

KEY SOLUTIONS

CONCURRENT ENGINEERING FOR THE 90'S

CE Issues

AGILE

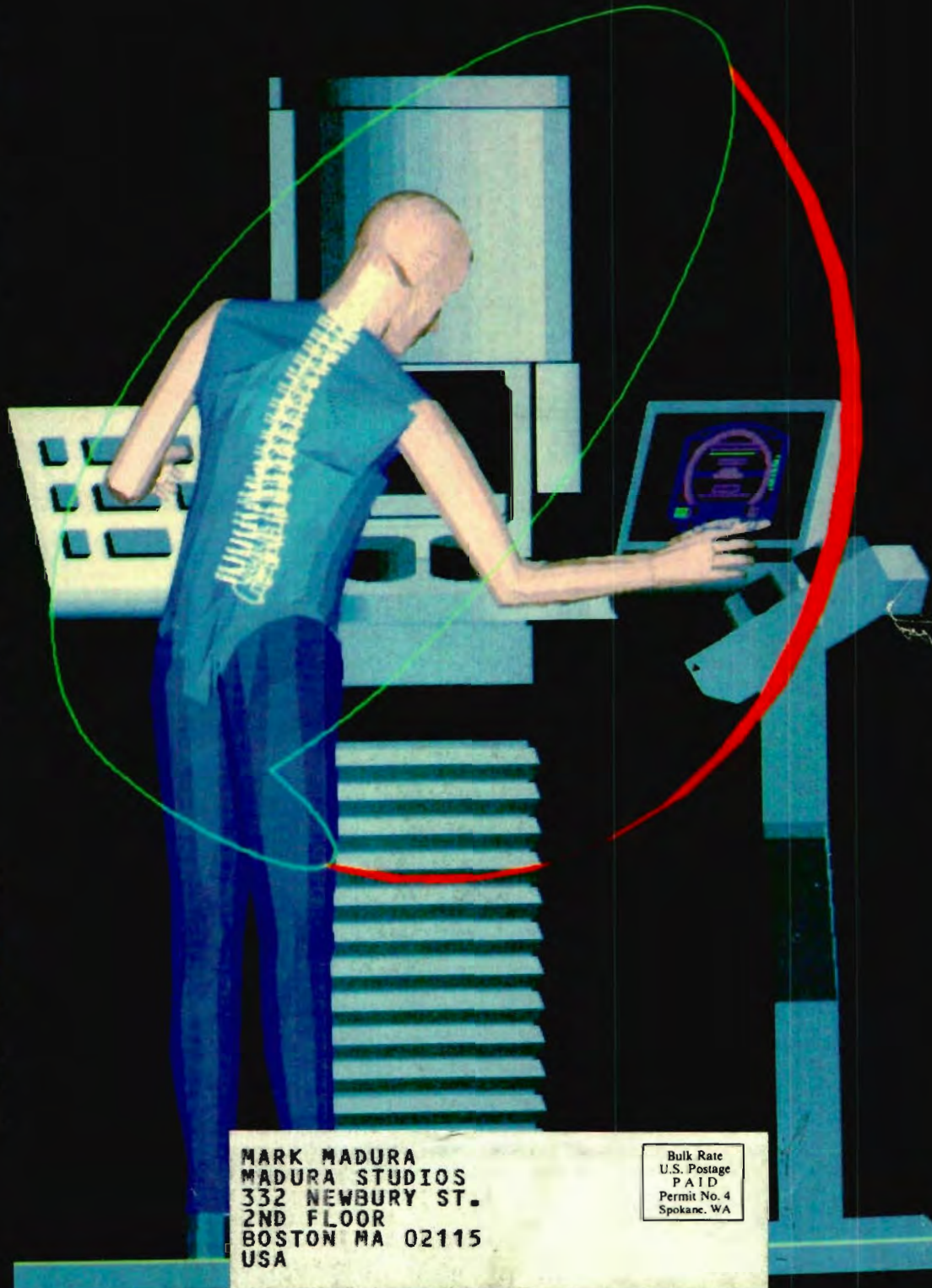
MANUFACTURING
What It's All
ABOUT

CE Solutions

Tips For CAD/CAM
DATA
TRANSFER

Products

MENU
TABLETS
With CADKEY



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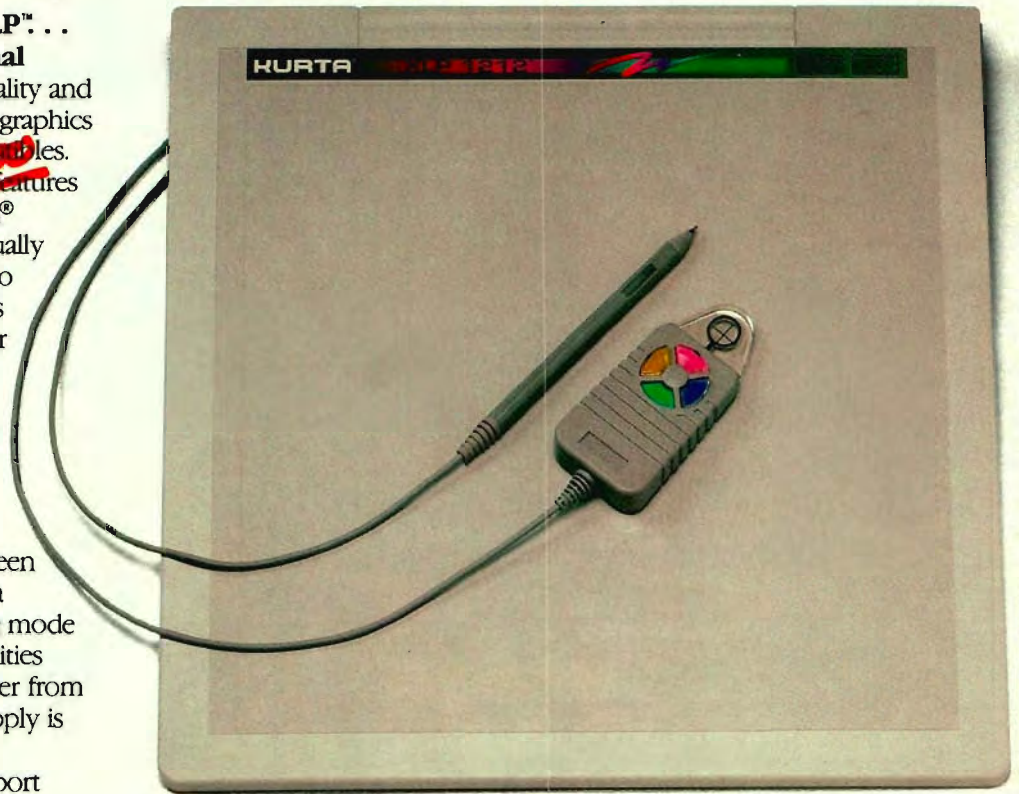
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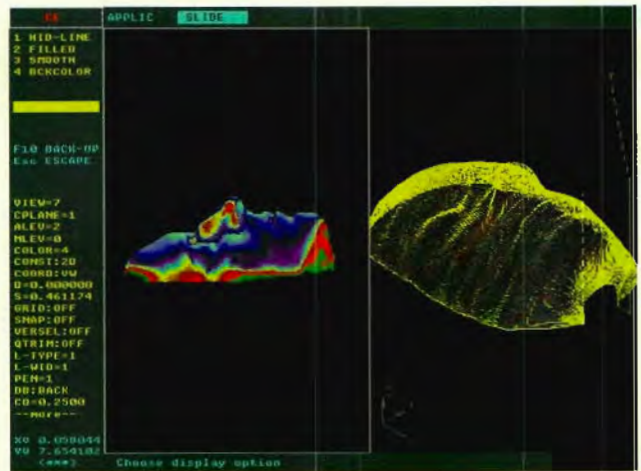
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LET'S FACE IT!

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

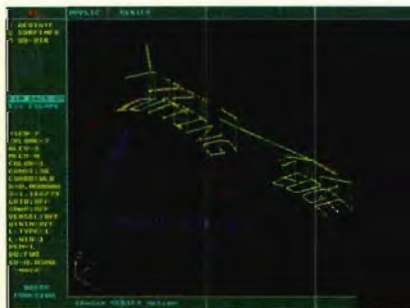


CUTTING EDGE SURFACES has:

- all the geometry of CADKEY
- surface modeling of FASTSURF
- complete tool path editing
- a library of over 100 post processors

No other CAM package has :

- 100% CADKEY data base compatibility
- 100% CADKEY human interface
- a complete CDE & CADL environment
- general NURBS surface machining
- CADKEY IGES capabilities

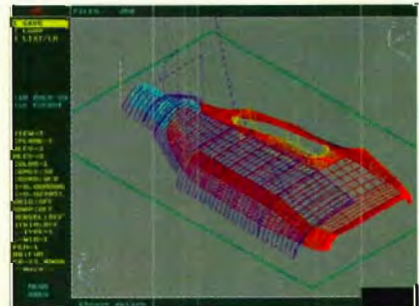


CUTTING EDGE SURFACES can be used as a stand alone CAM system for 3-axis milling, drilling, boring, reaming, slotting, pocketing, tapping and contouring. Immediate verification of the tool path before cutting reduces material waste.

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About Value Engineering

Value Engineering is a technique used to achieve maximum product value while cutting costs. It is not simply a search for new materials and processes. It is a well-informed, creative study of every item of cost in every part or material used. It focuses Engineering, Manufacturing, and Purchasing on one objective: equivalent performance at lowest cost.

About VEA

We at Value Engineering Associates are interested in helping your organization realize the benefits that lowered product costs contribute to the health and well-being of an enterprise.

At a time when competitive pressures demand not just low cost but superior quality as well, and at a time when in many cases there are fewer people available to respond to those pressures, we believe the value engineering approach ensures not just competing but winning!

VEA Services

- Value Analysis
- Product Design
- Tool Design
- Manufacturing Analysis
- Factory/Product Automation
- Domestic & International Sourcing

*The Savings Achieved Through
A Rigorous VE Effort Can Be
Dramatic!*

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SOME OF OUR CONTRIBUTORS



Peter L. Grieco, Jr. is President and CEO of Professionals for Technology Associates, Inc., an international consulting and education firm specializing in Automation and Systems Implementation, Just-In-Time, and Total Quality Control. With more than twenty-five years as a practitioner and educator in manufacturing, Mr. Grieco has co-authored numerous textbooks including *World Class: Measuring Its Achievements*; *Supplier Certification*; and *The World of Negotiations: Never Being A Loser*.

Frank Lucatelli formed Software Ventures, Inc. in 1983 for the design and implementation of custom and commercial engineering software. Mr. Lucatelli's consulting business, Performance Patterns, integrates principles of team work with the creative use of technology. His models for team work came from twenty-five years in Human Educational Alternatives Research, Inc. (HEAR), which he founded in 1969.



Bob Shaefer is the founder of PTI Corporation, which offers implementation consulting comprised of training in CAE technology and Personal Styles Technology for companies that use plastic materials. Formerly, he was general manager of the North American operations of Moldflow Pty. Ltd. With over twenty-five years in the plastics industry, Mr. Shaefer is a frequent contributor to industry publications, including *Modern Plastics*, *Plastic Technology* and *Computer Aided Engineering*.

On the Cover:

Model of a human programming an industrial robot in a work cell. For more on ANTHROPOS and CADKEY, see the story inside. Photos courtesy of IST GmbH, Gross-Rohrheim, Germany.

KEY SOLUTIONS

Concurrent Engineering for the 90's

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KEYTALK

As an avid magazine reader, I have plenty of personal opinions about magazines in general -- not just **KEYSOLUTIONS**. As a reader and consumer, I like the stories, but I think that even the display ads (maybe especially the ads) are informative and useful. They keep me in touch with new products and technologies. Even though I don't necessarily believe everything I read in the ads without checking, I find they give me ideas and help me gather data for purchases.

What's the scenario if you see an ad that sparks your interest? You have several choices of varying quality: you can call the company directly -- if it's a weekday and if you remember their time zone and if you want to take the time to ramble around an electronic answering system or talk to a real person; you can contact a store or dealer -- if you're close to one or want to take the time; or you can put little circles around those oh-so-tiny numbers on the "bingo card" and then hope you remember to mail it. If you opt for the "bingo card" and if you're real, real lucky, you'll eventually (as much as 6-8 weeks later) get some material in the mail or a phone call.

If you're a "right-now" type person like me, "bingo cards" just don't cut it. I don't want to wait that long. I want to know now! So after many conversations with readers and advertisers and some in-depth analysis, we came to the not-so-amazing conclusion that Reader Service Numbers are archaic in this age of computers and fax machines.

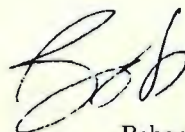
So, as 1994 begins, **KEYSOLUTIONS** is launching a new high-tech system to help readers and advertisers communicate. We have, in fact, replaced the Reader Service Numbers and "bingo" cards with an advanced fax service that will let you get fax and audio information on products -- instantly -- 24 hours a day.

Here's how it works. On some of the ads in this issue you'll notice an 800 phone number followed by a 6-digit code. You simply dial the toll-free number (day or night, even weekends and holidays) and enter the code when asked. Then select the information you want, enter your fax number, and leave your name, address, and fax number. Information on the product will be faxed to you -- *immediately*. What could be easier and more convenient?

This new fax system is optional for advertisers and so there may not be a code on every ad. You will continue to contact these companies directly.

We think this is a great way to do business for both you and companies you want to contact. Let us know your reactions and if you run into any problems.

Last, but not least! All of us at **KEYSOLUTIONS** wish you and your company in all your endeavors an incredibly prosperous, healthy and happy New Year.



Robert Martin
Technical Editor

S.O.S.

The S.O.S. Save Our Schools program at Selkirk High School has really given morale a boost. The kids are extremely excited about learning and technical education -- CAD, machining, etc. In fact, we have a waiting list for some classes.

School budgets being what they are, there is no way we could have set up the computer/CAD lab this year without the help of **KEYSOLUTIONS** and the wonderful companies who have contributed materials.

I want to express the most heartfelt thanks from the students, the staff, and the community to all who helped get the S.O.S. program started. A very special thanks to --

Cadkey, Inc. - for software for our fledgling CAD lab

Intel Corp. - without whose math coprocessors we could not run CADKEY

Glencoe Publishing Co. - for a set of "Mastering CADKEY" textbooks

HLB, Inc. - for CADKEY drafting productivity software and templates

ACECAD, Inc. - for five 12" X 12" digitizer tablets

Paradesign - for software

Interactive - for Electronics Workbench Software

Crary & Clark Attorneys, Spokane, WA - for setting up all the legal stuff

We'll let you know how the program is going through 1994.

*Robert Fromm, Superintendent
Selkirk School District
Metaline Falls, WA*

Can You Help?

The support S.O.S. has received so far has been extremely satisfying, but the needs at Selkirk are still great and we have been contacted by other schools that would like to become involved.

So, please, please donate any old computers (386s), old NC or CNC equipment, books, software, and even cold hard cash. Money goes into a special trust account as part of a non-profit corporation. ☐

Bob Martin - KEYSOLUTIONS

KEY NOTES

CADKEY in the News

Advanced Modeler Ships

Advanced Modeler, the latest addition to the Cadkey product line, is now shipping. This integrated surface and solid modeling package utilizes state-of-the-art NURBS-based technology. It offers a wide variety of surface and solid modeling capabilities, solid primitive construction, extensive editing features, and an advanced IGES bi-directional translator. "Every review indicates that this is an outstanding product," stated Malcolm Davies, President and CEO of Cadkey. For the name of a Cadkey dealer near you, call 203/298-8888.

New Business Hours* at Cadkey

Switchboard	8:00-5:00 (Ext 0)
Customer Service	8:00-6:00 (Ext 8030)
Sales	8:00-6:00 (Ext 6467)
Tech Support	8:30-6:00 (Ext 8060)

*Eastern Standard Time

DataCAD

Cadkey's three new product packages related to DataCAD were offered through an intensive direct mail campaign in November and December. The packages are DataCAD Starter (\$49.95), DataCAD Plus (\$99.95), and DataCAD Professional (\$149.95). After this promotion, DataCAD Professional returns to its regular price of \$495.

Cadkey and Windows

A pre-release version of the CADKEY OBJECT Developer is available for those interested in building applications on top of it. For more information, fax a request to Christine Sweeney at 203/298-6484.

Development is continuing on a version of

(Continued on next page)

Industry News Digest

Reported in Computer World . . .

. . . Microsoft Corp. will give its Windows NT Advanced Server client software to first-time corporate buyers — probably in an attempt to entice them to choose NT over Novell, Inc.'s Netware as their primary client/server platform. Less clear, however, is whether bargain-basement prices will help Advanced Server carve a significant slice out of Novell's 68% to 70% share of the overall network operating system installed base.

. . . Intel Corp. is staring straight at a pincer-like move that could force it to lower its prices and shift its Pentium strategy in 1994. Surrounding Intel are the PowerPC initiative from IBM, Apple Computer, Inc. and Motorola, Inc. and Cyrix Corp.'s coming M1 chip design. The PowerPC systems began shipping in September. Like the Pentium, the M1 features a superscalar design. But unlike the Pentium, it does not require 486 code to be recompiled to top performance. Cyrix claims that the 66MHz chip based on the M1 design will run most 486 code 30% to 50% faster than today's 66MHz Pentium.

Reported in CAE (Computer Aided Engineering) . . .

. . . Control Data, Arden Hills, MN, is remarketing Sun Microsystems Computer Corp.'s complete line of workstations, servers, and software worldwide. It will integrate Sun systems with other products and services and add value with a full range of integration services, consulting and application solutions.

IDEAL Wins Part NAVFAC CAD 2

IDEAL Scanners & Systems, Inc. has been selected by Cordant Inc. of Reston, VA to support Cordant's participation in the Naval Facilities Engineering Command Computer Aided Design Second Acquisition Program (NAVFAC CAD 2). IDEAL will provide the large format drawing scanners and software to capture existing engineering drawings for this major CAD program. NAVFAC CAD 2 is the largest Architectural Engineering and Geographic Information Systems CAD effort ever undertaken. Both Department of Defense and civilian agencies can order the contract's products and services. Cordant and Intergraph Corporation were each awarded twelve year contracts under this \$550 million procurement.

Faster Than A Speeding Modem

You will soon be able to transfer scanned or vectorized drawings and documents, black-and-white or color, at speeds in excess of those available via modem to anywhere in the United States, and eventually the world. Subscribers to Scan-Net, a service from Ideal Scanners and Systems, Inc. (Rockville, MD) will have their own Personal Earth Station and terminal equipment. Direct access is acquired by customers, suppliers, and vendors through interconnected LANs, which allow the transfers to take place electronically, eliminating paper waste. Unlicensed correspondents can gain access via licensed reprographic service bureaus.

Technical Paper on Mold Industry Wins Award

A technical paper written by Colin Austin, Managing Director of Moldflow, Inc. was selected as the best technical paper at Antec 93. The title of Austin's paper is "Industrial Metamorphosis." It explains how companies who design and manufacture plastics components using injection molding process are changing from a craft-based "over the wall engineering" approach to an approach using teamwork based on scientific understanding of plastics via CAE plastics flow analysis technology.

DOS 7 and/or Windows 4.0

Microsoft will provide alternatives to consumers in its next releases. Chicago or Windows 4.0 will combine DOS and Windows functions, and a character-based version of DOS 7.0 will also be available. Chicago, a 32-bit multitasking, multithreaded version of Windows that will not require DOS to run, is expected to ship in mid-1994. According to Steve Ballmer, vice president of Microsoft's sales and support group, "There will be a DOS 7.0 that can be surgically removed (from Chicago) and sold separately for those who want to only run character-based applications." But he added, "I don't think it will be as popular."

Some analysts and users predict that a character-based DOS 7.0 may be more popular among users than Ballmer is willing to admit. Sales of character-based DOS 6.0, released last April, have already exceeded 4 million copies, making it one of the company's best-selling products despite mixed reviews. "There is a lot of industry focus on Windows because that is where the action is. But there is a sizable-based business with DOS. I have to believe that DOS is still a very important business to Microsoft," said Ed Iacobussi, chairman of Citrix Systems, Inc. in Coral Springs, FL.

Autodesk Acquires Hoop

Autodesk, Inc. has acquired Ithica Software and its Hoops graphics system. Ithica Software will become a wholly owned subsidiary of Autodesk, Sausalito, CA. Ithica will retain its name and continue to operate from its Alameda, CA headquarters. Hoops is said to be one of the only systems capable of producing advanced graphics applications across the entire spectrum of workstations and PCs.

Wireless Communications Ahead for Mobile Computing

Traveling Software, Inc. of Bothell, WA and National Semiconductor Corp. of Santa Clara, CA have agreed to jointly develop and market integrated hardware and software products using wireless technology. The first product, expected in the first quarter of 1994, will use communications software from Traveling Software and integrated communication hardware from National Semiconductor. This solution answers the need for fast, convenient and low-cost ways to coordinate information between desktop, portable, and handheld computers in the home and workplace. It's compatible with current portable platforms and adaptable to future computing standards.

New Technical Center in Michigan

Desktop Engineering's new technical center in Southfield, MI will be the focal point in actively marketing their wide range of engineering services, including computer-aided software development, computer-aided engineering analysis, engineering testing programs and structural/mechanical engineering consulting. The technical center will also be the hub for servicing the many users of the company's packaged software products, including the DE/CAASE computerized engineering handbook.

Desktop Engineering pioneered the computerized engineering handbook which puts information that was once buried in books at engineers fingertips. Desktop Engineering is associated with Columbia University's testing laboratory. This 25,000 square foot lab provides nearly unmatched structural and materials testing capabilities, including universal testing machines, fatigue testing and strain gauge facilities, data acquisition systems, machine shop equipment, vibration and acoustics laboratory and photoelasticity capabilities.

CADKEY in the News

CADKEY under Windows and Windows NT. Its probable release date is planned for sometime in 1994.

CADL/CDE Training Kit Update

The CADL/CDE Training kit mentioned in the August/September issue of KEYSOLUTIONS will not be available until winter 1994 due to new additions to the product.

New Technical Support Policy

Cadkey is restructuring their Technical Support department. Under the new support policies, Cadkey no longer provides free, unlimited Customer Technical Support by telephone to non-maintenance customers. The elimination of free technical support is becoming standard practice in the software industry.

Unlimited Free Support will continue to be available via Compuserve and the Bulletin Board. All new customers, however, will receive 30 days free phone support. After the initial 30-day period, phone support will be available only through the purchase of support contracts.

The two new Technical Support Contracts available to customers are: 1) One Month Contract for \$75 and 2) Three Month Contract for \$150. This is telephone/fax support only. These support contracts do not provide product upgrades. Customers are still encouraged to obtain local support services from their authorized CADKEY dealer.

Dealer Support

Kim Garner and Ronna Goslin are now responsible for the North American CADKEY and DataCAD dealer channel. They have been the Dealer Managers for the Western and Mid-west regions respectively. Tony Mazzagatti, Director of North American Sales, will assist in Dealer support.

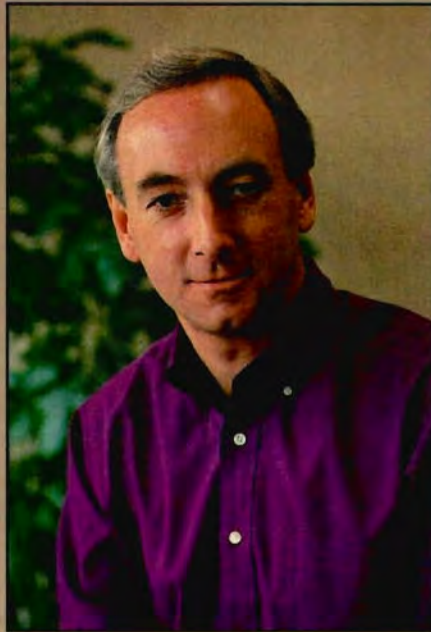
Cadkey Forum

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

I would like to recognize the valuable role played by our most important business partners: Authorized Cadkey Dealers. Unfortunately, we at Cadkey sometimes take our Dealers for granted. We suspect many customers do also. Cadkey could not exist without its Authorized Dealers; they are our local representatives, supplying excellent service and support, combined with local knowledge and experience.

Here's a partial list of reasons why you should build and maintain a good working relationship with your local Cadkey Dealer, and not simply think of the Dealer as a source of Cadkey software:

- *Local Knowledge:* Your Authorized Dealer knows you, and your business, systems and configuration.
- *Needs Analysis:* Authorized Dealers are able to assist customers in analyzing their needs and in recommending solutions.
- *Demonstrations:* Authorized Dealers are qualified to demonstrate and benchmark Cadkey software on-site where appropriate.
- *Systems Integration:* Authorized Dealers are experts in integrating and optimizing hardware, software and networking.
- *Technical Support:* Authorized Dealers are experts on Cadkey software and are best able to help with technical questions through annual support contracts.
- *On-Site Consulting and Customization:* Many Dealers are able to visit customers and provide personalized consulting services including the development of special drivers and software.
- *Training:* Authorized Dealers are able to offer customized training on Cadkey products to enhance customer productivity.
- *Scanning, Plotting and Printing*



Support: Many Dealers offer special services to handle customers peak-loads or special requirements.

• *Users Groups:* Many Cadkey Dealers support Users Groups where you can meet fellow Cadkey customers and share information and ideas.

Some of the services will be free, others will be subject to a reasonable charge. Remember, many Cadkey Dealerships are family businesses. They are small because their owners want to provide personal attention to every customer and to build long-term relationships based on quality of service and trust.

The purchase of Cadkey software is just the beginning of your Cadkey investment. Equally important is careful implementation of a training strategy and a data management strategy to maximize your return on investment.

Please use your Dealer as your business partner, not just as a supplier of Cadkey software. Your Authorized Cadkey Dealer has a vested interest in your success and growth.

Late Breaking News

Major Account Program

Cadkey's Major Accounts Program, launched during the summer of 1993, offers qualified end users discounts on Cadkey products ranging from 15% to 45%. "Companies such as AT&T, Eaton, EG&G, General Instruments, Honeywell, ITT, Siemens, Stanley and Zenith are a few who have joined the program within the last six months," said Andy Hidalgo, Director of the Major Accounts Program. Cadkey invites any user of its products who wants to explore whether their company can qualify for the Major Accounts Program to contact Andy Hidalgo at 800/394-2231.

DWG/DXF Translator Update

The DXF/DWG translators for CADKEY and CADKEY DRAFTER have been updated. They are available on the BBS (203/683-1379). The file name is DWGDXFDR.EXE and is dated 11/9/93.

New Users Group in Pennsylvania

A new Cadkey User Group has been started in Pennsylvania. For more information contact John Ewell at Prism Engineering, Inc. Horsham, PA at 215/674-9696.

Next CADKEY Resource Guide Due in March

The *CADKEY Resource Guide*, recently published by Value Engineering Associates and **KEYSOLUTIONS** was mailed with the Oct/Nov issue of **KEYSOLUTIONS**. It is also being distributed in new packages of CADKEY software. This handy reference guide contains comprehensive listings of third-party software packages, hardware and peripherals that support CADKEY and DataCAD. The *CADKEY Resource Guide* will be published twice a year with the next edition slated for March 1994. □

Charting a Course for the

CHANGES • CHALLENGES • GOALS

by Malcolm Davies

Cadkey's President and CEO revisits 1993 and shares the company's plans and visions for 1994.

Cadkey launched a series of innovative product and business initiatives during 1993 that will forever change the face of the PC-based CAD industry.

Cadkey was first to institute commodity pricing with the release of the full featured Drafter program (fully compatible with all our products) for \$995. This started a trend, putting an end to the artificial premium pricing in

PC CAD. In the AEC arena, architects and engineers now have a choice of three new versions of DataCAD 5 (formerly priced at \$1,995) at prices ranging from \$49 to \$149. This creates price points for robust software that are more than 10 times less the cost of competitive offerings.

The first sign that we were serious about reducing prices was our CAD tradeup offer at the start of 1993 when we packaged CADKEY 5 and a host of add-ins and add-ons together for \$495. List price at the time was \$3,495. At the low end, Cadkey broke new ground by offering CADKEY Light Version 5 (with 2D, 3D and drafting features) for \$99 - down from \$395.

The introduction of CADKEY 6 in 1993 was another step forward for this award winning 3D package. A major new feature is innovative shape recognition and shading technology called CADKEY Picture It. This intelligent PC-based visualization tool lets users work quickly on wireframe models interactively. CADKEY 6 is also the foundation for the ADVANCED MODELER, a NURBS based product that combines wireframe, surfaces and solids on the PC platform -- another pioneering achievement. ADVANCED MODELER is sold in a standalone version for \$995, and features a Windows-like interface.

Cadkey's MEC and AEC product strategy for 1994 and beyond capitalizes on the acceptance of Windows and Windows NT. Over the past three years, we have reengineered our technology upon an object oriented programming foundation. NT is ideally suited for this approach, which also allows third party developers to easily integrate engineering and personal productivity tools into enterprise solutions.

Our first offering is the CADKEY OBJECT Developer, which will ship on CD-ROM in February. This full object-oriented, scalable, modular package, lets users create applications entirely of their own design and database structure. OBJECT Developer's release will mark the first time an advanced graphics development environment has been combined with a powerful object-oriented database in one consistent user interface.

This array of new products and trend setting pricing policies can't be accomplished without changes in the way Cadkey does business. This model for the 90's is already paying dividends. For the fiscal year ending October 31, 1993, Cadkey total revenues were 20% greater than 1992.

Our sales strategy in the face of these changes is to employ mass marketing techniques. At the same time, we are initiating a major accounts program and continuing to sell CADKEY 6 and ADVANCED MODELER, our flagship products, through the VAR channel. As the prices for all CAD software continue to fall, the VAR is adapting by packaging their expertise, selling service and support to an increased customer base now able to cost effectively add new seats. Cadkey's major account restructuring is being done in conjunction with meeting VAR needs.

Changing the face of CAD also means reinventing a new Cadkey organization. We have opened an office in Asia and created Cadkey Europe through a \$1 million investment from Rudolph Kunzli, who put Autodesk on

the map in Europe. Rudolph also provided an additional \$1 million for domestic marketing and sales investment. After employing a series of internal streamlining measures, we have outsourced a number of these functions so Cadkey can completely focus its efforts on the two basic objectives of doing business in the 90's -- Product Development and Demand Creation.

Winners in the CAD arena of the 90's will be the companies who bring new technologies to market fast, offer mainstream pricing and provide seamless suites of quality software tailored for a variety of solutions. Cadkey's goal is to become the preeminent producer of low cost, high quality MEC and AEC software products. We intend to stand in the winner's circle!



NEW PRODUCTS

SOFTWARE

Machineable Fonts

Arcdraft America is shipping MACHINEABLE FONTS, a companion product to PRECISION FONTS FOR CADKEY. These full curvilinear implementations of industry standard typefaces can be output to NC postprocessing software. MACHINEABLE FONTS are extrudable and visible in all views, and are available in seven styles, precisely emulating HLV Light, HLV Medium, HLV Bold, UNV Heavy, Machine FUT2 and OPT. Each set of high resolution patterns includes all upper case, numeric and 20 punctuation characters.

Contact Arcdraft America at 800/447-4165 (U.S./Canada) or 904/389-4899 (overseas).

Menu Driven Digitizing/Measuring

GEOCOMP, LTD. has released a menu driven digitizing and measuring program, Easydij 8.1, for the IBM/PC and the PS/2, and any digitizer tablet. The program operates under DOS 2.0 or greater, Windows 3.1 and OS2. New features include: latitude/longitude or rectangular coordinates with azimuths between points; digitizes coordinates directly into a DXF or DBF file; and automatic conversion of degrees-minutes-seconds to decimal degrees in Locate menu. The user can define digitizer cursor buttons within the program, so that Easydij can plot points or draw lines in graphic form. Program licenses list for \$390 each; program updates are \$80 each.

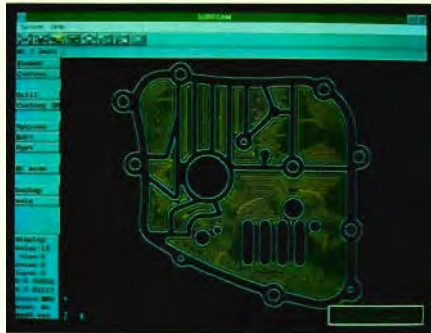
Contact GEOCOMP, LTD. at 303/233-1250.

SURFCAM 4.0 Released

Surfware, Inc. has announced SURFCAM 4.0 for DOS and Windows. The system includes new time-saving capabilities such as 3-axis multi-surfacing machining with end mill and bull nose cutters, additional CAD translators and new geometry construction techniques. SURFCAM 4.0 offers shaded surface modeling with an unlimited number of colors and user-defined light sources. Enhanced wireframe geometry construction offers new commands such as chamfer, two

point, tangent to three arc and circle construction, ellipse, helix, spiral, tapered spiral helix, and grid of rectangular and circular points. The IGES translator has been enhanced to allow customization of IGES files to specific CAD/CAM systems, versions and company parameters.

Contact Surfware, Inc. at 800/488-3615, 818/361-5605 or Fax 818/361-1919.



Surfware's SURFCAM 4.0 for DOS and Windows

3D Images and Motion Sequences

Visual Software announced Visual Reality, a family group of products for the creation of photorealistic images and motion sequences. The package (\$595) runs on PCs under Microsoft Windows. Features include modeling (Visual Model/Visual Fonts), rendering (Renderize for Windows), camera animation (Renderize Live), image composition (Visual Image) and a library of 3D models (Visual 3D Clip Art CD). All editing is done with the mouse and imported models and objects can be texture, bump, transparency and reflection mapped. Renderize features unlimited camera angles and light sources. Visual Model has high-end modeling functions such as splines, cut, extrusion, and surface of revolution. Registered Renderize and Renderize Live owners can upgrade for \$290 and \$195 respectively.

Contact Visual Software at 818/883-7900 or Fax 818/593-3750.

Draftsman Upgrade

Arbor Image Corporation has upgraded Draftsman, their raster to vector conversion program. Version 7.3 is now available for both DOS and Windows 3.1. Draftsman 7.3's new

features include the ability to set separate parameters for small entities and have these entities automatically placed on a second layer in a color different from the long lines and arcs. Draftsman's ability to convert drawings in segments has been improved and the segments are now seamlessly patched together. In addition to Draftsman's vector file support (DXF, IGES, CGM and others), Draftsman 7.3 produces HPGL and EPS formats.

Contact Arbor Image at 313/741-8700.

DMS PRO 2.0

The van der Roest Group, Inc. has released DMS Pro 2.0, a document management system for engineering and manufacturing environments. Designed to maximize productivity by cutting engineering change control cycle times and the cost of document distribution and fulfillment, DMS Pro supports simultaneous DOS and Windows operations on all major networks and client/server environments. Document formats can range from CAD drawings, text files and imaging file formats including CALS. DMS Pro is fully customizable with an optional tool kit which includes menus and screen builders, reporting options such as QBE, natural language and SQL, and hooks into programming languages like BASIC and C. DMS Pro has three primary modules: a required base system, one optional change control, and document distribution and fulfillment modules. The system is licensed on a concurrent users basis in increments of five. Site licensing is available.

Contact The van der Roest Group at 714/542-2201 or Fax 714/543-4931.

Coupler Curve Catalogue

Saltire Software announced the Atlas of Linkage Design and Analysis, a comprehensive software and book catalogue of coupler curves for mechanical engineers. Over 500 pages of diagrams describe the motion of four broad families of linkage: the crank-rocker, crank-crank, crank-slider and inverted crank-slider. Over 3000 coupler curves are shown. An introduction by Eugene Fichter, Ph.D., P.E. of Oregon State University covers the use of the Atlas in designing four bar linkages and the application of four bar linkages in

the design of more complex mechanisms. The accompanying Windows-based software allows any model from the Atlas to be loaded and analyzed for coupler location, velocity and acceleration throughout the motion of the linkage. The Atlas is fully compatible with Saltire's Analytix mechanism design and analysis software (\$895). The Atlas of Linkage Design and Analysis is priced at \$199. Contact Saltire Software at 503/622-4055 or Fax 503/622-4537.

INPUT

Flexible Digitizer
CalComp's Digitizer Division has released the E-size (36- x 48-in.) version of EstiMat, a flexible digitizer designed for estimating in construction and related industries. It is fully compatible with CalComp's DrawingBoard III family of digitizers. The EstiMat can perform "take-off" analyses, automatically translating printed plans into area, length or item count calculations. The flexible digitizer can be rolled up for easy storage and transport and can be used with the controller housing at the left or at the right edge of the tablet. EstiMat works with popular CAD applications, mouse-driven programs, and Windows. EstiMat connects to a standard RS-232 serial port. The E-size EstiMat is \$2395 and the D-size \$1995, including the digitizer, choice of one cordless pen or cursor, power supply, I/O cable, plan hold-down clips, software drivers and a two-year warranty.

Contact the Digitizer Division of CalComp, Inc. at 602/948-6540.

3D Digitizer Product Series
Science Accessories Corp. introduced the GP-12, a 3D digitizer which operates indoors, outdoors and under any lighting conditions. 3D data can be acquired from any solid object, inert or

in motion, regardless of its material content, or any object in motion within a 3.25 x 3.25 x 3.25 or 8 x 8 x 8 foot cubic volume. Standard systems have individual data point acquisition rates of 100 points per second and all

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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.

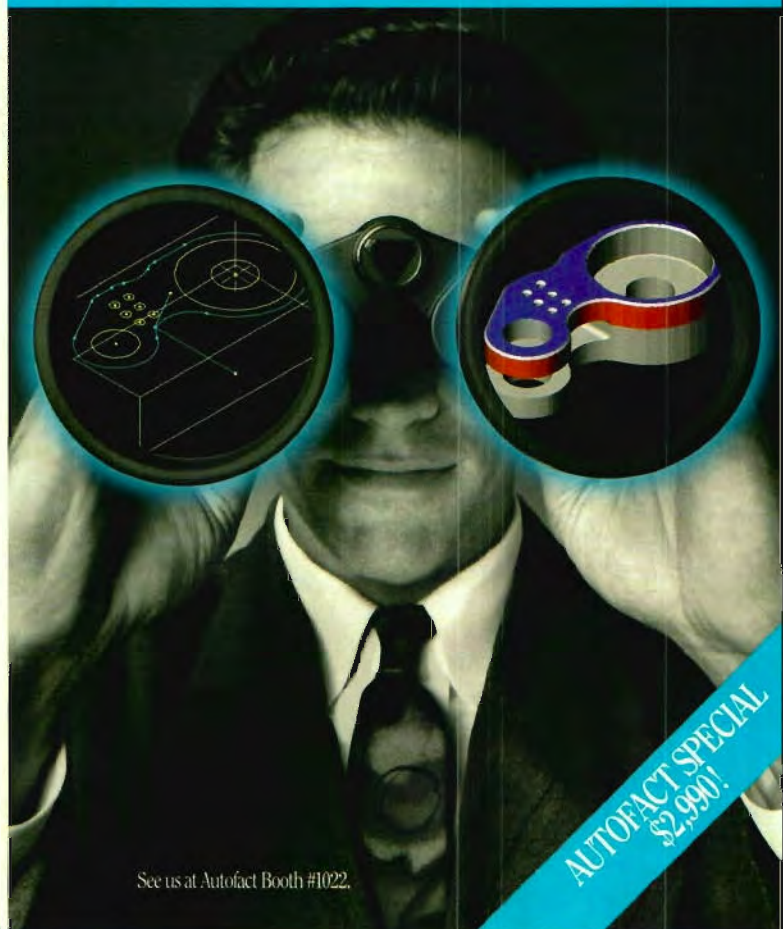
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NEW PRODUCTS

systems incorporate automatic continuous calibration. The GP-12 offers user-selectable resolution and formats that output X, Y, Z Cartesian coordinates to operate with the most popular CAD/CAM packages. The system includes: data collection array, hand held probe, interface controller with power supply, cabling, interface software and operation manual.

Contact Science Accessories Corporation at 203/386-9978 or Fax 203/381-9270.

HARDWARE

Cyrix 486DX Chips Released

Cyrix Corp. released 33, 40 and 50 MHz Cx486DX and Cx486DX2 CPUs. An alternate source for 486DX CPUs, Cyrix chips have an original design and independently developed microcode. They include an integrated math coprocessor, 8k write-back cache, clock doubling, and unique performance and power management features for low-power notebook and "green PC" applications. Prices range from \$289 to \$349.

Contact Cyrix Corp. at 214/994-8491.

ViewSonic Lowers Prices

ViewSonic has reduced the price of its flat-square ViewSonic 15 monitor to \$549. This 15 in. monitor has been upgraded to include power saving management capabilities, 2.27mm dot pitch, maximum NI resolution of 1280x1024, a double dynamic focus gun and ARAG coating for reduced glare. ViewSonic has also upgraded its warranty program to a three-year limited warranty on its New Generation line of monitors (ViewSonic 15, 17, 20, 21).

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

New MultiSync Monitors

NEC Technologies, Inc. announced the latest members of the MultiSync family of color monitors: the MultiSync 5FGp (17 in.), 6FGp (21 in.) and 3V (15 in.). The monitors feature NEC's OptiClear[®] surface and IPM[®], NEC's implementation of power management. NEC's Advanced Digital Control System automatically sizes and centers each screen image as graphics modes are changed. The MultiSync 5FGp and 6FGp support resolutions up to 1280x1024 at 74 Hz on PC's and

1152x870 on Macintosh[®] computers. The MultiSync 3V supports 1024x768NI on PC and Macintosh computers. Prices range from \$550 (MultiSync 3V 15in.) to \$2535 (MultiSync 6FGp 21in.) with three-year limited warranties.

Contact NEC at 800/388-8888 or Fax 800/366-0476.

Product Catalog

CAD ONE, Inc. has a comprehensive 172-page catalog of discounted computer graphics products, featuring a full line of the most current products from OEM's such as CalComp, XES, Koh-T-Noor, Rexham Graphics/GTI, K&E Imaging and CAD ONE Brand supplies and equipment. It specializes in ink jet, electrostatic, xerographic, pen plotter, thermal and diazo technologies, and proposes user tip & tricks and answers to commonly asked product questions. Same day shipping and a staff of sales and technical reps are available.

Contact CAD ONE, Inc. at 800/232-3335 ext. 345.

OUTPUT

Mutoh Plotter BBS

Mutoh America, Inc. announced a 24-hour Bulletin Board Service (BBS) for its plotter users. The BBS is accessed through a modem and supports PCs, Macs and Unix workstations. The BBS is intended to provide technical information to plotter users. Users can download a diagnostic program to help identify problem areas when plotting or users can input questions about Mutoh plotters and a Mutoh America technical support person will respond by phone or by leaving a solution on the recipient's computer. The BBS number is 708/952-8907.

Contact Mutoh America at 708/952-8880.

HP Inkjet Plotter

Hewlett-Packard announced a large-format monochrome inkjet plotter, the HP DesignJet 200, which plots up to five times faster than pen plotters. It is available in E-size for \$4695 or D-size for \$3695. The base model can be set up on a table or an optional floor stand

(\$450 for E-size and \$395 for D-size). The DesignJet 200 prints with a resolution of 300 dpi. An E-size plot can be completed in seven minutes and a D-size plot can be completed in four minutes. The DesignJet 200 plotter comes with Centronics/Bi-tonics and RS-232 serial ports for PCs. It may be connected to a LAN through an HP JetDirect EX external connection. It switches automatically between HP-GL, HP-GL/2 and HP RTL, and supports virtually all CAD software.

Contact Hewlett-Packard at 800/851-1170.



HP DesignJet 200 Plotter

High Speed Graphics Controller

BGL Technology Corp. announced the HSGC-4, their latest laser printer/plotter controller which is offered as a controller solution to print engine distributors and as an integrated part of all BGL LaserLeader printers (consisting of 15, 20, 26, and 32 page/min. printers). Standard features include resolutions from 300 x 300 dpi to 480 x 480 dpi, 20 to 32 MB of RAM, 105 resident fonts, floppy and hard disk drives, a dual RS-232 interface and choice of either a Centronics or Dataproducts parallel, or a Versatec interface standard. Standard emulations are BGL/PDL, CCITT Group III/

IV TIFF/CALS, HPGL, HPGL/2, HP PCL-4, LN03 Plus, Tektronix 4010/4014, Versatec V-80, CalComp 906/907, QMS Magnum Code V and BGL's "Z" emulation. The HSGC-4 is priced at \$5995.

Contact BGL Technology at 805/987-7305 or Fax 805/987-7346.

GRAPHICS

Genoa VideoBlitz

Genoa Systems released the VideoBlitz VESA Local Bus graphics accelerator. The VideoBlitz is based on the Weitek P9000 GUI accelerator chip and uses its standard 2MB VRAM to deliver high speed with rich color at non-interlaced resolutions up to 1600x1200. VideoBlitz can also deliver True Color (16.8 million colors) at 800 x 600 resolution.

Genoa's FlickerFree technology provides refresh rates of up to 75Hz at 1280x1024. Their Safescan utility allows users with overscanning monitors to eliminate the black border around the application work space. The VideoBlitz has drivers for Windows 3.1, OS/2 2.1, Ventura 3.0, Lotus 1-2-3, Microsoft Word and WordPerfect. VideoBlitz lists at \$549.

Contact Genoa Systems Corp. at 408/432-9090, 800/934-3662 or Fax 408/434-0997

CAM

Router Interfaces

Router Solutions, Inc. released Version 2 of the COOPER&CHYAN CCT SPECCTRA router interfaces. These interfaces are installed in multiple service bureaus which are specialized in routing services and are currently in use at over 5000 installations worldwide.

Contact Router Solutions at 714/721-1017.

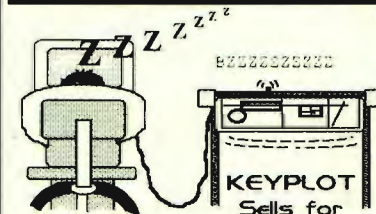
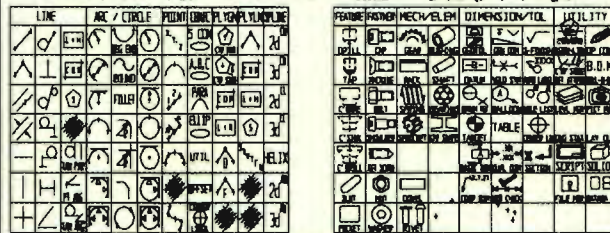
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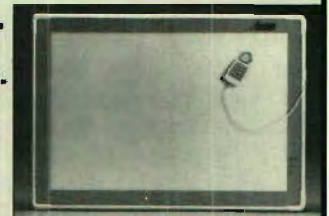


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NUMONICS

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What About Menu Tablets?

by Claudia Martin

... A study that compared CAD data input efficiency of a template/tablet and a mouse found that the template/tablet offered up to 54 percent greater efficiency. The study compared the number of "clicks" required to complete a series of sequences for each type of device and concluded that the template/tablet could reduce the design process time significantly. The study, conducted in 1992, was funded by Summagraphics Corp. and performed by Stephan LaKose, CAD manager for Farrell Industries, a Connecticut-based plastics manufacturer.

*Design Technologies -
October 1992*

The function keys and immediate mode commands make CADKEY extremely functional and easy to use. In fact, for folks who are "keyboard-oriented" in their approach to computing, these tools offer a superior interface. The only other thing needed is a little "mousing around" for cursor placement and some menu picks. The functionality of this interface has meant that CADKEY has not traditionally been a "tablet" or "digitizer" type program. Command entry in some CAD programs, AutoCAD for example, is so convoluted that a digitizer menu tablet is actually a necessity for maximum productivity.

Still, many CADKEY operations are several layers deep in the menu hierarchy and require multiple mouse picks or keyboard strokes. If you also use CADL/CDE routines or symbol libraries, command entry can get pretty complicated. A menu tablet, properly programmed (do it yourself or buy a third party program), can significantly speed up entry of commands and other data. Operations requiring multiple menu selections or keystrokes can be performed with one click. Macros and symbols are built-in and you can often add your own. In fact, several excellent add-on, third party productivity software packages for CADKEY come with digitizer templates. They are well worth the investment.

The small menu tablets - while technically digitizers - are not really practical for "heavy-duty" digitizing. First, the maximum active digitizing area is only 12" x 12" or 18". If a menu template is loaded, the area available for digitizing shrinks to about 3.75" x 3.25." While satisfactory for small parts or simple images, this small area is totally inadequate for inputting large complex drawings. In addition, the resolution of these tablets, while OK for simple work, does not match the resolution of large high-performance digitizers.

For all their pluses, menu tablets may not be for everyone. Their footprint is large and bulky compared to mice. They cost more - although not much compared

to really high-end mice. In general, their design has focused around function (successfully), but not around ergonomics, which increases the risks of RSI (repetitive stress injury in the wrist, elbow or neck).

Menu tablets also involve a learning curve, as you must get accustomed to the locations of the commands and operations on the tablet. Most people find they often take their eyes off the screen to look at the digitizer. Still, once learned, productivity tends to increase dramatically.

Technicalities

Common tablet digitizers consist of a tablet to hold the drawing, a pointing device called a transducer, stylus or cursor (the slang is "puck") to specify the coordinates on the drawing, and some form of electronics for determining the location of the cursor/stylus on the tablet's surface. In most tablets, two sets of parallel wires run perpendicular to each other inside the tablet. One set corresponds to the X measurement, the other to the Y. The cursor transmits an electric or magnetic field from the cursor point. The accuracy of the wire location on the tablet and the accuracy of the inter-wire interpolation determine the maximum resolution achieved by this technology. For high accuracy, most manufacturers use printed circuits (similar to those used on modern

Productivity Programs for CADKEY With Tablet Menus

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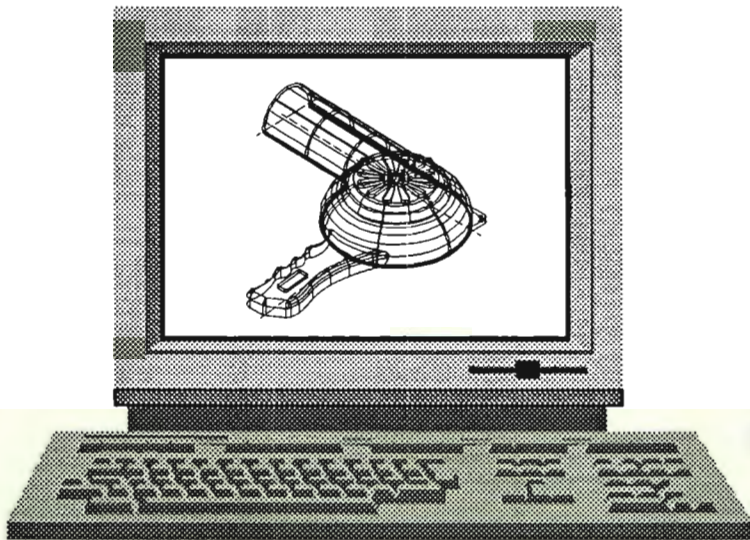
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electronic cards) to create the wires on the tablet. Today's technology is so reliable that most tablets have lifetime warranties.

The cursors on the other hand have moving parts and eventually wear out. Their life can often be prolonged by protecting them with a dust cover when not in use, especially in dirty environments.

Digitizer manufacturers have worked hard at "keeping up with the Joneses." The result is that the resolution, accuracy and other "tech specs" of today's tablets are nearly identical. Larger digitizers have superior accuracy, resolution and technical capabilities, but if you only use a tablet for selecting commands, these are not the most important issues.

The most important considerations are what we call "hands-on" issues — things like size, weight, shape, type of cursor, how it operates with the software, how it feels, and how flexible it is.

Feel - Relative vs Absolute

A mouse is a relative pointing device; a digitizer is an absolute device. This means the position of the digitizer's screen cursor is directly related to the position of the device on the tablet. The position of the mouse's screen cursor is relative only to its last position. The one-to-one correspondence of the screen cursor to the digitizer cursor position gives a tablet a very positive feel. You always know where you are and after a while can find your place without looking. It is also more accurate.

Size / Weight

Graphic tablets with a 12" x 12" active area measure about 16" x 16" and weigh from 2.5 to 8 pounds. If you have lots of desk space and a large monitor they can be placed directly in front of the display with the keyboard at the side. Many people place the digitizer to one side. Some of the newer units are so light they could even be held comfortably on the lap.

Cursors

Several configurations are available. Choosing the right one for you is a matter of function, personal taste and work styles. If you can, ask friends or co-workers if you can try different ones out. Most CAD users use the four-button "puck" which is used much like a mouse. Most companies also have 16-button versions which can be programmed

for additional one-button command input and can also function as a numeric keypad for data entry. This version is often preferred by power users. A stylus (like a hand-held pen) is another option. Useful for free hand drawing and sketching, a stylus is usually preferred for graphic art applications. Some are inking. Cordless cursors and styli are available from some manufacturers.

Flexibility

It used to be that if you used a graphics tablet for CAD, you also had to have a mouse for other applications which created competition for scarce I/O ports. Most digitizers now have a Microsoft Mouse mode which lets you use the digitizer cursor in relative mouse mode with two buttons for mouse-applications that do not support a digitizer. Windows also makes the scene a little more complicated, but the new WINTAB digitizer interface standard simplifies the problem of working in different modes. Make sure any digitizer you buy is WINTAB compatible.

Technologically and physically the tablets we looked at were very similar. They all had accuracy and resolution good enough for simple digitizing and more than enough for command and menu selection. The real differences - where the "tire meets the road" - were software, drivers, flexibility or ease of changing from digitizer to mouse mode, and the shape and functioning of the cursor. We looked especially closely at ergonomics. Long hours at the computer can increase the risk of repetitive stress injuries. The primary issues here were adjustable tilt of the board and the shape and handling features of the cursor or puck.

Selecting a Digitizer

The major considerations in selecting a digitizer are function, price and reliability. The most common cause of any equipment failure is wearing of mechanical parts. Tablet and acoustic digitizers have almost no moving parts. The part most susceptible to failure in

DIGITIZER TERMINOLOGY

REPORT RATE - the speed at which coordinate and other data (i.e., cursor button pressed) is transmitted to the computer; often called pps (points per second).

TRANSMISSION MODE - the method by which reports are sent to the computer. *Point*: one report for each press of the cursor key. *Stream*: a continuous series of reports that don't stop until the cursor moves outside the tablet's active limit. *Switch/Stream*: continuous reports that stop when you lift your finger from the cursor key.

RESOLUTION - the smallest distance or movement a digitizer can distinguish. Often this is 0.005 inches. The units of resolution are Lines Per Inch (LPI)

ACCURACY - the measure of how closely the coordinate data transmitted compares to its actual location. Most manufacturers specify accuracy of plus or minus 1/100 of an inch -- sufficient for most purposes.

REPEATABILITY - If the same point is digitized twice, ideally each transmission will be mathematically identical. When a difference exists, the difference is called jitter or lack of repeatability.

PROXIMITY - the distance at which the digitizer can sense the cursor. Proximity is usually at least 1/2 inch, which lets you digitize through a thin book.

tablet digitizers is the easily replaceable (and inexpensive) stylus or cursor. Most people select a 12" x 12" tablet digitizer because of this reliability and their relatively low cost. You may also want your digitizer to have some of the following special features.

Reset and On/Off Buttons - Digitizers with a reset button are easier to set up and use. For example, if you change the dip switches on a digitizer without a reset button you must turn the power off and on again to enable the changes. Digitizers that don't have a reset button usually also lack an off/on switch which means you must pull the plug to turn power off. An extension cord with an off/on switch included will solve this problem, but it's clearly easier to have a reset button.

Feature Selection - On some digitizers, modes or features are preset and remain constant. On others you can select features and change modes. The big question is how these changes are made. The different ways available include dip switch selection, entering commands from the computer, selecting them with the cursor from a menu located on the digitizer, or removing or setting a jumper on the digitizer. If you make lots of changes, be sure your digitizer has a convenient method for you.

Digitizer Features Chart

	ACECAD D-9000+	CalComp Drawing Slate	KURTA XLP	GTCO Ultima 1212	Genius HISketch 1212	Numonics GraphicMasterII	Summagraphics Summasketch III
Equipment							
Pointing Devices Included	4-button cursor & 2-button stylus	Cordless 4-button cursor	4-button & 2-button stylus	16-button cursor & 2-button stylus	16- or 4-button cursor or 2-button stylus	4-button cursor & 2-button stylus	4-button cursor & 2-button stylus
Additional Devices Available	3 button inking pen, 16-button cursor	16-button cursor, cordless stylus	No	4-button cursor & 2-button stylus	Same as above	16-button cursor	16-button cursor
Tilt Angles	3.5° & 6.5°	1.5°	8°	Yes-2	Yes-2	2°, 11°, & 16.5°	Yes-2
Power Source	Power Adapter	Power Adapter	Serial Port	Serial Port	Power Adapter	Serial Port	Power Adapter
Tablet Warranty	3 years	Lifetime	Lifetime	Lifetime (USA)	3 years	Lifetime	Lifetime
Accessory Warranty	1 year	Lifetime	2 years	2 years (USA)	3 years	1 year	2 years
Specifications							
Size	15.6"x16"	16"x17.25"	14.86"x15.35"	15"x15"	16.2"x16.2"	15"x15"	16.25"x16.25"
Active Area	12"x12"	12"x12"	12"x12"	12"x12"	12"x12"	12"x12"	12"x12"
Weight	3.86 lbs	2.53 lbs	3.5lbs	2.8lbs	n/a	2.8 lbs	5.5 lbs
Max. Resolution**	1061lpi	1270lpi	1016lpi	1000lpi	1000lpi	5000lpi*	2540lpi
Max. Accuracy	+/-0.01"	+/-0.01"	+/-0.025	+/-0.01"	+/-0.01"	+/-0.01"	+/-0.01"
Output Rate	To 150pps	200pps	150pps	125pps	5-90pps	160pps	114pps
Other Features							
Drivers***	MS Mouse, Wintab	MS Mouse, Wintab	MS Mouse, Wintab	MS Mouse, Windows	MS Mouse, Wintab	MS Mouse, Wintab	MS Mouse, Wintab
Software/Hardware Features	Stores up to 5 user configurations; user selectable output rate; Dust Cover	Extremely thin, lightweight, fast	Template builder software for custom Dos & Windows Templates	Diagnositics, clear-vue cursor	Windows Pen Extensions	One-touch keys on tablet for changing emulations; on tablet setup menu	Recessed area holds artwork securely
Toll Free Support	No	Yes	Yes	Yes	No	Yes	Yes
Bulletin Board	Yes	Yes	Yes	No	No	Yes	No
The Bottom Line (List Price)	\$329	\$395	\$395	\$399	\$449	\$595	\$599
	ACECAD Monterey, CA 800/676-4223	CalComp Scottsdale, AZ 800/932-1212	KURTA Phoenix, AZ 800/445-7823	GTCO Columbia, MD 800/344-4723	KYE International Ontario, CA 800/456-7593	Numonics Corp. Montgomeryville, PA 215/362-2766	Summagraphics Seymour, CT 800/729-7866

*Applies to Numonics format only; 1000lpi in Summasketch MM format

Lines per inch *All digitizers above also have ADI drivers

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Parametrics for **CADKEY® 6**

Parametric Solution (PS) stretches Cadkey's abilities in mechanical design a step further. It allows you to mold Cadkey to fit your individual needs. Cadkey contains a powerful programming language called CADL. Unfortunately, developing programs in CADL takes time and experience. PS changes this by converting dimensioned drawings into easy to use parametric programs. Using PS, anyone who can draw and dimension in Cadkey can make their own parametric programs. Once a parametric program has been developed, it can be used over and over to generate any variation of...

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ACECAD D-Series

ACECAD D-Series

The ACECAD has a full set of features, but is still the most economical. Ergonomically, it has adjustable feet to change the angle; the LEDs are on top and the switches on the side; and the 4-button cursor has a rounded base which fits in the palm better than those with square corners. The cursor has large, well-spaced buttons with easy to read numbers. The reticle could be a problem for some users. The circular clear area is surrounded by a thick (1/4" high and 1/8" wide) plastic border that sometimes interferes visually. The reticle lines also are thicker than most, making it difficult to place accurately. This is not optimum for detailed, accurate digitizing, but adequate for menu selection. A real minus is the shiny, highly reflective overlay. A real convenience was the two transducer ports. This lets you plug in both a stylus and a cursor so you can switch between the two without disconnecting or powering down. A dust cover is provided to protect the moving parts in the cursor.

CalComp DrawingSlate

The new DrawingSlate is the thinnest, lightest digitizer we looked at. CalComp designed the ASIC (application-specific integrated circuit) to achieve the nearly flat (about 1/8" thinness) profile. With this

near-zero build, it requires no dedicated desk space. You can put papers or files on top easily, or you can even work comfortably with it in your lap.

Still, it's a full-featured tablet with all the performance and reliability of its larger competitors. All the pointing devices are available in corded or cordless configurations. The 4- and 16-button cursors feature a unique design for the primary buttons. Buttons that perform the

functions of the buttons on a 2-button mouse are quite large and L-shaped. This gives a really positive feel; you never lose your place or click the wrong button by mistake.

The tablet's surface menu includes 18-user recordable macro blocks plus up to 16 additional user-recordable macro buttons from the cursor or pen.



CalComp DrawingSlate

Genius · HISKETCH 1212

The Genius HISKETCH 1212 is ergonomically sound. Snap-out feet allow the angle of the digitizer to be set in two positions. The unique reticle on the 4-button cursor can be swiveled to the right or left up to 45 degrees. This effectively clears the field of vision for right or left hand use. The edges are clear for good visibility. In addition, the buttons are large and well spaced. The plastic overlay that protects templates has a matte non-glare surface that does not

reflect room lights, a problem with monitors as well as tablets. Velcro tabs hold it firmly in place. Without a recessed area or a positive locking system like this one, templates can sometimes slip. The power and reset switches are inconveniently located



Genius HISKETCH 1212

on the back, but the LED on the top surface shows power, sense and status. A 16-button cursor is not available.

GTCO Ultima 1212

The UltraVu™ 4- and 16-button cursors are great. GTCO eliminated the coil so it's totally clear and thin (no lines or edges to block your vision). Cursor buttons are color-coded, shaped and positioned like the Summagraphics cursor. The slight indentations on the button tops are helpful. On the down side, this



GTCO Ultima 1212

cursor is boxy and large with really square corners. It didn't seem quite as comfortable as some of the others.

A nifty built-in pencil tray at the bottom edge is handy for holding the stylus or writing



KURTA XLP

instruments. The angle of the board can be changed with a snap-out bar. Unfortunately, this bar seems a little flimsy, but if you don't switch it back and forth very often, it should probably last.

KURTA XLP

The XLP is powered via the serial port and the tablet itself is light and slim. At the top of the tablet, a Logo Menu Strip has tablet and mouse emulation icons. Emulations are easily changed with a click of any button on either of the pointing devices. The four-button cursor has color coded buttons arranged in a circular pattern. The tops of the cursor buttons can be removed and legends inserted to label the buttons. The possibilities are endless — numbers, elaborate icons, or software-related

mnemonic references. The reticle is thick with a visual bulls-eye and thick cross hairs - adequate for menu/icon selection, but less so for accurate detailed digitizing. The tablet angle does not adjust, but is set at the ergonomically-correct 8 degrees. The KURTA documentation was superior (easily the best); easy to read and follow even for a neophyte.

NUMONICS GraphicsMaster II

The GraphicsMaster II has a slim profile and is lightweight. The four button cursor is small with rounded ends and easy to handle. The reticle is clear at the edges with fine cross hairs for visual accuracy. We found the

buttons small, but the unique t-shaped pattern made them easy to use. Detachable (ergo, losable) risers



Numonics GraphicsMaster II

allow you to adjust the tablet to three angles. The Numonics tablet draws its power from the serial port, or a power adapter kit is available. Six



Summagraphics SummaSketch III

on-tablet Softkeys on the edge of the tablet's active area let you place the cursor on the icon to enter setup mode, switch between four applications or return to the default. These softkeys are programmable to suit your needs.

SummaSketch III

Summagraphics developed and maintains the MM output format which has become the de facto industry standard. SummaSketch III is the fifth generation of digitizers under the SummaSketch name. Ergonomic and user interface enhancements were specifically designed for CAD users. The recessed area and overlay fit all standard CAD templates. The non-glare matte overlay reduces eye strain. The 4-button cursor is wider and easy to hold. The slight depressions in the color-coded buttons help you locate them easily. The reticle is thin with no borders for good visibility and the cross hairs are very fine which aids accurate placement. Instead of having a physical reset button, the Summagraphic's tablet is reset using the Summagraphic software utilities.

A Mini Digitizer / Mouse Alternative - the ACECAT II

Sometimes a 12" x 12" graphics tablet is just too big. Obviously, a full-size tablet is neither practical nor convenient if you travel with a notebook or laptop. More commonly, however, your work area may be quite small or filled with other equipment.

The new ACECAT II \pm 5" x 5" digitizer fills the gap. It uses less space than a mouse pad and weighs only 1.2 lbs (0.55 kg), which means it can be easily held and used in the palm of the

hand or lap, or on a crowded desktop. For standing, sitting or reclining an optional wrist strap (with holder) is ideal for using the tablet off the desktop -- in the field or as a presentation control tool (with the PC attached to an opaque projector) for drawing or writing.

Small size does not equal decreased functionality. It has all the technical features and capabilities of its larger cousins including 2000 LPI resolution, advanced shielding for cursor stability in

high RF environments (classrooms or offices where multiple devices are used nearby), new MM1201 emulation, and advanced Windows drivers. It comes with a programmable 2-button stylus.

Its size, absolute positioning, and price also make it a great mouse replacement.

For more information contact ACECAD

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Agile Manufacturing for

2000

and Beyond

by Peter L. Grieco, Jr.,
President and
CEO of
Professionals for
Technology
Associates, Inc.

Sometimes it seems that there is something new to learn about world class methodologies every day of the week. But the one lesson I have learned from my experience with clients in North America and in Europe is that a proactive stance is a necessity that everybody needs in today's business world. Companies must begin considering the implications of manufacturing in the 21st century. On the horizon is a vision of manufacturing in the next century known as Agile Manufacturing. What we shall soon be experiencing is a paradigm shift from the lean and flexible styles exemplified by Just-In-Time and Total Quality Control to a more inclusive and synchronous style which emphasizes the operations of the entire company and not just the factory floor.

Many of you may have already heard of agile manufacturing from stories about Japan's quest for the three-day car. The production of a car in three days is an example of their version of agile manufacturing as developed by that country's Japanese Manufacturing 21 Project. There are examples closer to home as exemplified by General Motor's Saturn, Benetton and Wal-Mart. Some of the agile ideas they are pursuing are described below:

AGILE IDEAS

Saturn - In planning production, Saturn "images" or creates stock orders for its dealers. The retailer then has the opportunity to change the order in real-time according to the desires of its customers. The new

specifications are directly reported to production scheduling at the Saturn plant.

Benetton - Instead of dying yarn and then knitting the sweaters, Benetton produces finished sweaters in neutral colors and then dyes them to meet the market demand for colors.

Wal-Mart - Wal-Mart lets individual stores order directly from suppliers. Using this method, Wal-Mart maintains high service standards with 25 percent of the inventory. The company has also been able to cut restocking time from 6 weeks to 36 hours.

At Pro-Tech, we have seen from our clients that agile manufacturing can truly be said to begin with the design phase. It has been estimated by many engineering experts that 85-90% of the total cost of a product is designed in. In our opinion, that leaves a lot of room for improvement. And the cost of not focusing on the design phase can be very high, as the data below demonstrates:

Cost of Nonconformance

<u>If a defect is found by:</u>	<u>It will cost:</u>
The Customer	\$100,000
Manufacturing	\$10,000
Planning	\$1,000
Design	\$100

Companies intent on implementing agile methodologies will need an accounting and finance system which assigns costs more accurately to products and services and which provides management

with the cost information needed to make strategic decisions. Activity Based Costing will be the system to meet these needs. In the future, there will be an even greater need to establish time-based metrics to monitor progress. For example, design engineering will need to measure themselves in at least the following areas in order to make agile manufacturing possible:

- Total design cycle time
- Number of engineering changes
- Material costs
- Labor costs (direct and indirect)
- Production cycle time
- Test cycle time
- Components per product
- Component standardization
- First pass drawing accuracy
- Number of preproduction and prototype units required.

Movement will also need to be made toward lowering costs by integrating information systems and designing equipment so that set-up time simply involves reprogramming the machine. There should be no physical removal of tools or dies, for example. The machine would reconfigure itself to the new job according to the instructions it receives from the company's integrated data base. This cost-cutting would also be reflected in the design of modular production facilities and products. Some futurists see the possibility of buying one car in your lifetime. As parts wear out or get improved, they would

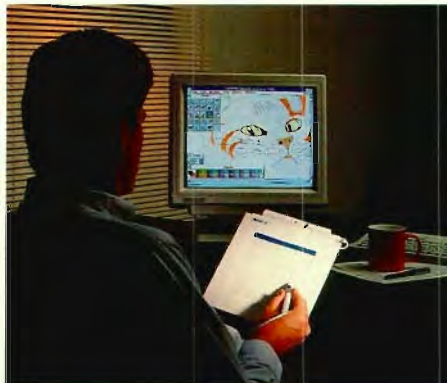
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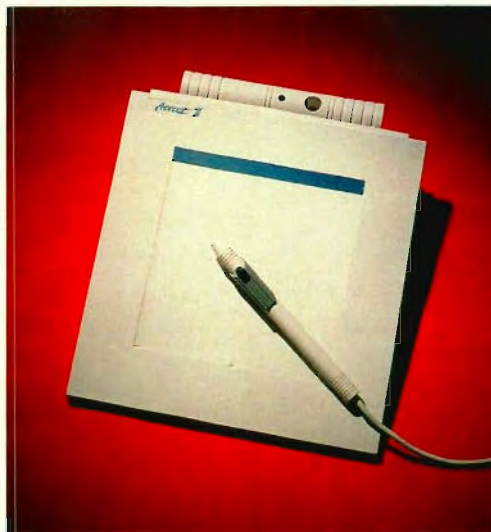
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as a slight wrist movement, a boon to those suffering from the tedious rolling strain of relative rodents! Use the included **Tablet Control Panel** to customize the button options in any combination of functions, left click, right click, left double click, left-drag, etc. Unlike mice or trackballs, you can use the CAT on your desk, off your desk, standing making a presentation or comfortably reclining in your chair. Work the way you prefer, with ease and spontaneity.



"We think the pen is the best pointing device. It's direct, it's more natural than even the mouse. It's familiar, unobtrusive, small and very precise.

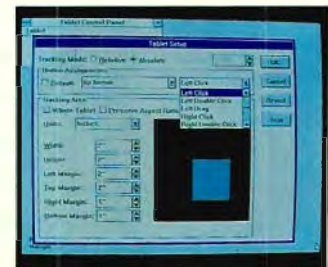
*William H. Gates III
Chairman / CEO Microsoft Corp.
Computer Paper, May '92*

"A mouse is wonderful for selecting a pull-down menu item, but when you need precise control . . . you should give up rodents and check out a cat — an ACECAT graphics tablet from ACECAD."

*Paul Bonner
Senior Editor / PC Computing*

The ACECAT II's ergonomic, lightweight (1.02 lb.) and compact design make it perfect for freehand sketching, drawing, CAD and even works with the latest Pen-Based Computing Applications! (Over 3000 Windows applications are already Pen Aware!) ACECAT II is your **COMPLETE** pointing tool!

ACECAT II is the next generation of the critically acclaimed ACECAT Graphics Tablet. New features include 2000 LPI (lines per inch) resolution, superior cursor stability, a custom template overlay, replaceable pen tips, cable channel for left handed friendliness, and all new custom drivers and utilities making switching between Windows and DOS a breeze. Consuming less desk space than a mouse pad, and as intuitive as the implement you first used to draw and write with, the ACECAT II is your ultimate pointing tool. See the ACECAT II in action at top Computer Retailers everywhere. For more information on the new ACECAT II and the complete ACECAD family of computing solutions, call us today at: (408) 655-1900.



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be replaced at "service centers." Even style changes would be done by outfitting your vehicle with new body panels.

CONCURRENCY

The philosophy described above is, of course, concurrency. Concurrency focuses attention on the concept and design stages where the impact of a change is least costly and least likely to adversely affect reaching the market on time. Quality is designed into the product and the process at the same time, thus guaranteeing that the product is producible and conforms to customer requirements. There are a number of principles and techniques which are gathered under the "concurrent" umbrella. A book would be needed to do them all justice, but I will describe a few of the more important ideas here.

• Design Standardization

Use existing components whenever possible. Use similar designs as basis for new components.

• Simulation Techniques

Evaluate product and process characteristics concurrently to determine the optimum product and process designs.

• Value Engineering

Use to increase performance to required form, fit, and function specifications at the lowest total cost.

• Synchronous Manufacturing

Use to maximize the acceleration of materials through the production process while minimizing resource utilization to minimize costs.

Be forewarned, however.

Concurrency is most effective when a combination of upstream and downstream functions work together in a team environment during the concept and design stages. The team should seek to isolate product and process problems and to eliminate them using problem solving skills which will help them create better product and process designs.

PARADIGM SHIFT

All these developments on the horizon will lead to a radical change in manufacturing which will require companies to adopt a service business strategy. This new business style will place an emphasis on zero inventory, zero waste and, perhaps most

TABLE I - PARADIGM SHIFT

Lean/Flexible

- Eliminate inventory
- Eliminate waste
- Flexibility in scheduling
- Shortened lead times
- Six Sigma quality in products and services
- Low unit cost via large volumes of similar products
- Focus is on factory floor enhancement of through-put
- Task-oriented training of employees
- Equipment/technology as primary asset
- Effective use of resources to contain costs
- Clearly defined roles
 - Customers
 - Competitors
 - Suppliers
 - Manufacturers/providers
 - Stakeholders
- Broad-based market view: economies of scale
- Fragile to the impact of change: optimized for one purpose
 - Focused factory
- Product designs are rigid and frozen only after numerous changes and enhancements
 - Value-added approach
- Products are designed for internal integration
- Operationally focused:
 - Short-term financial
 - Extend status quo as long as possible to amortize costs

Agile

- Zero inventory
- Zero waste
- Build to sales - daily
- Minimum lead times
- Quality & reliability measured in terms of total life cycle costs
- Low cost units from:
 - Modular production facilities
 - Easily programmable equipment
 - Enterprise-integrated information systems
 - Virtual products for each customer
- Focus is on total enterprise cycle time
- Enterprise-based training of employees for maximum capability and creativity
- Employees as primary asset
- Social responsibility
 - Products designed for recyclability and reconfigurability
 - Design-focused product changeover capability
- Constantly changing roles as defined by the requirements of the virtual enterprise
- Economies of scope: focus on servicing ever smaller niches
- Change optimized
 - Equipment
 - People
 - Information systems
 - Supply base
 - Admin. systems & structures
 - Technologies
- Products are designed for:
 - Producibility
 - Maintainability
 - Disassembly
 - Reconfigurability
 - Upgradability
 - Recyclability
- Products designed for maximum cycle time effectiveness
- Strategically focused:
 - Long-term performance
 - Diffused authority
 - Dynamic corporate structure

importantly, a fast response time and short production cycle. Table I summarizes what these shifts will be.

As you can see, the emphasis in the recent past has been on Total Quality Management (TQM), a worthwhile but somewhat limited goal in today's marketplace. TQM, as it is applied today, focuses on the manufacturing and quality assurance areas in an organization. For it to be truly total in the agile environment, it will need to embrace all functions and to adhere to the principle of driving out all non value-added activities. Cycle Time

Management has become a key tool in achieving significant results in that regard.

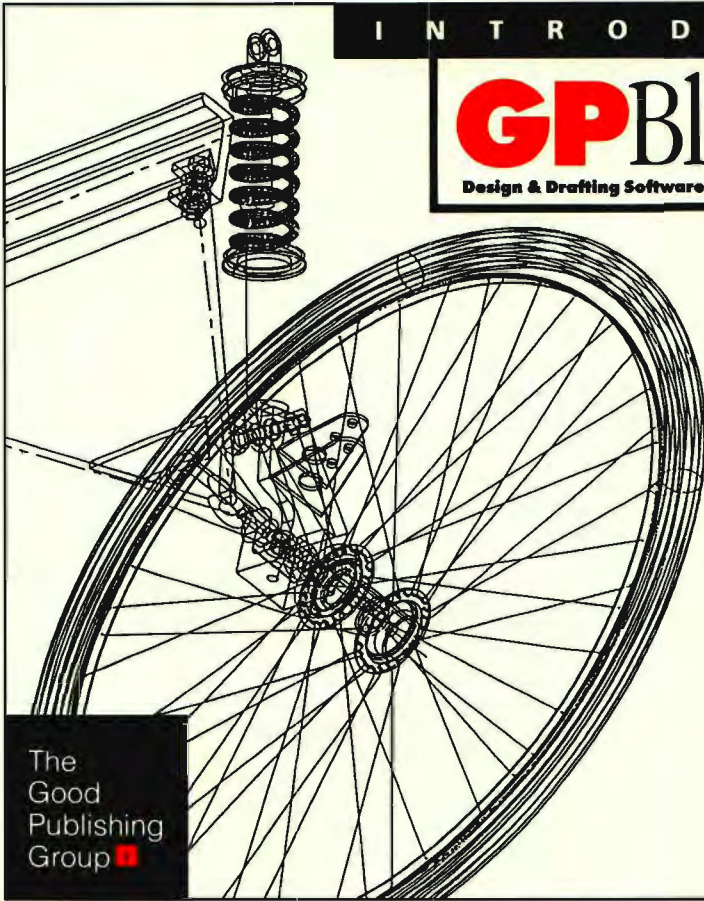
THE BASIC TOOLS

Cycle Time Management (CTM) manages information and time in much the same way that JIT methodologies have managed inventories. CTM promotes reducing the number of ways information is channeled through an organization by reducing the number of layers of management involvement. In other words, decisions are forced down to the lowest possible level within the organization. CTM says that all administrative and operational

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activities must be analyzed to ensure that they flow seamlessly from upstream suppliers to downstream customers in the shortest possible time. One technique found to be particularly effective in creating this seamless flow is Process or Organizational Mapping.

In Process Mapping, each activity within an organization is mapped to determine its functional involvement, process flow characteristics, time consumption, bottlenecks and disconnects, and batch nodes. The mapping of the current state is referred to as the "as is" map, or the baseline. Once this baseline is established, we recommend forming a cross-functional team to re-engineer the process so as to eliminate all unnecessary time consumption. The new process becomes the "should be" map. We have seen impressive results using this technique: 50-90% reductions in an activity's cycle time are possible. And, since upstream and downstream processors are involved on the team, none of the enacted changes is detrimental to the organization as a whole.

I have always tried to make it the

philosophy of Pro-Tech that you can become a lean organization by yourself, but that it takes partners to become agile. Agility requires key alliances with supplier/partners to ensure a continuous flow of quality materials, in the required quantities, at the right time. To achieve this level of support, world class organizations have implemented the supply base management technique of Supplier Certification.

Certification programs are used throughout the business world today, but with widely varying degrees of success. The reason why many are less than successful is because they are treated as one-shot programs with a definite beginning and end. Once process capability and process controls are verified, certification is awarded and receiving inspection is discontinued. That is not Supplier Certification. To be effective, certification must be seen as a process methodology. Once process capability and process controls are verified, the next step is the monitoring of ongoing performance to ensure that the supplier is dedicated to customer requirements. Only after

a statistically based number of 100% conforming shipments are received is certification awarded. Thereafter, performance, control and capability are monitored randomly to ensure compliance. Certification requires consistent performance or it will be suspended or revoked. Or, as I like to say, "In God we trust. All others must bring data."

CONCLUSION

The American economy is based on manufacturing and related support industries. Global competition becomes more and more keen with every passing month. If we are to stay competitive, drastic changes must be made immediately. The plan I have sketched in this article shows our best path to the future. Nothing which I have described is outside our ability. It is not easy. It requires an investment in time, money and resources. But, there is a return on that investment for those who are committed to long-term competitiveness. In fact, for some, the return may be the continued survival and vitality of their enterprise. ☐

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"CADJET is well laid out. It groups commands in an order that makes sense to CADKEY users. The bright background colors and logical icons make it visually appealing. It is easy to see that CADJET will add to the productivity of any CADKEY user. With all of the CADKEY commands at the user's fingertips, less time will be required to learn the system."

Paul Resatarits,
Co-Author - USING CADKEY

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Brian Gross,
CAD Manager



"I've been teaching CADKEY to users for several years and I'm convinced that CADJET will result in significant productivity improvements for both the new and experienced CADKEY users. Very user-friendly...Excellent product....A real winner!"

Tom Gray,
CADKEY Dealer

"CADJET saved our company time and money. Now, we have instant access to CADKEY's commands right at our fingertips. Detailed drafting and design is easier and much improved in quality. I highly recommend CADJET to any CADKEY user."

Mike Decker,
CADKEY User

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ANTHROPOS & CADKEY

A CDE Tool for Ergonomic Design

by Frank Simpson

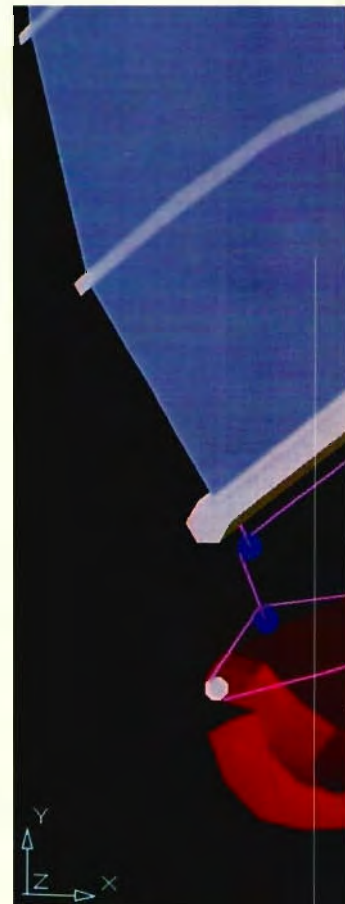
Ergonomics, or human engineering, critically influences the efficiency and productivity of workers in their workplace and, frequently, the usefulness of products manufactured for end-user customers. Designing products and workplaces so that people can interact with them efficiently and safely has reached a new level with a software package that works right inside CADKEY®. Recently released ANTHROPOS® Version 3.1 is a human body-type CAD software developed to promote the design of products and workplaces that real people can use effectively and safely. The package was developed by IST GmbH of Gross-Rohrheim, Germany. ANTHROPOS (Greek for human being or man) is written in C, and once loaded, integrates seamlessly with CADKEY Version 6 as a CADKEY® Dynamic Extension™ (CDE). ANTHROPOS features the same type of dialog-box user interface as CADKEY. The human models created in ANTHROPOS conform to data in the German Industrial Standard: DIN #33-402 that measures the physical capabilities of men, women and children. The ANTHROPOS models also incorporate the anthropometric data published in the Handbook of Ergonomics (1982), Bodyspace by Stephen Pheasant (1988), the Anthropological Atlas (1989), and other published research.

Body Types and Environments

ANTHROPOS has a library of body types, a library of ambiances or environments, and a model editor which lets you adapt any body type to the individual circumstances of a particular person. The body-type models include choices for gender, age and physical proportion. Because there are so many body types whose physical characteristics cannot be adequately represented by general models, such as, endomorphic (slender), ectomorphic (abdominal), mesomorphic (muscular), etc., ANTHROPOS allows a user to specify nine levels of physical characteristics, together with nine

levels of plasticity in the body for each level of physical characteristics. You can specify these 81 characteristics in the 1st, 5th, 50th, 95th, and 99th percentiles, at ten-year time intervals. Combining all these variable elements, ANTHROPOS currently has 1.1 million body-type models for each decade.

However, shaping a workplace for one or more handicapped persons





model's ability to reach things in its ambience with open hands, closed hands, or even just a finger pointing toward an object. The outermost points that the human model can reach defines the model's work envelope. The curve of this envelope gets defined as a polygon net. The human model moves within its CAD ambience according to the normal law of gravity, with automatic pelvic adjustment for standing, sitting, etc., and with the

body type, weight, physical condition and frequency of lifting correspond to the human model, in attempting to move such a load. ANTHROPOS also calculates the force that the individual must exert to perform the maneuver taking into consideration the model's position (lying down, seated, standing), pressure being exerted by the load on the subject, and the frequency of relaxation periods during the maneuver.

At the same time, in the background, ANTHROPOS displays data about the angles of motion of the human model's articulated joints and the forces and torques being exerted on these joints. ANTHROPOS also differentiates between the forces exerted on a part of the body (e.g., an arm) supporting itself extended in space or resting on a supporting surface. All data relevant to an ergonomic analysis can be displayed on the screen or output in hard copy by a printer.

ANTHROPOS as a CDE

Because ANTHROPOS works as a CDE inside CADKEY, the user profits from the full range of CADKEY functions. Any time a user leaves ANTHROPOS or turns off the computer, ANTHROPOS automatically saves the data content of the screen (model and specifications for actions).

ANTHROPOS also works with CATIA® and will soon work with AutoCAD®. English and German versions are available.

For more information, contact Susanne Krugmann, International Sales, IST (Industrial design, Somatographic CAD, Training) GmbH, Waldstrasse 13, D-6845 Gross-Rohrheim, Germany. Telephone (from outside of Germany): 49-6245-1795, Fax: 49-6245-6431. ☐

Editor's Note: English translations of the *Handbook of Ergonomics* (Handbuch der Ergonomie) and the *Anthropological Atlas* (Anthropologischer Atlas) do not yet exist.

requires special considerations. The model editor allows you to adapt any one of the 1.1 million body-type models to fit the unique requirements of a specific individual.

Genetic and geographical conditions in different parts of the world influence some of the physical characteristics of the human body. Therefore, ANTHROPOS provides models for some peoples of Europe (France, Germany, Great Britain, Italy, Poland, Russia and Switzerland), Asia (Hong Kong, Japan and Russia because it extends across Northern Asia), and North America (United States).

Every model in ANTHROPOS consists of 90 body parts (including the spinal column and all fingers and toes) and 90 joints. Users can choose the type of graphical display they want for their human CAD model: as a skeletal model (with or without the spinal column), as a wireframe model composed of polylines, as a solid model composed of 5,000 polygons, or as a shaded model.

Animating the Models

ANTHROPOS models can be animated within the CAD working environment, emphasizing the

arm-shoulder interdependence characteristic of human movement.

ANTHROPOS performs some biomechanical routines automatically (auto-animation). Auto-animation is especially helpful to a user who is a novice in the field of ergonomics, or who has a tight work schedule, for avoiding mistakes and faulty execution. Auto-animation always searches for the ideal way of performing a task in a single movement.

The ANTHROPOS model's animation includes the model's field of vision using both eyes as is normal or using only one eye. Objects which block or hinder the human model's sight and shadows which these objects project can also be displayed in ANTHROPOS. For example, the steering wheel of an automobile can interfere with a driver's ability to see parts of the dashboard. Or, as a car is moving down a street, the buildings along the sides of the street can cast shadows into the street or onto the car which the driver sees through the car's windshield.

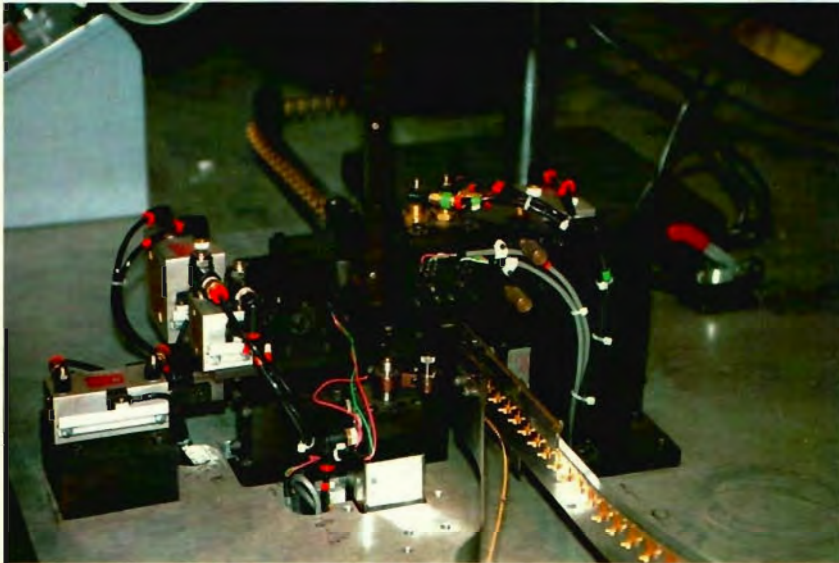
The human model can move loads, and ANTHROPOS can determine approximately the degree of danger for a real person, whose

a model

CONCURRENT ENGINEERING

company

by Frank Simpson



Automatic Assembly Machine

Complete Integration

A&J Electronics Corporation of Brookfield, CT manufactures turn-key electronic assemblies, components, and machinery used for varied applications in computers, and other electronic products requiring very tight tolerances. Their methods and practices are models of how concurrent engineering should work.

Although focused on electronics, A&J Electronics is, in reality, a company of six divisions integrated into one location: engineering, CNC manufacturing, insert molding, stamping, electronic assembly, and design and manufacture of custom-made machinery for other manufacturers.

Jackie Marsilio, President of A&J Electronics, manages the administration of the company. Arthur Marsilio, Vice President, and Bob Anderson, Engineering Manager, direct engineering and manufacturing. Ginger Rettemeier, Network Manager, handles the information system.

The Network's the Glue

A&J Electronics has integrated its three CADKEY® systems and two Mastercam® systems into a modified star-configuration network of personal computers, linking engineering design, CNC manufacturing and business administration.

"The network has three hubs, one active and two passive, and all hard drives in any computer on the network are accessible (for both reading and writing) from any other computer on the network. The network is virtually invisible. For our network system to collapse, all seven computers in the network would have to fail simultaneously," Art Marsilio stated. "By continuously upgrading PCs, we can stay abreast of technology."

"On the manufacturing end of our network we have 3-axis wire EDM equipment capable of holding tolerances of two ten-thousandths (0.0002) of an inch," Mr. Marsilio added.

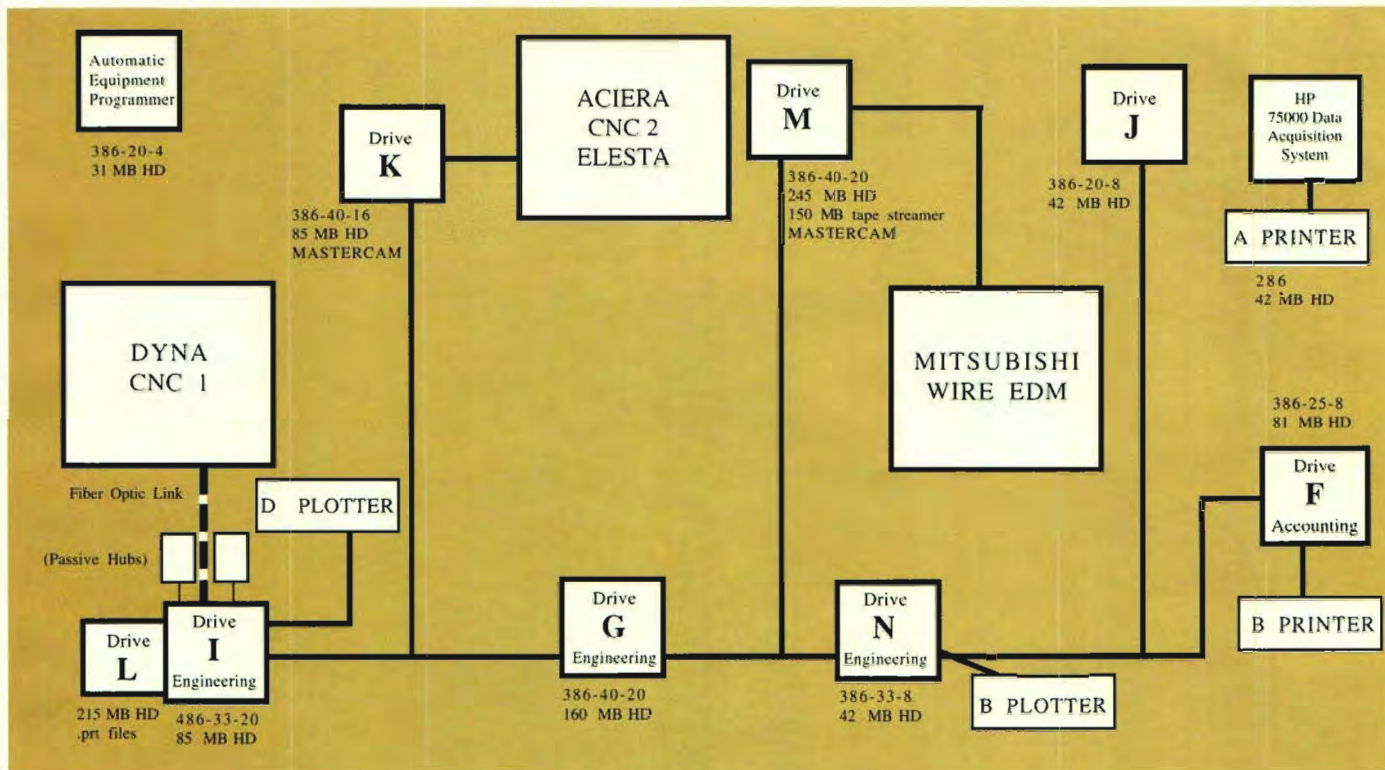
In addition to creativity in engineering and manufacturing, A&J Electronics has designed their own cost-per-hour analysis that keeps them on top of their business weekly. **Connecting with the Outside World**

A&J Electronics maintains contact with customers and suppliers via a 145,000-baud modem. "Now, customers are frequently bringing or sending their design in digital format," stated Bob Anderson. "We prefer to do less plotting of drawings internally and more digital transfer of information because it is one less step subject to human error."

Data Integrity

Every part file in the network is available to anyone, so anyone can do anything to it except save it by the same filename. However, only the first person to access the file can save it using the file's original name. The last opportunity that design data in a part file has to be incorrect is in the engineering office. If the 3D model in CADKEY is correct, when the model goes through Mastercam and the numerical control equipment in the shop makes the part, that part is accurate to the degree of accuracy of the NC equipment.

The NC equipment includes machining centers, wire and graphite-electrode electric-discharge machines (EDM), stamping presses that can handle jobs requiring up to



A&J Electronics Computer Network LANET

32 tons of shear force, and insert mold-making machines that can handle up to 30 tons of clamp force.

Rapid Response to Customer Needs

The flexibility of accessing design data from any computer in the network and of downloading it to any NC machine in the shop has given A&J Electronics the ability to respond to customers' needs very rapidly. "When a customer presents us with a need, we can frequently deliver a solution within 24 hours," Marsilio said. "It is not unusual for us to receive an order at 7:00 a.m. and to have the parts ready by 4:00 p.m. the same day. To do this, however, requires extensive lower-level, in-house capabilities, such as

heat treating, welding, glass beading, engraving, etc.

"When a customer proposes a new type of contact design, for example, we make prototypes, and even limited production runs, by blanking on our wire EDM machine," added Marsilio. "Rather frequently we produce a strip of contacts 12 inches long that appears to have come from a progressive die, before the die is built. This way we get parts to the customer so that they can make sure that the parts are going to do what they need to do before they incur the cost of manufacturing molds or dies. We often go through this process several times before a customer finalizes their design. This allows the customer to make changes in the

product at very low cost."

After the design is finalized, A&J then gets into the design and manufacture of dies or molds for mass-production manufacturing. In the design of dies for stamping, molds for insert molding or overmold cable assemblies, or electronic equipment, A&J Electronics builds the tooling necessary to meet the customer's requirements. "You have to be continually concerned about your customers' needs," Marsilio said, "to produce the equipment and tooling that they need, to do what they want on the date they want to do it."

The design and manufacturing philosophy of A&J Electronics is "A problem is a solution in disguise!"



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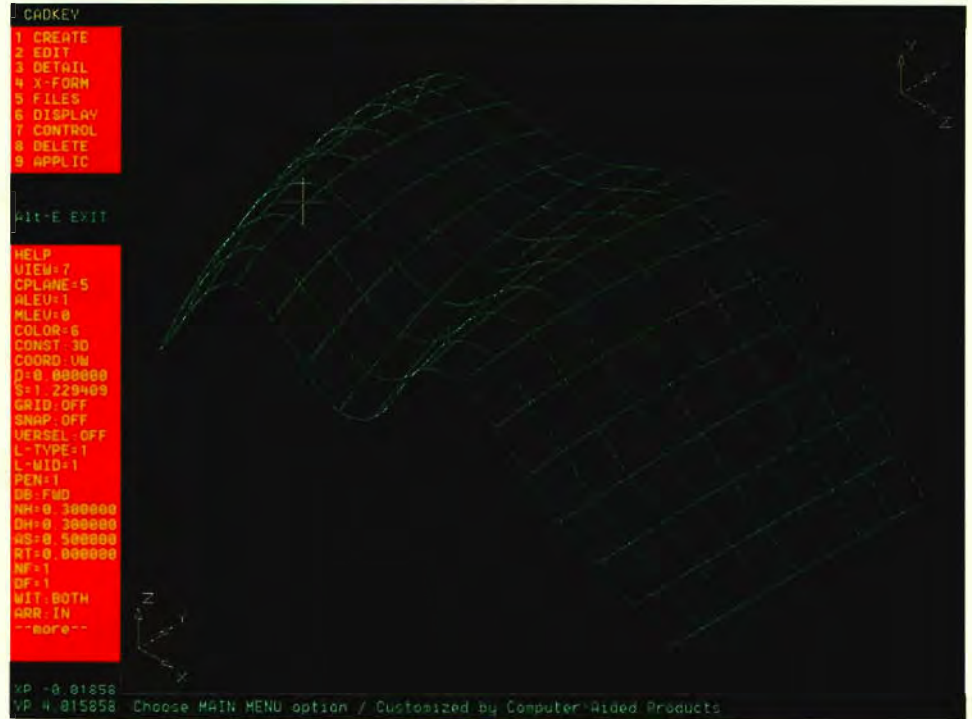
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Manufacturers today face many difficulties. Global competition makes product differentiation essential (but more difficult); consumers demand extraordinary quality as a matter of course; and product development cycles are compressed: up to 50% of lifecycle profits can be forfeited when a product is nine months late to market. The first two factors demand products with increased design content, while the latter dictates less time to accomplish this more difficult task! Fortunately, good integration of CAD/CAM data can help accomplish this. This article explains methods for making the transfer of data between CAD and CAM maximally efficient.

INTRODUCTION To CAD/CAM DATA TRANSFER

BY DANA SEERO



EXAMPLE OF CADKEY SPLINE MESH.

CAD DATA FOR MANUFACTURING

Although CAD and CAM software is designed to help implement concurrent engineering methods, I often find that CAD data is not used to maximum advantage when integrating manufacturing. This may be due to concerns about security and accuracy, or lack of familiarity with the techniques.

True, companies often work with a mix of CAD geometry, from 2D layouts through surface and solid models. However, all this geometry can be used for manufacturing integration. The examples I show here refer to geometry from CADKEY 6 and ADVANCED MODELER sent to SURFCAM for milling, turning, and wire EDM applications, but the techniques apply equally well to other CAD/CAM systems.

Manufacturers use CAD systems in different ways, depending on tools available, operator training, type of geometry, and organizational inertia. Product definition encompasses the following:

2D WIREFRAME

3D and solid models are much more valuable when integrating manufacturing. The additional time spent for product definition is more than made up for in decreased time-to-market. Still, 2D drawings can be used to good advantage for a wide variety of product geometry. For products manufactured using two and two and a half axis milling, wire EDM, waterjet, drilling, and routing, this two dimensional information allows programming directly from the data. SURFCAM can readily create complex contours, pockets, and sweeps from two dimensional information.

According to Jay Jacobs, Advanced Technologies Manager at Apple Pattern, "We definitely want the database because we can use the 2D views to locate features. We save 10-20% of the lead time required to make a model with a two dimensional database." SURFCAM allows Apple Pattern to create bosses and

pockets with draft from the two dimensional profile, or with tapered cutting tools.

Detailed view projections of a product usually include cross-sections and detail views to insure an unambiguous description. What can make 2D drawings difficult to use in CAM software is the fact that most CAM packages do not support text or dimension entities: only geometry is transferred. Therefore, the following cautions apply:

- Make sure all geometry is 1:1 scale. Without dimensions, the CNC programmer must use the geometry to determine minimum tool radii. And, because he won't have text notes, he won't be able to determine scale.
- If you have a series of cross-sections, reference the locations with geometry instead of tabular data - remember, there won't be text notes!

3D WIREFRAME

Three dimensional wireframe geometry can be used readily by the programmer to generate toolpaths.

For mold design, the inside and outside shapes can be scaled for shrink compensation, and separated to create the cavity and core. According to Jay Jacobs, "With a wireframe model we have better visualization of the end product. We don't have to worry about relative location of features. When necessary, SURFCAM can quickly create surfaces using the wireframe data to speed up cutting complex shapes. Overall, we save 25% or more of the time required to generate a CNC program."

One special capability of SURFCAM is the ability to convert a CADKEY spline mesh directly into a surface. MESH2DSN reads the CADL file directly from CADKEY. This allows the CADKEY operator to define extremely complex shapes without FastSURF or ADVANCED MODELER. (Spline files that form other systems can be exported as CADL files by SURFCAM for this conversion as well).

Another new tool to speed the process of generating toolpath information: Cadkey, Inc. has developed technology to take wireframe models from other systems and convert them into surfaces automatically.

SURFACES

Because a surface is an exact mathematical definition, this type of data is ideal for milling machine or rapid prototyping operations. The CAM software uses the explicit surface definition to define tool contact points and tangencies, and facilitates gouge checking. Therefore, CAM software that supports surfaces makes the process of generating toolpaths much faster.

Jeff Bean is owner of Bean Engineering and a CADKEY, ADVANCED MODELER, FastSURF, and SURFCAM user specializing in plastic and mold design for the automotive industry. He states, "Modern surface modelers provide very complete surface definitions. These accurate surface models save us 50-80% of the time required to generate toolpaths." Jay Jacobs of Apple Pattern adds, "We don't have to worry about designer's intent, especially for complex blends and fillets."

FastSURF surfaces should be output using the FastSURF IGES translator (under the APPLICATIONS menu), and ADVANCED MODELER geometry should be output using the Advanced IGES translator included with the product.

SOLID MODELS

A B-Rep (Boundary Representation) solid model can be understood as a surface model defining the

are working with vendors who can effectively use your CAD data. Be aware that the biggest obstacles to CAD/CAM data transfer are usually personal, not technical.

The time to survey your vendors and obtain agreement with your procurement staff on data transfers is **before** you are ready for tooling. CAD/CAM tools are so vitally important to job shops today that even those with rudimentary tools



MACHINABLE SURFACE FROM CADKEY SPLINE MESH IN SURFCAM FOR WINDOWS.

"skin" of the part, plus topology data that defines how these surface patches intersect to form a solid volume. However, IGES 5.0 does not support B-Rep solids (IGES 5.1 will, and the PDES/STEP standard will also improve this type of transfer). The IGES translators available with these systems usually output the models as NURB surface patches.

Many high-end solid modelers (including ADVANCED MODELER) provide tools to "sew" these surface patches back together to re-create the characteristics of a solid (volume analysis, boolean operations). As a result, solid models can be processed through IGES with little loss of data for manufacturing.

TRANSFERRING DATA BETWEEN SYSTEMS

One way to decrease product development time is to insure you

may claim expertise. Your purchasing staff has to have a plan in place to select potential vendors, transfer information, award contracts, and notify vendors of changes. Develop and test your process before you need it. Here are some basic techniques for transferring data to manufacturing.

1. Output the CADKEY files using IGES (or Advanced IGES with ADVANCED MODELER) or native CADKEY format when possible. CADL output is supported by many CAM systems as well, but doesn't currently support surface definitions. DXF is not recommended for data transfer to manufacturing, because of the very limited types of entities supported (for example, 3D splines are represented as polylines, ellipses as curve-fit polylines). Use .PRT or IGES for surface information. CADL is acceptable for wireframe.

INTRODUCTION TO CAD/CAM DATA TRANSFER

2. If you need to add information about the part (such as material, tolerances, etc.) create a text file with the same name. For example, if you are outputting IGESTEST.IGS, manufacturing notes should be contained in IGESTEST.TXT. If you have a project nearing completion, send out test files before the actual part files are ready to check the process. According to Mark Boudreau, (master moldmaker at Mark Technical Mold, a CADKEY, ADVANCED MODELER, and SURFCAM user), "It is helpful to mail or fax a hard-copy of the original geometry, so that we can check completeness of transfer. We like the inside and outside to be on different layers, and features to be separated as well. The wireframe representation should be contained in the file, also on separate, named layers."

3. Because IGES, CADL, and DXF files are in ASCII format, they are very large when extracted from the binary database. A useful shareware utility program, PKZIP (\$47. PKWARE, 414-354-8699), allows you to compress these files so that they will fit on a single floppy disk, or transfer faster and more reliably via modem. Compressed files are only about 20% as large as the originals. If you are transferring to a UNIX workstation, insure they have the UNIX version of PKZIP. As an alternative, you can use a text editor to split very large IGES files into pieces that will fit onto a series of disks.

4. The most common transfer medium is a 3.5" high-density floppy disk, because they can be read by PC's, Macintosh, and most engineering workstations. However, transfer by modem or bulletin board is increasingly common. (Your CADKEY dealer will often allow you to use his BBS as a

transfer point). Large capacity streaming tape drives are common on workstations, but are usually incompatible with other hardware brands.

5. Insure that a procedure is in place so that vendors are notified of changes to the CAD model, and a new version transmitted. It is helpful to create a manual procedure to insure that the database is current, and create a sign-off process before final toolpaths are released for production.

CONCLUSION

Working to maximize CAD/CAM data transfer with outside vendors requires a new approach to procurement. Because the CAD database represents a complete definition of your new product, purchasing managers must work with a small group of carefully selected vendors, with the ability and willingness to work from CAD data rather than prints. The benefits in lead time and quality more than make up for the smaller pool of potential vendors.

My company, Computer-Aided Products, conducted a study of molded parts requiring custom injection molds for manufacture. While CAD/CAM integrated and non-CAD/CAM integrated vendors provided similar quotes for price and delivery, actual performance was a different matter. Projects where mold shops worked directly from CAD data averaged 3-5 week shorter deliveries (out of 16-20 weeks), and 10-20% lower costs. Non-CAD/CAM integrated shops suffered from frequent delays and cost overruns.

True concurrent engineering with outside vendors is only starting to occur. According to Dick White of Mark Technical Mold, "While CAD/CAM transfer of data is common, we're only involved at the tail end of the development cycle. If a customer worked with us from product inception, we could complete the mold

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design (three weeks) and build a custom mold base (four to six weeks), before the product was completely released. We would only need about four additional weeks to complete the mold, versus the 16 weeks it takes with the current, serial approach."

But progress is occurring. Jaco Manufacturing, a sheet metal fabrication firm (CADKEY, PROFOLD, METALSOFT) in Bellingham, MA often works with customers to complete the detail design for sheet metal manufacture. According to John Sarnofsky, Engineering Manager, "Now, about 80% of our customers are sending us CAD data, mostly via modem. We often send back CADKEY files of a redesign for their review. Cost reductions of 10-20% are the norm." □

Dana Seero, president and founder of Computer-Aided Products in Marblehead, MA writes regularly for
KEYSOLUTIONS.



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REARRANGE YOUR PART FILES AND SAVE THEM!

The screenshot shows the software interface with a menu on the left containing options like 'Exit', 'Part', 'Pattern', 'Quick', 'Rename', 'WORKING', 'CASTING', 'POTS', 'VALVE', 'PORTS', 'RINGS', 'BUSHINGS', 'Single', 'Chain', 'Window', 'Polygon', 'Group', and 'Plane'. The main area features a large grid with colored squares and a 'LEVELGRID' label. A red diagonal banner across the top right reads 'FREE PROGRAM 30 DAYS FREE'. A white text box in the center of the grid says: 'Rearrange your entities on levels by color and subject matter, WITHOUT HAVING TO REMEMBER LEVEL NUMBERS!'.

LEVELGRID

The LEVELGRID is the large grid in the lower right-hand corner of the menu. It is divided into THREE SECTIONS: 7 columns of primary colors, 7 of secondary colors and 2 for Notes and Dimensions. The entities can be automatically sorted into the appropriate columns. Each of the 15 rows has 16 levels and can be NAMED and used for related subject matter. The Levelgrid updates Cadkey's levels.

SCREEN BUTTONS

The SCREEN button toggles between the LEVELGRID and the PART so you can see the entities before you process.

LOAD ABC-PM

When ABC-PM is loaded, it scans the current part and marks each level that has entities with a colored SQUARE, BLACK = LEVEL OFF and BLUE = LEVEL ON.

SELECTING LEVELS

The user may select one of two ACTIONS: MOVE (default) or DELETE. Only levels with entities can be selected. The levels can be individually selected, they toggle on and off. There are ALL ON and ALL OFF buttons (for ALL levels) and ON and OFF buttons for each ROW and each COLUMN. These buttons have FEEDBACK lights that indicate if the ROW or COLUMN is empty, has entities that are not

selected, partially selected or all selected. They are always available so you can select while the PART is on the screen.

MASK AND PARTIAL SELECTION BUTTONS

The MASK buttons mask to specific entity type, colors, etc. PARTIAL SELECTION buttons let the user select entities manually.

MOVE-TO BUTTONS

The MOVE-TO buttons control where levels selected for MOVE are sent. There are MOVE-TO buttons for each ROW and each COLUMN. Only one ROW and/or COLUMN button may be picked at a time.

If a MOVE-TO ROW button is picked the entities will move to that row, otherwise entities will stay in the rows they are in. If a MOVE-TO COLUMN button is picked the entities will move to that column and change to that color, otherwise entities will sort to their appropriate columns.

PROCESS

No entities are processed until <Enter> is pressed, so that menu buttons may be picked in any order.

REQUIREMENTS

- * Cadkey 5.02 or later
- * MS-DOS or PC-DOS 3.0 or later
- * 256 Screen colors
- * Minimum 800x600 Screen Resolution



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Enhancing CADKEY with MERITBAR Utilities

by Chavdar Popov

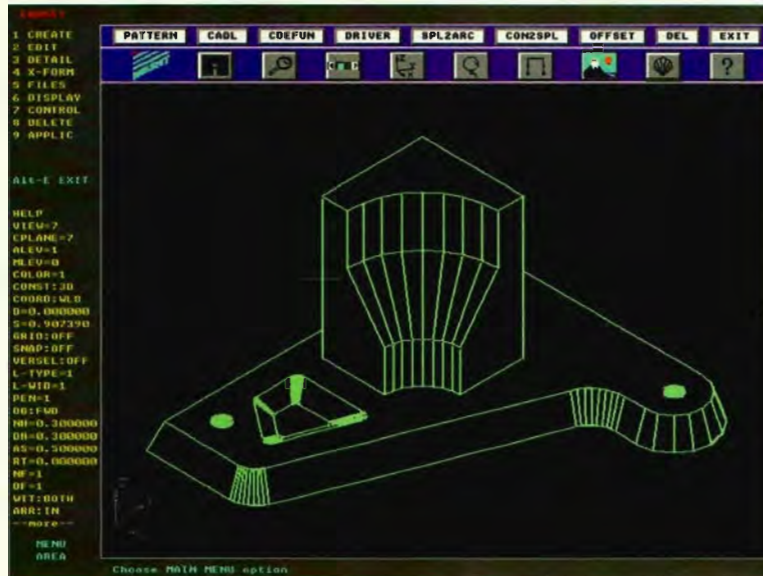
As versatile as the CADKEY interface is, many users still prefer the mouse-picking (left hand in pocket) method of selecting CADKEY functions. To save time and tablet money, we at Merit Systems have developed a new add-on utility that we call the Meritbar.

The Meritbar functions as an intelligent on-screen tablet. This gives you the option to short-cut the CADKEY functions by pushing the icon buttons displayed at the top of the drafting window. For those who like working with Windows, sliders have been added to help you pan the screen horizontally or vertically.

In addition to this enhanced interface, the Meritbar offers a set of drafting and advanced modeling utilities. These utilities incorporate sophisticated math routines which boost CADKEY's 3D power even higher. The following briefly describes the features of the Meritbar CADKEY utilities.

ROTAX - rotates the view about a 3D axis

Finding the best CADKEY view to inspect the details of a complex 3D wireframe can be a frustrating experience. The natural way to rotate the view of a part without losing your orientation is to have one axis fixed. With ROTAX you can actually see the axis of view rotations and push the part around it with the mouse until you are satisfied. The axis can be set anywhere on the part; it may be attached to a major feature (hole, bearing, etc.) about which the component will rotate or swing in its real-life application.



If you work in 3D on a regular basis, you will appreciate the advantage ROTAX gives by letting you decide where the part goes when the view is changed.

SECTION - creates cross-hatchable plane sections of 3D polygon models

The ability to create sections which can be handled separately from the 3D model has always been on the CADKEY users' wish list. The Meritbar will create single or multiple sections of a complex polygon model and automatically direct them to the CADKEY cross-hatching dialog box. The section is an entity of its own. It can be moved away from the part, dimensioned or edited as any other CADKEY entity.

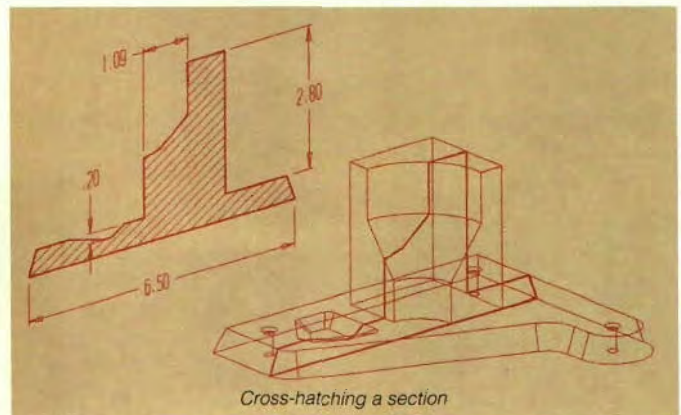
BALLOON - creates and edits balloons

Meritbar balloons can be edited extremely easily — just pick and stretch them with the mouse.

The program not only creates balloons, but also looks after them once placed in the drawing. It will automatically recognize which part of the balloon has been picked and stretch it while preserving the other end's position.

SPL2ARC - converts splines to a smooth sequence of arcs

The SPL2ARC utility will allow you to replace the CADKEY splines with a sequence of arcs prior to outputting them to your CAM system or machine tool. This dramatically reduces the size of the CNC program/tape while maintaining the quality of the machine curve. The composite curve created by Meritbar represents a precise copy of the spline geometry; it's always smooth and passes through the spline nodes and inflection points. Given the same number of segments, this method produces a much smoother curve compared with line segmentation. The spline-to-arc conversion is also helpful for exporting smooth curve data to a package that does not accept cubic splines.



SPLINE-FIT- converts 3D line/arc contours to splines

The SPLINE-FIT utility replaces a chain of 3D lines and arcs with a single CADKEY spline entity. The new one-entity contour may be used to create surface meshes having boundaries defined by more than one entity. The program also allows for the creation of composite curves that incorporate sharp corners. This way, a square-to-round surface mesh may be constructed. With this utility you can create splines that follow the



shape of an arc or circle. The algorithm employed calculates the appropriate end conditions so these splines seldom need to have any intermediate nodes.

EQOFFSET- creates line and contours

Offsetting contours is a problem that has been addressed with varying success by several third party developers and CADKEY itself. Performing a real offsetting operation is not a straightforward operation. The problem is that consecutive entities that are not tangent at their connection points need to be trimmed to each other when offset. Some entities disappear completely and new entities have to be introduced to round sharp corners. The Meritbar OFFSET utility automatically offsets and trims the new entities to produce a continuous contour or even multiple contours with a different offset. It also handles or warns of most irregularities that may occur in the process.

Meritbar is in its first release. It is designed to be continuously enriched with new functions. We are very anxious to get user feedback so we can enhance it even further. Please give us your suggestions.

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CAE TECHNOLOGY IMPLEMENTATION

by Robert Shaefer and Frank Lucatelli

Although this article focuses on the plastic industry and CAE technology, the concepts, problems and solutions are valid in all arenas.

Computer Aided Engineering (CAE) technology has been hailed as the most significant development in the design of injection molded products in the past twenty years. Using CAE, engineers and designers can perform tests on new products before cutting any steel, without costly prototyping or

manufacturing trials. The manufacturing process can be simulated to avoid pitfalls and improve process capability. It is even possible to predict the shrinkage and subsequent warping of molded plastic parts prior to committing to sizes for cavities in a mold.

Most plastic material suppliers have one or more CAE software programs installed and have completed extensive evaluations. It is difficult to find injection molding companies that have not heard of CAE software and most have had some experience with its use. Still, experts in the field put the number of active, installed CAE sites under 1000 in North America. *Plastics Technology* magazine reported that respondents to a survey in 1992 used CAE on about 10% of molds. Assuming there are nearly 10,000 molding shops in North America, the number of molds benefiting from CAE is around 1%. The figure might be slightly higher because of the number of consultants making CAE available to shops that do not own copies of software, but the fact remains that CAE technology is used on only a small fraction of new molds built in North America.

What stands in the way of the spread of CAE technology? Is there some fatal flaw in the software that reduces its effectiveness in the real world of injection molding product design? The answer to this question may reside in the system used to implement CAE at most companies. Since CAE is an engineering tool, it is normally used within the engineering or research group. Analysis work is usually done by a small group or even one person who has been trained to run the CAE

software. It is almost always used to avoid problems on "difficult" molds or to solve problems after they occur. As a result, the return on investment for this expensive tool is often limited to savings generated on very few molds. Economic justification is often replaced by viewing CAE as "correcting mistakes" or an expensive way to make up for shoddy work or inexperienced personnel. As a result, managers often use CAE only when it is unavoidable rather than seeing it as an investment in better quality and higher profitability.

Optimization with CAE

There are many direct benefits from the use of CAE such as reduced material usage, improved cycle times, lower scrap rates and less runner regrind. However, the largest possible savings from the use of CAE accrue when it is used as part of the design process to eliminate unnecessary material or to cut processing cycle times by using the unique properties of the plastic to provide required strength. The process has been described by Colin Austin, Chairman of Moldflow Pty. Ltd., as changing from "Metal-think" to "Plastic-think".

Many parts are made with constant wall thickness because the metal part was stamped from sheet metal and conventional wisdom says that will be easier to cool. Many structural components are designed to look like their metal forerunners. CAE can be used to overcome these deficiencies by finding areas of low stress and removing material. Innovative designers can often replace thick sections with ribs and structural shapes to save material and reduce cycle times needed for the thick sections.

Lastly, molding simulation can be used to design cooling systems that deal with the varying wall thickness and to optimize cycle times. The result can be a part that performs better, weighs less and can be processed faster. In a recent example cited by Mr. Austin, CAE was used to cut the cycle time in half and use one third less material. The final part was stiffer in resisting deflection because the material was concentrated where it served that purpose without adding undue weight to the part.

Optimization Requires Training and Teamwork

This process, called optimization, can only be successful if it is applied early in the product development process. It requires teamwork from a group with diverse skills. Optimization must be done early because it is a creative process and

CAE was used to cut the cycle time in half and use one-third less material.

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requires time to try out ideas. Teamwork is essential because improvements for one group may result in extra cost for others. The addition of

Direct benefits from the use of CAE . . . reduced material usage, improved cycle times, lower scrap rates and less runner regrind.

marketing and sales talent to the team may result in changes that can be sold as fulfilling a previously unmet need for the customer. Teamwork is also desirable because CAE software crosses many disciplines of part design, mold design and processing. Fundamental decisions may be required throughout the process, including changes to the original design of the part.

Another issue with the use of CAE is that it affects the jobs of many people. Most of these people have had

limited exposure to CAE technology and may find that CAE intrudes on their traditional roles. Tooling engineers and mold builders may question the suggestions generated by CAE such as putting the gate in a difficult place, or making small runners when they have always made them bigger. More fundamentally, they may feel threatened by the fact that someone else is doing a job that they were formerly asked to perform.

Cooling systems designed with CAE are often more difficult to build and result in higher tooling costs. Without a knowledge of CAE, it is difficult to agree that the extra effort and cost is justified. In manufacturing, the start-up people find that process conditions have been developed on a computer, but the computer doesn't know anything about the machines on the molding floor. Sometimes, the molding machines are not able to produce the conditions required. The tooling and molding engineers often feel manipulated by the CAE engineer. Unless they understand the process and are allowed to participate in it, many designs are scrapped before they are given a fair chance to succeed.

The first answer to this set of problems is education. Companies can conduct seminars for employees whose jobs are affected by the use of CAE. This is an invaluable element in successful implementation of CAE. However, introducing the organization to CAE only starts the process. It is also paramount to harness the creative abilities of the tooling, manufacturing and marketing people during the critical design step and to continue the communications through tooling construction and production. This goal is best achieved through teamwork. Teamwork has become one of the buzzwords of the 1990's. Companies everywhere are forming teams for various purposes. Some even tout design teams in television advertisements. But teamwork isn't that easy because we often don't really know what we are trying to do in simple terms; and we don't know much about the skills of the people we work with.

It should also be understood that cooperation need not be limited to one company. Since the majority of business involves interaction and collaboration, strong relationships between companies can enhance

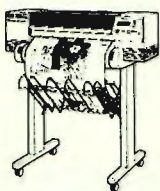
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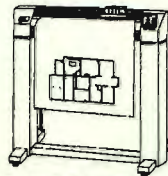
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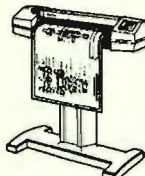
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business even when the entire product development process is not controlled by a single company.

Training and Team Building Approaches

For this process to work, two efforts must proceed hand in hand. Current technology usage must be understood while an inventory of human skills of the existing team is taken. An assessment of current technology is best done with a workshop for decision makers in engineering, manufacturing, sales and marketing. The workshop provides a forum for discussion of implementation issues within the organization. Introductory workshops can be tailored to address specific issues of interest to decision makers. A combination of presentation and discussion are used to form objectives and to develop a model for implementation.

Technical training for CAE users and for those affected by its use within the enterprise is aimed at removing the "mystery" from CAE. Any technology, when understood for what it can do and what it cannot do, is less threatening. The aim is to eliminate the feeling that CAE technology can replace the experience of skilled

workers. Indeed, CAE is most effective when all of the team members participate freely, answering questions about design and processing before the product reaches the floor. CAE can be a great learning tool when dealing with new or unfamiliar materials or new designs. It can even be used to calculate difficult process parameters like injection velocity and packing pressure profiles. These types of processes are normally never optimized since experimentation on the molding machine is time consuming and expensive.

Follow-through consulting is the process of monitoring the system developed to be sure that it stays on track. Requirements are likely to be high at first but should wind down as experience is gained. Continuing involvement is also advisable to recognize the need for refresher training or to introduce new people to the concepts of team building and CAE use. It is also important to maintain an ongoing record of accomplishments, expressed in financial terms, so that the value of the effort is recognized. Like any other investment, the return should be recorded and reviewed periodically.

The goal of implementation consulting is to provide a team that is skilled in the use of CAE technology and able to determine when and how much it should be used. Most companies now use CAE only on difficult projects. This has the effect of creating emergency use, often delaying the development of critical projects.

CAE can be a great learning tool when dealing with new or unfamiliar materials or new designs.

More general use of CAE has the effect of improving the skill level, making CAE an efficient tool on all projects, reducing the overall cost. CAE, when used effectively, can have a beneficial effect on all projects, and have significant benefit for difficult projects. Wise investment in engineering technology will return higher quality products and higher profitability. ☐

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Timberline TrueCAD and TrueGraphics True to Name

by Robert Martin

These days a lot of folks are putting together 486 PCs and calling them CAD workstations. From a price/performance perspective some are great - others only OK. A relative newcomer to the arena, Timberline of Meridian, Idaho is not as well known as some of the big guys, but this small company is producing a very good product.

Timberline sells and services a complete line of 486DX2 66s that range in price from \$3995 to \$8585, depending on the options you select. For example, the high speed hard drives range from 520M to 2.1G and RAM ranges from 8 MB to 64 MB.

Timberline has worked hard to make their machines high performers. In fact, PC Magazine tested 74 486DX2/66 computers in Jan. 1993. As part of this benchmark,

ZD Labs measured seven indicators of performance and speed: disk, Graphics Winmarks, DOSMark, processor, memory, Disk Winmarks and video.

Timberline completed the testing to compare their machines to the competition. Timberline would have placed in the top three on six of the seven tests. They were first in DOSMark, processor and Graphics Winmarks; second place in Disk, and third place in memory and Disk Winmark.

A strong point of the TrueCAD machines is their expandability and flexibility. Each incorporates a Pentium upgradeable motherboard, seven 32-bit EISA slots and one 32-bit Local Bus slot. The three 32-bit CPU design even lets you obtain parallel processing in certain cases.



The EISA SCSI caching controller comes standard with 32-bit drivers for DOS, Unix, and Xenix. This allows the use of multiple operating systems on a single platform and protects your software investment.

Good engineering shows and the small touches tell the tale. For instance, the power supply in the full size tower has its own "SMARTFAN" which constantly measures the interior temperature and automatically adjusts the rotation speed to the exhaust fan accordingly. ☐

For more information call Timberline at 208/887-0969.

A Hot C-Size Bubble Jet for Plotting

by Robert Martin

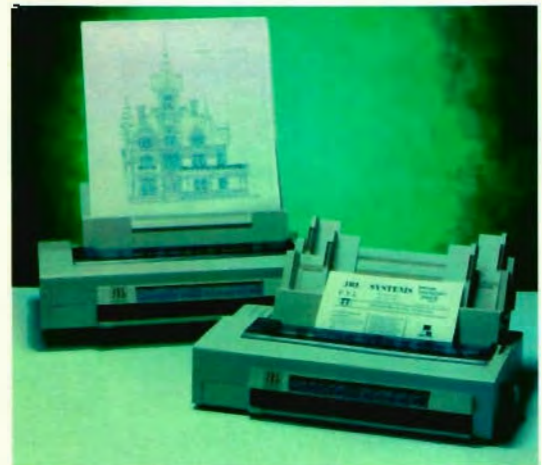
Recently several printer vendors have released desktop bubble-jet printers capable of C-size output and touted them as printer/plotters. You probably noticed that they all looked alike and wondered. These devices look nearly identical because their basic print engine and case come from the same manufacturer. However, that's where the similarities end because each vendor adds functions and capabilities with software, emulations, controllers, and paper handling.

I've tried them all and they work fine. I felt a little blase' when the JRL version arrived for a test, but I quickly discovered that this one's different. The JR 670 is more functional as a plotter than any other that I have used.

First, the JR 670 has superior paper handling for plotting. A full-size automatic C-sheet feeder is available that holds 100 sheets. (Others make you feed C-size media

one at time through the manual feeder.) Its paper parking capability lets you alternate easily between cut sheet and tractor media. It handles almost any media, including plain paper, vellum, envelopes, and transparencies.

The JR 670 supports ADI, HP-GL, CalComp 906/907, Epson LQ1050, and Postscript output. The JR 670 also handles CCITT Groups 3 and 4 compressed raster data in a superior and unique way. You can send this type of compressed raster file directly to the plotter without decompression (even through a network); the JR 670 decompresses and prints the file automatically. The others don't do this. The printer even recognizes the data format of the files you send and changes to the correct emulation automatically. Other features on the plus side



include super-fast processing times and 360 dpi resolution. Much of this power and flexibility is the result of JRL's proprietary integrated intelligent controller.

The Postscript model comes with 8 megs of RAM and costs \$2495; the printer without the Postscript option has 2 megs and costs \$1995. ☐

For more information contact: JRL at 512/288-6750; Fax 512/288-7676.

IN HIS TIME Makes My Day

by Steve Radford

A former devotee of black, bound daily appointment books, I now use a computerized system that is light years beyond my old manual method. The Windows program is called *In His Time*, and can best be described as "the Christian Information and Resource Organizer" - CIRO™.

CIRO's easy-to-use, well-organized features include tracking for appointments (either one time or repeating), things-to-do, and events to remember. These entries can be accessed by displaying a calendar for the year, month or week. Alarms can be set as a reminder. Additional features include a Daily Journal which can be linked to the Windows Notepad or your word processor, an address book, and printing of three popular sizes of day planners for when you must leave your computer and hit the road.

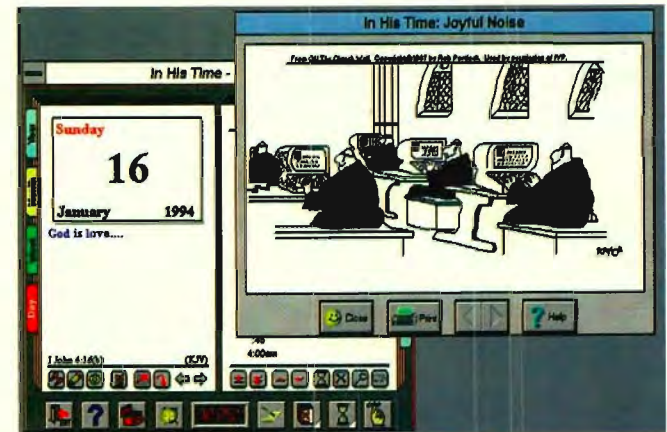
I have my system set-up to start each day with "Joyful Noise -- Comic Relief," a cartoon that should appeal to any Christian. I also print a daily summary report each morning when I arrive at my office. It includes my

To-Do-List for the day, appointments, events to remember, the daily Bible reading, and a prayer listing. A passage from Scripture appears both on the report and screen each day. I find this a great way to start the day and like the inspirational message. Scripture Topics is a listing of subjects (i.e., Adultery, Alcohol, Ambition, Anger, etc.) with a listing of Scripture references. There is a Daily Prayer Journal that lets you track prayer requests and answers.

In His Time is as powerful a personal resource manager as you can find anywhere. I personally like it's Christian elements, but if this is not your persuasion, you can turn them off and lose none of the software's power or features. For

me, it helps integrate some spiritual elements into a sometimes sterile business environment. ☐

For more information contact, Colannade Technologies, 206/822-2977.



TECH TIP

You can reorganize commands in CADKEY Status menu. Use a text editor to move the lines in the STATUS.TXT file so that frequently used commands are at the top. This trick works with DRAFTER and LIGHT as well.

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CADKEY dimensions are entities attached to a particular plane of definition. Once created, dimensions may be seen from any view by pressing Ctrl-N. However, unlike other view-dependent entities (arcs, conics, 2D splines), dimensions must be created in their definition views. Because the 3D geometry is often superimposed, it's sometimes difficult to control the depth at which a dimension will be placed.

The ISODIM program allows creation of linear dimensions in 3D without the limitation of having to change the view in order to work in a particular plane. This way, a wireframe 3D model may be dimensioned from the view in which it will be presented. By changing the construction plane, the user can control the position and orientation of the dimensions. The dimension text is oriented in accordance with the construction view axes.

Horizontal dimensions are measured along the X-view axis, vertical dimensions, along the Y-view axis. In depth, each dimension is attached to its first reference position. This allows for the creation of dimensions at different depth levels in the same construction view. To help with the 3D orientation, temporary dotted witness lines are displayed prior to indicating the text position. The two reference positions are projected onto a plane which is parallel to the construction plane and passes through the first reference position. The dimension is measured in this plane. If the construction view is perpendicular to the display view, the cursor movement cannot be traced on the screen. To prevent this, the program projects the normal of the construction view onto the plane of the display view and examines its length. As with CADKEY itself, zero length dimensions cannot be created. For faster operation, compile the program into a cdx file and don't forget to press Ctrl-N before you start dimensioning. A comprehensive dimensioning utility, capable of creating also circular, radial and angular dimensions in 3D, will be included in the Meritbar Set of Utilities, featured in this issue.

by Chavdar Popov
Merit Computer Solutions Ltd.
United Kingdom, tel: 011 (44) 495
301303, fax: 011 (44) 495 350504

```

REM ISODIM.cdl - creates dimensions in 3D isometric views
REM
REM The dimensions are measured and created parallel to the construction plane
REM Press Ctrl-N to allow dimension display in 3D

clear

int ENTATT[0]

array REFLN[2][4]
array ENTATT[9]

ufac      = (@units) ? 1:1/25.4
big       = 10000*ufac
vwangtol  = cos(80.001)

opt       = 3
form      = 1
id1=id2  = -1

mode draw

:selopt

drawent id1
drawent id2

getmenu "ISODIM: Choose option (HORIZTL)",\
        "HORIZTL",\
        "VERTICL",\
        "PARALEL" ,,,,,,1,1

form = (@key > 0) ? @key:form
on (@key + 3) goto end,end,

REM Check angle between view and cplane
call dotprod,@viewmat[2],@viewmat[5],@viewmat[8],\
           @cviewmat[2],@cviewmat[5],@cviewmat[8],\
           vvang

if (abs(vvang) > vvangtol)
    goto first

    pause "This view is perpendicular to the cplane <RET>"
    pause "Select a different view to dimension in this plane <RET>"
    goto selopt

:first

getpos "Indicate 1st position",opt
opt = (@key >= 1) ? @key:opt
on (@key+3) goto selopt,selopt,first,

        x1 = @xcview
        y1 = @ycview
        Z  = @zcview

set depth,Z

view 1, @cviewmat[0],@cviewmat[1],@cviewmat[2],\
        @cviewmat[3],@cviewmat[4],@cviewmat[5],\
        @cviewmat[6],@cviewmat[7],@cviewmat[8]

if (form == 1)
    VLINE x1,y1-big,Z,x1,y1+big,Z,1,14,,2
if (form == 2)
    VLINE x1-big,y1,Z,x1+big,y1,Z,1,14,,2
    
```


BOOKS, PUBLICATIONS, ETC.

```
:second
  getpos "Indicate 2nd position",opt
    opt = (@key >= 1) ? @key:opt
    on (@key + 3) goto selopt,first,second,

    x2 = @xcview
    y2 = @ycview
    z2 = @zcview

  REM check if distance is long enough
  dist = hypot(y2-y1,x2-x1)
  if (dist < 0.01*ufac)
    goto second

  if (form == 1)
    VLINE x2,y2-big,Z, x2,y2+big,Z,1,14,,2
  if (form == 2)
    VLINE x2-big,y2,Z, x2+big,y2,Z,1,14,,2
  if (form == 3)
    VLINE x1,y1,Z,x2,y2,Z,1,14,,3

  REFLN[0][0] = x1
  REFLN[0][1] = y1
  REFLN[0][2] = x2
  REFLN[0][3] = y2

:gettxt

  getcur "Indicate dimension text position",1,0
    on (@key + 3) goto selopt,second,gettxt,

    xt = @xcview
    yt = @ycview

  ang = (form == 3) ? atan2(y2-y1,x2-x1) : 0.0

  ENTATT[0] = 1
  ENTATT[3] = @pen
  ENTATT[4] = @level
  ENTATT[5] = @ltype
  ENTATT[6] = @lwidth
  ENTATT[7] = ENTATT[8] = 0

  REM Display temporary dimension
  ENTATT[1] = ENTATT[2] = 15
  lindim xt,yt,Z, ,REFLN,ang,form,,,,ENTATT
  ENTATT[1] = ENTATT[2] = 0

  getmenu "Accept dimension ? (YES),\"NO\", \"YES\"
    lindim xt,yt,Z, ,REFLN,ang,form,,,,ENTATT
    on (@key + 3) goto selopt,second,,,gettxt,

  REM Create dimension entity
  mode normal
    ENTATT[1] = ENTATT[2] = @color
    LINDIM xt,yt,Z, ,REFLN,ang,form,,,,ENTATT
  mode draw

  goto selopt

:end

  redraw
  exit
```

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Reports are available in most industry sectors for \$250 each. For more information contact Michael Seely, Dataquest, San Jose, CA; 408/437-8316 or fax 408/437-0292. □

MACROS CADL CDEs

by Craig Storms & Usman Rashid

A Shareware Compiler for CDEs

If you are thinking of writing CDE modules for CADKEY, you need the MetaWare High C compiler and the Phar Lap DOS Extender Kit. The reason you can't use any other compilers is that CADKEY is a 32-bit application and all extensions to it must also be 32-bit. This eliminates all but a few compilers on the market, such as MetaWare and Watcom. Since CADKEY itself is compiled with the MetaWare compiler, it's no surprise that the CDE loader in CADKEY only accepts CDEs compiled with the MetaWare compiler.

While this development system for CDEs is powerful, it can cost you nearly a thousand dollars. If you only want to do some minor tasks with CDEs, or you want to try out the CDE mechanism before you decide on using it, a thousand dollars seems like a costly investment. This article presents an alternative approach to building CDEs that will lower your costs considerably, and will still give you all the power and speed of CDEs.

The GNU Compiler

The GNU C compiler (GCC) is a product of the Free Software Foundation (FSF) of Cambridge, Massachusetts. It is part of the GNU project started by Richard Stallman in 1983 for producing a UNIX-compatible operating system. The purpose behind FSF is to give the users "...freedom to study, share, change and improve the software they use." For this reason, all software from FSF includes the source code along with the applications. Users can make changes to the source to suit their needs.

Using the source for the GNU compiler, D. J. Dolorie of Rochester, New Hampshire ported the compiler for 386 MSDOS computers. The DOS package contains a C/C++ compiler with utilities, a DOS extender, and a symbolic debugger. The compiler generates 32-bit code, which is why it can be used for creating CDEs. In the following sections we will show you how to build CDE modules using the GNU compiler.

Requirements

To create a CDE module with the GNU compiler, you need the following:

1. The GNU version of the CADKEY SDK. This SDK

- contains the necessary executables, header files and object files for building CDEs with the GNU compiler.
2. The GNU loader. This is a CDE module that loads GNU-compiled CDEs.
3. The GNU Compiler version 2.2.

Installation

All the required components listed above can be downloaded from the developer's area on Cadkey, Inc.'s bulletin board at 203/ 298-6405 (eight data bits, no parity, one stop bit, full duplex). The files are:

GCCMIN.EXE: Self-extracting ZIP file containing the GNU compiler.

GCCSDK.EXE: Self-extracting ZIP file containing the CADKEY 6 SDK for the GNU compiler.

GCC.CDE: Uncompressed loader for GNU-compiled CDEs.

To install the development system follow these instructions:

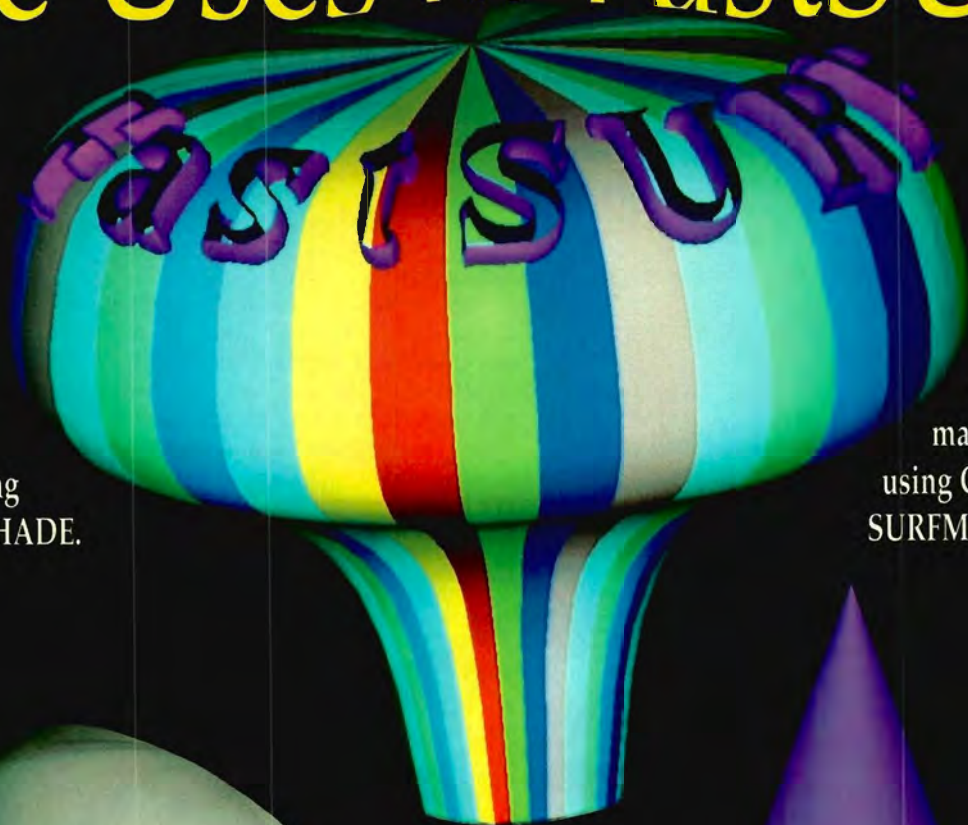
1. Make a directory for the compiler and copy GCCMIN.EXE into that directory. For example, at the C> prompt:
C:\> MD \GCC <Enter>
2. Extract the files by executing GCCMIN with the '-d' option, as shown below. This option re-creates the compiler sub-directory structure.
C:\> CD GCC <Enter>
C:\GCC> GCCMIN -d <Enter>
3. Make a directory for the CADKEY SDK and copy GCCSDK.EXE into that directory:
C:\> MD \GCCSDK <Enter>
4. Extract the files by executing GCCSDK with the '-d' option:
C:\> CD GCCSDK <Enter>
C:\GCCSDK> GCCSDK -d <Enter>
5. Set the environment variables required to run the GNU compiler. The file SETUP.BAT in the compiler directory shows all these variables and their values. It assumes the compiler is installed in the \GCC directory. If you name your directory something else, make changes accordingly.

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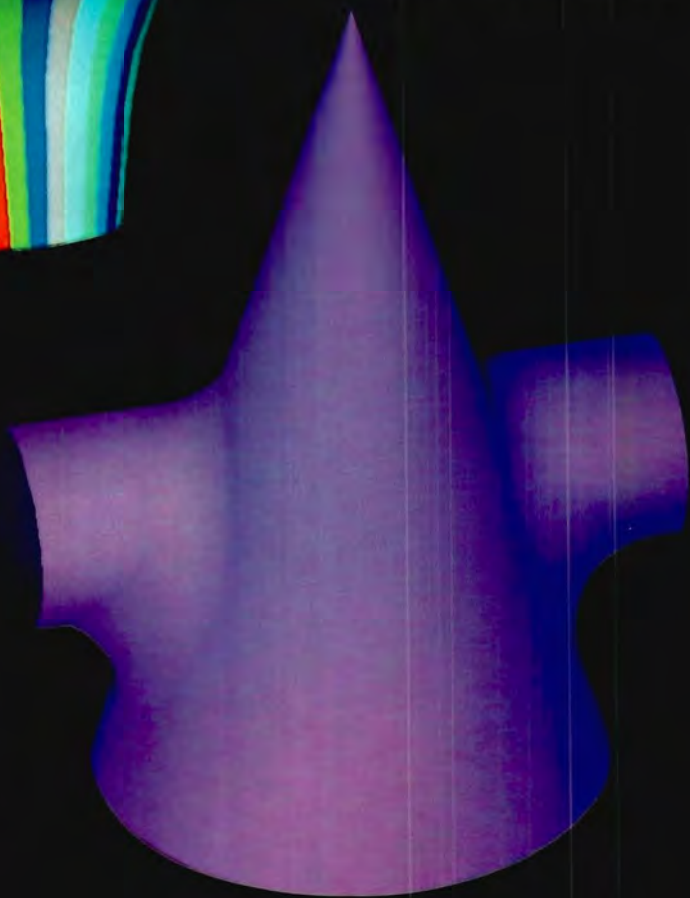
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A Shareware Compiler for CDEs

You can set the environment by running SETUP.BAT before you begin compiling. You can also move the contents of SETUP.BAT into AUTOEXEC.BAT. This way, your environment will be set as soon as you turn on your computer. You must also add \GCC\BIN to your path statement in AUTOEXEC.BAT.

Building a GNU CDE Module

The process for building GNU CDE modules is very similar to that of building a CDE module. The differences are in the command line for compiling and the use of GCC.CDE.

Header Files

Depending on the CDE functions you use, you need to include one or more of the following SDK linkage header files in your source files:

CK_CDL.H For CADL Library Functions
CK_DLG.H For Dialog Box Functions
CK_LAY.H For Layout Functions
CK_MTH.H For Math Library Functions
CK_REF.H For Reference Entity Functions
CK_SYS.H For System Library Functions

These files are located in the \GCCSDK\INCLUDE directory. There are additional header files supplied with the SDK which are necessary for creating GNU CDE modules. All the SDK header files must be present in the Include directory or you will not be able to successfully build GNU CDE modules.

Listing 1 shows the source file HELLO.C. It includes the header "CK_CDL.H" since it calls ck_pause, a CADL Library function.

```
----- Listing 1 -----  
/*++  
Name: Hello  
Summary: Prints a greeting  
*_*/  
void hello ();
```

Definition Files

Every CDE module requires a definition file. The definition file provides information about the CDE module so that CADKEY can load it. As a minimum, it must contain the names of the functions in the CDE module that need to be accessible from inside CADKEY.

The definition file for the "Hello, world!" application, HWORLD.DEF, is shown in listing 2.

```
----- Listing 2 -----  
#include 'ck_cdl.h'  
void hello ();{ck_pause(Hello,World!);}
```

Running CDEGEN

To include the definition file into the CDE module, it must be processed through the CDEGEN utility. CDEGEN reads the information in the definition file and creates a C file. This C file contains data structures that encapsulate the information about functions. When CADKEY loads a CDE module, it deciphers the functions in the CDE with these data structures. The definition

file is processed through CDEGEN the first time it is created and then every time it is modified.

To process HWORLD.DEF, use: cdegen hworld.def. This produces the file HWORLD.C.

Caution: Choose the name of your definition file carefully. Do not use the name of any of your source files. Otherwise, the C file produced by CDEGEN will overwrite it.

Compiling

The next step is to compile all the source files (the C file output by CDEGEN can be treated as one of the source files) to produce object files. Use the '-c' (compile-only) flag on the compiler command line so that it does not try to link it into an executable:

```
gcc -c -I/gccsdk/include hello.c hworld.c
```

The above command line assumes that the path for the SDK Include files is "\GCCSDK\INCLUDE". This step will yield the object files HELLO.O and HWORLD.O.

Object Files

The last step is to combine the source object files with the SDK object files into CDE module. The LD utility is used for this step. The SDK object files follow the same naming convention as the linkage headers. These files are located in \GCCSDK\OBJ\G87:

CK_CDL.O For CADL Library Functions
CK_DLG.O For Dialog Box Functions
CK_LAY.O For Layout Functions
CK_MTH.O For Math Library Functions
CK_SYS.O For System Library Functions
CK_REF.O For Reference Entity Functions

You only need the object files for the functions you call. HELLO.C calls ck_pause from the CADL Library, so it needs CK_CDL.O. The command line for building the CDE module is:

```
ld -r -o hello.cde hello.o hworld.o ck_cdl.o
```

To keep the command line short, you can copy CK_CDL.O from the SDK object directory into the project directory. Executing this command line will create the CDE module HELLO.CDE. This module is ready to be loaded into CADKEY.

Loading the GNU CDE Module

To load the GNU CDE module, copy GCC.CDE (the GNU loader) and HELLO.CDE into CADKEY's default CDE directory. Start up CADKEY and go to FILES menu. Choose the CDE option from menu. First load GCC.CDE and then HELLO.CDE with OPEN or LST/OPEN option. You can execute the hello function using the EXECUTE or LST/EXE options. This will display "Hello, world!" on the prompt line.

Once you have a CDE properly loading and executing, you can load the CDEs automatically by using option 5 of CADKEY's config program. Be sure to list GCC first so that the GNU-compiled CDEs load properly.

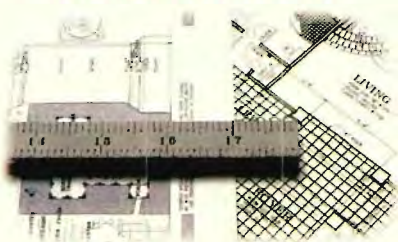
Conclusion

The GNU compiler is a freeware compiler that you can use to create CDEs. It provides a low cost alternative to the standard CDE development system you can use to test-drive the CDE mechanism. ■

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CADKEY CORNER



by Jack W. Allen

Drawing Layout Hidden Line Removal Methodology Using CADKEY 6.0

The purpose of this methodology is to enable designers to perform HLR (Hidden Line Removal) on their Drawing Layout Orthographic views using the "Picture It" CDE program.

1. Create a blank part with the following modals pre-set.
 - A. Name Layers 191 to 199 as follows:
 - L191 TOP VIEW HLR
 - L192 FRT VIEW HLR
 - L193 BCK VIEW HLR
 - L194 BTM VIEW HLR
 - L195 RHT VIEW HLR
 - L196 LFT VIEW HLR
 - L197 ISO VIEW HLR
 - L198 AXO VIEW HLR
 - L199 AUX VIEW HLR
 - B. Name any layers that you might reserve for type specific entities.
 - L090 DIMENSIONS
 - L091 SECTION LETTERS AND ARROWS
 - L092 BALLOONS AND BOM
 - L096 DRAWING SURROUND
2. Save this part as STARTUP.PRT and call this part whenever you start a new file. Save this as <filename>.prt where <filename> is the name of your job.
3. Upon completion of modelling, prepare the required orthographic views and name them accordingly.
4. Change to your first orthographic view: TOP and execute "PICTURE IT" HIDDEN LINE then save the result to the designated layer: L191. Continue this process for each of the required views and save the results to their corresponding layers. You could even do a POLYGON FILL ISO view and save this to its layer.
5. GOTO Drawing Layout mode and create the required instances. Then modify the layers of each instance so that all layers are OFF and only the HLR layer is ON in addition to any annotation layers that you need.

The end result is separate drawing layout geometry without modelizing and the ability to display rendered views. Your 3D model will remain intact.

Jack W. Allen is founder of Imagineering CADD Services (416/771-9236) and has done aircraft tool design and CADL programming since 1986. ☐

AND ANY ADDITIONAL VIEWS AS REQUIRED UP TO L255.
* DO NOT USE L256 FOR STORING ANY GEOMETRY.



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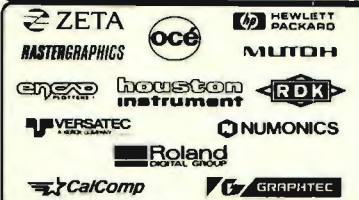
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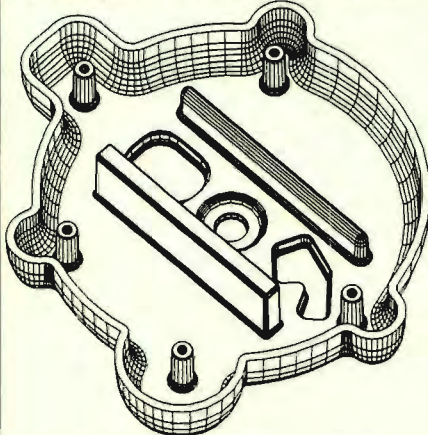


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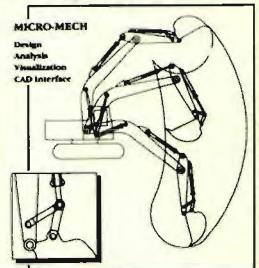
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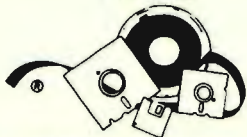
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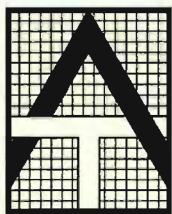
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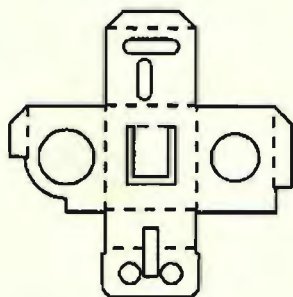


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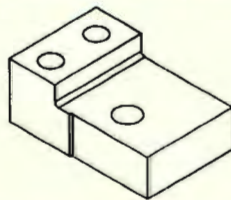
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Help Wanted

Mechanical Designers/Drafters: Experience with machine parts, sheet metal, plastics and packaging. Knowledge of ANSI standards and mil specs a plus, with 2 to 3 months of CADKEY. Rate: Open. Length of Position: Long Term. Contact: Michael St. Germain, Westwood Business Centre, 690 Canton Street, Westwood, MA 02090. Ph: 617/320-0064; Fax: 617/320-0340; in Rhode Island, call 401/861-1323.

Great opportunities for career-minded hardware and software engineers in the CAD/CAM/CAE/CNC industries. Send resume in confidence to Bill Wright CAD/CAM Recruiters Inc., 3400 High Hamptons Rd., Ste. 601, Charlotte, NC 28210; 704/541-1100; fax 704/541-7071. All positions are direct/permanent. All relocation and fees paid. Since 1981.

Contract Positions Wanted

Over 20 years experience in mechanical 3D design, packaging, and client/vendor interfacing and negotiations. Equipment available with employment. Macintosh dual screen Workstation with ACAD 12; CADKEY 6 - DOS version. Will provide references and samples. Call David S. Kiley, P.O. Box 537, Sutton MA 01590; Ph: 508/865-1724; Fax: 508/865-1535.

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Key Mail

Cadkey's Everywhere

You'll notice the cover of October's *Modern Machine Shop* is the photo from our (SURFCAM's) Cadkey ad. The story was written strictly as a tutorial and mentions neither SURFCAM nor Cadkey, but people around the world recognize that hair dryer as a Cadkey part! From the pictures, the whole thing looks like a Cadkey/SURFCAM story.

Marge Diehl, Surfware, Inc. San Fernando, CA

Hot Shareware Tip

Graphics Workshop for Windows is unquestionably the finest, most impressive piece of shareware I've ever encountered. There is a big .doc file in Windows Write format included. Basically you can scale, crop, translate and just an incredible number of other "...ate" operations in it. It reads and writes eighteen different graphics formats, including .gif which is the CADKEY SLIDE file format now.

Bud Alford, Inscale Design, Traverse City, MI

SOS Feedback

When I last spoke with Bob Fromm, he reported that the teachers were quite enthusiastic about the electronics learning module we donated through the Save Our Schools program. We're please that they like the equipment and hope it serves them well for many years to come.

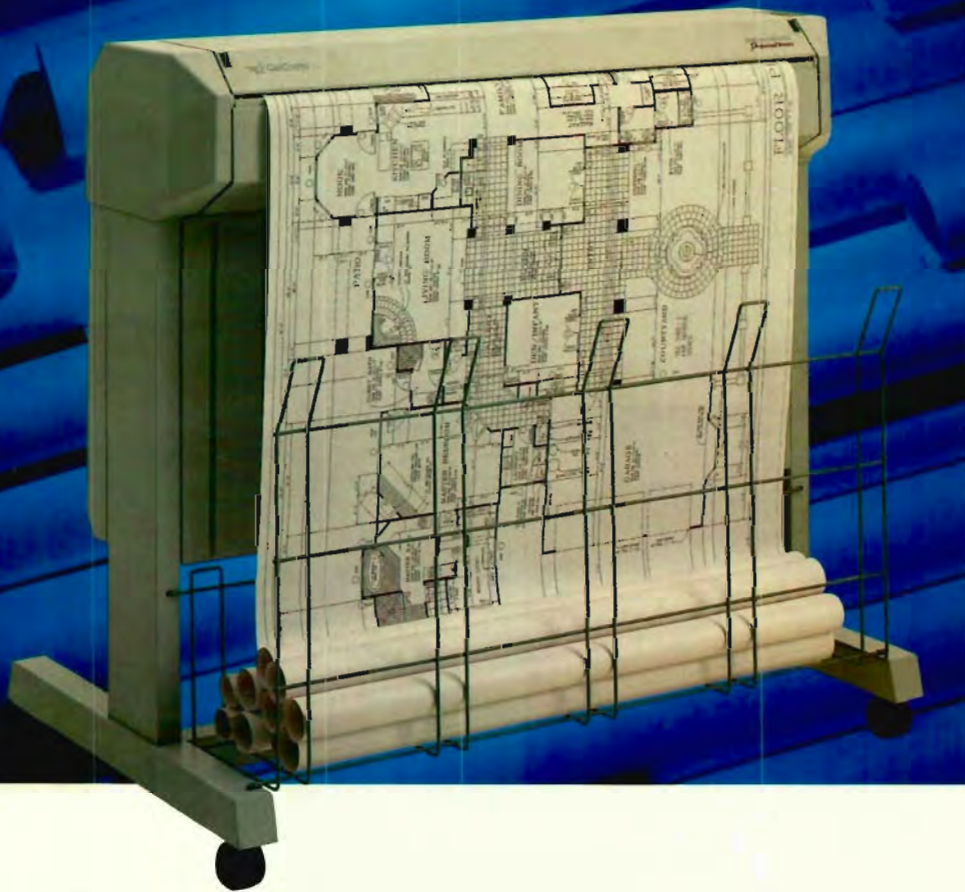
Denton Bramwell, Demax Education Products, St. Joseph, MI

Thanks for the Help

Twenty-three students who have been affiliated with the EAL/DOW College Opportunity Program will be leaving for college this fall. None of these youngsters would have been on the college tracks if they hadn't been participants. For example, in Chicago's inner city, twenty-five youngsters started out and seventeen graduated. We simply couldn't have completed these programs without the Public Service Ads that you have been running for us. Your ads bring in the inventory, generate the scholarships and change lives.

V.R. Roskam, EAL Glen Ellyn, IL

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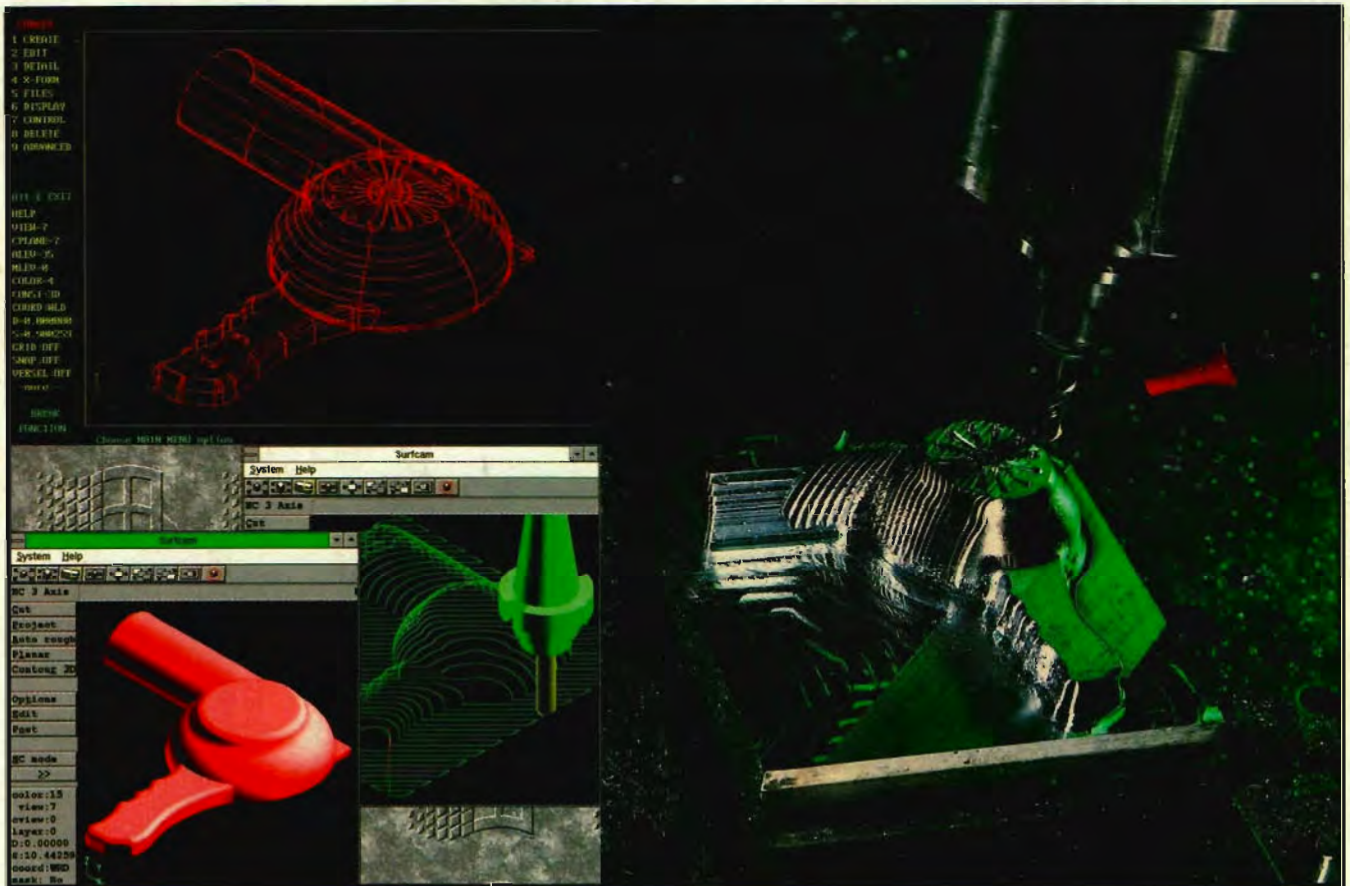
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