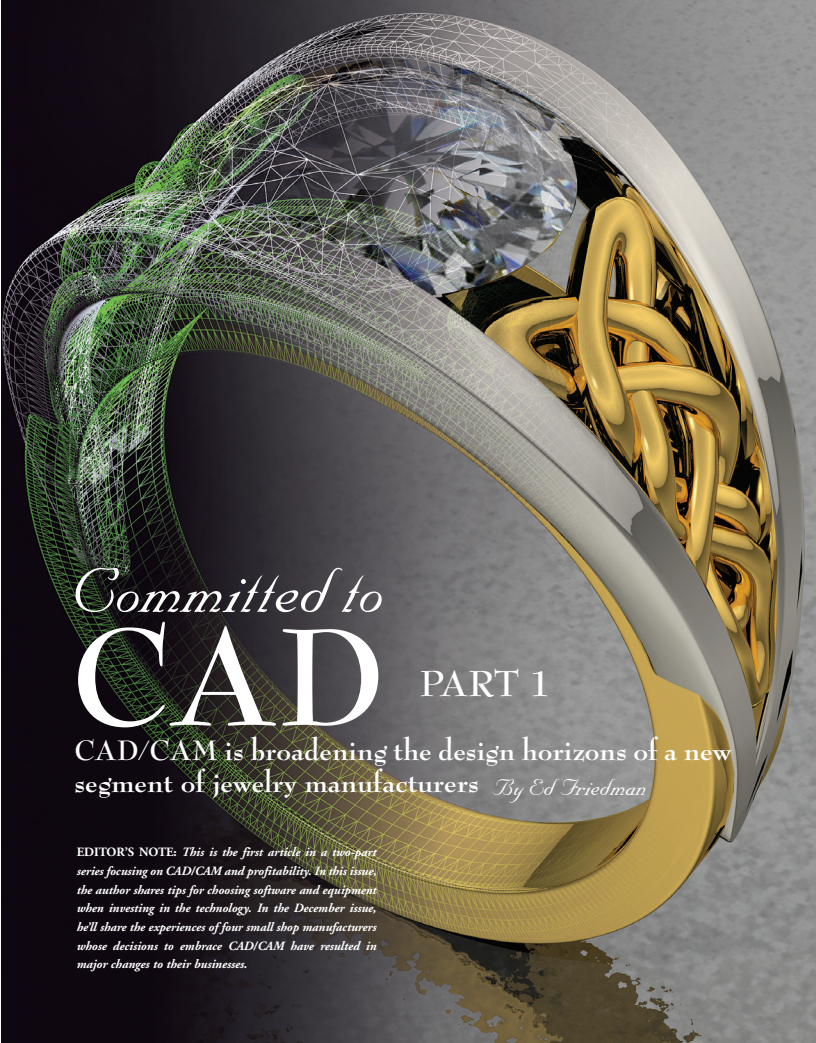




Committed to **CAD** PART 1

CAD/CAM is broadening the design horizons of a new segment of jewelry manufacturers *By Ed Friedman*

EDITOR'S NOTE: *This is the first article in a two-part series focusing on CAD/CAM and profitability. In this issue, the author shares tips for choosing software and equipment when investing in the technology. In the December issue, he'll share the experiences of four small shop manufacturers whose decisions to embrace CAD/CAM have resulted in major changes to their businesses.*

In the past few years, CAD/CAM has had a major impact on small, independent stores and trade shops. This group is using CAD/CAM to take on jobs that before only large manufacturers would consider. Empowered by the technology, smaller businesses are able to produce symmetrically perfect waxes, master models, metal molds, and class rings—all with superior surface finishes and incredible symmetry of design.

CAD/CAM's greatest strength is the ability to create precise wax patterns and master models in-house. Before CAD/CAM, the designer created the artwork by hand and gave it to the model maker, leaving room for miscommunication and misinterpretation. CAD streamlines the design process by turning the designer's handiwork directly into a master model. This improves productivity and ensures fewer mistakes.

Through my work as a CAD/CAM consultant, I have found that it doesn't really matter what program or machine is used. Creative members of the jewelry community are producing a complex and diverse array of products with a variety of CAD/CAM packages. As with any technology, there are a few key points to consider when deciding which system is best for you.

Decisions, Decisions

Choosing CAD software can be overwhelming. There are many packages available, and no matter what software you choose, you sometimes find that it does not do everything you want it to do. As a result, many people end up purchasing extra software and hardware to meet all of their needs.

One way to get a more complete software solution is to purchase a package that includes several programs. For example, the Matrix CAD package from GemVision includes two other programs, Rhino and Flamingo. You can purchase Rhino alone for about \$800, but the learning

curve is longer because you have to build all of the parts yourself—you don't get the stock components (images of rings, heads, bezels, and more) that are included in the Matrix package. In addition, Flamingo provides you with the ability to render your finished design—an option not offered by some programs. If your budget allows, the advantages of this and similar software packages are worth the investment. (*For a list of CAD options, see page xx, and contact the software suppliers for more details.*)

In cost, CAD programs range from about \$800 for a basic program to over \$7,000 for a complex package. Whatever your budget, it's important to ask yourself the following questions when choosing software:

- *Will the program that you are purchasing meet all of your needs?*

Make a list of what you want the design software to do and then compare it to the capabilities of the software that you are considering. Some questions you may want to ask include: How many files can be saved? What equipment is required to operate the software? and What other jewelry companies are using the software?

- *What type of file will the software export?* Most CAD software generates 3-D files that can only be exported to rapid prototyping machines. If you want to produce your parts on a CNC milling or routing machine, you will need a program that can generate a g-code or a toolpath file. There are only a few CAD programs that generate these files. However, if the software you choose doesn't, your supplier should be able to recommend a program compatible with your CAD software that will generate g-code or toolpath files.

CREATING THE MODEL

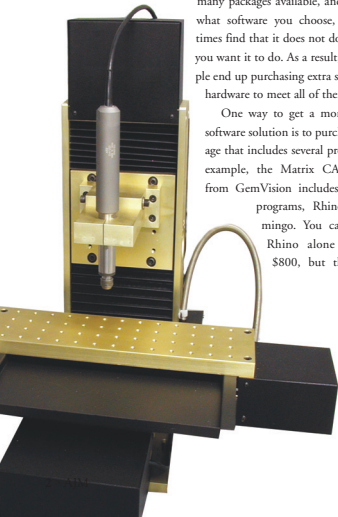
Once you've designed a model in CAD, the next step is to create the physical model. There are two machining options available: CNC milling or routing machines and rapid prototyping machines.

Like CAD software, CNC machines have both strong and weak points. CNC milling or routing machines can cut about 70 percent of jewelry-related files. They can also engrave lettering and do pocketing for inlay and drilling. CNC machines can produce a 20 mm by 30 mm pendant in as little as 25 minutes, and they can cut a 6 mm wide ring in as little 1.5 hours. The ability to cut into wax, plastic, and metals make CNC machines suitable for creating master models in-house.

Prices range from about \$2,500 for a basic milling machine to over \$14,000 for a high-end mill. The primary difference

CNC machines, which can cut into wax, plastic, and metals, are suitable for creating master models in-house.

CNC 1000 Photo courtesy of Model Master.



between mills is operation quality. It is important to make sure the machine you choose does not exhibit backlash—a hesitation in motion when the motor changes direction. This is caused by loose or imprecise mechanisms that connect the motor to the machine. Backlash causes inaccurate reproduction parts.

Another difference between milling machines is the length of time that it takes to mill a piece. This affects the quality on the surface of the model. As a general rule, the high-end mills produce cleaner models faster. You should take this into consideration when choosing a machine.

Milling machines do have a few limitations, however. For example, when having parts milled, the edge of the part will be angled about 7 degrees. This is caused by the angle of the cutting tool. When the model is complete, you have to use a file to straighten the edge. In addition, if you want an undercut on the

Rapid prototyping machines are ideal for designs with undercuts, tapered settings, and gallery wires.

side of a part, you will have to do it by hand: Most mills do not cut the side of the part.

If milling machines won't suit your manufacturing needs, you should consider rapid prototyping machines, which can produce five to 50 pieces in 24 hours, depending on the unit. They are ideal for designs that have undercuts, basket settings, tapered settings, and gallery wires. (Most milling machines are less effective with these types of designs.)

Rapid prototyping machines are more costly than milling machines, however, ranging from about \$50,000 to \$175,000. The differences between the rapid prototyping machines on the market are the way the wax is supported during construction and the durability of the model. A few examples of machines that I have had experience with illustrate these differences:

- The Thermojet Solid Object Printer supports the growing wax model with structures built out of the same wax. These supports are in the form of long strands of wax that fill in voids, and they can cause time-consuming cleanup of the model. As a result, the Thermojet works well on flat designs, such as pendants, logos, and corporate jewelry, in which the top surface of the part is not exposed to these support structures.

- The Model Maker II and Sanders Rapid Toolmaker create parts by printing thin layers made of two types of wax, a red support wax and a green part wax. Once printing is completed, the block of wax is soaked in a solution for several hours to remove the support wax. Although the finished model requires no additional finishing or cleanup, it is fragile and must be handled with care.

- The Viper system creates parts from a polymer that is hardened or sintered by a laser. These models are very durable and can be sanded, polished, and even silicon molded. However, the models are difficult to burnout and can require the use of a high temperature platinum or dental investment. *(For a list of rapid prototyping and milling machine options, see page xx, and contact the equipment manufacturers for more details.)*

Whatever rapid prototyping machine you choose, you should factor in the yearly cost of maintenance contracts when figuring out the cost of the machine. I recommend obtaining a service contract because rapid prototyping machines depend on several jets, which can clog or become damaged during normal usage. If they need to be replaced, it can cost \$1,500 to \$2,000 per jet. A service contract can help you avoid such expensive surprises.

SERVICE BUREAUS

If buying CAD/CAM equipment seems overwhelming or cost-prohibitive, but you are interested in exploring the technology, consider outside service bureaus. Such companies will mill or prototype your files for a fee, and many even have a CAD designer on staff who can model your piece.

When taking advantage of a service bureau's CAD services, it's best to find a bureau that uses the same software that you are planning to use. This will enable you to edit and use the files later. Once you have mastered CAD, your can still send your files to the service bureau to be milled or prototyped.

Whether you opt to use a service bureau's modeling capabilities, or just send out files for milling or prototyping, communication is very important to ensure that you get the type of model you want. The service bureau is just as dependent on you to supply the correct information as a traditional model maker would be: If the information is vague or incomplete, your CAD model may not meet expectations.

However you choose to invest in CAD/CAM technology, it will take some time to become proficient with the software and hardware. But with patience and practice, you're likely to find that CAD/CAM is a welcome addition to the design and manufacturing tools in your workshop.

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