Revolutionary evolution: IronCAD 3.0

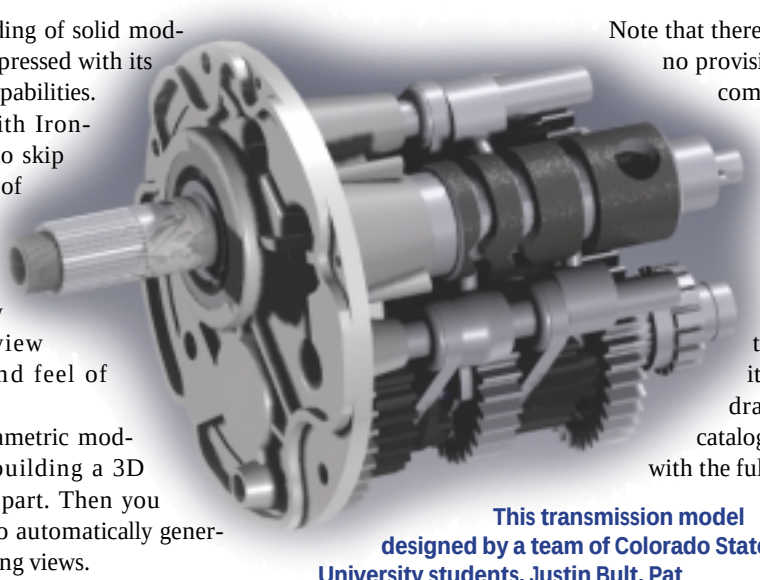
The first solid modeler to use both ACIS and Parasolid kernels intrigues the engineering world. by Bill Fane

New releases of software usually fall into one of two categories. Most new releases are largely evolutionary in that new features are added but the basic look, feel, and operation remain unchanged. More rarely, a new release is revolutionary in that it changes radically from its predecessors. IronCAD 3.0 is unique in that it is both evolutionary and revolutionary. I last reviewed IronCAD in its 2.0 incarnation for the August 1999 issue of *CADALYST*. At that time I was most impressed by its unique approach to the building of solid models, but a little less impressed with its 2D documentation capabilities.

Those familiar with IronCAD 2.0 may want to skip ahead to my review of the new features on p. 42. If you are not a current user, or if you missed my review of 2.0, I'll first review the general look and feel of IronCAD.

As with most parametric modelers, you start by building a 3D solid model of your part. Then you use the solid model to automatically generate 2D working drawing views.

Figure 1 on p. 40 shows the IronCAD screen. You control all functions and operations by toolbars, drag and drop, or clicking on the model. Most are also duplicated in the pull-down menu bar. Note that there is no command line and no provision for keyboard entry of commands.



This transmission model designed by a team of Colorado State University students, Justin Bult, Pat McMeekin, Jason New, and Tom Renfroe, took first place in a design contest.

I started the part in figure 1 on p. 40 by clicking on the Shapes tab at the upper-right edge of the screen. This brought up the catalog of standard shapes. I grabbed the Block shape, dragged it, and dropped it into the drawing scene. The Shapes catalog disappeared, leaving me with the full drawing screen.

Take another look at the Shapes catalog portion of the screen in figure 1. Some of the items appear solid, while others, whose names are prefixed by an H, look like holes. That is the difference. When I drag and drop a solid object from the catalog, it adds itself to the existing part. An H object attaches itself as a hole and cuts into the part. The shapes know how they should attach themselves to the part. If I drag a hole onto the top face of the block, it drills down into the block from the top. If I drag the hole onto the front face, it aligns itself and drills in perpendicular to the front.

As you drag a shape onto a face, green dots appear on the face as you approach the end or middle of an edge of the face, or the middle of the face itself. The shapes are magnetic and automatically snap attach themselves to a green dot if you drop the shape close to the dot.

IronCAD 3.0
3D modeling
Star Rating: 4.5 Stars out of 5
Pros: Dual kernels.
Cons: 2D dimensioning not as automatic as it could be.
Price: $4,995

Visionary Design Systems
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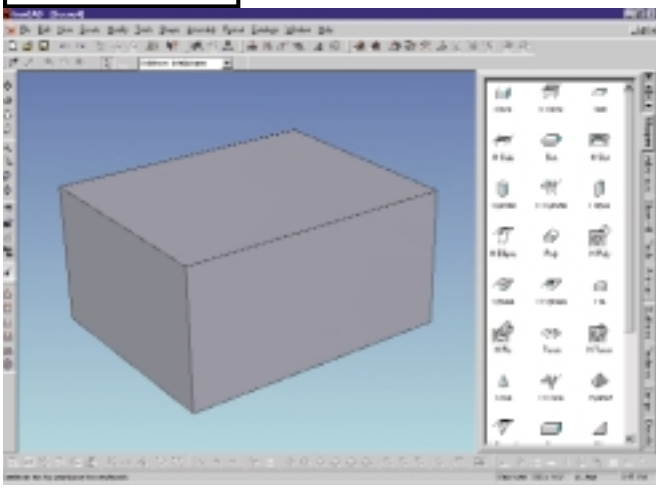

Figure 1. IronCAD's screen layout. I created the block with a simple drag and drop from the Shape catalog.

Add shapes work exactly the same way. Figure 2 shows the results of dropping a Hole cylinder onto the front face and an Add cylinder onto the left face of the block. Note that the part continuously renders as you work.

IronCAD comes with several catalogs of shapes, including a variety of advanced shapes, sheet-metal details, and special tools to create such things as gears and bearings.

However, you aren't limited to the shapes from the supplied catalogs. You can create your own custom shapes and add them to a catalog, or you can draw 2D lines, circles, and arcs to use as extrusion or revolution profiles directly on the part.

Figure 3 shows the profile I created, and figure 4 shows the result of the cut-extrude operation.

IronCAD also offers a number of other standard solid modeling operations. Figure 5 shows the result of adding fillets to many of the edges, and then shelling the part. Editing the size of the part or features is very simple. You can simply click on a feature to select it, then click again until the red editing grips appear. Next, grab a grip and stretch the feature to the desired size.

You can also right-click on one of the red grips to bring up the Sizebox dialog shown in figure 7 on p. 42. This allows you to type in exact sizes for the details.

Once you create a 3D model of your part, IronCAD can create 2D working drawing views. IronCAD has a simple dialog box for specifying the desired views, which it then scales automatically to suit the part and sheet size. If you change the 3D model, the 2D views update. However, as I indicated in my August review, the dimensioning aspects of 2D views are neither as automatic nor as powerful as in some other modelers.

IronCAD uses separate files for parts and drawings. This means that if you want to edit the part, both files must be present for things to stay in step. On the other hand, you can view, plot, and perform 2D edits on the 2D drawing file if the 3D model file is not present. This means that you can send the 2D file to vendors and clients without giving out the 3D model.

The start of evolution

As indicated earlier, release 3.0 is both evolutionary and revolutionary. Let's look at the evolutionary parts.

So how do you review a software release that touts "over 300 new features?" Let's start by comparing the 300 new features list

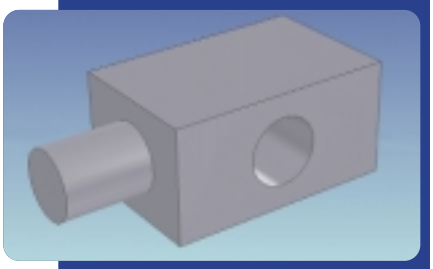

Figure 2. Add and subtract pegs and holes to and from the block simply by dragging and dropping pre-defined cylinder features from the Shape catalog.

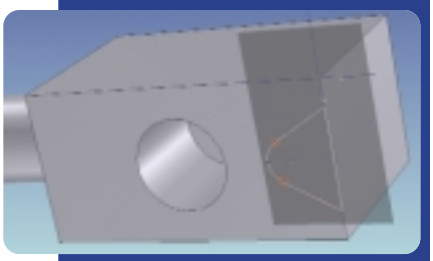

Figure 3. I sketched a custom profile onto one face of the block.

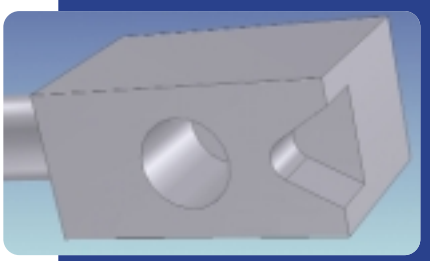

Figure 4. A cut-extrude operation adds the stepped notch to the part.

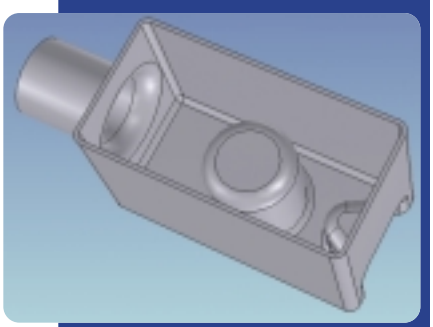

Figure 5. In this part, I added fillets to many edges, then shelled it out.

For AutoCAD users

IronCAD's command interface will be familiar to experienced Windows users with its toolbars and menu bar, but there is no command line. Release 3.0 does let you create your own keyboard mnemonics.

IronCAD has a very good set of 3D modeling and visualization tools, but it is not as well suited to generic 2D drafting.

Mechanical Desktop users will notice the absence of fully automatic dimensions in generated 2D drawing views. You must manually create and designate them in 3D, and then the 2D view dimensions are only one-way parametric.

IronCAD 3.0 has one of the most complete set of tools available to support the passing of 3D modeling data back and forth, including the ACIS kernel used by AutoCAD and Mechanical Desktop. Those who like to mess with the entrails will be pleased that menu customizing and VBA programming are now in release 3.0.

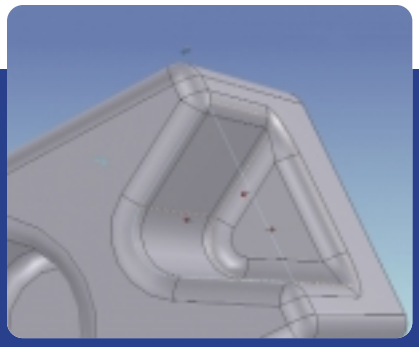

Figure 6. You can edit the size of a feature simply by grabbing and dragging one of the red editing handles.

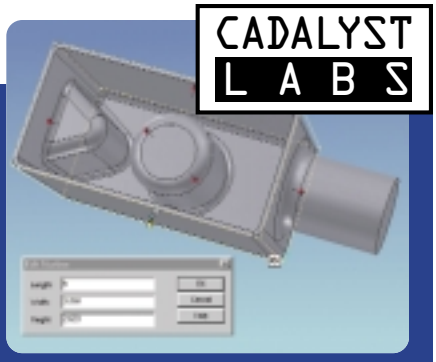

Figure 7. Right-click on an editing handle to pop up the Edit Sizebox dialog to enter precise sizes.

to my shortcomings list from August to see if any match. My first complaint about release 2.0 was that although IronCAD creates the 2D drawing views automatically from the 3D solid models, the dimensions don't carry across. In most parametric modelers, if you change a dimension in the 2D drawing views, the changes bounce back and drive changes to the 3D model, which in turn updates the 2D views.

In IronCAD 2.0, you had to manually add dimensions to the 2D drawing views, and they were not associative or parametric. IronCAD 3.0 goes about a third of the way to overcoming this problem. When you create the profile for a custom extrusion or revolution, you can specify that selected constraining dimensions transfer to the 2D drawing views.

If you use predefined shapes from the catalog, however, you must manually attach SmartDimensions to the solid model. You can automatically transfer these, and profile dimensions, to the 2D drawing by turning on the Annotations option in Tools|Options|Annotations.

Once you create or specify dimensions to transfer to a drawing, they automatically appear in the 2D drawing views and update to reflect any changes to the model. However, they are only one-way parametric—2D drawing view dimensions still don't drive the 3D model. You must do all editing to the model in the 3D modeling scene.

Now let's look at the rest of the improvements. Of all the 300 improvements, the biggest single category is 2D drawing. I've already mentioned the main dimensioning improvement, but several other dimensioning-related changes affect 2D drawing views. These include improved angular dimensioning, and the addition of symbols such as diameter, degree, plus and minus, and so on.

• You can now attach surface-texture symbols to edges in the 2D drawing views, and they follow if you move the edge.

• You can now drive thread representations and labeling in the 2D views by the specifications in the solid model.

• Assembly modeling documentation improvements let you specify parts to suppress in 2D assembly views and parts not to cut in a section view.

• New DXF/DWG support lets you import 2D documentation information such as borders and title blocks. In a large project, for example, other users may use a different brand of modeler to create some of the parts, but your 2D drawings can be consistent in appearance with theirs.

• A long list covers BOM (bill of material) improvements for assembly drawings.

• A number of improvements affect 3D modeling functions, including new and improved sheet-metal functions.

• Enhancements to 2D modeling profiles include an angle constraint between lines that don't touch and a new equal size constraint.

• IronCAD 3.0 overcomes another shortcoming from my last review. Customizability is greatly improved in this release. You can now customize toolbars and menus, and IronCAD now offers VBA programming support for those who'd like to create custom macros and commands. As indicated, IronCAD comes with a full series of catalogs of predefined features ready to drag and drop into your model.

You can now reorder the catalogs so that items you use more often move to the top, or you can create your own logical groupings to suit yourself.

• Sometimes the little details make a difference. Each pop-down menu item now starts with the matching toolbar icon to help you establish the relationships between menus and toolbars.

Revolutionary feature

With a list of 300 improvements, it's impossible to hit them all. No matter which ones I cover, someone is bound to say, "How come you didn't mention such-and-such?" However, one item must be covered. It slips in as a one-line entry in the improvements list, but is probably the most significant one.

Most parametric solid modeling programs don't use a unique, proprietary modeling engine or kernel to handle the actual solid modeling. Many programs license the ACIS modeler, while others use Parasolid. Each brand of program then provides its own "look and feel" user interface to access the modeling kernel.

Some time ago, VDS (Visionary Design System) announced that 3.0 would incorporate both of the common kernels. There has been a lot of speculation as to how VDS would accomplish this and what effect it would have on file sizes and speed.

Well, the word is out, and the word that comes to my mind is "intriguing." When you install IronCAD 3.0, it asks you to specify which kernel you want to use. This implies an either/or choice, which in turn would answer a lot of other questions regarding file size and speed.

The full story, however, is much more interesting. The installation choice is only your indicated preference to make it easier to export models to other systems. For example, if you often exchange models with Mechanical Desktop, you should pick ACIS. If you are in a serious relationship with SolidWorks users, Parasolid is a better choice. The initial choice doesn't commit you to a lifelong covenant. At any time, you can manually flip the system over to the other kernel and carry on, and you can set the Options to change the default for all new parts. In addition, you can always specify the kernel and version when you export.

But wait! There's more! As you work, the system automatically analyzes the nature of what you are modeling. Each kernel has its strengths and weaknesses, and so IronCAD automatically and transparently flips to the other kernel if it works better for a specific feature.

Assembly modeling is another case where the dual-kernel system comes into play. When building an assembly model, you can attach parts that were modeled by any other modeling program using either kernel. Iron-

CAD 3.0 can constrain these parts directly in an assembly model, making it much easier to work collaboratively and seamlessly with other brands of solid modelers.

As we have seen, IronCAD 3.0 introduces the revolutionary concept of dual modeling kernels in an interesting way. This "one or the other" approach adapts to the best of both worlds without any apparent penalties.

File sizes don't double because IronCAD isn't building a parallel model. In fact, VDS claims that significant changes in how you create section views and store files can reduce file sizes by up to 80%.

As a revolutionary change, the dual-kernel concept is all the more interesting because it makes virtually no difference to the user interface and to the normal operation of the program.

Interoperability is a buzzword that gets tossed around a lot in the computer industry, but IronCAD 3.0's dual-kernel approach appears to make it much easier to collaborate with other designers who use other systems. It is of less direct concern if you work by yourself or only with other IronCAD users.

Does figure 8 look familiar? It is the part we studied in the last two "Inside Mechanical Desktop" columns (January, p. 98 and this month, p. 72). I simply performed an Acisout command in Mechanical Desktop, then imported it into IronCAD. It lost its parametric relationships, but I can edit it directly in IronCAD.

IronCAD 2.0 boasted one of the most complete lists of import and export file format options. Release 3.0 adds to this list. For example, you can now load Pro/ENGINEER part files into IronCAD. IronCAD reads the b-rep data directly from the PRT file. Once imported, you can modify the model.

VDS also added VRML 2.0 import capability and a new IGES translator. It supports both ACIS and Parasolid models. A new Import dialog box option automatically converts imported IGES surface files to solids. When exporting, you can fine-tune the IGES translator to match specific target systems by selecting from a pull-down list of various solution partners and CAD packages.

IronCAD 3.0 increases the number of supported data types in DXF/DWG files and incorporates a new version of the STEP translator that supports ACIS 5.0.

As with the previous release, IronCAD 3.0's greatest strengths lie in the 3D solid modeling and visualization areas. IronCAD makes great strides in the 2D documentation side, but this is still its weakest area. ▮

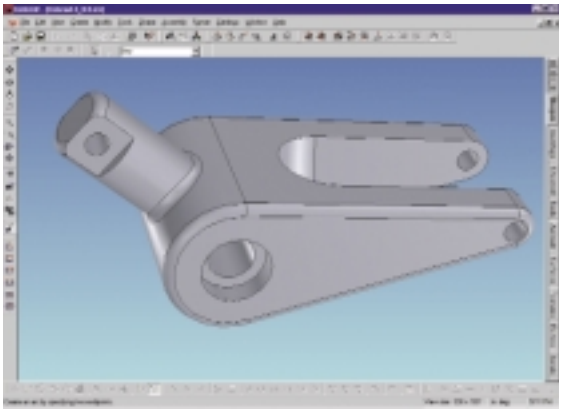

Figure 8. An ACIS solid successfully imported from Mechanical Desktop.

Features IronCAD 3.0
Visionary Design Systems

Release date	11.99
Initial price	$4,995
Annual maintenance fee	$1,295
Operating systems	
Supported	Windows 95/98/NT
Reviewed	Windows 98
Modeling kernel	ACIS 5.0 and Parasolid
Representation method (CSG/B-Rep/Hybrid)	B-Rep and Hybrid
Parametrics	One-way (3D to 2D)
Expressions	Yes
Sequential equations	Yes
Simultaneous equations	No
Explicit 3D Boolean operations	Yes
Variational features (sweeps, lofts, etc.)	Yes
Variable filleting	Yes
Fillet blending (corners)	Yes
Sew surfaces to solid	Yes
Geometry/topology healing	Yes
Feature reordering	Yes
Feature suppression	Yes
Spreadsheet-driven parts	Yes
History editing	Yes
Nonmanifold modeling	Yes
Basic surface modeling	Yes
Advanced surface modeling	No
Shelling	Yes
Draft checking	Limited
Mass properties analysis	Yes
Parting line functionality	Yes
Parting surface functionality	Yes
Lofting	Yes
Standard component parts (fasteners, gears, etc.)	Yes
Parametric selection of standard components	Yes
Sketching	Yes
Explicit 2D Boolean operations	No
Over/underconstrained sketches	Yes
Auto-constraining, dimensioning	Yes
Open profiles	Yes
Constraint analysis tools	Yes
Assemblies	Yes
Assembly features	No
Interference checking	Yes
Exploded views	Yes
Alternate component configurations	No
BOM generation	Yes
Auto BOM with balloons	Yes
Table-driven parts	Yes
Table-driven assemblies	Yes
2D engineering, drawing tools	Yes
Dim standards supported	ANSI, ISO, JIS
2D/3D associativity	One-way 3D to 2D
Sectioning of 3D views	Yes
Details of 3D views	Yes
Auto layout feature	Yes
Symbol library functionality	Yes
Geometric dimensioning and tolerancing (GD&T)	Yes
Visualization/rendering	Yes
Sheet-metal functionality	Yes
Kinematics	Animation
CNC machining	No
General Undo/Redo	Unlimited
OpenGL graphics	Yes
Customization tools	Yes
Model import formats: 3D Studio, ACIS, DXF, IGES, STEP, Raw Triangles, STL, TrueSpace, VRML, Wavefront	
Model export formats: 3D Studio, ACIS, DXF, IGES, STEP, Raw Triangles, STL, TrueSpace, VRML, Wavefront, and others	

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