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KEY SOLUTIONS

THE MAGAZINE FOR CADKEY & DATACAD

Trends & Issues

A Sneak Preview

CADKEY WINDOWS & DataCAD 6

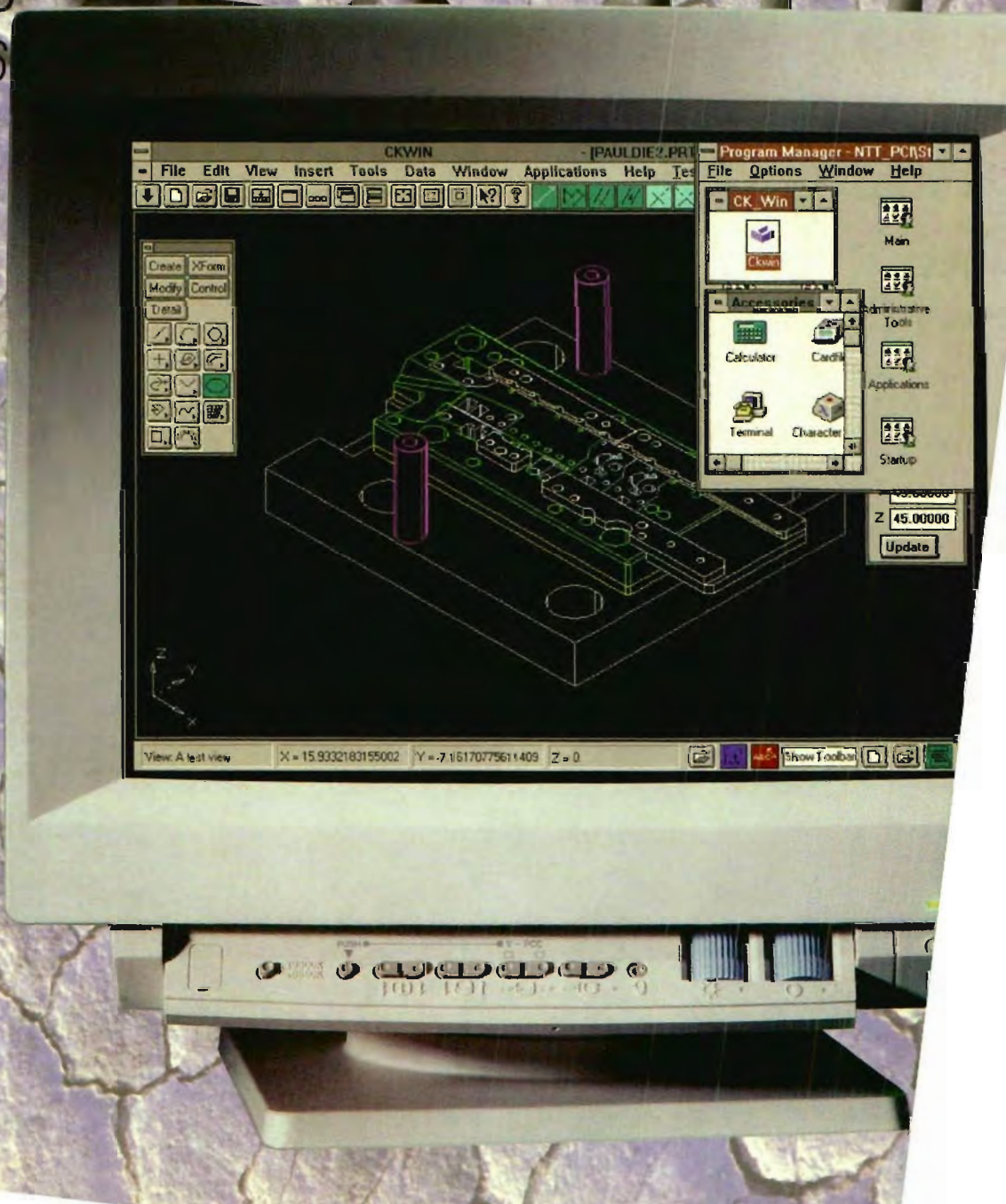
CAD At Work

Using Standards & Libraries for PRODUCTIVITY

Hot Student Projects!

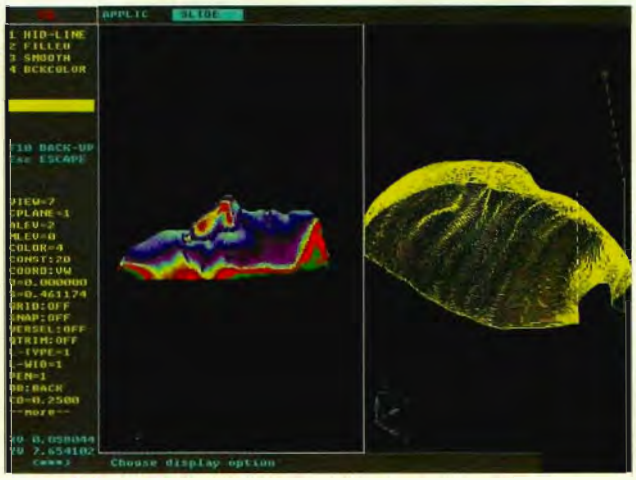
Product Focus

TIPS & TOOLS for Document PRODUCTION



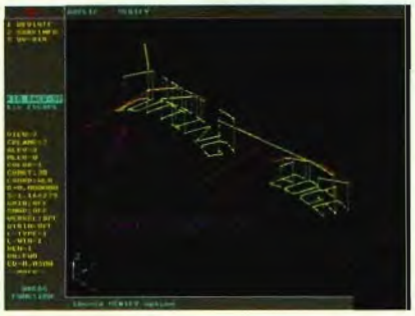
LET'S FACE IT!

If you use CADKEY and need a CAM program to machine surfaces at a price you can afford, you need ALL the facts and CUTTING EDGE SURFACES!



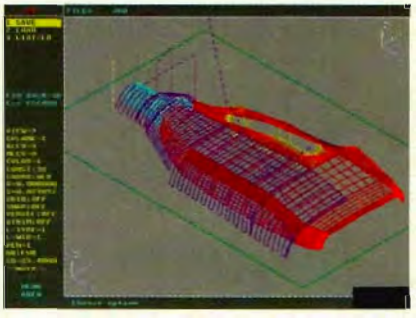
CUTTING EDGE SURFACES has:
- all the geometry of CADKEY
- surface modeling of FASTSURF
- complete tool path editing
- a library of over 100 post processors

No other CAM package has :
- 100% CADKEY data base compatibility
- 100% CADKEY human interface
- a complete CDE & CADL environment
- general NURBS surface machining
- CADKEY IGES capabilities



CUTTING EDGE SURFACES can be used as a stand alone CAM system for 3-axis milling, drilling, boring, reaming, slotting, pocketing, tapping and contouring. Immediate verification of the tool path before cutting reduces material waste.

CUTTING EDGE SURFACES is fully integrated into Cadkey's desktop engineering tools. Now you can manufacture your designs directly from CADKEY part files with 100% failure-free data transfer. NO TRANSLATION needed! You can also transfer other CAD files using IGES, DXF, and CADL.



CUTTING EDGE SURFACES offers ease of use unparalleled in the CAD/CAM world, an outstanding customization environment, general surface machining, and the ability to bring surfaces from any CAD system that supports IGES.

If you don't have a blue print or a CAD design, we can help with that too. Ask about the reverse engineering ability of CADDInspector.

Call your CUTTING EDGE dealer or Cutting Edge Technologies, Inc.

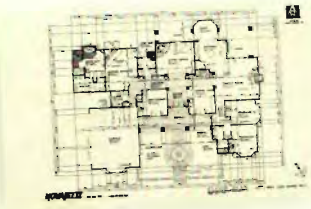
Cutting Edge Technologies

4 Griffin Road North Windsor, CT 06095 ▪ (203) 298-6433 Fax: (203) 298-6490

24 Hr. Automatic Fax Info 1-800-779-0202 Code 124408

Simply brilliant!

The new NOVAJET® III makes your best ideas look brilliant.



Fast line drawings

NOVAJET III **eliminates the pen plotter bottleneck** that can throw your project behind schedule. E-size (ISO A0) black line drawings are produced in as little as 6 minutes—color in as little as 10. And say good-bye to messy pens that clog or skip.

Brilliant color renderings

NOVAJET III goes well beyond drafting. It produces renderings that you have to see to believe. Brilliant color. No banding. In fact, the **images shown in this ad were printed by NOVAJET III and are unretouched.** And you can choose from a variety of fine inkjet papers and films for your best presentation.

Picture perfect quality

NOVAJET III can even print **photographic-quality images,** when professional imaging software is used. Your 3-D renderings or industrial designs come to life.

Priced right

At **$7495** for the 24" (61 cm) model and **$8495** for the 36" (92 cm) model, you won't find a better value.

We'll help you look brilliant

Don't take our word for it. See NOVAJET III in action.

Call 800-45ENCAD

or visit your nearest authorized reseller.

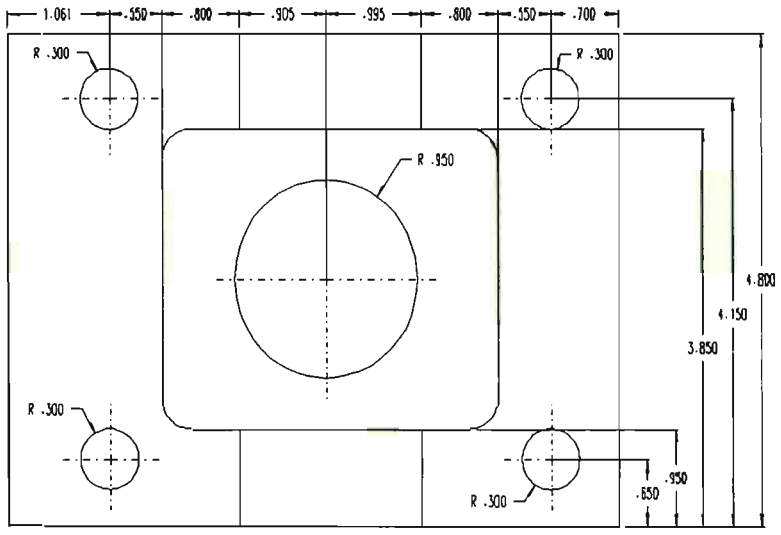
ENCAD®

ENCAD, INC., 6059 Cornerstone Court West, San Diego, CA 92121, Fax (619) 452-0891

Engine illustration by Jeff Goertzen, © 1991 Aldus Corp. • Ferrari illustration by Dennis Kimble • Map courtesy of Vestra Resources, Inc.

Automatic Dimensioning for Cadkey

Unitec, Inc., announces "Dimension *Guru*". A CDE utility that automatically dimensions geometry. The first in the **"*Guru*"** product set to be released for Cadkey users.



Simply select the geometry. Dimension Guru does the rest.

only: $99.95

Call about our new Cadkey 7/ "*Guru*" bundle for less than the price of Cadkey 7.

only: $479.95

Coming soon: "File *Guru*"

Unitec's new file management system that runs in Cadkey. Call us for more information.

Unitec's software pricing

Dimension Guru	**$99.95**	**Draftpak/BOM**	**$635**
Cadkey 7 (Unix or DOS)	**$395**	**Draftpak**	**$435**
Cadkey Drafter	**$195**	**Draftpak Overlay**	**$155**
Cadkey Advanced Modeler	**$995**	**Cadview**	**$195**
Cadkey Annual Upgrade	**$250**	**20" color monitor**	**call**
Cadkey Phone Support	**call**	**17" color monitor**	**call**
Cadkey Pro/Pentium/Guru bundle	**call**	**Custom turn-key system bundles**	**call**

Unitec Inc.

120 College St.
Middletown, Ct. 06457
Phone: (203)343-8460
Fax: (203)343-8462

1-800-365-9595

Call about our trial offers!!!

KEY SOLUTIONS
THE MAGAZINE FOR CADKEY & DATACAD

NOVEMBER 1994
Vol. 3, No. 6

TRENDS AND ISSUES

CAD AT WORK

PRODUCT FOCUS

DATACAD TECHNICAL

CADKEY TECHNICAL

COLUMNS AND DEPARTMENTS

Photo realistic image of custom home. For more, see The DataCAD Portfolio on page 26.

KeyTalk

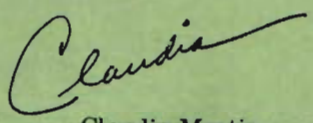
The "ivory tower" syndrome is a potential danger in any type of education. Even technical fields such as engineering and architecture are not immune. The problem is that theory alone is, at best, an impediment. It definitely is not adequate training for the real world pressure cooker of deadlines, design compromises, financing, cost reductions that don't diminish functionality, project management, working as part of a team and working with customers.

We all know that doing is one of the best ways to learn. Fortunately for the future of the design, engineering and architecture fields, today's students are getting involved in projects that not only hone their CAD skills, but give them hands-on experience in things not usually learned in a class room. Some participate in challenging intercollegiate competitions. Others take on projects springing from local needs. In both, they use "book-learning" to produce a "product" and see a project through from design to use. They learn skills not taught in their text books and experience the realities of design, engineering and manufacturing.

During the 1993/94 school year students using CADKEY and DataCAD did just that. Here are a few examples: seniors at California State University at Long Beach participated in the Human Powered Vehicle contest sponsored by ASME (American Society of Mechanical Engineers); sophomore mechanical engineering technology students at Penn State's Shenango Campus designed, built and raced a car for the SAE (Society of Automotive Engineers) Mini-Baja competition; and two high school seniors from Lewiston, Maine designed a handicapped-accessible house for a quadriplegic 6-year-old with DataCAD that was subsequently approved by the FHA and constructed by the community.

You can read about their projects in "Students Learn More Than CAD" in this issue. Their stories and Russ Thomas's description in DataCAD Portfolio of how he uses DataCAD to work with clients reminded me how easy it is to forget that CAD is just a tool of the trade. Even (maybe especially) at **KeySolutions** we get completely caught up in the "nuts and bolts" of making the software work. While we need to be as proficient as possible, CAD is a means, not the end.

Kudos to the super students (and their instructors and advisors) for their skills and their attitude. It's refreshing to know that not all members of the younger generation are going to Hades in a hand basket. Congratulations also to Cadkey, Inc. for their progressive support of education with software and technical support.



Claudia Martin
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KeySolutions
The Magazine for CADKEY & DataCAD

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Cadkey Forum

by Malcolm Davies,
President and CEO - Cadkey, Inc.

I am pleased to announce that the long-awaited CADKEY for Windows will be available shortly. This new product has the functionality of CADKEY 7, but with a full Microsoft Windows interface.

Cadkey, Inc. has been slow to make CADKEY and DataCAD available on Windows, but by waiting until now we have gained many

WINDOWS

+

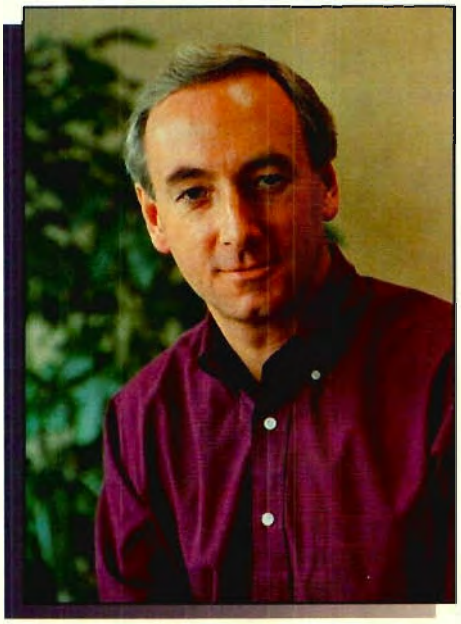
CADKEY

significant competitive advantages. CADKEY for Windows is a full 32-bit application. It runs very effectively on the 16-bit Windows 3.1 using the Win32s library and Windows NT in 32-bit mode. We also have it fully-operational in 32-bit mode running under Windows 95 (formerly Chicago) in the lab, ready when Microsoft ships that operating system.

CADKEY Windows uses some components of CODe (CADKEY OBJECT Developer) which is a C++ object-oriented environment supporting Visual C++ and Microsoft Foundation Classes. CODe is fully compliant with Microsoft standards. CADKEY Windows will be Microsoft Office compatible.

The user interface has been redesigned from the ground up to support the way in which Windows users work. As a Windows user myself, I believe that our technical team led by Steve Mastrangelo has achieved everything that a Windows user would wish for. The interface is totally customizable and looks and feels like a "native" Microsoft application which was the design goal.

CADKEY for Windows is a remarkable product and I am confident that it will attract not only many CADKEY DOS and UNIX customers but many users of competing products and many new users. There is no Windows CAD product available anywhere to match CADKEY for Windows in price ($495) or performance. For additional information, upgrade pricing, or to place an order, please contact your CADKEY Value Added Reseller.



P.S.: DataCAD for Windows is not far behind!

KeyNotes

CADKEY in the News

EduCAD Support Team

Cadkey has announced that Tech Ed Concepts (TEC) of Concord, New Hampshire will assist in sales and support of the EduCAD America campaign. TEC also offers technical support at a reduced rate on CADKEY and DataCAD for schools, educators and students. TEC has been an authorized Cadkey Educational Dealer for over six years. Richard Amarosa, president of TEC and former educator, has built his organization around Cadkey products and the educational market.

EduCAD America, Cadkey's latest educational program allows schools, educators and students to receive CADKEY 7 and DataCAD 5 Professional for $99 each plus shipping and handling. For more information on EduCAD America call TEC toll-free at 800-EduCAD Team (338-2238) or 800-639-5409.

Czech User Group Forms

DataCAD and CADKEY Users Groups were beginning in October in the Czech and Slovak Republics. For more information contact Josef Maly at 3E Praha Engineering, (02) 6835881, 6835882, 6840783.

DataCAD on the Internet

The DataCAD Boston Users Group (DBUG) has started an Internet Mailing List Forum dedicated to DataCAD issues. If you have an e-mail address through CompuServe, America Online, etc. or an Internet site, to join the Mail List just send an e-mail message to **datacad-dbug-request@world.std.com.** and in the body or RE: line type **subscribe datacad-dbug.** Joe DePietro of Cadkey, Inc. is currently working out the details for a DataCAD newsgroup on Internet. Details will be announced as soon as they are final.

Architects Go On Line

The American Institute of Architects (AIA) is introducing its AIA ONline software free to AIA members, associated members and allied members on the Macintosh, DOS and Windows platforms. The cost for using the service in 15 cents/minute for local line time; there is no monthly fee or long-distance charges.

Too Busy to Read Business Books?

Summaries of new business books are available on cassette tape or as 20-30 page booklets. One recent summary of The New Partnership by Tom Melohn, tells how he and his partners turned North American Tool & Die into a world class enterprise, achieving an average sales growth of 29% a year and a 480% increase in productivity. Recognized experts read the book and extract the important ideas and insights of the author. Tapes are approximately 45 minutes long and cost $6. For more information call Audio-Tech Business Book Summaries, Inc. at 800/776-1910 or 312/345-1910.

Have Modem, Will Plot

Mutoh America has announced a new direct modem connection for their LD-2000 series of LED electrophotographic plotters to enhance remote service and plotting capabilities. Mutoh America and Authorized Service Center technicians can diagnose a troubled LD-2000 from remote locations quickly and efficiently. Also, upgrades can be downloaded immediately and end-users can exchange drawing files for plotting from two remote locations anywhere in the U.S. or Canada.

'94 Movies Use State of the Art Graphics

Technological advances blur the line between reality and special effects in movies. For example, 16mm archival footage was manipulated to place Tom Hank's character in "Forrest Gump" at the scene of historical events. In "The Flintstones," the computer-generated character Dino was seamlessly integrated with live actors. These effects are the result of collaboration between JEDI (Joint Environment for Digital Imaging), an advanced production environment for creating digital imagery for special effects and computer animation; Silicon Graphics, Inc., a leading manufacturer of visual computing systems; and Industrial Light & Magic, the world's leading visual effects facility. According to Mike Ramsay, of Silicon Graphic's Visual Systems Group, "Today movie audiences demand technologically advanced, highly creative film. Those expectations drive animators to be more innovative and pushed Silicon Graphics to develop more sophisticated hardware. The entertainment industry is responsible for accelerating the pace of technology in the 1990s."

New Technical Centers

Desktop Engineering has opened technical centers in Ithaca, New York and Troy, Michigan. The new offices will actively market a range of engineering services including computer-aided software development, computer-aided engineering analysis, engineering testing programs and structural/mechanical engineering consulting. The technical centers will also service the company's packaged software products including the DE/CAASE computerized engineering handbook. DE/CAASE represents the world's largest known compilation of solutions to structural/mechanical engineering applications and incorporates solutions to over 5000 structural/mechanical engineering applications. Version 4.1 provides a new graphic interface that operates in Windows, UNIX and DOS.

Key Mail

CADKEY Fixes on BBS

Ed Vocelka of Distefano Tool and Die recently wrote Cadkey about CADKEY 7. We certainly appreciate user input as it helps us target areas of user concern and correct any problems that exist. Ed's first difficulty was that when he selected OLD-NEW, MOVE, POLYGON, the entities sometimes got translated to incorrect locations or did not get translated at all. This error (i.e., intermittent translation errors when using POLYGON on the CADKEY menus to select entities which are part of a collective) has been corrected. His second difficulty was that the Soft Engine cursor button setup for invoking Icon Panels using the Kurta IS-ONE digitizing tablet did not work properly. This error (i.e., incorrect cursor button response codes when using specific graphic cards and the Kurta tablet to invoke Icon Panels) has also been corrected. Both fixes are available as part of the CADKEY 7.03 Patch Utility via the Cadkey BBS.

Felix Giordano, Acting Director of Product Services - Cadkey, Inc.

New DataCAD Users Rave!

I have been absolutely thrilled with the performance of DataCAD 5. I have extensive knowledge of and experience with other CAD programs, too -- including that horrible AutoCAD. I've been wondering why there were no user groups or publications dedicated to this excellent program, but your flyer answered that question. I look forward to receiving my first issue.

Robert Takei - Pasadena, Calif.

Thanks to Cadkey and the designers of DataCAD 5! There is life after the "board." I began working with AutoCAD about 3½ years ago because it was the software my company had. I became frustrated because it did not operate with an architectural process. Company architects and engineers (who were used to the way the software worked and accepted it) would tell me that I had to customize it and write all these macros to get it running the way I wanted it to. I wondered why you should spend $3,500+ on software that wasn't designed for your trade. I purchased DataCAD in January and love it.

Henry Ford, Springfield, Mass.

NEW PRODUCTS

SOFTWARE

Blocks and Materials

Blocks and Materials™, a CD-ROM library, has over 600 3D blocks linked to 1,000 material definitions. All objects and textures can be used directly from the CD (without using any hard disk space) with any CAD software that can read DXF, DWG, and 3DS files. All blocks have been pre-scaled for imperial and metric use. There are 400 3D bitmaps available, of which 200 textures are seamlessly tileable. A set of full color cards are included to help the user locate any block in seconds.

Contact KETIV Technologies, Inc. at 800/458-0690 or Fax 503/252-3668.

Pixar One Twenty Eight

Pixar's collection of 128 photographic textures was created by a professional photographer and designed specifically for use in production quality imaging. Available on CD-ROM, this package includes a Photoshop compatible plug-in which allows the user to seamlessly tile a texture into any area. Each 512 x 512, 24 bit texture can be tiled to fit any area up to 4000 x 4000, or 300 dpi at 13.3" x 13.3", and can be used as backgrounds or as materials for mapping into 3D graphics. Any application that can read PICT or TIFF files on Mac, Windows, or Unix can be used.

Contact Pixar at 800/888-9856 or Fax 510/236-0388.

HARDWARE

ProTOOLS

Maxi Switch, Inc. is shipping programmable keyboards with ProTOOLS, a Windows-based keyboard programming utility. ProTOOLS provides on-screen viewing of the keyboard image, highlighting those keys that are macro keys or that have been remapped from the original factory setting. Clicking on any macro key on the screen, displays the full content of the macro, including variable fields of text and execution delay instructions. ProTOOLS now ships with all Pro Key-124 and Max Pro-II keyboards. The utility is available to all current users from Maxi Switch's electronic BBS or on disk for a small shipping and handling charge.

Contact Maxi Switch at 602/741-3306.

Eagle 3640C Color Scanner

ANA Tech introduces the Eagle 3640C Color Scanner, with 24-bit, single pass, color capabilities.The Eagle 3640C concurrently scans, classifies, compresses, and saves to disk original E/A0 size color documents. Incorporating three 5000-element, tri-linear, color CCD cameras, the Eagle 3640C offers variable scan resolution and a scan rate of 400dpi. The scanner uses Intergraphs's I/CLASS product on the scanned data, giving users the ability to separate multicolor originals into discrete color components.

Contact ANA Tech at 800/533-0165.

Replaceable Inkjet Cartridges

A new inkjet replacement cartridge system is now available from Dia-Nielson USA. This HP Deskjet compatible unit features a reuseable printhead (up to 8 times) and Liquid Ink High Capacity Refills. The refills which are filled with ink do not use sponge material in the cartridge, and provide over 900 pages of writeout. The cartridges snap into place, and are available in four colors: black, cyan, magenta, and yellow.

Contact Dia-Nielson at 609/829-9441 or Fax 609/829-8814.

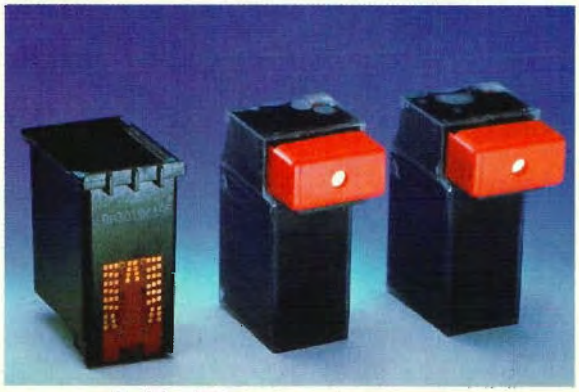
Genoa Graphics Accelerators

Genoa Systems Corporation recently announced the Hornet and the Phantom 64 graphics accelerator cards. Based on the NCR 77c32BLT GUI chip, the Hornet is a 24-bit DRAM-based True Color graphics accelerator, designed for VESA Local Bus architecture. It supports a maximum non-interlaced resolution of 1280 x 1024 and has a standard 1MB DRAM and built-in sockets for upgrading to 2MB. The Phantom 64 is based on the S3 Vision864 chip, with 64-bit architecture, True Color 24-bit at 1280 x 1024 non-interlaced, and a maximum refresh rate of 106Hz. It is available in PCI or VL-bus models, 1MB on board (with sockets for upgrading to 2MB) or 2MB on board. The Phantom 64 also features the "virtual screen," which simulates resolutions up to 1600 x 1200 on low-resolution monitors. Both boards support DPMS in accordance with the EPA's Energy Star program. Suggested list price for the Hornet 1MB DRAM accelerator is $159, and the 1MB DRAM Phantom 64 lists for $249.

Contact Genoa Systems Corporation at 800/934-3662 or Fax 408/434-0997.

Multimedia-Ready Notebook

Toshiba's Computer Systems Division is shipping its Satellites™, T2400C multimedia-ready notebook computer line. The Satellite T2400C Series features an optional sound card with Sound Blasters™, Pro software compatibility, a SCSI-2 port for CD-ROM connection, and the AccuPoint pointing device. It is powered by a 50MHz i486DX2 CPU, and comes with a Dynamic-STN dual



Dia-Nielson's inkjet replacement cartridge system.

scan color or TFT active matrix display. The T2400C ranges from $3200 to $3499. The Satellite T1960C Series includes the same CPU as the T2400C and choice of display with a 200MB or 320MB hard disk drive for $2749 to $2999. Both models include local bus video and graphics accelerator.

Contact Toshiba at 800/334-3445.

Energy-Saving UPS

Optiquest, Inc. introduced a line of green Opti-UPS (Uninterruptable Power Supply) back-up systems for monitors, CPUs, networks, tape drives, and other peripherals. Microprocessor controlled back-up systems include Models UPS-400 ($249), UPS-600 ($299), and UPS-800 ($399); the model number represents volt-amp capacity. Each model has a typical transfer time of two milliseconds with a pure sinewave output. The systems protect against power sags by providing automatic voltage regulation (AVR) which boosts line voltage by 12%. The Opti-UPS system performs a self-diagnosis every time the system is turned on.

Contact Optiquest, Inc. at 909/468-3750.

Optiquest's energy-saving Opti-UPS

New UPS Models

UPSONIC's new Station series of UPS models feature power ratings from 280-volt-amperes to 2 kilovolt-amperes and provide up to 15 minutes of battery power. The Station models automatically activate during power interruptions such as blackouts, sags, surges, noise, and brownouts. Key features include over-voltage protection, hot-start buttons, additional device recepticals, and Pulse Width Modulation circuitry. The six models are designed for use with PCs, LANs, telecommunications equipment, POS systems, and midrange computers. Each model is compatible with all major operating systems. Prices start at $142.

Contact UPSONIC at 800/877-6642.

NEW PRODUCTS

MISC.

The ArmStation

The Kode Company of Dallas, Texas has introduced the ArmStation™ as a solution to Repetitive Movement Injury. The station allows the user to align the arm and shoulder so that the arm can hang at a natural depth. Features include: removable arm and mouse pads, height adjustment, and left or right-handed use. The ArmStation™ can be used with mice, trackballs, joysticks, and small tablets.

Contact Kode Company at 214/351-3081.

The Kode Company's ArmStation™

Process Improvement

Process Dynamics International (PDI), a management consulting firm that helps companies increase profitability through process improvement and business reengineering, is offering a free booklet that explains its stage-based approach, a results-driven roadmap for implementing strategic and operational improvements in a company's key processes. The booklet describes five basic business principles and models that underpin the stage-based approach and includes a real-world study on how the approach has been successfully applied. PDI consists of an international network of senior level consultants.

Contact Process Dynamics Intn'l at 512/345-2588 or Fax 512/263-9105.

ENGINEERING

Geopath Upgrade

Solutionware Corporation announced Geopath for Windows, version 1.6. Features include Windows interface, fast programming support, 3D support, direct import of IGES, DXF, and other CAD files, high speed machining support, program modification, layer control, on-screen tool paths, built-in technology table, programmable feed-rate control, automatic RPM control, unlimited memory access, and a variety of special functions such as Describe/Label for identifying operations. System requirements are 486 with math co-processor, Windows 3.1, minimum of 8MB RAM, 6MB minimum of free hard disk space, mouse or pointing device, VGA card, and serial port for NC machines. This release is available as a complete package or as an upgrade for previous Windows or DOS users.

Contact Solutionware at 408/249-1529.

Digital Gages from Mitutoyo

Digi-Test Gages, now available from Mitutoyo, provide a selection of different jaw styles for use on difficult characteristics. The new models are designed with a large handle and thumb trigger. Measurements are presented on a high contrast LCD readout with 6mm high digits. The display operates in four modes: Continuous display, Maximum Hold, Minimum Hold, and Static Measurement. Eight models of Digi-Test are available for inside dimensions with a choice of two or three contact surfaces. Another five models are equipped with jaws for outside dimensions. Digi-Test is powered by a single 9 volt battery cell and an auto-power off feature to conserve life.

Contact Mitutoyo at 708/820-9666.

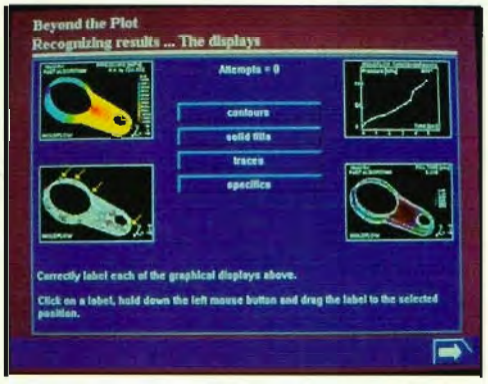
Automatic Part Placement Software

DTM Corporation announced the release of Automatic Part Placement software for the Sinterstation® 2000 System. This software allows for rapid placement of parts during the build set-up process, saving time when building many copies of the same part or single copies of many parts. The Automatic Part Placement software places selected parts in the build volume of the Sinterstation and calculates the location of each part. Information on the status of each part included in the build volume is readily available. DTM will be offering this software at an introductory price of $6,450 through the end of 1994.

Contact DTM Corporation at 512/339-2922 or Fax 512/832-6753.

Moldflow Dynamic Series

The Moldflow Dynamic Series for Windows is a suite of predictive analysis tools that optimize production of plastic parts. The Series lets an engineer assess the feasibility of a design in a short time. To help track analysis work, Moldflow's online project manager graphically



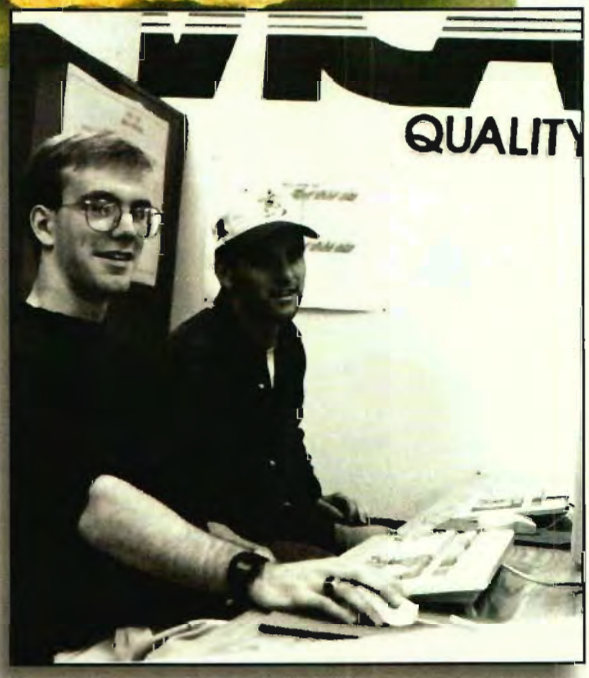
charts the stages of work completed. Analysis tools include: MF/WARP isolates and controls part warpage; MF/STRESS ensures the part meets structural and performance specifications; MF/SHRINK determines shrinkage to enable accurate mold cavity sizing; MF/GAS optimizes plastic and gas flow for gas injection molding; MF/TSETS optimizes thermoset molding; and MF/OPTIM determines optimum machine settings. All analyses are performed using a mouse controlled graphical interface in Windows 3.1. The series requires a 33MHz 486 PC with a minimum of 16 MB RAM and 100 MB free disk space.

Contact Moldflow at 203/925-0552 or Fax 203/925-1175.

Students Learn More Than CAD

by Claudia Martin

Designers, architects and engineers need more than good CAD skills – things like creativity, initiative, perserverence and the ability to work with people in real-life situations. How do students today rate in these areas? The following students not only learned to use DataCAD and CADKEY, but got involved in projects. In the process, they learned much more than CAD.



Derek Labrecque, left, and Eric Milliken, seniors at Lewiston High School, work at the computer on drawings for the handicapped-accessible house. (Photo by Winslow Durgin)

Designing a Handicapped-Accessible House

In June of 1991, 5-year-old Adam Bailey suffered injuries from a car accident that left him both quadriplegic and ventilator-dependent. The family's small apartment was not adequate; it wouldn't even permit free movement of Adam's wheelchair between rooms.

Concerned groups and individuals in the close-knit communities in and around Lewiston, Maine got involved and worked together to help solve the problem. They donated time, money, materials and also caring towards the construction of a handicapped-accessible home. Students from the drafting class at Lewiston Reginal Technical Center pitched in, too--by designing a special house.

Derek Labrecque and Eric Milliken, senior drafting students and local leaders in the vocational Industrial Clubs of America at L.R.T.C. became involved in the project in the fall of 1993 through the efforts of Susan Jalbert. She works for the People's Regional Opportunity Program and was coordinating the effort to build Adam's family an affordable handicapped-accessible home. Not so coincidentally, she is married to Don Jalbert, teacher of the Technical Center's Drafting Technology and Computer Aided Drafting Course.

Derek and Eric started with two basic plans, ran them back and forth to Adam's mother, Lisa, for changes and suggestions and eventually settled on a final plan. Even seasoned house designers know that those changes were infinitely easier on the computer. Working with DataCAD, they then developed a complete set of working drawings. The home was designed to meet Adam's special needs. The doors are all 3 feet wide, the shower is wider than normal and there are many ramps. Labrecque explained, "There's a door from Adam's bedroom directly to the outside with a ramp and another set of ramps in the interior of the attached garage." Milliken added, "There were a lot of changes and modifications. It was a struggle doing the fine-tuning." (Editor's Note: Think they're learning about real life here?)

Both students had purchased DataCAD for their home computers. "They worked at home as well as in class," said Don Jalbert, their drafting instructor. "They went well beyond what's strictly required of them. Labrecque even came in during summer vacation to help finish up."

Derek and Eric's house design received preliminary approval from the Farmers' Home Administration in the spring and after a final pass from a registered architect received final approval in late summer. Ground was broken in September and general contractor, Steve Lyons, was confident the family would be celebrating Thanksgiving in their new home.

Team XTASY with road race fairing (mounted on HPV) and sprint fairing, left to right: David Haigh, Harvey Cook, Kevin Sequeira, Louise Earley, Matt Wong and Shirlynn Cortez.

Wood mold for sprint fairing. XTASY directors, left to right: David Haigh, Kevin Sequeira and Harvey Cook.

Building and Racing a Human Powered Vehicle

The challenge in this ASME competition is to build and race the fastest human powered vehicle — basically an aerodynamically enhanced (usually with a turtle shell-like fairing) bicycle. For their senior project Cal State Long Beach engineering students Kevin Sequeira, Harvey Cook and David Haigh led a ten-student team that designed and built a human-powered vehicle, code-named XTASY, from scratch. This year's race was open to Standard (single seat), Tandem and Practical vehicles. XTASY was a semi-recumbent standard with a fairing.

XTASY's semi-recumbent bicycle and fairing were both engineering challenges. According to chief designer Kevin Sequeira, "We started with a racing bike design and modified the seat tube's position from the normal seventy-three degrees to thirty-five degrees, which put the seat further behind the crankshaft. Our modified bike had the comfort of a recumbent, and we could change riders as fast as a racing bike in the pit."

This was the first time a CSU-Long Beach team used a fiberglass fairing with true airfoils. Kevin created XTASY's fairing design concept. "I copied an airfoil design out of a model airplane book and modified it," he said. "I took a horizontal section of the airfoil and plotted those points on the computer to make the airfoil. Then I measured the rider on the bike in three dimensions and translated that into CADKEY. I placed horizontal airfoils around the bike and rider, scaled the airfoil around the rider at six-inch intervals, and then took a section cut and used those points to make a spline. CADKEY's 3D wire frame let us create all the shapes we needed." CAD was essential in this project for getting the complex shapes required in a fairing design.

The students then built a fairing mold using the CADKEY design data. They made vertical plywood cross-sections and put one-inch wood stripping across vertical cross sections to give it form and surface shape. They added spackle paste over wood, primed and sanded it, and finally added a fiberglass layer and put resin on it to form a shell. Two fairings were built from the mold, a full fairing (7.5′ x 5′ x 2′) for the sprint race and a partial for the longer thirty-five mile lap road race. "A full fairing gives you better speed over a short distance," explained Kevin. "But in a road race if you fall down with a full fairing, you can't get up without help."

The May competition at the University of California at Davis consisted of three phases: static in which the student's creations were judged on design innovation, testing, analysis, safety and aesthetics; a sprint race judged on the fastest speed through a 200-meter time trap; and a road race of thirty-five, nine mile laps to be completed in one and one-half hours, relay style.

The XTASY team's design refinements paid off in personal bests and an overall improvement in the school's ranking. Of 27 Standard entrants from five states, the XTASY

placed ninth overall, up from sixteenth in 1993. The team finished third in the road race in spite of heavy cross-winds and an upgrade track. The team had placed thirteenth in 1993 without the aerodynamic fairing.

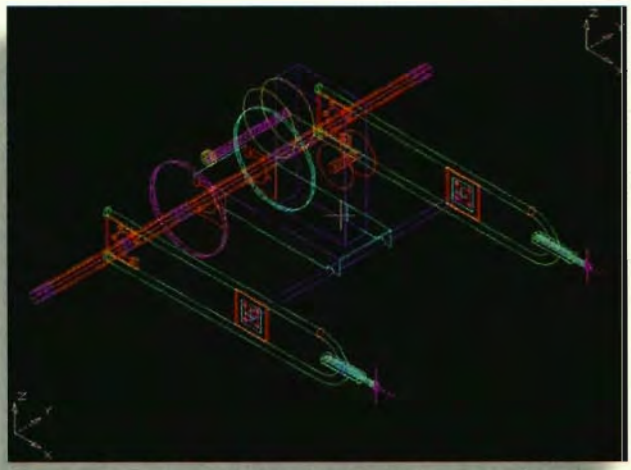
A First Time at the Midwest Mini-Baja

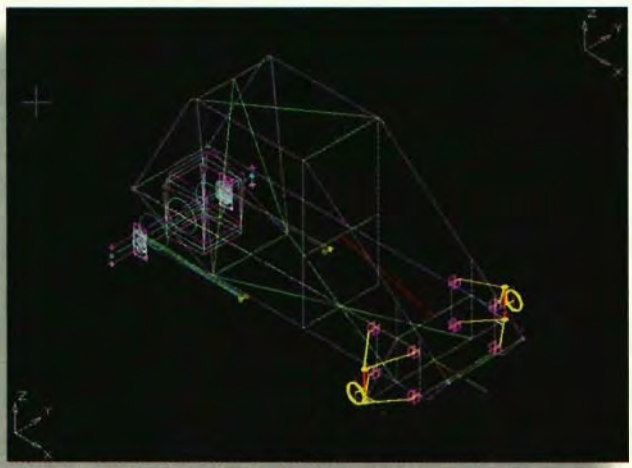
The Society of Automotive Engineers Mini-Baja competitions pit student-designed off-road vehicles against one another and against some tough terrain. The 1994 Midwest Mini-Baja in Waukesha, WI attracted 68 vehicles and some tough competition.

Some mechanical engineering technology students at Penn State University's Shenango Campus "did themselves right proud" this year. Shenango, a two-year technology and pre-engineering school, not only participated in the SAE Collegiate Mid-West Mini-Baja Design Competition for the first time, but they competed against engineering students at four-year institutions and placed in the middle of all the static and dynamic judged categories. They placed eighteenth in the combined category of design and cost reports and overall vehicle cost.

Penn State's Mini-Baja off-road vehicle.

According to William Henry, the team captain, they were especially proud of completing a complex project in a tight time frame. Although the rules for the Mini-Baja were received in September 1993, the students reviewed the rules and began designing the vehicle at the beginning of the spring semester 1994. They had the chassis design completed by the beginning of March so the chassis fabrication could be completed over spring break. A Safety Report was submitted February 7. All deadlines were met and the vehicle was ready to roll by race time during the first week of June..... on time and under budget!


Three dimensional detail drawing of rear swing arm and engine mount.


Three dimensional drawing of vehicle chassis including front suspension and rear swing arm.

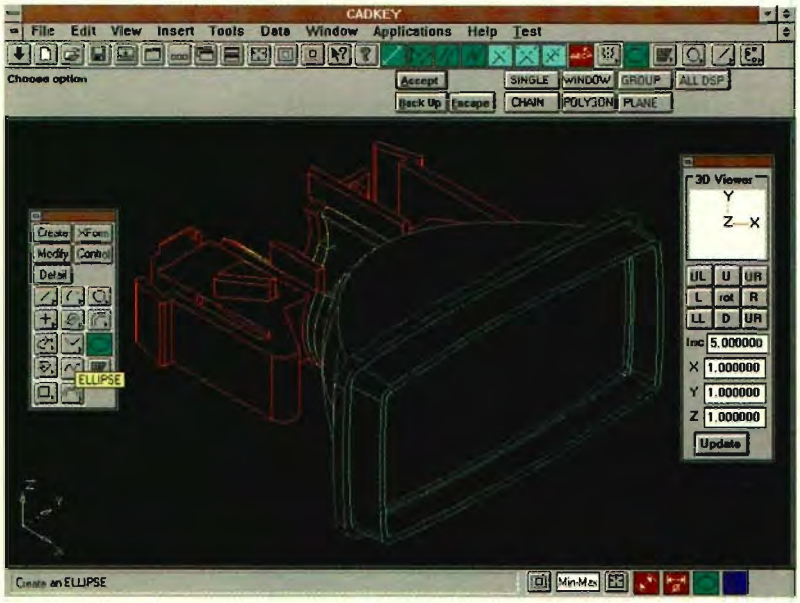
The students could have used another CAD system, but chose CADKEY because of its user friendly environment and analytical capabilities. It was used in many instances to calculate centroids and moments of inertia. In addition, they drew the entire chassis in 3D because it allowed them to analyze vehicle subassembly relationships, clearances and interferences, and driver ergonomics and safety.

A 3D welding fixture was conceptualized using CADKEY and eventually constructed from plywood and wood blocking. Then full scale plots were done of the chassis side frames and cross members to be used for the welding fixture. The full size plots of the chassis were also used to layout and fabricate all of the chassis structural elements which were made from aircraft tubing. Each individual structural element was fabricated by taking dimensional and angular data directly from the CADKEY generated drawings and setting up a small computer numerically controlled (CNC) mill to manufacture the parts. Don Styduhar, the Engineering Technology instructor, said it succinctly. "Without the time saving advantage of CADKEY with CNC, the short time frame for design and fabrication could never have been met."

The design of the rear wing arm and engine mount also benefited from CADKEY's strong 3D capability. As a result of 3D modeling, this assembly was designed as a modular unit which is attached to the chassis at six points. This allows for ease of servicing and replacement.

Plans are already being made for the 1995 Mini-Baja competition. The car's design will be improved by redesigning the front suspension, steering and power train — with CADKEY of course!

A FIRST LOOK



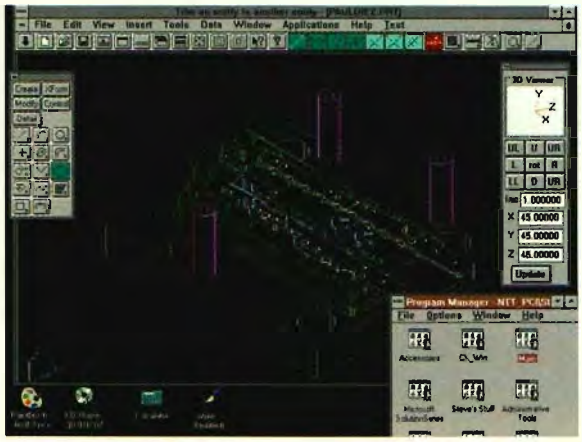
Cadkey's two major releases this fall are full of impressive and user-friendly features that should appreciably enhance functionality and productivity. Both packages -- DataCAD 6 and CADKEY for Windows -- have refreshing new interfaces designed for ease of use. Best of all, both reflect Cadkey's commitment to meeting the wants, needs, and criticisms of users. The development team really listened. Thanks!

At first glance you may not recognize this Windows CAD product as something from CADKEY. Once you begin working with it, you'll realize it is CADKEY -- a new and different CADKEY -- and a real Windows application that makes using CADKEY easier and faster. To create CADKEY Windows, the development team first made some involved decisions. Should the CADKEY Windows product look just like the DOS version? How "Windows-like" should it be? What about Windows NT? or Windows 95 (a.k.a. Chicago)? And most importantly, how do you take a powerful program like CADKEY 7 and make it work in a Windows environment while maintaining flexibility, speed and efficiency?

The goals set for CADKEY Windows were simply to make one product that works in Windows 3.1, Windows for Work Groups 3.11, Windows NT 3.5 and Windows 95; design the program so users never have to go more than three levels deep to execute any function; allow users the flexibility to change their screen layout at will; and take advantage of all the capabilities Windows offers.

Here are some highlights of the inaugural version of the Windows version of CADKEY.

- The 32 bit program runs under Windows 3.1, 3.11, NT 3.5 and Windows 95 -- right out of the box with no special versions and no extra cost. If you upgrade your Windows operating system CADKEY Windows still works.



- An intuitive layout and space saving design lets you get to functions easily and quickly. For example for the Create, Conic, Ellipse function all you need to do is select the Ellipse icon. Also, CADKEY Windows can handle up to 15 options per menu (the DOS version was limited to 9).

- All CADKEY Windows functions and controls reside in Dialog Boxes that can be undocked and moved anywhere on the screen. They are even smart enough to know when they are near an edge and will re-dock automatically. You can experiment with the screen configuration that works best for you.

- It's a true Windows application: you can minimize the session at any time to swap between different programs. You can also capture screen images to the clipboard.

- Its input flexibility lets you work the way you like to work. Functions can be executed via icons and the menu area, but you can also do it from the history line. Icons can be copied to a

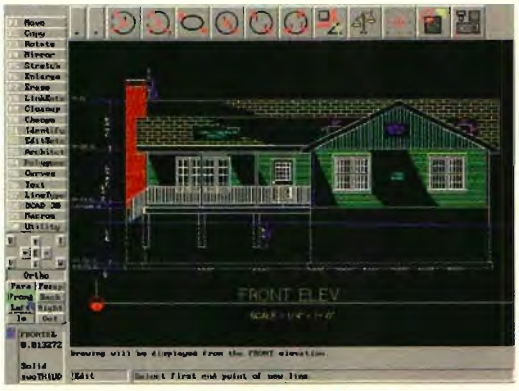
users customized toolbar simply by dragging and dropping. What used to require at least four keystrokes to create line strings can now be achieved by simply clicking on an icon.

- In addition, all CADKEY Windows Immediate Mode commands can be mapped to any two-key combination. They can also be mapped to multiple keys. For example, in Windows Ctrl-S saves a file and can be used to save a part file. However, you can also map Ctrl-F (just like CADKEY DOS) to save a file.

DataCAD 6

DataCAD 6's new key features include a major "interface-lift" based on an icon toolbar; new easier-to-use 24-bit color rendering; and a framing utility with an optional (add-on sold separately) estimating package.

Customizable icon toolbars now provide a visual and easy-to-use alternative to existing menus and hot-key access. You just point and click on the icons to access all the commonly used DataCAD commands, including Walls, Doors, Copy, Move, Stretch, Cleanup, etc. Even RenderStar can be accessed directly within DataCAD by clicking on the appropriate icon. (Remember how you used to have to exit to DOS to run this program?)



Icon Toolbar Interface

Icons are also available for the add-on macros Touch-Up, Blocker or Command Performance - if you have them now or buy them in the future.

RenderStar now comes up directly within DataCAD. This powerful program provides true photo realistic rendering. With point and click access, you can create high resolution color graphics and control light sources, shadows, texture maps and support of 16.7 million colors. This even works with simple IBM VGA 16 color graphics cards and drivers.


24 Bit Rendering


Frame It

Framing was the number one request from end users and here it is. Frame It automatically creates the framing for walls and floors from a 3D image of the building's foundations. Also, the system can output an ASCII file containing a description of the materials used for framing which is a complete list of "board feet" for all 2x4s, 2x6s, etc. The optional add-on estimating package accepts the text file output and allows a full cost estimate for the job based on the bill of materials.

Other new features of note include a filter to control layers with "wild card" characters like DOS (* or $) and two-way transparent file transfer between DataCAD 5 and 6.

Rx For Document Insanity

Simple Ways With Graphics

by Claudia Martin

All that architects and engineers do is conceptualize great designs, draw them in CAD and output beautiful drawings. Right?

W-r-o-o-n-g!! Although you might like it that way, nothing could be further from the truth. You must deal with (shudder) the written and printed word and regularly produce documents — letters, reports, proposals, presentations, catalogs, product sheets, etc. — to communicate information about your ideas, projects and products to customers, supervisors and team members.

These documents must not only be clear, concise and complete, but must include graphic elements. Including drawings, charts, tables, graphs, and spreadsheets is where document insanity usually begins.

So, here are some hints on how to get those pesky graphics out of CAD and into a document without glue and scissors, swearing and/or madness. Many of the ideas are based on our experiences at **KeySolutions** combining CAD output, assorted graphic files, spreadsheets and formulas with text.

A Sound Foundation

Since technical documents combine words with drawings and other illustrations such as spreadsheets, the problem is how to combine these disparate elements easily, effectively — and electronically. The beginning of the solution is word processing or desktop publishing software that can import a variety of graphic formats without gross problems. Many excellent products are available. The DOS and Windows versions of high-end word processors can perform many desktop publishing functions in addition to general word processing. The "biggies" in word processing are Word Perfect and Microsoft Word, but there are others. PageMaker, FrameMaker and QuarkExpress are the "heavy-weights" in Windows desktop publishing packages. AmiPro is somewhere in between.

INCLUDING DRAWINGS, CHARTS, TABLES, GRAPHS, AND SPREADSHEETS IS WHERE DOCUMENT INSANITY USUALLY BEGINS.

Whether you prefer to work in Windows or DOS may be a deciding factor. There are pros and cons. Windows brings WYSIWYG (what you see is what you get) and OLE (object linked embedding) capabilities. On the other hand, Windows programs gobble up disk space and can be appallingly slow unless you have a hefty hardware platform under them.

If your company doesn't produce mega-quantities of technical documents, you're probably best served by one of the all-purpose word processors. You save disk space and won't need to learn and use two different software programs which can get confusing.

That said, I'll confess that at **KeySolutions** we use two: Word for Windows 6 for general word processing of reports, office correspondence, small books and miscellaneous engineering documents. In spite of occasional bugs which crash everything, we like all the wonderful things it does. (Save often!) We also use PageMaker for rough draft layouts of magazine pages because our Macintosh-based graphics production people can work most easily with this PC file format.

If you work with outside artists or production houses, be aware that most graphic-types work on the Mac. Oil and water can mix, but PC-types must have their wits about them. For example, find out about compatibilities before you invest money in a product or time on a project. We got all excited when we got PageMaker 5, and then couldn't use it because the Mac version couldn't read PC PageMaker 5 files at that time. And even though PC-MAC file translations get more sophisticated all the time, some files and translations can be peculiar. Our Mac-based artist cannot open PageMaker files with graphics files embedded. We provide PageMaker (text only) and the graphics as separate files.

Importing CAD Graphics

Since text programs do not import CADKEY .prt or DataCAD .dc5 files directly, you must create a graphic

image of the drawing in a file format your document software understands. There are three methods: you can use the internal capabilities of DataCAD or CADKEY, an external screen capture program or scan a hard copy of a drawing. The method you choose will be determined by whether you want color images or lines.

It's important to realize that once you create a graphic file and place it in a document, you cannot modify it. You can manipulate it minimally - make the image larger or smaller and sometimes crop off the edges. But if you want to change the lines in the drawing, you must return to the CAD program, modify the drawing and begin again. As Windows CAD comes into its own, OLE will help with this limitation, but for now, "it's back to the drawing board."

Black Line Drawings - If all you need is lines, the HPGL files produced by your CAD program function beautifully with most word processing and publishing software. The files are relatively small, you get only the drawing without the menus or other screen stuff and the line quality in the final document is good.

You simply create the HPGL file the standard way and then import, insert or place it (depending on your software's terminology) in the document.

One confusing thing about working with HPGL files is that there seems to be no standardization for the file extent. If a particular package tells you it cannot recognize your HPGL file, look at the extent. You may have to rename the file to get the software to recognize it. Word for Windows 6 looks for an .hgl extent, but HiJaak and PageMaker want a .pgl extent — for the exact same file.

Note for CADKEY: *Warning! Files created by the PLOTFAST program (via the Files, Plot, Save menus) cannot be read by other programs. To create a true HPGL file, select Control, Plot from the Main Menu. Then select HPGL in the Plotter box and File in the Port box. Name the file with the correct extent. It will be saved in the main CADKEY subdirectory.*

Ways To Get CAD Drawings Ready for Documents

1. Create an HPGL file for lines
2. Create a CADKEY GIF or DataCAD POF file for a color image
3. Use a screen capture program
4. Scan hard copy -text or graphics

Color Images - Graphic images in color can be produced with DataCAD or CADKEY's internal tools or an external screen capture program. The internal image capture function in both CAD programs is easy to use and trouble free. You set up options (the entire screen, the viewport only, or a selectable area). Then with the drawing displayed the way you want it on the screen, you enter the command.

In CADKEY a GIF file is created and automatically placed in your CADKEY\PRT subdirectory. GIF, the standard Compuserve graphic format, is recognized directly by most other programs. CADKEY also names the files sequentially (S1.gif, S2.gif). At some point you should rename the GIF files and perhaps move them to a more logical subdirectory.

Some CDE and CADL routines interfere with CADKEY's slide function. The solution is a screen capture program like HiJaak. Such programs let you capture screens from any Windows or DOS program.

In DataCAD the process is similar, except the image file is produced in POF (pixel output format) and placed in the DataCAD/POF subdirectory. This proprietary format must be converted to a format usable in other programs. A utility in the DataCAD\POF subdirectory lets you convert the POF file to PCX or TIF but you must shell to DOS to use it.

3D Power Tools, a DataCAD macro (see details in "DataCAD Productivity Tools" column) can automatically generate a series of quick-shaded images from 3D Goto Views and batch process them to .tga, .pcx, or .2rn files with just one command. You can also use a shareware utility such as tga2fli to create fly-through animations from your quick-shaded views.

When you capture an image with your CAD program or an external screen capture program like HiJaak, remember it really is WYSIWYG. Color, line width, contrast and screen all affect the quality of the captured image. This may require some experimentation.

Resolutions below 1024 x 768 tend to look a little "jaggie." We also find that the line width normally used for drawing (looks great on the screen and is easy to see) doesn't work well for color reproduction via the screen capture process. (This isn't a factor in most HPGL files.) We take drawing files, widen all or most of the lines, and then capture the screen. It looks terrible on the screen (you would never work that way), but the hard copy output is legible. If we don't do this, the lines become pale shadows of their real self — wispy and too fine. Sometimes images that look dreadful on the screen print fine. Another trick for making an image in a document look better is to output an HPGL file at a larger than normal scale. Then when it is placed in the document reduce the size of the image. All those little "dots" that make up the raster image get pushed closer together — a less than technical explanation.

Scanning

Scanning is a really quick way to produce a graphic image. Once the image is scanned, the file can be dealt with exactly like files created through the CAD program or a screen capture program. This isn't a document application, but some engineers scan drawings from catalogs, convert them to vectors and use them as a library of symbols.

The OCR (optical character recognition) software that comes with most scanners is a real boon if you have pages of words that must be keyed in from hard copy.

The cost of small desktop scanners is coming down.

Graphic Files

All graphic files are big; some are humongous and those from rendering packages are bigger than that. For example, one photo realistic image of the house in this issue's DataCAD portfolio was over 7 megs. We received it on five floppy disks along with a little program called Combine that put it back together on our hard drive. To transport it to the Mac, we used a Syquest cartridge and a graphics service bureau. The point is — watch your disk space. It can get gobbled up in a flash. Delete or archive files as soon as you can.

In general, PCX files are the smallest. TIF is the most universally used and recognized format, but the files are very large. A 650,000k GIF of a CADKEY screen can easily expand to over a meg and a half when converted to TIF. Sizes like this make it difficult to transport the files on floppy disks. Fortunately, graphic files are very "fluffy" and can be compressed significantly with programs such as PKZIP.

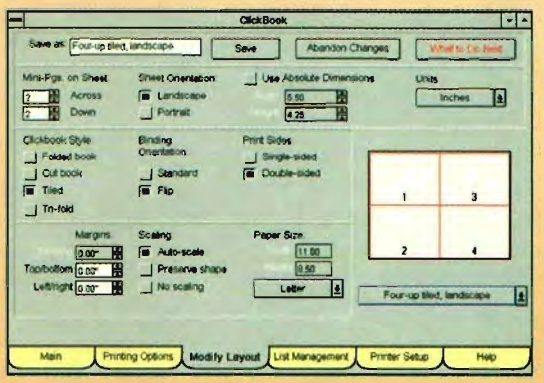
A Final Word

The number of ways to use drawings in documents is only limited by creativity. Consider Lockheed's Space Operating Company's Shuttle Engineering Organization. After every flight thousands of components of the Space Shuttle must be checked for wear and damage. To perform this testing, or any repair or replacements, the work order issued includes step by step instructions and graphical illustrations to make the work order easier for the crews to understand and execute. The Orbiter Electrical Hardware group maintains drawings for the repair and modification of Orbiter wiring which are incorporated into work instructions. They don't use CADKEY, but anything their program does, CADKEY or DataCAD can do.

Hang in there! Pictures are so valuable as a way to communicate it's worth the trouble to learn how to work with them in documents.

Easy & Affordable Answers to Your Document Questions

How can I create booklets, fliers or set up for printing on both sides of the paper?



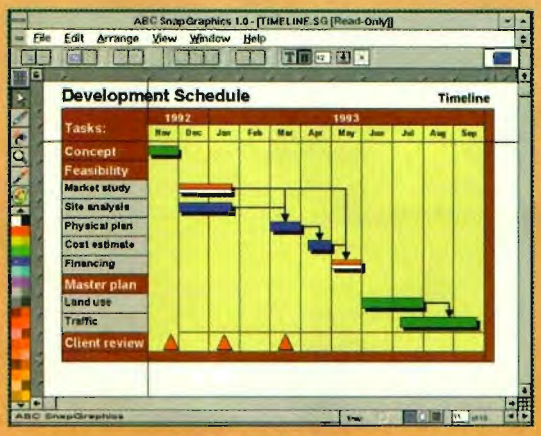
ClickBOOK for Windows

PageMaker 5 has this function built-in. If you don't have PageMaker 5, *Click*Book for Windows is a slick little program that lets you print any Windows document as a double-sided booklet or flier. *Click*Book provides many layout choices including trifold brochures, fold-up booklets, and flip-through booklets to be stapled. You can also size pages to Day Timer and DayRunner formats or make pocket size phonebooks from your PIM.

*Click*Book is implemented as a printer driver and supports graphics, Microsoft True Type and ATM fonts. As the information is sent to the printer, *Click*BOOK captures it, reorders it and scales it to conform to the specified booklet format. If you don't have a two-sided PC printer, you must re-feed each sheet into the printer on cue, but for small projects this is an easy task. It's a cinch to use: we printed our first sample in a matter of minutes. At $69.95 it's highly affordable.

For more information contact BookMaker Corporation at 800/766-8531, 415/354-8161 or Fax 415/856-4734.

How can I create simple charts in a spreadsheet or other drawing program without a major production effort?



ABC SnapGraphics

If you don't need to portray detailed, actual data and just need a few quick charts to illustrate ideas, concepts and relationships, try ABC SnapGraphics™ from Micrografx®. You can quickly produce graphics using one of the 20 templates of popular chart types without a large learning curve. Chart templates include: flow, org, circle/spoke, Venn, pyramid, block, timeline, comparison, and free form. You copy charts to other Windows applications via the ClipBoard. Output's good. A Black and White option optimizes the colors for black and white printing. An introductory offer of $49.95 for ABC SnapGraphics 2.0 will be in effect until March 31, 1995.

For more information contact Micrografx, Inc. at 800/653-1937.

What can I do if I want to place files from AutoCAD (DWG) or another CAD program (DXF) in a document?

You could take the file into your CAD program, manipulate it there, and then create an HPGL, GIF or POF file. However, if you don't need to modify the drawing, some word processors and publishing packages can import these formats directly.

HiJaak PRO's Browser utility creates thumbnails of your images and helps organize your graphic files.

Or, you can convert the files into the format you need with HiJaak. HiJaak is available in Windows and DOS versions and works with over 60 vector and graphic file formats.

HiJaak is a versatile, reliable, and indispensible tool for working with graphics. In addition to converting files, the Windows version lets you capture DOS and Windows screens of any resolution or color. Once the image is captured, you can edit the image. You can adjust the contrast and brightness; resize, rotate and crop the image, use smoothing to avoid "jaggies"; convert color images to gray or black and white; reduce color in images and more.

The Windows version has many special features. They include Aldus Filter and WordPerfect for Windows APIs, OLE image server functionality for OLE client applications, and comprehensive scanning support.

Is there an easy way to work with formulas?

WordPerfect, Microsoft Word, and Ventura Publisher (among others) have excellent equation editors. These editors create equations as graphical elements and embed them in the document as graphic files in the format it created them in. In WordPerfect this graphic format is WPG (WordPerfect graphic). The Word equation editor creates WMF (Windows Meta File). This process is fool-proof until you want to move a formula into another program that does not recognize the file format or work with the equation as a separate graphic file.

HiJaak PRO for Windows

The easiest way to deal with a MS Word or WordPerfect equation in these circumstances is to copy it to the ClipBoard, paste it into HiJaak, save and name it as a file and/or convert it to the format you need.

HiJaak Pro for Windows retails for $169.

For more information contact Inset Systems at 800/374-6738 or 203/740-2400.

DataCAD
Productivity Tools
3D POWER TOOLS

3D Power Tools, a new macro from Unique Software and Madura Studios, helps create and manipulate custom architectural elements. Here's what it does.

3D Knife slices and dices 3D slabs and polygons with a one-line-trim interface, and slices through slabs at custom angles to create mitered shapes.

Polyline to Polygon converts polyline shapes to 3D surfaces or slabs in one step. It also automatically supports polylines with an infinite number of sides by automatically tessellating polygons that go beyond DataCAD's 36 side limitation.

3D Plane edits roof planes in ortho view while maintaining a specific pitch. The smart void option lets you perform pseudo-Boolean operations to literally blow holes of any shape in your roof planes, i.e., stove pipes, skylights, chimneys, etc.

Triangle addresses DXF compatibility of DataCAD models with 3rd party rendering programs. See what your model will look like before you DXF it out of DataCAD.

Sweep lets you create a section in plan and apply it to any extrusion path defined by 2D lines and arcs, polylines, 3D lines and contours. Create complex geometric forms such as handrails and ramps, moldings, twisted balusters, fluted columns and more.

Snap Shot automatically extracts elevation, isometric and perspective views from 3D models with the DataCAD hide function.

Kaboom can blow up your DataCAD models. Set the intensity of the blast, light the fuse and drop the bomb. It is actually useful for creating organic forms such as foliage and can be used to extract individual forms from a complex model.

Multi-POF automatically generates one or a series of quick shaded images from 3D Goto views and batch process them to .tga, .pcx, or .2rn files with just one command.

The introductory price is $75. For more information contact Unique Software at 617/536-5326.

CAD Standards & Libraries

Why & How

by Robert C. Yule with Robert W. Bean, P.E.

Illustrations courtesy of Baystate Technologies, Inc., Marlborough, MA.

Since the first drawings on cave walls and rock faces, human beings have been attempting to communicate through pictures. Pictures can convey a tremendous amount of information, but it is often difficult to know for sure what the creator of the picture intended. This is definitely not what we want in the design and manufacturing world. A design drawing should be interpretable in only one way.

To ensure that all users of a drawing understand the design intent, standards have been developed for the designer and engineer to reference. For example, standards from organizations such as the American National Standards Institute (ANSI), the America Society of Mechanical Engineers (ASME), the Society of Automotive Engineers (SAE), and American Institute of Architects (AIA) provide information on every facet of design. Standards for mechanical drawings are generally from ANSI and the International Standards Organization (ISO). While many companies use these standards as their own, others create a set of standards relevant to their particular needs.

What Standard is Right?

Ultimately, it doesn't matter what standards you adopt as long as you know your customers' and vendors' requirements and select accordingly. In North America the most widely used standards for design documentation are ANSI based. Many aspects of ANSI drawing standards are similar to ISO standards ensuring understanding in European markets.

Interpretation of standards can vary from company to company. This is unavoidable as no standard can cover every detail relevant to all companies. In ANSI Y14.5M-1982 Dimensioning and Tolerancing Section 1.1.3 it states *"the absence of a figure illustrating the desired application is neither reason to assume inapplicability nor basis for drawing rejection."*

What is important is to follow the intent of the standard which is to establish a common language of design. Like any language consisting of thousands of words, you select those words appropriate for a given situation. It is critical for companies involved in design and manufacture to use a common set of standards in the complete design cycle. The benefits are many because everybody in the design cycle "speaks" the same language:

- Manufacturing can understand the design and produce correct parts
- Quality Assurance can verify that the parts conform to the original design
- Outside vendors will understand the design

Using CAD software in the design and manufacturing process offers distinct advantages to maintaining standards, but these are often unfulfilled. As many CAD users are painfully aware, the promise of CAD software vendors of a "common database of design information" is often a pipe dream. Many companies make the mistake of assuming that once a CAD system is installed, productivity will soar without any investment of time or money. The actual construction of a common database requires management to commit resources. Consequently, many CAD systems are used merely as electronic drafting boards and exhibit, at best, 1:1 productivity against the drafting board.

If a CAD system is to be productive, management must invest time and money in creating and maintaining standard part and pattern libraries. Libraries can consist of the following and virtually any commonly used item:

- Standard product line components
- Fasteners such as washers, pins, screws, nuts and bolts
- Standard features like drilled holes, tapped holes, counter bores, slots, and pockets
- Machine components like spur gears, shafts, keys, and sprockets
- Symbols such as electrical, piping, sheet metal
- ANSI and ISO drawing standard symbols such as weld, surface finish and GDT
- Drawing border formats and standard notes

Figure 1: Symbol Library Manager in CADKEY 7

The advantages of a design database are numerous. The greatest is design consistency because all users access the same data. This also eliminates much repetitive design effort. And companies can enforce design standards and procedures that already exist, for example, a set of notes that must be written in a certain way. Suppose a particular note in the company standard is written as:

CHEMICAL CONVERSION COAT PER MIL-C-5541, CLASS 3.

Among the users, however, the note is often written as:

IRRIDITE PER MIL-C-5541, CLASS 3

Both notes mean essentially the same thing, but the second refers to a trade name. This could cause problems when the part is sent to an outside vendor who does not use that particular product. If this note is readily available in a database the designer can select and place it without typing a long string (see Figure 1).

Libraries

After choosing items to include, there are two methods you can use to store and access libraries. They are:

- Geometry created once and stored in the parent CAD file format to be inserted into other part files
- Geometry created by a parametric program at the time of use

Both methods have advantages anddisadvantages. Patterns stored as geometric entities are best for parts unique to the company or for symbols such as electrical schematic symbols.

Entries in your pattern libraries should be easy to use and retrieve. Purchased libraries of components (like those from CAD Technologies Corp., Indialantic, FL) usually come with a printed manual with a picture beside the file name. Component libraries created internally require effort to compile and publish in printed form.

A better approach is to have a viewer internal to the CAD software that allows you to browse through the libraries and view files before selection and insertion into the drawing. Also, where the graphic alone is not obvious, you should be able to add a long description to the filename. In Figure 1 a symbol library viewer shows a note file stored in the company's **\STANDARD** directory. Figure 2 shows a portion of an electronic symbol library displayed as icon buttons in the same viewer. Selection is graphical, rather than through cryptic filenames. The description of the image at the bottom of the dialog makes the selection even easier.

Figure 2: Symbol Library Manager in CADKEY 7

For common parts (such as screws, nuts, bolts and even power transmission components) a parametric program approach is more efficient. The number of possible permutations (all socket head cap screws, for example) makes storing them all impractical.

Purchased hardware libraries generally require you to piece together a part. For example: to create a **.50"** long **.112-40 UNC-3A HEX SOCKET HEAD CAP SCREW**, (see Figure 3) with a purchased pattern library you need to place the head portion, place the **.112-40 UNC** threaded section on the head and then stretch the threaded section to **.50"**. If you then want to attach attributes (text information) to the screw you need to group the entities into a collective or block and assign the attributes manually. With the parametric approach, you enter all the required variables (see Figure 4) at once, or even better, select the item from a database listing. The program then creates the required geometry and attaches any relevant attributes to the resulting part. With a well-designed system you should be able to add your company's part number system to the database. Figure 5 is the same dialog box shown in Figure 4 with the database modified (also shown) to show only the NAS part numbers used by a particular company. Note that the type of screw description has been modified to match this company's naming conventions. This is another way to ensure your designers are using the company approved standard components.

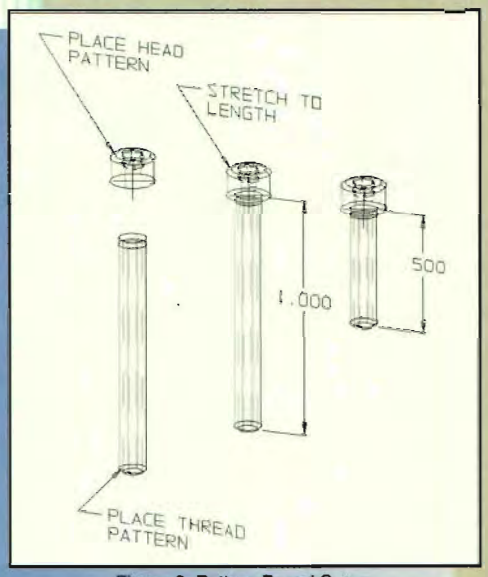


Figure 3: Pattern Based Screw

ANSI CAD Symbols

Another area that benefits from a parametric pattern library is the generation of ANSI and ISO drawing

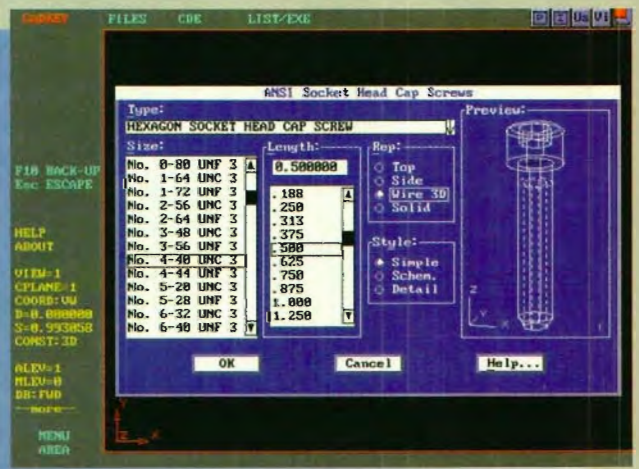


Figure 4: Parametric Based Screw Interface in CADKEY 7

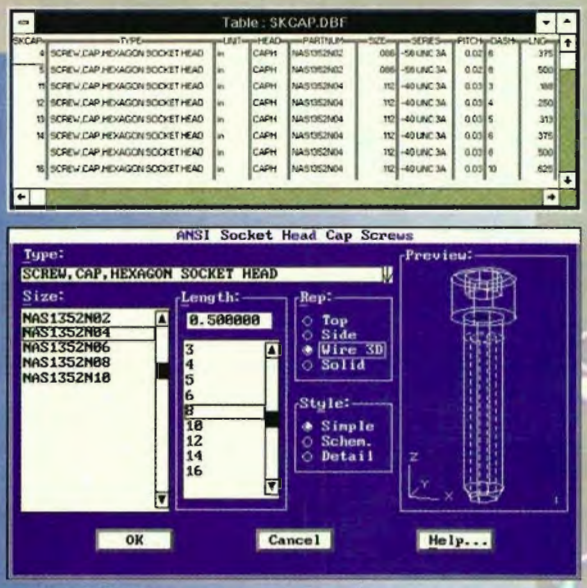


Figure 5: Customized Parametric Screw Interface and Associated Modified Database

symbols. With a well-defined interface you easily create and preview the symbol before placing it. Many existing products do not offer a preview of the symbols created. You must delete it or a portion of it to correct an error often caused by a non-WYSIWYG (What You See Is What You Get) interface. In addition, products based on stored libraries require you to piece together a symbol from several different files and then edit the text contents to obtain the desired result (see Figure 6). With a parametric approach, the user enters and selects all the information required in a single dialog box. If the interface features dynamic previewing then the user will see the symbol as it is being created (see Figure 7).

A well-designed rule-based interface will also only allow you to create correct ANSI and ISO symbology. For example, the dialog box in Figure 7 showing flatness, does not allow the addition of a datum reference (grayed out or frozen in the dialog) which is not relevant to flatness. Once created and placed, it should be easy to edit the symbols.

With stored pattern symbols, editing often means deleting and recreating (unless it is a simple text edit) the symbol or a portion of it. With the programmed parametric approach, the user should be able to edit the symbol created by the program with the program. Figure 7 shows an example of this. The ***Move*** and ***Edit*** buttons allow you to simply move the symbol or to reload the symbol into the dialog box and modify it. The benefit may not be obvious for the simple examples in Figures 6 and 7, but for complex symbols it is a great advantage. Figure 8 shows a complex positional tolerance created in a rule-based parametric dialog box. The dynamic preview allows the user to ensure the callout is correct in content (the rule-based interface will ensure that it is syntactically correct to ANSI) before placing the symbol in the drawing. Figure 9 is another example of complex drawing symbols being created in a parametric environment with dynamic previewing capability. Creating such symbols manually or piecing together patterns would be time consuming and awkward. The goal of any good interface should be to allow the designer to concentrate on the content of a drawing and not on the mechanics of building symbols.

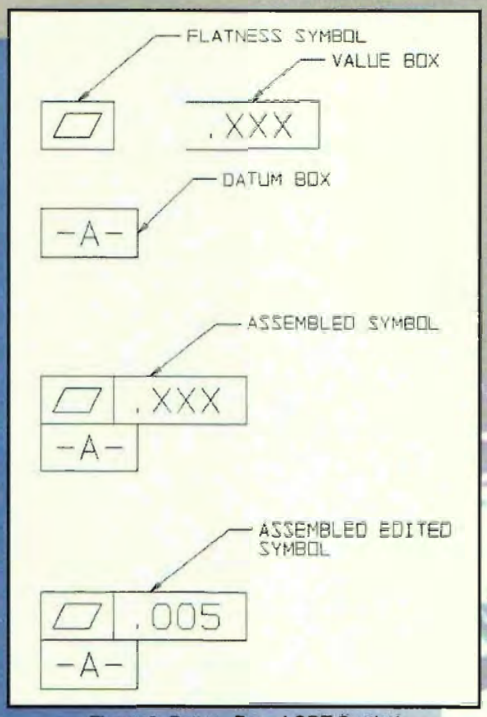


Figure 6: Pattern Based GDT Symbol

Drawingless CAD Models

One trend in industry today is the drawingless CAD model or annotated drawing. The idea behind this approach is that all design intent information is embedded in the 3D model of the design. With the wide spread use of Computer Aided Manufacturing (CAM) packages in even the smallest machine shops, only the 3D model is required. What would be missing is the datum, tolerance and hole information. So a drawing is still required to convey this design information, but only the critical tolerances, any GDT information, materials and finishes as well as special instructions. To further this concept, CAD software needs to allow you to embed this information into the 3D model. This will allow the NC programmer or CMM programmer to access the tolerance and datum information from the model. In addition, rule-based feature and symbol generator programs can be further enhanced to embed tolerance relationships between features.

Standards in CAD Programs

Until recently, the implementation of drawing standards in CAD software has been generally poor, particularly in PC-based CAD. Only the "high end" systems had ANSI and ISO drawing standards as part of the core program. For most PC-based systems like AutoCAD and CADKEY, the ANSI/ISO standards included are only for simple dimensioning. Complex Geometric Dimensioning and Tolerancing (GDT), weld, and surface finish symbols are generally constructed from primitive geometry (lines, polylines, arcs) and placed as blocks or patterns.

Figure 7: Ruled-Based Parametric ANSI GDT Symbol Generator in CADKEY 7

Figure 8: Complex ANSI GDT Symbol in CADKEY 7

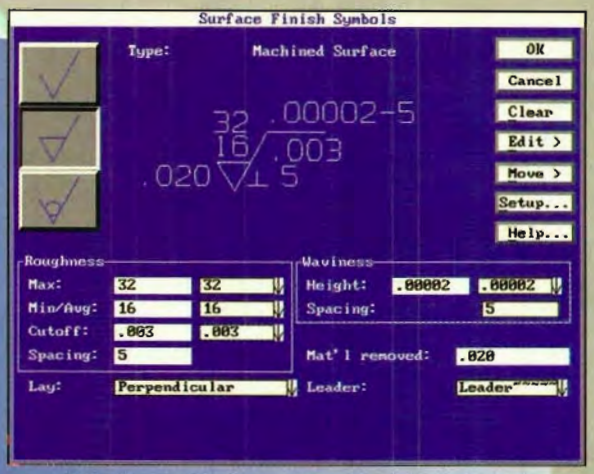


Figure 9: Complex Surface Finish Symbol in CADKEY 7

Fortunately, third party software packages are available to automate most of these complex dimensioning functions. Some key features to look for in a third party mechanical design and drafting package are:

- An on-line (inside the parent CAD software) viewer for existing component libraries
- A rule-based parametric interface to generate ANSI/ISO symbology, in particular, Geometric Dimensioning and Tolerancing, Weld symbols, Surface finish symbols and General ANSI labels
- Parametric fastener libraries with customizable databases
- Parametric feature libraries
- Parametric power transmission components
- Automatic hole location table generation
- Automatic labeling of features

Vendors producing software for the creation and placement of ANSI/ISO standards symbols include, DRAFT-PAK, from Baystate Technologies, Marlborough, MA, Toolbox and Toolbox Pro from Softdesk, Inc., Henniker, NH, ANSI Mechanical from Design Pacifica, San Luis Obispo, CA, Genius 12 from Auto-Code Mechanical, Dublin, OH, Mechslide 4.2 from EMT, Inc., Bellingham, WA, and AimaFast from Aima Soft, Inc., San Rafael, CA.

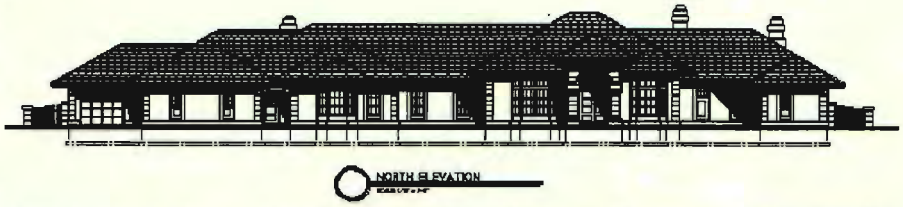
Robert Yule is a Senior Mechanical Designer in the Aerospace industry, working since 1982 on commercial, military, and space programs. He has been involved in standards implementation with respect to CAD for over 10 years.

Robert Bean, President of Baystate Technologies, Inc. and a registered Professional Engineer in Massachusetts, has been working in the mechanical design and software development field implementing software tools supporting standardization since 1982. One Baystate product, DRAFT-PAK, builds mechanical design standards into CADKEY and CADKEY Professional.

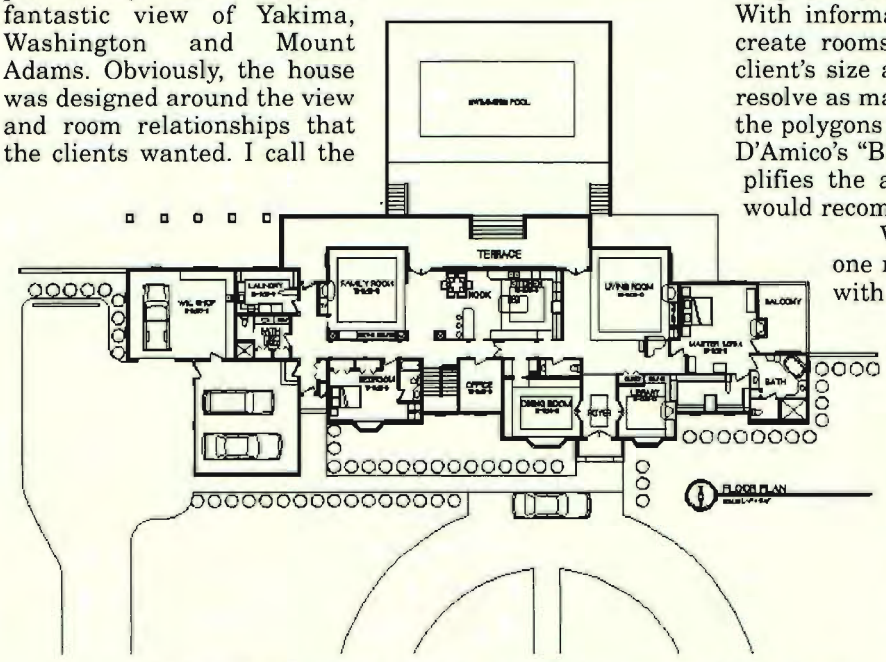
The DataCAD Portfolio

by Russell L. Thomas

Before attending Architectural School, as a CADD operator for a mechanical engineering firm I was exposed to several CAD software packages. At college I took many AutoCAD courses, from beginning to customizing and AutoLisp programming. I even did my Thesis Project on AutoCAD. After graduation, I worked in an architectural firm that was completely "AutoCADimated." If I could combine the best features of all these programs, I would ..... . Well, in the real world, I'll take DataCAD. As a designer of custom homes and additions, I find DataCAD an irreplaceable necessity. I have also developed some techniques that specifically take advantage of DataCAD and help me work with clients.



The project described here is typical of the way I use DataCAD. The clients had searched high and low and paid dearly for a lot with a fantastic view of Yakima, Washington and Mount Adams. Obviously, the house was designed around the view and room relationships that the clients wanted. I call the finished design "Neoclassical Revisionist" with neoclassical and traditional elements revised for the region's climate. The front/north side is somewhat introverted and unpretentious while appearing solid and secure. The back/south side is the exact opposite; large areas of glazing lighten up its appearance, and terraces and a swimming pool cascade down the sloped site in an extroverted fashion. The house reflects a life style.



Floor plan created using "Walled Polygons" and elevation created using floor plan and "Roofit" macro and then adding detailing.

As I begin a design, I have the clients fill out a Program Questionnaire and Spatial Adjacency Chart. With information from the spatial adjacency chart, I create rooms via "Polygons" with "Walls" ON to the client's size and location specifications. At this point I resolve as many design issues as possible and then edit the polygons into a floor plan. I recently purchased Bill D'Amico's "Blocker" macro which streamlines and simplifies the above technique into a few easy steps. I would recommend it to anyone.

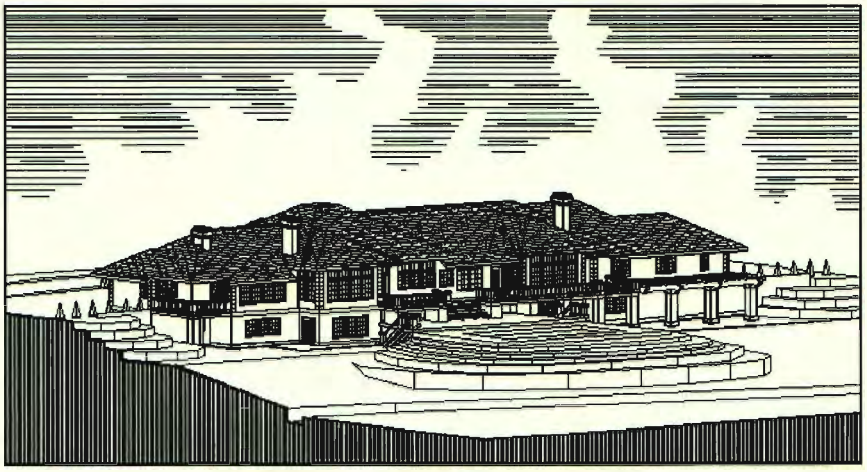
While modifying the floor plan, I schedule one meeting where I have the clients sit down with me at the computer and let them direct the modifications. If you have never done this before, I suggest you try it, as they feel that they are an important part of designing their house. The worst case scenario is some clients become addicted. Then I plot a nice inked drawing of "their" modifications to take home, which is something you can't do if you're drafting manually.

At this point, if you've set your "Z" heights properly, you already have a study model of the structure without a roof. Now I use the "Roofit" macro that comes with DataCAD and vary the set-

tings until I have a roof I like. If you maintain different line colors for different entities, you are ready to use the "Hide" command with "3D Views" to get elevations and a nice perspective. I use a variety of colors as well as layers because when you use the hide command your view becomes a 2D single layer entity. Next I use the "Editsets" command with the "Mask" option with "Color" so I can quickly move entities to separate layers and shut them off when needed during editing. Since I use 2D lines for walls this comes in handy in removing wall breaks from window and door insertions.

After cleaning up the views, I again use "Editsets" to set up groups of line types (i.e., ground, profile, etc.) which are easiest to select at this point. Then I apply hatching and special effects to the views to make them relate to the clients the essence of the finished product. I then change the line weights via the "Editsets" I set up previously. I use associated hatching; even though it has some quirks, the advantages outweigh them. Now I can easily change siding or roofing materials and present several options to the clients at the next meeting.

I find that the procedures above are fast and work well enough to get the "OK" on construction documents about 80% of the time. The other 20% need more help visualizing the end product. In addition, I think it's cost effective and very beneficial for any project that costs $350,000 or more to use some form of the following techniques. It is probably a good idea to use these techniques on smaller projects, but it may depend on how you are set up as far as billing. The main thing is to verify that the end product meets the client's expectations.

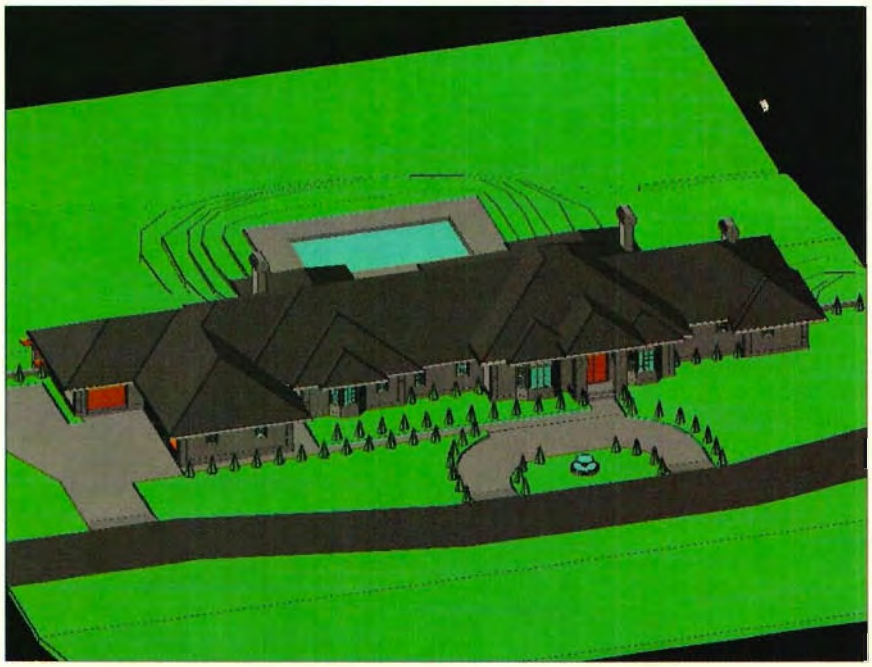


Hidden line removal: Isometric view created with HLR.

The 3D Model

A 3D model can be a physical or computerized model. I prefer a computer generated model because it can be used three different ways which I will explain later. For physical models, the following technique can produce gorgeous results if you have access to a pen plotter. You start by cutting out a substructure of foam core or cardboard using the elevation created previously. Using those same elevations, you then plot the exterior skin of your model on a variety of colored and textured construction papers with a variety of pen colors. Then just cut them out and apply to the substructure. The benefit of this technique is that you use drawings that you already have and you can easily have an intern make the model true to your "vision." The down side is storing actual models. Clients love them at first, but they eventually get damaged or destroyed. If you have a show room, these models do look real sharp!

The next three techniques require a computer generated 3D model. The same model works for all. I use all three methods as appropriate to the situation, but you might prefer one. I use all three because I have an HP DeskJet 1200C; it can be used as an A-size plotter and its color output looks great for Quick Shader TGA output and Photo Realistic renderings. I am not suggesting any particular inkjet printer, but I do suggest one that is HPGL compatible and has 300x300 dpi color capabilities. Inkjets and other color printers are now very affordable and by getting HPGL protocol you eliminate having to use DCPrint (believe me, you don't want to use it if you don't have to).



Quick Shader: Image created using "Quick Shader."

Creating a 3D model using slabs or polygons is something you will have to experiment with. It takes some practice. Fortunately, you're a design professional and already have a strong understanding of three dimensional relationships. I suggest you use your existing floor plan and set its Z-height to zero and build your model from that. The strength of using slabs or polygons is the fact that you can create voids and insert parametric doors and windows that look very realistic and translate into rendering programs via DXF fairly accurately. When somebody finally creates a macro that inserts a void when you insert a window or door and deletes it when you remove the window or door, I will gladly pay a week's wages for a copy.

Needless to say, this is a time consuming process, but it produces nice results. There are some macros I think are necessary to efficiently create good models that render well. You can do without them, but they make the process quicker and easier. I prefer "Roof Builder" by Erik A. Zetterberg. My next recommendation is Bill D'Amico's

"TouchUp." It adds hatching to the sides of three dimensional objects. There are others, but if you add the two discussed to the ones that come with DataCAD, you will become a very productive 3D modeler.

1 - The Quick Shader Technique

This option is new to DataCAD 5, but is very powerful. Sometimes it is hard to discern exactly what is going on when viewing a 3D wire frame image. Choose QS (Quick Shader) and solid entities instantly appear in its place. More important is the fact that it is a great presentation tool. No matter how big or complex your model, Quick Shader renders the view quickly. Your clients can choose views and see the scene quickly rendered in front of their eyes. The images can be saved as POF files and converted to TGA format and then printed or viewed as a slide show using a graphics file viewer.

Photo realistic image of frontside view.

The main factor in creating a good Quick Shader image is the color selection of the objects and materials they represent. It will never rival a photo realistic rendering, but you can quickly create images that represent the final product in color without leaving DataCAD or having to buy expensive rendering programs.

2 - Hidden Line Removal Technique

This option creates traditional looking line renderings. Some clients like the "human touch" and think computers are too impersonal. Here's an idea. Either use the "TouchUp" macro and add hatching to 3D objects before using HIDE, or add hatching to 2D images after using HIDE. First, select the view that you want and the view type -- isometric or perspective. Then HIDE and you have a 2D image that can be edited to suit your aesthetic bias. You could even change the line types to a "wiggle" variation so they appear as if drawn freehand. It seems a little hypocritical to preach the benefits of CADD and then suggest you modify it so it looks hand rendered, but many folks have associated with the old techniques a lot longer than with the new and therefore have certain biases. This technique was discussed earlier but the model used was a lot less detailed. If your model is large or complicated, you should probably start the HIDE command just before you go home and let the computer work on it over night. Better yet, use the "View Master" macro to set up several views and batch HIDE them over the weekend.

3 - The Photo Realistic Technique

This option is very computer intensive. I run a 486DX33 with 20 MEGs of RAM and a very large permanent swap file for Windows. I use "Renderize Live" instead of Velocity. Whichever software system you use, you will quickly find out that it is a time consuming exercise in trial and error. However, the end results can be breathtaking and well worth the effort.

Your clients can choose color schemes and view the project on the exact site. The clients know almost exactly what they are getting and foresee any changes they want before construction starts. I can print nice hard copies on my printer, but what I like to do is save the views as high resolution images (i.e., 4000 x 3000) and have a photo service make 35mm negatives and 12 x 8 color photos from the files. Then I frame them and present them to the clients. The clients get all excited and brag about their designer to friends and perhaps line up another job for you. I like these renderings over actual models because they are very impressive, easy to store, and look great in the "old portfolio."

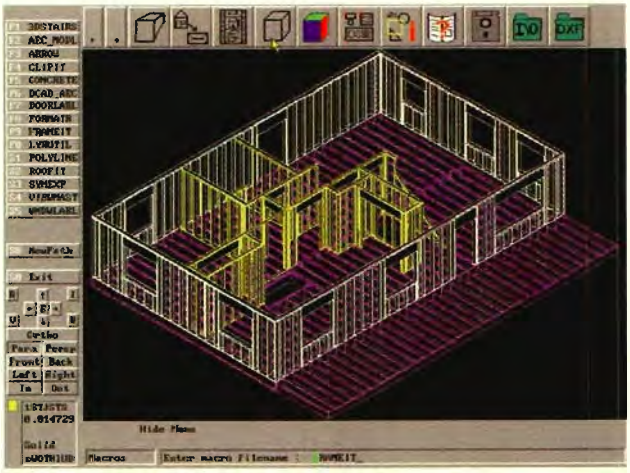
I hope you found something of use in these ramblings. I look forward to hearing how others do things, for I'm sure there are better ways.

Photo realistic image of backside view.

Russell L. Thomas, a graduate of Washington State University School of Architecture, owns C.A.H.D. (Computer Aided Home Design), a residential design studio in Yakima, WA.

DataCAD Tips

Using The FrameIt Macro



by Carol Buehrens

DataCAD 6 holds many new surprises! One of them, a powerful macro called FrameIt, automates the framing of floor plans. The resulting 3D drawing has all of the framing items as modeled entities. This program identifies each entity as cut and sized lumber, and with the new add-on estimating program from Cadkey, you'll be able to extract a complete "cut list" and estimate your material costs.

Here's a quick tutorial on how to use this macro. I picked a simple residential floor plan for my first try and had no problems. I used a modified plan for the example shown here only because the figures needed to be greatly reduced.

Prepare a drawing

Creating framing entities increases the size of a drawing considerably. You may want to create a separate framing drawing. To do this save the wall layers from the floor plan to layer files, then pull them into your framing drawing. The example below uses the original floor plan file.

1. Load a drawing that contains a floorplan.
2. Turn off all layers except the ones that contain the walls. Use **Layers, ActvOnly** and pick the layer the walls are on. Your draw ing may look similar to Figure 1.

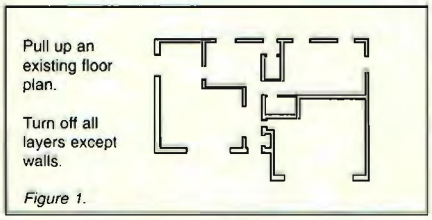


Figure 1.

3. Create two new layers for framing entities; one for walls and one for flooring, using **NewLayer** in the Layers menu.
4. Give the layers an appropriate name, like **FrmWall** and **FrmFloor** using **Name** in the Layers menu. (Plan ahead and later you can use the layer names with the new "search" option in Layers, called Filter, using frm*.)
5. Press **[Tab]** or use **SetActv** to make the wall layer for framing active.

Start FrameIt

1. Select the **Macros** option (in the **Edit** menu), or press the quick key **[Shift] M**.
2. Select the **FRAMEIT** macro.
3. The two options are: **Floors** and **Walls**. We'll do wall framing first, so select **Walls**.

Set the Wall Framing options

1. Select the **Exterior** option.
2. Select the **Sides** option. This lets you trace the outline of the walls by object snapping to the outside corners.
3. Select the **WallHgt** option and type in the height of wall and plate together, *at the topmost edge of plate*. In my example, I used **8.10** (8'-10"). Press **Enter**.
4. Select the **Plate** option. The Plate options menu appears for setting the plate parameters. **DoTop** creates a top plate and **DoBottom** creates a bottom plate. Make both active. When they are active, additional choic es become available.
   Set the plate options you want (double plate, single plate, or cus tomized number of plates). I set the Top plate to **Double**, Bottom plate to **Single**.
5. Select **Color** to define the color for your plate entities. I used the default, **Yellow.**
6. Press mouse button 3 to exit the Wallplat menu.
7. Select the **Stud** option. Make **DoStud** active to make the stud options appear.
   Select **Size** to set up the stud size you'll use. Pick the size you want. I used **2X6** for a 6" exterior wall. This creates entities that are actually 11/2" x 51/2", the nominal size for the stud.
   Select **Spacing**. Type in the cen ter to center measure of your studs. I used 16". You can type this in as **.16** (16") or **1.4** (1'-4"). Press **Enter**.

8. Select **Color** and pick the color you want the studs to be. I used the default **Brown**.
9. Press mouse button **3** to Exit the Stud menu and return to the Frame Walls menu.

Save the settings

Once you've defined wall framing parameters, you'll want to save the settings. You can use them again.

1. Select the **FileI/O** option from the Frame Wall menu and select the **SaveFile** option.
2. Type a name, such as **810-2x6** (8'-10" wall height, 2x6 studs). Press **Enter**.
3. Press mouse button **3** to Exit the FileI/O menu and return to the Frame Walls menu.

Create the wall framing outline

Now you're ready to frame!

1. Object snap to the first outside corner (step 1 in Figure 2).
2. Object snap to the second outside corner (step 2 in Figure 2).
3. Next, define the "other side of the wall" with a pick. This tells DataCAD which side of the exteri or outline the framing should fall on, in this case the inside. Pick on the *inside of the building* (step 3 in Figure 2). You only have to do this step once.

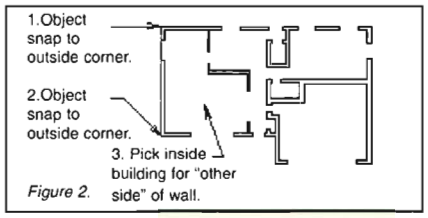


Figure 2.

4. Continue tracing the outside of the exterior walls by object snapping to each corner, as shown in Figure 3. (Notice that I missed the Exterior wall in the garage space. I'll get it later.)

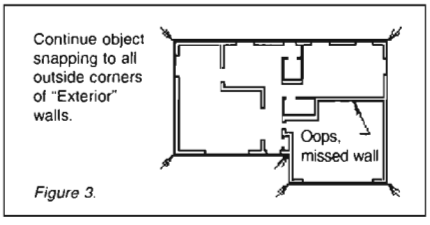


Figure 3.

5. If you object snap to a wrong corner, simply select **Backup** and try again. (Backup appears after the third pick.)
6. Make sure the **Closed** option is active.
7. After your last corner is snapped to, press mouse button **3** to close the outline.
8. You can add a garage or other part of a building as an attached exterior wall after the main build ing is outlined. Turn OFF **Closed**, then add this area.

Add Openings

Once the exterior is outlined, define any openings, primarily doors and windows.

1. Select the **Opening** option.
2. Select **Window** and set the options to your specifications. For my example, I set the **SillHght** to **3.0** (3'-0"), the **HeadHght** to **6.8** (6'-8") and the **HeadStyl** to **Cripple** (you have your choice of that or Boxed).
3. Once you've defined window settings, you simply object snap (again on the outside edges) to each corner of your window open ings. (See Figure 4.)

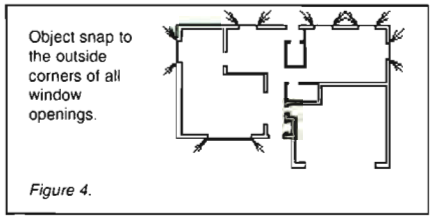


Figure 4.

4. Continue with other window openings, adjusting the heights and style as necessary.
5. Select **Door**. Again, set the options to your specifications. I set the **HeadHght** to 6.8 (6'-8") and the **HeadStyl** to **Cripple**.
6. Object snap to the corners defining your doors (Figure 5). Redefine the settings and pick the garage door opening. I didn't in my example. But that's okay, I'll fix it later.

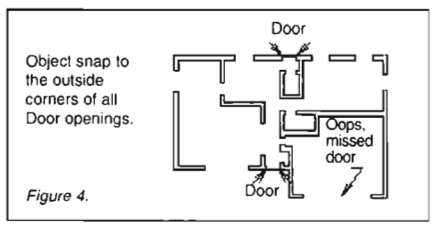


Figure 4.

7. When done, press mouse button 3 to return to the Frame Wall menu.

Create the framing

This is the easy and the fun part.

1. Select Build.
2. You can select items by the typi cal select modes. For the initial exterior framing, select Area to make it active.
3. Box around the entire plan. The system will calculate the wall and opening definitions and build the framing for you. When complete, the program will display the plan in an isometric view, similar to Figure 6.

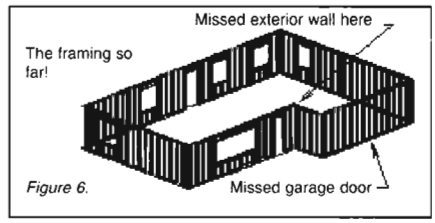


Figure 6.

In this view, you can see clearly where I goofed up on the garage - both by forgetting the opening and forgetting to include the exterior wall of the building inside the garage area. But, don't worry. The FrameIt macro has built-in modifiers for mistakes that allow you to dynamically add to your framing. You'll see this as we continue.

Add the interior walls

(For illustration purposes I didn't show the existing wall framing in the figures.)

1. Press mouse button 3 to return to the main Frame Walls menu. Your plan will return to the Orthoview automatically.
2. Pick the Interior option.
3. Pick Stud. Change the Size to reflect your interior wall framing. I used 2X4.
4. Change the other options if neces sary. Now you're in familiar terri tory -- exterior walls.
5. Object snap to the first two cor ners of an interior wall. When asked to indicate the "other side of the wall" pick to the side you want the framing to fall on. In other words, indicate with your pick the opposite side you're defin ing with the outline (just like a regular wall with "Sides" on).

As in exteriors, you'll only be asked to define the other side once. So, remember to continue outlining that same side of the wall, as shown in Figure 7.

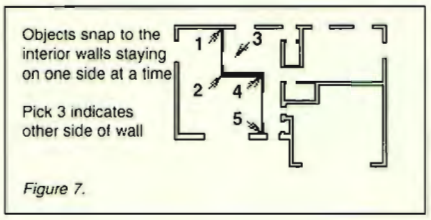


Figure 7.

Add interior openings

You'll add interior openings just like the exterior ones. The main difference is that a "window" on the inside of the building is called a "PassThru." An example of a PassThru in a residential building could be a window coming from the kitchen to the dining area, through which you could pass dishes.

1. With Interior still active, pick Openings. Notice now the two main choices are Door and PassThru.
2. Pick Door. You may want to double check the settings. For example, I found that interior doors hold the same setting as the exterior doors, so if you defined a garage door last, you probably will want to reset the HeadHght to 6.8.
3. Object snap to the edges of your interior door openings. You'll also use the Doors function to frame out a wall opening if applicable.
4. If you require a pass thru, pick the PassThru option. I found the settings need to be checked because PassThru grabs the sill and head heights from the Window setting.
5. When you're done, press mouse button 3 to Exit back to the main Frame Walls menu.

Build the entire wall framing

Now you can create the interior wall framing.

1. Select Build.
2. Again, you can select your interior outlines individually by Entity or Group (they are polylines), or a faster selection would be Fence. I chose by Area because my build ing was very small so it wouldn't take up a lot of time to reinvent the entire thing.
   If you do choose by area and sur round the entire plan, the pro gram first disassembles the exist ing framing, looks for any changes to the outline and openings, and then rebuilds it.
3. When complete, your framing will again automatically appear in the isometric view.

Fix missed walls/openings

Because the program automatically reevaluates the existing framing it's easy to fix mistakes!

1. At this point, I went back to the Exterior option and outlined the missing exterior building walls that were inside the garage space (step 1, Figure 8).

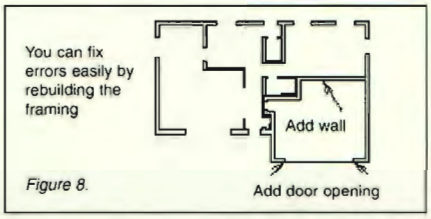


Figure 8.

2. Then I defined the Exterior garage door opening and the door from the garage space leading into the building (step 2, Figure 8).
3. If you need to fix an existing open ing, simply pick the Edit option from the main Frame Walls menu. From there you can use the Erase option to delete the line for the opening and redefine it. (Edit also allows you to Move, Copy, Rotate, Mirror, Stretch, Enlarge and go to Layers without leaving the macro.) Press mouse button 3 to return to the main Frame Wall menu when you're done editing.
4. Once the corrections are made, Select Build again. The program first disassembles the existing framing, looks for any changes to the outlines and openings, then rebuilds it. (Figure 9)

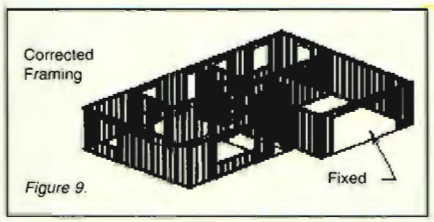


Figure 9.

Rules of the Road

As with any program, there are some general rules you'll have to adhere to:

1. Openings must lay in-line with the frame wall outline. In other words, an opening must be defined on the outline edge, the same side of the wall the outline was defined on.
2. There doesn't seem to be a prob lem with defining the opening in a different direction than the origi nal outline.
3. For now, to properly redefine an opening, you must first delete the original opening line. (Later, this may be enhanced with some kind of "change" feature.)
4. To change the parameters of the framed wall or floor, like an open ing, you must delete the outline and start again.
5. The outlines and openings are sin gle entity polylines that are attrib uted.
6. You MUST have your openings on the same layer as your frame wall outline.

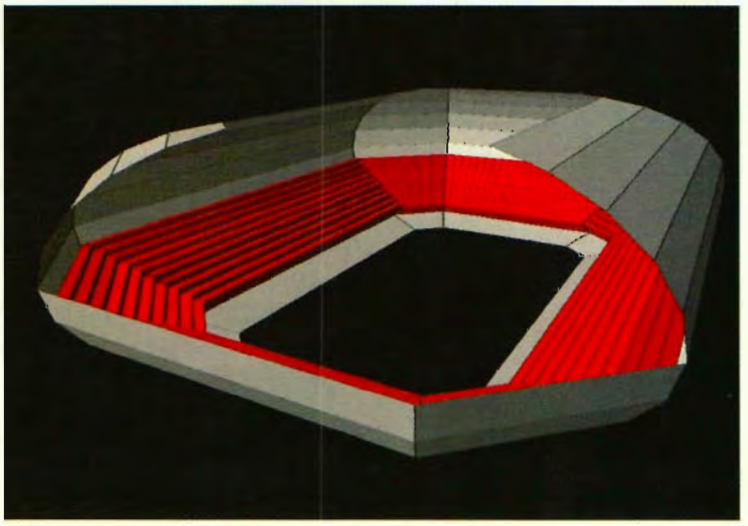
Future Releases

Future releases of DataCAD's FrameIt macro will evolve to meet user needs. For instance, "cavity walls" and "staggered stud members" are two issues that need to be addressed. Some kind of "change" facility will be added to make wall and opening modifications a breeze. And, "cross members" along with "roof joisting" are definitely in the future.

TECH SUPPORT DIRECT

The Sculptor's Tool Kit

by Berry Taylor



This month, rather than focusing on a particular DataCAD command, we'll look at how you can creatively combine several commands you already know to construct powerful 3D architectural models in just a few minutes.

The purpose of the exercise described below is not to create a finished model with every last beam and bolt in place. Modeling in that kind of detail would take many hours or days. Instead, our purpose is to learn how to use DataCAD as an "electronic napkin"-- how to create schematic 3D models so quickly that DataCAD becomes your primary 3D sketching and schematic design tool, in addition to being your primary 2D drafting tool.

For example, how many DataCAD entities do you think it would take to construct a 3D model of an elongated octagonal sports arena with bleacher-style seating and a semi-open canopy roof? Would you believe: two? That's right -- it took just two entities to create the entire schematic design of the sports arena pictured here.

The secret to creating 3D models as fast as you can sketch a perspective on the back of a napkin lies in making creative use of DataCAD's **3D Entity** and **3D Edit** menus. Think of the **3D Entity** menu as a sculptor's collection of variously shaped blocks of stone. The **3D Edit** menu is then the sculptor's tool kit of different chisels which are used in combination to create a beautiful complex form out of a dull hunk of granite.

The first step in creating a complex model quickly is to imagine what your design would look like if it was reduced to its most basic form. For example, an elongated octagonal arena is a variation of a simple octagonal object, which itself is a particular example of a general multiple-faceted spherical object.

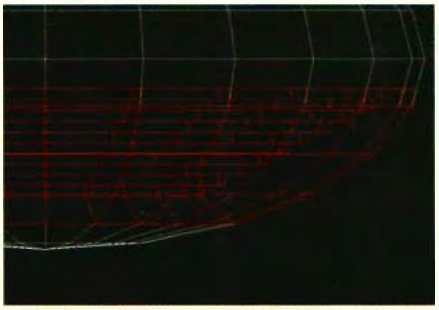
So, we begin the model of our sports arena by creating a **Sphere**, which is one of the 3D primitives found on the **3D Entity** menu. The sphere will serve as the basis both for creating the domed roof over the arena, and for defining the shell of excavation underneath the bleachers.

Next, we use the Enlarge menu to double the size of the sphere in the X and Z directions, so that the resulting arena is twice as long (X) and wide (Z) as it is high (Y).

Since the bleachers inside the arena will inevitably be related to the shape and location of the roof above them, it would be wise to create a basic form for the bleachers before we start to edit the form of the roof. That way, whatever design changes we make to the roof can simultaneously be made to the bleachers.

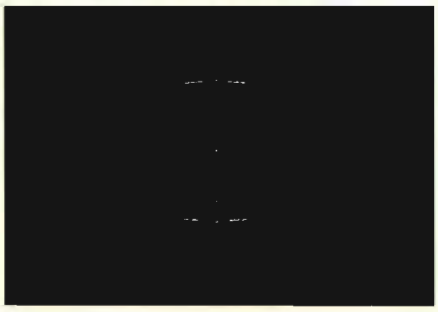
Again, we want to imagine the simplest basic form which could be used to describe bleachers descending from the edge of a domed roof. One way to define such bleachers would be to take a section through the middle of the dome, and then draw a profile of the steps of the bleachers.

This stair-step profile, swept about the vertical center-line of the dome, would create the circular form of the bleachers. So, we would use the **RevSurf** command on the **3D Entity** menu, which allows us to define a profile to be swept into a surface. For maximum editing flexibility, we will put each entity on its own layer.



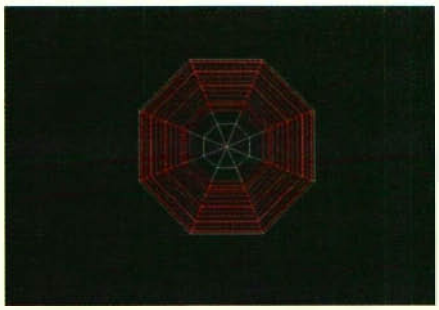
The sphere and the surface of revolution we just created are the only two entities necessary to create the schematic model of our arena. Now we need to take these two "hunks of stone" and "chisel" them into the proper shapes using the tools on the **3D Edit** menu. There are two basic kinds of changes we will make to the entities. First, we will modify their overall forms. Second, we will modify particular pieces of those modified forms.

Working from Elevation view, we begin by using the **Change** menu to change the number of facets (Primary Divisions) of the entities from 24 to 8. This produces a building which is octagonal in plan, but curved in elevation.

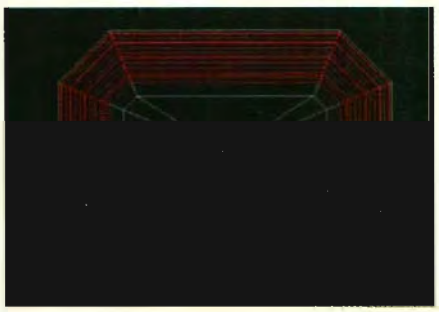


With our "global" editing of the entities now complete, we use the **Explode** menu to break up the entities into their component polygons for more detailed modifications.

At this point, we switch to Plan view, and use the **Rotate** menu to spin the building 22 1/2 degrees about the Z axis, so that the sides of the building are horizontally and vertically aligned. This will make further editing easier.



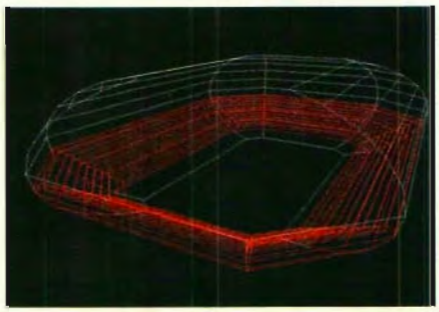
Then we use the **Stretch** menu to elongate the building into a rectangular arena with octagonal corners, simply by stretching the left half of the building in the X direction, and then stretching the upper half of the building a shorter distance in the Y direction.

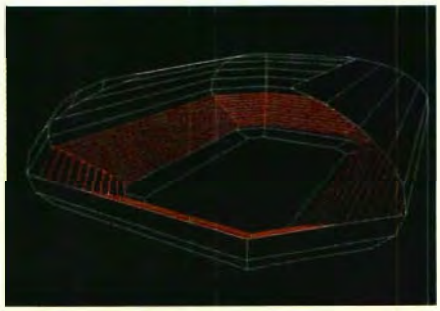


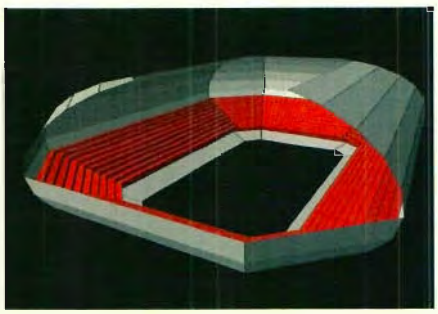
Our last editing step is to use the **Erase** menu to remove the very center of the roof, giving us a partially open arena. We also erase one end of the roof, so that we will be able to peer inside the arena when we create our shaded perspective.

Finally, we set up a perspective view from one end of the arena, looking in toward the center, and use the **Quick Shader** to create a fast "solid" color image of our newly designed sports facility. Then we call the client into the office to have a look.

Incidentally, if the client hates it, who cares? We can just design twenty more variations in a matter of minutes, and present them all. Then when we finally agree on a conceptual scheme, we can use DataCAD to proceed to the Design Development phase.







Berry Taylor is a DataCAD consultant who lives in Philadelphia. Trained as an architect, he has been a DataCAD user since 1985, and was formerly Cadkey's DataCAD Product Manager.

REVIEWPORT

PCs for CAD with a difference

These days it seems like anyone and everyone's trying to sell high powered PCs to the CAD market -- even if they don't know CAD from a hole in the ground. Granted, sheer "horse power" is important, but without a vendor who really knows CAD and understands what's required for heavy-duty engineering, manufacturing and graphic apps, many purchasers of so-called power platforms get hardware that's not really fine-tuned for their needs. That's why I found statements in a letter that accompanied the Quannon CAD Systems computer we tested for this issue refreshing and exciting. And I quote:

"We have been excited about bringing a truly customizable and configurable system to the CAD and CAM markets. Too many times, we hear stories of customers who have purchased low-cost systems from other sources and end up having to add or substitute components to run their CAD or CAM applications at a reasonable performance. We do not purport to have the lowest cost solution; however, we do understand CAD and CAM applications and what it takes to run them efficiently."

A little further research and I discovered these guys really put their money where their mouth is. Jerry Kardell, Quannon's Customer Support Manager and Jim Zink, Product Manager, spent months researching and testing various system boards, graphics accelerators, storage subsystems, and other components to find the best combination of price and performance. They came up with three models especially configured for CAD/CAM applications. Each can be fully customized for individual customer needs.

The Quannon configuration we ran through its paces was a 90 Mhz Pentium Powerstation with 16MB RAM, 256k cache, a Diamond Stealth64 PCI video card and an Idek 17" monitor. It came with CADKEY 7 fully installed.

With CADKEY and my large drawings I standardly use for platform benchmarks, the system sang. And the Diamond/Stealth-Idek combo was a real winner -- fast and clear with super resolution. The few technical problems I had on startup were quickly and efficiently solved by the obviously proficient support staff via telephone.

As a true systems integrator, Quannon is fully staffed for all software and hardware support and training. They have been representatives for name-brand software like CADKEY, AutoCAD, Cadvance, MasterCAM, UltraCAM, and Novell. They know CAD/CAM thoroughly and they know networking. Quannon installs, configures and tests all systems before they go out the door and then provides orientation with each new system installed.

Quannon's basic configurations begin with 16MB RAM, a 515MB enhanced IDE hard disk, a Diamond Stealth32 graphics accelerator with 2MB DRAM, and high resolution IDEK VisionMaster 17" flat screen monitor. They also have two floppy drives, a high quality surge protector, a Logitech 3-button mouse, and high speed serial and parallel ports that provide reliable support for high speed modems and printers. From there you can add or enhance components. Jerry Kardell states, "We can configure a system virtually any way you want it and deliver it in less than two weeks."

The three base systems are:

- *QCS CADstation 466/VESA* which is a low cost, entry level system. It features two VESA local bus slots for fast graphics and disk throughput. Upgradeable to 32 MB RAM, it can be ordered with 33, 50, or 100 Mhz processors.
- *The QCS CADstation P60/66* provides excellent performance for 2D/3D wireframe CAD and 2 $^1/_2$ axis machining applications.
- *The QCS POWERstation P75/90* is ideal for 3D solids modeling and surfacing applications.

For more information contact Quannon CAD Systems at 800/467-3467 or 612/935-3367.

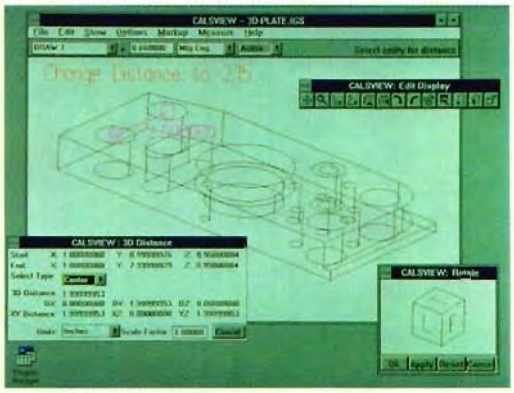
CALSVIEW for Windows

CALSVIEW, IDA's workstation viewing software, is now available for the PC in a Windows and NT version. This software provides graphics viewing, redlining/markup, geometric measurement and format conversion for 2D and 3D CAD, metafile, vector and raster formats.

CALSVIEW for Windows is an "intelligent viewer" that lets you take advantage of the intelligent graphics from 3D CAD and high-end technical illustrating systems. It's 3D viewing capability allows users who are inexperienced in blueprint reading to easily understand CAD drawings.

Further, users can control the display of levels/layers, entity visibility and style, all without needing an expensive CAD system. Users can review CAD drawings, measure distances and mark up the image with redlines as part of the engineering process.

Technical illustrators can view CAD drawings with the same viewer used for raster images to manipulate the images and convert them to technical publishing formats.



The intelligent graphics in CALSVIEW for Windows is the basis for a new generation of design review, document control and CALS CITIS systems. CALSVIEW for Windows and NT supports industry standard formats including 2D and 3D IGES (all subsets), CGM, CCITT G4, CALS tiled and untiled raster, monochrome TIFF, TRIFF, and multi-page TIFF.

This support for industry standards allows CALSVIEW for Windows to be used with almost any combination of applications the user chooses. Like its workstation counterpart, it provides an Application Programming Interface (API) to allow integration with data management systems.

Prices start at $595 with an aggressive discount schedule. Free demos are available.

For more information contact IDA at 708/344-1815.

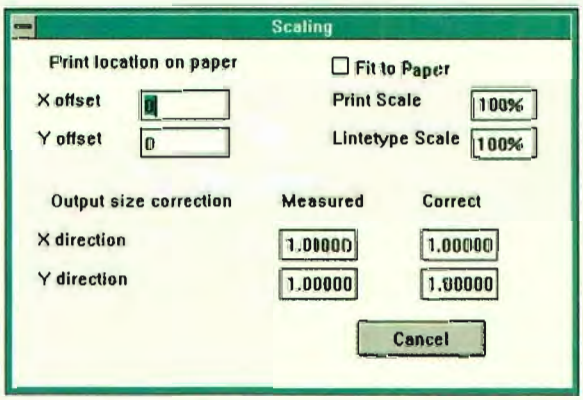
PrintIt!
Line Widths on Windows Printers

We recently tried PrintIt!, a printer/plotting utility that has been popular in Australia for several years and is a recent immigrant to the U.S. This little Windows program neatly solved several problems related to using a printer to plot drawings.

Plots sent to most printers come out with uniformly insipid thin lines because line width setting is rarely provided in common HPGL drivers. The higher the printer resolution, the thinner the lines. The output doesn't photocopy well, looks poor, is difficult to read as a drawing, but is fast and cheap.

PrintIt! lets you plot HPGL files on any Windows printer with line thicknesses and it can assign color to pens. This lets you produce high-quality, low-cost output from an existing or relatively inexpensive printer.

PrintIt! operates on single plot files (or groups) and has many options including scaling and rotating plots. Even if you make the wrong decision in CAD about the rotation of the plot, PrintIt lets you recover the situation without replotting. You can also assign the directory for plot files, erase plot files after plotting, etc.



PrintIt! is installed in its own sub-directory. The CAD program is then configured for one of the Hewlett-Packard series of plotters -- usually the 7545. You then plot the drawing to file and activate PrintIt! which translates the HPGL file and rasterizes the image, producing very high quality plots.

PrintIt! also lets you view HPGL files, copy to the Windows Clipboard and save HPGL files as WMF (Windows MetaFile) files. This provides a good way of getting CAD output into desktop publishers or Windows word processors, with user defined line widths. While many Windows programs can input HPGL files directly, they rarely make provision for line widths.

Some common Windows features (i.e., Drag and Drop printing, and background printing) come along as part of the package and bring a lot of productivity to working and printing in CAD.

With all these features, PrintIt! was extremely easy to use. It works well on stand alone PCs or as part of a network. Retail price is $175.

For more information call Milton at Galaxie Business Equipment, 800/876-3469 or 316/221-3469.

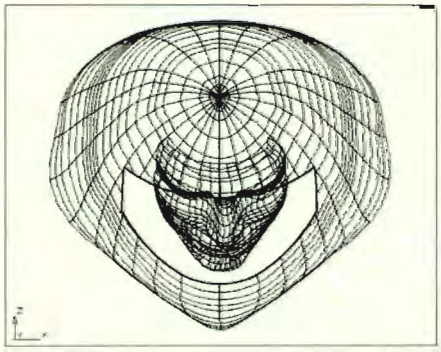
REVIEWPORT

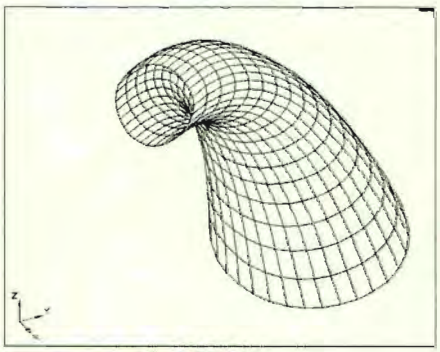
HighRES 3D Modeling Software

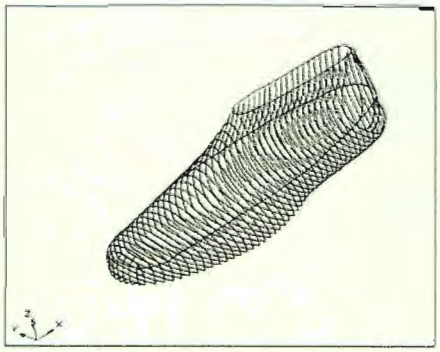
HighRES™, is a sophisticated new system for replicating physical objects. The complete system, which consists of the HighRES software, CADKEY, FastSURF and a 3D digitizing device, can be used to generate 3D surface models of physical objects. It has applications in a wide variety of industries -- from automotive, aerospace, replication, and industrial design to entertainment, virtual reality, animation, television and motion picture 3D special effects. Other potential applications include architecture and toy manufacturing.

Using the system is straightforward enough. A 3D measuring device or digitizer (for example, the SpaceArm or Metrecom from FARO Technologies) is used to capture coordinate data. The captured data is processed in CAD and then passed to the surface modeling program for surface definition.

Finally, the data can be output as IGES (128 BSPLINE) or DXF to a variety of digital application products. For physical prototypes or manufacturing applications it can go via IGES to a CNC or stereolithography machine.







HighRES is available in two versions, the basic *HighRES Shop* and *HighRES Studio* which has many advanced features. *HighRES Shop* features 3D axis planes that let the user define a cutting plane that passes through the physical object and to capture three dimensional coordinates that fall at the intersection of the cutting plane and the surface of the object. You can also capture points falling at the intersection of two planes, project captured points into a user-defined plane, and detect maximum and minimum points along an object's surface. Seven user selectable input programs let the input process be tailored to the specific situation.

In addition to all the *Shop* features, *Studio* includes the following features: World/local/axis views, advanced axis locking and rotation, and *Smart* Edges/Corners/Sides (lets you locate the edge or corner of simple or complex objects and construct digital sets from miniatures quickly and easily.)

HighRES, Inc. also offers consulting and 3D digital services.

For more information contact: HighRES, Inc. in La Jolla, CA at 619/459-9027.

SpaceArm from FARO for Affordable 3D Digitizing

SpaceArm, the newest 3D digitizer from FARO Technologies, is small enough to set on a desktop and features an affordable price tag. The SA36 model has a 36-inch spherical diameter digitizing volume for $3995 and the SA48 has a 48-inch spherical diameter digitizing volume for $4995.

The SpaceArm has a small 6" x 8" footprint and connects to any PC or Macintosh computer through a standard RS232 cable. And unlike other digitizers, there are no line-of-sight limitations and the SpaceArm can digitize any object including metals.

All SpaceArm systems are shipped with SoftSpace, a fast, powerful, full-featured and easy to use 3D digitizing and modeling software. A set of output file translators can export the finished wireframe model into popular 3D rendering, animation and CAD/CAM formats.

Both the new desktop models work like the larger FARO digitizing arms. They feature a six-axis degree of freedom articulated arm; use steel point, non-marring plastic point and 1/4 inch ball probe digitizing tips; and can capture x, y, z, pitch, roll, and yaw data from any object.

The SpaceArm and all other Metrecom CMMs are manufactured by FARO Technologies in Lake Mary, Florida. Created, designed and manufactured in the U.S.A., these articulated measurement arms have been used for three-dimensional measurements in medical diagnostic, surgical, and manufacturing applications for over ten years.

For more information, contact FARO Technologies, Inc. at 407/333-9911, or Fax 407/333-4181.

Color NOVAJET Enhances Plotting

NOVAJET III, ENCAD's latest wide-format color-inkjet plotter, has some new features. It's easier to use and its color printing capabilities are better than ever.

Here's what "easy to use" means. There are dedicated "quick action" buttons for frequently used instructions. Seven buttons and five LED indicators give you complete information about plotting tasks and easily accessible control. An LCD menu lets you access other functions. An ink level estimator alarm (an exclusive feature) warns you when a cartridge's ink supply is low so you can change it before a long plot. It has a remote control feature that lets you select plotter functions from your computer. Roll media holders are built into the printer so roll paper is easy to install. Drawings are automatically cut and stacked in the basket.

CAD renderings, maps and other color images are difficult for any inkjet. Quality plotting of solid color images has been on the slow side because of ink drying and banding issues. NOVAJET III

includes two new faster modes which allow a trade off between speed (for check plots) and quality printing. Images that took 42 minutes for the NOVAJET II now take 15 and can take as little as 10. E-size monochrome line drawings can be plotted in as little as three minutes. Speed is also a function of getting the information out of the computer and to the plotter. NOVAJET III has an efficient HP-GL/2 driver and a Centronics interface. A standard 4MB buffer accommodates more plot files, but it can be upgraded to 32MB with standard SIMM.

The NOVAJET III is priced at $7,495 for D-size and $8,495 for E-size.

For more information contact ENCAD, Inc. 800/356-2808 or 619/452-0882.

CADKEY LISP

by Ron Brumbarger and Scott Workman

This continuing series covers various aspects of the CADKEY LISP programming language. This month we use the file I/O functions of LISP to create geometry based upon the file contents. If you have suggestions or an idea about what we should cover in these articles, leave a message via Compuserve - Cserve ID: 72730,3154

LISP Functions

In previous articles we concentrated on the CAD geometry functions of CADKEY LISP. While these are among the most important functions in a programming language used to customize a CAD engine, it is when these are combined with the internal functions inherent to the language that useful programs can be built.

It would not be very efficient to create a new LISP program for every part that needed to be drawn. While a program offers advantages over manually drawing a part, it is more effective to write a program that does not draw a specific part with the input obtained from the user or in the case of our example here, from a command file.

The LISP language has several internal functions to open, read, write and finally close a text based file. The read and write functions allow a single character or an entire line to be read or written from a file. In this article we use these functions, combine them with the geometry creation functions from the last several articles, and draw parts based upon the file contents.

About the Program

The program in this article, filedraw.lsp, draws an arbitrary part based upon a limited set of commands and coordinates passed to the functions that implement these commands. The drawing commands are stored in a file so that each part can have a separate command file that can be read by the program.

The commands implemented in the program are COLOR, LINE, ARC and END. One command appears on each line of the file and the command name is separated from the coordinates needed to draw the part by a single space. Where a command requires more than one coordinate, a single space separates each coordinate from neighboring coordinates. The syntax is:

LINE x1 y1 z1 x2 y2 z2
ARC x1 y1 z1 x2 y2 z2 radius
COLOR colornum
END

The LINE command draws a line from the (x1 y1 z1) coordinate to the (x2 y2 z2) coordinate. The ARC command draws an arc starting at (x1 y1 z1), ending at (x2 y2 z2) with the given radius. The COLOR command changes the active drawing color to the color number specified. The END command informs the program that no more commands follow in the file. Note that each command expects the format to be followed exactly. Changing the format of the command within the file will cause unexpected results.

An example command file is shown in Listing 1. Remember, each command parameter is separated by a single space.

Listing 1

```
COLOR 1
LINE 0.25 0.0 0.0 2.75 0.0 0.0
ARC 2.75 0.0 0.0 3.0 0.25 0.0 0.25
LINE 3.0 0.25 0.0 3.0 2.25 0.0
ARC 3.0 2.25 0.0 2.75 2.5 0.0 0.25
LINE 2.75 2.5 0.0 0.25 2.5 0.0
ARC 0.25 2.5 0.0 0.0 2.25 0.0 0.25
LINE 0.0 2.25 0.0 0.0 0.25 0.0
ARC 0.0 0.25 0.0 0.25 0.0 0.0 0.25
END
```

Program Specifics

The program has two main areas of functionality. The beginning of the program reads and interprets the commands from the file. The second part of the program contains functions to implement the drawing commands.

The program begins with the **c:filedraw** function. (See Listing 2.) This function is started by the user typing filedraw. The function asks the user for the name of the file containing the drawing commands, opens the file for read access and calls the **runcmd** function to read and interpret the file contents. If the file does not exist, an error message is displayed and **runcmd** is not called.

The **runcmd** function begins by turning off the command echo variable so that the command prompts are not displayed while the program is running. It then calls the **getcmd** function to obtain the next command in the file. This continues until the END command is read by the **getcmd** function. Each command is examined and the appropriate function is called to implement the command.

The **getcmd** function is where the actual file input occurs. The function reads the next line from the file which should contain the next command. If there are no more lines in the file, the command name is assumed to be END. Otherwise, the getword function is called to parse off the command from the line just read. The **getcmd** function will return either the word returned from the **getword** function or the string END if the end of the file has been reached.

The **getword** function relies heavily upon the LISP internal string functions to parse the next word from the current line. The **substr** function is used to examine one character at a time. A loop continues examining each character until a single space is found or the end of the line has been reached. As each character is examined, it is added to the current word using the **strcat** function. This builds the word one character at a time until the separating space is found. After the word has been built, the current input line is adjusted past the current word so that the next time the **getword** function is called, it will parse off the next word. The **getword** function returns the uppercase string of the word parsed from the line.

The **getnum** function simply calls the **getword** function to parse the next word and then converts the returned string to a floating point number. This is useful for commands that are expecting coordinates or distances.

The rest of the functions are the command implementation functions. Each command calls either the **getword** or **getnum** functions to obtain the parameters to the command. After the parameters have been obtained, the appropriate CADKEY LISP command is called to draw the geometry.

The **drawline** function calls the **getnum** function for each x, y and z coordinate at the end points of the line. The end point coordinates are combined into a list that represents a point in LISP and the two lists are passed to the CADKEY LISP line command.

The **chgcolor** function is used to change the active drawing color to the color number specified with the command. The color number is a CADKEY LISP compatible color number where 1=red, 2=yellow, 3=green, etc.

The **drawarc** function is similar to the drawline function. The arc is drawn using the two endpoints of the arc and the radius. The **getnum** function is used to obtain each parameter to the command. The CADKEY LISP arc command is run using the start point,/'E'nd point/'R'adius method.

The final two lines of the file are used to display execution instructions at load time.

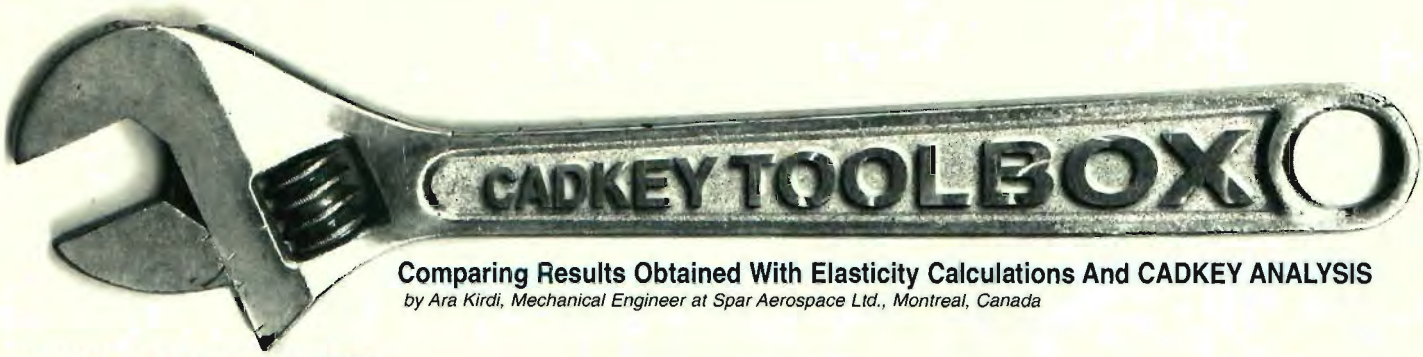
Conclusion

This is one method of using the internal language functions of CADKEY LISP to extend the flexibility of drawing geometry within CADKEY. Try different command files of your own to draw assorted parts of interest to you. Enhancements to the program can include additional commands to draw other geometry types.

Ron Brumbarger is the President and Scott Workman is the Director of Technology for BitWise Solutions, Inc. BitWise Solutions offers software products and services specializing in the CAD/CAM and Multi-media markets.

Listing 2

```
; filedraw.lsp
;
; Draw a part based upon the commands and coordinates
; stored in a command file.
;
(defun c:filedraw ( / fname fp buf )
  (setq fname (getstring "\nEnter command file name: ")
        fp    (open fname "r"))
  (if (= fp nil)
    (princ "\nUnable to open file.")
    (runcmd fp)
  )
)

; Run commands from the file until the END
; command has been reached.
;
(defun runcmd ( fp / oecho cmd )
  (setq oecho (getvar "cmdecho"))
  (setvar "cmdecho" 0)

  (while (/= (setq cmd (getcmd fp)) "END")
    (cond
      ((= cmd "LINE")  (drawline))
      ((= cmd "COLOR") (chgcolor))
      ((= cmd "ARC") (drawarc))
    )
  )

  (close fp)
  (setvar "cmdecho" oecho)
)

;  Get a new line from the file and parse
;  off the first word as the command.
;
(defun getcmd ( fp / )
  (setq buf (read-line fp))
  (if (= buf nil)
    (setq cmd "END")
    (getword)
  )
)

; Parse off the next word from the current line
; and remove the word from the line.
;
(defun getword ( / word a i )
  (setq word ""
        i   1
        a   (substr buf 1 1))
  (while (and (/= a " ") (/= a ""))
    (setq word (strcat word a)
          i    (1+ i)
          a    (substr buf i 1)))
  (setq buf (substr buf (+ (strlen word) 2)))
  (strcase word)
)

; Get the next word and convert to a number.
;
(defun getnum ( / )
  (atof (getword))
)

; LINE command:  LINE x1 y1 z1 x2 y2 z2
;
(defun drawline ( / x1 y1 z1 x2, y2, z2 )
  (setq x1 (getnum)
        y1 (getnum)
        z1 (getnum)
        x2 (getnum)
        y2 (getnum)
        z2 (getnum))
  (command "_.line" (list x1 y1 z1) (list x2 y2 z2) "")
)

; COLOR command:  COLOR colornum
;
(defun chgcolor ( / )
  (command "_.color" (getnum))
)

; ARC command:  ARC x1 y1 z1 x2 y2 z2 radius
;
(defun drawarc ( / x1 y1 z1 x2 y2 z2 rad )
  (setq x1  (getnum)
        y1  (getnum)
        z1  (getnum)
        x2  (getnum)
        y2  (getnum)
        z2  (getnum)
        rad (getnum))
  (command "_.arc" (list x1 y1 z1) "e" (list x2 y2 z2)
"r" rad)
)

(princ "\nType FILEDRAW to execute this program." )
(princ)
```

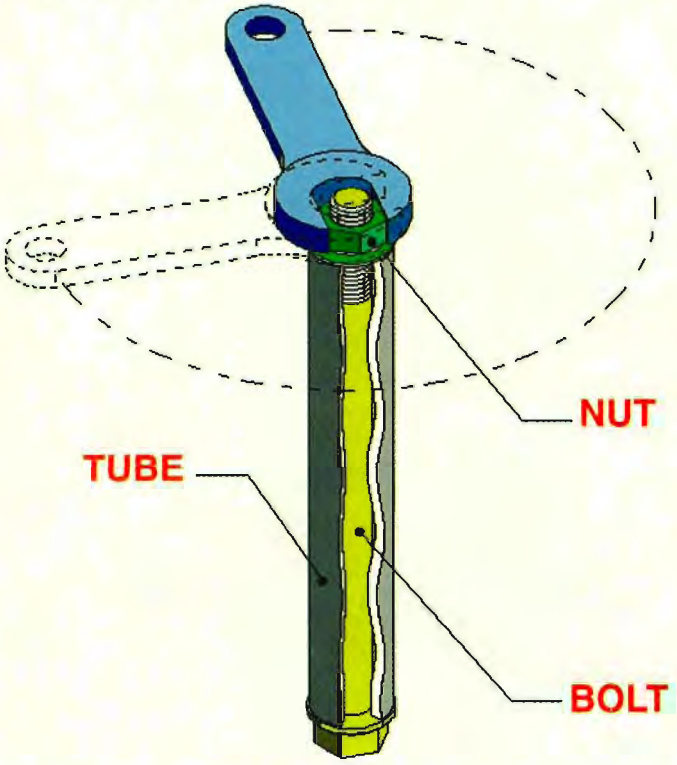


Comparing Results Obtained With Elasticity Calculations And CADKEY ANALYSIS

by Ara Kirdi, Mechanical Engineer at Spar Aerospace Ltd., Montreal, Canada

PROBLEM DESCRIPTION

A yellow annealed brass bolt of 0.75 in. diameter has been placed inside a 10-in.-long aluminum (7075-T6) sleeve of 1.0 in. inside diameter and 0.25 in. wall thickness. The bolt and the sleeve are held firmly together with a 10 threads per inch nut.



GOALS

Determine the stresses and axial deformations in the bolt and in the sleeve due to a three-quarter turn on the bolt.

DATA

$E_{Bolt} = 1.523 \times 10^7$ psi
... *Modulus of Elasticity of Yellow* Brass

$E_{Sleeve} = 1.03 \times 10^7$ psi
... *Modulus of Elasticity of Aluminum*

$L_{Bolt} = L_{Sleeve} = 10.0$ in.
... *Length of Bolt / Sleeve*

$R_{Bolt} = 0.375$ in.
... *Radius of Bolt*

$IR_{Sleeve} = 0.50$ in.
... *Inner Radius of Sleeve*

$OR_{Sleeve} = 0.75$ in.
... *Outer Radius of Sleeve*

$A_{Bolt} = \pi \bullet R_{Bolt}^2 = 0.442$ in.^{2}
... *Cross-Sectional Area of Bolt*

$A_{Sleeve} = \pi \bullet (OR_{Sleeve}^2 - IR_{Sleeve}^2) = 0.982$ in.^{2}
... *Cross-Sectional Area of Sleeve*

THEORETICAL ANALYSIS

Equal and opposite forces are applied to ends of sleeve and bolt where the three-quarter-turn deformation has the effect of lengthening the bolt and shortening the sleeve. The sum of the deformations according to Hooke's law is

$$\Delta = \Delta_{Bolt} + \Delta_{Sleeve} \qquad \textbf{(Eq. 1)}$$

$$\Delta = \left[\frac{F\,L}{A\,E}\right]_{Bolt} + \left[\frac{F\,L}{A\,E}\right]_{Sleeve} = \left(\frac{3}{4}\ \text{Threads}\right)\left(\frac{1\ \text{in.}}{10\ \text{Threads}}\right) = \frac{3}{40}\ \text{in.}$$

$$\Delta = \left[\frac{F \cdot 10}{(0.442) \cdot (1.523X10^7)}\right]_{Bolt} + \left[\frac{F \cdot 10}{(0.982) \cdot (1.03X10^7)}\right]_{Sleeve}$$

Simplifying the above equation and solving for the force F yields 30,313 lb.

The bolt increases in length under this tensile load (+F). According to Hooke's law

$$\Delta_{Bolt} = \left[\frac{(30{,}313\ \text{lb}) \cdot (10.0\ \text{in.})}{(0.442\ \text{in.}^2) \cdot (1.523X10^7\ \frac{\text{lb}}{\text{in.}^2})}\right] = 0.0450\ \text{in.} \qquad \textbf{\textit{(Ans.)}}$$

Furthermore, the sleeve decreases in length under this compressive load (-F). Once again according to Hooke's law

$$\Delta_{Sleeve} = \left[\frac{(-30{,}313\ \text{lb}) \cdot (10.0\ \text{in.})}{(0.982\ \text{in.}^2) \cdot (1.03X10^7\ \frac{\text{lb}}{\text{in.}^2})}\right] = -0.0300\ \text{in.} \qquad \textbf{\textit{(Ans.)}}$$

The axial stress found in the bolt is then calculated as

$$\sigma_{Bolt} = \frac{F}{A_{Bolt}} = \frac{30{,}313\ \text{lb}}{0.442\ \text{in.}^2} = 68{,}581.45\ \text{psi} \qquad \textbf{\textit{(Ans.)}}$$

Likewise, the axial stress found in the sleeve is

$$\sigma_{Sleeve} = \frac{-F}{A_{Sleeve}} = \frac{-30{,}313\text{lb}}{0.982\text{in.}^2} = -30{,}868.64\ \text{psi} \qquad \textbf{\textit{(Ans.)}}$$

CADKEY ANALYSIS (CKA) V. 7 SOLUTION:

• *Models Creation*

1. Bolt

- Create a rectangle of 0.375 units wide by 10 units high.
- Locate the rectangle's lower left corner at (0,0,0)
- Save the file as a CADL file (Bolt.CDL)

2. Sleeve

- Create a rectangle of 0.25 units wide by 10 units high
- Locate the rectangle's lower left corner at (0.50,0,0)
- Save the file as a CADL file (Sleeve.CDL)

• *Launch CADKEY ANALYSIS*

1. Bolt

Files

File Name: *Bolt.CDL*
File Type: *Line Segment*
Session Output: *Bolt.SES*
OK

Config

Analysis Type: *Elastic*
Dimensionality: *Axisymmetric*
Units: *Eng_(in)*
Material: *Yellow Brass (65% Cu, 35% Zn)*
OK
OK

Segment

Global
0.1875 (↵)
Process
Done
Save As: *Bolt-S.CDL ('S' for Segmented)*
OK

Assign

CONDITION

• DISPLACE
Displacement-N: *0*
Displacement-T: *0*
Selection Type: *Element*
Orientation: *Local*
OK
Window: *Lower Horizontal Edge of Bolt*
OK
Done

• DIST-LOAD
Pressure: $-F/A_{Bolt}$ = *-30,313 lb / 0.442 in.²*
= *-68,581.45 psi*
Shear: *Disable The Check Icon (✓)*
OK
Window: *Top Horizontal Edge of Bolt*
OK
Done
F10 (Back-Up)
Done

Solve

OK

Results

Result Type: *Stress*
Component: *ZZ Comp.*
Plot Type: *Shaded*
Dimension Mode: *2D_View*
OK
OK
OK
Save: *Bolt1.PTN*

Result Type: *Deflection*
Component: *Z Comp.*
Plot Type: *Shaded*
Dimension Mode: *2D_View*
OK
OK
Save: *Bolt2.PTN*
Cancel

2. Sleeve

Files

File Name: *Sleeve.CDL*
File Type: *Line Segment*
Session Output: *Sleeve.SES*
OK

Config

Analysis Type: *Elastic*
Dimensionality: *Axisymmetric*
Units: *Eng_(in)*
Material: *Aluminum (7075-T6)*
OK
OK

Segment

Global
0.25 (↵)
Process
Done
Save As: *Sleeve-S.CDL ('S' for Segmented)*
OK

Assign

CONDITION

• DISPLACE
Displacement-N: *0*
Displacement-T: *0*
Selection Type: *Element*
Orientation: *Local*
OK
Window: *Lower Horizontal Edge of Sleeve*
OK
Done

• DIST-LOAD
Pressure: F/A_{Sleeve} = *30,313 lb / 0.982 in.²*
= *30,868.64 psi*
Shear: *Disable The Check Icon (✓)*
OK
Window: *Top Horizontal Edge of Sleeve*
OK
Done
F10 (Back-Up)
Done

Solve

OK

Results

Result Type: *Stress*
Component: *ZZ Comp.*
Plot Type: *Shaded*
Dimension Mode: *2D_View*
OK
OK
OK

Save: *Sleeve1.PTN*

Result Type: *Deflection*
Component: *Z Comp.*
Plot Type: *Shaded*
Dimension Mode: *2D_View*
OK
OK
Save: *Sleeve2.PTN*

Figure 2 and Figure 3 show the results of deflections and stresses, compiled from the above pattern files *(Bolt1.PTN, Bolt2.PTN, Sleeve1.PTN, and Sleeve2.PTN):*

Comparison

The following tables show the comparison between Theoretical results and CADKEY ANALYSIS:

Table 1 DEFLECTION (in.)

	Theory	*CKA*	*Difference*
BOLT	0.0450	0.0449	0.256 %
SLEEVE	-0.0300	-0.0298	0.530 %

Table 2 STRESS (psi)

	Theory	*CKA*	*Difference*
BOLT	68,581.45	68,573.38	0.012 %
SLEEVE	-30,868.64	-30,865.83	0.009 %

Reference

John D. Constance, P.E., *Mechanical Engineering For Professional Engineers' Examinations*, 4th ed. (New York: McGraw-Hill Book Company, 1985), pp. 12-13.

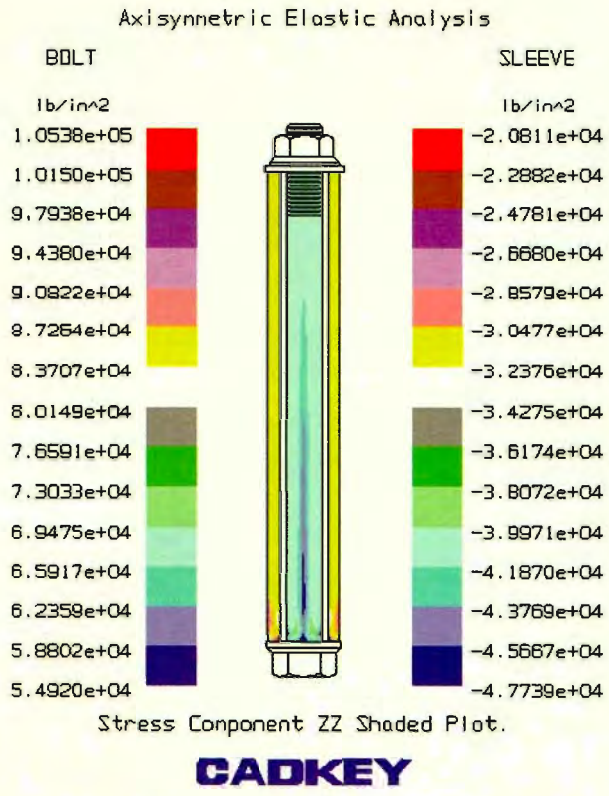


FIGURE 1

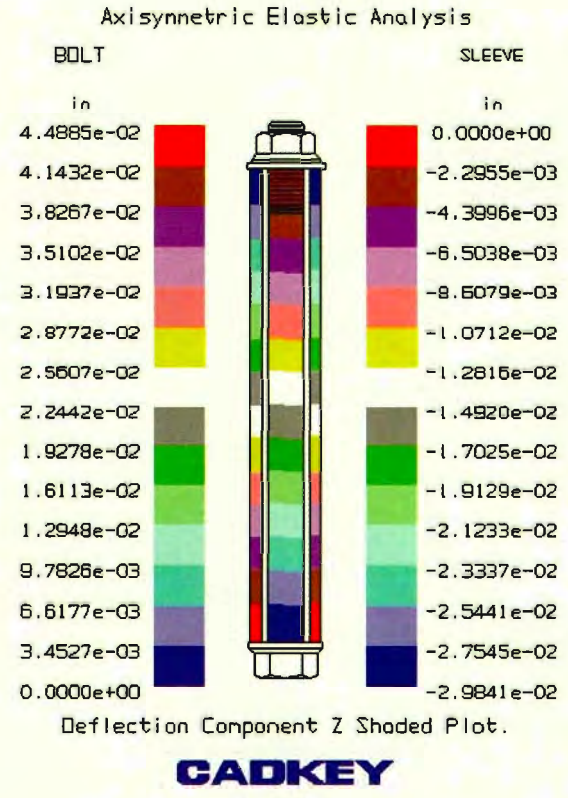


FIGURE 2

BACKFACTS

FACT:

Bending forward over your desk in a conventional chair exerts as much pressure on your lumbar discs as bending forward from a standing position to pick up 22 lbs -- a sure route to back problems!

FACT:

Sitting subjects the spine to 50% more stress than standing -- 90% of our seated tasks are performed in a forward position not accommodated by conventional chairs.

Exercise-Break Software Can Help Prevent Injury

User-Friendly Exercises soft ware program is an "injury prevention alarm clock." At selected time intervals, a model "pops up" on the screen to guide the user through exercises to reduce strain in the eyes, wrist, neck and shoulders. The exercises reduce stress and fatigue as well as the likelihood of repetitive motion injuries and Carpal Tunnel Syndrome.

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Available from AliMed 800-225-2610.

Computer Ergonomics:

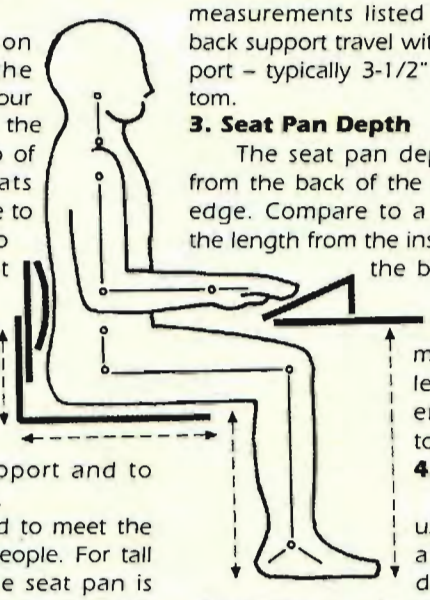
SELECTING THE RIGHT CHAIR

By Seth Frielich

People are all different sizes. To eliminate some of the confusion you encounter when trying to select the right chair for you, AliMed offers some guidelines for chair selection:

1. Height of Chair

With your feet flat on the floor, measure the height from the floor to your knee/inner thigh. This is the starting height to the top of the seat pan. Most seats have an adjustment range to allow the seated person to move up and down to fit the desk. If the seat is raised up to align the arms to the desk height, and the feet do not rest on the floor, a footrest should be used for support and to relieve stress in the thighs.



Some chairs are sized to meet the needs of tall and short people. For tall people the height of the seat pan is extended to permit leg extension. For shorter people, the size of the seat is scaled to a shorter body's proportions.

2. Seat Backs

The back support on a chair should be adjusted vertically to place the lumbar support in the curved section of the lower back and the spine in a proper "S" shaped curved. Measure from the base of the spine to the center of the curve in the lower back. This corresponds to the measurements listed for the range of back support travel with the lumbar support – typically 3-1/2" up from the bottom.

3. Seat Pan Depth

The seat pan depth is the length from the back of the chair to the front edge. Compare to a measurement of the length from the inside of the knee to the base of the spine. Some chairs feature an adjustment of the back to lengthen or shorten this dimension to fit the user.

4. Armrests

The armrest is used to support the arms and shoulders. Adjustable height arms can be moved vertically so they contact the elbows or forearms. Lateral adjustments are desirable. Measure the distance from the elbows to the seat pan when seated. This is the proper height of the armrest.

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An incorrect phone number was printed for DBUG (DataCAD Boston Users Group) in our September issue. The correct phone number is 617/367-9622.

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