

KEY SOLUTIONS

CONCURRENT ENGINEERING FOR THE 90'S

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CE Issues

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Products

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Ergonomic
M I C E

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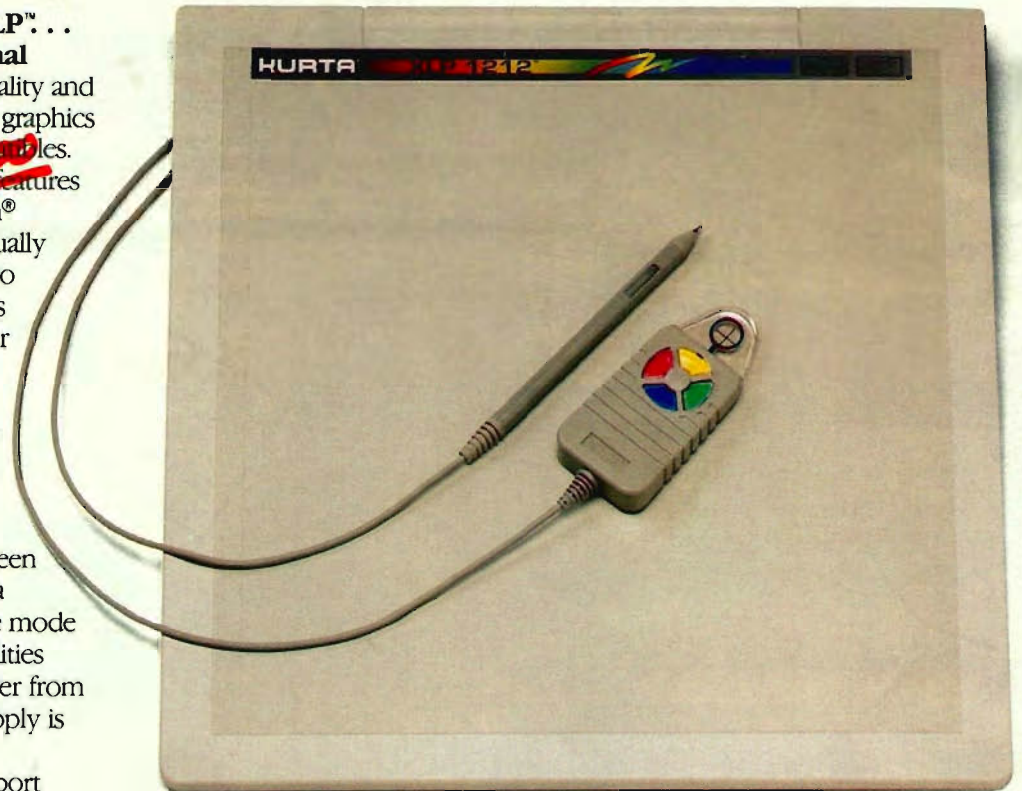
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¹ With RedLine Module.
² With DDRMS Module.

SOME OF OUR CONTRIBUTORS

Ronald G. Stokes is Director of Engineering at CreativePen Systems, a marketing and engineering design firm in the portable pen based communicator market. He owns RGS Designs, a contract engineering service company. Ron has a Mechanical/Industrial Engineering degree from Cal Poly, San Luis Obispo, Ca., and has been a manufacturing and design engineer for 12 years. He is very involved in the rapid prototyping industry.



Charles Taylor, an anthropologist, presently operates a rural TeleCenter and is Director of the Omnilink Computer Training Center in northeast Washington state. Formerly director of the Big Island Computer Center and Parker High School computer training program in Hawaii, he now assists Selkirk School District in implementing CAD/CAM/CAE training into the high school vocational education curriculum.

Stas Mylek is the Product Manager for the CADKEY product line at Cadkey, Inc. He has over 12 years of CAD experience and has been with Cadkey for 7 years in positions such as Applications Engineer, Manager of Application Engineering and Technical Services, and as a Regional Sales Manager. As the Product Manager, he is responsible for the specification, management, and future direction of the CADKEY product line.

On the Cover:

The humble mouse has evolved in 30 years from an odd-looking, one-button, wooden device into a sleek sophisticated tool. The latest generation gathered on the cover has features that address the risks of RSI to the user.

The wooden prototype in the photo below was developed in 1963 by Doug Engelbart of Stanford Research Institute for use with his Augment computer. It was a simple analog device that responded to each movement of the mouse by sending a signal to the software that shifted the position of the cursor on the screen. Inside the wooden mouse body were two

wooden wheels that were connected to the shafts of two variable resistors.



Cover art direction by Melissa Clark.

Photography by Gayle Simpson.

Prototype photo at left courtesy of Microsoft Corporation.

KEY SOLUTIONS

Concurrent Engineering for the 90's

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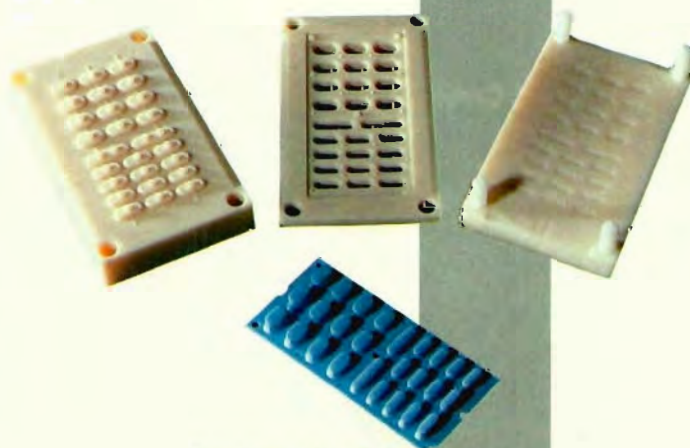
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Three-piece mold for an elastomer keypad.
Rapid prototyping produced this with FastSURF.
See page 18.

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CIRCLE CARD 256

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KEY TALK

I haven't been on my soap box regarding education for a while now, but some alarming things are happening in Washington state that have spurred me to share my concerns. The problems in Washington are about money and here's the story. The state constitution mandates that **all** students (K through 12) shall receive equal state funds, presumably so they can have an equal education. But somehow, some way, someone has been able to undermine this mandate. Reports from the Department of Education and individual school districts show that for 1992/93 and 1994, educational funds are being disbursed unequally with schools in urban districts receiving more dollars per student than those in rural districts. The difference ranges from over \$1200 per student in urban districts to \$247 in the poorest rural districts.

This is significant and is causing rural districts to cut their already meager budgets to the quick. For example, in Eastern Washington, the Superintendent and the two-person office staff of one district volunteered to go on half-pay to avoid laying off a teacher. In addition to being unconstitutional, this unequal disbursement of funds is entirely unfair and undemocratic. The real problem is that if allowed to continue, it will adversely affect the education of a significant portion of our young people.

Why am I sharing this in **KEYSOLUTIONS**? This is, after all, a CAD magazine and engineers, designers and manufacturers are really busy with the world's work. Besides, your state may not have this predicament. If you think these problems do not relate to you, think again. First, competition for funds in the shrinking coffers of any state is fierce. Financial shenanigans and chicanery are a potential anywhere. Second, the future health of our profession, businesses and national economy depends on the cornerstone of education. It's where our new engineers, draftsmen, technicians and computer experts get their start -- and they need a good one. If they don't, we will all be hurt for decades to come.

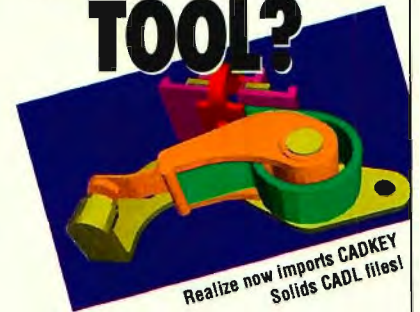
My actual opinion is that government has no place in education. This slow moving legislative body has proven to be -- at times -- corrupt, self-serving and fraught with influence peddling. There is no room for this in education. I am realist enough to know that this involvement is likely to continue for the foreseeable future.

In the meantime, we don't dare live in an ivory tower. We must be informed and involved. Support and vote for candidates that support education -- especially vocational education. Write to your state and federal officials on educational issues, and find out what you can do to be involved.



Robert Martin
Technical Editor

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CIRCLE CARD 235

CADKEY in the News

On the Road Again

Top Cadkey management and technical staff conducted a series of two-day dealer meetings, product training sessions and user meetings nationwide during May and June. Cities included in the tour were Raleigh, N.C.; Toronto, Ontario; Irvine, CA; Ypsilanti, MI; Seattle, WA; Dallas, TX; Windsor, CT; and Baltimore, MD. Dealers received hands-on training in the new features in CADKEY6. The Advanced Modeler, which is being released as this goes to press, FastSURF, SurfMill and the new Varimetrix products were also demonstrated.

The highlight of the user meetings was the opportunity to meet Cadkey technical personnel (development and tech support) face to face, ask questions and receive one-on-one demonstrations. The meetings were well attended by 100 to 200 users in each of the cities visited.

In Seattle, Charlie Ferrucci, V.P. Marketing, emphasized the company's desire to provide superior technical support and to be responsive to the requests and desires of Cadkey users. He stated, "Version 7 is on the drawing board and we are looking for as much user input on needed enhancements as we can get. Be sure to write, fax, send a message through the BBS or call."

CADKEY 1993 Resource Guide

The 1993 Cadkey Resource Guide will be published by **KEY SOLUTIONS** magazine in late summer 1993 and replace the previous Cadkey Applications Guide. This publication will include detailed information on third party application software, compatible hardware and peripherals, complete listings of User Groups, authorized training centers and learning materials, and general information about CADKEY, DataCAD and Varimetrix. The 1993 Resource Guide will be distributed to registered users and inserted in every Cadkey product package.

New Cadkey Staff

Dick Kretzmer, Vice President of Sales,

WINDOWS Brings Hidden Costs

A Microcomputer Manager Association study of 402 corporate MIS managers in sole-proprietor to Fortune 500 companies reveals higher than expected costs for upgrading to Windows. The study concludes that the expense for a onetime conversion to Windows averages \$3,286 per seat including hardware, software, training and service. This figure does not include internal development or ongoing support costs. The study, released at the Windows Summit in Carlsbad, Ca., further states that survey respondents said they expect to increase their technical and training staffs in order to handle a change to Windows.

Respondents, however, noted a perceived increase in productivity. Some 59% of those surveyed considered GUIs a strategic platform. Fifty-two percent of those who moved from DOS to Windows said their productivity increased, and roughly 60% said moving from DOS or Windows to OS/2 made them more productive. Survey participants said the greatest productivity gains were made by moving from DOS to UNIX. The study also finds that usage of OS/2 2.0 was expected to increase over the next 12 months.

Microsoft Doesn't Always Win

The United States Patent & Trademark Office rejected a bid by Microsoft to trademark the word *Windows*. This victory for software developers who say Microsoft Corp. has unfairly controlled the Windows trade name has not gone unchallenged. Microsoft will appeal the ruling and try to persuade the Patent Office that *Windows* is not a generic word. Microsoft's justification is that it offers vendors the right to add the phrase "for Windows" to their software names.

Pentium Alternative

Mips Technologies offers the Mips R4000 and the Mips R4400 high-performance processors which are competitively priced with Intel's about-to-be-released Pentium chip. Silicon Graphics, Mips' parent company, claims that the R4000 is twice as fast as Intel's 50MHz 80486 microprocessor and the R4400 is twice as fast as a 66MHz Pentium microprocessor. SGI has signed Acer, NEC, Olivetti, Toshiba, Siemens and other PC makers to begin production of NT-capable Mips machines for less than \$5,000.

New UNIX Unification Plan

In a new attempt to satisfy customer demand for consistent technologies across multiple platforms and provide greater technology choices, several UNIX system companies have announced their intention to deliver a common open software environment (COSE) across their UNIX® system platforms. Although previous attempts such as OSF and the ACE initiative have fallen markedly short of expectations, Hewlett-Packard Company, IBM Corp., The Santa Cruz Operation, Inc., Sun Microsystems, Inc., Univel and UNIX System Laboratories, Inc. are again attempting to establish uniform standards for UNIX. They have defined specifications for a common desktop environment and a consistent set of programming interfaces for developers for the HP, IBM, SCO, SunSoft, Univel and USL platforms. In addition, they have endorsed specifications, standards and technologies in the areas of graphics, multimedia and object technology, and have announced a working group in the area of systems administration.

(continued on next page)

The common desktop environment will incorporate aspects of HP's Visual User Environment (VUE), IBM's Common User Access model and Workplace Shell, OSF's Motif tool kit and Window Manager, SunSoft's OPEN LOOK® and DeskSet productivity tools, and USL's UNIX SVR4.2 desktop manager components and scalable systems technologies.

The companies plan to publish a preliminary specification by the end of June 1993 and will periodically release updates to the industry. They have agreed to submit the specification to X/Open for incorporation into the X/Open portability guide. HP, IBM, Sun and USL will make an implementation for the common desktop based on X/Open specifications available in the first half of 1994. This implementation will be openly licensable to the industry. The six companies will host a Developers Conference in early October to give users and software developers details on products and direction.

Noticeably absent from the list of involved companies is Silicon Graphics, a major UNIX supplier to many CADKEY users. Jim Barton, Vice President/Advanced Technology at Silicon Graphics, discussed some issues related to these developments with KEYSOLUTIONS. According to Barton, this attempt may succeed because it is scaled back from previous plans, but he does not expect to see any major progress immediately, and probably not for several years. "In the meantime," said Barton, "Silicon Graphics will not sit around and wait. We will continue to provide our own advanced ease-of-use technology and the standard XIIR5 and Motif® 1.2 interfaces to our customers. When and if the standard is a reality, we will be able to fit in easily by integrating a COSE implementation from any of the suppliers into our value-added user interface environment."

Market Research from ITA

The International Trade Commission (ITA) has published the U.S. Industrial Outlook for 1993, an annual survey which examines key industries and predicts growth rates for the coming year. The 650-page 1993 report provides detailed analyses of 350 occupations in both manufacturing and services. Among this year's fastest growing manufacturing trades will be computers, peripherals, software, and durable goods. Some of the best service industries will be electronic information, data processing, and health-based.

For the first time, the U.S. Industrial Outlook is available on CD-ROM (\$35) as part of a collection called the National Trade Data Bank. The information is also on 3.5- and 5.25-inch floppy disks for \$135. The book version is \$37. To order, call the Department of Commerce 202/482-1986 or write to the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954.

BBS Services Under Attack

The Software Publishers Association and the FBI plan to continue aggressive attack raids on commercial bulletin board services who illegally distribute copyrighted software. On January 30, 1993, the FBI raided Rusty & Edie's BBS in Boardman, Ohio. Following a sting operation instigated by SPA member complaints, FBI officials seized computers, hard disk drives, telecommunications equipment, and financial and subscription records. For an annual fee of \$89, subscribers could download popular business and entertainment programs without having to pay a copyright fee. Similar raids on other boards are expected shortly. ☐

CADKEY in the News

recently announced the appointment of several additions to the sales and marketing team.

Andy Hidalgo has become Cadkey's Director of Major Account Sales. Andy brings to Cadkey extensive experience in CAD/CAM with emphasis on large corporate accounts worldwide. He has worked with Schlumberger/APPLICON, General Electric/CALMA, SIGMA Design and THEMATIC SYSTEMS. Andy has direct responsibility for Cadkey's major account program, regional managers, and all field sales activities in the United States and Canada.

Tony Mazzagatti has joined Cadkey as the Director of North American sales. He has many years of experience in the CAD/CAM industry, most recently with Autodesk.

Bill Ross is Cadkey's new Southeast Regional Manager. He will focus on Major Account activities, taking advantage of his CAD/CAM sales experience.

Multiple Platforms for 6

CADKEY 6 operates on various platforms including OS/2, popular UNIX systems, 386/486 DOS, and can run as a full screen DOS application under Microsoft WINDOWS™. CADKEY Corner in this issue gives detailed instructions on how to run Version 6 under WINDOWS.

800 Number for Canada

Cadkey, Inc.'s toll-free telephone number 800/394-2231 is now working in Canada.

CADKEY 6 Training Materials

Training manuals for CADKEY 6 are available for end users, dealers, training centers, and schools from Cadkey, Inc. An introductory set covers 2D and 3D design and drafting in student workbook format. Advanced manuals cover more sophisticated techniques. These manuals augment CADKEY 6's on-line computer-based tutorial (CTB) which offers brief lessons to help reduce learning curves.

CADKEY® DRAFTER

Breaks Price / Performance Barrier

by Frank Simpson

CADKEY®DRAFTER is a new product targeted at mechanical designers and engineers who need low-cost drafting tools.

One-Third the Cost

"The new DRAFTER product will be priced at only \$995 in the United States," stated Malcolm Davies, Cadkey president. "This

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 - △ Introduction to DataCAD®
- Training with your local dealer/value-added reseller
- On-site training at your facility. Call for details.
- Training at Cadkey Training Centers
- CADKEY includes CADKEY® TUTOR, a self-running computer-based tutorial.
- Training materials are available for CADKEY and DataCAD.



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sets a new price/performance standard in the CAD industry," declared Davies. "Price has been a limiting factor in the wide acceptance of CAD software. This full-featured drafting package for under \$1,000 breaks the price barrier and provides a professional, mechanical drafting-and-design system that is less than one third the cost of higher-priced CAD systems."

Encouraging CAD Co-existence

CADKEY DRAFTER has fully integrated DWG and DXF® translators that let users easily import and export files and encourages co-existence with other CAD software, for example, AutoCAD®. "The DRAFTER's full binary capability provides a low-cost alternative for existing AutoCAD users who need to add more seats," stated Davies. "The DRAFTER also can use the CADKEY IGES Translator which provides exceptional configuration capabilities and full compatibility with other CAD systems."

Drafting Standards Support

CADKEY DRAFTER provides complete support for ANSI, ISO, DIN and JIS drafting standards. It also features a robust set of automatic dimensioning features to produce accurate professional drawings and a complete set of functions for creating, editing and transforming geometry with multiple viewports. Dimension associativity eliminates costly design errors because changes made to the geometry, in any view, create an automatic update in the detail drawing.

CADKEY DRAFTER includes advanced drafting features, such as geometric tolerancing and dimensioning, dual dimensions, general-dimensioning symbols, welding symbols, center lines, section lines, balloon notes and libraries of 2-D patterns (electrical, fluid-power, logic, piping, sheet-metal and flow-chart symbols). The DRAFTER's intelligent cursor adds to its ease of use and increases productivity.

GUI Increases Productivity

"Engineers designed CADKEY DRAFTER for engineers; so ease of use was of paramount importance," said Davies. "Our research shows that it would take only half-a-work day for an engineer to switch from a competitive system and become productive with the DRAFTER."

The DRAFTER's graphical user interface (GUI) simplifies many operations. Windows-like dialog boxes consolidate multiple menu selections into a one-step operation. DRAFTER's immediate-mode feature places the most frequently used commands only one keystroke away. On-line Hypertext help provides instant answers. DRAFTER's GUI seamlessly incorporates file management, printing and plotting. A dialog box furnishes access to powerful cross-hatching functions, and Quick Hatch lets users cross-hatch with a single cursor selection. ☐

- CADKEY DRAFTER is fully compatible with the entire CADKEY product line.
- CADKEY DRAFTER operates on 386/486 DOS platforms, and can run as a full-screen DOS application under Microsoft Windows and OS/2.
- CADKEY DRAFTER is available through authorized dealers or directly from Cadkey, Inc.

Editor's note: AutoCAD and DXF are registered trademarks of Autodesk, Inc., Sausalito, Ca.

Cadkey Forum

Developing a Winning Strategy

by Malcolm Davies, President - Cadkey, Inc.

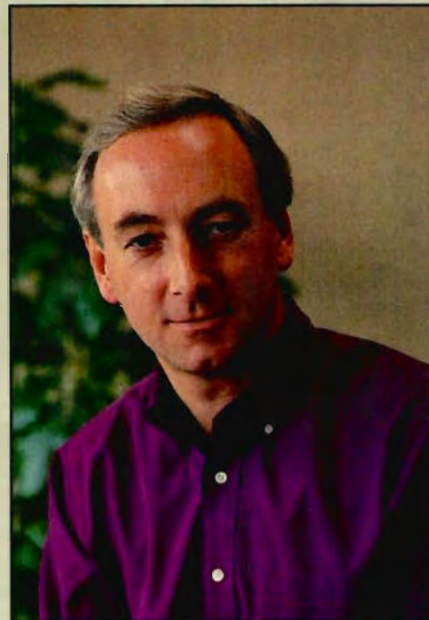
With the launch of CADKEY*6, CADKEY* DRAFTER and CADKEY* ADVANCED MODELER, I believe that Cadkey has begun a process that will change the face of the CAD industry and open the door to the next generation of PC-based CAD.

Our two latest products, DRAFTER and ADVANCED MODELER, are unprecedented in price and performance. Each sells for \$995 in the United States. The DRAFTER is a true breakthrough, smashing the \$1,000 price barrier for professional CAD. The ADVANCED MODELER is also an industry first, introducing integrated NURBS-based modeling that combines wireframe, surfaces and solids on a PC platform.

Today, Cadkey delivers solutions that span the complete range of PC-based concurrent engineering needs. It's quite a line-up, leading off with CADKEY* LIGHT at \$99, followed by the DRAFTER for low-cost professional drafting and our power hitter, CADKEY 6, the 3-D mechanical CAD system that has won awards, quite literally, around the world. CADKEY*6 is also the foundation for the ADVANCED MODELER. Another major player is our 3-axis machining product, CADKEY* NC.

Our strategy of fielding a full team is significant because I am convinced that customers want to buy integrated systems from a single vendor. And, it's very clear that low-cost CAD products designed for PC platforms, with robust features and high price/performance ratios, are what users require now and in the future. We are delivering on Cadkey's commitment to become the producer of the lowest-cost software in the engineering marketplace.

A major component of Cadkey's product strategy is encouraging co-existence. Reality in the workplace is very frequently a mixed-CAD environment. CADKEY DRAFTER is binary com-



patible with CADKEY 6, and can import files created with earlier versions of CADKEY. Further, the DRAFTER's fully integrated DWG and DXF* translators let users easily import and export files from, for example, AutoCAD* applications. Our IGES translator also gives DRAFTER full data compatibility with other CAD systems.

Our customers told us that a product like ADVANCED MODELER should have an intuitive, easy-to-learn-and-use interface, with a "windows"-like environment and a single data structure. CAD software, designed correctly, can make a major contribution toward compressing the time it takes a company to bring a product to market.

I believe that Cadkey has the right products at the right time, understands the dynamics of this marketplace, and has the ability to adapt rapidly to changing environments. The DRAFTER and the ADVANCED MODELER are clear signals that Cadkey is taking the necessary steps to become the vendor of choice among design professionals.

An engineer's desk looks
pretty flat without it.

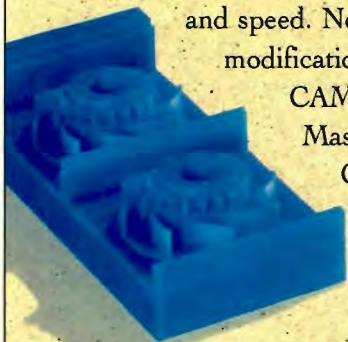
CAMM-3 Model 2500
\$12,995

CAMM-3 Model 3000
\$15,995

CAMM-3. Affordable Desktop Manufacturing. Up until now, the output range of an engineer's desktop has pretty much been limited to X and Y... two-dimensional images of three-dimensional objects. Well, we'd like to open up your desktop by adding a Z axis.

CAMM-3 brings rapid prototyping onto the engineer's desktop, where it really belongs. Designed like a three-dimensional plotter, it mills exact prototypes out of wax, wood, and non-ferrous metals with amazing precision and speed. Now engineers can check and refine their work without waiting on a model shop. Make modifications on the spot. So you see results in less time. For far less money.

CAMM-3 is designed to work with *your* software. You can cut parts directly from SmartCam, MasterCam, SURFCAM™, AutoCAD using AutoCAM or NC Polaris; CADKEY® using CADKEY®NC, and other popular programs. Operate on a Novell network. Work with your favorite Macintosh CAD/CAM programs. In fact, with the addition of our advanced G-Code driver, the full list of compatible software is almost endless. Included with the CAMM-3 is Basic CAD/CAM Tutorial Software, a full-featured package that guides you through 3D operations such as surfacing, pocketing, offset routines, and automatic toolpath generation. Affordable rapid prototyping from the desktop isn't just a wish anymore. For CAMM-3 users in industries as varied as automotive, aerospace, consumer products, medicine and education, it's the new way to work. Call us at 714-975-0560 for more information.



Roland
DIGITAL GROUP



NEW PRODUCTS

INPUT

E-size Digitizer

The Digitizer Division of CalComp Inc. introduces the E-size version of EstiMat, a flexible digitizer designed for estimating in construction and related industries. Architects and construction estimators can use EstiMat to perform "take-off" analyses—automatically translating printed plans into area, length, or item calculations.

EstiMat has cordless electronic pen or cursor input options. The E-size EstiMat is available for \$2395.

Contact Digitizer Products Group at 602/948-6540.

OUTPUT

Color Inkjet Plotter/Printer

ENCAD'S NOVAJET II color inkjet plotter/printer offers improved black-and-white line quality and an enhanced color mode of 300 dpi. NOVAJET II has added several new convenience features. Users can choose print modes (draft, normal, quality, and enhanced) depending on quality and speed needs, and all relevant parameters are automatically set. Four additional user settings (eight total) allow users to store their custom set of plot parameters or software-specific settings.

Contact ENCAD at 619/578-4070, 619/296-0605 or Fax 619/578-4613.

Image Printers

JRL Systems, Inc. offers a new line of printers for imaging applications. The EasyCopy Line consists of the J Series BubbleJet Printer and L Series Laser Printer. Both have controller technology which enables them to accept compressed raster data in CCITT Group

3 and Group 4 format. Both feature optional integrated network interfaces to Ethernet or Token Ring.

The J Series BubbleJet can produce drawings up to 17" x 22" in resolutions up to 360 dpi. The L Series Laser can produce drawings up to 11" x 17" at resolutions of 300, 400, or 600 dpi. The J Series BubbleJet is priced at \$2995 and L Series Laser is priced at \$5650.

Contact JRL Systems, Inc. at 512/288-6750 or Fax 512/288-7676.

Desktop, Wide-Format Plotters

Roland Digital Group has introduced new editions of its SketchMate (desktop) and GRX (wide-format) plotters. The new small format models are enhanced with an electrostatic paper hold system. Specifications include a 16" per second plotting speed, HP-GL compatibility, serial and parallel interfaces, and a 5K buffer. The new GRX models achieve a mechanical resolution of 0.00006"/step. They have HP-GL/HP-GL2 compatibility, an auto-protocol, mirror, and smoothing function that provides for high precision output of arcs and curves. SketchMate printers are priced at \$1295 for the B-size and \$995 for the A-size. The GRX models are \$4995 for the D-size and \$5995 for the E-size.

Contact Roland Digital Group at 714/975-0560 or Fax 714/975-0569.



JRL Systems' Easy Copy™ L Series Laser Image Printer and J Series Bubble Jet Image Printer

HARDWARE

Graphics Boards

National Design, Inc. announced a series of moves to upgrade existing products while holding or improving prices. The Volante Warp10 has been replaced by the Warp10Plus, a high-performance Windows/CAD accelerator board featuring the S3 86C801 and supporting 16 colors at 1280 x 1024, and 1152 x 900, 256 colors at 1024 x 768, and as many as 16.7 million colors at 640 x 480. Pricing has been lowered on the Warp10LB, Warp10LB-2 (both local bus products which double the raw display speed of the Warp10Plus), and the AT1000 and AT2000 Series ISA bus products. Prices range from \$299 for the Warp10Plus to \$1895 for the AT2000 Series.

Contact National Design, Inc. at 512/329-5055 or Fax 512/329-6346.

High-Resolution Monitor

EPSON added the 20" Professional Series II Monitor for large screen high-resolution design or graphics applications. Featuring a Sony Trinitron CRT, it offers 1280 x 1024 resolution, color clarity, line definition and high contrast needed for CAD/CAM, CAE, desktop publishing and imaging applications. With refresh rates of up to 76Hz and an aperture grille pitch of 0.31mm, it also offers fourteen standard and eight user-programmable display modes. The monitor is both DOS and MAC compatible. Suggested retail price is \$2749.

Contact EPSON AMERICA at 310/782-5161 or Fax 310/782-5179.

VL-BUS Workstations

Tri-Star Computer Corporation is now shipping its new line of 2nd generation VL-BUS workstations. The new

NEW PRODUCTS

workstations offer users the option of dual removable hard drives. This subsystem allows the option of configuring one large hard drive volume or two duplicate volumes. Another configuration includes a VL-BUS IDE cache controller with 2MB RAM. This 66MHz configuration offers a 16MB per second data transfer rate.

Contact Tri-Star Computer Corp. at 602/961-3401 or Fax 602/961-4010.

SOFTWARE

Graphics Utility

Inset Systems Inc. recently announced HiJaak PRO 2.0, an upgrade of HiJaak for Windows. HiJaak PRO lets you view, convert, capture, enhance, and print graphics images in the Windows environment. In addition to the 60 graphics formats supported in version 1.0, HiJaak PRO can load Kodak Photo CD images directly from the CD ROM. JPEG compression is built into the program, giving it the ability to compress images up to 200 to 1. An image catalog application allows the user to automatically create thumbnail-sized representations of images. List price will be \$169 for the expected June '93 release.

Contact Inset Systems at 203/740-2400 or Fax 203/775-5634.

Graphics/Statistics Software

CoHort Software of Berkeley, CA offers a full line of high-quality, IBM PC-compatible graphics and statistics software for scientists and engineers. CoPlot creates publication-quality, scientific graphs of data and equations. CoDraw lets you create high-quality technical drawings. CoStat performs statistical analysis of your data. CoVis is capable of making animated scientific graphs. CoStat, CoPlot,

and CoDraw are available at \$159 each, or bundled at \$395. CoVis is \$395.

Contact CoHort Software at 510/524-9878 or Fax 510/524-9199.



Inset Systems' HiJaak Browser Screen

CAD to Mac

CAD to Mac, a universal CAD graphics importer for Macintosh publishing, moves and translates CAD drawings into Macintosh publishing systems. It provides easy translation of CAD drawings into Macintosh PICT format, and eliminates the need to redraw objects from scratch or work with scanned bit-mapped images. It supports popular CAD platforms such as CADKEY, Mentor Graphics, SDRC, I-DEAS, AutoCAD, and P-CAD which provide an HP plotter interface. The serial capture feature allows smooth transfer of drawings directly from a CAD system to a Macintosh computer without requiring disk drive compatibility. List price is \$495.

Contact CELECT Software at 513/573-6100.

PC-based Design Software

EASi Engineering, Inc. has announced the introduction of PC-based software that can greatly simplify the design of air-tight seals. The first release software will

be specially designed for automotive seal applications such as doors, hoods, and deck lids. Future releases will address aerospace, appliances, power plants, etc.

Program output provides all of the information required by the engineer including animation of seal cross-section, load/deflection curves, stress/strain contours and force/time curves. The program costs \$8000 in the single user version.

Contact EASi Engineering at 313/377-4200 or Fax 313/377-2342.

MISCELLANEOUS

Display Controller

ARTIST Graphics introduced the WinSprint 1000i, a high performance display controller designed for document image processing. The WinSprint 1000i displays 256 colors and provides a non-interlaced resolution of 1600 x 1200, which corresponds to 120 dots per inch (DPI) on 19" monitors. WinSprint 1000i is unique in that it displays this resolution at a refresh rate up to 76 Hz, eliminating the flicker that occurs with lower refresh rates. Retail price of the WinSprint 1000i is \$1695 and it comes standard with 2 megabytes of VRAM.

Contact ARTIST Graphics at 800/627-8478.

Free Catalog

The Dataprint 1993 Catalog offers a complete in-stock selection of brand name Drafting, Plotter/CAD and Graphic supplies at discounts up to 70%—with same day shipment. This 84 page catalog features an expanded plotter supplies section, drafting equipment, media, furniture, calculators and more.

Contact Dataprint Corp. at 415/340-0550.

Optical Storage

Optical Laser, Inc. introduced a new series of optical storage subsystems for networking applications with up to 54GB capacity. The OptiDriver universal SCSI driver, bundled with selected jukebox configurations, allows systems integrators and OEMs to add optical storage to a network. The driver can be used with most WORM, Magneto-Optical and Phase Change erasable drives and most jukeboxes/autochangers. OptiDriver is compatible with virtually all MS-DOS systems, allowing storage equipment to be connected together on the SCSI bus and treated as separate devices or drive letters.

Contact Optical Laser at 800/776-9215 or Fax 714/536-0817.

Thermal Plotter

IDEAL Scanners & Systems has announced the IDEAL/Contex FSP 4200 direct-imaging thermal technology plotter. The 36" wide, 400 x 200 resolution plotter is designed for high-speed raster image output. With a SCSI 2 interface, the plotter is platform independent, mirrors the IDEAL/Contex FSS series of multi-platform scanners, and is supported by the CADImage software family. List price is \$10,900.

Contact IDEAL Scanners & Systems at 301/468-0123 or Fax 301/230-0813.

Low-Cost SUN SPARC Systems

Technicad, Inc. has announced the introduction of a complete SUN SPARC 1+ system for CAD/CAM users. The complete system includes 25MHz SPARC processor, 8MB of memory, 16-inch monitor, 207MB hard disk and the SOLARIS 1.1 operating system for under \$3000. ☐

Contact Technicad, Inc. at 714/258-2303 or Fax 714/258-2305.



Two days ago, Michael's prototype was just a sketch on a napkin

Right after a lunchtime brainstorming session, Michael faxed his sketch to 3D Systems Technology Center. Within two days Michael had a detailed 3-dimensional model to present at a critical design review meeting.

Now, thanks to 3D's rapid prototyping technology, Michael's project is six months ahead of schedule and under budget. And, he's also cut his product's time-to-market dramatically. Stereolithography by 3D Systems has given Michael and his company the edge over the competition.

3D's Tech Center is the world's leading resource for solid imaging technology. The Tech Center transforms your ideas into 3-dimensional objects using any design documentation, from napkin sketches to CAD files.

The Center's solid imaging technology specialists have the experience and resources to produce concept models, patterns for soft and hard tooling, and preproduction parts in plastics or metals. In fact, through 3D's QuickCast™ rapid tooling technology, the Tech Center gives you investment castings in record time.

The Tech Center is not just for the Fortune 100 either. Every day small, dynamic companies who want to power products to market faster than their competitors are taking advantage of 3D Technology Center's capabilities. The Tech Center has become their vital, strategic partner in transforming ideas into marketable products.

Put rapid prototyping and rapid tooling to work for you. For more information and free brochures on 3D Systems Tech Center, or solid imaging equipment, call today:



3D's QuickCast™ produces investment castings in such metals as steel, aluminum, copper, beryllium and titanium.



3D SYSTEMS

3D Systems Technology Center
26081 Avenue Hall
Valencia, CA 91355 USA
Telephone: (805) 295-5600 Ext. 252
Fax: (805) 295-0249



Telephone Design by Derek Rosent

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FOR INFORMATION ON TECHNOLOGY CENTER SERVICES, CIRCLE CARD 273
FOR INFORMATION ON SOLID IMAGING EQUIPMENT, CIRCLE CARD 274

Rapid Prototyping Technologies

by Ronald Stokes

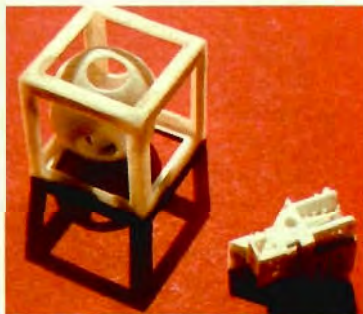
"A design isn't complete until it's approved physically by hand." -- but with competition becoming more fierce daily and the development cycle shrinking (6-9 months time to market) most companies can't afford to wait 3-6 months to view the first 3D models or afford to spend hundreds and thousands of dollars to produce tools only to find that the design doesn't work or meet specification.

Fortunately, technology is available that lets engineers have functional models hours (not days or weeks) after the design is complete. Engineers, customers, management and marketing handle, fondle, assemble, test and verify the design together before any tooling or fixturing has been started. Design errors can be changed and marketing decisions can be made to cut costs, improve manufacturability or optimize performance. This is concurrent and value engineering at its *BEST!*

Rapid Prototyping

Rapid prototyping is the ability to fabricate 3-dimensional solid objects out of raw materials from 3-dimensional CAD data in a fraction of the time required for conventional model building. The two most common approaches are through subtractive and additive processes.

Subtractive means material is removed from a



Parts produced by SLS process.

solid substance. These methods have been around for a long time and the tools used for subtractive processes are part of conventional model making. These tools include CNC mills,



Part produced by LOM process.

lathes, EDM's and lasers. Additive means a shape is produced by adding or building up raw material (liquid or solid) by lasers. This can be accomplished by technologies which have caused much excitement in the industry.

The software for, and automation of, subtractive machines has advanced in the past few years and they are assured a place in the future of model building. However, this article focuses on the newer, less familiar state-of-the-art additive processes.

Additive Processes

All the additive methods have some common elements and steps. Basically, three-dimensional data is converted to an STL transfer file which is then put through a slicing file where it is "sliced" into thin sections or layers ranging from .002 to .025 inches thick. The raw material is then prepared by leveling or registration, and the first or bottom layer from the slice file is "drawn" on the raw material with a laser. The laser fuses, cuts or solidifies the raw material and a thin 3-dimensional cross-section is produced. The completed section is then lowered, the material leveled and a new section is placed on the existing section. Each new layer is bonded with the previous layer. Finally, the completed part is removed from the machine for post cure and bench work.



Enclosure of a pen based computer produced by SLA

...concurrent and
value engineering
at its best

A few steps are necessary to prepare your 3D data file for use with additive rapid prototyping machines. The CAD database must be 3-dimensional solid. This can be achieved by using solid modelers or developing a wireframe and converting it into a solid.

CADKEY has excellent solids conversion capabilities to handle this requirement.

Then the solids data must be converted into STL format. This format basically breaks the solid data into small triangles called facets. Each triangle is described by coordinates and an inside and an outside plane. The facets are used by the system for slicing. The quality or precision of the triangles can be chosen by the engineer as a step in the conversion process.

CADKEY can convert 3D solids into STL formats. The STL format conversion is not without problems, but none are unsolvable. These problems can be worked through by bisecting the CAD database and by developing new conversion packages.

In general, the additive technologies are much faster than conventional methods. The following describes a few systems which have been developed and are successfully being used in the field.

StereoLithography Apparatus (SLA)

SLA produces parts by solidifying thin layers of liquid photopolymer by the use of a laser. As the part is built, it requires a support structure that is attached to a movable elevator. When a layer is completed, the elevator moves down the thickness of the next layer and the polymer is prepared for the next layer. After comple-

tion, the part is post cured and the structure removed and benched.

Selective Laser Sintering (SLS)

SLS produces parts by fusing thin layers of powdered material with a laser. The principle is

similar to the SLA, but powder material is used instead of liquid. Another difference is that neither post cure nor support structures are required. The excess powder acts as the

structure. There are several materials available from DTM, including investment wax, nylon and polycarbonate. Other materials are being developed and tested to help expand the SLS's capability.

Laminated Object Manufacturing (LOM)

LOM produces parts by cutting thin layers of sheet material with a laser and then bonding the layers together with heated rollers. The layers are positioned automatically and are supported by the excess sheet material. One difference is that the perimeter of the part is cut versus the entire solid being produced. This cuts build time and costs. Another difference is that the parts, when completed, look like wood, not plastic.

Fused Deposition Modeling (FDM)

FDM uses a .050 inch diameter modeling filament wire which is fed through a heated head and nozzle. The material is then deposited in thin layers as it builds up the part. The material solidifies as it is deposited and requires little clean-up. This process, like SLS, provides the ability to use different types of material. Currently available for FDM are wax and several Stratasys-produced plastics.

Summary and Future

Rapid prototyping is valuable for conceptual or design verification, but it is also exciting from the tooling and small volume aspect. Since rapid prototyping can produce 3D physical parts in hours, it can also produce masters to be used for RTV and Epoxy molds as well as metal castings, etc. So depending on the tooling process which best fits your needs, you could have 15 to 200 piece parts within days. In addition, rapid prototyping processes will be able to produce the core and cavity inserts for injection molded tools and a lot more in the near future.

There are some concerns which should be mentioned here. They are toxicity, cost, minimum wall thickness, heavy detail precision, small detail precision, overall part size and warpage. Fortunately, the manufacturers are actively researching and improving the performance and cost of their machines.

Additive rapid prototyping is gaining momentum and saving engineers and companies millions of dollars along with months and years of time. As the paradigm shift takes place and the industry moves to high gear, I see rapid prototyping systems becoming a tool placed in every engineering department or even on each engineer's desk -- similar to PC's. I also see the interface between the PC and the rapid prototyping system being as easy as using and hooking up a printer. It's going to be an exciting ride! ☐

Potential Uses

Medical - Implants
Art - Computer Sculpturing
Geographic - 3D Contour Maps
Aeronautical - Air Foil Design
Industrial - Computer Enclosures
Architecture - Structure Remodeling
Plastic Surgery - Facial Reconstruction
Archeology - Bone Reconstruction
Dental - Jaw/Teeth Reconstruction
Education - Study

Where to Get Information

Systems

StereoLithography Apparatus
3D Systems • 805/295-5600

Selective Laser Sintering
DTM, Inc. • 512/339-2922

Laminated Object Manufacturing
Helisys, Inc. • 310/782-1949

Fused Deposition Modeling
Stratasys, Inc. • 612/937-3000

Services

Plynetics • 510/613-8300

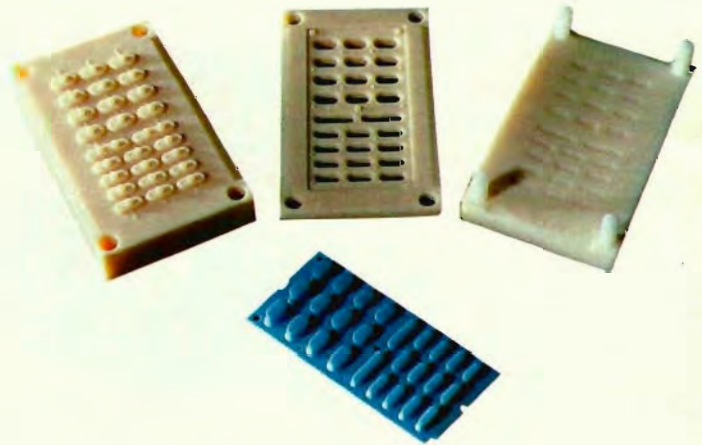
RAPID With FastSURF PROTOTYPING

by Claudia Martin

Concurrent engineering is more than a buzz word at IDE, Inc. This seven year old design and product development company can produce prototypes in five weeks or less. All facets of most projects -- from analysis, research, development planning, design, and engineering to prototype development, tool building, and literature production-- are done in-house.

A current project illustrates their modus operandi. They are developing a state-of-the-art

keypad is an offset of the free form handset geometry. In addition, each keytop was ob-round and domed, resulting in a unique key geometry for each key on the keypad. (The proprietary over-all design cannot be shown until the product is released later this year but IDE was able to share details of the keypad development.)



Three-piece Mold for Elastomer KeyPad (shown in blue).

Chicago who digitized the model with a Brown and Sharpe. Design Facets also uses FastSURF, so the file was immediately usable by IDE.

COMPANY PROFILE

IDE was founded in 1985 by industrial designer David Moriconi and mechanical engineer Peter Sehnal. Moriconi has developed a methodology that allows a prototype to be produced in five weeks once the design is complete. Sometimes prototype parts (from 5 to 30) of any geometry that can be injection molded can be manufactured by IDE in three weeks. These capabilities and the quality of their work have increased IDE's sales to \$1.5 million annually and their client list reads like a Who's Who of International Business. This California-based firm currently has 15 employees. To contact IDE, call 408/438-2888.

telephone based on a brand new technology for Rose Communications, and producing 30 working prototypes.

They are designing, analyzing, and testing the telephone components from the case and keypad to packaging of the internal electronics.

Some extremely complicated challenges were presented by the organic shape of the telephone's case, handset and keypad. The shape created by designer Hari Matsuda was presented to IDE as a clay model. Not only are the contours and surfaces of the base unit extremely complex, but the

These organic surfaces were far more complex than any IDE had worked with before. Moriconi was confident that they had the tools to handle the job. They have used CADKEY for a long time for its 3D and solids capabilities. According to Dave, they use FastSURF because of its flexibility and the fact that it works inside CADKEY, which made learning/training easier. Dave says that although they probably pushed FastSURF to the maximum for the telephone project it performed the job beautifully.

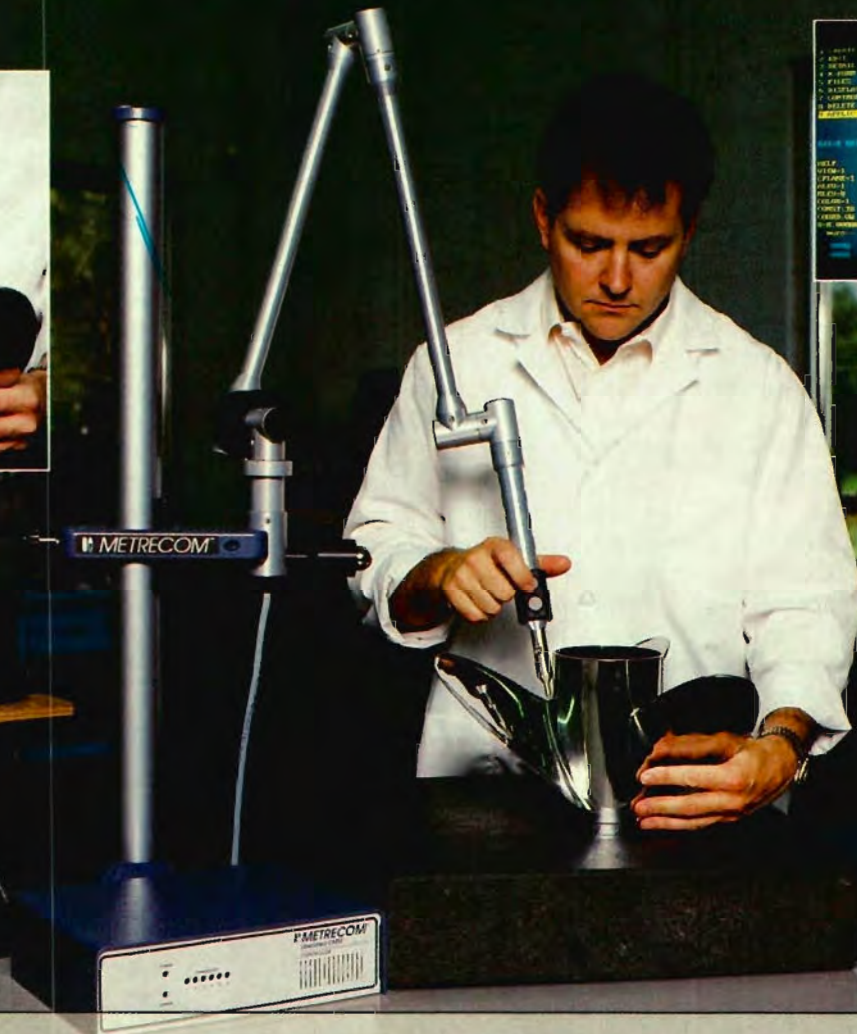
The first step was turning the clay model into a usable 3D CAD database. The job was performed by Dave Plahm of Design Facets in

Back at IDE, the FastSURF file was fine tuned and the contours refined. Then, an IGES translation was fed to the model shop who built the molds with a 3-axis tree milling machine. The molds for this project were special because of the complexity of the parts. The negative, three-part molds were machined in layers.

President David Moriconi is especially proud of the fact that IDE has achieved a truly paperless system, and that the company not only builds models but is a role model of concurrent engineering. ■

3D DIGITIZER

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The Real Benchmark

SPEED

by Jack Bilderback, CPIM

Concurrent engineering. A common definition involves cooperation between departments – the coming together of marketers, sales people, engineers, buyers, manufacturing personnel, and field service techs in the design process. It's the way to include many points of view as early in the design process as possible.

But concurrent engineering has another dimension. As important as it is to involve all pertinent parties from the beginning, reducing the total amount of time it takes to deliver an end item is even more vital.

Speed has replaced the strict focus on cost in improving a company's performance and competitiveness because speed, or more correctly the lack thereof, has become the most influential element affecting cost and profit. An economic model developed by the McKinsey & Co. management consulting firm several years ago showed that high-tech products that come to market six months late but on budget will earn 33% less profit over five years. Those completed on schedule but 50% over budget cut profit only 4%!

Among those companies who have grasped this fact, speed has also supplanted quality as the primary focus area. This isn't to say that quality is no longer important. Rather, today quality is regarded as a given. Most customer companies have developed internal quality

programs and have instituted quality measurement systems for their suppliers. Indeed, the end user or consumer *insists* on quality and reliability. Further, the pursuit of speed, if managed correctly, is entirely consistent with every quality precept.

Since low cost and quality are now just the ante to get into the game, a company's ability to produce quickly and with innovation provides the edge which will determine winners and also-rans in the 1990's and beyond.

Synonymous with speed in discussions pertaining to competitiveness is flexibility, or the ability to make rapid changes in design or product mix once in production. Flexibility also assumes an important role as companies discover the need to modify their strategic plans in favor of increasing the speed at which they do business.

Japan, U.S. and Speed

A dedication to speed has existed in Japan for many years, and is in fact the game plan most responsible for many of the successes we read about. It is also the fundamental strategy for many U.S. competitors who have chalked up significant achievements in new product introduction and/or customer service.

Companies with shortened product development cycles are in a position to not only capture market share, but in some cases define the market itself with innovative or feature-laden products. It is also a corollary that being first to market includes the opportunity to command a premium price for that honor.

The American automotive industry seized the concept and has begun to make serious inroads in the lead that Japan developed over the U.S. in new car quality and time-to-market cycles. This in turn

has led to increased sales revenue and market share. Chrysler's new facility in Michigan is a

monument to concurrent engineering which brings together all stakeholders in the beginning of the design process. The result has been a revolutionary new product line, the LH car, brought to market far faster than any preceding model. The Saturn car company, a GM subsidiary, reflects those ideals and is also proving worth the gamble.

Intel is an excellent example of a company with a speed culture. Their microprocessors are at the forefront of technology, and they dominate their industry. They have made the constant improvement of their design and manufacturing processes an important part of doing business.

By challenging existing procedures and focusing on consistent, steady improvement, positive results are inevitable

The now-famous Motorola pager is also testimony to the effectiveness of a strategy based on the ability to respond rapidly to both a marketplace and individual consumer need. The manufacturing cycle time of the pager improved from 3 weeks to 2 hours, and the average product development cycle at Motorola shrank from five years to 18 months.

Importance of Processes

Tools, like systems or processes, exist to make a job easier and increase productivity. From early manual implements to sophisticated CAD/CAE/CAM software today, the level of effort required to accomplish a task and the quality of output have been sources of inspiration to those intent upon advancing technology through tool design. Tools alone, however, provide only so much impetus to revolution in performance. In addition to tools, the methods or systems employed to achieve an end must be considered and revamped.

Measuring Cycle Time

How does an organization not only take advantage of the latest technology with the tools it chooses, but also create an environment in which all activities are designed to add value and eliminate wasted effort?

The measurement of cycle time is an important place to begin. Cycle times are most often associated with manufacturing activity. Surprisingly, according to the Thomas Group, a Dallas consulting firm specializing in speed, between 60% and 90% of the cycle times critical to achieving competitiveness occur outside the manufacturing area.

In fact, all processes can be broken down, measured, analyzed and improved upon. Whether we're looking at engineering routines, order entry, daily accounting systems, scheduling the factory floor, or processing data and administering office activity, to be successful it is necessary to apply this concept to every area of the company, not just in production

and the direct labor force.

When working to reduce cycle time, each step should be analyzed and justified based on the value it provides in the flow chart of the business process as a whole. If an operation adds value, determine the optimum time required to accomplish the task. If it adds no value, eliminate it from the process. Of course, it is then the challenge to go after that optimum goal with a relentless sense of purpose.

For those of us who have spent much of our professional lives at desks or working in an office, the revelation that according to a study on productivity conducted by the Illinois Institute of Technology, blue collar productivity in manufacturing has been consistently above 80 percent and rising while white collar productivity in office environments has been below 40 percent and falling, is an embarrassing eye opener (or confirmation of what we already suspected). Most importantly, it should also serve as the clarion call to apply all the energy necessary to achieve the same results in white collar work that are seen in manufacturing.

The theory of internal customers versus external customers also provides a new perspective to improving process cycles. NOAC, or

Next Operation As Customer, a system aimed primarily at the service industries, was developed under the auspices of the American Management Association by Keki R. Bhote, a senior corporate consultant on quality and productivity improvement for Motorola. Derived from an idea by Dr. Kaoru Ishikawa, the father of the quality movement in Japan, it provides a blueprint for process review and redesign in an effort to not only reduce cycle time but increase quality and productivity.

Benchmarking

Benchmarking, or comparing one's own effectiveness to that of a competitor or role model, serves to gauge just how much improvement is going to be required. "Best-in-class" companies, or those who stand out as examples of superior providers of service or products, furnish truly ambitious goals for anyone looking to improve--regardless of which customers or markets are served. A well-performed process has universal application.

A not uncommon mistake is to evaluate an activity or step in a process based on its impact to the immediate area. It is entirely possible that an improvement made in one department can lead to an

Design/Development Cycle Time

<u>COMPANY</u>	<u>PRODUCT</u>	<u>OLD</u>	<u>NEW</u>
Honda	Cars	5 years	2 years
AT&T	Phones	2 years	1 year
Navistar	Trucks	5 years	2.5 years
Hewlett-Packard	Printers	4.5 years	22 months

Manufacturing Cycle Time

<u>COMPANY</u>	<u>PRODUCT</u>	<u>OLD</u>	<u>NEW</u>
General Electric	Circuit Breaker Boxes	3 weeks	3 days
Motorola	Pagers	3 weeks	2 hours
Hewlett-Packard	Test Equipment	4 weeks	5 days
Brunswick	Fishing Reels	3 weeks	1 week
Matsushita	Washing Machines	360 hours	2 hours
Harley-Davidson	Motorcycles	360 days	3 days

Examples of companies who instituted a speed culture, resulting in improved competitiveness. Reprinted with permission, APICS, "Time-Based Competition: Building the foundations for Speed," 35th Annual Conference Proceedings, Phillip L. Carter and Steven A. Melnyk, 1992, pp. 63-67.

overall reduction in effectiveness by adding time elsewhere. It is the improvement of the entire cycle time, from beginning to end, that is the true measure of success.

Measure and Publish

Once a business process has been identified and broken down into components, and a target established for cycle time reduction (by benchmarking or using statistical or theoretical possibility), it is absolutely essential that it be measured as frequently as makes sense. There's an old saying: if it isn't being measured, it isn't being managed.

Hand in hand with measurement is publishing and distributing progress reports, preferably in the form of charts or graphs (a picture is worth a thousand words). The publishing of progress is essential for two primary reasons. It will keep all those who are interested informed. And it will keep all those involved motivated.

Streamlined Communication

Streamlining communication is another area worthy of focus. Communication has considerable impact on the speed with which things happen, and improvement may be accomplished in a number of ways.

One is a reduction in organizational layers. This has become a frequent and popular subject precisely because it presents a tremendous blueprint to increase the rate at which decisions are made and improvements implemented. It's worth pointing out that a reduction of layers does not necessarily eliminate people. Roles change as organizations are redefined and provide previously unidentified opportunity for those in jeopardy of being phased out. But the goal must definitely be the flattening of the pyramid.

Focus on time and on how much of what is done really adds value to overall operations and customer expectations.

Team-Based Problem Solving

Team-based problem solving, the essence of concurrent engineering, is another highly effective method of tearing asunder the impediments to a quick-response mentality.

The serial mode in which problems are handed to the department down the line becomes a nightmare of less-than-adequate communication, offering no guarantee of truly creative solutions. It's amazing how much energy is spent wrangling with fellow workers over issues which should really bring people together. After all, the competition is outside those four walls, isn't it?

The breakdown of the functional mentality is a precursor to optimizing human resources.

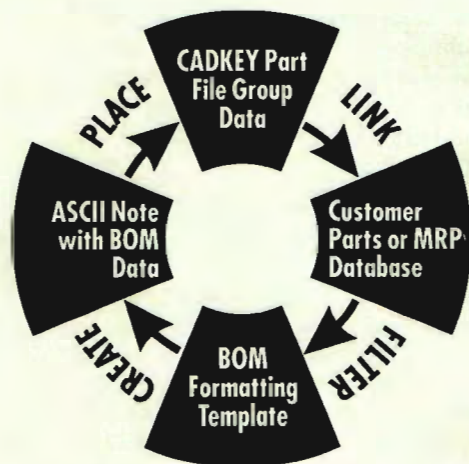
The authority to make decisions must go along with training in team-based problem solving. Training and empowerment of those trusted to find the solution to

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problems is critical to a speed-based philosophy.

An extension of the team approach would include those outside the company. To create an unbroken network of suppliers, internal departments, and customers, a prescription of regular visits, early involvement in the design process by both suppliers and customers, and expanded use of technology in the form of the fax machine and electronic data interchange to handle specs, drawings, bills-of-material, purchase orders, shipment authorizations, invoices, etc. would increase the rate at which business takes place.

Conclusion

The habits developed and institutionalized over what might be many years are oftentimes representative of stagnant and comfortable routines. However, by challenging existing procedures and focusing on consistent, steady improvement, positive results are inevitable. The worst that can happen is less-than-total success. It is preferable to record many small increments of improvement which occur on a regular basis versus the one great leap which happens infrequently.

Above all, focus on time, and on how much of what is done really adds value to overall operations and customer expectations. There should be a concerted effort to both accelerate the response, and to develop an organization structured and managed to respond. The size of the company doesn't matter. The product or service provided doesn't matter. Speed is not about frenetic activity or longer hours or more people. It's about being effective in what we do by analyzing our activities and eliminating those which do not allow us to work smart as opposed to harder. ■

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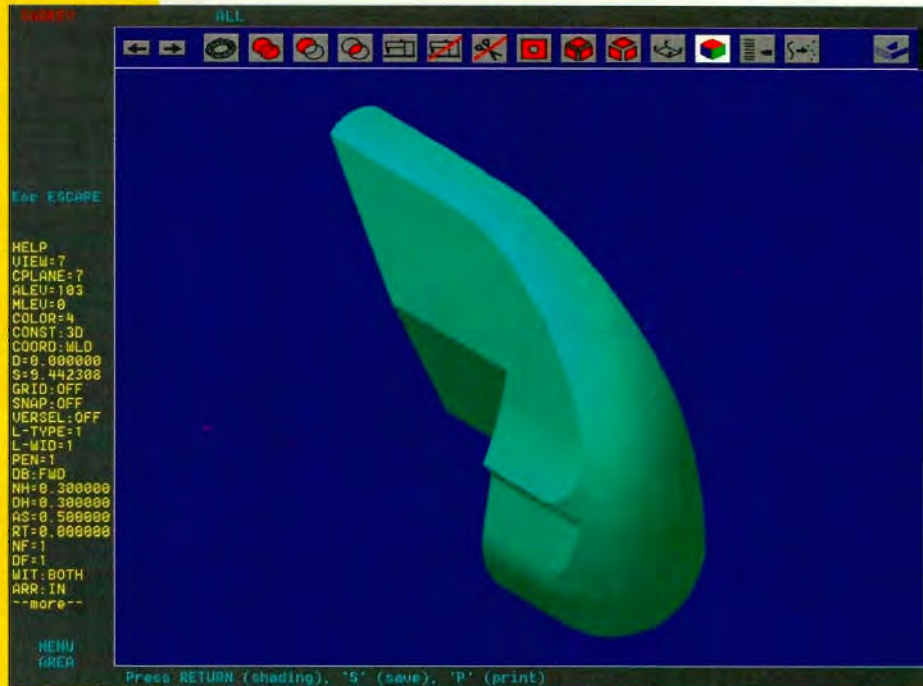
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CADKEY ADVANCED MODELER -

NURBS-Based Surface and Solid Modeling

by Stas Mylek and Frank Simpson

The first of two articles on the new CADKEY® ADVANCED MODELER explores the latest technology, explains the ADVANCED MODELER's basic capabilities, and offers insights on the benefits of integrated NURBS-based surface and solid modeling. The next article will describe and analyze the ADVANCED MODELER's more complex capabilities and discuss Cadkey's future direction for this new technology.



Shaded image of a plastic lever.

Traditionally, surface and solid modeling has required a high level of sophistication from both the user and the technology. Most surfacing and solids products in the past operated on workstation platforms whose use was limited to the more experienced CAD users. The learning curve for these tools was much longer than conventional CAD, the interaction of the products was cumbersome, and their capabilities were often too limited for complex design.

Due to technology limitations, many products weren't flexible enough to allow designers to mix both surface and solid modeling techniques. In fact, surfaces and solids functions were usually separated; what was designed as a solid model had to be brought into a separate surface module (if, at all) for downstream design or manufacturing. This interaction was not always transparent to the user.

With the advent of integrated NURBS-based surface and solid modeling, the CADKEY ADVANCED

MODELER (scheduled for release early third quarter, 1993) breaks down the boundaries of traditional design and opens the door to new and innovative, easy-to-use design alternatives.

Just what are NURBS, and what do they mean for a CAD user? NURBS are Non-Uniform Rational B-Splines. A Non-Uniform Rational B-Spline is a basis (or building-block) spline that has mathematically verifiable node or knots points located at irregular intervals in three-dimensional space. NURBS provide increased flexibility for creating, displaying, modifying and exchanging design data.

The ADVANCED MODELER will put unparalleled design capabilities in the hands of designers and will set a new standard for 3D modelers. As the first phase of several scheduled releases, the ADVANCED MODELER allows designers to combine wireframe, surface, and solid modeling disci-

plines to reduce operator complexities and to shorten the design process. The objective was to develop a package that would give users who are less experienced in 3D modeling simple tools for constructing 3D models and give designers who are experienced in 3D modeling faster and more efficient methods for complex modeling applications.

NURBS-based Surfaces and Solids

The ADVANCED MODELER is an integrated surface and solid modeling package which utilizes state-of-the-art NURBS-based technology. It addresses the industry's movement towards NURBS modeling by offering a wide variety of surface and solid modeling capabilities, solid primitive construction, extensive editing features, and an advanced IGES bi-directional translator. The use of the entire product has been simplified with an easy-to-use tool bar and dialog box interface which uses either icons or pull-down menus.

Surfacing

The surfacing capabilities are divided into the basic modeling techniques. These include tabulated cylinder, ruled, complex, 3-sided, swept, offset, and constant and variable radius fillet surface construction. Each surface type is described by indicating simple wireframe geometry and assigning the necessary parameters, if applicable. The subsequent surfaces that are created can then be displayed as user-defined spline, line, or polygon meshes, depending on the required format.

Seamless Solid Modeling

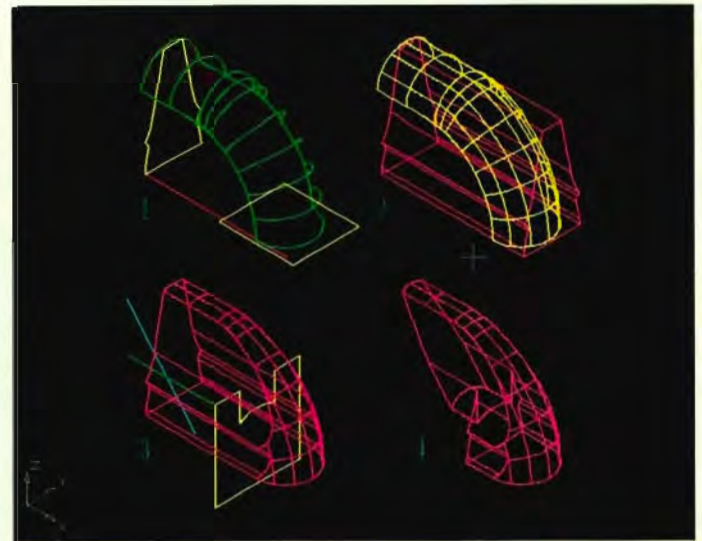
The ADVANCED MODELER provides seamless solid modeling capabilities through the use of primitive construction including blocks, cones, spheres, tori, and user defined extruded profiles. These features allow the user to quickly and easily define geometry which can later be manipulated and edited.

Interaction for modeling solid primitives has been enhanced to include dynamic construction. Users can dynamically drag or stretch a primitive into the desired configuration. This gives designers immediate

visual feedback and allows them to quickly generate each primitive. A user-defined snapping value is displayed as the geometry is dragged to assist the designer in defining the actual size and location of the geometry.

One of ADVANCED MODELER's more unique features is the ability to create a solid by defining a 2D wireframe profile and specifying the desired thickness. Once a solid has been defined, the user can combine primitives to form new solid primitives through the use of Boolean operations: union (addition), difference (subtraction), or intersection.

The Boolean operations found in the ADVANCED MODELER are not limited to solid entities or



1) The PROFILE function is used to create an extruded solid from the 2D contour (yellow) driven along a vector (purple line). 2) A complex surface is created (yellow) based upon the cross-sectional information (green) in Step 1. The extruded solid is then trimmed to the complex surface. 3) An extruded solid is created from the yellow contour. This solid is then removed from the lever using a difference function to form the cut-out. 4) The top portion of the lever is produced as a solid.

primitives. For complex modeling applications, surfaces can be used when performing Boolean operations. This gives designers the ability to trim solids to free-form surfaces.

Unique Editing Capabilities

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combine a variety of editing and construction operations between wireframe, surface and solid entities. These techniques are unique to personal CAD systems (and in some cases many high-end CAD products) and are extremely important in creating and editing complex models.

In the ADVANCED MODELER, surfaces can be used to trim solid geometry or solid objects can be trimmed to wireframe entities using the standard CADKEY EDIT menu. This integrated capability, found under the TRIM/EXTEND and EDIT-SECTION menus, duplicate CADKEY's easy-to-use interface.

Full surface trimming is also supported in the ADVANCED MODELER. By accessing the same TRIM/EXTEND menu, surfaces can be trimmed and extended to one another. The same trimming functionality can also be activated during any fillet surface operation by using the *sew* and *trim switch*. As surfaces are filleted, the designer can automatically *trim* and *sew* the resultant surfaces together to form one single

surface unit. This level of functionality is important when defining complex geometry where multiple operations are required.

Another unique capability is the "Punch" function which allows



5) A cylinder primitive is combined with a sphere using a Union option.
6) The two solids are combined to produce the final model.

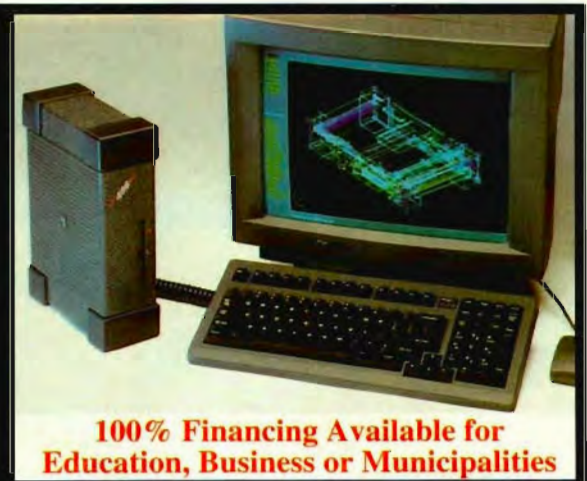
designers to use typical 2D drafting profiles (wireframe) for creating or editing 3D surface and solid models. The Punch function allows designers to punch out or trim a desired contour from a surface or solid. This feature provides designers with an easy method for constructing 3D

models by allowing them to take two profiles, such as the front and side views, and combine their projections to create complex geometry. By relating construction to simple 2D drafting projections, this capability is especially beneficial for those who are unfamiliar with 3D modeling.

Solids from Surfaces and Vice Versa

Creating solid models does not have to be limited to solid primitive construction and operations typically found in other surface and solid modeling systems. With the ADVANCED MODELER, the designer has the ability to create a solid from a set of surfaces or explode a solid into a surface model.

By using the Solidify function, users can create a solid by selecting a set of surfaces which contain a volume. This option creates a solid by "sewing" its boundaries together. This same process can be reversed through the Decomposition function which converts (or unsews) a solid model into a set of surfaces. These unique functions are extremely useful in defining complex geometry or isolating



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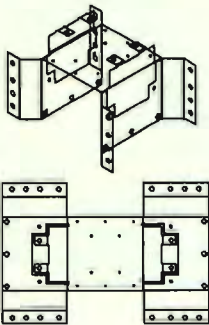
With the ADVANCED MODELER, Cadkey has developed a product which is powerful and flexible enough to be used by both novice and experienced 3D designers. The unique capabilities and NURBS-based technology used to develop the ADVANCED MODELER is unprecedented in the area of personal CAD systems and represents an unlimited solution set for the future. ☐

Editor's Note: For additional information about the use of NURBS in computer-aided design, see "NURBS: CAD by the Numbers," by Dr. Brian C. Kuttner and Dr. Michael A. Lachance, published in *Action Line*, January 1991.

Action Line is a publication of the Automotive Industry Action Group, Southfield, Michigan. Telephone: 313/358-3570. Fax: 313/358-3235.

Dr. Kuttner is President and Dr. Lachance is Director of Research and Development, C-TAD Systems, Inc., a leading CAD-data exchange company, Ann Arbor, Michigan. Telephone: 313/665-3287. Fax: 313/665-9736.

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Mice and RSI

Minimizing the Risk

by Claudia Martin

Over 200 years ago, an Italian physician reported that serious occupational diseases could develop from "irregular motions and unnatural postures of the body." Guess what? Nothing's changed. According to the U.S. Bureau of Labor Statistics, RSI, a muscular-skeletal disorder caused by performing small repetitive movements, is the leading cause of occupational illness. CAD operators are especially at risk.

While it's not in the same class as AIDS, RSI (repetitive stress injury) is a potentially serious problem for anyone who spends long hours at a computer using a mouse and a keyboard. Although many body parts can be affected, the wrist and elbow are the most common problem areas for CAD operators. This makes sense. If you're an average CADKEY operator, you know you spend much more time every day holding hands with your mouse than with your significant other. However, propelling the cursor across the screen through drawings and menus, pointing and locating, and pushing mouse buttons multitudinous times can cause repetitive stress injuries such as carpal tunnel syndrome, tendinitis and tenosynovitis.

Unfortunately, RSI is frequently

unrelated to motions performed at work, because the symptoms (pain, numbness, tingling) are usually most severe at night, hours after leaving the job. In addition, there are no consistent patterns and the symptoms begin so gradually that the condition often takes years to develop. So the symptoms are often "written-off" as arthritis or the "wear and tear" of getting old. The condition can be out of hand before it is taken seriously. The truth is, RSI can be so perilous that in severe cases victims have had to retire or change jobs.

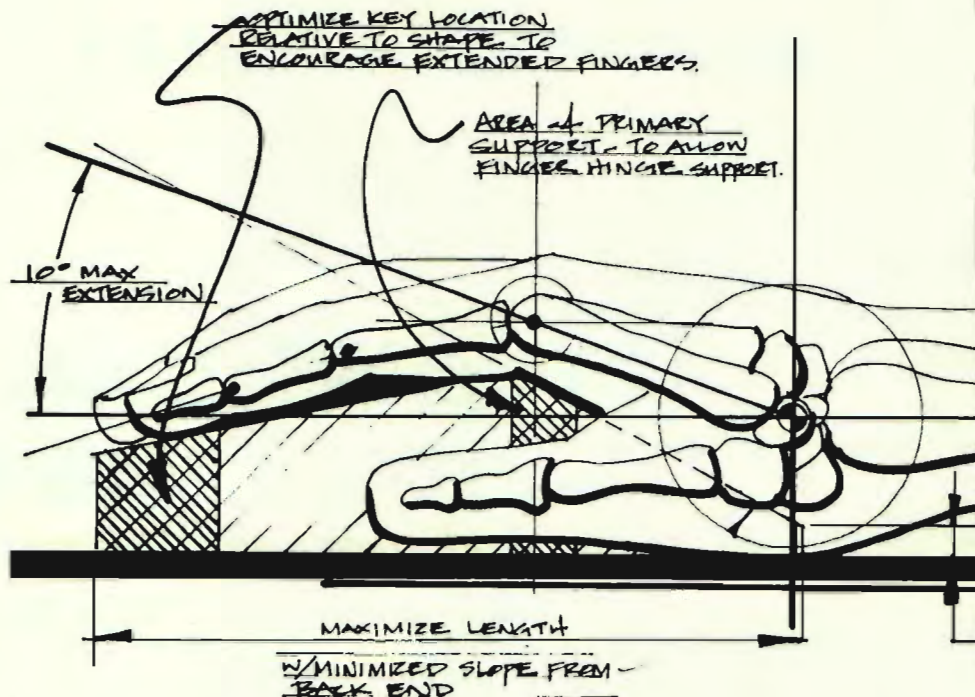
The ubiquitous mouse is small and most of us tend to take it for granted. You may not have selected it as carefully as you did your computer, plotter and software. In fact, if your current mouse was bundled with a hardware or software purchase, it was selected for the best bundling price, not comfort or fit for you.

Fortunately, as the dangers of RSI have become recognized, a whole new batch of ergonomic pointing devices has been developed. Nowadays, a mouse is not just a mouse. The mouse is still alive and well but has been joined by trackballs, pens and unique devices like the Felix. These new devices address the ergonomics of mouse use. All are a vast improvement over

previous mice—even last year's models.

The original mice can best be described as "clunky." They were tall, boxy, and featured square corners and sharp edges. It was necessary to move them as much as 8-10 inches to move the cursor an equivalent distance. Clearly, ergonomics was not a priority. Technical issues (e.g., being able to use a serial port and lessening the travel distance) took precedence. As these issues were resolved and RSI became a recognized problem, manufacturers began to design for the human body. They noticed (VOILA!) that the palm of the human hand in a natural relaxed position does not have angles but is composed of arcs and smooth curves. They noticed that the heel of the hand was level with the wrist in a straight position and lower than the cupped portion.

Some of the issues in mouse ergonomics are the distance the mouse must be propelled, the angle(s) at which the hand, wrist and elbow must operate, and the fit of the device to the hand and fingers. The new crop of ergonomic mice has smooth curved surfaces and a low profile where the wrist and heel of the hand connect. Improved resolution has reduced the "travel" required to propel the cursor across the screen to less than 2 or 3 inches.



Several years ago alternative devices began to address the problems caused by propelling the mouse across a surface.

Trackballs and the Felix are stationary so all the action is performed by the fingers and thumb. This reduces arm and wrist motion. Until recently trackballs were also able to claim that they took less precious desk space than a mouse. As the resolution of the mouse has increased, this feature is less of a difference.

The mouse, trackball and Felix all perform well as pointing devices, but the feel of these devices is so different that most users prefer one over the other. Presently, the mouse seems to win out in popularity with users. There may be something more intuitive or natural in the mouse, or it may be just tradition since the mouse came first.

You should be able to find a match, but like shoes or hats, finding a fit is a very personal matter.

An Ounce of Prevention

Minimizing the risk of mouse-related RSI involves more than buying an ergonomically designed device, although that is important. Other factors are the physical arrangement of the work environment, how you actually use the mouse and keyboard, and how you take care of your body (things like posture and exercise).

Using the Mouse

Analyze the way you use your wrist and arm. It is important to keep your wrist neutral. This means avoid using the wrist in a twisted or bent position; maintain a straight wrist position. For some, trackballs

or other stationary pointing devices fill the bill. Rearranging your work area to change the position of the mouse/mouse pad in relation to the computer and the keyboard can also allow you to work with a straight wrist. Here are a few hints.

- Position the keyboard directly in front of you on the desk.
- Position the mouse at the same height as the keyboard. Try to avoid light sources that can reflect on the surfaces of your mouse and keyboard.
- If you use a mouse pad, make sure it is not so thick that it raises your arm and the mouse. Your arm should maintain an approximate right angle to the horizontal table top. The mouse pad should provide smooth friction for ease of use—it should not be too slippery.
- Whenever possible, use your entire arm to move the mouse around. Avoid excessive tension in your hand by relaxing - do not grip the mouse too hard.
- While you are using the mouse and keyboard, keep your shoulders relaxed and let your upper arms hang freely at your sides. Let your elbows hang loosely near your body and allow enough room on your desk for unhindered movement of the mouse. Your forearms should be nearly parallel and at approximately right angles to the floor as you type.
- Minimize repetition. Avoid holding the mouse the same way for long periods of time. This helps you from repeating the same motion over and over, and avoids unnecessary strain on your arms and hands.
- Learning every keyboard command and equivalent available, and macroing as many operations as possible should help you get your hand off the mouse. Using the function keys and Immediate Mode Commands in CADKEY can help immensely. Windows also has many keyboard commands.

Chair, Desk and Posture

A chair that is adjustable in height is a good place to start. It should be comfortable and provide firm support to the lower back (lumbar region). If your feet don't rest flat on the floor, use a footrest that is high enough so that your thighs are parallel to the floor while you are seated.

If possible, place your system on a desk designed for a computer. Traditional writing desks are sometimes too high for computer use. A proper height between

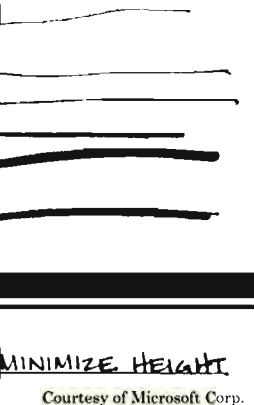
your chair and your desk is essential. And do not forget good posture—slouching puts unnecessary strain on your back and weakens muscles.

Exercise and Rest

Take periodic breaks to rest your eyes, move your body, and get your circulation flowing. Try some of the following exercises several times during the day.

- Gently press your hands against a table, stretch and hold for five seconds.
- Stretch and massage your fingers, hands, wrists and forearms throughout the day. Gently shake your hands and fingers to relieve tension and help blood flow.
- Rotate your shoulders in a full forward circle four times. Then roll them backward four times. Then rotate each shoulder separately four times. Do this at least twice daily.
- Do conditioning exercises to strengthen hand and arm muscles. For example, squeeze a tennis ball for six seconds and then relax for six seconds. Or, squeeze your fingers together while holding your wrist and fingers straight. With wrists straight and hands in gentle fists, press your thumbs into the sides of the index fingers; hold, relax and repeat.
- Rest. Give your hands and wrist periodic breaks. Switch hands, if possible; alternate hard and easy tasks; or rotate work activities.

A physical therapist who specializes in treating dancers and musicians in New York says, "People need to release tension and shake the muscles out when they finish any repetitive activity, whether it's dancing, playing the violin, or working at a computer. They need to learn how to properly relax tendons and stretch joints." So, shake those hands and fingers, stretch them gently, and remembering that the "wrist bone's connected to the arm bone" etc., relax the muscles in your neck several times a day. Drop your chin to your chest and then stretch out your arms and shoulders. ☐



ERGONOMIC



Microsoft Mouse 2.0

The Microsoft Mouse has had a major overhaul and has been redesigned ergonomically. The 2.0 version mouse is sleek and comfortable. In addition to the new shape, it has a shorter softer cable, longer and wider keys for more varied grips and finger positions, and an opto-mechanical encoder which enhances accuracy and is more reliable. Teflon glides ensure that no mouse pad is needed. However, there is a risk with not using a mouse pad. The ball and mechanism can pick up contaminants from certain surfaces.

It is still highly DOS and CADKEY compatible, but there are new software features just for Windows. These include: *Orientation* - lets the user set the direction the pointer travels on the screen when the mouse is moved; *Snap-to* - minimizes mouse movements by automatically "snapping" the cursor to the default button with any command that results in a dialog box; *Screen Wrap* - moves the cursor around to the opposite side of the screen when it is moved off any edge; *Locate* - returns the cursor to the center of the screen if it is momentarily lost; and *Magnify* - enlarges the screen area at the pointer to allow precise cursor movement.

MS Mouse 2.0 fits a variety of hand sizes. The documentation claims that it can be used right- or left-handed, but we found it slightly awkward for left-handed use.

Microsoft Corporation
One Microsoft Way, Redmond WA
98052, 206/882-8080

MOUSEMAN

Logitech's new MOUSEMAN is a three-button mouse with ergonomic features. It has a low rear end that allows the heel of the hand and the forearm to rest on the work area for firm support. Its smooth, hand-conforming shape feels natural. MOUSEMAN is available in right- and left-handed versions and LARGE for medium- to large-size right hands.

MOUSEWARE is a utility program that includes a drag lock key that allows you to scroll across the screen without holding down the mouse button, ballistic drivers that let you



adjust cursor sensitivity for extra precision or speed, software that lets you easily create customized menus, pre-created menus to let you work more easily with popular non-mouse-based applications and control panels to make it simple to adjust mouse settings in DOS.

Logitech has several ergonomic mice including MOUSEMAN CORDLESS and TRACKMAN, a trackball. Logitech has a comfort replacement program and a left-handed exchange program. After purchasing a Logitech mouse, you can exchange it for another Logitech you think would be more comfortable. Right-handed mice may be exchanged if the dealer was out of left-handed mice or a volume purchaser has both right- and left-handed employees.

Logitech Inc., 6505 Kaiser Drive,
Fremont CA 94555, 510/795-8500

SICOS Colani Mouse

The SICOS was designed by Luigi Colani, a well-known European designer using the principle of bio-design. This mouse looks like a mold of a person's hand in a relaxed position on a desk and fits most hands like a glove.

If you hold this mouse like a traditional mouse, it seems too large for many hands and reaching the buttons is difficult. You end up elevating the arm and wrist -- an ergonomic "no-no." The suggested method is to lay your hand and arm on their side with the thumb pointing up, reaching slightly around to the buttons. This works for all but the smallest hand and is surprisingly comfortable.

The mouse comes in right- and left-handed versions. It operated smoothly and was recognized by our software without even installing the SICOS mouse drivers. The utility software lets you make mouse-controlled menus for programs not designed to be operated with a mouse, and contains pre-prepared menus for dBASE, WordStar, Lotus, DOS and Turbo. The documentation comes in English, French, German, Spanish, and Italian.

Moustrak, Inc. also has a complete line of mouse pads and custom computer accessories including wrist pads for keyboards, mouse gloves, and machine pads and anti-static pads.

Moustrak, Inc., 2701 Conestoga Dr.
#123, Carson City, NV 89706,
800/221-6687, 702/884-1931



MICE & KIN



MOUSE-TRAK

MOUSE-TRAK is a Cadillac of trackballs. In addition to standard trackball features (i.e., small foot print, no special surface required, and stationary placement), this one is large enough to let the whole hand spread out comfortably and has an integral padded area that firmly supports the hand and wrist.

MOUSE-TRAK can be used in a 2- or 3-button mode. The buttons are user definable for left- or right-hand operation. You tell keys 1, 2, or 3 to be positioned left, center or right simply by changing the easy-to-access jumpers. For tight areas and incredible precision, you can change the cursor velocity instantly by pushing the small button on the face of the device. This slows the cursor down to a crawl.

It comes with software, but we had it up and running instantly with the Microsoft driver already on our computer.

The top-notch engineering in this trackball makes operation smooth and fluid. Its heavy 5 oz. cast phenolic ball is round to within +/-0.005 inches and has Rockwell H85 hardness. The ball rests on hardened and polished stainless steel shafts with precision stainless steel bearings.

An industrial model is even tougher for harsh environments and heavy use. Its case is a glass-filled Xenoy® thermoplastic alloy; a Mylar® ring is added around the ball opening for protection from dust and debris; the PCB has a conformal coating for water resistance in high moisture areas; and the cable is shielded for additional strength and reduced EMI. Models are available for most UNIX platforms, PCs, Mac and others.

*ITAC, 3121 Benton Street, Garland TX
75042, 214/494-3073*

FELIX

The feline name is the clue that this pointing device is not a mouse although it performs all the mouse functions. Felix has a one inch square movement caged in a 5.75 inch platform. It is controlled by finger motions similar to holding a pencil.

This unique design offers some interesting productivity enhancements and solves most of the ergonomic problems associated with mice. Holding the Felix and moving it within one square inch is a lot faster than rolling a mouse to the edge of the pad, lifting it up and placing it back on the pad. Like a trackball, Felix stays in one position. Because your palm and forearm can rest comfortably on your desk and the motions are smaller, you take most of the stress and strain off your wrists, elbows, shoulders and back. Holding and moving the Felix is quite intuitive.

The screen can be covered with movements slightly over one inch. This small motion can cover screen sizes from 9 inches up to 40 inches. At start-up you just touch all four edges of the screen to "teach" Felix the size of your screen.

Felix's performance is different and takes some getting used to. One user said that going from a mouse to Felix is like going from a pick-up to a high performance race car because of its precision and speed. These are the qualities that make it a perfect candidate for CAD.



Technically like a digitizing pad in one square inch (an optical device unlike the mechanical mouse), Felix is an absolute rather than a relative device. Absolute pointers can allow for more precise reproduction of measured images, and can be easier to use for detailed work. In addition, you can have fast motion for blasting around the screen, or slow down for finer control and absolute accuracy.

Felix is based on optical technology and never needs routine maintenance or cleaning.

*Altra, 520 West Cedar, Rawlins WY
82301, 800/726-6153*

Features and Prices

Mouse/ Company	Device Type	Ergonomic Features	Platforms	Special Features	Price
FELIX Altra	Tablet 2-button	1" active area low profile	PC, Mac	Speed control, high res, absolute device	\$118
Microsoft Mouse 2.0 Microsoft	Mouse, 2-button	Smooth shape	PC	Mouse Manager, Windows support	From \$109
Mouse-Trak ITAC	Trackball, 3-button	Elevated, padded wrist support	SGI, Sun, Mac PC, PS/2	Industrial models, speed control button	\$179
Mouseman Logitech	Mouse, 3-button	Right-, left-hand & large versions	PC, PS/1 & PS/2	Mouseware utilities, exchange policy	\$119
Colani Mouse Moustrak	Mouse 3-button	Hand-shaped, right- & left-hand versions	PC, PS/2 Mac	Lowest cost, molded for human hand	\$79



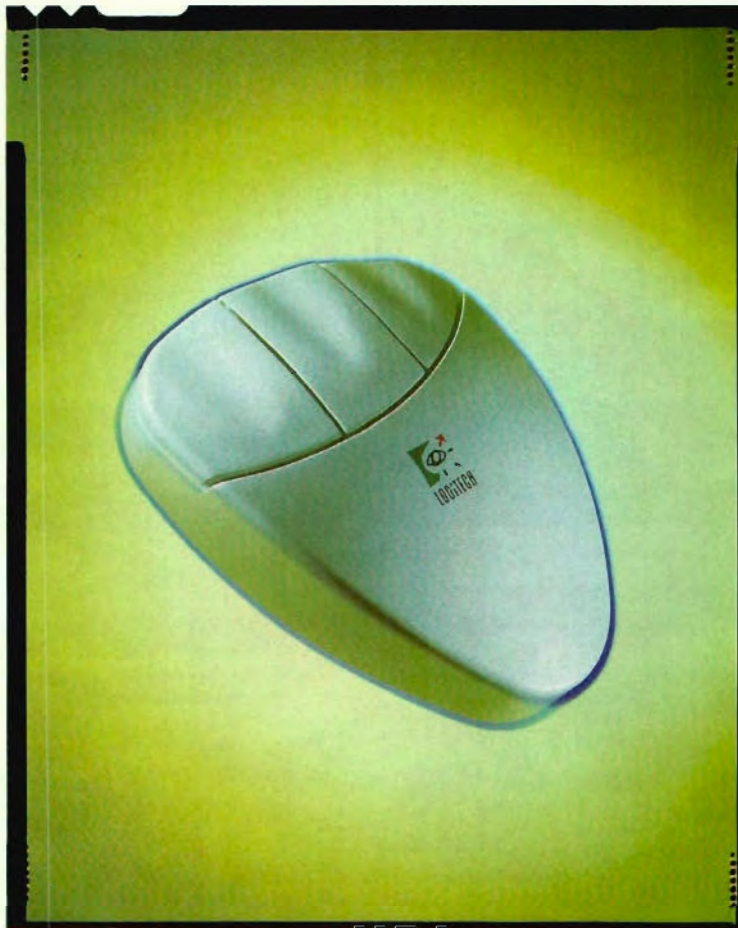
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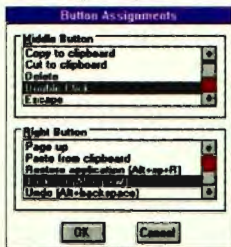
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by Charles Taylor
Selkirk High School has been adopted by KEY SOLUTIONS in a pilot project to revamp vocational education in small suburban and rural school districts. After months of preparation, they will be expanding their focus when school reopens in September.

Industrial Arts instructor, Larry Jungblom, advises student Kelsey Damron on cutting a brass drop weight. Photo above: Selkirk High School, Metaline Falls, Washington.

"CADKEY Valley" is what we will soon be calling this remote corner of Eastern Washington. Part of our program at Selkirk

gram. A Bulletin Board System is being installed in a prominent location in the high school, and students will be encouraged to use the E-mail and message capabilities to communicate with each other. This is a clandestine way of introducing computers to the entire student body without defining their learning experience as computer instruction. Three or four students, trained in its operation, will introduce other students to the experience, and the stu-

classes are training with CADKEY. At the same time, the Omnilink Computer Training Center, located in the community, is introducing a CAD training program focusing entirely on CADKEY as the principle software package. This program has turned up two skilled CAD operators and preparation is underway to train them as CADKEY trainers. ☐



Student, Andrew Stewart, cutting a steel taper and hinge pin in Selkirk's shop.

High School is the development of a computer consciousness in the entire community. Out of this will emerge the support system necessary for the successful development of this radical change in the school's vocational training pro-

gram. Students will soon be using the BBS from home. Selkirk vocational education



Student, Cory Baker, training on CADKEY® Light in Selkirk's Computer Training Room.

Photos by Adam Teem, Selkirk H.S. student.

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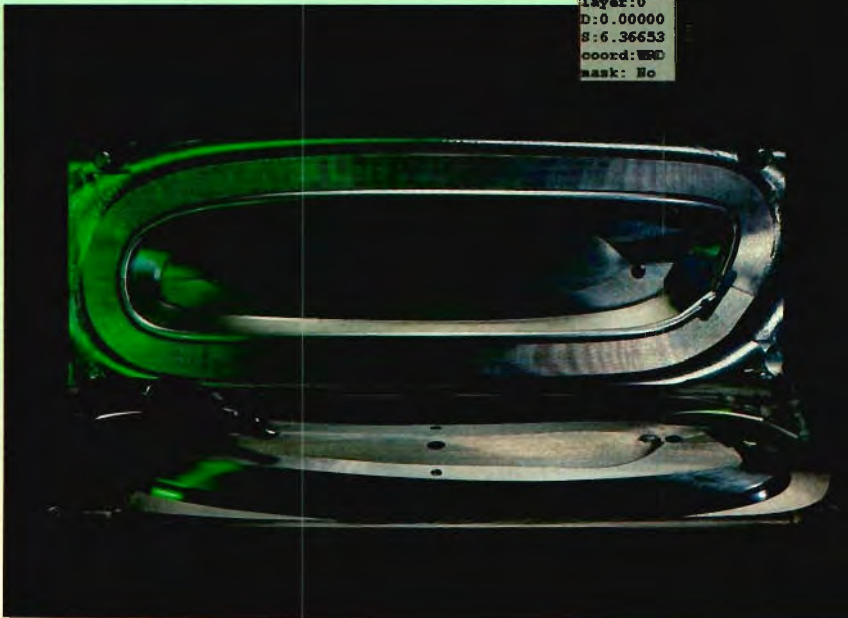
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At the end of this lesson the student will be able to...

by Ron Shea



Corey D. Malone
(206) 943-4465

"At the end of this lesson the student will be able to...". This is the question every teacher should ask themselves before class starts. Each should determine the outcome, competency or skill the student will be able to walk away with from the lesson.

The problem is that educational outcomes or standards must be measurable and curriculum and technologies are rapidly becoming more sophisticated. In the old days a mechanic "just tuned cars". Now a mechanic must be able to link the car to the computer diagnostics **and** repair the car to specifications. In the old days the title was "drafter." Now it's Computer Aided Designer.

At the beginning of the school year, CADKEY Version 4 was still going strong. Then came Version 5, about mid-year. Now CADKEY Version 6 is shipping. CADKEY instructors need a way to track the competencies for CADKEY.

With the Student ScanTrac 2001 bar code system, instructors can not only keep track of student progress,

but will also track student attendance. This is especially helpful to vocational classes requiring intern or apprenticeship time monitoring. In most schools instructors take attendance manually. Then the attendance sheet is sent to the attendance office and re-recorded in the school's computer system. This is redundant!

identification badges can also have an infrared coding to allow entry or added security for classrooms. Additionally, class competencies can be put into bar code format, with a competency rating.

Designers John Linder and Mel Parse of New Market Vocational Skills Center have been using the bar code template and equipment



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The Student ScanTrac 2001 system uses a student's picture Identification Badge or Activity Card and adds the student information in bar code format. Student

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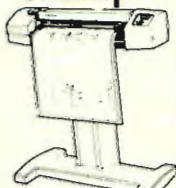
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need to improve in. The data is collected using a slot reader, a pen reader and a portable collector. The information in the portable collector is downloaded into the classrooms PC at the end of the day.

CADKEY functions have now been put into bar code format, for integration into this type of system. The Student ScanTrac 2001 is a complete system including slot reader, pen reader, portable pocket reader, bar code generating software, software to program the portable pocket reader and the CADKEY bar codes. The pocket reader's programmable software uses a Microsoft Windows interface and is very easy to program. The information collected is downloaded in ASCII delimited format into the database or spreadsheet software.

The bar code generating



A sample Bar Code for CADKEY competencies.

software can not only be used for adding custom competencies but can be used to generate the student's identification badge bar codes.

Additionally, the bar code system could be used for school supplies inventory control or library book tracking, again using the students bar coded picture identification badge.

Using the Student ScanTrac 2001 system helps streamline grading procedures. It takes the "this teacher just doesn't like me" out of the excuse box for students. It gives students a goal to aim for. With the printout of the necessary competencies for each course, the student knows the expectations of the instructor and most importantly the expectations of industry.

The Student ScanTrac 2001 system is a great new technology to aid instructors and reduce the time required for record keeping and other non-instructional tasks. Yet school budgets around the country do not keep up with the changes in technology. If schools do not have the funds to keep current with technology, how are they going to

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Maxi PRO-II • A Useful CAD Tool

The Maxi PRO-II is the industry's first standard (124-key), fully-programmable keyboard. Programmable means you can set up special keys to perform operations in a single keystroke that would normally require many keystrokes, menu selections and/or command line typing. In addition, all the keys can be easily remapped so the keyboard layout conforms with the user's personal habits or preferences. For example, you can exchange the locations of the "Caps Lock" and "Ctrl" keys. Keys can also be programmed to perform special functions, such as diagonal cursor movement.

If some of this sounds familiar, it is. The concept is simply the old-fashioned macro function set in a unique hardware environment dressed up with special software that does some nifty things. Obviously, macro capabilities already exist in many software programs, but Maxi PRO-II works with any software, even those that don't have macroing capabilities, and enhances those that do.

The list of features is impressive. The Maxi PRO-II is plug compatible with IBM PCs and PS/2 computers. It automatically senses the type of system you are using so there are no switches to set. The

keyboard has non-volatile, on-board memory. Although the macro feature can contain up to a total of 1,800 characters, it doesn't use any system

memory because active macros are loaded in the Maxi PRO-II's memory.

Keyboard circuitry prevents macros and customized features from being lost when the power is off. The rate at which a key repeats itself when held down is adjustable. Repeat rates range from two to thirty characters per second.

Macros can contain fields for interactive input of variables, and delays to allow time for the function to execute before the macro continues. Macros can be suspended with a single keystroke.

Macro libraries created for different applications are stored on disk. An interactive pop-up utility program permits easy storage. Down-loading can be accomplished at the command line or by including the command line utility in an application batch file.

This could get involved, especially if you program macros for a number of applications. What if you forget what you've done, make a programming error, or simply want to see the contents of your macros? Maxi Switch currently has under development Pro TOOL, a software utility that provides an on-screen image of the keyboard that highlights user defined macro keys and those that have been remapped

from the factory. When you click on a key using a mouse, the contents of the macro is displayed, including variable fields or text and execution delay instructions. Pro TOOL also indicates if the macro contains modifiers, such as SHIFT, CTRL or ALT. Pro TOOL will be available later this year.

The keyboard has two sets of function keys, one across the top and one on the left, but physically only takes about 2 inches more desktop space than a 101 keyboard. Function keys on the left are a real productivity advantage for programs like CADKEY and Word Perfect which are heavily dependent on them.

The function keys and immediate mode commands are already very easy and fast in CADKEY. Will CADKEY users realize any benefits in programming macros for this keyboard? Absolutely! Especially if you use involved, repetitive routines on a regular basis. You can substitute a single keystroke for complicated command lines, multi-layer menus or lengthy "boilerplate" text.

Maxi PRO-II is available for \$129 and has a three-year guarantee. The Tucson 101-PRO (with 101 keys and top function keys only) has the same full-programmability of the Maxi PRO-II and sells for \$95. Both products are manufactured by Maxi Switch of Tucson, Arizona, a leading U.S. manufacturer of computer keyboards for more than 20 years.

For information contact:
Maxi Switch, Inc. 602/294-5450
or Fax 602/294-6890

DRAFTPRO PLUS: Enhanced, Low Priced Pen Plotter

The pen plotter, that old reliable engineering tool, is alive and well in 1993 in spite of the inroads of the raster output devices like thermals and inkjets. In fact, pen plotters can be an ideal solution for low volume plotting needs.

The recently released Hewlett Packard HP DraftPro Plus is a case in point. It is low priced compared to raster devices of an equivalent size, is easy to use, has excellent plot quality, and offers more features than its predecessors for a lower price. The DraftPro Plus, replaces the DraftPro EXL and DXL and is available in E-size for \$4,995 (U.S. price) and D-size for \$3,695 (U.S. price).

The unit that KEYSOLUTIONS evaluated lived up to HP's sales claims. It was easy to set up and get running right out of the box. HP plotters are normally a "plug and play" proposition with CADKEY. In addition, the look, feel and operation of the unit was "first rate" all the way, a quality we have come to expect from HP plotters.

The new features of this plotter should help productivity. They include a standard 1 MB of memory to help reduce lockout time, and enhanced speed and acceleration, improved by some 10 percent (to 110cm/s and 3g) over earlier HP DraftPro models. A Centronics parallel interface (for improved transmission times) has been added to the standard serial interface. The menus are simpler, and a vacuum fluorescent display panel clearly outlines operational steps. Total HPGL/2 compatibility enhances the performance, imaging capabilities, and standardization.

The new DraftPro Plus also incorporates features that improve plot quality but were formerly only



found in HP's top of the line pen plotter, the Draft Master. Line quality on curves has been improved through an HP-developed algorithm. Addressable and mechanical resolutions of 0.025 mm (.001 in.) and 0.0125 mm (.0005 in.) ensure well defined lines and characters.

According to Richard A. Stearns, Marketing Manager for HP's San Diego Technical Graphics Division, "There continues to be strong demand for our low-end pen plotters. For many users, the DraftPro Plus will meet their need for years." Typical users include small engineering, architectural or manufacturing firms or small departments in large companies. Most are users of stand alone PC's, although some may be on networks.

The DraftPro Plus comes with an industry-leading limited three-year, on-site warranty. The original DraftPro Plus (now discontinued) and the DraftPro DXL and EXL plotters will be supported by HP for five years.

A good buy if you're needing a pen plotter!

For more information contact:

Hewlett Packard Co. Direct Marketing Organization, P.O. Box 58059, MS511L-SJ, Santa Clara, CA 95051-8059 ☐

RAPID PROTOTYPING REFERENCES

The Rapid Prototyping Directory; CAD/CAM Publishing Inc; \$69.00.

The Directory includes listings of rapid prototyping service bureaus, equipment manufacturers, vendors of specialty software for rapid prototyping, and suppliers of rapid prototyping materials. The Directory was compiled and edited by the staff of the Rapid Prototyping Report, a monthly newsletter.

CAD/CAM Publishing Inc, 841 Turquoise St, Ste. E, San Diego, CA 92109, 619/488-0533.

Rapid Prototyping & Manufacturing: Fundamentals of Stereolithography by Paul Jacobs, Ph.D.; Society of Manufacturing Engineers and Computer Automated Systems Association: 434 pages; members, \$65; \$76, non-members; \$3 postage.

This book details how the stereolithography process works and how manufacturers can utilize it. Seventeen authorities contribute as chapter authors and co-authors. Case studies involving Chrysler, Texas Instruments and AMP illustrate use of SL in design process. Society of Manufacturing Engineers, Customer Service Center, One SME Drive, PO Box 930, Dearborn, MI 48121; 800/733-4SME.

CASE STUDY

DOWNSIZING AND IMPLEMENTING DMS

by Martin van der Roest

ITT Barton, located in the City of Industry, California, is a recognized leader in the manufacture and supply of flow measurement instrumentation for fluids and gases, and caters to the oil & gas, industrial process, and power generation industries. Its products range from basic sensors to highly sophisticated measurement sub-systems for applications requiring precise and reliable process control. The quality of its products is highly recognized in the field of instrumentation throughout the world.

When ITT Barton's burgeoning design needs caused them to expand their engineering design capabilities, high costs prohibited them from expanding their existing mainframe CAD system. They also needed a cost effective engineering and document management system.

Like many large companies, ITT Barton used a mainframe-based CAD system in the 1980's to design, manufacture and control their product configurations. They had six terminals in the design area hooked to a single mainframe shared by their engineers. As design activity increased, ITT needed to expand. More mainframe stations could be added, but this was very expensive. The high cost of mainframe system maintenance was also a negative.

ITT started searching for a PC solution. 3D CADWARE from Temecula, California, helped them review PC-based CAD software. ITT ultimately chose CADKEY on a PC network because CADKEY's 3D capabilities met their engineering design requirements.

A major area of concern was managing drawings and related

documents. The mainframe had drawing management support built into the CAD system. A well developed document control cycle had also been defined for the manual process that included design, approval, archiving, and established procedures for the document release cycle once a drawing was approved. ITT wanted to computerize the entire process.

They needed to manage a variety of CAD drawings and support documents and more than 30,000 raster files being converted from old hard copy drawings. They also needed additional

searching and viewing capabilities.

ITT found the PC drawing management options available at that time very limited. In fact, according to Mel Contreras, engineering supervisor at ITT, "On the PC, there was no solution." Although most systems could track drawings, none were able to manage their whole engineering environment. Their research led them to The van der Roest Group, Inc. (The Group) who was developing a comprehensive drawing management system and happened to be looking for companies to help with the development. For ITT, this was an ideal situation. They would be able to find a solution to their problem, and also have the opportunity to influence the outcome.

Analyzing the Needs

Understanding existing drawing management procedures was the

main requirement for understanding and planning implementation of a comprehensive drawing/document management system. The first step was to identify and define all drawing management needs and existing conventions. To do this, ITT formed a working committee with members from the ITT engineering and MIS departments and The Group.

Primary DMS Requirements

- Security
- Multiple Page Drawings
- Families of Parts
- Multiple File Types
- View Only Capabilities
- User Interface
- Customization

Security was another primary issue. Previously, master documents were vaulted on aperture cards or blueprints under the physical control of

the document control (DC) department. When a drawing was requested, DC would retrieve the document from the vault, get a copy of the blueprint or send it to the plotter and pass out a hard copy. Once the revision to the drawing had been made and approved, it was returned to DC who checked in the revision and updated the master. Could this type of security be implemented over a network with multiple users accessing drawings directly?

To complicate the issue, there would be a variety of users on the system. These users would be in different departments and each had special requirements for the type of data they needed to access from the master database of documents. There needed to be a way to restrict access to only the data each user (or group of users) required. Some

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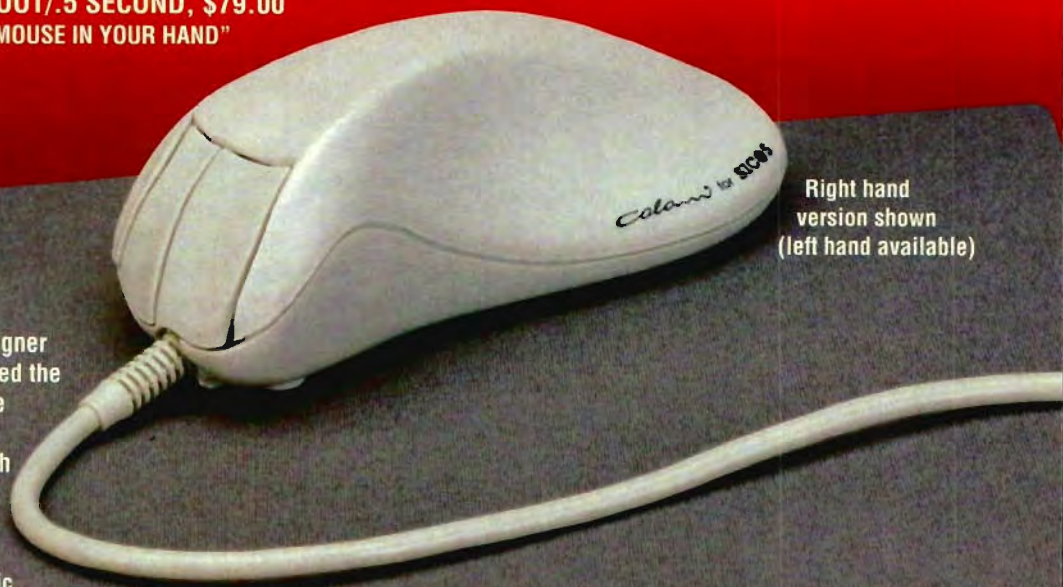


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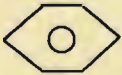
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CIRCLE CARD 283

users also only needed to quickly view and/or print the contents of the documents (CAD, raster, word processing, etc.) without being able to modify them. A "view-only" capability would assist quality control, purchasing, sales, and other departments by providing immediate access to drawing data while maintaining data integrity.

The next issue was the relationship between drawings. This was complicated because each drawing could consist of multiple pages, and each page needed to be associated with the same part number, but have different page numbers assigned and displayed. Also, a single drawing could be used for a family of parts. An example is the screw in the illustration. (See below). A screw may have one shape but be available in various diameter sizes. To address this, a single drawing would maintain the base design and a note of the different diameter sizes would be on the drawing. Each diameter size would have its own part number that needed to be tracked to the original screw drawing.

Screw Drawing		Part#	Size
Part #	Size	1001	1/4"
1000	1/8"	1002	1/2"
		1003	3/4"
		1004	1"
		1005	1 1/4"



Sample of 'family of part' drawing

The ability to track multiple file types, view them and maintain logical groupings and relationships was also a desired feature. Initially, CADKEY part drawing files would be tracked within the system. But ITT also planned to scan and catalog over 30,000 paper-based drawings. These would be converted to Group IV raster format and made available for quick retrieval and viewing. They also wanted to track documents that supported the CAD drawings in formats such as word processing and spreadsheets.

Since many different types of documents were being tracked and made available in many departments, ITT needed an easy user interface that let users search, select and view a document automatically, without having to identify or run the application that originated the file. Further, a relationship needed to be established/maintained between files so that if a change was made to one file, the effects could easily be traced to the related drawing or document files.

Implementation

PCs and a local area network replaced the mainframe for design and document control. This hardware downsizing saved money immediately, even when the time for developing the Document Management System and training was factored in.

DMS Pro, the base DMS software, provided the databases and the front end capabilities for search and retrieval of documents. For the raster drawings, ITT selected ViewBase™ from Image Systems Technology, Inc. To view CADKEY files, ITT selected KeyView™ from The van der Roest Group, Inc. KeyView allowed users to access the drawing file directly without being able to modify it. This combination gave ITT a way to make drawings available corporate-wide without the risk of the drawings being modified or deleted accidentally.

Another benefit was that ITT could customize DMS Pro so each user could have their own interface to the DMS depending on their requirements. This provided ease of use for the casual user while giving the designers all the access and information they required. Each user had access to only those documents or data relevant to their job. This gave ITT the security they required over their new LAN system.

The Specifics

Tracking multiple page drawings was easily handled. Each page of the drawing was treated as a separate file. Internally in DMS Pro, the same part number (which

ITT used to identify the drawings) was assigned to each of the multi-page drawings with the page number reflected for each file. When a user queried the system for a part number, a list would display all the files with the same part number and the page number of the file.

Tracking a family of parts from a single drawing posed an interesting challenge and The Group helped ITT customize the database to track this information. In DMS Pro, a drawing is tracked in the "document" database. This database contains a unique identifier for each drawing and all support information such as drawing name, description, part number, etc. To track a family of parts, a "products" database was created which tracked similar information such as part number, part name, description, etc. Then a field that listed the unique identifier from the "document" database of the original file was added to the information being tracked in the "products" database. This let the user query the "products" database to locate a part and quickly retrieve the file from the "document" database.

ITT brought the 30,000+ paper-based files on-line in electronic format along with the documents that supported their CAD environment. ITT looked at both in-house and vendor based solutions for converting the hard copy files. ITT contracted this work to Visual Support Corporation of Troy, Michigan. According to Bob Grisdale, vice-president systems, "ITT was able to cost-justify the work due to the amount of drawings that needed to be converted. It was very costly and time consuming for ITT to maintain their current system of aperture cards and manually update their files each time a change was made to a document. Now, ITT has an instant update if a change is made to any of the documents."

Creating relationships between different types of documents was also handled easily with DMS Pro. In the development of DMS Pro, three relationship models were identified: peer-to-peer, parent/

child, and derived. The peer-to-peer model allows drawings to be associated with one another, without implying a hierarchical relationship. The parent/child model allows drawings to have a dependent/independent relationship. The derived model allows documents that are a derivative of another document to maintain a relationship noting a change from the original file to the derived document. ITT utilizes the peer-to-peer model to maintain the multiple page drawings. This gave ITT the ability to check these peer drawings for any modification that was necessary.

Viewing documents is now easy and quick, merely a matter of searching for the document and identifying the appropriate file. Once selected, the document is automatically loaded into the application or viewing software for the file. As a drawing or document is brought into the DMS Pro environment, the originating application is linked to the drawing. DMS Pro also provides the ability to identify a viewing software, if available, for the application. This gives the users who do not have access to the originating application or do not have the right to modify the document, the ability to view and print the document. ITT Barton's PC/network and DMS system also allowed them to integrate a variety of vendors into their overall document management solution (CAD, DMS, viewing and conversion).

Conclusion

The system assembled by ITT has been in production for over a year and continues to accommodate the ongoing evolution of the ITT design process. By all accounts, the move to a PC-based DMS has been a success, and ITT is, as a result, better positioned to meet its design and document management challenges. ☐

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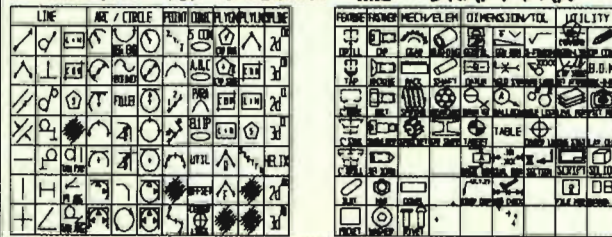
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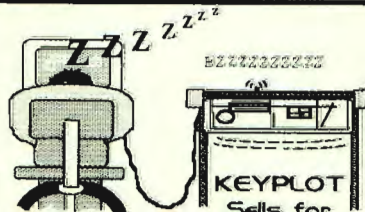
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CONCURRENT ENGINEERING WORKSHOP

Part 3

Stress Analysis with CADKEY ANALYSIS

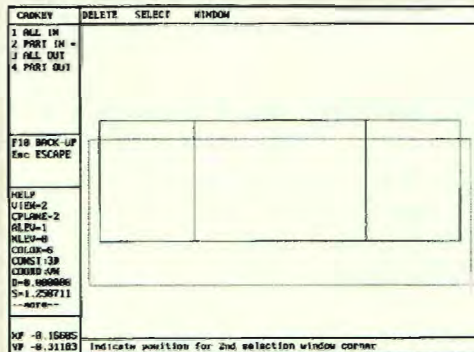
by Craig Storms and Ken Fortier

This is the third in a multi-part series designed to familiarize you with several Cadkey concurrent engineering tools. The first covered conceptual design of a cylinder storage bracket. The second evaluated the structural integrity of the bracket using CADKEY ANALYSIS. This session shows three ways to improve the design that give dramatic results when reanalyzed. The Von Mises stress plot of the original design showed high stress concentrations at the sharp edges where the feet met the body of the part, and a large region of low stress at the center of the part. The redesign includes larger cross-sectional areas and fillets in place of the sharp edges which transfer the forces throughout the part. In the low stress areas, a machined out pocket removes a considerable amount of material.

OPTIMIZING THE DESIGN OF A CYLINDER BRACKET

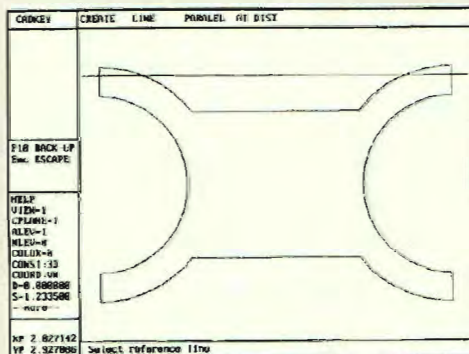
1. Load the part file

- Change to view 2 (ALT-V) and autoscale (ALT-A).
- Choose DELETE, SELECT, WINDOW, PART IN.
- Enclose everything but the top of the part in a selection box.



2. Change the view

- ESC to the main menu.
- Change to view 1 (ALT-V).
- Change the line limits to Viewport (ALT-L).

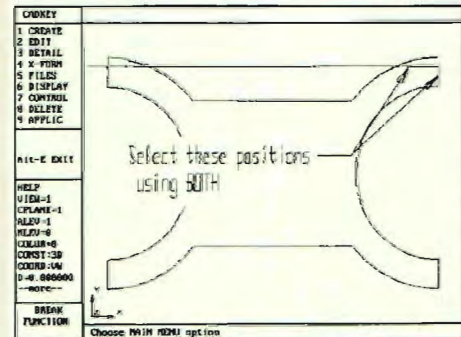


3. Create a line parallel to the horizontal lines of the part

- Choose CREATE, LINE, PARALLEL, AT DIST.
- Enter 0.6 as the parallel line distance.
- Select the top horizontal line of the part and then select above the line to indicate the side.

4. Trim the line to the edge of the part

- ESC to the main menu.
- Change the line limits to function using ALT-L.
- Choose EDIT, TRM/EXT, FIRST.
- Select the right half of the line and trim it to the edge of the part.



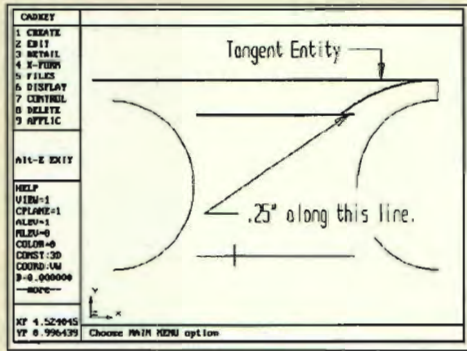
5. Define a new arc

- ESC to the main menu.
- Choose CREATE, ARC, ROUND.
- Select the right half of the newly created line as the tangent entity.
- Choose ALONGL and select the right half of the original horizontal line.
- Enter a value of .25 as the distance along this line.
- Choose CCLKWSE to define the new arc.

6. Delete the parallel line

- ESC to the main menu.
- Use CTRL-Q to delete the line.
- Redraw the display using CTRL-R.

STEP 5

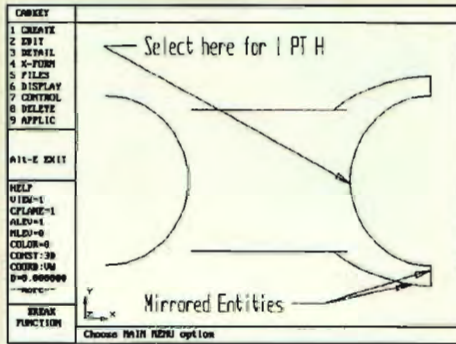


7. Copy and transform the arc

- Choose X-FORM, MIRROR, COPY, SINGLE.
- Select the new arc and press <Enter> to end the selection.
- Choose 1 PT H (Horizontal), CENTER.
- Select the large arc shown in the figure.

A copy of the arc is created, mirrored across the horizontal plane that passes through the selected point.

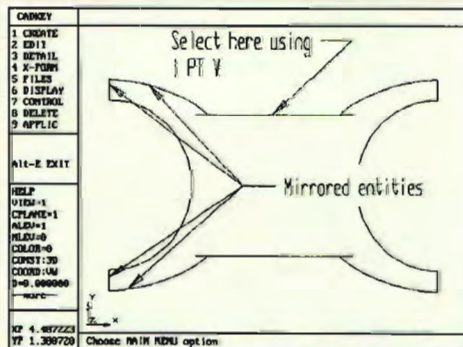
STEP 6



8. Transform a copy of the two new arcs across the part

- Choose BACKUP-UP, SINGLE.
- Select the two new arcs.
- Choose 1 PT V (vertical), CENTER.
- Select the upper line across the top of the part.

STEP 8

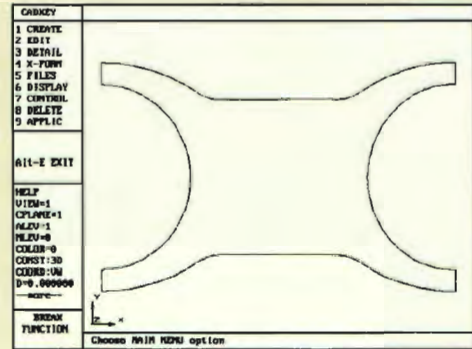


9. Fillet all new arcs

- ESC to the main menu.
- Choose CREATE, FILLET, ARC TRIM.
- Enter a radius value of 0.6.
- Select the first arc as the first fillet entity.
- Select the horizontal line as the second fillet entity.
- Select an arc as the first fillet entity and the closest horizontal line as the second fillet entity. (Repeat for each of the arcs.)

To correct mistakes and try again, use UNDO.

STEP 9



10. Remove the unneeded lines

- ESC to the main menu.
- Delete geometry using CTRL-Q.
- Select all 4 original arcs.
- Press <Enter> to end the selection.
- Redraw the screen using CTRL-R.

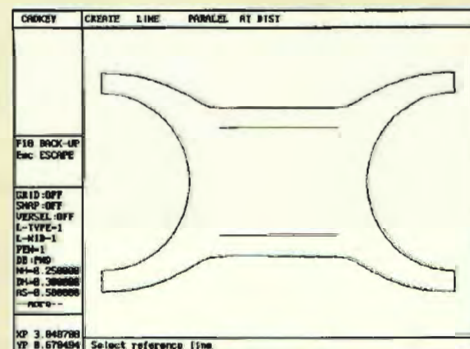
11. Trim the remaining lines

- Choose EDIT, TRM/EXT, FIRST.
- Select the vertical lines as the entities and the new arcs as the trimming entities. (Select the part of the line you want to keep.)
- ESC to the main menu.

12. Draw parallel lines

- Choose CREATE, LINE, PARALLEL, AT DIST.
- Enter a distance of 0.35.
- Select the top upper horizontal line and cursor pick below the new parallel line (below the original).
- Create a parallel line above the lower horizontal line.

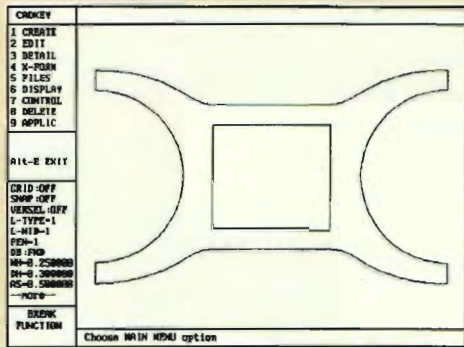
STEP 12



13. Create a rectangle

- Choose CREATE, LINE, ENDPTS, ENDENT.
- Select the right ends of both new lines.
- Select the left ends of both lines.

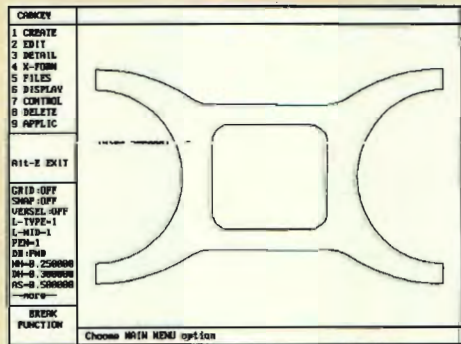
STEP 13



14. Create fillets for the inner rectangle

- Choose CREATE, FILLET, ARC, TRM.
- Enter a value of 0.3 as the fillet radius.
- Select the sides of the rectangle to create four corner fillets.
- ESC to the main menu.
- Redraw the screen using CTRL-R.

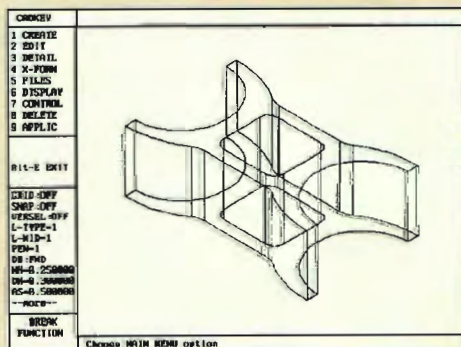
STEP 14



15. Complete the redesign

- Choose X-FORM, DELTA JOIN, ALL DSP, ALL.
- Enter 1 for the number of copies.
- Enter 0 for dXV, 0 for dXY, and -2 (negative) for dXZ.
- Change to view 7 (ALT-V) and autoscale the display (ALT-A).
- Save the part under a new file name (CTRL-F).

STEP 15



16. Select the top view of the redesigned part

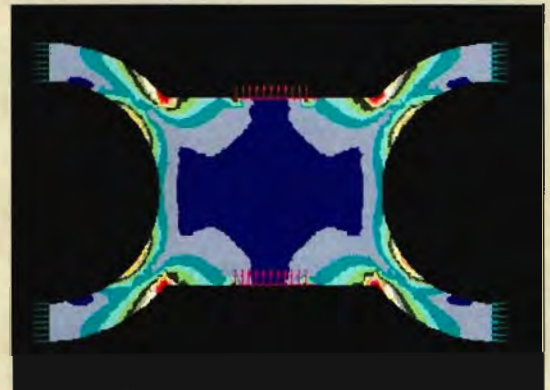
- Choose FILES, CADL, OUTPUT, and the file name of the redesigned part.
- Choose SELECT, PLANE, ENTITY.
- Select any of the arcs in the top plane of the part. (All geometry in the plane is simultaneously selected.)
- Choose DONE to end the CADL output.

17. Run ANALYSIS on the redesigned part

- Proceed through the analysis described in Workshop 2.

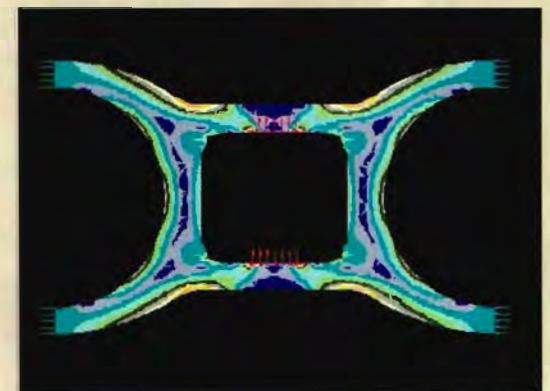
The redesigned part is smaller, lighter, and stronger than the original. The stress plot shows that the maximum stress fell to approximately 600 psi from 2000 psi from the previous plot. With a safety factor of 3, the maximum stress value is 1800 psi which is well below the Yield Strength of 60,000 psi.

Before



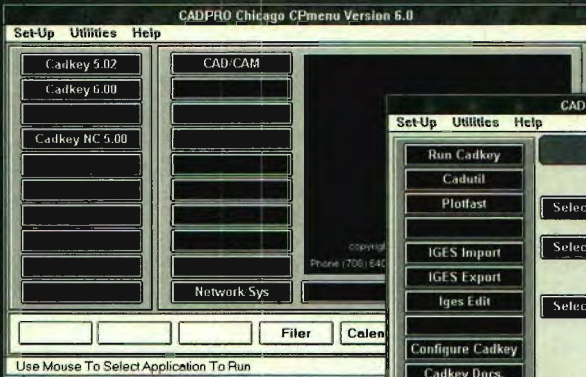
Save the results in a pattern file, which can be placed in any drawing (part file) for future reference.

After

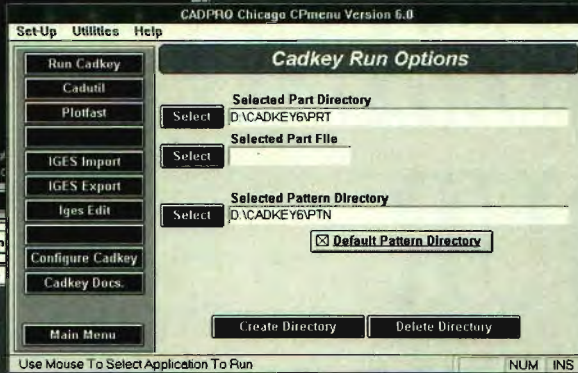


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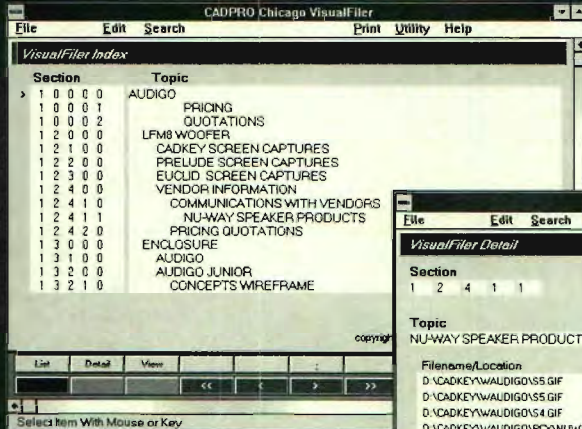
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- Support for Cadkey N/C
- Unix/Dos networking tools

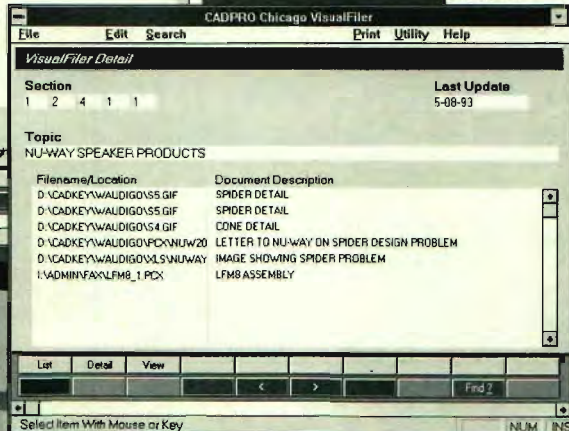
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CIRCLE CARD 265

CK-Synergy Provides Extensive Drafting Tools

Correction and Addendum

CK-Synergy is a full featured program with extensive drafting productivity tools. Unfortunately, several of its features and capabilities were omitted in the article on productivity tools in the last issue, especially in the chart.

CK-Synergy has all the tools listed in the general purpose area of the chart with the exception of Beam, Channels and Ducts, and has fewer styles of fasteners. It has, in fact, many unique features including:

- Multiple nested bubbles
- Tablet overlay included
- Alignment lines with bubbles
- Offset arcs
- Match arcs
- Shaft breaks
- Customizable standard notes program
- Spell checking
- 2 box & 2 Helvetica fonts
- 2 types of ANSI hole code tables
- Enlarged/detail view callouts
- Full compatibility with CK solids and Picture-It

Since the last article, a major update has been released which includes a new user-friendly Icon menu interface as well as a tube generation program. CK-Synergy is a very generalized tool and is not specialized for the aerospace industry.

A final note. The telephone number in the article was incorrect. For information on CK-Synergy or a free working copy, contact Hansen Design by calling 206/828-9863 (the correct number). ☐

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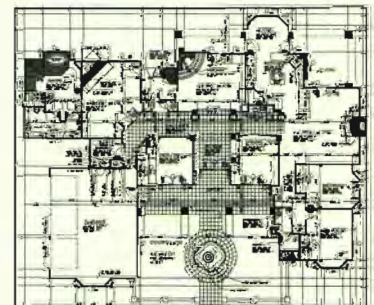
	NOVAJET II		
	Mono	Color	Pen Plodder
Draft	4:27	11:49	2:36:11
Normal	6:21	14:02	—
High Quality	19:13	19:40	—

PLOT TIMES FOR E-SIZE FLOOR PLAN
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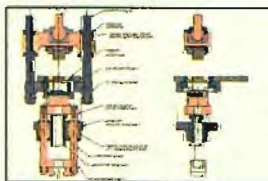
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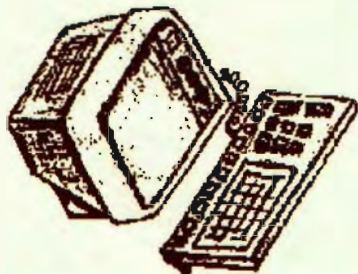
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CAPTURE THIS.....



by Ron Shea

In the past we have been held captive by the "limitations" of software. This has been true especially in the area of data compatibility, effectively defeating the "whole" purpose of computers which is being able to take already existing data and use it in another program, effortlessly. With output devices, this was very easy - print the report; plot the part; stuff the data into another computer through an itchy-bitsy telephone wire. But, happy CADKEY users, just try to get a part file into a word processor or desktop publishing program.

As a professional writer, I have spent 13 years writing computer manuals, book reviews, and technical and training manuals. It used to be that trying to get CADKEY part files into a word processing or desktop publishing program inspired me to gyrations and dances you may have seen on an old re-run of National Geographic. I'm normally very sedate.

But it was worse than that! Let's add a scanner, so we can print or plot our part file, and then scan it back into the computer in a format that is compatible with the word handling software. Oh, yeah! That

makes cents? That is just what it did. Made money, but not for us! It reminds me of going to the tire store to buy those elliptical shaped objects, so I can pay to have them balanced, so they will turn in a circle on my car.

Cadkey would have none of this! We will make a slide file, and save it in .SLD format so it will be compatible with oranges and Dr. Halo, whichever you prefer. So let me get this straight. You paid approximately \$4000 for a CAD package, and had to pay an additional \$150

or so to be able to use the data. NOT!

CADKEY®6 finally saved the day. It

can save the slide file in .GIF format. Some conversion is still required to get the files compatible with word handling programs, but at least you do not have to be on hallucinogenic drugs to get the results you expected. Better, but

... just try to get a part file into a desktop publishing program



not perfect. YET!

Better still is CADView version 1.5. This software from Information Technology International Corporation allows you to view, capture, import and manipulate CADKEY part files. You can copy it to the Microsoft Windows Clipboard and place the part file into such applications as Aldus' PageMaker. Thank you! Thank you! Thank you! Documentation development made easy - FINALLY!

Literally, CADView lets you view your part file in any view that has been defined. Top, Isometric or user-defined views are all a piece of cake! It even read a level that I had saved a hidden line Isometric view on. However, it did not interpret a filled part level correctly. Maybe the next revision?

The Main Menu options are File, Edit, View, Scale, Levels, Options and Help. On the File Menu, Printer Setup and Exit are standard within the Windows environ-

ment. I was surprised to see Portrait or Landscape print options.

The Edit Menu's one option, Copy to ClipBoard, is your passport to other applications. By copying to the Windows ClipBoard any Windows-compatible word handler can use the part file. The options under the Copy to ClipBoard are Image, which copies the graphic contents as a Bit Map Image; Static, which copies the graphic contents as a Windows Metafile with a fixed size and the background color controlled by the receiving application; Scaleable, which copies the graphic contents as a Windows Metafile but with a fixed aspect ratio that will not let the file be stretched out of shape; and Stretchable which lets you independently stretch the height and width of the Windows Metafile within the receiving application software.

The View Menu allows you to select Standard Views or List the views defined within the CADKEY part file. This is very effective for documentation, and lets the user display and import those views for complete understanding of what the part looks like.

The four Scale options are Auto,

Half, Double and Window scale. Auto, Half and Double scale work like they do in CADKEY. Window Scale functions like you're in CADKEY, but the twist is you're not. You window in on any section of the CADKEY part file and choose just a portion of the part while in CADView. Pretty slick, huh?

The Levels Menu is just a little redundant. First you choose Levels, then List to get a list of the CADKEY part file level descriptions. It

CADView lets you view, capture, import and manipulate part files.

seems to me, if I were going to get the levels list anyway, why choose twice? This is a minor gripe, as you can choose any level defined. These do not have to be activated within CADKEY. CADView filters the entities for you.

The Options Menu has two selections: Clipboard Colors As Black and Printer Colors As Black. Both options force a white background with black entities when used.

Having raved about CADView's time saving qualities, let's talk annoyances. Because I require CADKEY screen dumps and word handler compatible part files, I had set my glorious technicolor CADKEY to white background and black geometric entities. Stop yawning! When I brought my files into CADView, they were gone. Not really. I just could not see them. CADView defaults permanently to a black background. I went into CADKEY and changed back to the default colors, went into each part file and changed the color attributes accordingly. It was like hitting a 10 penny nail with a greasy ball peen hammer. The 24-page owner's booklet does not address this issue.

I also feel the retail list cost is a little "pricey" at \$495, but student discounts are available (\$49.95 for full time students and \$99.00 for schools) and quantity corporate discounts are deep (\$195.00). But overall, I was, as you can tell, very pleased with the functionality of CADView.

For more information contact Information Technology International at 203/644-2557. ☐

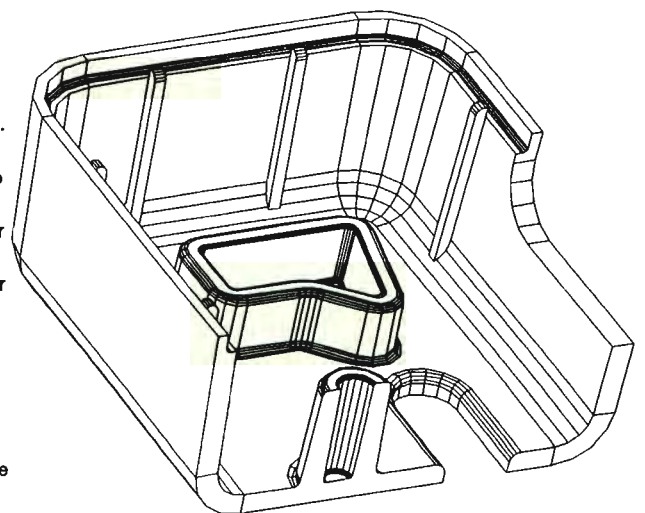
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CADL TOOLBOX

LONGNOTE.cdp

The LONGNOTE.cdx utility creates disk notes from files that are longer than the CADKEY disk note limit of 1024 bytes.

The standard way of placing a block of text in a CADKEY drawing is to create a file-note. During design, this approach allows for the note file to be updated with a preferred text editor, while all changes are automatically reflected in the CADKEY drawing every time a REDRAW is performed. However, as soon as the drawing is completed and has to be archived, this feature becomes a disadvantage. The problem is that not all of the information which appears on the CADKEY screen is actually contained in the part file. At this stage it is a common error that the part file be archived or even sent out to a customer without the note file attached to it. The result is data loss.

The LONGNOTE utility imports large text files in CADKEY by splitting them into individual notes that are collected and positioned to form a single text block. The current CADKEY parameters for text height, rotation and line spacing are used by the program to calculate and draw a number of notes, each not exceeding 900 bytes in length. For faster operation, the program reads the text file line by line. Lines longer than 80 characters are wrapped around the 80 character limit.

Before execution, the program code has to be compiled to a binary executable CADL file. To run - select FILES:CADL:BINEXEC and enter LONGNOTE. At the prompt, enter the full name of the text file and indicate the note's position. On the prompt line, the number of individual notes, the size of each note and the current line of text being input will be displayed. A new text note is created at every 900 bytes read. Press ESCAPE if you wish to interrupt the input. The program will then display the last text note and restart itself.

by Chavdar Popov

Telephone: (U.K.) 0495 350503 work
(U.K.) 0495 308634 home

```
/* LONGNOTE.cdp - CADL utility to import disk notes bigger than 1024 bytes */

local double xt,yt,yofs,ang
local int nlines,linelen,notenum,maxbytes,bytecount,eof
local string $linestr(85),$t(995),$fname(60),$newline(2)

:start

xt=yt=yofs=ang=0
nlines=linelen=notenum=bytecount=eof=0
maxbytes=900
$newline="n"
$(0)=0
close devin

getstr "LONGNOTE: Enter file name or ESC to end (%s)=>",$fname,$fname
if (@key <= -2)
    exit

set devin,$fname,0
if (@error != 0)
{
    pause "LONGNOTE: Cannot open file %s <RET>",$fname
    goto start
}

/* get position for note */
getpos "LONGNOTE: Indicate note position",1
if (@key <= -2)
    goto start

xt=@xview
yt=@yview
ang=@noteang/3.1415926*180

set collect,1

while (eof == 0)
{
    getkey
    $linestr[0]=0

    input "%80[^\n]", $linestr /* read a line of text (max 80 chars) */

    if ((@error != 0) || (@key == 27))
        eof = 1

    input "%*1[\n]" /* skip the '\n' character (if any) */

    prompt "NOTE %d (%d)=> %s",notenum+1,bytecount,$linestr

    call strcat,$linestr,$newline
    call strien,$linestr,linelen

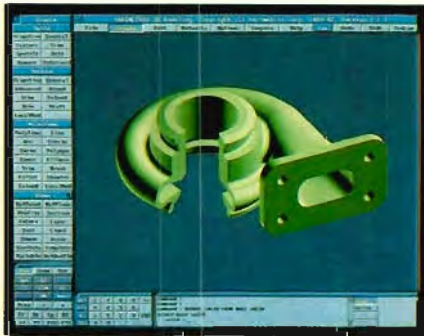
    if ((bytecount+linelen < maxbytes) && (eof == 0))
    {
        /* add the line to the current text note */
        bytecount=bytecount+linelen
        call strcat,$t,$linestr
        nlines=nlines+1
    }
    else
    {
        /* create the current text note */
        note xt=xt+yofs*sin(ang),yt=yt-yofs*cos(ang),$t,ang
        notenum=notenum+1

        /* add line to the next note and calculate offsets */
        $(0)=0
        call strcat,$t,$linestr
        yofs=nlines*@noteht*(1+@noteline)
        nlines=1
        bytecount=0
    }
}

set collect,0
prompt "LONGNOTE: File %s is split into %d note(s)", $fname,notenum
wait 1
goto start
```


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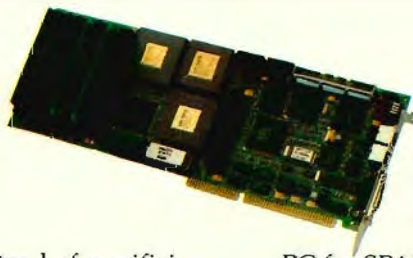
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5 FILES
6 DISPLAY
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8 DELETE
9 APPLIC

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CPLANE=1
ALEV=1
MLEV=0
COLOR=1
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D=0.000000
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The Uses of FastSURF

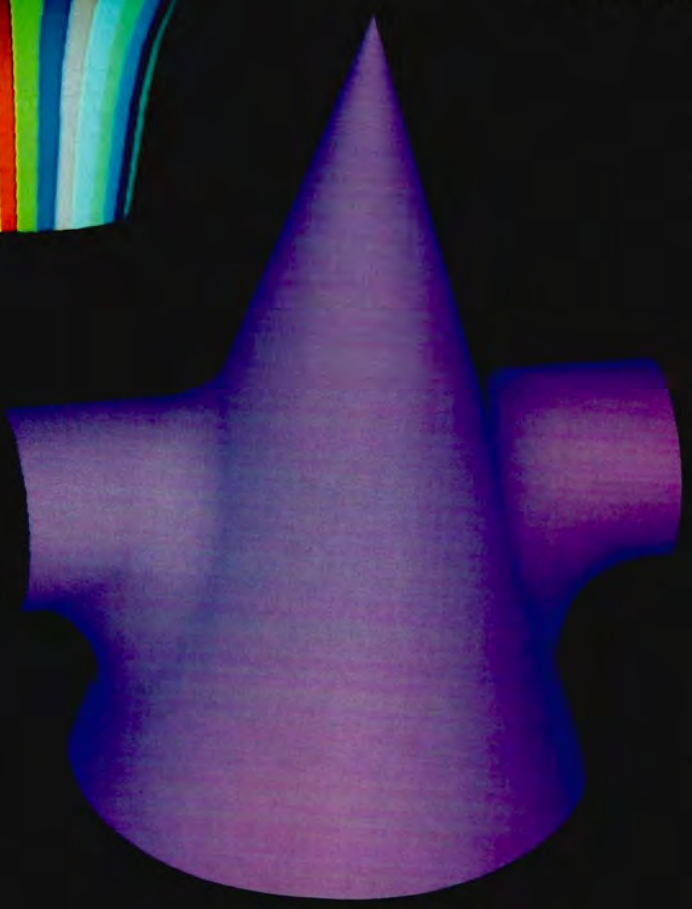
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A pattern can be digitized and then
engineered into a surface definition.



Standard geometry is easy
to define as surfaces.

A 4 curve surface can solve the 3 corner convergence problem

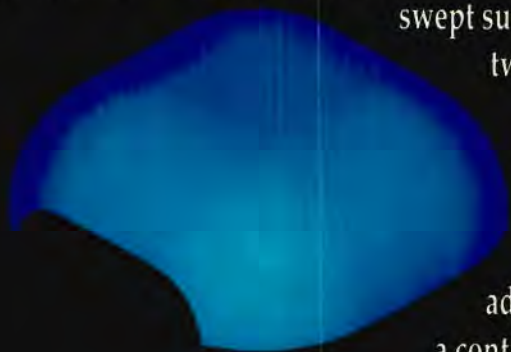


Then tessellate the surfaces & output an SLA file from the polygons.

The intersection of tabulated cylinders can simulate the projection of one curve onto another curve. Hard to design 3-D splines can be defined in 2 views using this technique.



Swept surfaces cover a wide variety of surface modeling applications. FastSURF has several variations within the swept surface function:

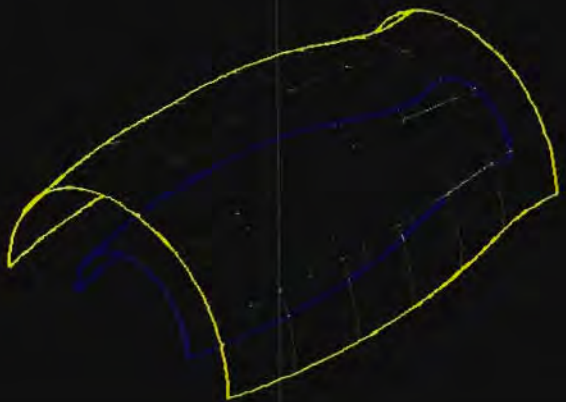


swept surface function: two, three and four curve sweeps, with or without rotation. For added effect, use a control surface.

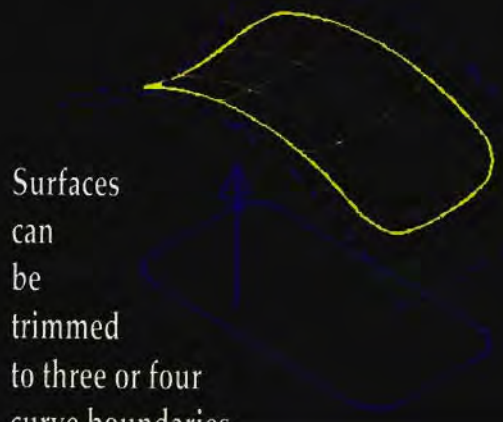
Surfaces of Revolution can have quite complex profiles. Chain the individual curves in the profile into a single spline.



Offset surfaces can model wall thickness. And tapered offset surfaces can define otherwise difficult to model geometry.



Trimmed surfaces provide the finishing touch for a fully surfaced part.

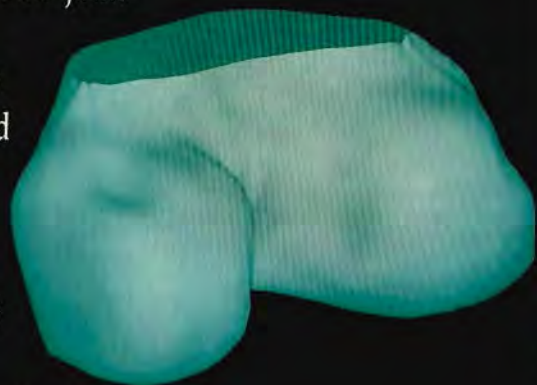


Surfaces can be trimmed to three or four curve boundaries

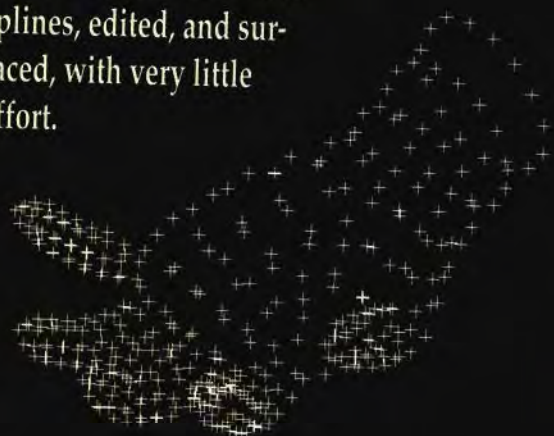
Images are produced by FastSURF because surfaces are tessellated to a cord height tolerance based on surface curvature.



... surfaces can be converted into surfaces. This 3-D surface is a replica of the human knee joint and can facilitate simulated surgery, or aid in the design of custom prosthetic devices.



Digitized data can be read into FastSURF, converted into splines, edited, and surfaced, with very little effort.



This shaded image of a human hand was laser scanned, modeled, and shaded in record time.



ADVANCED SPLINE MODELING

Point- Vector splines



Chain to spline single



spline from a Line-arc chain

Offset spline with copies



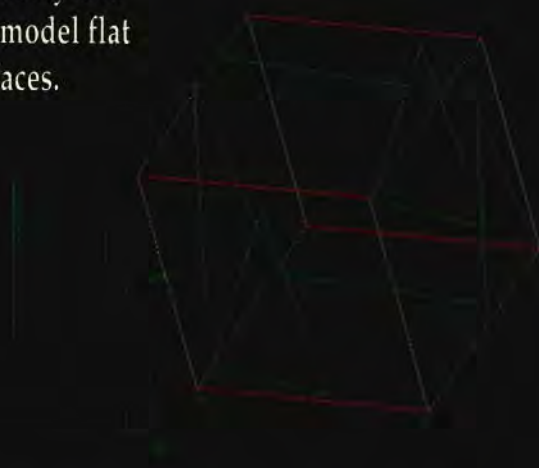
Polyline control net.

WHY FastSURF?

As you can see in these pages, FastSURF supports a wide variety of applications. Surfaces may well be the most concurrent piece of geometry in the CAD data base. That is, surfaces directly support more peripheral applications than any other entity. For example: CMM inspection, reverse engineering, SLA prototyping, NC programing, photorealistic imaging, and just plain and simple part design all benefit from surface definitions. The fact is that surfaces make easy work out of otherwise impossible to accomplish tasks. With FastSURF's rich set of tools such as: intersection, projection, verification, editing, advanced splining, planes, vectors, and IGES, you get as powerful a surface modeler as exists on the market and in the industry.

tapering helix surface is easy to build using FastSURE.

Planes are a simple, yet powerful piece of geometry and can model flat surfaces.



Projection of curves onto a surface is a fundamental process.

That the projected map onto the extension.

Multiple planes can intersect multiple surfaces all at once, thereby creating a grid of splines that could be used to rebuild the entire area under one



FastSURF's Planes module is available as shareware on the BBS.

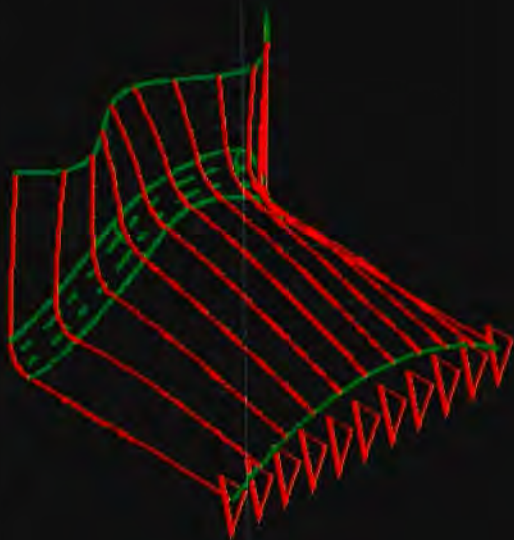
FastSURF can read and write IGES SURFACE FILES

```

1H.,1H.:7HFASTRF,1H.,13HFASTRF V2.0,8HIGES 4.0,32,38,6,308,
14,1H.,1.0,1.2HIN,32768,0.1,13H930312.085028.,001,5000.0,
9HPRESIDENT,
7HCAD/CAM,6.0:
    128      1      0      1      1      0      0      000000000D
    128     7586      1     12      0
128.3.3.3.3.0.0.0.0,
0.0.0.0.0.0.0.0,1.0,1.0,1.0,1.0,0.0.0.0.0.0.0.0,1.0,1.0,1.0,1.0,
1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,1.0,
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S      3G      4D      2P      12
    
```

```

S      1
S      2
S      3
G      1
G      2
G      3
G      4
G      4
1P     1
1P     2
1P     3
1P     4
1P     5
1P     6
1P     7
1P     8
1P     9
1P    10
1P    11
1P    12
T      1
    
```



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CADKEY DEALER FOR
MORE INFORMATION**

CADKEY CORNER



by Steve Falusi

Though CADKEY 6 is not a Windows application, it can be launched from Windows 3.1 as a DOS full screen application. This allows you to work with CADKEY and many of your Windows applications at the same time. Under specific setups (resolutions), you can also share the clip board for cutting and pasting images.

However, setting up to launch CADKEY under Windows requires a strong understanding and working knowledge of DOS, memory management, system configuration and Windows. If you have this, you shouldn't have any difficulty with the following steps. If you're not sure, get help.

Initial Setup

There are five basic steps to set up your system to launch CADKEY under Windows. The first three are performed in DOS; the others, in Windows.

In DOS

1. Install and configure CADKEY 6

This is covered in the Getting Started Manual. Make sure you can enter CADKEY by typing CADKEY.exe at the CADKEY root level.

2. Copy PHARLAP.386 from the CADKEY root directory to the Windows root directory

If CADKEY were installed in C:\CADKEY and Windows in C:\WINDOWS, the DOS command would be:

```
COPY C:\CADKEY\PHARLAP.386 C:\WINDOWS
```

3. Edit the Windows INI file to reflect new device driver

Assuming that Windows is installed in C:\WINDOWS, the next command would be:

```
EDIT C:\WINDOWS\SYSTEM.INI
```

Use the arrow keys to scroll down the file until you reach the [386 Enh] section of the system.ini file. Then insert the line:

```
DEVICE=PHARLAP.386
```

Save the file and exit to DOS.

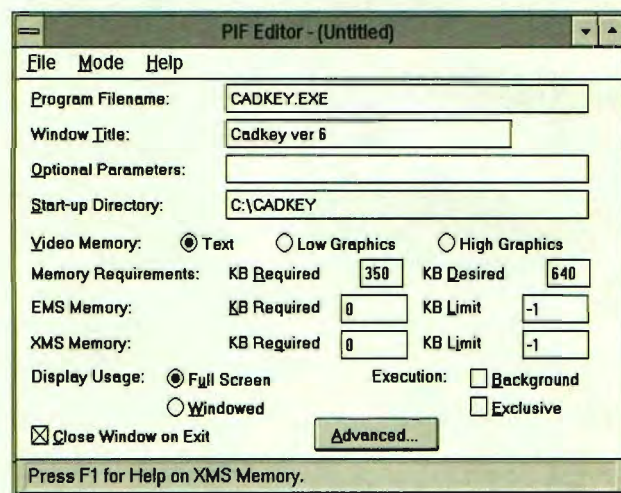
In Windows

4. Create a new .PIF file

Start Windows, enter the Main window and double-click on the PIF editor icon. PIF stands for program information file, and tells Windows how much memory to give to the application it's executing. The -1 option tells Windows to give CADKEY as much memory as it can. If you plan to run a number of other applications including CADKEY, enter them first and then enter CADKEY. This will keep you from

getting an "insufficient memory" message from Windows.

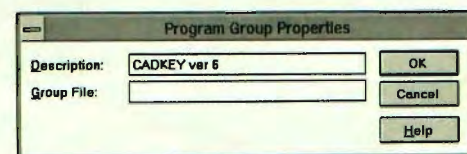
Match the information in Fig. 1 and choose FILES-SAVE AS and save as CADKEY.PIF.



(Fig. 1)

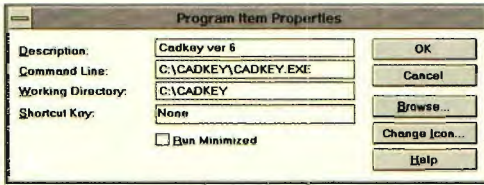
5. Setup a Windows Program Group, Properties and Icon.

Program Group: Choose FILE-NEW from the top of the Program Manager and choose the Program group option. (See Fig. 2)



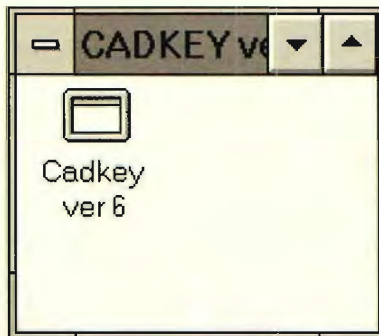
(Fig. 2)

Icon Creation: The next step is to create the CADKEY icon and point to the PIF file. Choose the NEW PROGRAM-ITEM option from the Program Manager Menu. (See Fig. 3)



(Fig. 3)

If all was successful, you should have a program icon that looks like the one below. (See Fig. 4)



(Fig. 4)

Memory, Resolution, Etc.

- Memory should be a minimum of 12 MB, though 16 MB or higher is recommended. The HIMEM.SYS file shipped with Windows 3.1 will recognize a system with greater than 16 megabytes which will help CADKEY run better under Windows.
- Configure all your memory as expanded memory (or at least 12 MB) to run CADKEY under Windows.
- Do not attempt to run CADKEY at a higher resolution than Windows (i.e., don't run CADKEY at 800x600 and Windows at 640x480). In addition, maximum CADKEY resolution of 800x600x256 is not supported. Running any DOS application at higher than standard resolution (standard = 640x480x16 or 800x600x16) can cause problems in Windows. This is because Windows screen grabbers (*.gb3s) don't understand the higher resolutions. If you attempt to switch tasks or

simply exit Windows, Windows won't know how to restore your screen and your display will be unreadable. There is also a problem with Windows with video cards with graphics co-processors. Again, this confuses Windows so that most of the time it is unable to restore the graphics display. You may be able to launch CADKEY at a higher resolution, but Windows probably won't be able to restore the

display.

- Any other graphics TSR (terminate and stay resident) programs may conflict with CADKEY/Windows.
- Windows version 3.0 has many memory management bugs and CADKEY is not supported under this version.
- Launching CADKEY under Windows is not supported on any other operating system than DOS 5.0.
- If you can't enter CADKEY from DOS by typing CADKEY.EXE from the CADKEY directory, you will not be able to enter CADKEY from Windows. Make sure you load your mouse and CADKEY video driver *before* entering Windows.
- For greater graphics speed inside Windows, enter CADKEY using the MS-DOS prompt Icon, change to the CADKEY subdirectory and type CADKEY.EXE. This method is unsupported, however it increases the apparent graphics speed of CADKEY under Windows.
- Using the clip board to capture CADKEY images is only supported if Windows is running in enhanced mode. You can determine this by choosing HELP-ABOUT PROGRAM MANAGER from the Program Manager Menu to display the status dialog box.
- If you are using CADKEY Vibrant drivers and are running under Windows, the only resolution supported is Generic VGA. ☐

TECH TIPS

Here's a grab bag of tips to make using CADKEY a little easier. This batch is from Dana Seero of Computer-Aided Products, a Cadkey VAR in Marblehead, MA.

UNDO/DELETE

CADKEY features a repeat undelete feature. If you delete something by mistake, select CONTROL-U and the entity will reappear. Continue to select CONTROL-U to undelete additional entities. You can also retrieve entities through the menu by selecting EDIT RECALL ALL-DISPL BY-TYPE, and select the choices you want.

The "UNDO" command EDIT RECALL LAST will recover the last eight entities you've deleted--keep selecting LAST.

MACROS

You can save units, window, scale, view, depth, and entity and text attributes with a macro. Turn on the keystroke recorder by pressing CONTROL-J, and typing in a macro name (such as Settings). The RECORD message will appear in the upper left hand corner, above the menus. Press ESC twice to clear the menus, then select the default settings you want. Close the macro by typing CONTROL-J. To run the macro, type CONTROL-E, and type in the macro name.

Macro binding is case sensitive (i.e., "Macro 1" is different from MACRO 1") If the system can't find the macro, check to see if your CAPS LOCK key is set.

You can make a macro that uses parametric design by specifying variables instead of numeric values. Or, if you have made a macro with specific values and want to make it parametric, do FILES-MACROS-LIBRARY-TEXT OUT. Then use a text editor and replace the specific values with variables. Use TEXT IN, and define a new macro name.

AUTOMATIC SPHERES

You can automatically make a Sphere in CADKEY, either as polygons or splines. (Polygons process readily through SOLIDS; Splines are more accurate.) Use CREATE POLYGON MESH SPHERE, or CREATE SPLINE MESH SPHERE to create these shapes.

COLOR & PEN PLOTTERS

You can use a single pen plotter to make multi-color drawings by changing the plotter setup. Go into CONFIG, and select plotter options. Scroll through the selections until you get to the selection for pen color. Select PAUSE FOR PEN CHANGE, and SORT BY PEN #. This will allow you to plot all pen 1, then pen 2, etc.

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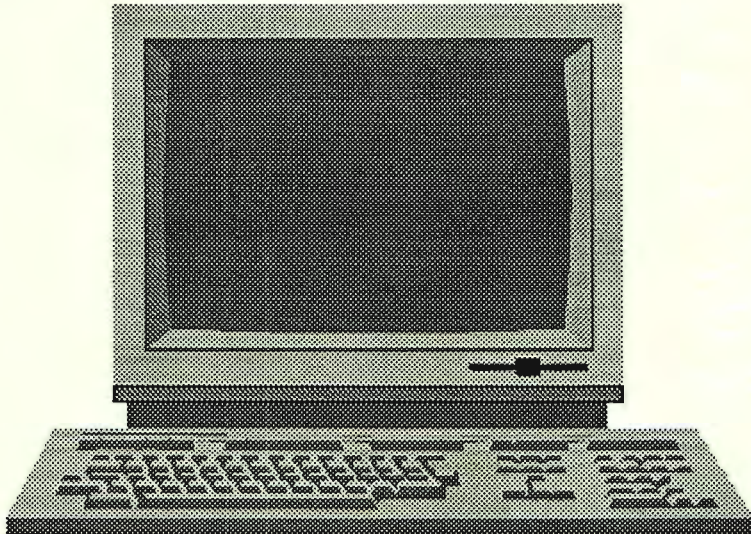
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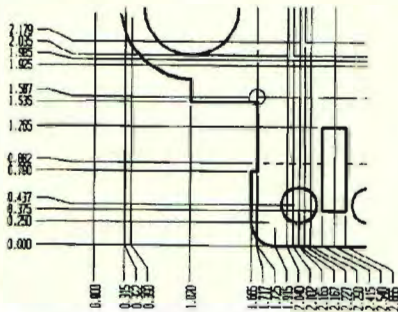
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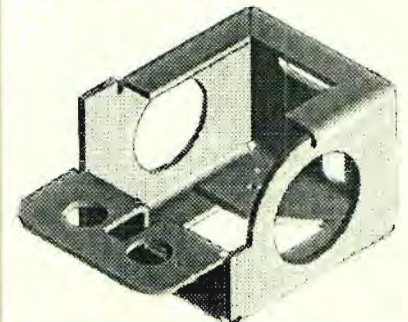
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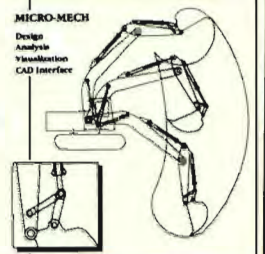
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KEY MAIL

Platform Concerns

Your article (Selecting a CAD Platform, by Kenneth Billing, Feb/March issue) may have been "on target" regarding DOS and its hardware platforms, but your inferences are the kind which has cost me a three-year bet on the merging of computer compatibility. Your conclusion that investing in a DOS system to run CAD applications "because there are too many to become obsolete" runs counter to encouraging computer users to apply market pressure needed to achieve more productive graphic system compatibility between their offerings.

You also failed to recognize the contribution of the Macintosh: the alternative created to run graphics . . . Without the growing and enthusiastic Macintosh user influence, your favorite CAD-on-a-PC system would today still be only capable of drawing "stick figures" on monitors designed for character display resolution. The down side is that while the Mac is friendlier than UNIX and much more capable at running CAD than DOS, it introduced yet another box to port that CAD package to. And another set of filters to write.

So in your next article, do us consumers the favor of encouraging Apple, Big Blue, and the several UNIX houses to cooperate in developing a suitable replace-

ment for that complex-instruction DOS dinosaur. But a user-friendly and efficient one we can all love. One that lets me send my CAD file to someone without having to first ask what brand of computer (or GUI) he is running, even when he is using the same brand of CAD application. I'd like to win the technology bet the next time.

C. P., Ijamsville, MD

It's About Time

I was pleasantly surprised to receive a copy of KEYSOLUTIONS recently. I can only describe it as first class. It is about time we had a CADKEY magazine similar to MICROSTATION MANAGER or CADENCE. I found it most useful and informative and look forward to the next issue. I trust it will not be too long before you go monthly. Since our last telephone conversation I have become a Registered User of CADKEY and eagerly await Version 6 to arrive in South Africa. I wish you and your colleagues success with the new magazine.

S. G. M., Johannesburg, South Africa

BOOK REVIEW

by Jack Bilderback, CPIM

Concurrent Engineering: The Product Development Environment for the 1990's

This interesting treatise persuasively promotes CE as the necessary vehicle to competitiveness in the ultra-competitive '90's.

The authors, Donald E. Carter, a Technical Director at Mentor Graphics, and Barbara Stillwell Baker, a freelance writer, write from real-world experience in the highly dynamic electronic design industry, but the ideas are applicable to a wide range of products.

The text is concise, direct, and comprehensive, aimed at "decision makers" and "managers of change." It progresses logically and smoothly from an introduction of concurrent engineering's first beginnings through the process of synchronizing and ultimately automating the development environment.

Most importantly, it is consistent with and incorporates the wisdom of many recognized experts in the fields of marketing, technology, quality, manufacturing, and finance. The book is divided into four sections: 1) change and its effect

on today's development processes; 2) the four key dimensions of the CE environment; 3) an Assessment Tool, provided for purposes of benchmarking one's relative position to world-class organizations; and 4) the transition to an effectively automated environment.

The glossary of CE terminology and abbreviations is not limited to engineering or technical types. The resource listing is extensive and well organized, covering every subject related to state-of-the-art theory and practice. On this level alone the book provides value.

While the introduction sets the stage well, there is, however, no final summary or conclusion. The last chapter ends rather abruptly, leading directly into the Appendices which provide more complete Assessment Tool information. Perhaps a small fault to find in what is otherwise a worthy effort.

The book retails for \$36.95 and is published by Addison-Wesley Publishing Co., One Jacob Way, Reading, MA 01867; 617/944-3700 (ISBN 0-201-56349-5).

CADKEY User Group News

Please send all material to:

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Spokane, WA 99211-1978



Please note the following correction to the April/May issue of KEYSOLUTIONS:

The phone number on the qSHEET ad for Consulting Services International, found on page 59 of Solution Mart, was printed incorrectly.

The correct phone number is 818/994-8881.

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