A CAD/CAM Checklist

There are a number of key questions every potential CAD/C (computer-aided design/computer-aided manufacturing) user sh be able to answer before making a commitment.

By PAUL OLSEN, Product Line Manager
GRAFTEK, Inc.
Boulder, Colorado

With so many CAD/CAM systems available today, how does a potential user determine which one is right for his company? Any person delegated to find the proper solution to a company's productivity problems is faced with literally hundreds of vendors declaring their product is the only one that will properly do the job.

Since it is impossible to completely check out a multitude of CAD/CAM systems, the field must be narrowed to a few select vendors. How is such a formidable task performed? It starts by asking yourself a series of questions and getting honest answers. This is follo with the right questions to pros tive vendors and customers, again making sure the answers valid.

Questions For Yourself

What does management expect gain from a CAD/CAM system?

There are many things that CAD/CAM system can do for company; the following are ju some of the more importa benefits:

- Increase design productivity b tween one and six times.
- Improve data flow and commu

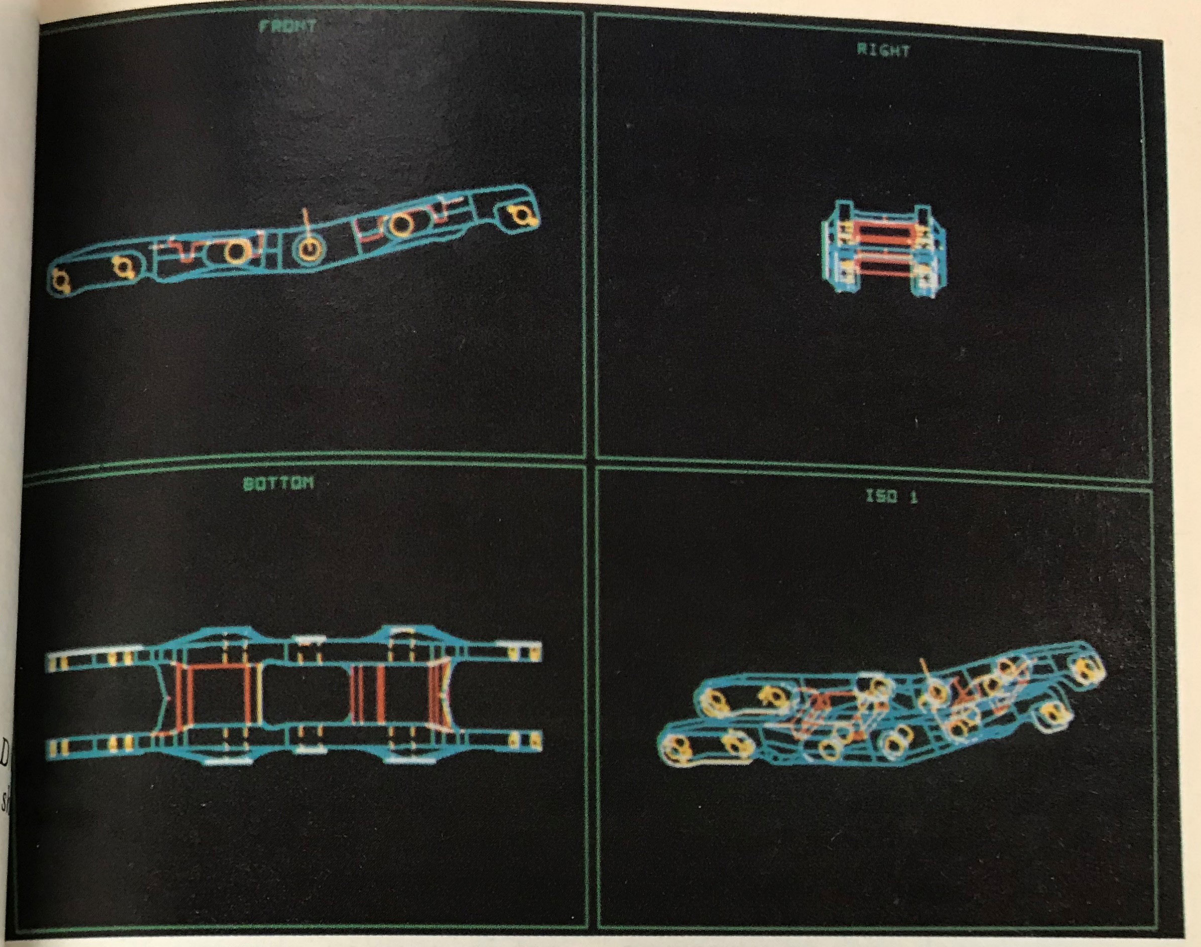


Fig. 1—A true 3-D database enables a user to view a model, such as this wireframe component, from any angle.

nications between design and manufacturing.

- Utilize the generated design database for manufacturing functions such as NC part programming, production planning, and cost analysis.
- Shorten the design process.
- Allow old designs to be modified and used rather than recreating similar parts again and again.

The list could go on and on. However, if this new expensive tool is used improperly, CAD/CAM will be the most expensive toy you have ever purchased. Which brings us to the next important question.

Are there people in my company who can and will make the CAD/CAM system work?

A CAD/CAM system is only as good and only as efficient as the people running it. There are too many cases where a CAD/CAM installation failed because people did not allow the concept to succeed.

Start out by selecting a system manager and allow this person to be part of the selection team. This person must have a general knowledge of computers or the willingness to learn, a good knowledge of the company and its products, the authority to work across department

Fig. 2—Shading is an important tool that aids the user in determining the validity of the model.

thresholds (work with engineering, design and manufacturing), and a won't-quit attitude. In other words, this person must be one of the best in your company. This type of person usually comes from within but can be hired from the outside; however, selecting the right person is more difficult that way.

How will the purchase of a CAD/CAM system affect my company?

In most cases, a CAD/CAM system will allow the company to be more efficient and produce more work. CAD/CAM will also allow the company to increase the complexity of its work. The purchase of the right CAD/CAM system could allow you to do some or all of the work

now farmed out. Like CAD/CAM offers contract sho excellent opportunity to bro their capabilities and servic customers.

There is little doubt that the chase of a CAD/CAM system change your company. It is responsibility to make sure it change for the better.

Will my company purcha CAD/CAM system from only a established company?

Many companies automati opt to go with the safest decisi which is to purchase from only old, established vendor. There advantages and disadvantages this decision. A big advantage is old, established companies hav greater chance of surviving a sl in the economy. A big disadvant is that it may take them longer to act to sudden changes in tech ogy. A good example is the slaught of the 32-bit process Some vendors were so rooted in isting 16-bit products that they a hard time reacting and shifting the faster and more powerful 32-b configuration.

Also, some people believe larg established vendors are not willing to address the unique and specific problems of a customer.

Does my company require a 3-D database?

A system without a 3-D (three-dimensional) database is only an automated drafting package. A true 3-D package will be able to construct 3-D sculptured surfaces, calculate volumes and surface areas

Fig. 3—This example of numerical control programming is just one of many CAM processes.

able to view this model from any angle (see Figure 1). However, the 3-D database requires much more computer overhead and data storage capability. If the added capability is not needed, don't buy it.

Caution: Don't be fooled by a vendor pushing a 2-D database that can project these 2-D entities to a depth and show that data in an isometric view. This is not a true 3-D database; in fact, very few parts can be represented this way.

Does my company require CAE applications?

CAE (computer-aided engineering) is an increasingly important design engineering tool. This covers everything from finding the moment of an arbitrary shape, to simulating and analyzing the flow of plastics into a mold, to using FEM/FEA (finite element modeling/finite element analysis) to analyze the stresses on a critical component of a machine. Notice the shading on the FEM part shown in Figure 2.

If the company plans to use FEM/FEA, remember that the CAD/CAM system selected must have the capability to communicate with it. The original part geometry should be used for the finite element model so that the engineer doesn't have to recreate the model.

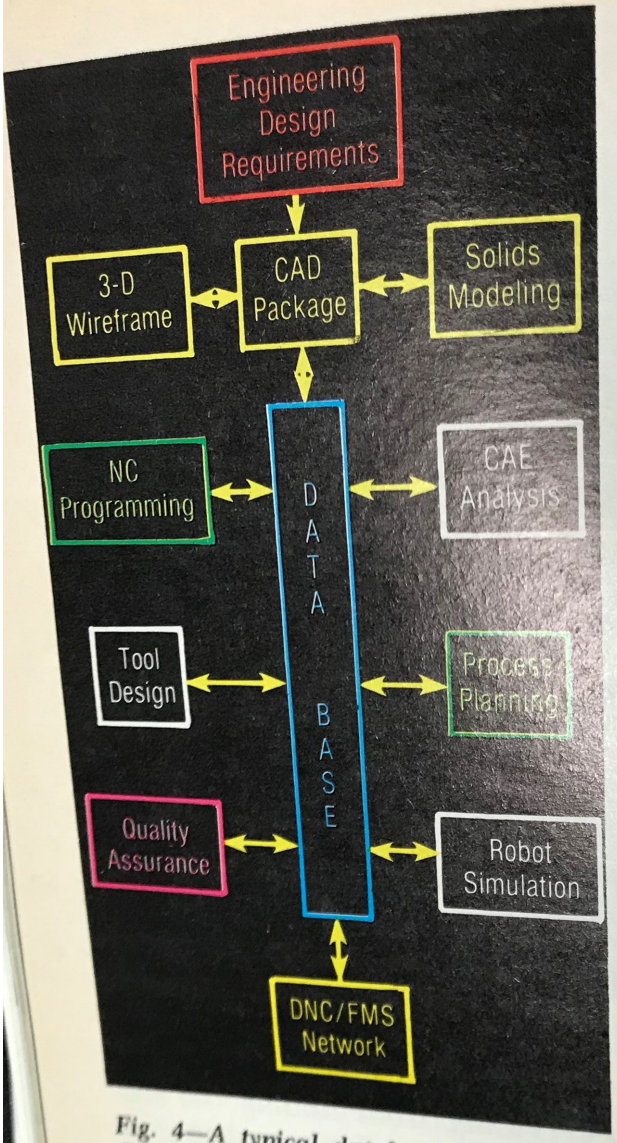


Fig. 4—A typical database information flow. Notice that in the fully integrated CAD/CAM system there is no database conversion between application packages.

What total solution does my company need?

Selection of a CAD/CAM system should be oriented toward a total solution to the company's major problems. If manufacturing is done in-house, a big advantage of CAD/CAM is the information flow between the design department and the engineering department. The system selected should have an integrated solution (one database) for design, engineering and manufacturing. Even solids data should be available throughout the entire design and manufacturing process.

An example of a CAM process is shown in Figure 3 with the information flow from design through manufacturing shown in Figure

Is solid modeling right for my company?

Solid modeling is no longer just a picture generator. In the fully integrated CAD/CAM system, the user can take advantage of all the capabilities of a solid modeling system as well as the added power of the various wireframe application packages.

Not so very long ago, solid modeling was very expensive and required a lot of computer power. It was affordable only by the most advanced research groups with very large and powerful computers. Now the solid modeler has become an essential tool for a number of design and manufacturing processes. A number of parts, similar to the one shown in Figure 5, have shapes that are conducive to solid modeling. They can be visualized and designed very much as a person would mold a piece of clay. With hidden line and shading algorithms operating almost instantly, the designer gets the illusion of walking around the part. Rather than working with single entities that make up the part, as is the case in 3-D wireframe packages, the designer can work with a solid object consisting of many faces and edges as a single entity.

Must the CAD/CAM

tailored to the company's specific needs?

More than likely, there is no turnkey CAD/CAM package on the market that is totally suited to a company's specific applications. That is why a graphics interface language is one of the most important tools that a CAD/CAM package can offer. This programming language allows the user to tailor the system to the specific needs of the company.

Families of parts can be developed and modeled with the aid of a graphics programming language. For example, one program was developed to draw 440 different lengths and widths of mold bases in 2-D or 3-D wireframe. With all the different size mold components associated with these 440 mold bases, the number of different parts that can be represented is virtually unlimited (see Figure 6).

Does my company require multiple drafting standards?

Some international companies require multiple drafting standards. In such cases, the ability to design and draft in one standard and convert automatically to another standard is a very desirable capability. For example, the ability to design and draft in the ANSI standard and convert it to the ISO standard automatically would be very beneficial.

Does my company have to transfer drawings to other companies or divisions that have different systems?

This requirement is becoming more necessary every day. The Initial Graphics Exchange Specification (IGES) is a powerful tool which

Fig. 5—A solid modeling system contributes to faster design of models, such as this high resolution shaded model.

allows dissimilar CAD/CAM systems to exchange design data. Thus, company A can design a part to be manufactured by company B, even though companies A and B do not have the same kind of CAD/CAM system.

Questions To Ask The Vendor

Does the vendor offer a turnkey system?

Turnkey systems have several advantages. A turnkey vendor supplies the hardware and software as a package and if the system is not functioning properly, it is the responsibility of the vendor to fix it if the problem is either hardware or software. Another advantage is that the vendor will fine-tune the software to run efficiently on the hardware that is sold as part of the package. This may not be the case if the software and hardware are purchased separately. This is particularly true for the graphics workstation. In most cases, unless it is sold as part of a turnkey system, a ven-

dor will implement a workstation without fine-tuning the software to take full advantage of all the workstation's features.

Will the vendor give you a live demonstration?

Normally, a vendor presents a rehearsed demonstration. This may indicate what the system will do, but the buyer wants to see how the system arrives at a solution and how long it took to do it. Have the vendor give a live demonstration. Choose two benchmarks: (1) A design or process which will show all the features typically needed in a CAD/CAM system and (2) a simple workpiece that is typical of the work that is done on a day-to-day basis.

The first benchmark should be sent to the vendor in advance so that the results can be reviewed when the facility is visited. The second benchmark should be presented during the visit. Allow the applications engineer to do the entire part from start to finish. Time the process and note any difficulties encountered while constructing the part. Make sure the vendor knows exactly what is required and give him 20 or 30 minutes to plan his approach. Only the most experienced person can process a part without any advance planning time. Take into consideration the person's experience and their knowledge of any particular requirements. It would be helpful to explain how it is presently being done without CAD/CAM.

Can the demonstration be done on the same hardware that you will be purchasing?

Have the demonstration performed on the same equipment that is being purchased. Don't buy a low-cost system and see the software demonstrated on an expensive piece of hardware. If software is being purchased to run on in-house equipment, have the vendor do the benchmark in your plant. If at all possible, run the system with the same number of workstations that will eventually be used. This will provide a good idea of how much productivity can be expected.

What will it cost to add workstations after the initial purchase?

This is an important question because some vendors will quote a low initial price to get the business and attempt to make up for it on additional equipment. Plan ahead for the company's growth. Ask for current pricing on the additional hardware and software that will be required.

Where is the nearest service center and what uptime will the vendor guarantee?

Every system will eventually have a failure. Find out how long your system will be down in such a situation before help arrives on the scene.

What does maintenance cost? Are new software releases covered under maintenance agreements?

It should be determined at the outset if the monthly maintenance fee provides rights to new releases of software free of charge or if there is an additional

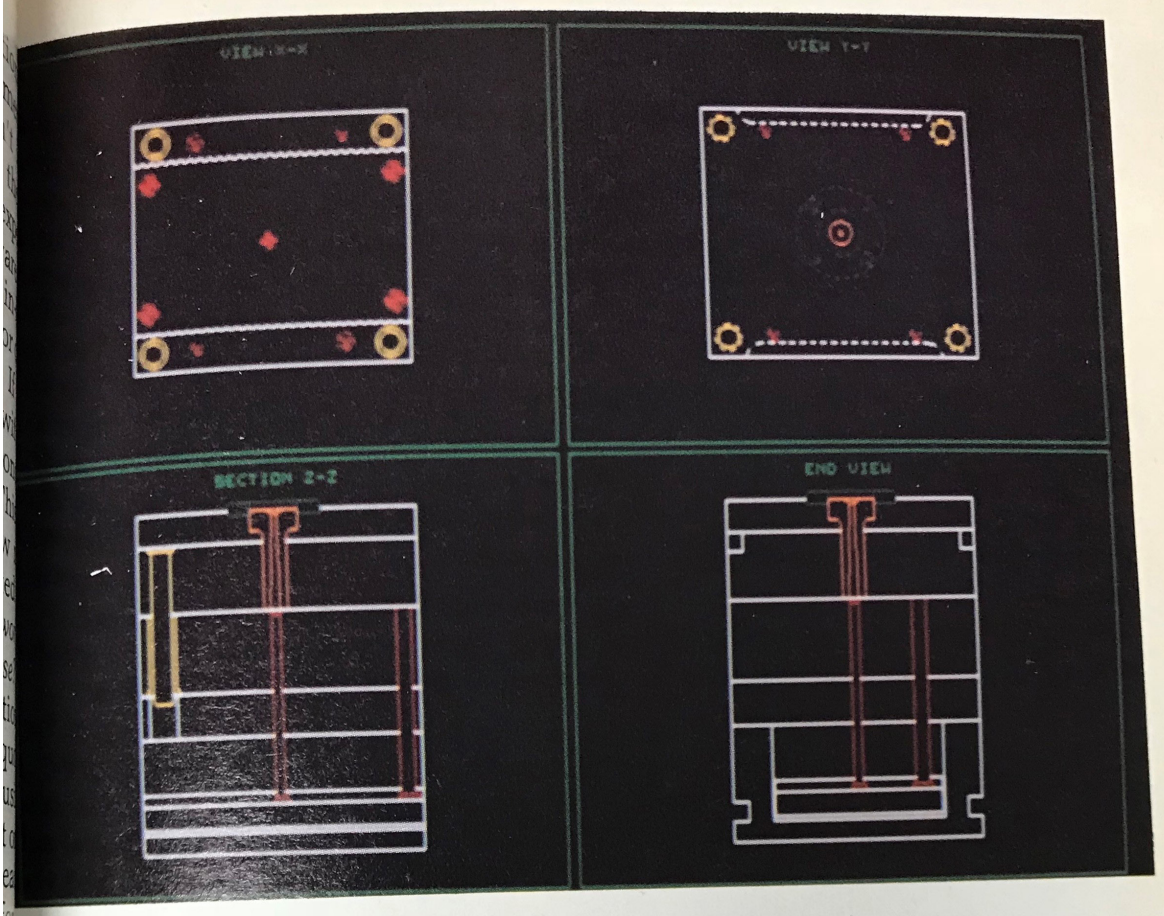


Fig. 6—One of the 440 different mold bases modeled with a single graphics interface language program.

what each vendor's system will cost the first year, the second year, and the third year of operation. Remember to include planned expansion to the system.

Questions To Ask Users

Ask the vendors for a list of references that may be contacted. These companies should be doing work similar to the type being done in your plant. Also, try to contact a few users that are not on the vendor's list. These customers may give another perspective on how the vendor's system performs. The CAD/CAM user should be asked at least the following:

What is the mean uptime as a percentage of the available time?

This provides a good feel for reliability and vendor response time. The figure should be between 85 and 98 percent; see how this compares with the vendor's response.

How reliable is the software?

Ask the user for specific examples of software problems and how long it took the vendor to respond and correct the problems. This will reveal a lot about the vendor and the product.

How often are software updates released?

Most vendors don't give users fixes between releases of software. Therefore, the user has to live with the software until the next release, which may be eight to ten months. Six months is the longest time a customer should be required to wait for the next release.

What applications does the user have and which ones does he use? How has productivity been affected by the CAD/CAM system?

CAD/CAM should increase productivity 300 percent or greater and should allow the user to accomplish tasks that were never attempted by manual means. Discuss specific successes and failures. Any failures should be examined very closely to determine if the cause was the responsibility of the vendor. Attempt to talk with the people doing the work on the system; talking with a manager may or may not produce a realistic answer.

Was it necessary to hire a computer expert to run the CAD/CAM system?

Operation of a CAD/CAM system should be simple enough for a good designer or engineer to use. If the company had to hire an external computer expert to run the system, find out why.

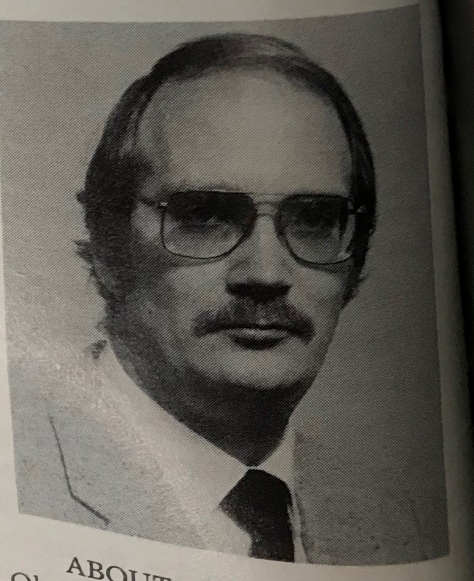
How long did it take the average user to become proficient with the system?

A one- or two-week training course and six to nine weeks of supervised experience should be sufficient for the average user to become proficient with the system. If this is not the case, the learning curve this CAD/CAM system should scrutinized.

Conclusions

Not every question that a se tion team should ask has been vered, and the flavor of the qu tions can be converted to a ye specific list tailored to a compan needs. The selection of a CAD/C system is by no means an easy ta In most cases, the decision sho be made by a selection commit composed of experts from ea department that plans to use t system. If these experts have a ha in the selection process, they will more inclined to make the syst work when it is installed. MS

*For information about GRAFTEK's CAD/C system circle **38** on Postpaid Card.*



ABOUT THE AUTHOR

Paul Olsen is a graduate of Brigham You University and has ten years of experien in CAD/CAM/CAE applications at L Alamos National Laboratory and GRAFTE Paul spent three years as Software Qua Assurance Manager at GRAFTEK prior to h present position of Product Line Man