A BETTER WAY TO CHOOSE 3D CAD

A Guide to Evaluating CoCreate® Explicit Modeling Software

With so many 3D CAD solutions on the market, it's hard to determine which one best meets your needs. But it doesn't have to be complicated. This evaluation guide walks you through an easy, three-step process to help you match the best 3D CAD solution to your unique product design process. In this process, you simply:

STEP 1: Identify your design approach

STEP 2: Find a vendor

STEP 3: Choose a 3D CAD system

With the right 3D CAD solution, your company will be more effective, more profitable, and more innovative, so you get the best products to market faster.

3D Product Development

Two mainstream, accepted approaches to 3D design exist within the manufacturing industry: parametric and explicit.

➔ Step 1: Identify Your Design Approach

It's an established fact that there are two mainstream, accepted approaches to 3D design within the manufacturing industry: parametric and explicit. Each approach differs widely from the other, and each offers its own benefits and applications. The trick is determining which approach works best for your company.

CoCreate Modeling, a solution from PTC, Inc., uses the explicit approach to 3D design. With the explicit approach, designers can quickly and easily create 3D designs, and then modify them via 'on-the-fly' interactions with the model geometry. Explicit modeling is by far the most flexible and easy-to-use approach to 3D, so it's ideal for companies who create one-off or highly customized products – products that simply don't require all the extra effort of upfront planning and the embedding of design information within models.

So, is the explicit approach right for you?

To answer this crucial question, you must first consider your company's product strategy, design strategy, and the average development cycle length for new designs. To do this, simply evaluate how strongly each of the following statements describes your company. The more strongly you agree with these statements, the more likely an explicit approach to 3D design is right for you.

Product Strategy

- [ ] My company expects products to evolve in new and unpredictable directions.
- [ ] My company develops one-of-a-kind, new-to-market products.
- [ ] My company develops custom, design-to-order products.
- [ ] My company creates specialized instrumentation and engineer-to-order machinery.

Design Strategy

- [ ] At my company, designers often work concurrently on a large number of design projects.
- [ ] Anyone on our project team should easily be able to pick up existing designs and continue work with them.
- [ ] I often repurpose existing design work to create new, unique product designs.
- [ ] My company's product designs must radically adapt and change to new and shifting design requirements.
- [ ] I can't always anticipate how my product designs will need to change.
- [ ] I need a 3D CAD system that won't limit my ability to respond to unexpected design changes.
- [ ] I like to evaluate a broad range of options as I refine my designs throughout the development process.
- [ ] I need to modify imported design data from any 3D CAD system as if it were native 3D design data.
- [ ] My company's extended suppliers and/or partners send us product design data from different 2D and 3D CAD systems which we use in our product development.
- [ ] My company employs a flexible working staff, so project members change frequently.
- [ ] I work for a global company, so product development often moves between different parts of the world.

Average Development Cycle Length

- [ ] My company's product design cycles range from weeks to months.
- [ ] My company faces intense competition, time-to-market pressures, and/or shorter marketing windows.
- [ ] My company needs to reach a design solution as quickly as possible.
- [ ] Designers often balance the many demands of their position with limited opportunities to design products.
- [ ] It takes a long time for new users to learn our current 3D CAD system.
- [ ] I would be more productive if I could modify my designs with quick and responsive on-the-fly interactions with 3D models.
- [ ] Software and hardware performance issues sometimes interfere with my productivity.

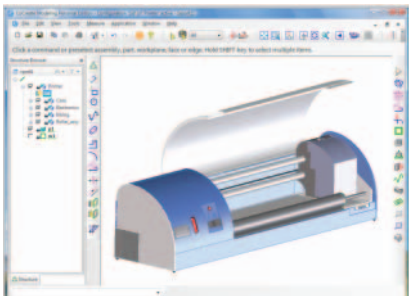
So how did you do? If you didn't agree with many of the above statements, then you're probably a better candidate for the parametric approach to 3D modeling. And that means you've accomplished the first step – identifying which approach to 3D design is best for you – and you don't have to continue reading this evaluation guide. Instead, check out Pro/ENGINEER, a two-time recipient of IndustryWeek's Technology of the Year Award and the most powerful parametric 3D CAD system on the market, also available from PTC. (**PTC.com/products**)

However, if you agreed with many of the above statements, then CoCreate Modeling and the explicit approach to 3D design could be a good fit for you and your company. Keep reading and learn how the explicit approach can help improve your product design process.

Top Benefits of an Explicit Approach:

1. EASY TO LEARN

With an explicit approach to 3D design, you only interact with model geometry, not with a sequence of design features. That makes initial training on the software far easier. But it also means designers working within an explicit 3D CAD system can easily 'pick up' a design where others left off, much like anyone can open and immediately continue working on a Microsoft Word document. Thus, the explicit approach appeals a variety of audiences: companies with flexible staff; infrequent users of 2D and 3D CAD; and anyone who is involved concurrently in a large number of design projects.



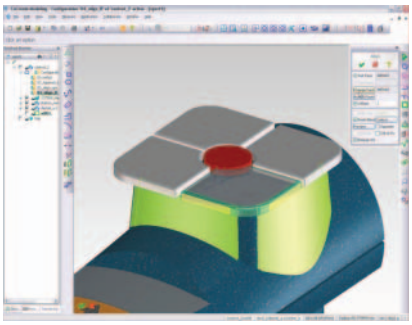
Download CoCreate Modeling Personal Edition for free to experience the benefits of the explicit approach to 3D design first-hand.

2. EASY TO REPURPOSE DESIGNS

When designers repurpose model geometry, they take an existing 3D design and radically transform it by "cutting/copying and pasting" geometry to derive a new design, one that's entirely unrelated to the concept of the original design. With an explicit approach, companies have accelerated their product development by repurposing existing designs into new and completely different products. Companies using CoCreate Modeling, the leading explicit 3D CAD system, give examples where 50% of parts within new product development are repurposed from previous designs. When designers can repurpose designs, companies can shave weeks or even months from project schedules – a unique, time-saving characteristic of the explicit approach.

3. FLEXIBLE

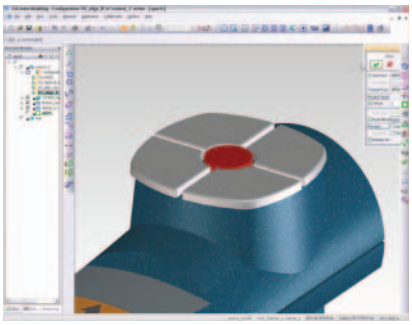
Companies that develop new-to-market and one-off product designs often face changing customer and product requirements throughout the development cycle. An explicit approach gives these companies the flexibility to handle either new product information, or major product changes, or even last-minute change orders, in the shortest time possible, throughout the entire product development cycle. An explicit approach also provides true flexibility because it doesn't require any upfront planning or embedding of design information within models, unlike some other 3D design approaches.



4. RAPIDLY EVOLVE, EXPLORE AND ITERATE DESIGNS

Any designer will readily admit that innovative product design involves exploration and discovery. An explicit approach gives designers the freedom to rapidly evolve a product design in unpredictable and new directions where modifications can't be anticipated in advance.

With explicit modeling, companies can also rapidly test new ideas, evaluate a broad range of options, and constantly adapt and refine a product as it moves through the development process. When product designs aren't locked into a specific development path, companies can save money by experimenting with changes while changes are inexpensive.



With an explicit approach, you're free to make last-minute changes to your design, like dramatically altering a button to create a more ergonomic outline, for example.

5. MAINTAIN FLEXIBLE DESIGN TEAMS

An explicit approach frees any team member to contribute to and carry a design forward so companies can rotate designs between engineers to increase engineering productivity and eliminate resource bottlenecks or project delays. When companies rotate designs between engineers, they create opportunities for higher quality and more creative product designs, because different engineers can both review the work and add their own perspective, which improves communication and results in fewer design errors.

→ Step 2: Find a 3D Software Vendor

Once you've identified your design approach, you're ready to find a vendor that offers a 3D CAD system based on that approach. When shopping for a vendor, make sure you look at the vendor's product portfolio, industry expertise, services and support network to ensure that it satisfies your company's design needs.

Since you're evaluating CoCreate Modeling, here are some things you should know about its parent company, PTC.

Top Ten highlights of PTC:

1. OBJECTIVE SOLUTIONS

PTC is the only 3D software vendor embracing more than one approach to design, so it's also the only vendor in the industry that can genuinely stay objective about customer requirements. Because PTC offers both a powerful, robust parametric system (Pro/ENGINEER) and a lightweight, flexible explicit system (CoCreate Modeling), PTC is free to focus entirely on finding the best solution to match your company.

2. A HISTORY OF INNOVATION

Not only is PTC the only vendor embracing both mainstream approaches to 3D design, it was also the pioneer of both parametric and explicit 3D CAD systems. In 1988, PTC launched Pro/ENGINEER, the first parametric 3D CAD system. The explicit approach evolved inside the highly innovative Mechanical Design Division of Hewlett-Packard in 1993, eventually resulting in the product now known as CoCreate Modeling. Now that CoCreate is part of the PTC family, you can access both approaches to 3D design from a single vendor – and benefit from their combined experience and unparalleled history of innovation in 3D CAD.

3. MARKET LEADERSHIP

When you select a 3D CAD system from PTC, you get market leaders in both the parametric and the explicit approaches – and as market leaders, these systems are proven, tested, and reliable. You can trust that PTC will continue to expand these powerful solutions going forward.

4. A SINGLE FOCUS

Unlike other CAD vendors that try to cater to a diverse set of industries, PTC focuses completely and exclusively on discrete manufacturers. That means PTC is unequivocally dedicated to developing products that help you optimize your PTC solutions, so you can create the most innovative products and improve quality and time-to-market, while decreasing errors and cost. Plus, PTC continually expands product offerings through product development, strategic partnerships, and acquisitions to create new opportunities that will help you realize more value from your PTC solutions.

5. COMPREHENSIVE SOLUTION CHOICES — FROM 3D CAD TO PLM

PTC provides a complete set of CAD systems – parametric, explicit, specialized and 2D – enabling our customers to select from the most comprehensive portfolio of design approaches in the CAD industry. And for both CoCreate Modeling and Pro/ENGINEER, PTC delivers a broad set of add-on, integrated design modules to help specialized contributors to maximize their productivity and design potential.

In addition to CAD systems, successful companies today also need a product development solution to effectively manage product complexity and variability. The PTC Product Development System delivers all the essential capabilities you'll need to accomplish that with an integral, Web-based architecture that supports today's globally distributed environment.

PTC completes its comprehensive product development software packages with other complementary solutions for design data management (Windchill®), engineering calculations (Mathcad®), publishing (Arbortext®), enterprise PLM (Product Lifecycle Management), and team collaboration (ProductView™) – everything you need to complement and enhance your product development process.

6. COMPLETE SOLUTION SERVICES

PTC is also a full solution provider, so you benefit from much more than exceptional software. PTC delivers a complete range of technology installation, configuration, and migration services to fully optimize your product development process:

- With PTC Consulting Services, you'll make the most of your people, processes and technology with product development best practices. Plus, PTC Consulting Services helps ease the transition to your new solutions.
- Buying software is one thing – implementing it can be quite another. That's why PTC Implementation Services offers you the fastest path to technology deployment, while still meeting your business objectives, without disrupting your company processes.
- At PTC University you'll get everything you need to boost your productivity and be successful with your PTC products. Select from an extensive curriculum of expert instructor-led courses and computer-based training that fit both your budget and your schedule.

7. EXCEPTIONAL SUPPORT

You have enough problems with resource bottlenecks, delayed supplies, and understaffing. You certainly don't need problems with your software as well, which is why PTC offers exceptional Technical Support for all your PTC products.

In terms of CoCreate products alone, you'll find full phone- and email-based support from experienced engineers in CoCreate Support. These expert support teams dedicate themselves to resolving your support requests, usually in a single day. And with CoCreate Support, you'll reach experienced engineers who speak a language you can understand, whether you're in the Americas, Europe, or Japan.

8. TIGHT PARTNER NETWORK

To bridge the gap between discrete manufacturing and other industries, PTC has cultivated tight partnerships with over 800 software and hardware vendors, consultants, and resellers. Through these partnerships, you can access a comprehensive suite of capabilities and processes to find the perfect partner, product, or service you need to support your business.

9. GLOBAL PRESENCE

When you choose PTC software products, you won't alienate your distributed design teams by forcing them to work with uncommon tools. The fact is, more than 50,000 companies worldwide are using PTC's leading CAD, PLM, content management, and dynamic publishing solutions.

10. WORLD-RENOWNED CUSTOMER BASE

PTC customers include many of the world's most innovative companies in the manufacturing, publishing, services, government, and life sciences industries. You can find PTC products behind some of the most successful organizations in the world – including manufacturing giants like Toyota, Airbus, Caterpillar, John Deere, Canon, HP, Agilent, and Olympus.

When you join the PTC family of customers, you'll become a part of this prestigious network. You'll have the opportunity to attend PTC/USER World Events where you can meet people from similar organizations and learn what problems these companies have solved and the best practices that make them so successful.

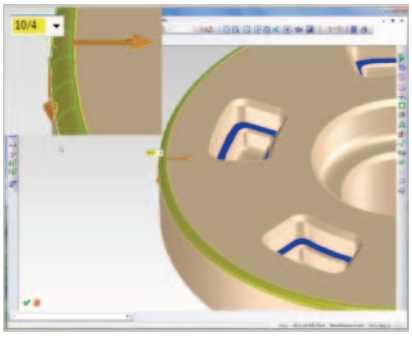
➔ Step 3: Choose the Product

Once you've surveyed the available CAD vendors, you're finally ready to select a product. Any 3D CAD system based on the explicit approach should include the following:

Top ten highlights of CoCreate Modeling:

1. ON-THE-FLY MODEL MODIFICATION

Parametric 3D CAD systems capture intended product behavior with parameters, persistent dimensions, features, or relationships. CoCreate Modeling, as an explicit 3D CAD system, doesn't work that way. In CoCreate Modeling, designers first create profiles that become 3D models. Then designers modify the 3D models through on-the-fly interactions with the model geometry.



With CoCreate Modeling, you can modify 3D geometry like blends (rounds) completely on-the-fly, at any point in the design process.

You can still use your favorite machining commands like Extrude, Turn, Mill, Punch, and Stamp. In CoCreate Modeling, however, you'll find some other commands that particularly illustrate the modeling capabilities of an explicit 3D CAD system – commands you might not have seen before in parametric systems, or commands that work a little differently.

Here are a few commands that you'll want to check out:

Align – With Align, you can change the model geometry of one face to precisely align with the geometry of a reference face or reference plane. That means you can design and modify parts in context of the complete assembly design.

Taper – You can taper at any time in the design and manufacturing process—because it's never "too late" to make changes in CoCreate Modeling.

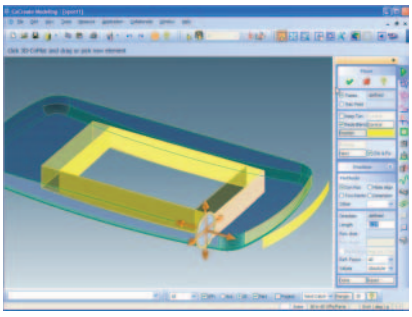
Offset – When you're working with plastic, uniform-walled thickness or snap-fit parts, you can use Offset to make on-the-fly design changes, such as relative dimensional changes if your model needs a clearance of .010 inch, for example. This is just another convenient option to help you resolve complex design challenges.

Blend – Just like Taper, you can Blend (that's a round or fillet to you parametric users) at any time in the design process, so you're totally free to explore new and different designs.

Scale – When you're working with plastics, and you're preparing a mold design, you can use Scale to account for shrinkage and inevitable size changes.

2. INSTANT DESIGN CHANGES

Because designers create and modify 3D models via on-the-fly interactions with model geometry, CoCreate Modeling offers Microsoft Word-like functionality to designers when they need to make instant design changes.



With the explicit approach, you can make instant design changes through on-the-fly interactions with model geometry.

For example, designers not only can "cut, copy and paste" whole groups of faces, like bosses, for example, but they can also dramatically repurpose models by cutting or removing a section of a part and pasting the remaining two pieces back together. Blends on the newly rejoined pieces instantly 'recognize' each other and reconnect just as they existed on the original part–no 'healing' required.

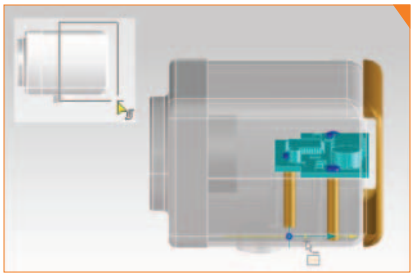
In CoCreate Modeling, you can remove any unnecessary model geometry at any point in the design process and continue to design without limitations, as if your modifications were always exactly what you intended. It's very similar to removing a sentence from a paragraph in Microsoft Word. CoCreate Modeling completely removes the unwanted geometry, without any reminders at all of your changes, so you're completely free to explore limitless design possibilities.

3. COMBINED PART AND ASSEMBLY MODELING

In a parametric 3D CAD system, designers work in separate part or assembly modes, meaning they can work either on individual parts or on the complete assembly.

CoCreate Modeling embraces a different method for designing parts and assemblies. In CoCreate Modeling, designers can create and modify their 3D models completely in context of whole designs by referencing the existing 2D or 3D geometry of surrounding parts and assemblies. When designers find interfering parts in their designs, they can modify the necessary parts while working within the context of the complete assembly. Designers can also make modifications across multiple parts and assemblies in a single operation, which ultimately increases design speed.

For example, you can use Align to change the model geometry of one face to precisely align with the geometry of a reference face or reference plane. Likewise, you can use the Move by Box command to simultaneously move faces and position parts together. When you move a face, the geometry connected to the face stretches to change the size of the part. If you move entire parts or assemblies, CoCreate Modeling naturally adjusts the position of the parts and assemblies.



You can use the Move by Box command to enlarge an electronic enclosure to accommodate a new, larger circuit board, for example.

4. FLEXIBLE ASSEMBLY STRUCTURES

CoCreate Modeling features a completely flexible, evolutionary Structure Browser that displays your list of parts, assemblies, and any other 3D elements you'll need to create your designs. In CoCreate Modeling, part and assemblies act exactly like files and folders that you can 'drag and drop' to arrange and rearrange just like files into a folder structure.

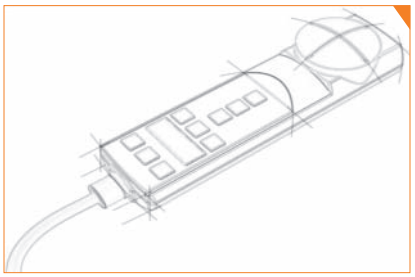
With this unique characteristic of CoCreate Modeling, you can arrange parts and assemblies as you design. Then, when you send your designs to manufacturing, you can restructure your design for their needs. When your designs finally reach production and distribution, you can rearrange your parts and assembly structure again to create a specialized view for your end customers. Thus, you'll always maintain a logical product structure throughout the entire design process.

The Structure Brower is so flexible that you can leverage assembly structures from multiple 3D CAD systems and repurpose them into an entirely new product assembly. What happens when you import the 3D design data? The Structure Browser not only recognizes the part and assembly structure of the imported design data, but it also allows you to reorganize and manipulate the structure however you wish.

5. INTUITIVE ENGINEERING AND 2D-BASED CONCEPTS

In terms of flexibility and technique, CoCreate Modeling is the closest 3D CAD system to 2D design. In CoCreate Modeling, designers don't need to plan their designs in advance. Instead, they can let their designs evolve freely and intuitively throughout the entire design process, exactly the same way they design in 2D. That means existing designers can easily transfer their 2D skills to quickly adopt CoCreate Modeling, and they can pursue exploratory design options, such as sketching in 2D and changing designs by adding ideas, or removing geometry that doesn't work.

Plus, CoCreate Modeling adapts certain 2D techniques to 3D modeling. For example, designers can move and stretch 2D geometry with on-the-fly 3D modify commands like Move, Position, and Cut, or use the convenient box selection of geometry to move entire sections of their models at once. Designers can even design directly within one or more 2D cross sections of a 3D model, or use 2D cross sections to visualize part and assembly interferences.



With CoCreate Modeling, designers can pursue exploratory design options like sketching in 2D.

6. MULTI-SOURCE CAD DATA

Geometry is the only common element across all CAD systems, and because CoCreate Modeling is specifically designed for on-the-fly interactions with model geometry, it excels at the import and modification of multi-source CAD data, and thereby enhances the interoperability between different CAD systems.

Companies that work across an extended supply chain for procured components or subcontracted design can import STEP and IGES files as essentially native 3D design data formats. CoCreate Modeling automatically recognizes the assembly structure, shared parts, sheet metal parts, surfaces, and even blends, which designers can either maintain or modify as needed. Again, in CoCreate Modeling, designers can modify imported 3D models as flexibly as they can copy and then edit text in Microsoft Word.

Plus, CoCreate Modeling offers additional features like Compare Parts, so you can compare imported designs with the original design data. Or, you can import 2D designs to re-create 3D models, which is helpful for companies migrating their 2D design process to 3D modeling.

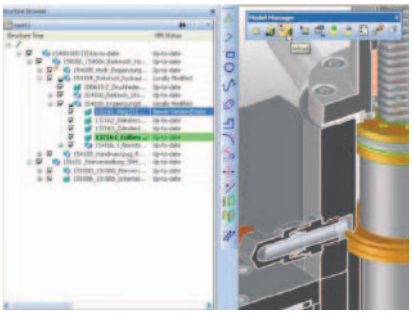
7. LIGHTWEIGHT AND DATA-MANAGEMENT COMPATIBLE

In a parametric 3D CAD system, data files usually include parameters, persistent dimensions, features, and relationships that capture intended behavior. CoCreate Modeling, however, reduces data files to the 3D geometry only, dramatically reducing the design data of each individual part, so large and complex designs don't overwhelm your hardware or software performance. Customers of CoCreate Modeling report that files can be as little as 33% the size of a similar design file from a parametric 3D CAD system.

So, working within the same physical or virtual memory limits as parametric 3D design, designers using the explicit approach can load three times more geometry in CoCreate Modeling. Even shared parts don't increase file sizes, and you can modify shared parts instantly, without clogging your system performance. Smaller file sizes mean designers can: load and store data files faster; reload and update parts to new revisions instantly; and make better overall use of their computer memory.

When you combine the Professional Version of CoCreate Modeling with CoCreate Model Manager– an integrated data management system, you can also load product designs using lightweight models, which are ideal for the design of large assemblies and complex products. A lightweight model is a three dimensional graphical representation of a model that looks like any other model in the viewport. However, lightweight models use less memory because they only include 3D representations of the geometry data, 3D labels, and 3D annotations associated with a part.

CoCreate Model Manager can also help you manage complex relationships associated with large assemblies. For example, CoCreate Model Manager automates file revisioning, manages the 3D to 2D relationships between parts and assemblies, and encourages true concurrent team design because all designers have access to the most up-to-date design data. When all design data is centralized in a common database, companies can ensure that no one either works on the wrong revision of a component, or changes a component reserved by someone else.



To support your work with large assemblies, CoCreate Model Manager offers lightweight models – sheer graphical representations of your 3D models that won't clog your system performance and thereby boost your productivity.

8. FULL FIT, CLASH AND INTERFERENCE ANALYSIS

You can avoid costly mistakes in manufacturing, and unnecessary investments of time and money on physical prototypes, by checking your 3D models for both potential problems and overall quality first, with Clash Analysis in CoCreate Modeling.

When you use Clash Analysis to investigate potential problems earlier in the design process, you can substantially reduce the number of expensive change orders later. And when manufacturers produce fewer physical prototypes and change orders, they create better quality designs, shorten their time-to-market, and reduce product development costs.

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Clash Analysis takes you far beyond the standard clash capabilities like investigating interferences and checking assemblies for touching parts; it also guides the annotation and classification of existing clash issues, checks the same parts or assemblies in different configurations, and walks you through each individual clash issue for clarity and resolution. Plus, you can store and reuse your clash checks and results between your CoCreate Modeling sessions, or run a Clash Analysis on revised models to track common volume problems and touching parts.

In the Professional Version of CoCreate Modeling, you can validate your product designs to make sure they meet the necessary physical demands with CoCreate Finite Element Analysis–the integrated stress and thermal analysis add-on module for CoCreate Modeling.

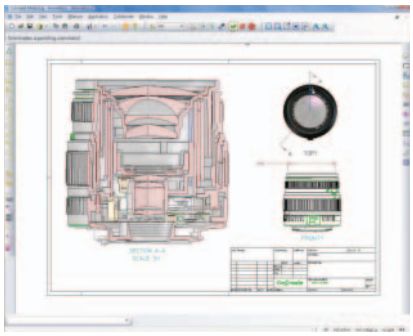
With Clash Analysis, you can identify any potential problems with interfering parts and avoid costly mistakes before they happen.

9. FAST AND ACCURATE 2D ENGINEERING DRAWINGS FOR MANUFACTURING

CoCreate Modeling includes Annotation–a 3D-to-2D associative add-on module that's fully integrated with CoCreate. In Annotation, designers can leverage the 3D model to instantly create 2D manufacturing drawings, with drawing views such as cutaway, section, and broken views Annotation can also leverage 3D information like GD&T specifications.

The tight integration of CoCreate Modeling and Annotation assures and maintains the association between models and drawing, so if models are modified, drawings are automatically updated to reflect the changes. Thus, while engineers are designing, drafters can annotate drawings, and downstream departments can work concurrently with design teams.

With the Professional Version of CoCreate Modeling, you also receive CoCreate Drafting, a stand-alone, industry-proven, 2D mechanical CAD system – perfect for sketching out freeform design ideas and supporting the entire 2D product development process. CoCreate Drafting offers the same flexible part and assembly structure capabilities as CoCreate Modeling, matching how mechanical engineers design and manufacture products. It also includes specialized features, such as shared components and parametrics, that extend beyond the full set of standard 2D design capabilities.



Easily leverage your 3D models to create 2D drawings with Annotation, a 3D to 2D associative and fully integrated add-on module, included as part of CoCreate Modeling.

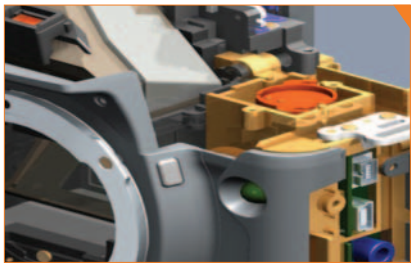
10. COMPLETE VISUALIZATION AND IMPROVED COMMUNICATION

Visualization and communication are critical parts of the product design process. That's why CoCreate Modeling offers several options to help designers visualize a complete product design and communicate those design details to anyone involved in the product development process.

For example, with the powerful rendering capabilities automatically included as part of CoCreate Modeling, you can produce photorealistic images of models that improve both visualization and communication. You can select from a variety of different materials to simulate the look of your part or assembly, then adjust the lighting and add background scenes for your models.

In addition to first-class images, designers can create 3D Configurations in open or closed states to easily visualize how all the components of their mechanical designs will move in different positions. With the Professional Version of CoCreate Modeling, designers can use Animation to create complex animations of their product designs, which they can then share as an AVI file with others.

Since most communication is done via email today, the Professional Version of CoCreate Modeling also includes CoCreate 3D Access, a native multi-CAD viewer that easily shares both 2D and 3D design data with team members across the entire organization. And with the eDrawings Professional for CoCreate Modeling add-on module, you can share 3D or 2D design data with partners or customers.



Use the powerful rendering capabilities, included as part of CoCreate Modeling, to produce high -quality 3D images of your products long before you ever build the first prototypes.

Conclusion

Choosing the right 3D CAD solution for your business is absolutely essential to your company's success. By following these simple steps, you can better evaluate the solutions on the market, more easily compare features and functionality, and then make an intelligent decision.

In the end, you'll discover that there's a vast difference between parametric and explicit modeling, as well as between the vendors that offer these solutions.

Learn more

For more information about CoCreate products and PTC, please visit **PTC.com**, or contact your PTC representative if you have additional questions, or to see a live demonstration of any PTC software product.