

## Why Manufacturers Need Direct CAD

Direct CAD is a must have tool for job shops, contract manufacturers or any manufacturing operation that works with multiple CAD formats to obtain manufacturing CAD data from part designs.

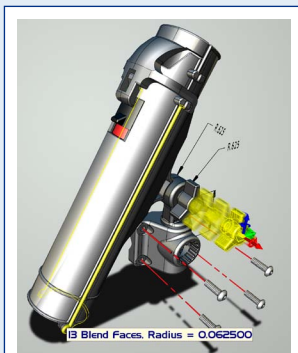
### ***What is Direct CAD?***

A Direct CAD model is created and edited by directly working with geometry and commands. A history-based model is created and re-created from a list of sequential commands contained in a history tree.

Making edits to a Direct CAD model is simple. The geometry is changed by using dynamic tools or by placing dimensions on the geometry. The model is changed in real time.

History-based edits are made to specific features in the history tree in the correct place in the tree. The model then must “rebuild” or “regenerate” the geometry. Each command in the history tree is executed and the model is rebuilt. History-based CAD software literally goes through each command in the history tree and rebuilds the model. If edits are introduced that do not conform to the initial steps used to create the model (often referred to as design-intent), then the model may hang-up, get stuck or worse – crash your software.

This doesn't happen with Direct CAD. With Direct CAD, the model is not built from the steps of the tree. The model is the geometry and not the history of operations.



Making edits to a Direct CAD model is simple.

### ***Why is Direct CAD particularly good for manufacturing?***

The ability to read and edit multiple CAD files is often necessary for manufacturers. Manufacturers, especially contract manufacturers and job shops, typically need to work with many types of CAD files from various systems because their customers all use different CAD systems.

One solution is to own, maintain and train personnel on all versions of all software with which the company works. This can be very expensive, and requires manufacturers to purchase and maintain multiple CAD packages, as well as teaching its CAD operators to be proficient in multiple CAD software systems. Even then, newer versions of the same CAD software are sometimes not even compatible with older versions, as has been the case with Catia V4 and Catia V5. This incompatibility means that companies must run several versions of a CAD program, thus making operations even more complex and costly.

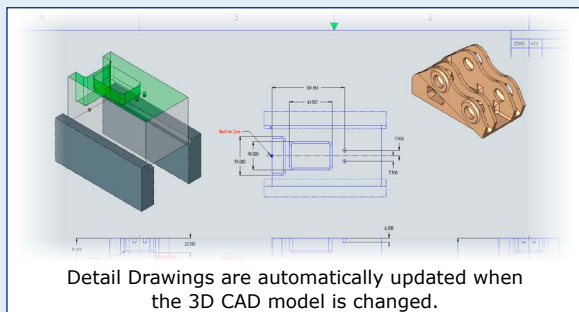
Manufacturers often receive CAD files in neutral formats which do not contain history. Some history-based systems have the ability to import this data, but lack the ability to make changes to it. Manufacturers also receive files that contain errors due to the import or export of the CAD data. Fixing CAD files can be a tedious and time consuming process. In both cases CAD operators often choose to redraw the entire CAD file from scratch, wasting precision time. Many studies have shown that as much as 25% of CAD operators time is spent fixing CAD files.

A Direct CAD package allows users to open and edit the most popular CAD formats. Depending on the Direct CAD software, there can be many tools available to assess and repair bad geometry in a model – bad geometry that’s due to import or export issues or poor CAD modeling practices. Direct CAD repair tools can include a quality checker, simplification of the model, healing, topology modification and surface creation.

Once the CAD file is open, the manufacturer can reuse all or part of the geometry for the purposes of manufacturing operations.

These manufacturing operations can include:

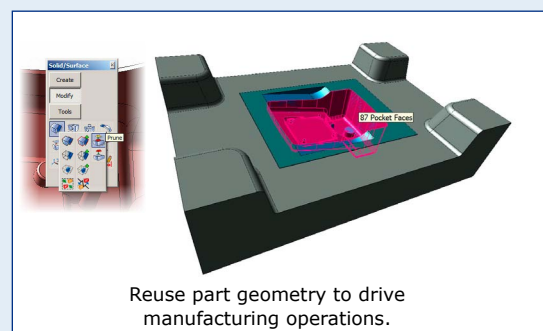
- Creating detailed work instructions for manufacturing the product
- Designing fixtures or work-holdings for the product
- Designing molds, tools or dies
- Developing machining strategies and NC tool paths



In all of these cases, the manufacturing CAD data can be obtained directly from the part model. Direct CAD tools for de-features and decomposing the CAD model are the backbone of repurposing part data for manufacturing. In addition, surfacing, topology modification and geometry organization tools greatly enhance the reuse of CAD data for manufacturing. Some Direct CAD operations used for these purposes include:

- Prune – removing features from the model
- Graft – adding a feature that may have been removed or copied from the CAD model
- Boolean Operations – merging geometry
- Imprinting – adding 2D geometry to aid in changing the geometry
- Stitching – combining surfaces to create a solid
- Dynamic face editing
- Surfacing – creating and editing complex surfaces
- And other operations

Although repurposing and reusing CAD files can be achieved using a history-based CAD system, it is far easier, and as much as ten times faster, when using a Direct CAD system.

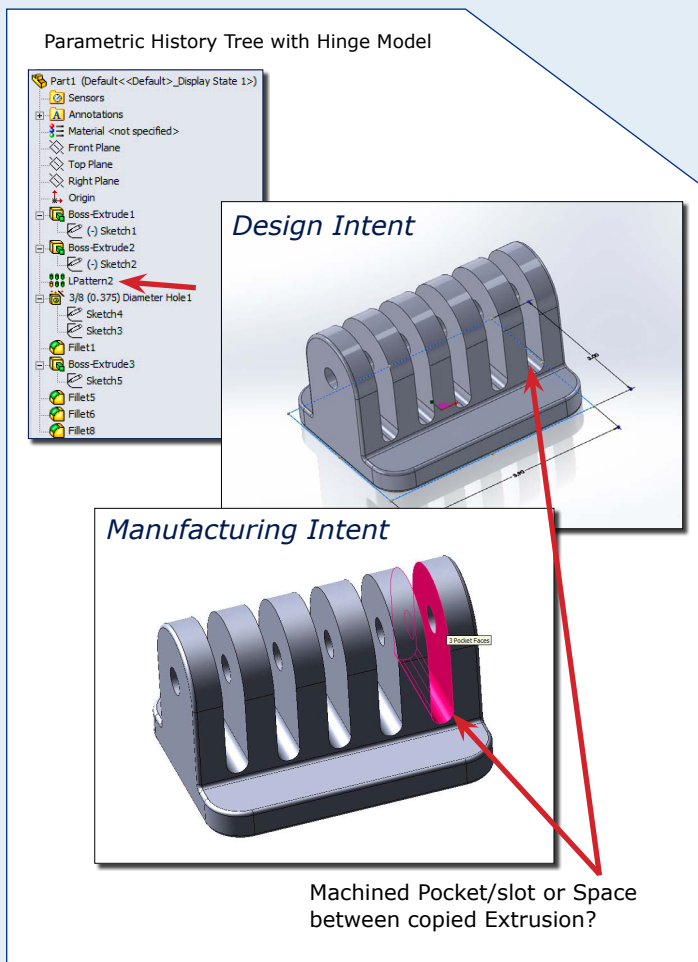


## Isn't design intent essential for repurposing the part model and deriving CAD data for manufacturing?

No, it is not. Manufacturing intent is actually more important than design intent when trying to derive manufacturing CAD data from part models.

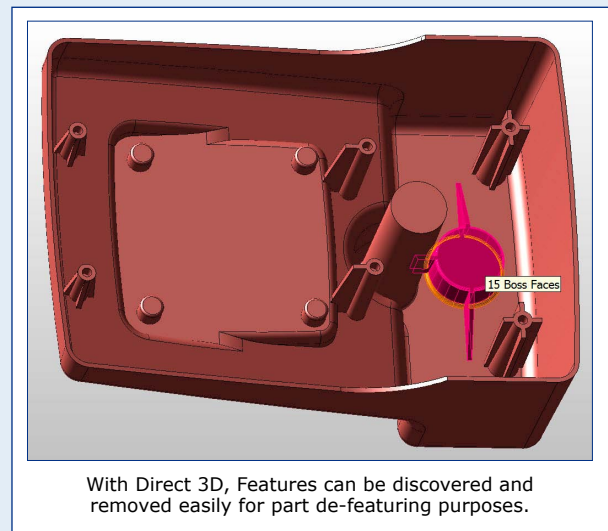
Let's illustrate this with a simple example.

The history tree may show a series of operations: Sketch, Extrude, Sketch, Extrude, Copy, Blend, etc.



While these operations may be very useful for designing a model, they are not helpful in planning or executing manufacturing operations. Unless a model is prepared with manufacturing intent in mind, design intent often becomes irrelevant to a manufacturer, and in some cases, can be a hindrance to reusing the CAD file for manufacturing. If the history-based model becomes too difficult to work with, the manufacturing engineer will then need to redraw the CAD file from scratch. With a very complicated design, redrawing can be very difficult, time consuming and may introduce errors into the model. It's far easier and more efficient to use the part design to derive the manufacturing data using Direct Modeling tools.

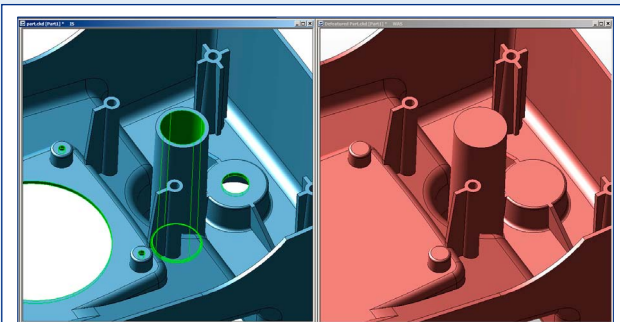
Direct Modeling is also superior to history-based modeling when defining in-process models for machining operations.



Direct CAD allows users to prune features from the original model to prepare for various machining operations. Defeaturing the model in this way simplifies the process and saves time.

### **Managing Changes in the Manufacturing Process**

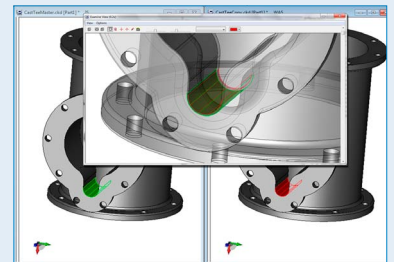
Change is constant in the design and manufacturing process, particularly during model decomposition and repurposing where both intended and unintended changes are most likely to be introduced. Manufacturers are required to handle changes seamlessly and accurately without impacting delivery schedules. Unfortunately, design change communication is often imperfect, and can cause projects to miss schedules or lose money. Direct CAD comparison tools, however, ensure that design changes are recognized and easily communicated throughout the manufacturing process.



Changes to parts are verified to insure desired defeaturing has been successfully accomplished.

Having a full set of CAD comparison tools will ensure that no changes are missed, either in the preparation of the model based on the original design or when changes are required to the original project. The ability to easily see any geometric or tolerance change will help the project to be completed properly the first time and within budget.

HAVING A FULL SUITE OF COMPARISON TOOLS BECOMES INVALUABLE TO ENSURE THAT THE WORK IS DONE PROPERLY THE FIRST TIME.



For manufacturers, especially job shops and contract manufacturers who must work with CAD files from varying sources, Direct CAD allows full CAD data reuse, saving significant time and money. The ability to repair CAD files through quality checking, simplification, healing, and topology modification ensures accuracy of the CAD data for reuse. CAD model de-featuring, decomposition, surfacing and geometry organization tools allow the manufacturer to complete downstream manufacturing operations without the need to redraw complicated CAD files. CAD comparison tools that clearly identify changes ensure that errors do not enter the manufacturing process. The result are up to a ten times improvement in throughput plus saving realized by avoiding the expense of purchasing, maintaining and training personnel on multiple CAD software packages.