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KEY SOLUTIONS

CONCURRENT ENGINEERING FOR THE 90'S

CE Issues

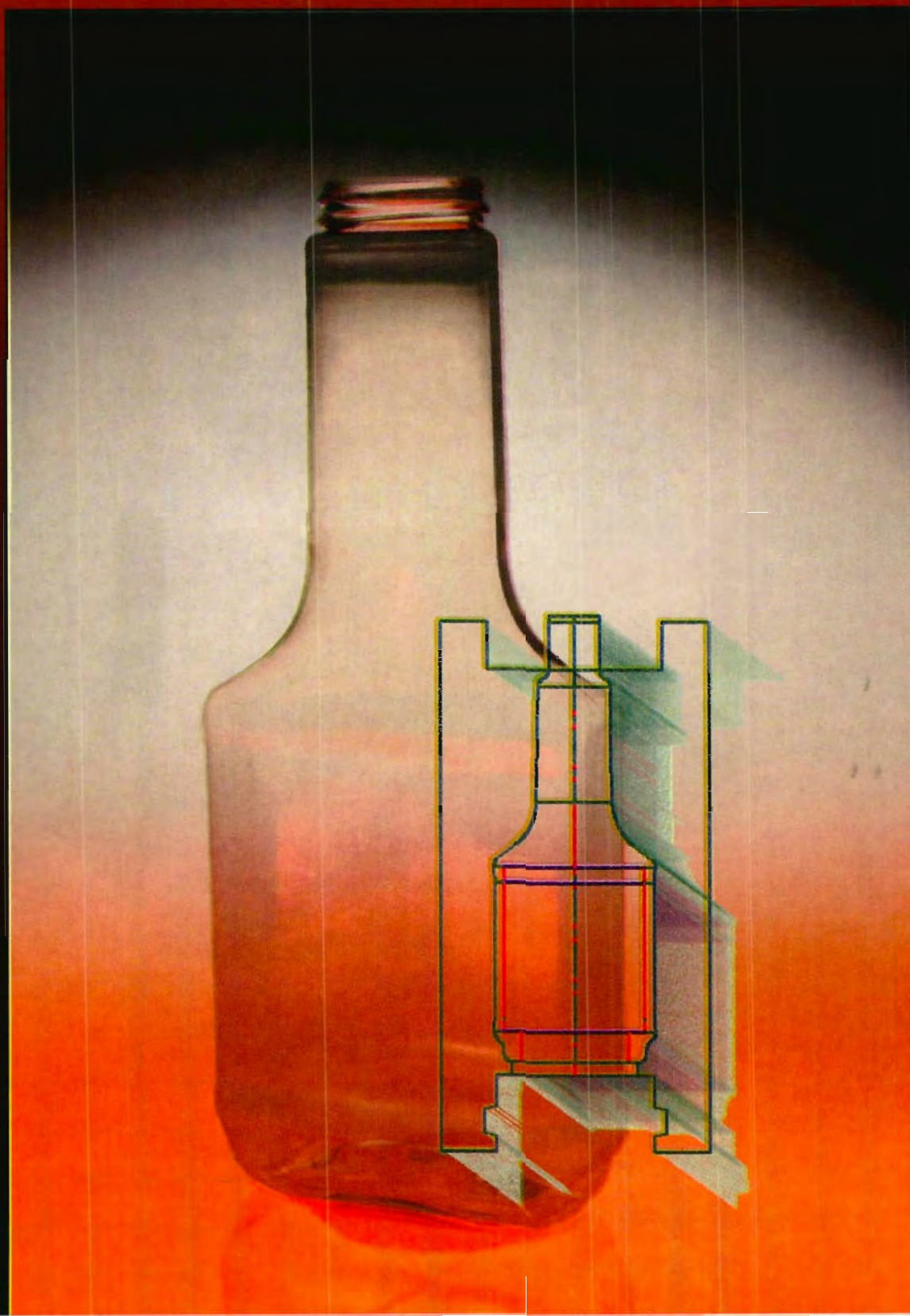
Cost Reduction:
A CASE STUDY

CADKEY AT WORK

Designing
BLOW MOLDS

Products

PLOTTERS
And Productivity
TOOLS



FastSURF

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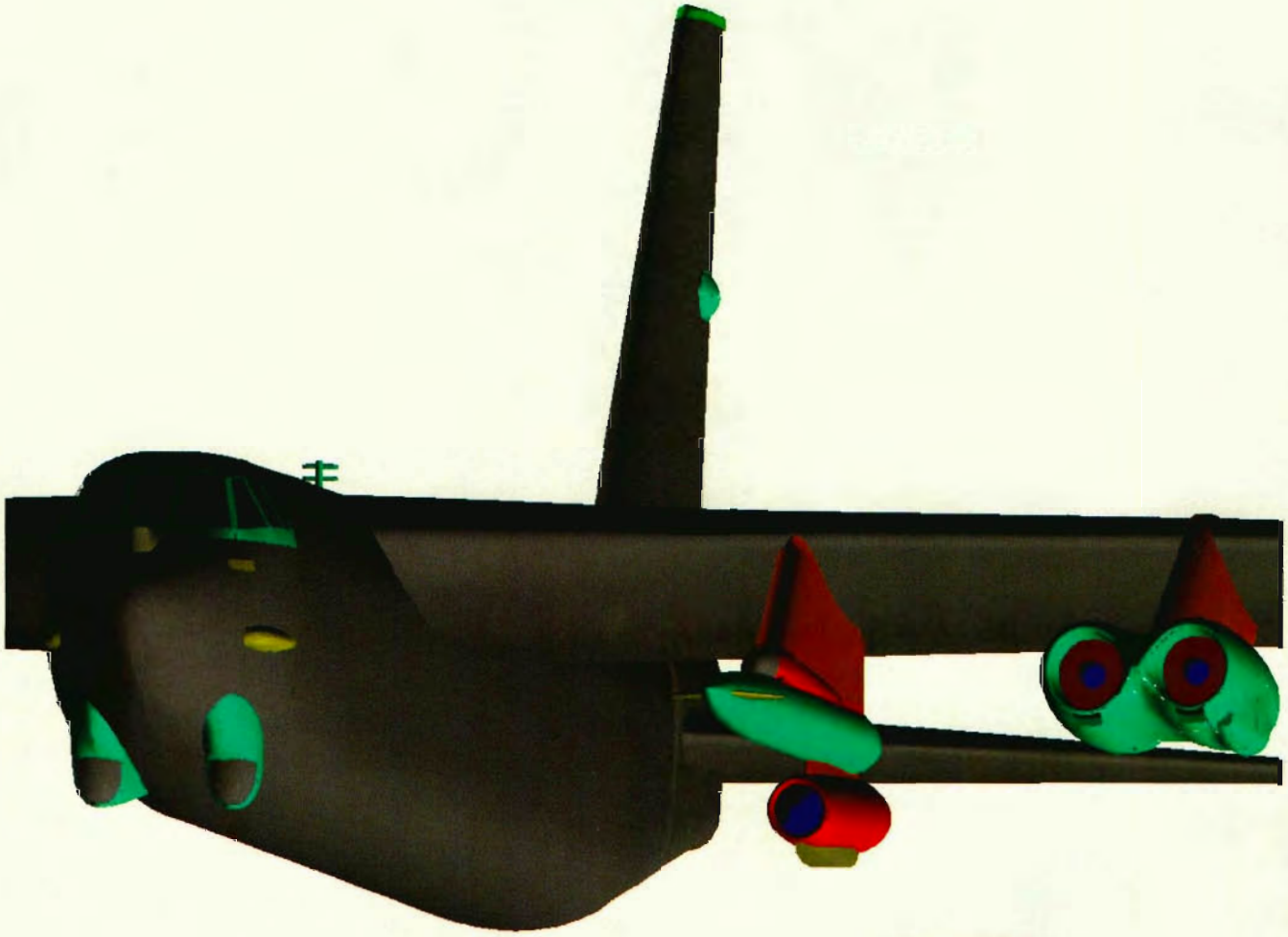

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KEY SOLUTIONS
CONCURRENT ENGINEERING FOR THE 90'S
March 1994
Vol. 3 No. 2

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An airplane designed with CADKEY and FastSURF. See page 43.

On the Cover:
Cover photography and photos on pages 24 and 25 by John Cessna.

KeyTalk

Ever notice how the world never stands still? The new year has barely begun and Cadkey has made major changes in their pricing/marketing strategies. I have heard opinions from readers, third party developers and others ranging from concern, anxiety and anger to elation and excitement. There will obviously be a brief adjustment period, and only time will tell, but I think Cadkey's moves are the best thing that's happened in the CAD industry and to Cadkey for a long time. There's no reason that CAD software shouldn't be a commodity much like WP and business software. Kudos to Malcolm Davies and Cadkey for being the first. Expect others to follow suit.

KeySolutions is making changes too. The major one will affect you directly. **KeySolutions** is changing from a free-controlled circulation to a paid subscription. Here's why. For a year and a half **KeySolutions** was distributed without charge to CADKEY users. We are pleased we could introduce the magazine to so many readers on this basis. However, with each issue we found it increasingly difficult to cover production costs with advertising income alone.

At the same time readers told us how much they appreciated the type of articles, tutorials and product data in **KeySolutions** and that they looked forward to every issue. The magazine was obviously filling a real need.

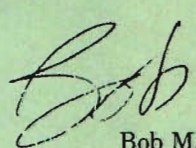
Although these expressions of reader satisfaction affirmed the success of our mission, they simultaneously highlighted the magnitude of the dilemma we faced. Could we continue to produce a top-notch product, for free, without cutting costs so much that the quality suffered? After lots of agonizing soul-searching and in-depth business analysis, we realized we couldn't.

We also couldn't think of a single independent software magazine worth a darn that didn't have a subscription fee. That ought to have told us something. Anyway, we knew for a fact that the content of **KeySolutions** is pretty special. Where else can you get a publication devoted exclusively to information about CADKEY and concurrent engineering? Surely, readers would be willing to support the magazine with a paid subscription. We polled a random sample, who said they would indeed be willing.

So paid subscriptions are effective beginning with the May issue. We have kept the rates low and are offering a discount for cash. Readers are still our top priority. True, this is your last free **KeySolutions**, but you don't have to miss out on any. Just fill out the subscription card in this issue and mail it right away. If you hurry, you will receive the May issue.

Your continuing support will enable **KeySolutions** to grow and improve. We are still strongly committed to our goal of creating the best CAD magazine around for the best CAD software around.

Thanks again for your support!



Bob Martin
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Call for SPECIAL DIRECT PRICE to CADKEY User Group Members

PC MAGAZINE
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May 25, 1993
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Hitachi Puma Plus: The Best Choice for your Digitizer Needs

PC Magazine says:

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Cadkey Forum

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

Welcome to the REVOLUTION!

Cadkey, Inc. is determined to become the leader in PC-CAD. On January 17 we announced a bold move to take the initiative and make CADKEY products the undisputed CAD software of choice among design professionals.

Up until now CAD pricing has been established by Autodesk, and the rest of the industry has followed. For some time I have believed that professional CAD prices are simply too high, by a long way, and that 2D and 3D wire-frame CAD should be priced in the same range as other commercial applications, that is, below $500. In our test marketing, we have proved that there is tremendous demand for such pricing, and we are confident that by becoming the first major CAD vendor to deliver, we will greatly increase both market share and revenues.

While our competitors can only offer reduced-functionality "Light" products at $495, we know that customers want the "Real Thing." We therefore reduced the price of CADKEY to a suggested $495, effective January 17, 1994. This version of CADKEY is CADKEY 6 without CADKEY ANALYSIS (which is now available as an add-on module), but with the addition of the Advanced Drafting Module from Baystate Technologies.

We also announced that for far less than our competitors' wire-frame systems, Cadkey is launching a new product: CADKEY Professional, which combines CADKEY, CADKEY ANALYSIS, CADKEY ADVANCED Modeler, Advanced IGES, Draft-Pak from Baystate Technologies, and FastSURF. It is designed for customers who require 3D wire-frame, Surfaces and Solids on a PC, at an unbeatable price, a suggested $3495.

CADKEY Drafter has been reduced in price from a suggested $495, to $249.95. CADKEY Light remains unchanged at $99.95.

We also announced that effective immediately, CADKEY products will no longer be shipped with a hardware protection device. This is a result of customer requests and improved copyright laws.

All of these changes are designed to provide better value to customers, to increase our market share, and to increase our revenues. Our Authorized Dealers remain just as important as ever. They will continue to sell and support CADKEY products and should be the primary contact for customers who require additional information about these changes, or who wish to see CADKEY software. If you do not know the name of your nearest CADKEY Dealer, please call 1-800-394-2231; we will be happy to provide it.

CADKEY TRAINING VIDEO:

Introduction to CADKEY: Learn CADKEY 6.5 from experts. Our video tape learning system includes official CADKEY training manuals and nearly eight hours of lectures and tips from Dana Seero. $199. plus S&H

Bundle: CADKEY 6.5 with Introduction to CADKEY Video and training manuals - $595 (save $100.)

Toll Free telephone technical support for CADKEY - One year $295. per user.

IF YOU WOULD LIKE TO RECEIVE OUR USER NEWSLETTER, PLEASE CALL THE NORTHEAST'S LEADING CADKEY DEALER

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KSL 3/94

KEYNOTES

CADKEY in the News

New CADKEY Pricing Strategy Shakes CAD Industry

As part of a new corporate strategy, Cadkey, Inc. will sell its flagship CADKEY® 2D and 3D wireframe modeler for $495 via direct marketing channels and through a network of authorized dealers. It has also lowered the price of the CADKEY DRAFTER program to $250 from $495. This move makes Cadkey the first maker of PC-based CAD software to provide a fully-featured product for the professional engineering market at under $500.

Hardware Locks Removed

Cadkey, Inc. announced the removal of the hardware lock on its products worldwide. "Copyright laws and normal standards of ethical behavior are now adequate to protect our interests," said Malcolm Davies. "Lifting the locks also simplifies and reduces our costs, enabling us to pass these savings along to our customers."

New Cadkey Training Center in San Diego

Campbell & Campbell (Authorized Cadkey Dealer) in San Diego offers professional training at their new Cadkey Training Center. Classes cover issues from Cadkey/Computer basics to advanced Cadkey topics and links to manufacturing. Campbell & Campbell is dedicated to supporting all Cadkey products and third party applications. For a class schedule please call 619/749-6405 or fax 619/749-0156.

Cadkey Europe Announces Personnel Landslide

The exodus of leading figures from Autodesk, Inc. to play key roles at Cadkey, Inc. continues. Cadkey (Europe) AG, based in Fullinsdorf, Switzerland, has been responsible for the marketing and sales of all Cadkey products in Western and Eastern Europe since October 1993.

(Continued on next page)

1993 CAD/CAM, CAE Software Revenue

Worldwide CAD/CAM, CAE software revenues were forecast by Daratech, Inc., a Cambridge, Massachusetts market research firm, to top $3.8 billion in 1993, a growth of 6.4% over 1992. Software growth slowed substantially from the 15.1% rate seen in 1992 due to the disruptive transitions at major vendors coupled with down economies worldwide, says Daratech.

Important trends emerging in 1993 include the first signs of what may develop into a software price war that could eventually destabilize 1993's accepted price norms. According to Daratech, typical prices for high-end technology-driven CAD/CAM software have declined from $100,000 ten years ago to less than $20,000 today; furthermore, the slide in UNIX-based software prices is likely to be hastened by the advent of Microsoft's Windows NT.

In the market for value-driven products - AutoCAD, Microstation, MICRO CADAM, CADKEY, Prelude and others - Autodesk's recent announcement of AutoCAD LT sets a new price standard for industrial strength CAD, and appears bound to shake the foundations of this market.

Today, value-driven CAD/CAM products - those seen by customers as offering the best available technology and performance for price-sensitive applications - account for a major and still-growing share of total CAD/CAM unit sales. On the other hand technology-driven systems, which typically offer unique technology and/or high performance for price-sensitive, critical applications, still account for most of the industry's software revenues.

Worldwide 1993 revenue from DOS/Windows-based CAD software was projected by Daratech to top $674 million, or 8.2% of total industry software revenue.

CAD/CAM/CAE Strategy Workshop

Daratech, Inc.'s strategy workshop on March 8-9 brings together CAD/CAM, CAE, EDM and the computer industry's CEOs to share their vision of the industry's technology, and discuss business and direction with high-level representatives of the world's leading engineering users. Now in its ninth year, this meeting is regarded by many as the world's premier showcase of CAD/CAM philosophy and direction.

Special Interest Group for x86 PCMCIA Compatibility

In an effort to accelerate acceptance of the widely supported PCMCIA standard for PC Cards, and more clearly define the PCMCIA compatibility requirements for x86 based systems, key members of the portable PC industry have joined together to form the QuikSwap‡ Special Interest Group (SIG). The SIG member companies have worked together for over one and a half years to achieve compatibility of their equipment through open dialog and hardware and software exchange during the definition of the PCMCIA specification. The SIG has been formed to complement PCMCIA by expressly addressing the PCMCIA card compatibility needs of the x86 architecture, in contrast to the more general goal of cross platform compatibility.

SME Launches New Magazine

Forming and Fabricating, a new magazine published by the Society of Manufacturing Engineers (SME), debuted early in 1994. The magazine, to be produced nine times a year, will address the technical needs of professionals in the stamping, and forming and fabricating industries. Editor-in-Chief John R. Coleman, CMfgE will guide the editorial direction of *Forming and Fabricating* and lead the magazine's editorial team. Coleman will also continue in his role as editor-in-chief of the monthly *Manufacturing Engineering*, the Society's flagship publication. For more information contact SME at 313/271-1500.

Upgrading Your CPU

Intel is now selling OverDrive Processors, which speed the pace at which 486 systems perform both integer and floating-point calculations. The OverDrive Processor boosts 20/25/33 MHz Intel 486SX/DX CPU-based systems to 486DX2 performance. For example, the internal operating speed of an OverDrive Processor equipped 33 MHz 486DX system doubles to 66 MHz. In benchmarks, Intel reports the following software performance increases: AutoCAD Release 12.0, 50%; Computervision Corp.'s DesignView, 62%; Intergraph's Microstation, 73%; and OrCAD's SDT386, 50%.

Currently, Overdrive Processors are for use with Intel 486SX/DX systems. However, Intel reports that a Pentium OverDrive Processor is in the works for users of 486DX2 systems and should be ready to ship in the second half of 1994. For more information, and to receive a copy of the *Intel Overdrive Processor Upgradability Guide*, call Intel at 800/523-3019.

JDL Selected for Honors

JDL, the U.S. Sales Division of Japan Digital Laboratory Co., Ltd., recently announced several significant achievements: as JDL's parent company in Japan celebrated its 25th anniversary in 1993, it was selected to the highest level of the Tokyo stock exchange, making it one of the fastest corporations in Japan's history to successfully achieve first-level status; and The Nikkei Simbun (Japan's equivalent to the Wall St. Journal) recently ranked JDL 37th on Japan's Corporate 500 Excellence List. This ranking puts JDL ahead of firms such as Canon, Honda, Toshiba and Sharp.

In the United States, JDL supplies large-format plotters for the engineering CAD, document management and reprographics markets. In Japan, JDL designs, manufactures and sells word processing, DTP, document management systems, and stand-alone systems for accounting firms.

First Place in VARBUSINESS Survey

ViewSonic, a Walnut, CA-based monitor company, edged out its competitors in a recent VARBUSINESS Magazine survey of high-resolution monitor vendors. Against major competitors like Sony and NEC, ViewSonic came out on top in both the products features category and the business features category. In business since 1990, ViewSonic has doubled in size every year. In 1991 and 1992 ViewSonic was chosen by Inc. Magazine as one of the 500 fastest growing companies in the U.S., averaging 100% growth each year.

CADKEY in the News

Cadkey Europe is headed by Rudolf Kunzli. Now president, CEO and Chairman of the Board of Cadkey Europe, Kunzli was sales manager (German-speaking areas), managing director for Europe and co-founder of Autodesk. Philipp Schmidli, former sales and marketing director in Europe for Autodesk, is now senior vice-president and COO of Cadkey (Europe) AG. He is responsible for production, technology and support. Renato Pretot, former sales manager (German-speaking areas) and managing director of Autodesk Softtrade was responsible for introducing Auto-sketch, Animator and Generic CADD to Europe. He is now vice-president for sales and marketing of Cadkey Europe. Malcolm Davies, former Autodesk senior vice-president for sales and marketing became president and CEO of Cadkey, Inc. late in 1992. Davies was followed by George Krucik, former senior manager of development and managing director and COO of Autodesk Australia, who is now senior vice-president and COO of Cadkey, Inc.

CADKEY Hebrew Language Version Available

CADKEY has added one more language to the existing list. Cadkey now has a Hebrew language version of the Vibrant fonts, and has translated CADKEY LIGHT, the prompt line, and the first CADKEY Reference Manual.

CADKEY 6.5 In the Works

A major upgrade to CADKEY 6 is in development and release is planned in three to four months. Enhancements to look forward to include Vibrant Graphics Soft Engine, a chain offset CDE, drafting enhancements, and a Windows/Motif look and feel.

New PA-Based Users Group

For more information on a new Pennsylvania Users Group contact John Ewell at Prism Engineering, Inc., Horsham, PA., 215/674-9696.

NEW PRODUCTS

SOFTWARE

CommWorks for Windows

Traveling Software Inc. announced that CommWorks for Windows will be pre-loaded on Toshiba's new Portégé T3400 ultra-portable series. CommWorks provides five communications tools including remote drive and printer access, fax, terminal emulation, file notification,and the file transfer program LapLink® V. CommWorks enables users to send and receive faxes directly from their PC, dial popular on line services, and access remote disk drives and printers over a cable or modem. The T3400 ultra-portable series is an SL Enhanced i486SX 33MHz CPU with a VESA local bus video controller. The T3400 provides a 7.8-in. TFT active-matrix color display (or optional 8.4-in. monochrome display). Suggested retail price is $3999 for color and $2599 for monochrome. CommWorks is also available separately at resellers for $199.95.

Contact Traveling Software, Inc. at 206/483-8088.

CAD/CAM Tooling Library

Carr Lane Mfg. Co.'s tooling library contains three new product lines: modular fixturing, power workholding, and many new toggle clamps. The library, Tool Designer's Assistant®, is a CAD database containing precise drawings of thousands of standard tooling items in the Carr Lane catalog. With more than 6,000 components, it is the largest, most comprehensive standard library available from a tooling manufacturer. Carr Lane can supply the tooling library in dozens of ready-to-use software formats, 3D and 2D, for virtually any workstation, microcomputer, or mainframe system.

Contact Carr Lane Mfg. Co. at 314/647-6200.

Carr Lane's Tool Designer's Assistant

Spelling Checker for CADKEY 6

HLB Technology, Inc. introduces SPELL CHECKER, a 100,000+ word base dictionary, including a customizable user defined dictionary. Designed to work inside CADKEY, an on-screen icon calls up SPELL CHECKER. The program shows the incorrect word on the screen, where it is located in the CADKEY drawing file and offers alternatives. SPELL CHECKER uses 30-50K of memory during the spell checking session. It has a Swapper Utility for applications that do not have enough memory available, allowing a swap between a temporary disk file and the EMS memory. SPELL CHECKER works on all DOS platforms and requires CADKEY 6 or greater. Priced at $199, an introductory price of $149 is effective until May 30, 1994.

Contact HLB Technology at 703/977-6520 or Fax 703/977-6531.

High-Performance Image Reproduction

Insight Development Corp. introduced RenderPrint‡ which produces fast, photo-realistic 3D images on any printer at full printer resolutions. It works as a standalone application, as a TSR that pops up inside any graphics application, or in ADI protected mode within ADI supported applications. Features include brightness, contrast and gamma control; large format, multi-page image creation with "tiling"; view images before printing; batch printing, up to 99 copies; conversion to and from BMP, GIF, IGES, JPEG, PCX, TIFF, TGA and WPG files; and offers selection from 1200+ optimized graphics printer drivers.

Contact Insight Development Corp. at 510/244-2000 or Fax 510/244-2020.

Autonesting

SIGMATEK Corp. introduced SigmaNEST, a nesting and NC programming system for oxyfuel plate

RMT

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PHONE - 203 284-0337 / FAX - 203 269-6590

burning, plasma cutting and laser cutting of sheet metal. Based on an advanced algorithm, the program does not use a rectangular nesting method, but offers true, feature-based technology. NC code, including pierce points, lead-in lines and tool offsets, is generated automatically by the program. Implemented on a local area network, SigmaNEST can be interfaced to MRP, production management and DNC software, and can read geometry from any CAD system with DXF. SigmaNEST can nest arbitrarily shaped parts on arbitrarily shaped sheets of raw material. This and other functions such as automatic drag and rotate and work order management enable fabricating companies to save on material wastage, time and effort. Priced at $11,500.

Contact SIGMATEK at 206/649-9021 or Fax 206/643-8008.

Sheet Metal Design for Windows

Metalman Corp. announced MetalMan™, a concurrent engineering tool running under Windows 3.1 that allows users to design manufacturable sheet metal parts quickly and easily. Sheet metal drilling, punching and bending is graphically represented on-screen. Machine operations can be parametrically referenced and modified. The program produces a DXF output of the 3D wireframe geometry or a flat pattern template. The program also creates shop reports, mechanical specification reports and estimates of manufacturing costs, etc. The ShopEdit™ utility allows users to customize the software for a specific machine shop. Priced under $1000.

Contact Metalman Corp. at 800/346-5278 or Fax 505/247-0208.

HARDWARE

17" ViewSonic Monitor

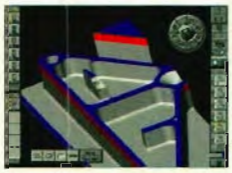
ViewSonic released their energy efficient ViewSonic 17G equipped with an on screen programming system. The ViewMatch color control system adjusts screen colors to match printer output. The monitor conforms to VESA display power management signaling standards and supports the EPA's Energy Star Program. A free power management software driver that

See Parts Faster, Fewer Errors and Bigger Profits with New Virtual Gibbs.

Get ready for a brand new vision of PC CAM in your NC machine shop. Gibbs has unleashed Virtual Gibbs, and now you can see it before you machine it!

The Only PC-Based CAM Package with Integrated *Real-time* Rendering

Virtual Gibbs integrates a full-featured CAM system with a verification system that shows a solid model of the part as the tool takes each cut. It is literally two powerful manufacturing software systems in one! Striking graphics give you a view of exactly how the machine will cut your part. Blue represents uncut surfaces and red flags tool interference. This seamless integration enables you to program parts *and* verify machine code at the computer, saving machine time and reducing scrap.



Virtual Gibbs' graphic user interface lets you SEE what you're doing. Organizing and editing complex operations is as simple as dragging files.

Uniquely Designed to Handle Change

Coping with change is the most challenging aspect of NC programming. A changed print, a changed schedule, a changed mind. Most CAM systems discourage instead of encourage you to make changes in a program. Virtual Gibbs gives you the freedom to work interactively with your programming system, to try different scenarios, to make changes without penalty, to create optimized programs quickly.

Virtual Gibbs gives you the power to see NC machining in a whole new way. Call us today for a demonstration, demo disk, or more information at **800-654-9399**, or in Southern CA at **805-523-0004**.

Available for both IBM® and Macintosh® Personal Computers

Gibbs and Associates

See it before you machine it.™

FINALLY, A CAM SYSTEM THAT LETS YOU SEE IT BEFORE YOU MACHINE IT.

NEW PRODUCTS

interfaces with most video cards is included. Other features include an anti-reflective, anti-glare ARAG coating and a flat square screen. Priced at $999.

Contact ViewSonic at 909/869-7976, 800/888-8583 or Fax 909/869-7958.

INPUT

Split and Raise Keyboard

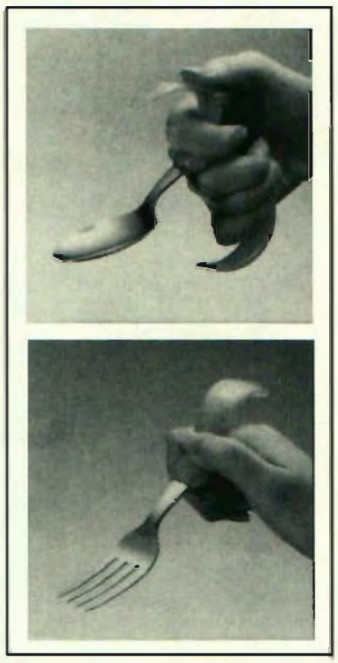
Maxi Switch, Inc. introduced the Ergo Max, an ergonomic keyboard that allows the user to physically arrange the keypad in multiple positions for maximum operational comfort and efficiency. Designed for IBM AT and PS/2 personal computers and IBM-compatible PCs, principal components of the Ergo Max include a 72-key main keyboard and a 30-key numeric keypad. Optional equipment includes a 40-key numeric/calculator keypad and an integrated wrist pad/trackball. Priced at $99, the model features a three year parts and service warranty.

Contact Maxi Switch, Inc. at 602/294-5450.

SpaceController

Spaceball Technologies, Inc. offers SpaceController, the only device supported in CADKEY which enables a user to manipulate a 3D CAD model with simultaneous six-degrees of freedom control. A user is able to perform any combination of x, y and z translations and rotations, manipulate 3D objects or walk through scenes. SpaceController moves the real CADKEY geometry, so status indicators work as they normally do within CADKEY. Productivity is improved by as much as 30 percent over using any other device or method.

Contact Spaceball Technologies, Inc. at 508/970-0330 or Fax 508/970-0199.



Mitsubishi's Shape Memory Polymer

OUTPUT

Engineering Document Plotter on Video

JDL, the U.S. sales division of Japan Digital Laboratory Co., Ltd., announced the availability of product videos for its high-end 4000E Engineering Document Plotter. The six minute program provides an overview of the features and benefits of the 4000E for users needing to plot 50 or more drawings per day. The JDL 4000E outputs high quality, 400 x 400 dpi plots up to E-size in less than one minute. It produces finished drawings in E- thru B-size formats by automatically cutting each plot in both the X- and Y-axis, prints a user ID and stacks individual plots on a removable bar for easy retrieval. The 4000E uses low cost plain papers, vellums and films, and retails for $38,900.

Contact JDL at 805/388-8709 or Fax 805/388-8708.

MATERIALS

Shape Memory Polymer

Mitsubishi Heavy Industries Ltd. has developed Shape Memory Polymer (SMP), a patented polyurethane material featuring shape memory technology, and distributed by Memry Corporation. Under specified condi-

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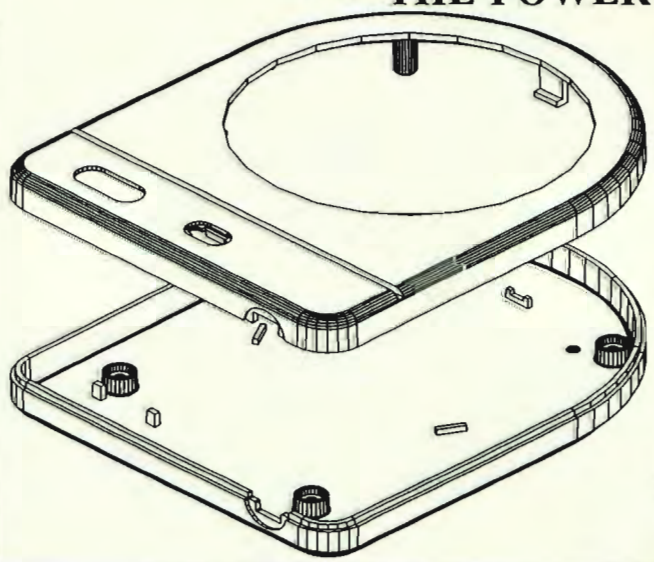

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- Demo diskette available for CADKEY® 5-6.0.

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tions which can be customized, SMP can transform its shape and hardness and on cue return again to its original state. The range of hardness to softness can be customized, plus a uniquely broad range of transition temperatures can be chosen. SMP is available in pellet, solution or liquid and can be easily compounded. It can be formed by extrusion, injection molding, coating or casting processes.

Contact Memry Corp. at 203/740-7311 or Fax 203/775-2359.

New Casting Resins

General Pattern Co., Inc. introduced its new HPR (High Performance Resin) casting resins that accelerate the reproduction of industrial prototypes. The new technology can reduce the time it takes to produce multiple copies of a rapid automated prototyping pattern by a factor of 90 percent or more. The HPR polyurethane casting resins let you remove the part, fully cured, from the mold in 30 minutes. Five resins of varying properties have been developed which exhibit higher heat deflection ratings than standard polyurethane resins, and slightly more shrinkage, which can be accounted for in the mold design. Resins 3175, 3170 and 3160 meet UL94VO flammability standards.

Contact General Pattern Co., Inc. at 612/780-3518 or Fax 612/780-3770.

CMM

High Speed/Accuracy CMM

Mitutoyo/MTI Corp. has added the FHN-906 to its Coordinate Measuring Machine line. This gantry type model is constructed of lightweight components to provide a high drive speed of 430mm(17")/s, four times faster than previous models. Maximum acceleration is 2000mm/s2** (0.2G) allowing efficient measurement in CNC mode. The range of the unit is 36"(x), 24"(y), 24"(z). The z-axis spindle has a built-in safety feature which stops all travel instantly if touched during operation.

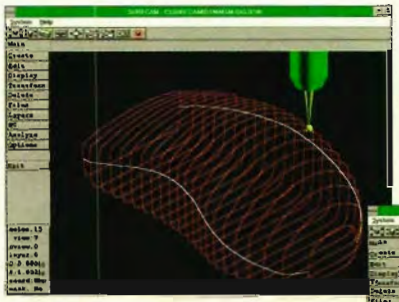
Mitutoyo has also developed a graphical offline part programming system called CADpak for Coordinate Measuring Machines (CMMs). Within CAD, CMM operations such as probe path generation (measurement and go-to), geometric construction, coordinate systems, tolerancing and feature/probe definitions are performed in graphical simulation, resulting in a part program file to be executed at the CMM.

Contact Mitutoyo/MTI Corp. at 708/820-9666 or Fax 708/820-7403.

Microsoft® Builds a Better Mouse with SURFCAM®

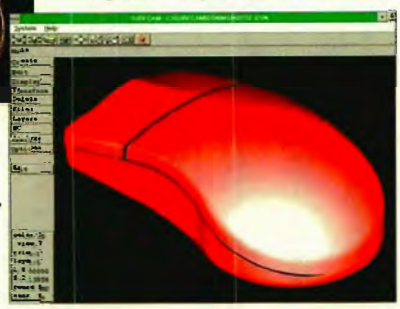
"The techniques used in the development of the mouse enabled Microsoft to achieve its chief goal — creating one of the most ergonomic products — and, as an additional benefit, to streamline the product's manufacture."

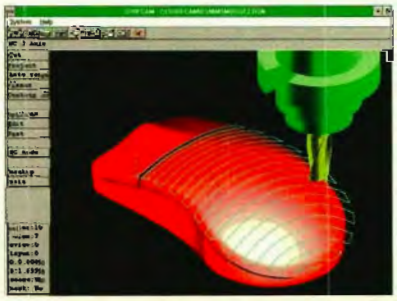
— Steve Kaneko, Industrial Design Manager, Microsoft Corp., Redmond, WA.
CAE Magazine, Oct. 1993



Step #1: Microsoft's industrial designers hand-carved mouse models, which were extensively tested for comfort and then digitized with a coordinate measuring machine. From the CMM data, 3D computer models were created in SURFCAM to replicate the physical model.

Step #2: Adjustments were made in the SURFCAM model, such as lowering the hump in the middle, creating the raised surface between the key surfaces, and working with different variable fillet radii around the edge of the case.





Step #3: CNC toolpaths were generated in SURFCAM to machine the final models for ergonomic verification. The same data was then used to create the electrodes for the injection molding tools. Western Industrial Tooling, Inc., of Redmond, WA, was both the model builder and the fabricator of the injection molds.

Step #4: The finished product! "Eliminating 2D or 3D CAD documentation reduced time to market by minimizing the lengthy production documentation step, which can take companies from weeks to months to generate."
— Microsoft's Steve Kaneko

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NT's Here

Now What?

by Beverly A. Beckert

The months of listening to the hype about Windows NT are over. The actual product is shipping - and must now stand on its own merit.

What makes NT such a hot operating system (OS), and what impact, if any, will it have on the Unix market? Microsoft disciples, vendors and analysts are wrestling with these very questions -- and others.

Fitting In

Windows NT, like Unix, is a 32-bit operating system. Brian Moran, manager in the Developer's Relations Group at Microsoft, Redmond, WA, explains that NT is being positioned as a high-end desktop or server OS that is "ideal" for workstation-based tasks such as CAD/CAM/CAE. The product line includes Windows NT, Windows NT Advanced Server, SQL Server for Windows NT, and SNA Server for Windows NT. Pricing for NT begins at $495 (street price is less); the cost for server versions vary, depending on the number of users.

According to Moran, DOS users don't particularly need NT. Rather, it will be the "power users" who will be most interested in the OS. He says DOS/ Windows supporters will be more inclined to move to NT than DOS users.

Moran, who has worked closely with software developers, reports that mechanical CAD (MCAD) and Architectural, Engineering & Constructions (AEC) vendors are neck and neck with the Electronic Design Automation (EDA) companies in supporting NT. More than 500 business/ technical NT applications were expected to be released by the end of 1993 and another 1500 are under development. What's more, NT is said to run more than 5,000 existing DOS- and Windows-based applications already on the market.

Finding the Price Points

As the Windows NT product family rolls out, CAD users are especially interested in the cost of applications running under it. However, it's hard to find concise information about technical software developers' strategies. It depends on whether they are primarily in the DOS/Windows or Unix markets.

Mike Seely, director in the CAD/ CAM/CAE Consulting & Services Group at market research firm Dataquest, San Jose, CA, says, "In general, larger vendors (with Unix products) will tend to keep their prices (for Unix and NT versions) the same. Developers migrating from DOS/Windows will increase their (NT) prices a bit, but not as much as a comparable product from the Unix worlds."

In an informal survey of CAD/ CAM/CAE software vendors, *Computer-Aided Engineering* identified some early OS pricing trends:

- For the most part, companies offering Windows 3.1 and DOS products price their applications the same.
- Vendors that provide NT and Windows 3.1 software vary in their approaches. For some, there is no difference between the two; for others, the NT version costs anywhere from $100 to $1,500 more.

To be sure, vendors will be watching users' buying patterns carefully. Steve Cruickshank, Pro/ Engineer product line manager, Parametric Technology Corp. (PTC), Waltham, MA, explains that the pricing issue ultimately rests on customers' hardware purchasing and upgrading decisions.

Dataquest's Seely agrees. And, he notes that there is a real opportunity in the market to create a very high-performance platform - be it labeled "workstation" or "PC" - that will run NT, but at a lower price point than seen in the past. He sites Digital Equipment Corp.'s Alpha chip as an example of a CPU that could power such a platform. "In the next three to four months," he says, "you could see a $2,500 to $3,500 price range for a PC that's almost two orders of magnitude faster than two years ago. That hardware price could soften the blow of the higher-priced (NT) software.

NT Features

In terms of functionality, NT doesn't break any new technical ground, according to David Smith, director of Unix and Advanced Operating Environments at market research firm International Data Corp., Framingham, MA. "It is," he says, "Unix in another name. Users have an interest in NT because they think it will be easier to use and software costs will be lower; however, these are unproven assumptions. Users' expectations may be set too high."

NT and Hardware Requirements

NT will run on Intel-based PCs using the 486 or Pentium chips and Risc-based workstations. The requirements are similar to those for Windows 3.1 -- but heftier. The following is commonly required:

- At least 12MB RAM - According to most sources, 16MB or more is better for CAD and for having more than one application open at a time.
- 200MB hard drive
- A VESA (VL) bus architecture for a 32-bit link between the CPU and peripherals.
- CAD users with large drawings may need a high-performance graphics accelerator for Windows.

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What sort of capabilities does NT provide? Microsoft's Moran reviews some of interest to technical users:

- **Symmetric multiprocessing.** Lets OS code run on any free processor in a multiprocessor computer; this is said to provide better throughput than asymmetric multiprocessing systems, which only use one processor to execute OS code.
- **Pre-emptive multitasking.** A type of multiprocessing that enables multiple applications to run at once. This technique gives the OS the ability to interrupt the execution of a thread (a subroutine) to run other waiting threads, thus ensuring that no one thread monopolizes the processor.
- **Networking.** Supports local-area network transports such as TPC, IP and others, allowing users to share files, printers, and workgroup applications.
- **Security.** Meets the U.S. government security C2-level standards.
- **User interface.** Provides one of the most well-published graphical user interfaces, Windows, for ease of use.
- **Platform independence.** Runs on more than 1,700 different Intel and reduced-instruction set computing (Risc) machines. NT also supports 650 printers, 50 SCSI peripheral devices, various network adapters and display adapters, supporting VGA, Super VGA, and XGA video modes with resolutions up to 1280 x 1024 and up to 16 million colors.
- **Application diversity.** Can host general-purpose and technical tools, delivering the capability to run both types of applications on one hardware platform.

NT on Unix Turf

It's too soon to tell how NT will be accepted by Unix users. Among Unix vendors, though, the initial reaction is mixed.

PTC, an early NT supporter, sees this OS as giving PC users access to high-end applications, enabling them to address the entire design-through-manufacturing process and implement concurrent engineering. "Many companies," says Cruickshank, "have made a significant investment in their Intel-based PCs. Upgrading these to run Windows NT is far more cost effective than replacing them with workstations."

Intergraph Corp., Huntsville, AL, is backing NT big time. Tom Steele, executive vice-president of Systems Software, explains the company has a dual platform strategy for Unix and NT that includes interoperability between the two in file formats, networking protocols, data management, and printing/plotting. "We'll give our users," he says, "a migration plan and an interoperability plan."

"As you see PC and workstation functionality converging," continues Steele, "users will want to do their business and personal productivity applications on the same platform as their CAD applications. NT lets us get set about applications on Intel and provides us with a platform that will marry technical business, and personal applications."

Others in the Unix industry are skeptical about NT. Richard Jaross, executive director of UniForum - a Santa Clara, CA, non-profit, vendor-independent association that promotes and exchanges information about open systems, software applications and standards -- says a key issue regarding NT is maturity -- or rather a lack of it. While robustness is promised, it isn't quite there yet.

"In certain parts of the computing environment," says Jaross, "NT will certainly be a force, and hopefully a good one. People who think that shared industry standards - and adherence to standards - are important must ask themselves how NT will conform to those standards. While Microsoft's NT adheres to a number of communications standards, conformance to Posix, etc. is very limited."

Unix OS vendors are not standing still. In March, several of them - Hewlett-Packard, IBM, The Santa Cruz Operation (SCO), Sun Microsystems, Univel, and Unix Systems Laboratories - formed the common open software development (Cose). The goal of this initiative is to improve the commonality and interoperability of the many Unix versions on the market.

In addition, Sun Microsystems' SunSelect recently announced its Windows Application Binary Interface (Wabit), software that runs 16-bit Windows programs on Unix hardware. The company will license this technology to other Unix vendors.

What's more, Novell - which owns and licenses Unix code through the Unix Systems Laboratories - is challenging NT with its own OS called UnixWare. The company will tweak it to interact seamlessly with its local-area networking software, NetWare. And, it will introduce programming tools so software developers can do two things: write applications that will run under both UnixWare and NetWare, and adapt Windows programs to run on UnixWare as well as Unix versions from Hewlett-Packard, IBM, and Sun Microsystems.

Make no mistake. The Unix vendors do not want to lose any ground to NT. Time will tell how successful they and Microsoft will be in maintaining or capturing the technical user base.

Beverly A. Beckert is Senior Editor of *Computer-Aided Engineering.*

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CADKEY and NT

Cadkey, Inc. is aggressively getting ready for the NT revolution with several new offerings.

CADKEY Object Developer

A brand new Cadkey product, the Object Developer released this month, is a powerful toolkit for developing applications in Microsoft® Windows 3.1™ and Windows NT™. For details see the article in this issue.

CADKEY -- NT Version

An NT version of Cadkey currently under development will be released sometime in the fourth quarter of 1994.

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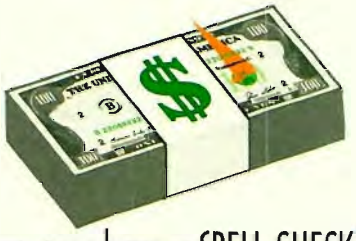

Yes, we now have a SPELL CHECKER for CADKEY6. With a Main Dictionary containing more than 100,000 English words, you won't have to worry about misspelled words on your CADKEY drawings again! There is also a USER SPECIFIC Dictionary which allows users to enter new words into the Dictionary during the spell checking sessions. To use you simply call up the 'SPELL-CHECKER' routine directly from inside CADKEY. 'SPELL-CHECKER' will show you the incorrect word on the screen, actually where it is located in your CADKEY drawing file, and give you a number of alternatives to choose from. You may also add the incorrect word to the User Dictionary, or ignore the incorrect word, or type in a replacement word, so that any subsequent occurrence of the same word is automatically corrected.

'SPELL-CHECKER' routines have been highly optimized. A performance benchmark on a 286, 12 MHz computer reveals that SPELL CHECKER can process 75-100 words per second! On a 386, the speed performance jumps to 500-700 words per second. These benchmarks employed a text file containing normal English words.

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New Software from Cadkey!

by Frank Simpson

CADKEY OBJECT Developer, Cadkey's newest product, offers a unique software development environment that works in Microsoft® Windows™ Version 3.1 and Windows NT™ (Microsoft Corporation's new operating system for personal computers). According to George Krucik, senior vice president of product development at Cadkey, Inc., "CADKEY OBJECT Developer is the first real product to deliver software based on object-oriented programming techniques to the CAD industry."

Object-oriented programming is a method for creating software as individual modules or components of reusable code that can be linked, shared and easily maintained. CADKEY OBJECT Developer provides objects and modules, written in the C++ programming language, that serve as a flexible framework for building application software.

"Cadkey has reversed the traditional process," adds Krucik. "Application developers traditionally developed an application package and then added a toolkit to work with it. CADKEY® and CADL® (CADKEY Advanced Design Language) are typical examples. With CADKEY OBJECT Developer, Cadkey developed the toolkit first." CADKEY OBJECT Developer now becomes the new foundation for the development of Cadkey's own mechanical and AEC CAD products.

The interface requirements for these reusable components are tightly controlled. CADKEY OBJECT Developer's graphical user interface (GUI) supports the GUI of Microsoft Windows 3.1. These modules can be used and reused, in a plug-and-play fashion, in different types of software programs. Individual modules can be unplugged at several structural levels in the development of application software, without compromising the functionality provided by low-level libraries.

The ability to use and reuse components simplifies and shortens the software design process. This is a new type of structured programming. Moreover, these components do not have to be used exclusively for developing CAD-specific applications.

> The first real product to deliver software based on object-oriented programming techniques to the CAD industry.

CAD Software Development

When developing products for computer-aided design, CADKEY OBJECT Developer supports more than 25 different types of geometric entities, including curves, surfaces, solid primitives and boundary-representation solids. The OBJECT Developer's complete, polyhedron-based, boundary-representation solid modeler supports a full complement of object generators and editing capabilities. CADKEY OBJECT Developer provides complete support for instanced geometry. This facilitates the handling of multiple occurrences of the same object. It also supports user-defined, instanced geometric objects which may be parametric, variational or table-driven.

CADKEY OBJECT Developer includes complete support of CADKEY® part files, DataCAD® drawing files and AutoCAD® dwg and dxf® files. CADKEY OBJECT Developer also supports a new binary or ASCII data exchange format.

For software developers working in networked environments, CADKEY OBJECT Developer includes an option to use its client/server database subsystem built on ObjectStore® by Object Design, Inc. The OBJECT Developer also provides a flexible integrated mechanism for storing non-graphical data, such as multimedia data, which can be linked to graphical objects in the database.

CADKEY OBJECT Developer supports Microsoft's Application Programming Interface (API) and soon the full Object Linking and Embedding (OLE/2) specification. These provide the interface control for the OBJECT Developer's reusable modules. It also supports Microsoft's Multiple Document Interface (MDI) for applications that need to transfer data from one document to another easily. Each document can contain multiple overlapping viewports.

CADKEY OBJECT Developer supports Microsoft's Dynamic Link Libraries (DLL) so that software developers can easily enhance the already extensive collection of class libraries included in the OBJECT Developer. The OBJECT Developer also supports Microsoft's Dynamic Data Exchange (DDE) which allows users to exchange data directly to and from other Microsoft Windows applications.

Cadkey, Inc. is planning to support the Microsoft Foundation Classes within the OBJECT Developer. This would facilitate the use of off-the-shelf GUI development tools, such as Visual Basic®.

Two Basic Methods for Writing Applications

Two basic methods are available for writing an application using CADKEY OBJECT Developer. In the first method, developers access CADKEY OBJECT Developer's components directly through the Microsoft Application Programming Interface. This gives developers the most freedom in designing a user interface and database structure for their application. In the second, developers use the CADKEY OBJECT Developer's own Applications Framework. This CAD-oriented user interface provides tools for screen

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design and layout. Other features of the Applications Framework include:

1. foreign-language support
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4. a Graphics Display Manager that allows developers to construct Windows-based graphics applications with 3-D multiple-viewports, hidden-line removal and shading
5. a Geometric Modeler that allows developers to create 2D/3D wireframe constructions and polyhedral solid models, as well as to perform editing operations, such as 2D/3D curve trimming, solid splitting, punching, chamfering, and in addition, provides attribute-control, analysis and verification tools
6. Math Libraries that support 3 x 3 and 4 x 4 matrix operations for viewing and mapping, 2D and 3D intersection and tangency calculations for curves and surfaces, mass-property solvers, and analytical geometry functions
7. bi-directional Data Translators

Software and Hardware Requirements

CADKEY OBJECT Developer requires the Microsoft Windows NT Version 3.1 operating system and the Microsoft Visual C++ 32-bit compiler, running on a Windows NT-compatible personal computer, with a minimum of 16 megabytes of random-access memory. For graphics, the PC must have VGA or better because the ability to access up to 256 colors is necessary for rendering applications. The PC also needs a CD ROM drive because CADKEY OBJECT Developer is distributed on CD ROM. The CD ROM includes: installation instructions, object libraries, source files, development tools, on-line Hypertext-based Electronic Reference Documentation (ERD), source code and sample applications for developers to test, run, and even include in their applications.

Radically New Approach to Software Development

"CADKEY OBJECT Developer is going to dramatically reduce the cost of producing CAD products," said Krucik. "It is also going to alter the types of CAD products that will become available. End users will no longer buy a monolithic CAD product, and then also need to buy application-specific software to work with the CAD product. They will be able to buy only the specific CAD products that they need."

Windows sample interface created with CADKEY OBJECT Developer. Picture created by Sweet's Electronic Publishing.

"A full, object-oriented distributed database will open CAD to multimedia, audio and video support. With object linking and embedding and multiple document support, the OBJECT Developer opens up the possibility of linking CAD drawings with spreadsheets, word-processor documents and audio or video clips, for example."

According to Krucik, Cadkey, Inc. will have three price categories for the CADKEY OBJECT Developer. In the first price category, CADKEY OBJECT Developer (under $500), developers may purchase the basic libraries of the development tool. Developers can use this product to create their own product and market them royalty free, and there is no requirement that these products have any connection to any of Cadkey's products.

In the second price category, CADKEY OBJECT Developer Professional ($3,000 to $5,000), developers may purchase not only the basic functionalities but also the OBJECT Developer's full-function, NURBS-based (Non-uniform rational B-spline-based), CAD development environment, with surface and solid modeling capabilities, for sophisticated CAD applications. Depending upon the technology for which developers choose to develop products, there will also be royalties between 5% to 10% payable to Cadkey, Inc., based on the sale of CAD products developed using the OBJECT Developer.

In the third price category ($250,000), developers may purchase licenses for the OBJECT Developer's source code. Support contracts for $60,000 per year will be available to source-code licensees.Upgrades of the source code will be priced separately. Non-retail products developed with the OBJECT Developer will be royalty free. There will be a 5% royalty to Cadkey, Inc. for retail products developed using CADKEY OBJECT Developer's source code.

Reaction to pre-release copies of CADKEY OBJECT Developer has been quite enthusiastic, according to Krucik. "We produced a pre-release version of the OBJECT Developer on CD ROM for the Fall '93 COMDEX Show in Las Vegas," Krucik said, "and distributed 3,000 copies. We distributed 300 copies at the Microsoft Developers' Conference in Anaheim, California, December 13-14, 1993. We have received requests from overseas, and lots of requests for pre-release copies from AutoCAD developers. The CADKEY OBJECT Developer got feature billing at the OBJECT World Show in Boston, Massachusetts, January 11-13, 1994. Reaction from those who are working with the product has been supportive. I expect to see the first CAD applications developed with CADKEY OBJECT Developer as soon as the fourth quarter of this year."

UNITEC Inc.

One of Cadkey's fastest growing resellars suggests:

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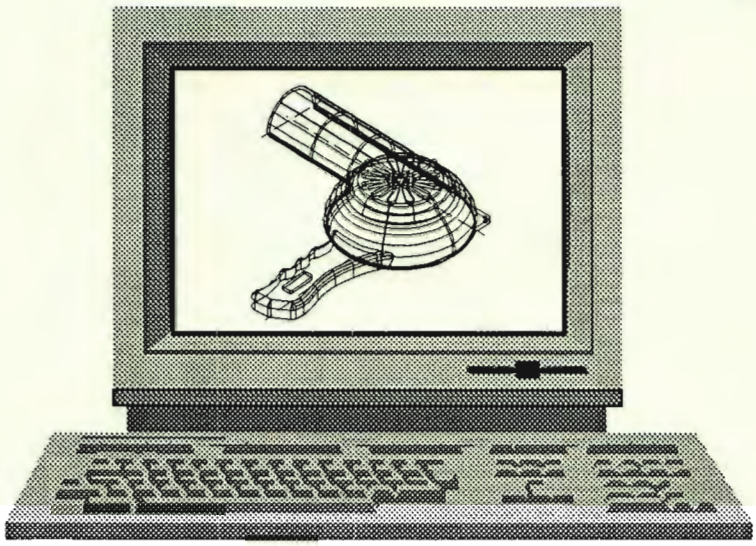

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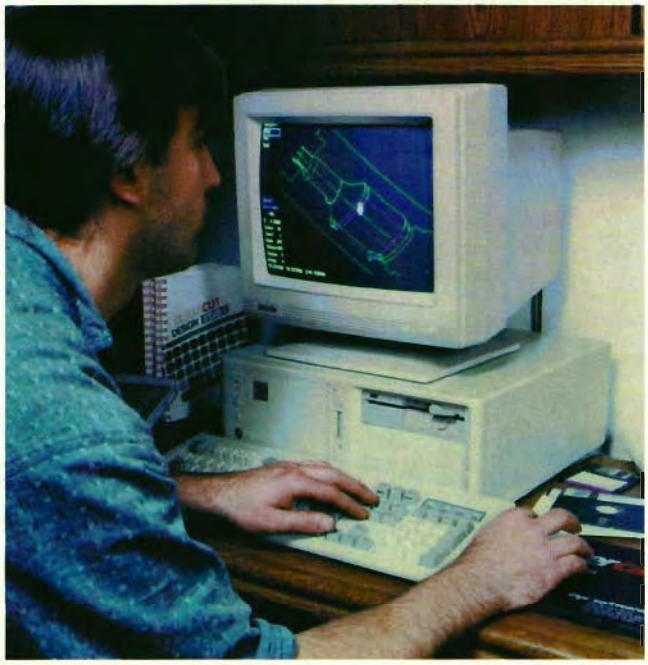
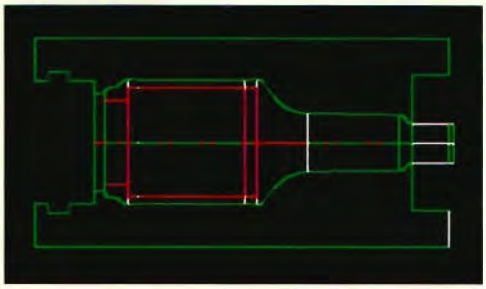
Blow Molds WITH CADKEY

More than Hot Air

by Frank Simpson



Toolpaths are created in Mastercam using CADKEY CADL files.



Design output as a CADL file.

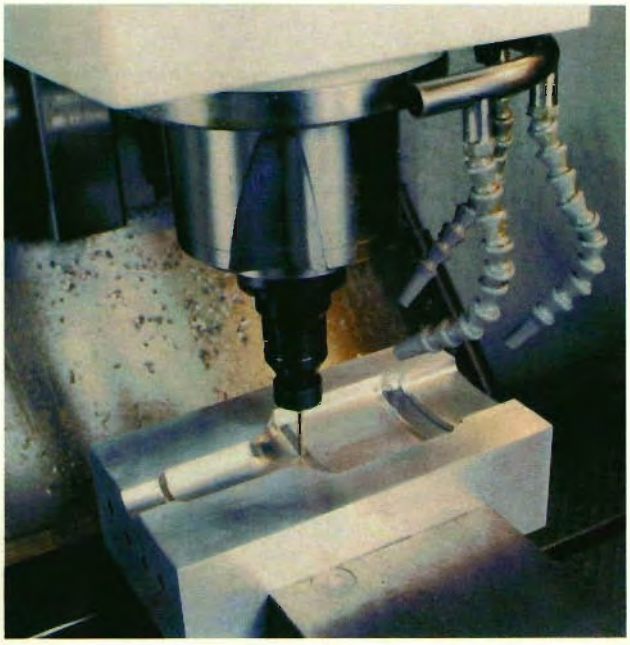
Plastic bottles are so commonplace that they are taken for granted by most of us, but not by Repaci Mold & Tool Corporation of Wallingford, CT. Repaci Mold & Tool designs and manufactures the tools for blow molding hollow objects in plastic, primarily bottles.

Benefits of CAD and CAM

Repaci uses CADKEY® and Mastercam® to design and manufacture molds in aluminum, tool steel, stainless steel or beryllium copper, depending upon the design requirements. "We create the mold's cavity, mounting holes, water lines (holes drilled into the mold to allow circulation of liquid coolant - water or glycol and water solution), venting to let air trapped between the parison and the mold's cavity to escape and pinch relief, all in CADKEY, and we output the design as a CADL® (CADKEY Advanced Design Language) file that we use as input into our Mastercam system," said John Repaci, President. "We find this combination of CADKEY and Mastercam very effective because there is no need for data translation from CAD to CAM."

"For us, being able to obtain volume measurements from the three-dimensional model is an important benefit that CADKEY provides," Repaci added. "However, the most important benefit of using CADKEY is knowing that what you have designed really is as you have designed it. The design is accurate."

Accuracy is critical because the 3D model goes directly to the shop floor for input into Mastercam to create the tool paths for machining. "The greatest benefits that we see from Mastercam," said Repaci, "are the consistency from part to part because mating parts fit together better, and the quality of the surface finish of the mold, which reduces bench time for finishing work by hand."



After creating the toolpath the part is cut in a vertical machining center.

Blow Molding - A Primer

Blow molding, a process for making hollow plastic objects, involves inserting a hollow tube of plastic, called a parison, into a mold, and blowing air into the parison. This forces the plastic against the surface of the mold's cavity to create the product. Air trapped between the parison and the cavity surface of the mold escapes through minute vents.

There are four types of blow molding: extrusion, injection, reheat and stretch. In extrusion blow molding, the tube of parison descends from a reservoir through a die or nozzle into mid-air, and the two halves of the mold close over it. Air is then blown into the parison to expand it against the surface of the cavity.

In injection blow molding, the parison is injected onto a core rod. The two halves of the mold enclose the core rod and the injected plastic. The air to inflate the parison against the mold's cavity surface comes through the core rod.

Stretch blow molding and reheat blow molding involve two molding processes: injection molding followed by blow molding. In stretch blow molding, the parison is injection molded on a core rod into a preform mold. This preform gets heated or cooled to condition the plastic for clarity and strength. When the two halves of the blow mold close around the preform, the stretch rod actuates, stretching the preform to the bottom of the mold, and simultaneously air is blown through the extended stretch rod into the preform to force the plastic against the surface of the mold's cavity.

Reheat blow molding is very similar to stretch blow molding, but the two steps (injection molding and blow molding) take place at two very different times and frequently in different locations. The parison is injection molded into a preform that resembles a large test tube. Frequently, this preform is a finished product for the injection molder. Preform is then shipped in bulk to the blow molder's location, where it is reheated and blown into bottles. The biggest advantage to reheat blow molding is the speed at which the final manufacturer can actually produce plastic bottles: approximately one second per bottle. It is only necessary to reheat the preform to approximately 130 to 140 degrees for it to be ready for blow molding. Because the plastic is really only warm at 130 to 140 degrees, a finished bottle can cool almost instantly and be ready for immediate use.

Components to be assembled into the finished mold, including cavities, mounting plates and bottom plugs; technician checking cavity depth with a dial depth gauge.

Contrast Between the New and Old Ways of Mold Making

"If you think about the old way of making molds before CAD and CNC, the differences are amazing," Repaci said. "From two-dimensional drawings we used to make wooden models. Sometimes there were variations or interpretations in highlights or sharpness of elements in the model. We used the wooden model as a male pattern to create a female mold in epoxy. We cut cavities from the duplicating master with a hydraulic duplicator, for example a Bridegeport TruTrace®, into the metal mold. The water lines and the mounting holes were all done by hand. Now, we still make a physical model if the customer requests one, but ordinarily we skip everything that I have just described. We go directly from 3D CAD model to CNC tool paths and cutting metal using our Fadal® vertical machining center."

The finished product.

Not Just Another Buzz Word!

Review of Value Engineering analysis findings.

by Roger McMillan, President
Colmac Industries

The engineering world is inundated with buzz words like Concurrent Engineering, Just-in-Time,Total Quality Management, etc., etc. Remember Liza Dolittle's musical complaint in *My Fair Lady*, "Words, words, words, there isn't one I haven't heard." Exactly my opinion. Several months ago a new one appeared in my office rolling glibly off the tongues of a consulting engineering team who called themselves (wouldn't you know) Value Engineering Associates. I didn't take their words -- "value engineering" -- seriously because, like Liza my attitude was simply "show me." But I listened and thought their ideas were worth trying.

A family owned company, Colmac Industries has profitably manufactured large industrial laundry equipment since 1959. I took over the reins of the company in 1974. Located in Colville, WA, 65 miles north of Spokane, Colmac grew from a 2-member company in 1959 to one with almost 140 employees in 1994. Our equipment, sold worldwide, dries and presses garments for companies like Levi, Wrangler, Aratex, American Linen and Cintas.

In spite of our achievements, by 1992 the 20th-century manufacturing blues were catching up with us. The laundry equipment industry is extremely competitive. Costs were escalating, profit margins decreasing, and our engineering department was working at full capacity just handling day-to-day design and manufacturing issues. As "one-ofs", most of our machines (although based on previous successes) require much custom design and manufacture. It was time to find ways to improve our productivity and profitability. I presented several of our most pressing (pardon the pun) problems to the team and they returned several days later with an analysis and a plan of action.

Value Engineering Defined

I soon learned what value engineering is and is not. In the simplest terms, it's a technique for achieving maximum product value while reducing the cost of manufacturing the product. The *primary* goal of value engineering is to maintain, and ideally enhance, product value. We knew this was what we needed to do at Colmac. We produce top quality equipment and don't dare to do less. Our competition would stomp all over us if we did. Besides, we're proud of our products and care about what we do.

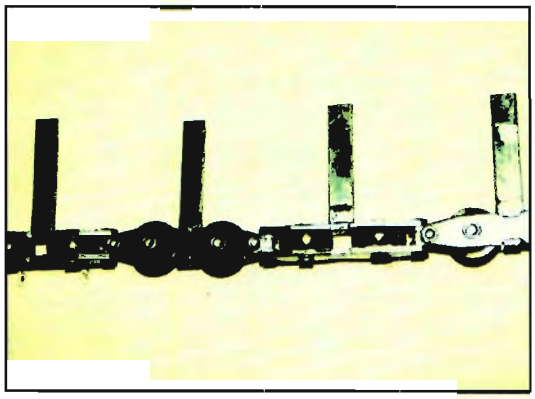
Value engineering *is not*, however, simple cost cutting. A good purchasing department can cut costs, but purchasing personnel usually don't have the engineering or manufacturing expertise to know if, or how, a particular economy will affect the function and quality (i.e., value) of the product. While value engineering considers costs of purchased items, it simultaneously evaluates all other design, material and manufacturing considerations.

I guess I've finally come to view value engineering as a "holistic" approach to a manufacturing company's health. It's a multidisciplined, focused, organized appraisal of all aspects of a product's design and manufacture. It covers everything about a product from basic design concepts and materials to manufacturing processes. If there's a secret to value engineering, it's questioning everything about a product - - taking nothing for granted. When confronted with the status quo, you ask why, what, who, where, how and how much on every item of cost.

Redesigned model and drawings.

Value Engineering at Colmac

One of the first projects submitted to VEA for a value engineering analysis was the large chain in the conveyor system in our garment finishers. We were purchasing this part from a vendor who was the sole source of this type of chain in the



The end result of one Value Engineering project.

United States. Even though we paid a very high price, the chain was trouble with a capital "T". Lint buildup in the bearings caused it to freeze with annoying regularity. There's nothing like a frozen bearing to bring work to a halt.

During the process of re-sourcing the chain, we were able to modify the chain's design to include sealed bearings with a high-temperature permanent lubricant. Not only do we pay less than half of what we paid before, but the improved quality makes our customers very happy.

Currently, the VEA consultants and our engineers are working jointly to reduce the costs of our standard shirt presser. One of the most expensive components is the drive system, consisting of the gear box, stepper motor and controller. We are replacing it with a system that will use a standard motor and custom designed gear box that we will manufacture. This new design provides accurate indexing that almost duplicates the acceleration curves of a controlled stepper motor. The costs of the new system are 50% of the old. I estimate that when we pass these savings on to the customers, sales of this machine will increase threefold.

Working with VEA

Initially we were quite leery about working with outside consultants. In my experience, consultants come in for a few days, do some research and then write a huge report telling you all of your problems with some vague ideas about how to solve them. Then they send you a bigger bill all due at once and you never see them again.

Intrigued by VEA's approach and needing to cut costs, I wanted to try them out without committing to a large expenditure. So I designed a plan to work with VEA on a limited, structured basis. We prioritized projects and selected one (the chain). I allotted a finite number of hours and dollars per month to that project. VEA and Colmac engineers met regularly. As outsiders, the VEA engineers were able to look at products, processes and projects with fresh eyes. They also brought areas of expertise that we didn't have. We did not have to hire additional full time engineers, but budgeted for as many hours as we want to afford in a given time frame. The chain was so successful we have expanded our VEA budget for 1994.

Conclusion

Properly implemented, value engineering works. We're pleased with the progress at Colmac. We have a plan and are making significant progress in cutting costs while actually improving our products.

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Ergo's PowerBrick 66 is the latest in a long line of powerful CADKEY systems. With a 66MHz 486DX2, up to 32MB RAM, a 200MB or 340MB HD, and local bus accelerated graphics, the PowerBrick outperforms most desktop PCs. Use it as your main Cadkey machine with a big screen monitor at 1024 x 768 resolution with 256 colors. Or use it on-the-go with its easy to read TFT active color or dual scan passive color 10" LCD and 3hr battery. Discover how handy CADKEY is when you don't have to leave it behind. *Call our automatic FAX Line for complete information, pricing & photos.* Dealer Inquires Welcomed.

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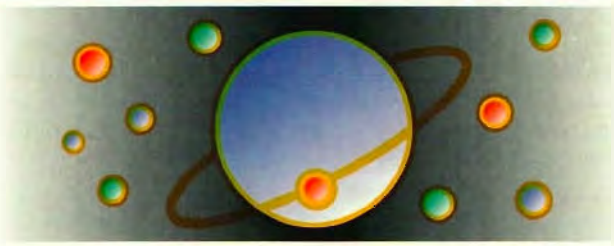
If It Doesn't Move, It Isn't 3D



Fact or folklore, Jim Clark, the founder of Silicon Graphics, a leading 3D workstation supplier, is often attributed to having said, "If it doesn't move, it isn't 3D." Now for the first time PC CAD users can smoothly and dynamically manipulate 3D models with simultaneous six degrees of freedom control -- made possible with a new 3D input device, the SpaceController, from Spaceball Technologies.

Even though we live in a 3D world, translating simple human motions to the 3D design environment is not so simple. A real world example, drinking a glass of water. Your hand reaches for the glass in one smooth continuous motion. The complex X, Y and Z translations and rotations of your hand and arm are performed effortlessly, with simultaneous six-degrees of freedom control (S6DOF).

In 3D CAD things are more complicated. What is actually viewed is a representation of a 3D model on a flat 2D screen. Because of this, the only way to design and fully comprehend the model is to move it. Traditional input devices, though, only let you move the model one or two degrees of freedom at a time.

The great news for CADKEY users is that S6DOF capability is now fully supported in CADKEY (Version 6.5) through the integration of a proprietary software interface called SpaceWare IMC and a new 3D input device, called the SpaceController, both from Spaceball Technologies. Developed exclusively for the PC market, the SpaceController lets CADKEY users pan, scale (zoom) or rotate 3D design parts or models effortlessly, with full simultaneous six-degrees of freedom control.

CADKEY is also "SpaceWare IMC Certified" which simply means that the proprietary software interface is integrated into CADKEY. This ensures optimum dynamic performance of the SpaceController device. Plus, there's no driver software to load.

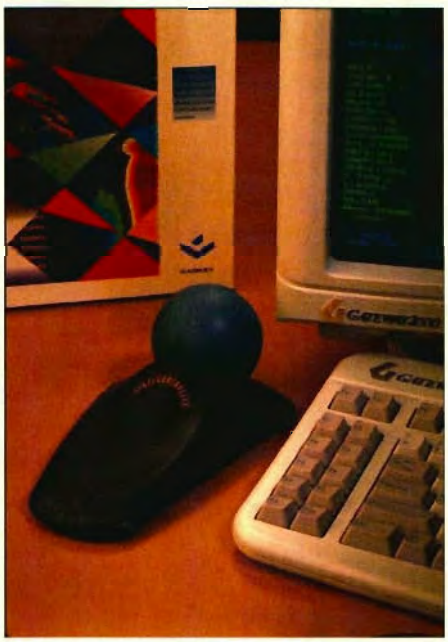
The SpaceController is very easy and intuitive to use. To use it, fingertip pressure is applied to the SpaceController ball. Any pressure, twisting motion, or combination of movements applied, happen instantly to the part on the screen. Also, the harder the ball is pushed, the faster the object moves. Because 3D manipulation is natural and intuitive, productivity is significantly enhanced. Concentration remains on the design task at hand.

Additional functionality is provided in the SpaceWare IMC software for use with CADKEY, accessible through two function buttons located on the sides of the device, one which activates a pop-up menu. Menu functions include: the ability to turn either translations or rotations on/off, a *Single Axis Mode* (restricts image movement to one axis at a time), ball sensitivity adjustments, a *Select Center of Rotation* function, and a *Keep In View* command. For faster dynamics, the number of entities to be displayed during movement are also adjustable. Pressing the right SpaceController button performs a CADKEY *Auto Scale Function.*

"We are delighted to offer support for the SpaceController," states Charley Ferruci, Cadkey, Inc. vice president of marketing. "Cadkey has invested significant development resources in expanding the 3D capabilities of our application. With SpaceController, users will be able to really drive it."

This technology has been available in the UNIX workstation market for three years through a product called the Spaceball 2003, also from Spaceball Technologies. The company boasts over 10,000 units installed with major companies like General Motors, McDonnell Douglas, 3M Corporation, and General Electric.

One large Spaceball customer performed a comparison using the Spaceball in an UNIX-based 3D CAD application. The customer noted that, "A reorientation of 3D geometry that might take fifteen to twenty seconds using the menu picks would only take two to three seconds using the Spaceball." Productivity gains using the SpaceController in CADKEY would be comparable.



There are more benefits to a S6DOF device. Greater 3D interactivity improves design comprehension. Design concepts are communicated more effectively. Errors are caught sooner. All contributing to lower development costs, faster time to market and more reliable products.

For the first time, CADKEY users will have the same dynamic 3D control capabilities as high-end workstations. This and enhanced functionality for $595 (see ad on page 29). That's pretty reasonable. An added bonus: SpaceController is also "awesome" with a number of PC action games.

This is a paid advertisement.

Now Available for Cadkey Users for a Special Price of $595.*

*Includes special $200 SpaceWare IMC Certification Instant Rebate off regular list price of $795.

Like Reaching Into the Screen and Moving Design Parts Directly.

It's definitely a new frontier for PC CAD. Natural, intuitive interactive control of your 3D design parts, as easy as reaching into the screen and moving them directly. Imagine getting to any viewing angle or orientation instantly. Pan, zoom (or scale) and rotate parts effortlessly with simultaneous six-degrees of freedom control.

No complicated mouse, button and menu maneuvers. With light fingertip pressure push, pull or twist the SpaceController ball. Any combination of movements applied to the ball happen instantly to your 3D design part. And there's no need to change modes. Move actual 3D geometry right within your design window!

It's a proven fact. The ability to easily and intuitively move 3D design parts can significantly improve productivity – by 25% or more. Design comprehension is enhanced. You'll find errors sooner and better communicate ideas to others.

Your Guarantee of Optimum Performance:

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Proficient 3D graphics interactive motion control (IMC) with a Spaceball device is only provided in an application through proprietary software called the SpaceWare IMC *interface. Certification ensures that this interface is customized to your application and is our guarantee to you of optimized performance.*

Dennis T. Gain
President & CEO, Spaceball Technologies, Inc.

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Plotters For All Reasons

a grab-bag of technologies, functions, sizes, and prices - or a little something for everyone

by Claudia Martin

There are literally hundreds of plotters on the market. Each technology -- pencil/pen, pen-only, electrostatic, direct imaging, LED/laser and inkjet -- offers varying degrees of speed, output volume capacity, quality, investment cost, operational cost and ease of use. We selected the plotters described here as good representations of each technology. Totally different, all are excellent products, but each needs the right setting to be maximally useful and make their users happy and productive. All the companies represented here produce other output devices - with other technologies, sizes and prices. For information on their products, refer to the list at the end of this article. They can provide detailed literature, up-to-date pricing and sometimes demonstrations.

All Purpose Laser

Genicom Laser - Model 7170

The Genicom 7170 laser printer is fast and flexible, printing everything from CAD drawings to general office documents at 17 ppm. In addition to IBM Proprinter XL24E, the 7170 has emulations especially useful for CAD. Its HP Laserjet IIISi® emulation (PCL5 with HP-GL/2) and optional GeniScript‡ (a PostScript language compatible interpreter) are both directly addressed by CADKEY. I'm especially partial to PostScript output because CADKEY has an excellent driver. The 300 dpi plots from the 7170 in GeniScript were excellent. Automatic emulation sensing makes changing applications easy.

For B-size plots, the Genicom 7150 Model has 11" x 17" capabilities, GeniScript, HP7475A® and other high performance features.

The options available for the 7170 (e.g., a 1500-sheet feeder, 10-bin mailbox sorter, duplexer for two-sided printing, and multipurpose feeder envelopes, transparencies, labels or plain paper) make it an ideal network printer.

Good design shows in the little things. The 7170 with duplexing and feeder option was very easy to assemble and the documentation and front panel control menus were easy to use.

Prices start at $2,995.

Inkjet - Small

CalComp TechJET Personal

The low-cost and high performance of this newcomer in the small inkjet arena make it a great choice for putting a B-size check plotter on every desk or as an inexpensive printer/plotter with quality output.

CalComp has effectively solved problems inherent in some of the desktop inkjets we've looked at. Paper feeds easily and reliably from the 100-page built-in sheet feeder. Inking is reliable with *no* skipping or missing; in weeks of continuous operation we didn't need to use the print head cleaning routine once.

The printer supports major CAD and graphics software protocols, including Postscript language compatibility, HPGL, ADI, CalComp PCI/907, Epson and IBM24E emulations, CALS G4, NeWSprint and Windows.

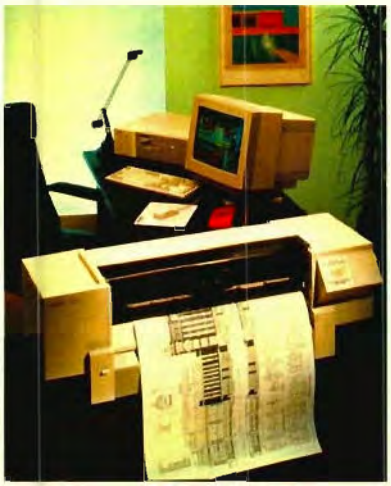
We found the 360 dpi output quality excellent and closer to laser quality than some inkjets. It's quiet, fast, and has an extremely small footprint for a machine capable of tabloid/B-size output. You control output quality and speed, selecting the normal High Quality, Super High Quality, or Draft print mode from the front panel. Ink cartridges, made expressly for TechJET Personal Printer, are available from CalComp or their supplies dealers.

Price is $699.

Inkjets - Large Format

HP DesignJet 200

Hewlett-Packard's large-format, entry level monochrome inkjet is priced like a low-end pen plotter, but plots up to five times as fast. Two models are available: E-size for $4,695 and D-size for $3,695 (U.S.).The base model can be set up on a table or the optional floor stand.



The DesignJet 200 prints with a resolution of 300 dpi and has final and draft print modes. In draft mode, algorithms are used to selectively apply half the ink. It switches automatically among HP-GL, HP-GL/2 and HP RTL (HP's raster transfer language which provides support for rendering applications). It also includes drivers for Microsoft Windows. The DesignJet 200 comes with standard PC ports or may be connected to a LAN through an HP JetDirect EX external connection.

Many user-friendly interface features are designed to help CAD productivity. The front panel design is simple, and Help cards provide a reference for basic operations and troubleshooting.

An exclusive HP feature makes plotter configuration easy. You press the Setup button on the front panel, a setup form immediately prints. You mark the desired settings by hand and feed the form back through the plotter, which scans the form, configures itself to the requested settings and produces a confirmation sheet.

HP's line of DesignJets includes the monochrome 600 and color 650C. These high end models provide enhanced functionality such as greater speed and resolution.

Prices range from $3,695 for the 200 to $9,995 for the 650C.

ENCAD NOVAJET II®

ENCAD introduced NOVAJET, the industry's first low cost, wide-format, color inkjet plotter/printer. This plotter was ultimately transformed into the current model, the NOVAJET II which is loaded with the features most desired by CAD users.

In addition to excellent black-and-white plotting, this machine's forte is top-notch color output. In enhanced mode, shading and heavy area fills (often used in rendering) can be printed with *no* banding. The enhanced mode also minimizes bleeding and buckling by reducing the ink volume per pass and using multiple passes. In fact, on ENCAD's presentation grade bond paper the results are great and on premium media, the results are stunningly excellent. We know of no other color output that can hold a candle to it.

Let's talk color. From the front panel you can define up to 16 logical "pens" from 256 pre-defined colors and 15 line widths (from 0.08 and 1.27 mm). In raster mode up to 16 million colors are addressable, the actual number depending on the software you're using.

Paper handling is good. It handles cut sheets or rolls, A- through E-size bond, vellum or polyester, has an automatic cutter and paper catch basket.

Plot speed is also good. Plotting time for the E-size Carson mansion (including transmission, rasterization and plotting) ranges from 3:54 minutes for monochrome in draft mode to 7:40 for color in normal mode.

Prices are $6,995 (A-D size) and $7,995 (A-E size).

NEW

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An even better solution for your plotting bottlenecks!

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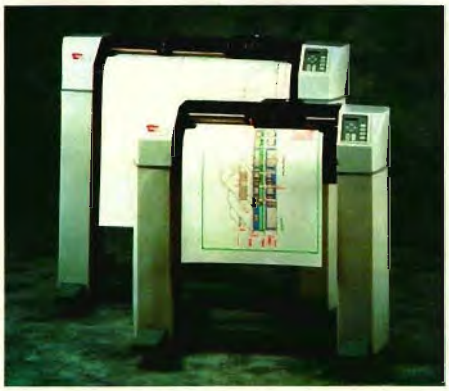
Vector Plotters - All Sizes and Shapes

E-Size Pen Plotter



HiPlot 7000 Series

The HiPlot 7000 series from Houston Instrument/Summagraphics is a standard 8-pen pen plotter with a difference. In addition to doing all the things a pen plotter should do and doing them very well, these plotters have several unique and useful features.

First is the media movement system. Paper can take a beating in any plotter that moves the paper during plotting. The Hi-Grip Drive System tracks media accurately and reliably at high velocities and accelerations using a special drive surface. This surface consists of thousands of tiny peaks that act like a miniature sprocket drive to hold the media in place and reduce media fatigue. A flexible, pliant platen extends from the front and back media exit to control the paper movement as the plotter accelerates, decelerates and makes quick changes of direction. To reduce pen tip wear and produce uniform, high quality lines, this plotter actually plots on a channel of air rather than on the platen. Second, is the SCAN-CAD® optional accessory and software than turns the plotter into a large format scanner.

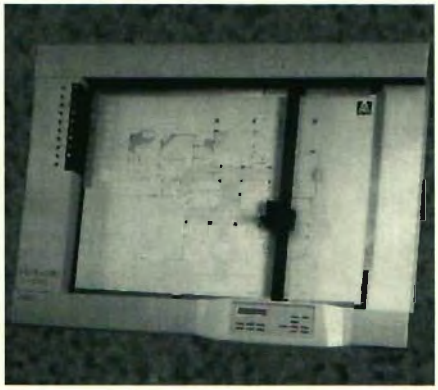
For quick computer release times, the HiPlot series supports HP-GL/2, 38.4K baud transmission rates and a standard 1MB buffer (to 4MB) buffer. It has replot capability, storage of 4 user configurations, and automatic scaling of plot files to different media sizes.

Prices range from $3,595 to $4,695 depending on options.

D-Size Flatbed

Marksman GF-1060

Galtech Computer Corp.'s ISO A1-A4/ANSI D-size flatbed plotter is a thrifty, solid workhorse for offices with moderate plotting volumes and throughput needs. With a speed of 42" per second the Marksman literally flies along and it uses standard pens. The ten pen slots let you mix pen types. Automatic pen return control and pen capping keeps water-based pens from drying out. The standard 512K buffer is upgradable to 4MB.



Unlike paper-moving plotters, flatbeds are ideal for a wide variety of media -- from standard plotter paper to tracing bond, polyester film, to OHP transparent film and posterboard. Because the paper stays put, flatbeds have excellent resolution and are very accurate. I like flatbeds because you can easily view the plot in progress.

Features on the easy-to-use LCD control panel include manual pen speed setting, pauses, manual pen return and pen selection, step resetting, buffer clearing, pen up/down control and error warning. An optional stand (with accessory slot and shelf) tilts up to 90 degrees making this plotter practical in small spaces.

Galtech has also recently introduced a high performance E-size roll type plotter, the PlotPal. It features a standard 1MB (expandable to 4) buffer, a LCD control panel and a curve generator for smoother curves, circles and arcs.

Prices on Galtech plotters range from $2,000 to $4,000.

E-Size Pencil/Pen

Mutoh XP-500 Series

Why would you want a plotter capable of plotting with pencil? The answer: speed, quality, cost and ease of use. Pen speed is limited by sheer mechanics and capillary action; pencils can fly along at a maximum plotting speed of 50 inches per second with an acceleration rate of 4.2 Gs and never skip a dot. For check plots, this is great, and plots can be edited by hand if required.

Pens are quite expensive compared to pencil leads. Use pencil for check plots and save pens for finals. Once you've loaded XP's pencil lead feeders, you rarely have to add or change. As many as 720-0.2mm, 280-0.4mm, 200-0.5mm, or 120-0.7 leads can be accommodated. Or you can combine lead sizes and hardnesses to produce the visual effect you're after. The plotter carousel holds up to eight drawing devices and pen and pencil can be mixed in the same drawing.

XP models with high-end options are available. The XP-510R roll feed plotter has a horizontal cutter and paper drop bin. It can operate all night unattended if you wish.

Every XP-series plotter includes a 1 MB buffer with replot capabilities, a user selectable pen force and an easy to read LCD display. They also feature vector sorting, pen sorting, a high quality mode, page management, automatic pen speed/acceleration/ and pressure settings, a plot time display, pencil end detection and automatic sensing.

The EP-series is solid, reliable and well engineered. Prices range from $3,495 to $5,695.

The Big Ones

Direct Imaging

JDL ExpressPlotter II

The E-size ExpressPlotter II offers high-volume plotting for a low-budget price.

Setup and configuration are easy, plotting speed is exceptionally fast, and the ExpressPlotter II can cut, label and stack plots for distribution.

Features include an automatic cutter and stacker, a plot ID stamp, and many image control features such as auto nesting and rotation, and mirror image. It comes with 4 MB of memory, a 52 MB hard drive, three standard interfaces (SCSI, parallel, serial) and accepts both HPGL and HPGL/2.

Clean, reliable direct imaging technology, uses no pens, toners or inks and requires minimal user maintenance. Price is $11,995.

D - Size LED*

CalComp - Solus 4

If you need a D-size plotter capable of monochrome, large volume, high-throughput with an excellent image quality at a reasonable price, the Solus 4 (CalComp's latest addition) might just fill the bill. This LED* plotter has a resolution of 400 x 400 dpi and an extensive range of features comparable to other plotters costing more than twice as much.

Features include fast output - 10 pages per minute for A-size, 3 per minute for D-size; plain paper capability in addition to film and vellum; dual paper rolls letting you use any combination of A- to D-size media; and easy set-up, configuration and operations with special features such as automatic data format recognition.

The Solus supports the standard HPGL, HPGL/2, CCRF, CALG4, TIFF formats. In addition to standard parallel, serial and OPCOM connections, expansion slots are provided for optional internal upgrade to Ethernet, Postscript language, VPI or additional parallel ports. Price is $19,995.

E - Size LED*

JDL 4000E

The JDL 4000E Engineering Document Plotter is an E-size LED designed for companies producing high volumes of final documents and multiple checkplots. You'll get an E-size on plain paper -- cut to size and ready to go -- in about a minute.

The 4000E plots on roll media of various widths, cuts plots both vertically and horizontally to eliminate manual plot trimming and wasted media, and conveniently drapes over 100 plots on a removable stacker bar. Plots can even be labeled and collated. Multiple interfaces and emulations and Automatic Emulation and Interface Sensing provides simple connectivity, fast data transfers, and software compatibility.

The 4000E is easy on your budget and the environment. It costs thousands of dollars less to operate over five years than most large-format technologies. And LED technology uses low-cost, plain papers and non-hazardous toner that's environmentally safe.

**In a less than technical way LED technology is a large-format "souped-up" laser. Without the detail of how it works, the fact is that the images and lines produced are sharp and exceptionally clear.*

Printer/Plotter Companies

CalComp
Pen plotters, inkjets, lasers, direct imaging, electrostatic
2411 West LaPalma Avenue
Anaheim, CA 92801
714/821-2000 or 800/932-1212

ENCAD
Color D/ E- size inkjets, pen plotters
6059 Cornerstone Court West
San Diego, CA 92121
800/326-2808 or 619/452-0882

Galtech Computer Corp.
Pen plotters - flatbed & E-size rollbed
5320 Derry Ave. Suite H
Agoura Hills, CA 91301
818/707-3696

Genicom Corporation
Nonimpact and impact business printers
14800 Conference Center Dr. #400
Chantilly, VA 22021
800/443-6426

Hewlett-Packard
Pen plotters, inkjets
3000 Hanover St.
Palo Alto, CA 94304
800/851-1170

JDL
LED/laser, direct imaging, color impact-matrix
4770 Calle Quetzal
Camarillo, CA 93012
800/899-8709

Mutoh America
Pencil/pen plotters
500 West Algonquin Road
Mt. Prospect, IL 60056
708/952-8880

Summagraphics
A-E size pen plotters, C-size inkjet, thermal wax transfer
Sixty Silvermine Road
Seymour, CT 06483
203/881-5400

Feedback

Here at Computer-Aided Products, we do not recommend the use of Picture-It for Layout Modes views (as described in CADKEY Corner in the January issue of KEYSOLUTIONS *and in the CADKEY Training Manual) unless you do not want model-drawing associativity. Using DETAIL LAYOUT INSTANCE MODIFY BLANK to create hidden-line views will automatically update all views and dimensions. Because each use of Picture-It will replace view geometry instead of modifying it, dimensions will have to be re-attached. In addition, hidden line views from Picture-It will facet arcs, so they cannot be properly dimensioned without creating the geometry.*

Dana Seero

Check It Out

Remember when you used to circle little numbers you couldn't read and then wait weeks to get product literature in the mail? No more! Several advertisers in this issue are offering KEYSOLUTIONS readers an extremely special and innovative product information service called Mercury FAX.

With Mercury FAX, you never wait to get product information. You can receive literature by fax 24-hours a day. Just call **800/779-0202**, enter the six-digit code number for the participating company and stand by your fax machine. The following are some companies participating in the Mercury FAX program.

Company	FAX Code
Cutting Edge *CAM software with surfaces*	124407
MechTech Solutions *MICRO-MECH mechanism design*	017201
Powertronic Systems *Integrate R & M software*	013307
Surfware, Inc. *CAM software*	013701

Tips on Plotter Selection

Variety is welcome, but can be perplexing. The question that always comes up is "What's the best choice?" Bruce Bachman, product manager, Mutoh America, Inc. recently answered questions about plotter products, technology trends, and the selection process.

What's the latest and greatest?

The great debate today seems to be between raster and vector technologies. Remember, there is no single tool or technology that is "right" for every user. It's not a case of "what's newest" or "best," but of what best fits the purchaser's needs and budget.

Where do vector plotters fit in?

The older, vector (pen/pencil) plotter technology remains as viable as any of the newer technologies (thermal, laser, ink jet). In fact, for many companies pen plotters remain the workhorse. Several factors explain this: the reasonable cost of the device itself; its low operational and maintenance costs; and the high quality image produced. Manufacturers are continuing to adapt, design and improve their pen plotters. Recent innovations include paper cutters, automatic pencil/pen loading, better optimization of random vector data and greatly enhanced user friendliness and throughput.

Should you change to raster?

A move to raster is dictated by a demand or need for greater throughput speed and volume. For those accustomed to vector's superior line quality, it is important to note that raster image quality is directly proportional to the cost of the raster device.

How do you make the "right" choice?

The simplest way is to create a needs matrix that covers: output needs, quality and application needs, software and hardware compatibility and total throughput.

Vector-to-raster conversion rate is a critical consideration. Pen plotters use vector data from the CAD system directly to draw lines. With raster devices, vectors must be converted to bit-map data to create the dot pattern image. All the vector information must be converted to bit-map before the raster device can begin generating the image. In evaluating a raster device, look at the time this process takes as well as the speed with which the image is put on the paper. An electrostatic plotter, for example, may have a print speed spec of 2 inches/second, but this doesn't create a true picture of how long it takes to create a plot.

What are some other factors?

Operational costs are another important point. Each plotter technology has a different, identifiable cost of operation which has to be measured against other needs such as quality, speed, volume, etc. A good rule of thumb is that first year operational costs for any type of plotter generally run about the same as the cost of the original equipment. This whole issue is also colored by the volume of plotting you expect to do. Take a close look at the cost of consumables. The critical question is cost per plot.

The next step is to look at specific products. If possible, query people familiar with using a specific plotter. Ask about product quality, reliability, warranties, service and technical support.

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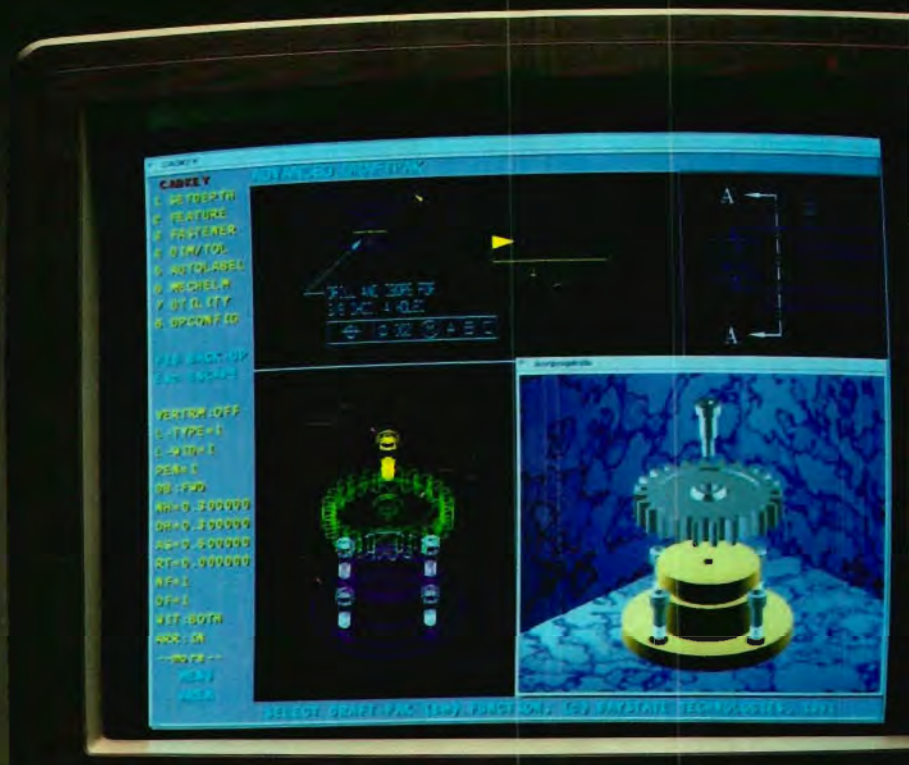
me·chan·i·cal de·sign (mi-kăn′ i-kəl dī-zīn) *n.* **1.** the creation and rendering of machines and mechanisms using a CADKEY® system equipped with DRAFT-PAK. **a.** parametric generation of geometry for features, fasteners and mechanical elements from raw engineering data. **b.** split-second insertion of dimensions, details, labels, callouts and symbols by supplying only the most essential information. **c.** rapid production of multi-view CADKEY drawings on minimal instructions from the user. **2.** the facility to maintain a consistent, accurate database throughout a design process. **a.** instantaneous access to a vast computer library of ANSI/ISO and machine designer's standards and specifications. (*see also,* Bill of Material Database Generator, DRAFT-PAK Professional Tablet Overlay, 2D Mold Designer, DRAFT-PAK View/Redliner and POINT 3 Continuous Improvement Software)



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A Bevy of Plotting Tools

by Claudia Martin

Today's printers and plotters are marvels of speed and quality, but actually getting electronic drawings onto paper can be a problem. One major frustration is that plotting directly from CADKEY can tie up the computer for long periods, keeping you from work. Fortunately, a variety of simple and inexpensive hardware and software tools are available that can make plotting easier, faster and much less frustrating. Most take advantage of CADKEY's "plot to file" feature. The following products are each in a class by themselves and can be used alone or in combination.

Turn a Printer into a Plotter & More

PrintAPlot® Pro, a thrifty, little (less than 20K) DOS program, provides powerful plotting utilities. First, it lets you plot to *any* printer (laser, inkjet, PostScript, and dot matrix) at resolutions from 75-600 dpi *inside* CADKEY.

Using it is easy. You plot the drawing to a file, pop up PrintAPlot, define parameters, tell the program to plot and get back to work. PrintAPlot takes over, converts the plot file to its own PPP format and prints/plots using optimized drivers which speed the printing process significantly. PrintAPlot can put the power and performance of an $8,000 HP DesignJet plotter into an HP $500 DeskJet printer -- except for the size of paper accommodated.

Flexible, PrintAPlot can run standalone, pop up as a TSR, or run in DOS under Windows. A feature I especially like is that PrintAPlot can plot while I process words or wrestle spreadsheets in my Windows applications. You can't, however, print from Windows applications while PrintAPlot is printing.

PrintAPlot Pro lets you preview drawings on the screen and change pen or line widths, patterns and colors outside of CADKEY -- an advantage because you can experiment with output options and not change the drawing. PrintAPlot can also adjust plot scaling or rotation and batch print to a stand-alone printer or Novell NetWare queue. It supports 255 pens/colors with 20 pen settings for line widths and eight for patterns. A "setting sheets" feature lets you save customized plot templates.

PrintAPlot Pro supports 25 paper sizes and long plots on continuous paper. You can tile A to E size drawings at 1% to 600% of the original, useful for E-size check plots on an 8 1/2" x 11" printer. On wide carriage printers you can produce almost C-size output.

The program is available in two versions: PrintAPlot Pro supports HP/GL2, includes the plot preview feature and an AutoCAD driver, and costs $199. PrintAPlot (no Pro) supports HPGL and doesn't include plot preview. The program requires a PC/XT/AT, PS/2 with 256K free RAM and Dos 3.0 or higher. As a TSR it requires 6K RAM.

For more information contact Insight Development Corp: 800/825-4115; 510/244-2000; fax 510/244-2020.

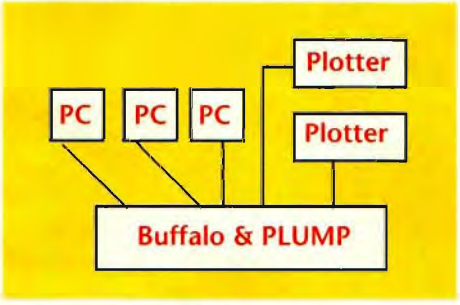
Hardware/Software Spooler/ Print Server

Buffalo/PLUMP-Rx consists of a hardware buffer and plotter sharing device, and the PLUMP software spooler. In an over-simplified way, it works like this. You plot the drawing to file and send it to PLUMP; PLUMP organizes sending the file to Buffalo's internal buffer for plotting. Once the plot file is sent from CADKEY, you're free to continue work on your computer.

This dynamic duo provides a solution for several different environments. Offices without a LAN can simply connect the spooler/sharing device to the CAD output device. For those with a LAN, but without a print server, it can serve as an alternative to the print server. Simply connect the sharing device on the LAN server, and then all users can direct print jobs to as many as nine printers. This configuration reduces LAN overhead and support issues and more printers can be shared than with a print server. For large network configurations, the spooler/sharing device is sometimes used to share printer and plotters in networked groups. Only one node is used for several printers and plotters.

Output using PrintAPlot® Pro

In all configurations, the computer is returned back to the user almost immediately versus waiting 15 to 30 minutes for a plot to be completed. For smaller businesses or work groups,



A simple configuration

Buffalo/PLUMP-Rx can, in many cases, eliminate the need to install an expensive client server network.

As an "intelligent" sharing device (ISD), the Buffalo provides several advantages: multiple users can print to the ISD simultaneously; it can convert data to parallel or serial output so connected users can share practically any device; and it can boost the signal so output devices can be located farther

away from the switch or computer than normally allowed. It's also fast; Buffalo boxes can accept input from the computer at 180,000 cps (characters per second) using parallel input and 115,200 baud serial input or output. Any computer can transfer data at its maximum speed. Buffer sizes are expandable from 1MB to 16MG.

PLUMP is a background spooler with a Windows-like interface. It requires only a small amount of memory and has the ability to set spooling priorities according to size, file age, or first-come first-serve. It has the ability to recognize when printer initialization strings are required. This feature allows any language such as Postscript, PCL or HPGL, to be used by any user without manual intervention.

Depending on options, prices range from $349 to $999.

For more information contact Buffalo Products, Inc: 800/345-2356; fax 503/585-4505.

Disk Based Hardware Solution

pSERVERplus offers an effective and straightforward hardware solution for non-networked PCs. A standalone plotter server and plot buffer, pSERVER plots from plot files on a floppy disk. The pSERVER box is connected directly to the plotter using a standard plotter cable. Use is simple; after you plot the drawing(s) to file, you place the file(s) on a floppy, insert the disk into pSERVER and plot. You can also connect your PC to the plotter through the pSERVER to keep direct PC to plotter access.

Even with all the steps and handling involved, this can save mega time especially with large or multiple drawings. Basically, writing to file is faster than plotting directly or loading a RAM buffer over a serial line. And pSERVERplus doesn't interrupt you as a software spooler sometimes will.

I can hear you from here. "My drawings won't fit on a floppy!" Not to worry. pDISK®, a supporting program, compresses plot files (with a proprietary compression algorithm) while copying them to the floppy. As significant as the difference is, some files may still be so large they don't fit on one disk. pDISK can split these files among several separate floppies.

pSERVER's front panel lets you control the plotter, choose which files

pSERVERplus

to plot, select multiple files to plot in sequence on sheet feeding or continuous feed plotters. It also graphically indicates plot progress.

pSERVER is compatible with all plotters and printers. It comes with either a 5.25" 360K/1.2MB or a 3.5" 720K/1.44MB drive. Dual drives are an option. The price is $795 for the single drive version; $945 for dual drives.

For more information contact Far Mountain Corporation: 206/392-6541; fax 206/392-8373.

Date and Time Utilities for CADKEY Drawings

Using the plot to file function in CADKEY, the NEWPLOT™ utility program lets you time and date stamp hardcopy outputs. It imbeds current file information into the CADKEY® plot file, including current system time and date, the part file's name, size, and/or the CADKEY version used to create the database. This is extremely useful if you're trying to keep your place. Have you ever wanted to know if the plot and part file it was made from are both current or if the part file has been revised since the plot was made? You can associate plots with a specific version of a part file or trace plots back to the time they were created. The DATE™ utility adds the part file name, time and date directly into the CADKEY part database.

For more information contact JES Engineering: 619/436-5510.

TECH TIPS - Plotting to File in CADKEY6

CADKEY's ability to plot to file lets you plot off-line and export drawings to a variety of software programs and hardware devices. The fact that there are two totally different ways to plot to file can be confusing. If you don't use the correct method for your purpose, the file simply won't work.

PLOTFAST Files - This method creates files primarily for use with the CADKEY PLOTFAST program. The proprietary format of these files cannot be read directly by other programs. To create files in this format from the Main Menu, select - FILES (F5) - PLOT (F3) - SAVE (F1) and enter a file name and press Enter. CADKEY automatically places the file in the CADKEY6/plt subdirectory. A list of these files can be viewed and manipulated when you select FILES\PLOT\LIST.

HPGL Files - To create a plot file for use with the products described here or with a word processer, desktop publisher, etc. that accepts HPGL files, you must use the second method.

From the Main Menu select CONTROL(F7) - PLOT(F7) and define the drawing area to be plotted. The Plotter Configuration Dialog Box will pop up. In the PLOTTER box, select HPGL (or HP/GL2 if external application requires it). In the PORT box select FILE and enter the file name and optional three-letter extent in the box directly below. DOS file name restrictions apply. Click on OK and CADKEY automatically places the file in the main CADKEY subdirectory.

Although you can enter a path and go directly to a floppy, if the file is large (they tend to be) it may be simpler to let the file go to the hard disk and then assess the situation. You may need to compress the file with a program like PK ZIP just to get the file on a floppy. HPGL files can also be converted to raster formats such as PCX, TIFF, etc. with programs like HiJaak for Windows and the powerful shareware program, Graphics Workshop.

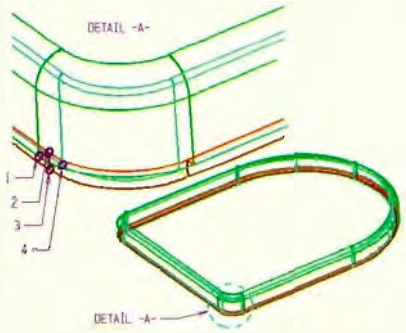
Molds and Cases Are a Snap with PowerTools Bundle 2.5

by Robert Martin

POWER TOOLS BUNDLE™ 2.5 is a suite of programs (Offset, Fillet, Advanced Measure, Features, Parapath, and Pathchange) that make designing molds, injection molded and cast parts easier and faster -- right inside CADKEY.

Since a picture is worth a thousand words, I have included three drawings of a plastic case for a coffee cup warmer. The geometry was created using POWER TOOLS and CADKEY. This case has all the elements that make designing a part like this a challenge - wall thickness, draft, ribs, counterbores, and bosses.

PARAPATH and the FEATURES programs are the workhorses here. With PARAPATH you have the powerful capability of extruding paths (a series of connected lines and arcs) with draft, wall thickness, fillets and rounds. Since wall thickness is an option, the objects can be "hollow" and represent molded or cast parts. You can even run parts created by POWER TOOLS through Picture It™ to create complex renderings of your designs.



To create the case geometry here, we simply defined the profile of the part with simple lines and arcs in CADKEY, entered the parameters such as depth, radii, draft angle, wall thickness, etc. and let PARAPATH rip. The POWER TOOLS operations took place very quickly once dimensions and feature locations were determined. Operations are easily "undone" with a convenient Undo button.

Parameter definition is at the core of PARAPATH as well as the FEATURES programs. They are form driven and have graphical and context sensitive Help, extensive error checking for conflicting parameters with suggested changes. PARAPATH can create complex pockets, bosses, blocks and shells. Pockets can literally be "blown" into plates or construction planes.

The FEATURES programs are all new for this release and will even create ADVANCED MODELER™ solids. They are all Dialog box, parameter driven. You can even save your features for later reuse. Here are some details of "FEATURES":

Circular Boss - You define the OD and ID height and draft angles, as well as the fillets and rounds at all the corners.

Counterbore / countersink - Depths and draft angles define the feature with fillets and rounds available at all the corners. A large value of draft will result in a Countersink.

Rectangular Rib / block - The length, width, depth and draft angles are all user defined. Rounds are definable at all corners and a fillet can be placed around the rib to construction plane intersection. The rib can be oriented at one of nine orientation points and rotated about the orientation point before placement.

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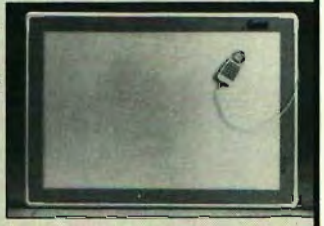

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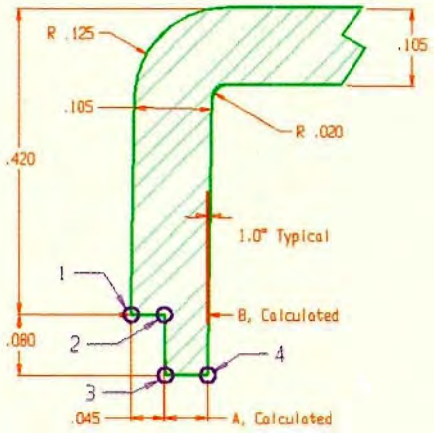

Full Radius Slot - With basically the same options as the Rib program, this program automatically calculates the radii necessary to produce a full radius slot.

Other features include an Undo button, constant vertical edge radii approximation, and a reduced horizontal edge option for Picture It compatible parts. The programs all use the CADKEY construction plane and are accessed through a dialog box. POWER TOOLS BUNDLE comes with a 120 page manual packed with over 100 illustrations and many examples. A tutorial, table of contents and index make it really useful. As I said in an earlier review, this program is a "must" for developing castings, moldings, etc. The developers constantly improve it and it shows in this latest release.

For more information contact Paradesign, Ph & Fax 619/484-8386.

A Sturdy CAD Desk with Leg Room

by Robert Martin

When it comes to work space, CAD professionals have special needs. We recently had the good fortune to try CADesk from CimTech, Inc. which was designed specifically with these needs in mind.

Extremely functional, its 30" depth (56" at the corner) provides plenty of space for all the drawings, books, parts, digitizers, and other "paraphernalia" our engineers need at their fingertips. Its standard 29" height makes it easy to integrate with other furniture.

As engineers we really appreciated its well thought out design and construction characteristics. The most unique design feature is that the entire front of the desk is open (no legs getting in the way of your legs), but it is strong enough to hold the largest payload including monitors, etc. CimTech, in fact, has patents pending on this feature. We reviewed the smallest corner configuration and still had enough room for a tower computer leaving plenty of space for uncluttered leg room.

The frame is fabricated from steel and when assembled forms a uni-structure to give optimum strength in design. The frame and vanity panels are fabricated within .005 inch for accuracy in assembly. We were able to assemble the entire desk within 30 minutes with the tools provided.

The work surface is fabricated from a high density wood product with a hard coated laminate surface that's really tough. The desk also has leveling feet, which lets you compensate for an uneven floor. Optional drawers for hanging files or 5.25" and 3.5" disks have full extension guides. The unit is attractive enough to fit in any office setting and tough enough to go in the shop or on the manufacturing floor.

There is no product quite like CADesk currently on the market. All other desks have legs in the area of the operator and cost considerably more.

By the way, it's all in the family. CADesk was designed in CADKEY.

For more information contact CimTech, Inc. 203/488-3032 or Fax 203/483-8041.

24 Hr. Automatic Fax Info 1-800-779-0202 Code 019301

Electronics Teaching Tool Gets A Good Grade

by Robert Fromm, Superintendent
Selkirk School District

One really special software package we've worked with at the KEYSOLUTIONS' S.O.S. school* is Demax Corp.'s beginning electronics module, "Teaching With the Demax System." It consists of a lab manual, an instructional video tape, and an electronics learning module or lab kit. Course content covers Mastering the Digital Multimeter, Direct Current, and Alternating Current.

It's designed to permit instructors with no electronics experience to incorporate electronics in their science classes. The well organized manual provides step-by-step procedures for the instructor. Although the manual told us the instructor should have some background in science or technology, we asked a teacher with neither to complete the "Mastering the Digital Multimeter" section, which they did without difficulty. This is a good indication of the quality of the written material.

The course is experiment oriented and the learning module appears to be "student proof." Complete components for student experimentation and instructor demonstration are housed in a sturdy high-impact plastic case. The module is powered by 9 volts AC, providing AC, DC and rectified AC for experiments. All fit snugly in the case which minimizes possible damage and most components have lugs for easy attachment to the binding posts which really reduces wear and tear -- broken wires, etc.

The video, the core of the teaching program, is intended to provide the instructor with sufficient background to use the material. We previewed a pre-release version. In spite of what we presume were pre-release glitches, there is no doubt that novice instructors will feel comfortable with the material after the activities outlined in the manual are completed. Our main suggestion is that chalk board sequences be improved by using a video lettering system.

Based on the opinions of several instructors, the manual, equipment and video tape are a worthwhile educational tool.

For more information contact, Demax Education Products 616/428-4431 fax 616/418-7411

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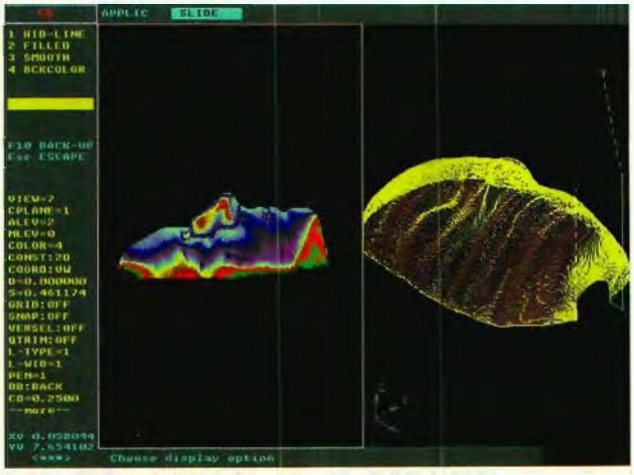

CUTTING EDGE SURFACES has:
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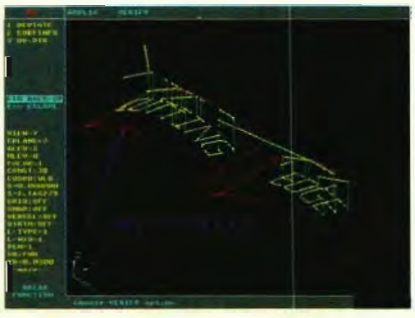

CUTTING EDGE SURFACES can be used as a stand alone CAM system for 3-axis milling, drilling, boring, reaming, slotting, pocketing, tapping and contouring. Immediate verification of the tool path before cutting reduces material waste.

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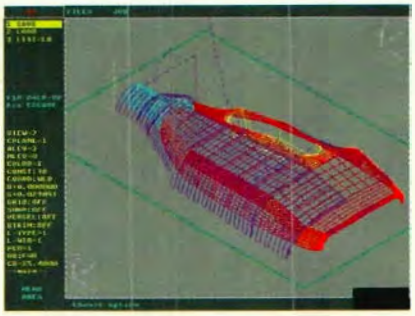

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CADL TOOLBOX

After using CADKEY for 1-1/2 years I have devised some methods to help me handle levels. I have written a few cdls I would like to share with other users:

lchg.cdl Changes the level and color of an entity to that of another, by a screen pick.

levset.cdl Changes the active level by a screen pick.

loff.cdl Turns off a level by a screen pick.

This CADL Toolbox was provided by J.D. Frawley of QualiTROL Corporation, Fairport, NY, CompuServe 73237,674

If you have developed cdls that help you work more efficiently and you would like to share them with other CADKEY users, please submit them to the Technical Editor, KEYSOLUTIONS, P.O. Box 11978, Spokane, WA 99212.

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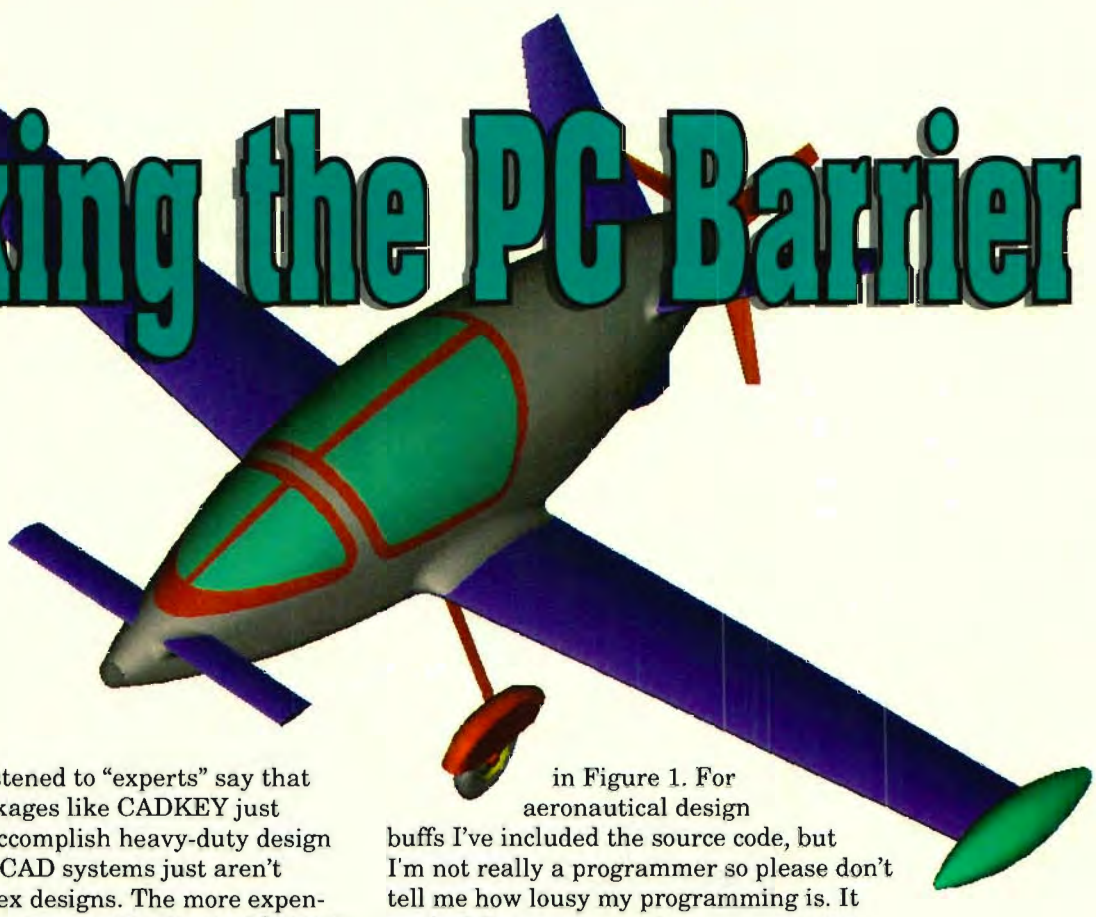
```
rem  LCHG.cdl
rem  Purpose: To change the level and color of an entity indicated
rem  by a screen pick, to that of another screen pick.
rem  ************************************************************
:top
rem   Get level and color of the first entity
  getent "Select the entity you wish to move", enttype
  id = @mscdat[0]
  col = @intdat[3]
rem   Exit with F10 or ESC
  if ((@error != 0) || (@key < -1 ))
    goto exit
rem   Choose second entity (the level and color to change to)
  getent "Select an entity on the destination level" , enttype
  lev = @intdat[4]
  col = @intdat[3]
  defattr  color, level
  setattr id, col, lev
   redraw -1
  clear lev, col, id
rem   Select another entity
  goto top

:exit
```

```
rem  LOFF.cdl
rem  Purpose: To turn off the level indicated by a screen pick.
rem  ************************************************************
:top
  getent "Select an entity on the level to turn off", enttype
rem   Exit with F10 or ESC
  if ((@error != 0) || (@key < -1 ))
    goto exit
  lev = @intdat[4]

rem   Tun off chosen level
  levels 0, lev
    redraw -1
  clear lev

rem   Select another entity.
  goto top

:exit
```

```
rem  SETLEV.CDL
rem  Change the active level (and color) with a screen pick.
rem  ************************************************************
rem    Get level and color
       getent "Select the new active level.", enttype
         lev = @intdat[4]
         col = @intdat[3]
rem    Exit with Esc or F10
         if ((@error != 0) || (@key < -1))
         goto exit
       set level, lev
       set color, col
         redraw -1
      clear lev, col
:exit
```

Breaking the PC Barrier

by Robert Martin
with Robert White



For a long time I've listened to "experts" say that general purpose 3D PC packages like CADKEY just aren't powerful enough to accomplish heavy-duty design tasks. To quote one, "Micro CAD systems just aren't sufficient for modern complex designs. The more expensive CAD systems (costing in the neighborhood of $15,000 to $20,000) are needed to meet modern design requirements." Hogwash!

But, trying to tell anyone (let alone a so-called expert) that they're wrong seldom works. So I decided to tackle a really complex design to prove my point. I concepted a small, four-passenger aircraft which I named the Wild Weasel. The Wild Weasel is rather unusual. It's a fiberglass/graphic fiber and foam composite construction and is pusher driven with three flying surfaces. This airplane has very complex curves and surfaces but is mechanically very simple which makes it ideal for this demonstration.

Basic Design with Code

One efficient way to start a design is to first set essential parameters and then perform a series of calculations to establish the basic design. I used a little Basic program I ginned up from some old design books I own. It allowed multiple iterations of the data until I was able to arrive at a set of satisfactory design specs. The results from this program gave me the information to generate the three-view drawing in Figure 1. For aeronautical design buffs I've included the source code, but I'm not really a programmer so please don't tell me how lousy my programming is. It worked for my purposes.

Developing the Surfaces

Once the basic design was complete, I could develop the aircraft's surfaces and from the surfaces the station sections. I developed the surfaces by first drawing the side profile, full scale in *View 2, Cplane 2*. Then I shifted to *View 7*, remaining in *Cplane 2* where I established three vertical lines at strategic points along the side

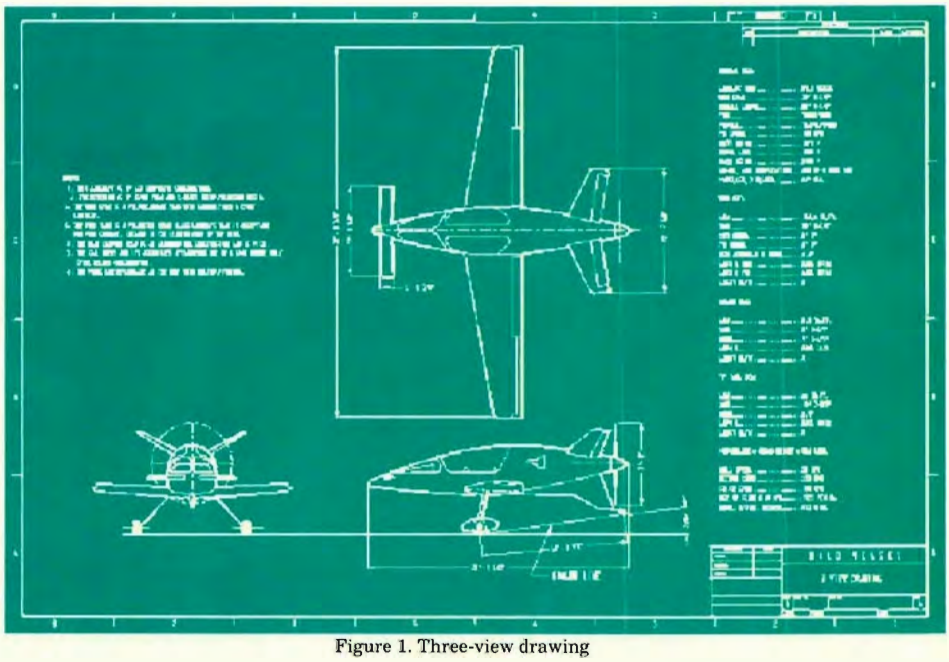


Figure 1. Three-view drawing

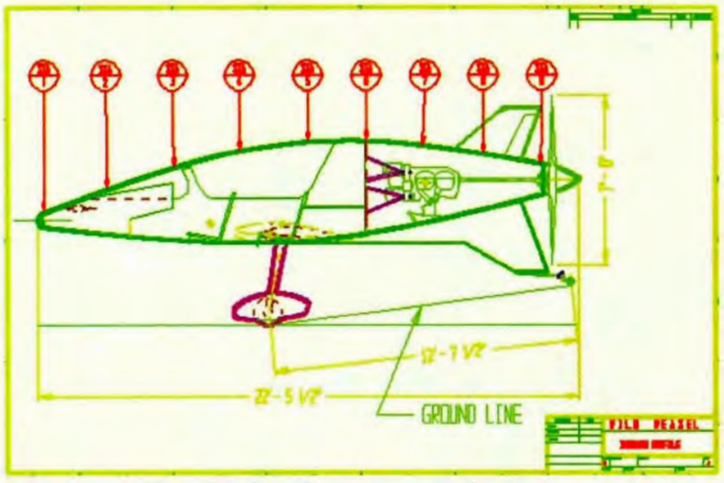


Figure 2. Side profile showing station locations.

profile (one at a forward most position, one amidships, and one at the far end just before the spinner) which would become the locations of form controlling curves. I then drew curves at those locations that closely represented the shapes I wanted there.

When the curves were drawn for one side of the fuselage, I Mirrored them to produce a full fuselage cross section. Then I called up FastSURF and invoked the *Create, Spline, Chain, Single,* command string and created splines over the curves created in CADKEY. I drew these splines in a different level than the original curves. Now instead of having two CADKEY curves that represented the cross sections, I had one FastSURF spline at each location.

Then I shut off the levels containing the CADKEY curves, including the side profile. I invoked the FastSURF commands *Create, Surface, Gencurve* and picked the three stations/curves that represented the cross sections starting at one end and picking them in succession. I now had a fuselage shape that fitted my curves.

Next, I created the flying surfaces in place on the aircraft. I had to go out into CADKEY for this. I created the four airfoils using CADKEY's spline command and the NACA airfoil coordinates. I made pattern files out of these and placed them into the aircraft drawing, making sure that the airfoils were scaled to the proper size for the wing.

I went back into FastSURF and at the extreme end of each flying surface repeated the steps to create a *Gencurve.* I picked the root as well as the tip airfoil which created the respective flying surface, wing, canard or horizontal stabilizer.

We had the beginnings of a flying machine.

To Be Continued

The story of this project will be told in two more installments. Next time we'll show how we added instrument panel covers, canopy, windshields, etc. In the final article we will deal with the modeling and testing of our airplane as a model. I will also describe concurrent engineering techniques for developing the prototype. In addition, more basic programs will be available for the basic aircraft design.

Complete drawings and the basic code used to develop this design are available on disk. Just send $15 for shipping and handling charges to Airplane Project, KEYSOLUTIONS, P.O. Box 11978, Spokane, WA 99211-1978.

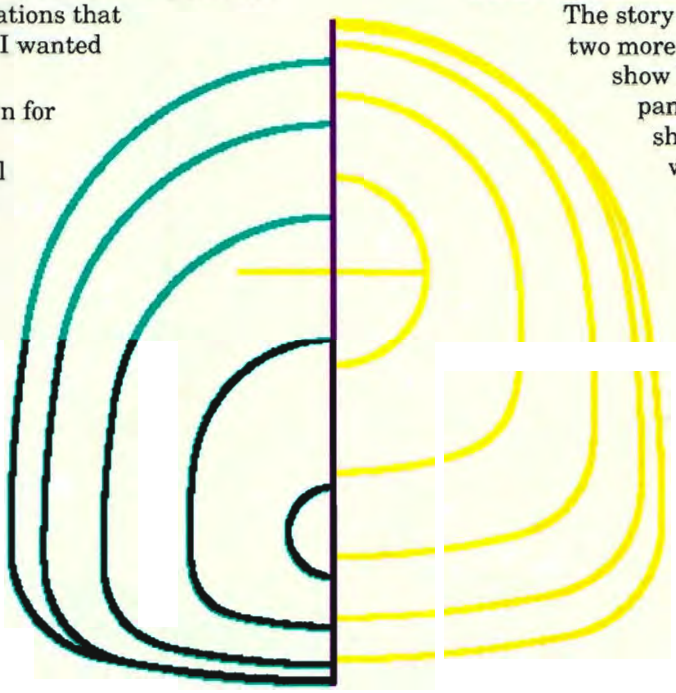


Figure 3. Bulkhead profiles as shown in Figure 2.

```
5 CLS
10 PRINT "      AIRCRAFT DESIGN PROGRAM, (c) 1993 by R. L. Martin"
15 REM _______Input Data__________
16 PRINT "": PRINT ""
17 INPUT "Design Name.....", DesignName$
20 INPUT "Number of Seats.....", No.ofSeats
25 INPUT "Maximum Baggage Weight.....", Baggage
30 INPUT "Maximum Fuel Load (gal.).....", Fuel
35 INPUT "Flat Plate Drag (see table 3.4).....", FPDrag
40 INPUT "Maximum Lift Coefficient (see table 3.2)...", CLmax
45 INPUT "Number of Engines.....", No.ofEngines
50 INPUT "Desired HorsePower.....", Power
55 INPUT "Engine RPM.....", RPM
60 INPUT "Wing Area.....", WingArea
65 INPUT "Canard Area (enter 0 if no canard).....", CanardArea
70 INPUT "Horizontal Tail Area.....", TailArea
75 INPUT "Wing Aspect Ratio.....", WingAR
80 INPUT "Canard Aspect Ratio.....", CanardAR
85 INPUT "Horizontal Tail Aspect Ratio.....", TailAR
90 REM_________Aircraft Design Program_________
95 PRINT ""
100 IF CanardArea <> 0 THEN 115
105 CanardArea = 1E-10
110 CanardAR = 1
115 IF TailArea <> 0 THEN 130
120 TailArea = 1E-10
125 TailAR = 1
130 TotArea = WingArea + CanardArea
135 WF = Fuel * .6
140 UL = 170 * No.ofSeats + Baggage + WF
145 GW = UL / .4
150 EW = GW - UL
155 PP = No.ofSeats * 170
160 VS = SQR(840.34 * GW / (TotArea * CLmax))
165 Vsmph = VS * .682
170 Cwing = SQR(WingArea / WingAR)
175 Bwing = WingArea / Cwing
180 Ccanard = SQR(CanardArea / CanardAR)
185 Bcanard = CanardArea / Ccanard
190 Ctail = SQR(TailArea / TailAR)
195 Btail = TailArea / Ctail
200 V = SQR(1682 * Power * No.ofEngines / FPDrag)
```

```
205 Dia = 360 * (Power / (V * RPM ^ 2)) ^ .25
210 REM_____Maximum Speed_____
215 Tstatic = No.ofEngines * 7.38 * (Power * Dia) ^ .667
220 Vm = 0
225 Vm = Vm + 2
230 TD = Tstatic * (1 - .106 * Vm * SQR((RPM * Dia ^ 3) / (Power * 10 ^ 7)))
235 Drag = .00119 * FPDrag * Vm ^ 2
240 IF Drag > TD THEN 250
245 IF Drag < TD THEN 225
250 Vmph = Vm * .68
255 REM _____Propeller Diameter_____
260 Dia = 360 * (Power / (Vm * RPM ^ 2)) ^ .25
265 Din = 12 * Dia
270 REM _____Performance_____
275 Vcruise = .85 * Vm
280 Vcmph = .68 * Vcruise
285 CLcruise = 2 * GW / (.00238 * TotArea * Vcruise ^ 2)
290 Alpha = 57.3 * CLcruise * (TotArea + 2) / (6.283 * TotArea)
295 Vcl1 = SQR(GW * 840.34 / TotArea)
300 ROC = 60 * Vcl1 * (10.44 * Power * No.ofEngines / (GW * SQR(GW /
    TotArea)) - .02 - 1 / (3.14 * WingAR))
305 SFC = .000446 * Power ^ 2 - .0125 * Power + 2.79
310 Range = Fuel * Vcmph / SFC
315 REM _____Output_____
316 LOCATE 1, 2: PRINT ""
317 CLS
318 PRINT "": PRINT "": PRINT "            "; DesignName$
320 PRINT "Empty Weight          ="; INT(EW); "lbs"
325 PRINT "Pilot and Passangers   ="; INT(PP); " lbs"
330 PRINT "Baggage              ="; INT(Baggage); " lbs"
335 PRINT "Fuel                 ="; INT(WF); " lbs"
340 PRINT "Useful Load           ="; INT(UL); " lbs"
345 PRINT "Gross Weight          ="; INT(GW); " lbs": PRINT ""
355 PRINT "Flat Plate Drag Area   ="; FPDrag
360 PRINT "No. of Seats         ="; No.ofSeats
365 PRINT "No. of Engines        ="; No.ofEngines
370 PRINT "Engine Power          ="; Power; " hp"
375 PRINT "Propeller Speed       ="; RPM; " rpm"
380 PRINT "Total Static Thrust    ="; INT(Tstatic); " lbs"
385 PRINT "Propeller Diameter     ="; INT(Din); " inches": PRINT
400 INPUT "Hit Enter to Continue"; a$
401 CLS
405 PRINT "": PRINT "": PRINT "" : PRINT ""
406 PRINT "            "; DesignName$
410 PRINT "Wing Area            ="; WingArea; " sq.ft."
415 PRINT "Wing Span             ="; Bwing; " feet"
420 PRINT "Average Chord         ="; Cwing; " feet"
425 PRINT "Cruise Lift Coefficient  ="; CLcruise
430 PRINT
435 PRINT "Canard Area           ="; CanardArea; " sq.ft."
440 PRINT "Canard Span           ="; Bcanard; " feet"
445 PRINT "Canard Chord          ="; Ccanard; " feet"
450 PRINT "Tail Area            ="; TailArea; " sq.ft."
455 PRINT "Tail Span             ="; Btail; " feet"
460 PRINT "Tail Chord            ="; Ctail; " feet"
465 PRINT "": PRINT "": PRINT ""
470 INPUT "Hit Enter to Continue"; a$
471 CLS
475 PRINT "": PRINT "": PRINT "": PRINT "": PRINT "": PRINT ""
476 PRINT "            "; DesignName$
480 PRINT "Maximum Air Speed      ="; INT(Vmph); " mph"
485 PRINT "Optimial Cruise Speed  ="; INT(Vcmph); " mph"
490 PRINT "Stall Speed           ="; INT(Vsmph); " mph"
495 PRINT "Maximum Rate of Climb  ="; INT(ROC); " feet per minute"
500 PRINT "Range, no reserve      ="; INT(Range); " miles"
505 PRINT "": PRINT "": PRINT "": PRINT "": PRINT "": PRINT "": PRINT ""
510 INPUT "Want to print these results"; a$
515 IF a$ = "Y" OR a$ = "y" THEN GOTO 516 ELSE GOTO 710
516 REM _____Printed Output_____
517 LPRINT
518 LPRINT "": LPRINT "": LPRINT TAB(30); ""; DesignName$; " Design
    Results"
519 LPRINT : LPRINT
520 LPRINT TAB(10); "Empty Weight          ="; INT(EW); "lbs"
525 LPRINT TAB(10); "Pilot and Passangers  ="; INT(PP); " lbs"
530 LPRINT TAB(10); "Baggage              ="; INT(Baggage); " lbs"
535 LPRINT TAB(10); "Fuel                 ="; INT(WF); " lbs"
540 LPRINT TAB(10); "Useful Load           ="; INT(UL); " lbs"
545 LPRINT TAB(10); "Gross Weight          ="; INT(GW); " lbs": PRINT ""
555 LPRINT TAB(10); "Flat Plate Drag Area   ="; FPDrag
560 LPRINT TAB(10); "No. of Seats         ="; No.ofSeats
565 LPRINT TAB(10); "No. of Engines        ="; No.ofEngines
570 LPRINT TAB(10); "Engine Power          ="; Power; " hp"
575 LPRINT TAB(10); "Propeller Speed       ="; RPM; " rpm"
580 LPRINT TAB(10); "Total Static Thrust    ="; INT(Tstatic); " lbs"
585 LPRINT TAB(10); "Propeller Diameter     ="; INT(Din); " inches": PRINT
610 LPRINT TAB(10); "Wing Area            ="; WingArea; " sq.ft."
615 LPRINT TAB(10); "Wing Span             ="; Bwing; " feet"
620 LPRINT TAB(10); "Average Chord         ="; Cwing; " feet"
625 LPRINT TAB(10); "Cruise Lift Coefficient  ="; CLcruise
630 LPRINT
635 LPRINT TAB(10); "Canard Area           ="; CanardArea; " sq.ft."
640 LPRINT TAB(10); "Canard Span           ="; Bcanard; " feet"
645 LPRINT TAB(10); "Canard Chord          ="; Ccanard; " feet"
650 LPRINT TAB(10); "Tail Area            ="; TailArea; " sq.ft."
655 LPRINT TAB(10); "Tail Span             ="; Btail; " feet"
660 LPRINT TAB(10); "Tail Chord            ="; Ctail; " feet"
670 LPRINT
680 LPRINT TAB(10); "Maximum Air Speed      ="; INT(Vmph); " mph"
685 LPRINT TAB(10); "Optimial Cruise Speed  ="; INT(Vcmph); " mph"
690 LPRINT TAB(10); "Stall Speed           ="; INT(Vsmph); " mph"
695 LPRINT TAB(10); "Maximum Rate of Climb  ="; INT(ROC); " feet per
    minute"
700 LPRINT TAB(10); "Range, no reserve      ="; INT(Range); " miles"
710 INPUT "Want to redo data"; a$
715 IF a$ = "Y" OR a$ = "y" THEN GOTO 5 ELSE END
```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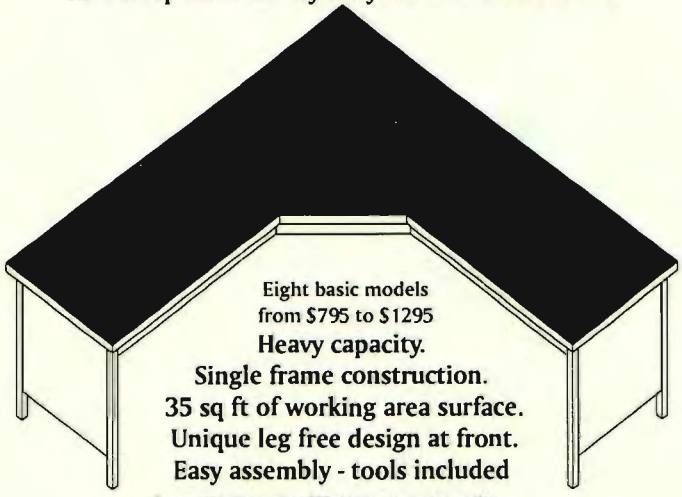

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DMS Dossier

by Martin van der Roest

I want to review some of the feedback we received from the first FAX poll this spring. That column addressed what an engineering drawing/document management system (EDMS) could do for an organization. The associated FAX poll was oriented to identify the general profile of the readers, and their interests and experiences related to DMS.

The responses were consistent with information I have collected over the years. No real surprises.

There still seems to be varying views of what EDMS is. In fact, the word 'varying' may be substituted with the word 'confused' in some cases. An EDMS solution is not simply the management of CAD drawings. CAD drawings are part of the picture (no pun intended), but the solution must also consider other document types, release and change controls, and document distribution and fulfillment issues.

A basic file management utility may suffice in some instances for supporting the improved organization and accessibility of CAD drawings. If that's the case, then an EDMS solution may not be required for your department or areas of your responsibility.

Let's look at the results of the first FAX poll, focusing on the following: :

How is CAD being used?

What networks are being used?

How quickly are documents being found and retrieved?

Confidence that the retrieved documents are the correct version?

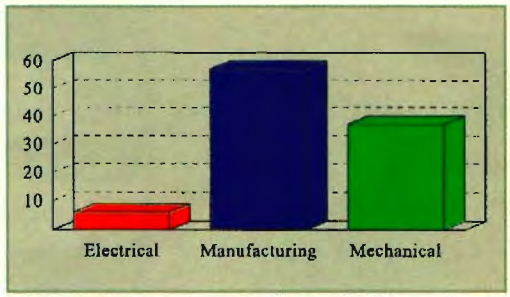
Topics of interest and concerns for future columns

The bar charts use standard notation. The vertical axis or Y-Axis identifies a percentage ratio. A sample set of 30 to 38 responses is being used. Variations are due to the fact that not all questions were answered.

How is CAD being used?

No surprises here. CADKEY is being used in the manufacturing and mechanical areas. Only two responses indicated a use in the electrical area. Better than ninety percent of the responders were in a technical position versus management or administrative.

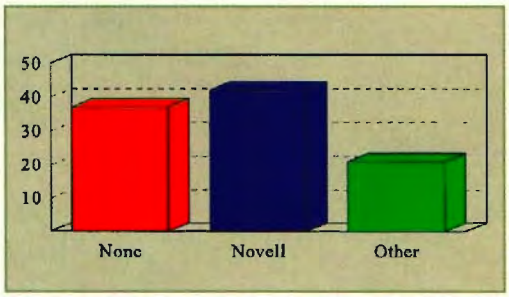
Manufacturing and mechanical applications are ideally suited for an EDMS solution. These environments tend to be parts intensive. These parts are either made (in-house or farmed out) or purchased off-the-shelf. As a result, change control and distribution methods are critical. These methods and the way in which they are implemented are some of the key components of an EDMS solution.



CAD Applications - Percent Makeup of FAX Respondents

What networks are being used?

Networks are definitely a key part of the automation process. More than 60% of the respondents use networks. Novell is the primary supplier, followed by MS' LAN Manager, Banyan, and Lantastic.



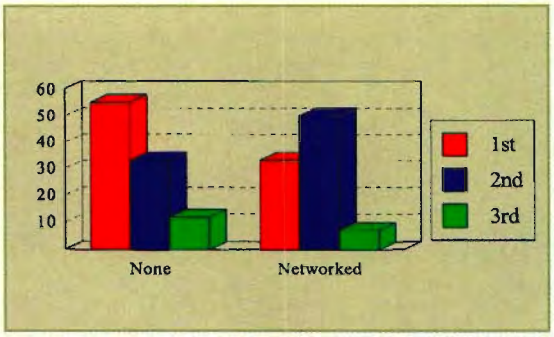
Networked Usage - Percent Makeup of FAX Respondents

If drawings and/or documents are shared, a networked environment is going to be a big help. However, sharing documents is not necessarily the only prerequisite for justifying a network. Other engineering related functions, such as the electronic routing of drawings for checking and approval, and local or remote distribution of documents requested by other departments of organizations are contributors.

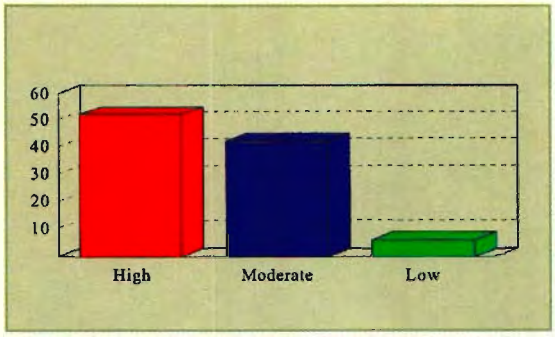
How quickly are documents being found and retrieved?

The results here were not unusual, but still worth noting. Finding a document seems to be quicker on a single user workstation, than on a network. Intuitively, this might be attributed to the fact that there is less information to keep track of for a single user outside of a networked environment. With the network, multiple users may be contributing to the same pool of data. As a result, managing multiple documents generated by multiple users becomes more difficult.

Adding a network seems to point to the need for improved functionality for document search and retrieval. The question is whether to suffer the inconvenience and use nothing, get a good file management utility, or



Drawing Access Performance Characteristics - Percent Profile



Confidence Level That Drawing is Correct - Percent Profile

pursue the implementation of an EDMS solution.

Confidence that the retrieved documents are the correct version?

Once you've got a document, are you sure that it's the right document (i.e. correct version, most recent, etc.)? One out of two respondents seem to be very confident they are getting to the right document.

The other half have a moderate to low level of confidence they are getting to the right document. If these documents are in a prerelease stage, that may be tolerable. But if these documents are released, this could be very costly.

The cost may eventually be reflected in cancellation penalties due to ordering the wrong part, or in manufacturing down time because good parts were rejected during inspection with wrong drawings, or visa versa.

Topics of Interest/Concerns for Future Columns

Poll participants relevant to EDMS indicated interest in the following topics:

- BOM Linkage to External Data
- Job Costing
- Drawing Numbering System
- Document Relationships
- Document Distribution and Fulfillment
- Engineering Change Controls
- Integration with MRP Systems
- Cost of Implementation (Hardware, Support, etc.)

I'll discuss these issues one at a time in future columns.

In the meantime take a look at this issue's FAX poll. Fill it out and FAX it in. Your input is important!

KEY SOLUTIONS

Document Management Forum / FAX POLL (No. 4)

We want to hear from you. Tell us what's going on with your CAD related drawing management activities.
FAX form to (714) 543-4931.

1. Once CAD drawings are 'done', are they released or 'vaulted' away for limited access? That is, any additional changes must be effected in a more controlled setting. If NO, then the need for a DMS solution is probably minimal. In fact the following questions are probably not applicable (if otherwise, I definitely want to hear about your situation).
   Circle one: Y/N
2. Is there a company organization that is responsible for the management and control of drawings/documents?
   Circle one: Y/N
3. If Yes to question 2, then does this organization get the 'done' or released drawings for change control and distribution?
   Circle one: Y/N
4. Do organizations other than the CAD group contribute to the pool of released drawings or documents managed by the company document control group?
   Circle one: Y/N
5. Do other organizations outside of the CAD group request the CAD drawings generated?
   Circle one: Y/N
6. If changes are desired within a document, does your organization have change request/authorization mechanisms?
   Circle one: Y/N
7. If Yes to question 6, do the change requests get submitted to a change review board for authorization?
   Circle one: Y/N
8. What does your company make?_____
9. What specific questions or topics are of interest to you for future column discussions?
   _____

NOTE: If you answered Yes to at least questions 1, 2, and 3, then a DMS solution may be applicable to your organization.

Contact Information - (Optional). All respondent's identities will be kept confidential.

Name/
Company_____

Phone_____Fax_____

MACROS CADL CDEs

by Craig Storms, Debbie Rossing, and Usman Rashid

Macro Text Commands: Editing Macros and Customizing Status.txt

Macros are essentially memorized keystrokes and cursor pick positions. Once you begin recording a macro (CTRL-J), all actions are recorded and available for playback. For short and simple macros, it is easy to take a series of steps from start to finish, and if you choose to make changes, start over and record the whole macro again.

As the complexity of steps increase, the strategy of repeating the entire macro from scratch becomes less effective. An advanced tip is to "text-out" a macro. To do this with a macro library loaded simply choose FILES, MACROS, LIBRARY, TXT-OUT. Type in the name of the macro (you must know it, use the LST/EXE option to reveal a list of macro names in the current library). You are prompted to enter the file name, always given a .txt extension.

The file can be edited using any text editor such as DOS EDIT. A simple sample file is shown below. LOADBLK1.TXT contains the text for a simple macro used to load a blank file (BLANK1.PRT) without stopping to save the current file (careful!).

```
LOADBLK1
ROOT
ROOT
ROOT
MENU5
MENU1
MENU2
MENU1
blank1
ACCEPT
ROOT!).
```

To make a similar file that loads a different blank file, perhaps one with different system settings called blank2.prt, it might be easier to change the name of the file (from blank1 to blank2) and the name of the macro (from loadblk1 to loadblk2) to create a new macro. Using the TXT-IN option creates the new macro and automatically stores it in the current library.

Similarly, if errors were found in the macro and it was fairly complex, it might be easier to text-out the macro, edit the file and text-in in the modified text with the same macro name. Careful here! Once a macro is read in it permanently changes the library file.

Advanced editing tricks like this can enable you to build very complex macros. As macros grow in size, it is sometimes helpful to break them into smaller pieces. This is easy to do since you can chain (or jump) one macro to another. Executing CTRL-E (to run a macro) while you are recording a macro brings up a prompt for jump condition. A jump condition of 1 is true, and this condition will execute the macro name that gets keyed in on the prompt line. Using this technique you can chain one macro to another repeatedly. In fact you can create a macro that loops by chaining or jumping to itself. This is known as a recursive program.

The following lists macro text commands for basic keyboard control and all immediate mode commands such as redraw (CTRL-R) and autoscale (ALT-A):

F1	MENU1
F2	MENU2
F3	MENU3
F9	MENU9
ESCAPE	ROOT
ENTER	ACCEPT
F10	BACKUP
CTRL-A	ARROWS
ALT-A	AUTO
CTRL-B	WITNESS
ALT-B	BACK1
ALT-C	SHOWINST
CTRL-D	DEPTH
ALT-D	DOUBLE
CTRL-F	SV_PRT
ALT-F	SLIDE
CTRL-G	GRID
ALT-G	MDL_LAY
ALT-H	HALF
CTRL-I	CALC
ALT-I	UNDO
CTRL-K	PAUSE_MACRO
ALT-K	CPLANE
CTRL-L	LEVEL
ALT-L	L_LIMIT
CTRL-M	HATCHT
ALT-M	EMASK
CTRL-N	DIS_DIM
ALT-N	MLEVEL
CTRL-O	MPT_MACRO
ALT-O	SEL_LIST
CTRL-P	HATCHINT
ALT-P	PAN
CTRL-Q	DEL_SNG

CTRL-R	REDRAW
ALT-R	DBSW
CTRL-S	HATCH_UP
ALT-S	SCALE
CTRL-T	TRACK
ALT-T	LSTYLE
CTRL-U	UNDEL
ALT-U	HELP
CTRL-V	VWWLD
ALT-V	VIEW
CTRL-W	CONST
ALT-W	WINDOW
CTRL-X	SNAP
ALT-X	COLOR
CTRL-Y	DIGITIZE
ALT-Y	LWIDTH
ALT-Z	PEN

Note that for each immediate mode command or status window selection there is a macro text command to match. An added trick here is that these text commands can be used to customize the CADKEY status window.

The text file status.txt is the text file that is read into CADKEY at startup to configure the status window area. Do not edit this file without making a backup copy first (copy status.txt status.bak)!

The comparison in Figure 1 shows a default system status.txt file and a new one incorporating changes into the status window area. In this example the immediate mode commands autoscale (ALT-A), redraw (CTRL-R) and window-in (ALT-W) are placed at the top of the status area, making them available with the click of the mouse rather than using the keyboard. Many users prefer this convenience, and the technique can be used to rearrange status line items as well.

By substituting the new status.txt file, the system interface shown in Figure 2 occurs at startup. Notice the new status window area. Macro text commands provide a dual approach to system customization by allowing you to edit macro text files and customize the status window area inside CADKEY.

As always, be sure to backup all files (macro libraries, status.txt) before making any changes to your system.

Default Status.txt	Customized Status.txt
	WINDOW WINDOW
	REDRAW REDRAW
	AUTOSCALE AUTOSCALE
HELP HELP	VIEW VIEW=%d
VIEW VIEW=%d	CPLANE CPLANE=%d
CPLANE CPLANE=%d	DEPTH D=%f
LEVEL ALEV=%d	CONST CONST:%s/2D/3D
MLEVEL MLEV=%d	VWWLD COORD:%s/VW/WLD
COLOR COLOR=%d	LEVEL ALEV=%d
CONST CONST:%s/2D/3D	MLEVEL MLEV=%d
VWWLD COORD:%s/VW/WLD	COLOR COLOR=%d
DEPTH D=%f	SCALE S=%f
SCALE S=%f	HELP HELP
GRID GRID:%s/OFF/PRIM/ALL	GRID GRID:%s/OFF/PRIM/ALL
SNAP SNAP:%s/OFF/ON	SNAP SNAP:%s/OFF/ON
VERSEL VERSEL:%s/OFF/ON	VERSEL VERSEL:%s/OFF/ON
LSTYLE L-TYPE=%d	LSTYLE L-TYPE=%d
LWIDTH L-WID=%d	LWIDTH L-WID=%d
PEN PEN=%d	PEN PEN=%d
DBSW DB:%s/BACK/FWD	DBSW DB:%s/BACK/FWD
NTXTHT NH=%f	NTXTHT NH=%f
DTXTHT DH=%f	DTXTHT DH=%f
TXTASP AS=%f	TXTASP AS=%f
TXTANG RT=%f	TXTANG RT=%f
NFONT NF=%d	NFONT NF=%d
DFONT DF=%d	etc. (to match left)
WITNESS WIT:%s/BOTH/1st/2nd/NONE	
ARROWS ARR:%s/IN/OUT	
LEADER LDR:%s/BOTH/1st/2nd/NONE/SOLID/1SOL/2SOL/NARRS	
QTRIM QTRIM:%s/OFF/ON	
HATCHT HTRIM:%s/OFF/ON	
SEL_LIST SELLST:%s/OFF/ON	
HATCH_UP HTCH_UP:%s/OFF/ON	

Figure 1

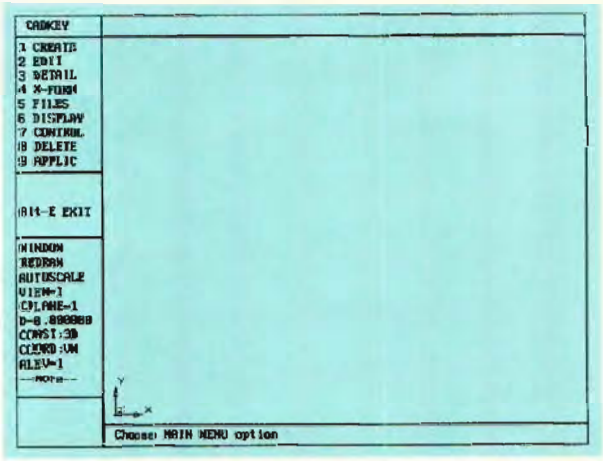


Figure 2

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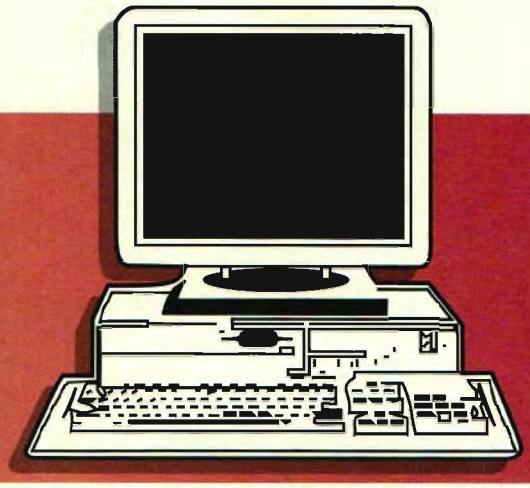

by Dana Seero

Getting a Grip on Model-Drawing Associativity

Model-drawing associativity is the ability of a CAD system to create 2D drawing views from a 3D model, and have the drawings update as changes are made. The ability to create and maintain these relationships saves time required for engineering changes. CADKEY 5 and 6 can do this, but I'm always surprised to find that many users don't take advantage of this power.

How is layout mode used? After completing the 3D model, you define paper size, drawing views, and add dimensions. Once this relationship is defined, any changes made in model mode will be reflected in the layout.

You can use CADKEY's dynamic rotation feature (DISPLAY VIEW NEW ROTATE PART) to create a new view. When saving, you have the option of naming the new view. If you don't, CADKEY will assign the name "System View" to each new view number after 8.

Does your drawing require supplemental views or sections? One technique to create an associative section uses EDIT SECTION POINTS to create cross-section geometry within the part geometry (Figure 1). Connect the points with a line string, then delete the points. You will be able to use this line string as your section, and any changes to the 3D model will also update the cross-sectional view (Make sure it's displayed when you make the changes.)

Access layout mode with the commands DETAIL LAYOUT, or

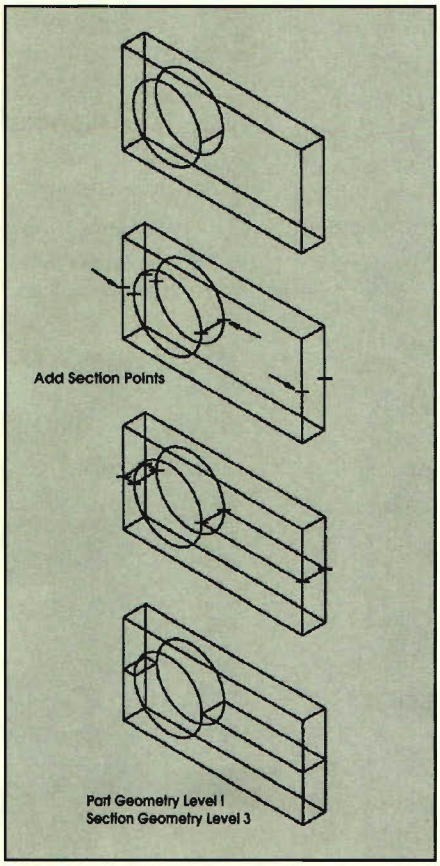

Figure 1

with the immediate mode command ALT-G. If no layouts are currently defined, the popup menu "New Layout" will prompt you for layout name, description, paper size, and initial drawing scale. If layouts exist, you will get the "Load Layout" menu, and a list of active layouts will be displayed.

After selecting the initial scale and paper size, you will see a screen with a heavy dashed-line border. If the border is not displayed, click on the PAP LMTS selection in the status window. These limits delineate the size of the paper defined, with the lower left corner at X=0, Y=0. Load a drawing template using FILES PATTERN LST/LD, and locate it using KEY-IN, at location 0,0. The standard templates in CADKEY are BORDA to BORDE; metric versions start with BORDA0.

Locate your views by eye. Once completed, you can change their scale on the paper using DETAIL LAYOUT INSTANCE MODIFY SCALE, and selecting each instance (dimensions will be correct regardless of scale). You can also rotate them using the LOCATE selection. Finally, you can insure that each view is properly aligned using DETAIL LAYOUT INSTANCE MODIFY ALIGN. Selecting AUTO will allow you to locate views orthographically from a fixed instance: MANUAL allows you to locate views according to other geometry.

There are several ways to blank unneeded entities. Often, the fastest method is to blank all entities in the active viewport, then bring back only those required for that detailed view. Use DETAIL LAYOUT MODIFY BLANK (and UNBLANK). For isometric views, you can also process the model using Picture-It, saving the hidden-line-removed view to a new level, then activate this geometry through the INSTANCE MODIFY LEVEL command (you must run Picture-It each time you change the geometry: blanking the hidden lines in an instance will give you a view that automatically updates).

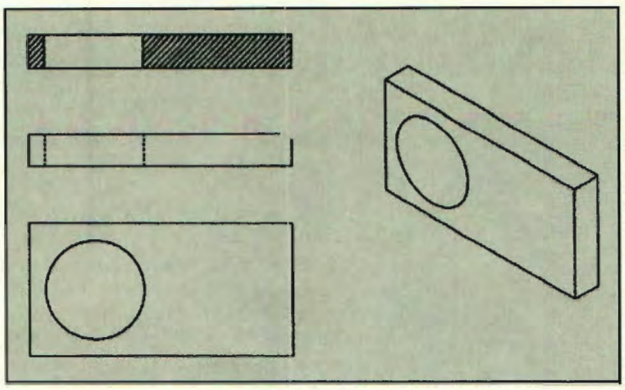

Figure 2

One method for creating a cross-section associative with the geometry is shown in Figure 1. By creating this cross section on a different layer, you can blank all the part geometry as required. An example of how this technique works is shown in Figures 2 and 3. Notice that, if you use BOX MOVE to shift the hole from left to right, the cross-section (defined by the cross-section geometry) shifts with it. This is a simple example (you don't need to create the section lines to do the same thing), but illustrates the technique.

Because creating drawing views is a repetitive process, there are a number of tools available to speed up the process. First, the CDE "CRE4VIEW" ships with CADKEY 6. You must first load it using FILES CDE LST/OPN, then run the program using FILES CDE LST/EXE. The program prompts for the layout name, description, paper size, and scale, then automatically creates a four-view drawing from the information you provided. Another free utility, "HORZLNS" automatically creates horizon lines for arcs and circles.

There are also third party drafting automation tools available. For example, Draft-Pak will automate the process of creating layouts and views. It allows dynamic scaling of instances, provides a form to fill in the title block (which can be customized) and adds center lines and horizon lines to arcs and circles. K

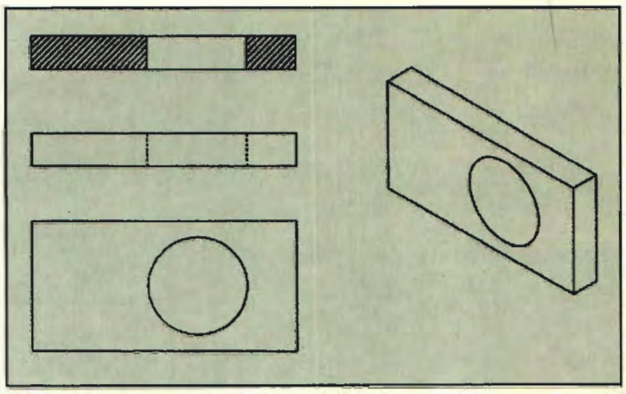

Figure 3

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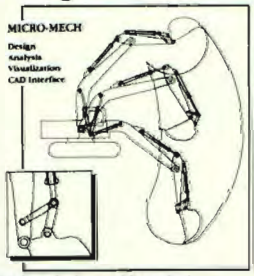

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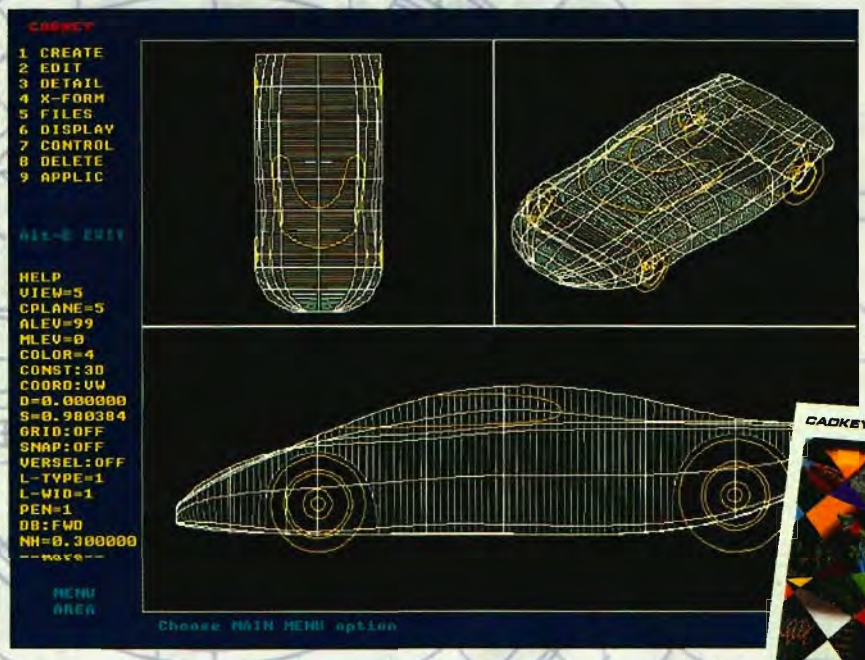

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