



Evaluating the availability and range of training, support, and user group programs, such as those accessible via the SolidWorks Customer Portal, is an important step in determining how easy a 3D CAD system is to learn and use.

**3D
TIP**

Assess both the training demands and available instructional resources for a specific CAD system to determine ease of use.

Next Steps



Manufacturers now have an exciting opportunity to take advantage of the proven benefits of 3D product design by making the move from 2D to 3D. By choosing the powerful, easy-to-use SolidWorks 3D CAD system running on high-performance, certified Dell Precision workstations, product development professionals like you can realize the improved productivity, increased operational efficiency, and greater design

and manufacturing flexibility you need to compete successfully in the global manufacturing economy.

This 2D to 3D CAD Transition Guide is designed to enable you to evaluate 3D CAD software and hardware capabilities against your unique product development needs in a systematic way, so you can begin taking steps toward a successful 2D to 3D CAD migration. In line with other satisfied customers, you too could find that SolidWorks 3D CAD software and Dell Precision workstations offer the best combined solution for transitioning to 3D effectively.

Over 300,000 2D CAD users have already made the move to 3D with SolidWorks software. More than half of new SolidWorks customers upgrade their hardware when they implement SolidWorks software, and more than 50 percent of all SolidWorks customers use Dell computers. The time to move to 3D is now, and designing better products by migrating from 2D to 3D has never been easier.

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