

## 3D Mechanical Desktop Shows Versatility

By Ben Wiens

The AutoCAD CAD package, used mostly for 2D drawing, is so popular, its DWG file format is an industry standard. When it comes to mechanical 3D solid modeling though, Parametric Technology Corp's Pro/Engineer has set the standard.

In 1986, PTC pioneered parametric solids, whereby the model can be changed at any point in the design cycle by text input. About a year ago, Autodesk released Mechanical Desktop, a solid modeling PC package priced at less than \$10,000 with the intention of competing eventually with the \$20,000-40,000 Pro/Engineer, which still is primarily a Unix program. Mechanical Desktop is actually a suite of programs running overtop of AutoCAD R13 with any mixture of 2D, R13 solids, Designer solids, or AutoSurf surfaces.

There are several other competitors aiming for the mid-price PC market. Probably the most serious threat in terms of comparable performance to Pro/Engineer is SolidWorks, currently selling for US\$4000. This PC program has been on the market for less than two years, but already has most of the functionality of Pro/Engineer and is far easier to work with.

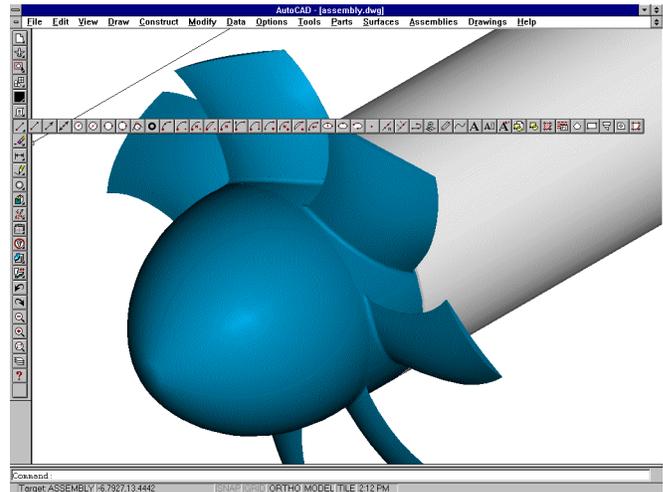
SolidWorks attempts to model complex shapes entirely with solids using the exotic ParaSolid modeling engine. Mechanical Desktop, on the other hand, uses the ACIS modeling engine, which is more widely used, but presently is more limiting and so complex shapes are constructed by either using AutoSurf surfaces to cut a solid, or surfaces are used by themselves. AutoSurf objects have mass and surface properties and so can be used interchangeably with solids in assemblies, but are not parametric like Designer solids. My initial impression is that the present Mechanical Desktop v1.1 can model more complicated shapes than SolidWorks'96, but in SolidWorks more complicated solids are much easier to work with than Mechanical Desktop's. Presently Pro/Engineer, Catia and Cadkey all must use surfaces for very complex shapes.

In a test to see how well Mechanical Desktop v1.1 worked, a high speed axial fan (shown) was drawn. The blades are complex shapes being forward swept, variable cross-section, and twisted. Such a shape is impossible to draw with just the solids in AutoCAD R13.

In the first test, the blades were shaped by using AutoSurf to cut R13 solids and Designer solids. It was found that the junction of the blade and the hub was too complex to fillet using the Fillet command in either Designer or R13.

Next the entire assembly was converted to AutoSurf surfaces. Again AutoSurf's fillet command failed. In the end a fillet could be created manually by drawing 30 wires and so creating a surface. Unfortunately the 2D drawing views, which are generated automatically, did not register all the AutoSurf surfaces properly and created many garbage lines. Luckily this 2D drawing view can be saved as a 2D DWG file and fixed using normal AutoCAD commands.

These problems can be the cause for despair—however, improvements seem to be coming quickly. Apparently there are nearly 100 programmers at Autodesk working on new enhancements. At press time, the latest free upgrade was slated to have a brand-new, easy-to-use interface as well as an updated ACIS v2.0 modeling engine. Mechanical Desktop already has an Assembler which allows one to draw individual parts and then simply create a reference to these in the assembled view. In the latest release



*Axial fan with complex blades can be drawn with Mechanical Desktop v1.1. A single custom toolbar containing all several hundred icons is shown that avoids the usual clutter of the multiple toolbars. For the last icon used to surface, single flyouts are used. To make it, open all the toolbars and drag the icons onto the new toolbar.*

the part models will be able to be modified in this assembled view—saving considerable time.

Are companies buying Mechanical Desktop? According to Autodesk, it had sold 20,000 copies in the first 9 months since first shipping. It already had an installed base of 5x the nearest serious mid-priced PC-based mechanical 3D CAD competitor. By comparison, PTC has sold 70,000 copies of Pro/Engineer in 9 years. There are 1,600,000 licensed copies of AutoCAD of which 30-40% are used largely for mechanical drawing.

For all those companies who already have thousands of AutoCAD drawings, AutoCAD licenses and staff with years of experience in AutoCAD, spending a few thousand dollars to upgrade from R13 to Mechanical Desktop may be a good decision. This means a company can make a slow move into the 3D world with minimal disruption to everyday business. AutoCAD may also be used for other drawing functions already, such as graphical databases, mapping, architectural, and facilities management. Mechanical Desktop v1.1 already appears to be quite stable, is easy to use, and for a majority of shapes works well.

Autodesk has every intention of putting together a first rate solid modeling program. Considering that there have been major improvements within this last year, there is a reasonable chance that within a few years we will have the same functionality that Pro/Engineer has presently.

*Copyright 1997 by Ben I. Wiens...when credits to the author including the URL www.benwiens.com are listed for part or whole of this present article it may be reproduced on a limited volume basis such as for own use or for distribution in a classroom.*