FEB / MARCH 1993

KEY SOLUTIONS

CONCURRENT ENGINEERING FOR THE 90'S

CE Issues

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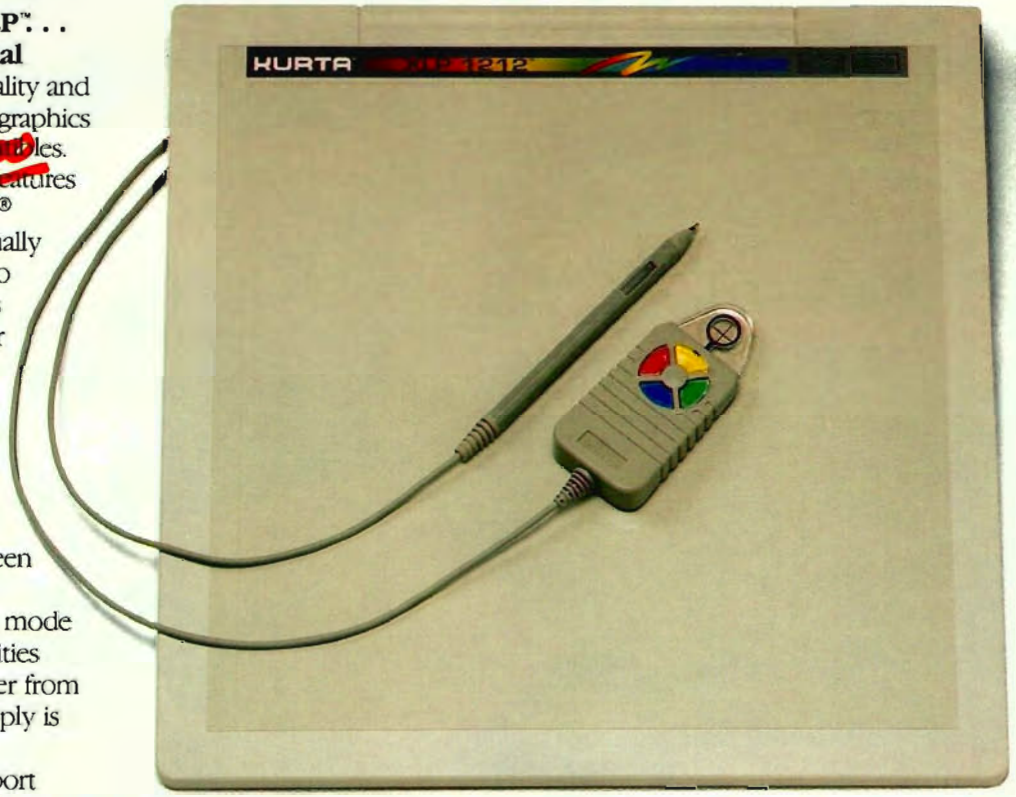

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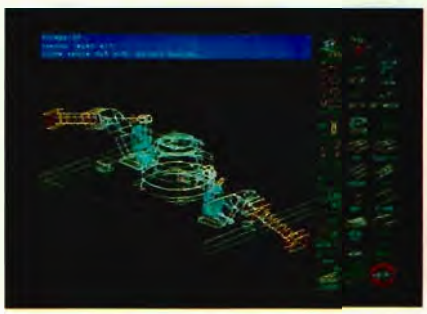

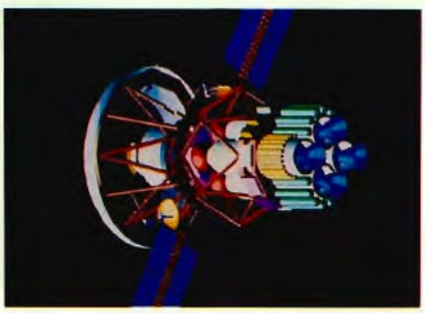

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CADKEY

February 15, 1993

Dear Readers of **3-D WORLD**:

We want to announce a positive development that is newsworthy for you as Cadkey customers. Cadkey, Inc. and **Key Solutions**, the independent publication for concurrent engineering in the 1990's, have entered into an agreement which expands coverage of Cadkey's products as the best available tools for concurrent engineering and manufacturing. **Key Solutions** remains an independent publication while featuring in-depth articles about using CADKEY and CUTTING EDGE in the highly competitive global economy. **Key Solutions** is a bimonthly magazine.

One consequence of this new situation is that **3-D WORLD** and **Key Solutions** essentially duplicate each other's efforts. Therefore, Cadkey has ended **3-D WORLD** as its corporate publication.

From now on, you will receive **Key Solutions** in place of **3-D WORLD**. If for any reason you do not begin to receive your very own copy of **Key Solutions**, beginning with the February/March 1993 issue, just fill out and mail in the free-of-charge subscription card that appears in every issue of the magazine. Or, you may fax your subscription request to (509) 928-4937.

As Editor of **3-D WORLD**, it has been a great pleasure for me to work with you to produce a newsletter that addressed your widely ranging interests as users of Cadkey's products. Now an even better opportunity to serve your interests has arisen through the expanded opportunities that **Key Solutions** offers. I look forward to collaborating in this new endeavor. I hope that you will share the excitement of the prospects which this new development presents to all of us.

Very truly yours,

Frank Simpson

Frank Simpson
Editor, **3-D WORLD**
Contributing Editor, **Key Solutions**

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KEY SOLUTIONS
CONCURRENT ENGINEERING FOR THE 90'S
FEBRUARY / MARCH 1993
Vol. 1, No. 3

IT ALL COMES TOGETHER WITH CADKEY® 6

CONCURRENT ENGINEERING SOLUTIONS

ISSUES

PRODUCT FOCUS

COLUMNS AND DEPARTMENTS

Prototypes created on the CAMM-3
See page 46

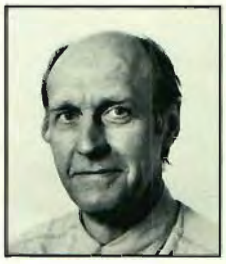
SOME OF OUR CONTRIBUTORS

Paul Bergetz is president of CADPRO Chicago, Inc., a Cadkey dealer VAR specializing in computer based systems for mechanical engineering and design. Prior to forming CADPRO, Paul spent eleven years designing, building and selling professional audio systems for video and audio production. Earlier, Paul was a Tool and Die maker and designer in the metal working business.

Brian R. Carlisle, co-founder, Chairman and CEO of Adept Technology, Inc., is also the current President of the U.S. Robotic Industries Assoc., Co-Chairman of the Automation Forum of the National Electrical Manufacturers Assoc., and a member of the National Science Foundation Advisory Board on Computer Science Research. Mr. Carlisle directed the design of the AdeptOne, the world's first direct-drive robot.

Kenneth W. Billing is West Coast Manager of PacifiCAD, Inc., a CAD consulting and services firm with offices in Portland, Oregon and Spokane, Washington. He has been involved in the CAD industry since 1984 and has authored or co-authored several books and numerous articles on networking and related topics.

Martin Faulkner is a Design Instructor at the Cranfield Institute of Technology, School of Industrial and Manufacturing Science, in Bedfordshire, UK. He also undertakes personal consultancy, solving problems, and designing machines and products for industrial sponsors. Earlier in his career he worked extensively in the auto component industry developing special purpose production machines. He has also taught engineering in both the UK and Africa.



On the Cover:

A collage created by Christine Sweeney, graphic designer at Cadkey, Inc., from CADKEY, CADKEY ANALYSIS, and CADKEY® NC (formerly CUTTING EDGE) files. You can also see this design on the Version 6.0 package and promotional posters and T-shirts.

KEY SOLUTIONS

Concurrent Engineering for the 90's

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EDITORIAL POLICY: Key Solutions is an independent publication without obligation to any software or hardware dealer, vendor or distributor, except as indicated. Articles noted as news or features are written without knowledgeable bias. Articles noted as editorial represent the opinion of the author. Technical articles represent the opinion of the author and are selected by virtue of their educational value.

SUBSCRIPTION CORRESPONDENCE: (orders, change of address, etc.) should be directed to Key Solutions, P.O. Box 11978, Spokane, WA 99211-1978. Allow six weeks for processing.

EDITORIAL CORRESPONDENCE should be directed to Managing Editor, Key Solutions, P.O. Box 11978, Spokane, WA 99211-1978. Key Solutions encourages readers to submit articles, letters, questions and technical tips.

KEY TALK

Exciting things are happening for Cadkey and **Key Solutions.** The relaunch of Cadkey and the release of CADKEY®6 top the list, of course, but if you've read Frank Simpson's letter on page one, you know that **Key Solutions** and Cadkey have formed a closer relationship and that **Key Solutions** is taking the place of 3-D World.

Key Solutions will maintain editorial and publishing independence. However, the results of the stronger communications link between the two companies is already evident in this issue. For example, the complete section on CADKEY®6, the increased number of pages, the expanded number of articles on how to use CADKEY--none of this could have been accomplished as easily without Cadkey's assistance and support.

The real advantages of this relationship are for CADKEY users and **Key Solutions** readers. You are, in fact, the very first to read about CADKEY®6. In the magazine business this is called "scooping the competition." Over the coming months, you will also have access to in-depth information about using Cadkey products as concurrent engineering tools. **Key Solutions** will print articles that would have appeared in 3-D World. Subscribers of 3-D World will now receive six issues of **Key Solutions** per year instead of four issues of 3-D World.

This very special issue was made possible by the concerted efforts of **Key Solutions** and Cadkey, Inc. Many thanks to -

Charles Ferrucci, Cadkey V.P. of Marketing for providing the necessary editorial and technical resources.

Frank Simpson, Cadkey/Key Solutions Relations Manager for coordinating communications.

Stas Mylek, CADKEY Product Manager for providing pre-release and technical information on CADKEY®6.

Jay Hirth, CADKEY®NC (CUTTING EDGE) Product Manager for providing technical product support.

Craig Storms, Cadkey Training Coordinator for supplying CADL Toolbox since the first issue.

Many others have contributed to the success of **Key Solutions**. To all at Cadkey who helped, but who are not mentioned due to space limitations, heartfelt thanks. And thanks to Cadkey dealers, third-party developers and advertisers who have provided support. And finally, thanks to all the readers who have sent letters of support. Your letters let us know if we're doing our job and are real morale boosters for the **Key Solutions** staff.

Stay tuned! Bigger and better things are yet to come!

Robert Martin
Technical Editor

KEYNOTES

CADKEY in the News

3-D World

Cadkey, Inc. and Key Solutions, the independent publication for concurrent engineering in the 90s, have entered into an agreement which expands Key Solution's coverage of Cadkey's products. Key Solutions remains an independent publication, but will feature in-depth articles about CADKEY and CUTTING EDGE and receive editorial and technical assistance from Cadkey. To avoid duplicating efforts, Cadkey has ended 3-D World as its corporate publication. Frank Simpson, previous editor of 3-D World, will function as Cadkey's liaison with Key Solutions and be a contributing editor to Key Solutions along with his other duties at Cadkey.

Developer Wins Award

Robert Bean, P.E., M.E., and president of Baystate Technologies was awarded the "Enterprise Award" in the 1992 "VISIONS 2000 Leadership Project" for his development of DRAFT-PAK, a Cadkey productivity tool for mechanical design. Sponsored by Worcester Telegram & Gazette, the award is given annually to an individual in Central Massachusetts "..for an invention, idea, or technological advance that has produced measurable positive results during the past year." Founded in 1989, Baystate develops and markets a range of enhancement products for desktop CAD systems in a design and manufacturing environment.

CADKEY '93 Spring Show Schedule

National Design Engineering Show March 8 to 11, Chicago IL - CADKEY Version 6.0 will be the highlight at the Cadkey booth at NDES. The Cadkey User Group meeting will be held at 6:00 PM March 9 at the McCormick Center Hotel. Call Danielle Cote at 203/298-6424 for free tickets.

Cadkey will also be at the following shows during the spring quarter:

WESTEC '93 - March 22-25 - Los Angeles Convention Center, Los Angeles, CA.

Atlantic Design Engineering Show - April 22-25 - Garden State Exhibit Center - Somerset, NJ.

(continued on next page)

PC'S

Intel Continues Growth

Intel Corporation will spend more on new plants and equipment in 1993 than any other semiconductor company, marking the third consecutive year Intel's investment level will have led the world's chip industry. Intel, America's largest chip maker, has been the world's fastest growing major chip company for the last five years, with chip revenues expanding about 32 percent per year 1987-91.

This is partly explained by the high demand for Intel486 microprocessors that were expected to push Intel's fourth quarter revenues to up to 25 percent or more from those of the third quarter of 1992.

Mainframes Continue Decline

The outlook for IBM's mainframe computers are dim at best. IBM still gets more than $22 billion of its annual revenue and 60 percent of its net income from mainframes, but mainframes are rapidly being replaced by smaller computers, especially personal computers. The outlook is good for midrange computers. IBM will sell 58,000 AS/400 midrange computers this year, up 12 percent from last year.

HP Takes DEC's Number 2 Spot

For the first time, Hewlett-Packard has surpassed Digital Equipment Corp. in revenues in the U.S. market for midrange computer systems, giving HP the number two ranking behind IBM. Recently HP has experienced a double digit, year-to-year growth rate, while Digital's growth has declined slightly over the past five years.

Flash Memory

Flash is one of the faster growing semiconductor technologies, with sales estimated to grow 10 times in the next five years, from $200 million today to $2 billion in 1997, according to DataQuest and other sources. Flash is the most advanced form of non-volatile memory available today, with the advantage of being erasable and rewritable cost effectively, even when installed in a system. NAND flash introduces cost effective electronic mass storage, replacing low and medium density hard disk drives. NOR flash provides for user upgradable firmware in PCs, communications, and automotive devices.

Who's Who in PC's

Channel Marketing Corp.'s new list of PC manufacturers tells "Who's In, Who's Out and Who's Still Around" for 1993. Left the market in '92 (OUT): Goldstar, Magnavox, KLH, Smith Corona, Emerson, Samsung, Sensor, Tandon, Wang, PC Brand, Everex. New in '92 (IN): Canon, CMC, Leading Edge, EasyData, EiSys, Apple, Compaq, NEC, AT & T, Hewlett-Packard. Were in, left, then returned, all in '92 (IN/OUT/IN): ESP, Laser, PC Partner, Emerson. First in the channel and still around (STILL AROUND): Packard Bell, Acros/Acer, AST, IBM. May be thinking of entering (TO WATCH): Sony, Epson, Panasonic, Toshiba. CMC predicts just as much turmoil in the retail channel during 1993, but personal computer sales will continue to soar.

UNIX

Sun Combines Operations

Sun Microsystems, Inc. said it intends to compete more aggressively in the personal computer networking market by combining the operations of two of its businesses: SunSelect and Sitka Corp. The combined business unit integrates SunSelect's open client-server networking and emulation product families with peer-to-peer and mobile networking product lines from Sitka.

Novell Moves Into Unix

Novell gained a weapon in its battle with Microsoft Corp., agreeing to purchase American Telephone & Telegraph Co.'s Unix System Laboratories for about $360 million in stock. The deal gives Novell control of Unix. In return, AT&T gains a 3 percent stake in Novell, the second largest supplier of PC software after Microsoft. This also sets the stage for a new round of competition between Novell and Microsoft. Next year, Microsoft plans to introduce an operating system called Windows NT aimed at fans of Unix. Novell and Microsoft already compete in networking software where Novell holds a wide lead, and in PC operating software where Microsoft dominates with DOS and Windows.

KnowledgeWare and Unix

KnowledgeWare, Inc. announced plans to expand into the Unix market with a version of its Application Development Workbench(R). This version of the popular ADW integrated CASE product line will offer familiar features and functions.

Unix Wordperfect 5.1 Available

Two new versions of the WordPerfect word processor for Unix began shipping in December 1992; WordPerfect 5.1 for SCO Unix for System 5 Release 3.2.4 and 100 percent compatibles and WordPerfect for SCO XENIX.

ODDS AND ENDS

Drunk Detection Computerized

Alcohol-impaired pilots or professional drivers can now be identified through micro-chip technology at a very rapid speed. Deep-lung air is the substance analyzed instantly by devices such as the Intoxilyzer manufactured by CMI to determine blood alcohol content. This advanced micro-chip technology and computer software can detect and record alcohol content to a degree of accuracy that stands up in court.

Fire Trucks to Get Faxes

Three fire trucks in Scarborough, Maine will be equipped with fax machines next year. The faxes will be used to give fire fighters floor plans of burning buildings and information about hazardous waste.

Russian Changes Tracked on Software

With the Russian Parliament on a rampage and economic changes wreaking havoc across Russia, a Louisiana company has released "Who's Who In Russia," a software product designed to keep up with the rapid changes in Russia. A spokesman for D.N. Young & Associates Inc., said the software is maintained by a staff of 20 programmers in Moscow and gives users instant access to approximately 50,000 Russian decision makers.

CNN Transcripts On-Line

Daily transcripts of 50 CNN programs are now available electronically via DataTimes' online service. Journal Graphics transcripts of "Larry King Live," "Prime News," "Moneyline" and other CNN shows join 1,700 network news, newspaper, wire and financial database services on DataTimes.

CADKEY in the News

CADKEY in Eastern Europe

Cadkey is continuing to build long-term, free-market partnerships with manufacturing, government and education in Eastern Europe. Cooperative agreements are now in place and Cadkey software has been installed in automotive and aerospace applications, enjoying full production status.

Cadkey's place in Eastern Europe was firmly established before the fall of the Communist bloc. Despite COCOM regulations which restricted the sale of Western high-technology products such as CAD/CAM, Cadkey (based on its strengths for an industrial manufacturing environment) was allowed to sell software to Hungary, Czechoslovakia, Bulgaria and Armenia from 1989-1990. In 1990 the former Soviet Union's Ministry of Construction purchased DataCAD to assist in rebuilding areas of Armenia devastated by the 1988 earthquake. Cadkey training centers are currently in place at the University of Miskolc, a technical university in Hungary, the University of Wroclaw and the University of Technology Warszawa in Poland, the Technical University of Zlin in Czechoslovakia, and several technical centers in Russia.

Richard Kretzmer, Cadkey's V.P. of sales, has extensive experience among the people of Eastern Europe and the Commonwealth of Independent States (CIS). He has published several articles in business planning, sales and marketing to assist fledgling Eastern European entrepreneurs launch free-market enterprises successfully.

CADKEY is available in 12 languages, including Czech, Magyar (Hungarian), and Russian. CADKEY is becoming the preferred design/manufacturing solution for Eastern Europe and the Commonwealth of Independent States.

THE SECRET IS OUT

Only *one* company today can offer engineers *fully* integrated computer-aided design, analysis and manufacturing for desktop concurrent engineering: Cadkey.

Introducing CADKEY® 6

CADKEY 6 takes the design-to-manufacturing cycle to a new level of performance never before available in a desktop environment. To an award-winning 2-D/3-D CADD product, CADKEY 6 now adds analysis, giving engineers unprecedented flexibility and control early in the design process. Opt to add CAM with CADKEY® NC, and product designs can be moved into manufacturing rapidly and with significant time savings!

It all comes together with Cadkey

Cadkey offers everything a design engineer could possibly want: Technical superiority. Complete data exchange between other CAD systems. Direct customer support. Computer-based training. Hundreds of third party solution partners. And at $3,495 CADKEY 6 offers an exceptional price/performance advantage *with a money back guarantee.* Visit your authorized CADKEY dealer, or call Cadkey for more information and a free CADKEY 6 poster.

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Cadkey Forum

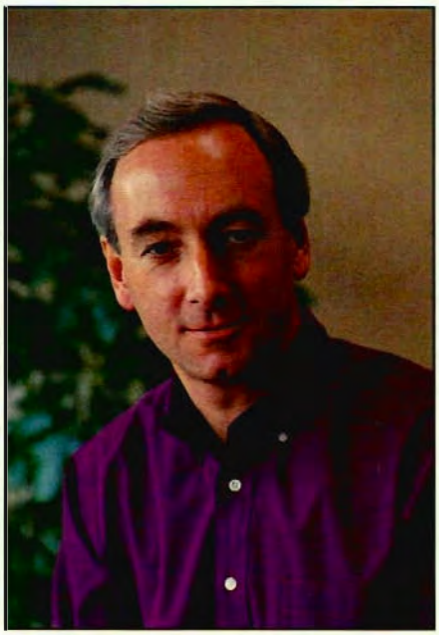
The Secret is Out! Cadkey Relaunch Underway

by Malcolm Davies, President-Cadkey, Inc.

Cadkey, Inc. is a revitalized company! We have officially begun the relaunch that I announced in October when I joined Cadkey. Since last summer I have been telling everyone that Cadkey's products were the best kept secret in the industry. When I joined Cadkey I saw my first job as president to be that of taking the wraps off the secret. Now the secret is out. Our relaunch is underway.

Our mission is to become the Number One provider of desktop concurrent engineering and AEC software worldwide. We will achieve this mission by meeting customer requirements, by delivering the highest value in the industry, by providing full international support, by marketing creatively and aggressively, by working smarter not harder, by improving continuously, and by exemplifying honesty and integrity.

There are two phases of the relaunch of our integrated set of CAD/CAE/CAM software products for concurrent engineering and manufacturing. Phase One begins in March 1993 with the release of CADKEY® 6. Many of the details are described in this issue of Key Solutions. CADKEY®6 builds on and vastly enhances the capabilities of CADKEY 5 -- greatly expanding its usefulness as a concurrent engineering tool. The second phase will involve the introduction of DataCAD®5 targeted for 1993.



Malcolm Davies

Our corporate objective is to achieve "best-in-class" status in the industry's leading competitive benchmarks: products, documentation, service and support.

The responses of our users are also an important benchmark. Please feel free to communicate with me through Key Solutions.

Send your comments and questions to:

Malcolm Davies, President

Cadkey, Inc.

c/o Key Solutions

P.O. Box 11978

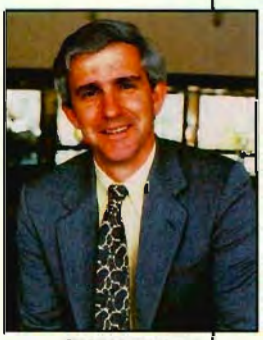
Spokane WA 99211-1978

Or, send comments to the Cadkey section of CADDVEN Forum on CompuServe®.

Cadkey Names New Marketing/ Sales VPs

Two members of the Cadkey management team have been promoted to vice presidential positions: Charles Ferrucci to V.P., marketing and Richard Kretzmer to V.P., sales.

Ferrucci was previously marketing manager, a position he assumed last year after joining Cadkey from the Entrepreneurial Resource Group. There he was a consultant specializing in management analysis of fast growth companies. In his new post, Ferrucci is responsible for worldwide marketing which includes product management, collateral materials, pricing, training, promotions, and marketing communications. He began his career at Southern New England Telephone Company where, over an 18 year period, he was promoted to a variety of management positions. Ferrucci was also the first director of marketing for SONECOR Systems.



Charles Ferrucci

Richard Kretzmer was elevated to V.P., sales from sales manager. As sales manager, his primary focus was establishing and reinforcing international distribution channels. He now assumes responsibility for worldwide sales, strategic alliances and related activities. Kretzmer joined Cadkey last year after 26 years in senior domestic and international sales management positions with Gerber Systems Technology, a division of Gerber Scientific, Inc.

New VP and Tech Manager for Asia/Pacific Operation

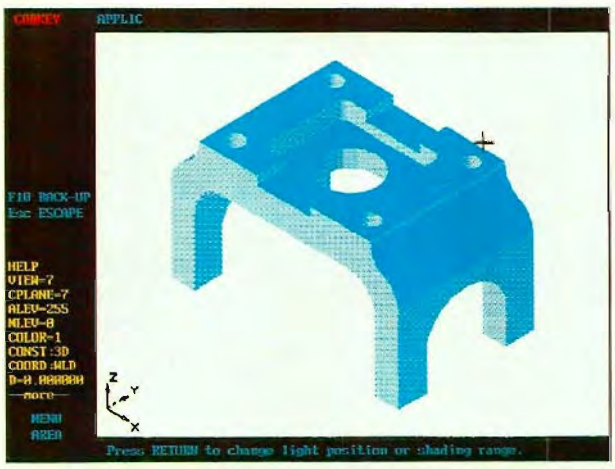
Bobby Cheng has been appointed V.P. of Cadkey's Asia/Pacific operations based in Singapore. Mr. Cheng brings a wide variety of computer industry experience to Cadkey (Texas Instruments, DEC, Computervision and Autodesk) especially in marketing CAD/CAM software to industries in the Pacific Region.

Wee Phuay Hoon has been appointed regional technical manager and Christine Png, office manager. Both report to Mr. Cheng in Singapore. Wee Phon Hoon is a mechanical CAD/systems engineer. Before joining Cadkey, he served as Autodesk's technical manager in Singapore.

CADKEY 6

Shape Recognition / Shading and File Compatibility Top List of New Features

CADKEY®6, released this month, is bigger and better from start to finish. It's loaded with powerful new innovative features. It also includes excellent major enhancements to the user interface and other basic operations. Always the tool of choice for mechanical CAD, CADKEY 6 is a testament to Cadkey's commitment to the mechanical engineering and manufacturing market. Here's an overview of what you'll experience.



Picture It

The hottest and most innovative feature is PICTURE IT™, the CAD industry's first, integrated, shape-recognition and shading system on a PC. Now you can display a wire-frame model right inside CADKEY 6 in several ways: as a hidden-line, dashed-line, filled-polygon, or even as a smooth-shaded image. PICTURE IT also provides output that is compatible with many popular, photorealistic rendering packages and for stereolithography.

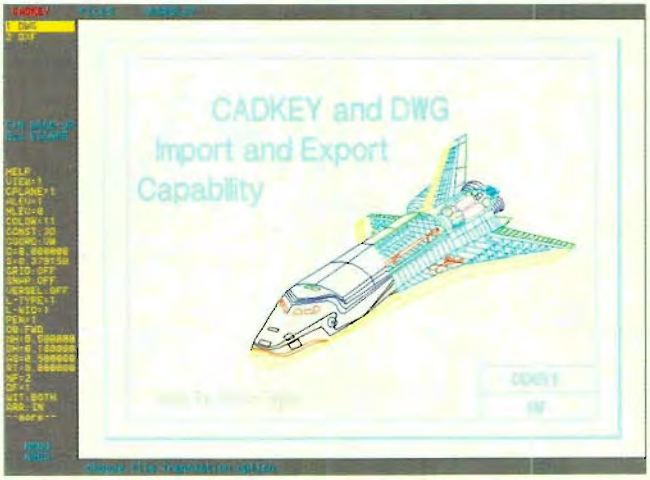
DWG/DXF Translators

Here's another totally unique CAD first. CADKEY 6 can read and write AutoCAD® DWG and DXF files directly - as easily as loading a CADKEY part file without any exterior translation. More important, there is no degradation of geometry. This feature has incredible potential as a productivity tool; for example, if you work in a mixed-CAD software environment; if you receive DWG or DXF files from vendors or others; or if you are converting to CADKEY from other CAD packages such as AutoCAD.

The new integrated DWG and DXF translators also have profound implications for third-party development. They reaffirm Cadkey's long-standing commitment to open architecture for the development of complementary software applications. The ability to read and write DWG and DXF files directly, combined with the existing CADKEY Dynamic Extensions™, CADL® (CADKEY Advanced Design Language), and the CADKEY® IGES Translator, expands development capabilities so essential in a system dedicated to mechanical engineering and manufacturing.

Bi-Directional Part Files

Remember when changing software versions could create chaos because earlier drawings couldn't be read by the new software and visa versa? No more! The CADKEY part file database has not been changed in CADKEY 6. This binary compatibility insures a seamless part file exchange between CADKEY 6 and CADKEY 5. This database integrity is critical for precision manufacturing.



CADKEY 6

User Interface Enhanced With Increased Windows-Like Dialog Boxes

On-Line Tutor and Help

Help is only a menu away in CADKEY 6.

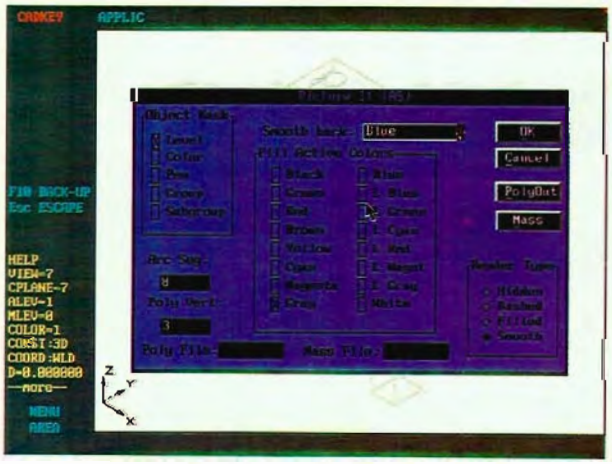
CADKEY Tutor is still the only PC on-line learning tool completely integrated into a PC CAD product. CADKEY Tutor consists of short twenty-minute lessons on a variety of topics designed to reduce the learning curve. The Tutor can be selected from the APPLICATIONS menu.

Hypertext HELP is easily accessed, comprehensive on-line documentation. Simply select HELP from the Status window and choose the function you want to reference. You may use the HELP Index or type the word to display the desired information.

CADKEY 6 has many powerful new features, but familiar software is comfortable. In real life, learning new software or software upgrades can be extremely inconvenient and uncomfortable. Will the transition to CADKEY 6 be smooth for those who upgrade? Will getting up to speed with CADKEY 6 be quick and easy for new or novice users? The answers are yes and yes.

For "upgraders," the familiar commands and basic structure of CADKEY 5 have not changed. Changes in the user interface make some previously complicated functions simple.

New Windows-like dialog boxes simplify and speed up everyday functions like file management, printing/plotting and masking. These dialog boxes consolidate information and operations that previously required a number of menu steps.



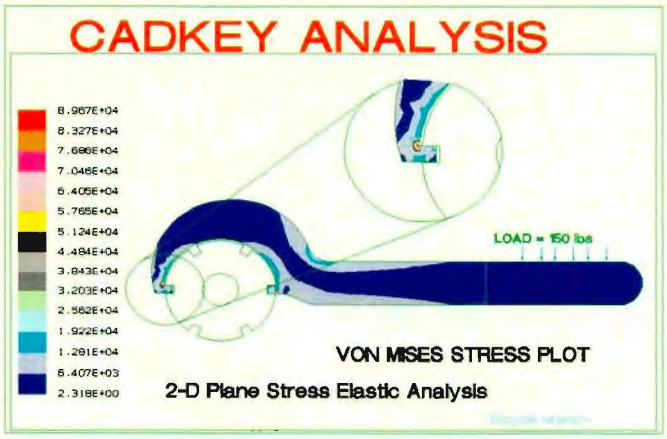
File Management

File management is now handled right inside CADKEY 6. This includes everything from copying, deleting and moving files, to reading a part file without a .PRT extention in the file name. You can roam freely through different subdirectories and change disk drives without ever having to leave CADKEY. You can sort files by name, extension, size or date of creation. File attributes such as date, time, etc. are also displayed.

Printing and Plotting

In CADKEY 6 all printing and plotting information has been combined into separate boxes. You can print with "portrait" or "landscape" orientation.

Another Windows-like feature is the ability to "drag" a piece of paper (which includes your paper settings) over a drawing and place it over the area to print. Of course, CADKEY 6 will still automatically center your paper if you want.



Other Enhancements

Masking

You can select entities, mask entities or display all entities, from the options displayed in a single dialog box. A Selection List lets you select groups of entities, making a complex multiple step selection a single step.

Cross-Hatching

Cross-hatching boundary recognition and capabilities have been greatly enhanced. It's no longer necessary to break boundaries for simple cross-hatching. All cross-hatch patterns are now displayed in dialog box format as icons which let you identify the patterns before use. In addition to an increased number of default hatch patterns, you can define customized hatch patterns. Any cross-hatched area can be edited and the cross-hatching will reflect any changes made to geometry within the cross-hatch boundary. Inside the cross-hatched boundary you can even add or subtract islands (non-cross-hatched areas). For example, notes and dimensions can now be treated as islands if they fall within a cross-hatch boundary.

Detail Drafting

CADKEY users can now save all settings for Detail Drafting as a Template file for repeated use, and the settings for all detailing now appear in a single dialog box. This simplifies a previously complex operation. New options in Detail Set include the ability to substitute any ASCII character for the standard dot in dimensions, as well as the ability to set the spacing between the end of the witness line and the object line.

Layout Mode

CADKEY 6's drawing layout mode continues to have true 3D mode/layout associativity, but also includes instance scaling, rotation, alignment and blanking. Instance ghost boxes scale to the displayed entities. Any object can be linked to an instance so that it moves and aligns with the instance that has been added.

Levels

A Levels dialog box lists Level names for a Motif®-like interaction. A count option has been added that can list the types and numbers of entities on a level, including CADKEY Surface types and Collectives.

View List

You can now switch views by selecting from a list of user-defined view names.

ANALYSIS and IGES Operate Inside 6

CADKEY®ANALYSIS, the software tool based on the Boundary Element Method (BEM), was released last year as a separate package. Now ANALYSIS is an integral part of CADKEY 6 and can be invoked as easily as a spell checker in a word processor. CADKEY ANALYSIS gives engineers an easy-to-use, powerful, quick and accurate way to analyze parts. It can handle single, isotropic, and homogeneous materials within their specific elastic limits for both 2D and axisymmetric bodies. Modules included are Thermal Elastic (Steady State Heat Transfer), Elastic (Linear Elastic Stress), and Thermoelastic analysis.

The CADKEY IGES translator, which also used to be a separate software module, now operates seamlessly from inside CADKEY 6 interface. This allows CADKEY users to import and export IGES files directly. There is no longer any need to run an external IGES translator.

Slides

CADKEY 6 produces slide files in CompuServe's industry-standard GIF® (Graphics Interchange Format) format.

Unix

The Unix version of CADKEY 6 supports Sun Microsystem's SOLARIS® operating system.

An Engineer's

CADKEY® 6 and AutoCAD® 12

by Robert Martin

Comparing CADKEY®6 and AutoCAD®12 is a little like talking about apples and oranges, but I'm going to give it a try. Based on my experience I'm totally convinced that CADKEY is the best mechanical CAD / concurrent engineering package around, and I think it's important to understand what the two programs are all about.

I'm a consulting mechanical engineer and an ex-AutoCAD user - writer - teacher for more years than I care to admit. Late in 1988 I became involved in the B2 bomber program when one of my clients was subcontracted by Northrup to produce a subsystem. Right out of the starting gate there was trouble. When we attempted to translate drawings sent in IGES format into AutoCAD, strange arrays of lines that did not meet at the vertices or corners appeared on the screen. Curves were represented by a series of straight lines that made very little sense. And that was just the beginning of the mess.

We began a frantic search for a PC CAD product that would translate the IGES files. The answer turned out to be CADKEY 3.5. Not only could we translate the drawings with great accuracy and relative ease, but CADKEY let us manipulate the resulting entities just as easily. Needless to say, the entire subsystem was designed using CADKEY and molds for the parts were machined via CADKEY CADL files. Even though it couldn't save the B2 project from limbo, CADKEY literally "saved our bacon."

My experience, while not unique, does illustrate some essential differences between CADKEY and AutoCAD. The products as they exist today are extensions of the profoundly different developmental philosophies and marketing strategies. Recent corporate statements from both Cadkey, Inc. and Autodesk make this clear.

In their AutoCAD 12 Feature Summary Document, Autodesk stated that their goal was *"to provide a product which is fast, looks good, is easy to use, addresses new markets and enhances current AutoCAD capabilities."* Nothing's changed! AutoCAD was originally developed as a generic graphics engine that could be turned into any type of CAD application using third party software. It was an adequate (not great) 2D and 2 1/2D drafting package, and it was inexpensive and well marketed. In the early CAD market AutoCAD had few competitors and so Autodesk sold lots of software.

This broad focus coupled with marketing strategies that targeted the AEC market hindered development, especially in the mechanical arena. It also led to the situation that Autodesk finds themselves in today, with the AEC market going flat and the mechanical being the only growth market.

CADKEY, on the other hand, never tried to be all things to all people. Their published goal is *"to provide a robust, easy to use and cost effective set of productivity tools for the mechanical engineering market."* From the beginning Cadkey, Inc. focused on the needs of this market. CADKEY is and always has been a true 3D package with features specifically for the mechanical engineer and designer.

The release of CADKEY 6 with PICTURE IT™, the integrated DWG and DXF translator, the integration of ANALYSIS and the shared database with CADKEY®NC (formerly CUTTING EDGE) just strengthens and lengthens CADKEY's lead as a concurrent engineering tool.

Autodesk, in an attempt to catch up technologically and capture a bigger share of the mechanical market, recently bought Micro Engineering Solutions (MES) of Novi, Michigan. I feel that they're a day late and a dollar short. Even though MES is a high-end CAD/CAM company with NURBS surface for machining and twelve years experience in the automotive industry, that doesn't mean that AutoCAD is going to be able to incorporate NURBS surfacing in the near future. By the admission of one of MES's own marketing people, "NURBS surfacing integration into AutoCAD is at least 12 to 18 months away." Besides, AutoCAD has other deficiencies as a mechanical package, not the least of which is that it's accuracy just isn't good enough for most NC work.

There are three primary areas where CADKEY outperforms AutoCAD:

View-

- 3D Wireframe Construction
- Advanced geometry creation
- Dimensions

In general, CADKEY's ability to work in 3D space remains far superior to AutoCAD. The ability to define construction planes on the fly while performing true 3D transformations is one of CADKEY's strongest attributes. This capability remains archaic, at best, in AutoCAD. View manipulation and multiview layouts are still not inherent features in AutoCAD.

Since its inception, CADKEY has used sophisticated geometry types such as conics and splines and helix construction which AutoCAD still does not support. The polyline surface approximations in AutoCAD are virtually unusable for machining. The fact that these deficiencies have continued for twelve years without change attests to Autodesk's lack of concern for, and dedication to, the mechanical CAD market.

Dynamic dimensioning is another of CADKEY's strongest features. All dimension attributes can be changed on the fly; the decimal precision of dimensions can be automatically aligned and edited; dimensions can be moved and placed; and ordinate dimensions can be automatically aligned and edited -- all of which is *non-existent* in AutoCAD.

In addition to these global differences, AutoCAD does not fare well in a micro-analysis of operations and raw commands (or lack thereof). Even asking obvious questions, such as how many keystrokes, mouse clicks, menu layers, and/or steps are required to perform common functions, is revealing. These small issues may not seem critical, but their cumulative effect can dramatically impact the efficiency and speed of a CAD operator.

I find AutoCAD slow and "clunky" even for simple drafting operations. The Immediate Mode commands in CADKEY may be old hat, but they still deserve "honorable mention" in my book because of the advantage they provide the user. AutoCAD does not have anything close. For example, in AutoCAD just to do a Window Zoom (probably the most commonly performed function in a drawing session) you must leave the command you're in and slog through layers of menus and mouse picks before you can define the window. In CADKEY all you do is press ALT-W and you're ready to define the window -- without exiting the current command.

The chart above contains an overview of some of the differences between AutoCAD 12 and CADKEY 6. Upcoming issues of Key Solutions will analyze these and others in detail.

A Summary of Features

Function	CADKEY 6	AutoCAD 12
Dimensions		
Dynamic	Yes	No
Auto Align Ordinate	Yes	No
Move & Place	Yes	No
Edit attributes"on fly"	Yes	No
Dynamic tolerence addition	Yes	No
Display Features		
Predefined Views	7	4
User definable ViewPorts (up to 20)	Yes	No
Immediate Command Mode	Yes (42)	No
3D Functions		
Wireframe to solid	Yes	No
Wireframe to multiple views	Yes	No
Bi-directional data exchange between models and 2D views	Yes	No
Shape Recognition/Shading	Yes	Shading Only
Assembly drawing support for multiple 2D drawings	Yes	No
Wireframe hidden line representation or removal	Yes	No
Wireframe fill & Shading	Yes	No
Supported Complex Geometry		
Conics	Yes	No
Splines	Yes	No,Pline Approxi-mations only
Point Meshes	Yes	No
Line Meshes	Yes	No
Spline Meshes	Yes	No, Pline Approxi-mations only
Polyline Meshes	Yes	No
Polygon Meshes	Yes	Yes (limited & inaccurate)

NEW PRODUCTS

INPUT

New GTCO Digitizer

GTCO Corp. offers a 12 x 18 inch digitizing tablet, the Ultima, with the UltraVu 16-button cursor. The tablet is compatible with Summagraphics MM1201, Windows and mouse drivers. It has an accuracy rate +/- 0.01 and can operate without an external power supply or batteries by plugging into a serial port of a computer.

Contact GTCO at 410/381-6688 or Fax 410/290-9065.

Fully Programmable Keyboard

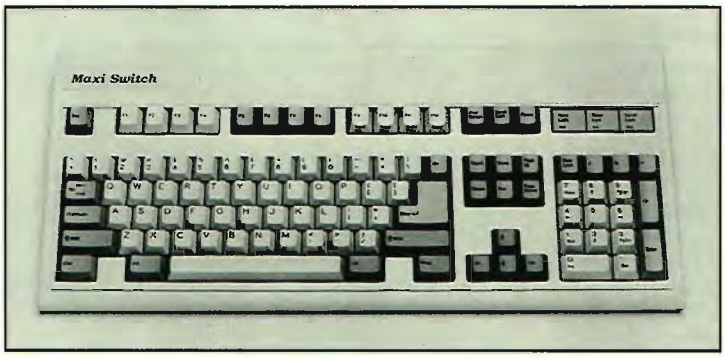
Maxi Switch, Inc. announced the Tucson 101-PRO, a new 101-key keyboard. It has the same full-programmability of the company's 124-key keyboard, at $30 less than its top-of-the-line counterpart. Keys can be remapped to match the user's personal working habits or to perform special functions. The Tucson 101-PRO is compatible with PS/2 and IBM-compatible PCs and comes with a 3-year parts/service warranty and is priced at $95. Pro TOOL-1, a keyboard software utility providing on-screen display of user-programmed "macro" and "remapped" key settings is also available.

Contact Maxi Switch at 602/294-5450 or Fax 602/294-6890.

Raster-to-Vector Conversion

Genasys offers Genarave, a tool for raster-to-vector conversion of scanned maps and drawings. Genarave uses the Motif-based Genius graphical user interface and operates under X-Windows on a variety of UNIX workstations. It accepts standard monochrome compressed or uncompressed TIFF images, enhances captured data using raster and vector editing tools, and outputs data in several standard interchange formats.

Contact Genasys at 303/226-3283 or Fax 303/226-0869



Maxi Switch's Tucson 101-PRO

HARDWARE

New Graphics Accelerators

STB Systems, Inc. has introduced two new graphics accelerators for ISA bus computers and one for the new VESA Local (VL) bus. The WIND/X Pro, PowerGraph X-24 (ISA), and PowerGraph VL-24 (VL-bus) are based on graphics controllers from S3, Inc. All three support true color (16.7 million colors) drivers at 640x480 resolution as well as top-end resolution of 1280x1024. Each comes equipped with a full 1MB of RAM. The PowerGraph X-24 has a suggested list price of $249; the local bus VL-24, $299. The higher performance VRAM WIND/x Pro lists at $399.

Contact STB Systems, Inc. at 214/234-8750 or Fax 214/234-1306.

SOFTWARE

Object-Oriented Database

Bionic Knight Software offers DEED V1.3, an object-oriented database for engineering and product management which now supports DXF files. Features include multilevel bills of material and a purchasing list function that groups parts by each vendor for easier purchase order preparation. DEED allows users to store detailed data specifications and track changes for any type or class of part or object. A find/edit function allows users to select and edit parts across type categories. DEED is available for PC and Sun SPARCstations. A network version features record locking and password protection. Prices start at $2995.

Contact Bionic at 919/847-1531 or Fax 919/847-3182.

New Project Planner Features

Primavera Systems has added new features to its Project Planner management and control system. These include resource allocation and leveling, custom reporting, integrated scheduling, cost control and presentation graphics. Using HP-GL files, the Project Planner can create banded bar charts, pure logic diagrams and time scales; cumulative curves; and resource and cost profiles. Users can schedule multiple projects, bring in predefined network segments to assemble complex networks, and create reports with the custom report writer. List price for single-user is $4000; for three-user LANs, $9500.

Contact Primavera at 215/667-8600 or Fax 215/667-7894.

CAD/CAM C Libraries Source Code

Building Block Software now offers source code for all of its CAD/CAM Developer's Kits™ (CCDK). The kits are C function libraries which

support standard CAD/CAM operations such as reading and writing DXF files, and constructing, editing and displaying 2D and 3D CAD geometry. With this source code, CCDK users can debug more effectively by tracing into CCDK routines, port their applications to any platform using an ANSI-standard C compiler, and satisfy government contracts which require delivery of systems in full source format. Source code prices for the three CAD/CAM Developer's Kits range from $998 to $1998 for the Personal Edition; prices range from $1998 to $3598 for the Professional Edition.

Contact Building Block Software at 617/899-4350 or Fax 617/899-4399.

Sun/PC/Mac Link

Pacific Microelectronics, Inc. offers Common-Link Plus, a software utility that enables a Sun SPARCstation to read or write Macintosh or PC files from its 3.5 inch, 1.44MB floppy disk drive or format a high density diskette as Macintosh or PC. In addition, Common-Link Plus enables the SPARCstation to read/write Macintosh data from SyQuest and Bernoulli removable drives and Sony optical drives. This allows trading of large files (over 20MB) without interfering with network operation. Information created on Macintosh and DOS systems can be transferred directly to the SPARCstation's local system files.

Contact Pacific Microelectronics at 800/628-3475 or 415/948-6200.

Design Data Bridge

Silicon Mountain Design, Inc. has released DXF/GDS Design Tools which automates the exchange of design data between PC-CAD systems and semi-conductor industry design tools. The Tools convert DXF to GDSII Stream and GDSII Stream to DXF. This allows designers to implement semiconductor circuits, thin-film sensors, or optical-style designs in the PC-CAD environment and then transfer the data to the semiconductor tools for final processing.

Contact Silicon Mountain Design at 719/576-4800 or Fax 719/576-4170.

Math Software for SPARC

The MathWorks Inc. offers Matlab Version 4.0 numeric computation and visualization software for Sun SPARCstations. This version features sparse-matrix support, object-oriented graphics and sound-output and graphical-user-interface control. Matlab merges a programming language, graphics, numeric computation software and an extensive family of application-specific toolboxes. Matlab Version 4.0 is priced at $2995 for a single-seat license. Education and quantity discounts are available.

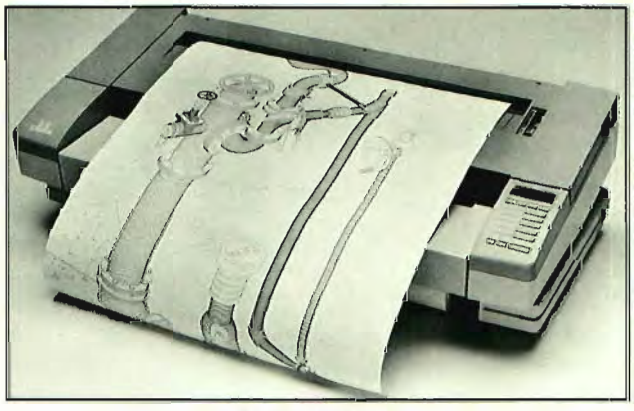
Contact The MathWorks Inc. at 508/653-1415.

OUTPUT

JDL Price Reduction

Japan Digital Laboratory Co., Ltd. has announced a $1000 price reduction on its A- to C-size AutoPlotter XP, now listed at $2495 and a $1500 price reduction on its A- to D-size OmniPlotter, now listed at $4995. Both plotters support vector and raster plotting, and output drawings with resolutions up to 360 x 360 dpi and incorporate the proprietary protocol, JDLPlot, which increases transfer times. The 14-color AutoPlotter XP offers five line widths, HP emulation, a replot function, and tri-mode media handling. The 20-color OmniPlotter supports multiple users and has a variety of interfaces, seven line widths and built-in roll and manual cut sheet feeding.

Contact JDL at 800/899-8709 or Fax 805/388-8708.



JDL OmniPlotter

Plot Spooling Software

Eclipse Software, Inc. now offers three new versions of its plot-spooling software which allow users to print or plot files in the background while other programs run as foreground applications. The memory-resident programs run on any MS-DOS PC-compatible computer. PLUMP ($125) plots to a single serial device. PLUMP-Rx ($175) supports simultaneous background spooling to both a serial and a parallel printer or plotter. PLUMP Professional ($225) can spool simultaneously to an unlimited number of printers and plotters.

Contact Eclipse Software at 206/676-6157 or Fax 206/676-0921.

Flexibility in Printer Buffers

Kansai Electric announces its EDB series of printer buffers which offer printer-sharing capabilities through three, four, or five parallel ports. The buffers feature three SIMM

NEW PRODUCTS

sockets that accept memory modules in increments of 1MB or 4MB (expandable to 12MB). Direct Memory Access architecture, available on all boards, allows the user to receive data at up to 280K/sec. A serial RS-232C modular jack and a modular-to-25-pin adaptor cable are also available. Multiple buffers can be linked to support an unlimited number of computers and printers.

Contact Kansai Electric at 408/377-7062 or Fax 408/377-7085.

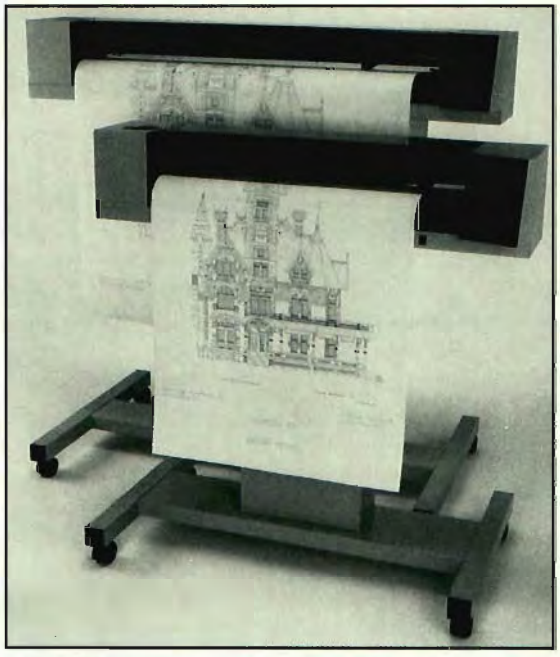
New Generation Pencil Plotters

Mutoh America introduces three new models of its XP-500 Series, the XP-511, 510 and 510R. All models have a maximum plotting speed of 50 ips and an acceleration rate of 4.2 Gs. Other features include a new automatic pencil lead feeder which can hold up to 720-0.2mm pencil leads, combinations of lead sizes and hardnesses, a plotter carousel capable of mixing pen ink and pencil lead within the same drawing, and increased pen response time of 40 times per second. All XP-500 plotters include 1 MB buffers with replot capabilities, a user selectable pen force of 15 to 450 grams, an LCD display with 16 characters by 4 lines, and a standard RS-232C serial interface with 19.2 bps support.

Contact Mutoh America at 708/952-8880.

Plotter Price Reductions

ENCAD® (formerly Enter Computer, Inc.) has lowered the price of its ENCAD NOVAJET 300 dpi E/A0 color inkjet plotter/printer to $9995. It has HP-GL, HP-GL/2 and HP RTL (raster) emulations. Standard features include roll feed with automatic cutter, color palettes (256 colors--vector, 16 million colors--raster), long plot capability, white space management, RS 232 and Centronics interfaces, and a 4MB buffer expandable to 14MB. In addition, ENCAD has lowered prices on its SP 1800 (now $2995) and SP 2800 (now $3995) wide-format pen plotters normally used in CAD applications.



ENCAD's SP 1800 and SP 2800 wide-format pen plotters

Contact ENCAD at 800/356-2808 or Fax 619/578-4613.

CGM Compatibility for Electrostatic Plotters

CalComp has announced the availability of CGM (computer graphics metafile) compatibility for its current line of large-format electrostatic plotters. The CGM option is priced at $995 with no installation charge when ordered with a CalComp Model 67436 monochrome or 68000 Series color electrostatic plotter. Existing units can be field-upgraded. The CGM option also includes plotter-resident firmware that meets ANSI and ISO standards.

Contact CalComp at 800/932-1212.

CADKEY UTILITY

GEORGE/QUIKSEC Price Reductions

Pooled Design Quorum is now developing and marketing GEORGE and QUIKSEC (formerly developed and marketed by Denco, Inc.). Both are CADKEY CADL utilities that address recognized CAD bottlenecks: GEORGE can create workable 2D drawings from 3D wireframes; QUIKSEC generates cross sections from wireframe models. Together they can save 30-60 minutes for each drawing. GEORGE is now priced at $295 and includes a free copy of QUIKSEC. QUIKSEC, sold separately, is now $95. Prices for both have been reduced from $495.

Contact Pooled Design Quorum at 302/998-1716.

CAM

Computer-Controlled Laser Systems

Universal Laser Systems, Inc. offers ULS computer-controlled laser systems that are directly compatible with all CAD software. The systems will cut plastics and wire stripping, mark tags and produce gaskets by setting laser parameters and downloading a CAD drawing. Features include velocity adjustment, 1MB of memory, software-controlled laser power changing and a work area of 17 x 11.5 inches. The ULS line includes 20-, 100-, and 200-watt CO_2 systems and 50-watt YAG systems.

Contact Universal Laser Systems at 602/483-1214 or Fax 602/483-5620.

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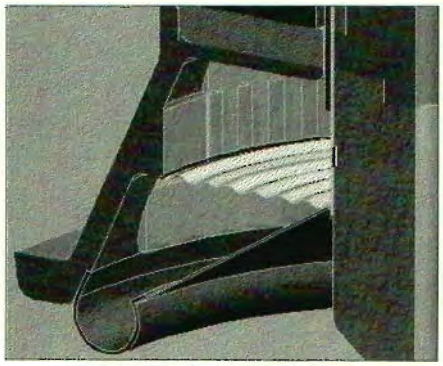
AUDIGO

In July 1991 Silicon Graphics announced Indigo™, a new computer that offered visual processing at an affordable price. Paul Bergetz, owner of CADPRO Chicago - a value added reseller of Cadkey products, Silicon Graphics and Euclid-IS® - was drawn to its impressive digital audio capabilities. He was also looking for a way to channel his eleven years experience in the audio recording systems industry.

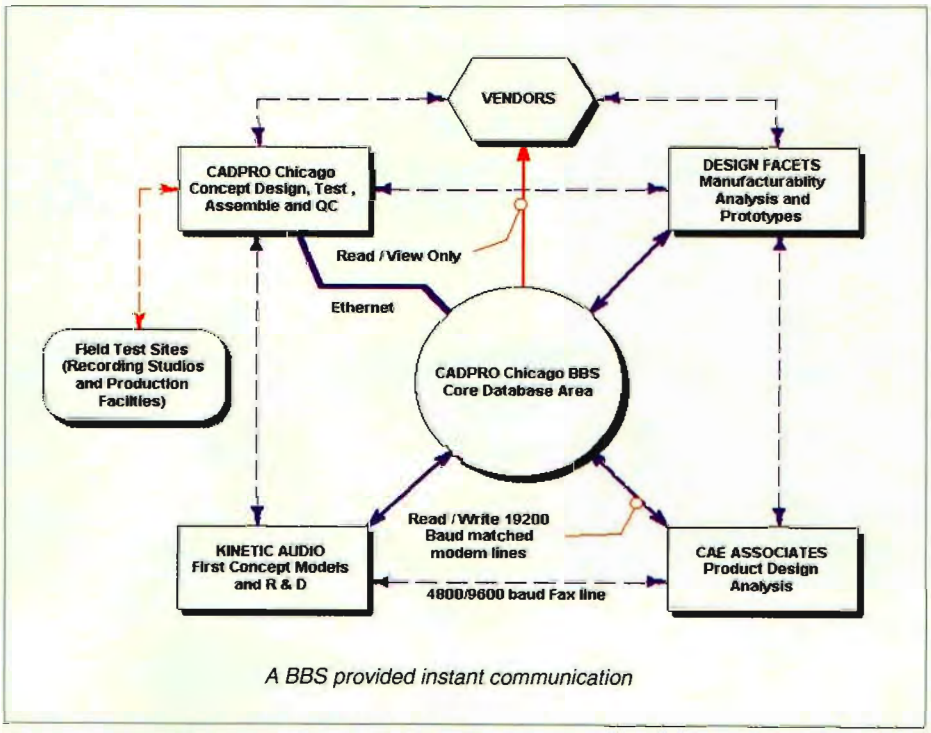
When I first learned about the Indigo I thought, "Why not build a set of near field monitors that complement Silicon Graphics' Indigo styling and audio capabilities?" They would be small and compact, the size of the Indigo, and yet present the sound field of large studio monitor systems. Thus the Audigo speaker project was born. As the project developed, I also saw an opportunity to turn the undertaking into a model concurrent engineering project using state-of-the-art software.

The first goal was to create a world class product with limited resources, similar to those that many small American manufacturers have, by drawing on the expertise of a network of colleagues. The second goal was to demonstrate that concurrent engineering can be implemented even in the smallest manufacturing and design groups with cost effective tools.

Four companies were involved. Ted Karson, President of Kinetic Audio in Chicago, handled the acoustic R&D and first concept models; CADPRO Chicago handled testing, concept design and marketing. As the design and testing moved past the first concept milestone, other companies joined in. Kevin Coughlin, President of CAE Associates, analyzed the LFM8 motor (woofer) and Dave Plahm, President of Design Facets, was responsible for all phases of manufacturing.



Actual Fax Output of change

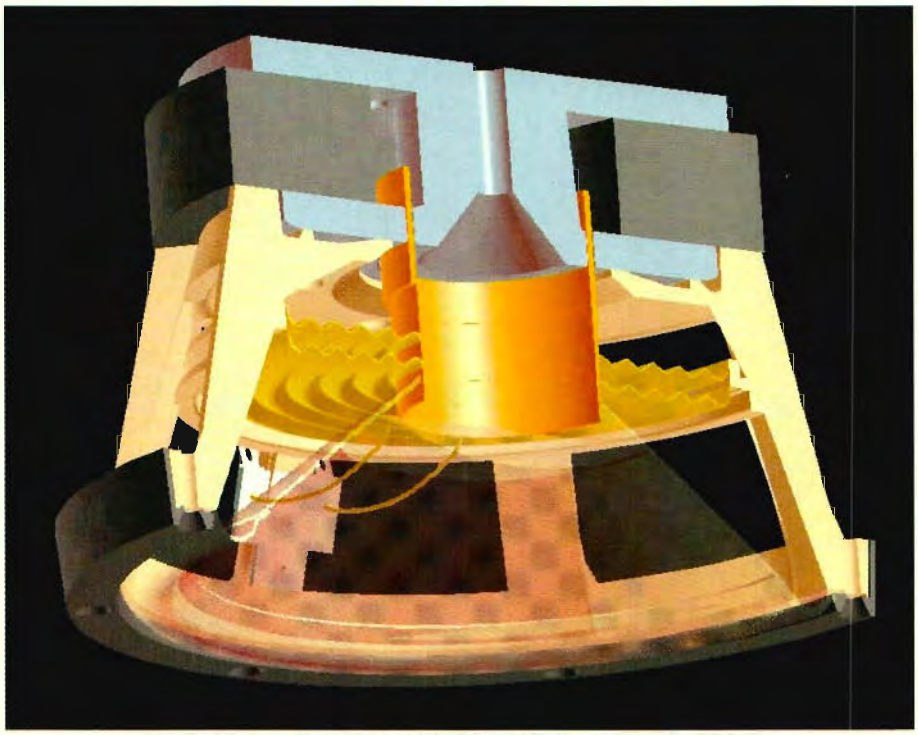


A BBS provided instant communication

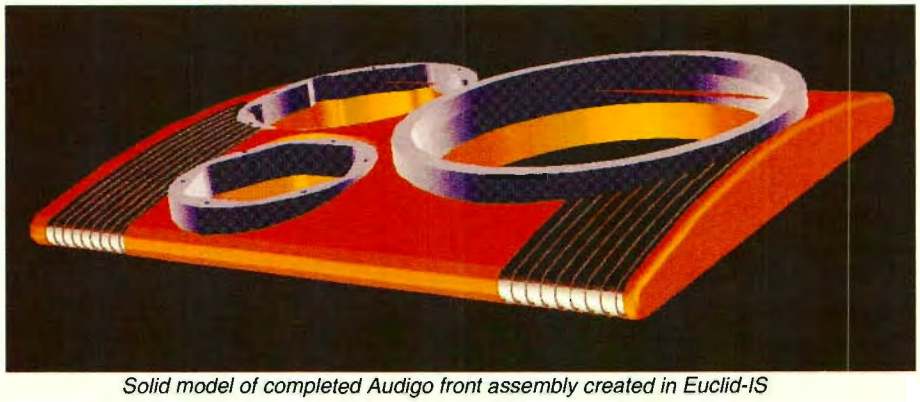
Concurrent engineering requires careful attention to communicative skills between all involved in a design project. The four companies in the Audigo project needed to communicate in as

A MODEL CONCURRENT ENGINEERING PROJECT USING STATE-OF-THE-ART SOFTWARE

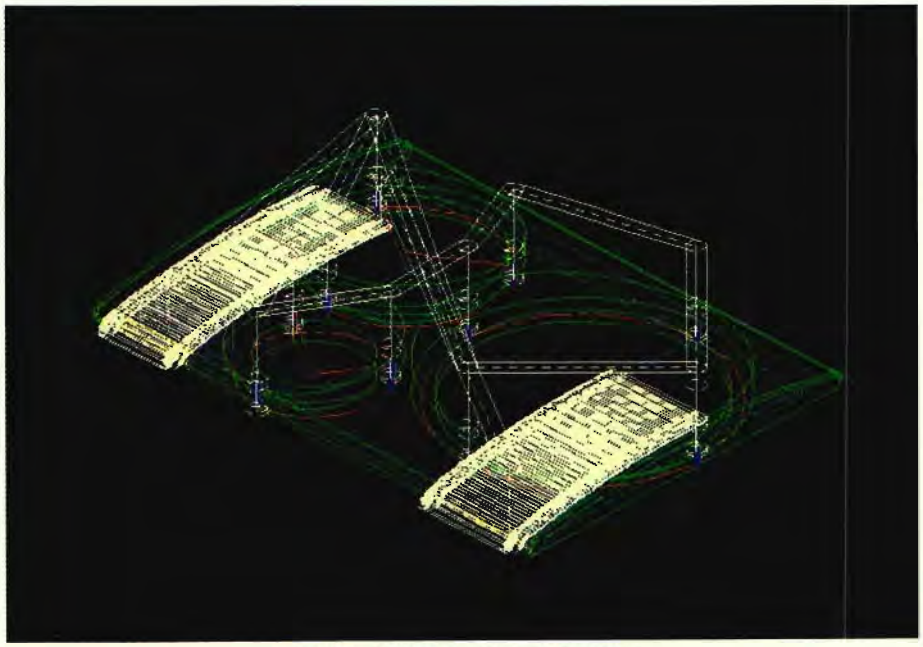
close to real-time as possible, since they were all working from the same 3D CADKEY model. So the companies were linked to a password protected area on our Bulletin Board



Sectional view of a solid model of the LFM8 created in Euclid-IS



Solid model of completed Audigo front assembly created in Euclid-IS



Cutting Edge toolpath of Audigo front

WHAT ARE NEAR FIELD MONITORS?

Music production has changed dramatically since the advent of the CD and digital recording. Higher levels of acoustic detail are attainable. The mixdown focus has switched from the main wall mount monitor systems to a near field environment. The engineer sits in the sound field at the center of the sound source one to two meters from the sound source, eliminating many boundary reflections caused by the room acoustics. Near field monitors must be ultra accurate, powerful, clean and "blow-up" proof. The Audigo can run at 105db at 1 meter all day long while remaining transparent and unfatiguing. The Audigo operates from 20hz to 20khz at +/- 3db with a distortion of less than 1% above 300hz.

A CUSTOM WOOFER

Kevin Coughlin, President of CAE Associates studying Magnetic analysis plot of motor output.

After testing twenty-five combinations of mid-range and high frequency drivers, we found a good mix in a D54AF from Dyn Audio in Denmark and a Morel MDT33 from England. The real problem came with the eight inch woofer. In order to attain the low frequency response and maintain a tight clean bottom end response we required, we had to design and manufacture our own low frequency driver (woofer), the LFM8 (low frequency motor 8 inch). This driver is capable of front and rear excursions of .700 inches. The flux density and magnetic field of the motor was optimized by CAE Associates after eight iterations, eliminating costly pole piece prototypes. All components in the 18 lb. structure are epoxy bonded into a cast epoxy basket. An optional 6 lb. iron shield is used to stop passive magnetic radiation. The entire motor is magnetically lubricated and vented.

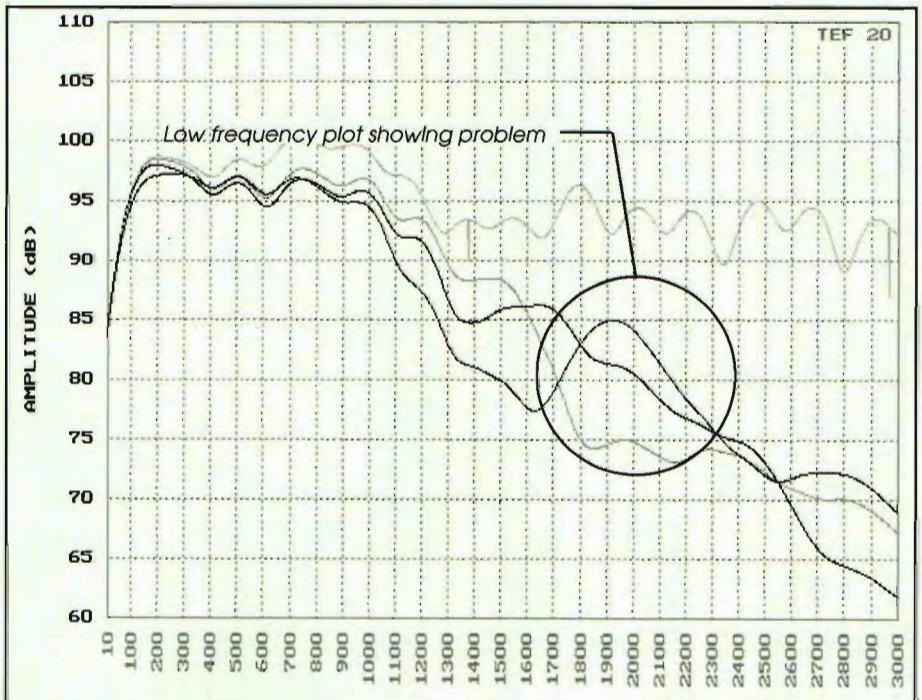
Magnetic analysis plot of motor output

System using 19.2 Kb modems. The BBS was linked in real-time via NFS to CADPRO Chicago's design network. When changes were made, the master files were on the BBS within seconds so any of the "AUDIGO" team could access them. At the same time, the network fax was used to transmit changes to everyone's terminal.

All phases of the AUDIGO project, from planning to manufacturing, were handled using advanced engineering software. All component profiles were designed in CADKEY and sent to Euclid-IS for solid modeling, interference testing and properties analysis. After all parameters were tuned on the screen in Euclid-IS, the profiles were sent back to CADKEY for manufacturing. Dave Plahm from Design Facets took the concept data of the four cast epoxy parts inthe LFM8 basket and manufactured the prototype tooling. We were able to complete the LFM8 with only two sets of prototype tools, thanks to the upfront modeling and analysis.

As the analysis, modeling and prototype testing continued, the design for the enclosure was beginning. The Indigo front shape was digitized using CADKEY CopyCAD and the profiles transferred to Euclid-IS for solid modeling. Dave Plahm's expertise in materials as well as model and moldmaking was put to good use. Dave decided to use prototype tools made of hard epoxy instead of rubber. The advantage was parts that were dimensionally more stable and the tool life was extended from a dozen parts to several hundred at only 25% increase in cost. This would allow us to generate the capital necessary to build hard tools. Conventional wood patterns were made instead of using SLA models because of the large size and detail of some of the parts. All of the patterns were machined using CADKEY CUTTING EDGE.

Testing was accomplished using a TEF® analyzer from Techron®, a division of Crown



A problem caused by unequal acceleration of the LFM8 cone from the inside diameter to the outside diameter was revealed by the TEF analyzer. This problem was smoothed by adding foam damping to a precise position on the cone back.

Components such as the Indigo front were reverse engineered using CADKEY CopyCAD

International, Inc. This analyzer allows the operator to make anechoic measurements in a non-anechoic environment. All tests were performed at 1 meter using a B & K 4007 Microphone at a level between 90 and 100db. The listening area was 20 x 14 feet in size with the Audigo speakers located in the center of the 20 foot wall approximately 6 feet apart. The ambient room noise was less than 39db. The Tef analyzer saved an estimated 500 hours in tuning the performance of the Audigo.

In the end, concurrent engineering methods proved effective in networking off-site experts into a successful team. The project worked so well that the final drawings were not made until after the initial production run was complete. Everyone worked from the 3D model.

For more information, contact CADPRO Chicago at 708/640-1853

Paul Bergetz at the controls of test equipment

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CIRCLE CARD 204

To get my design through committee,
I thought I'd have to change it.

(I was right.)

To get my project approved,
I thought I'd have to modify it.

(Right again.)

To get a workstation on my desk,
I thought I'd have to give up some software.

Turns out, there are some places
you don't have to compromise.

Where Do We Go From Here?

by Brian Carlisle

These days you often hear a lot of doom and gloom talk in business circles about the state of American industry. The talk often focuses on the fact that other countries (especially Japan) are sweeping the field. Indisputably, the statistics and numbers are alarming and should be taken seriously. The robot industry is a good case in point. Industrial robots were invented in the U.S. in the early 60's. When Unimation, an early U.S. robot company began selling to Japan, the Japanese quickly adapted and expanded on the robotic concepts. There were 30 to 35 U.S. companies making robots in the 1980's compared to one today. Japan currently has 250.

During the decades following World War II, Japan took the lead in many manufacturing areas. By the 1970's and 80's, American industry realized they were in trouble and began analyzing Japanese techniques. This led to the U.S. recognizing such techniques and concepts as World Class Manufacturing, JIT, design for manufacturability, etc. As excellent as these concepts are, they have been erratically and sparingly applied and now it's truly catch-up time. Still, I don't believe for a minute that the race is lost.

As president of the Robotic Industries Association and CEO of Adept Technology, a manufacturer of industrial robots and automation equipment, I have made it a priority to understand some of the problems facing U.S. manufacturers and to look for solutions. The following presents a brief analysis of Japan's successes and a plan for what many of us believe the U.S. can do to turn the situation around. Basically I see two themes: 1) the Japanese have concentrated on the manufacturing process (robotics, quality control, inventory management, CNC machine tools, and industrial automation) and 2) the Japanese government has aggressively provided extensive support to their manufacturing businesses. But they're not doing anything we can't do. In fact, a handful of top companies such as Motorola and Hewlett Packard are leading the way. They have begun extensive programs of employee training in world-class manufacturing, design for ease of manufacture, quality control, continuous improvement and automation.

At the same time most small to medium size American companies are woefully behind in industrial automation. To succeed they either need low cost, skilled labor or precision automation. Since finding a low cost, skilled labor force in the U.S. is not very likely at this point, the basic challenge becomes devising methods for building precision products that we design, and utilizing efficient and cost effective manufacturing process technologies.

Let's get back to the example of Japan and robotics. It was estimated in 1991 that the Japanese had 300 robots per 10,000 workers, while the U.S. had approximately 25 per 10,000. The Japanese had several sound reasons for their rapid assimilation of robots and automation technology. According to Shigeaki Yanai, research manager of the Japan Industrial Robot Association, these include rapid economic growth and forecast labor shortage; a need to improve productivity due to oil and yen crises; a shortage of skilled workers in small to medium size companies; a need for accident prevention and improved job conditions; technical advances which made robots cheaper and easier to use; and generous government incentives to promote the use of robots.

Japanese government programs related to robots are extensive and economically beneficial to all concerned. In direct R&D support alone, $120 million was allocated for advanced robot technology from 1983-90. Currently $200 million is earmarked for micro robots for 1992-95 and $100 million for robot sensors. Then there are tax incentives, including an R&D tax credit of 20% (limited to 10% of tax liability) and a mechtronics investment promotion tax system (7% of investment, limited to 15% of tax liability). Accelerated depreciation (1 to 5 years) is 30% for robots during the first year and up to 100% in one year for semiconductor equipment.

MANUFACTURING FOR THE 21ST CENTURY: TURNING IDEAS INTO JOBS (Clinton/Gore)

•170 Market-Driven Extension Centers.
Create 170 market-driven manufacturing centers to help small- and medium-sized manufacturers choose the right equipment, adopt the top business practices, and learn cutting-edge production techniques.

• Targeted Centers for Conversion.
Help convert our economy with manufacturing extension centers targeted to areas hard hit by defense cuts and staffed by our former defense personnel.

• A Manufacturing Training Initiative with Guarantees to Employers.
Fund private sector-led training centers that guarantee employees the skills they need for a high-wage future.

• Civilian DARPA.
Institute a civilian DARPA to invest in advanced manufacturing techniques and promote market-driven industry consortia.

• Investment incentives and Regulatory Reform.
Reform anti-trust laws and government regulations so that companies here can work together the way others do abroad. Create a targeted investment tax credit, exempt from certain taxes, to stimulate growth.

• Expert Promotion and Streamlined Export Controls.
Streamline East-West export controls and expand export promotion for small and medium manufacturers.

To complete the picture, the cost of capital in Japan is low. Ten year loans were available for robots in 1992 at 5.3%. The cost of equity capital was 3%-5% in 1990. The long term capital gains tax is 5%. A small business infrastructure support for robots was established in 1980 and is still in effect. Interest free loans are available up to $240,000 and there is a lease rate of 4.5% up to $160,000.

General small business support in Japan is also extensive. The Fiscal Investment and Loan Program was $29 billion in 1989 and credit guarantee association loans were $56 billion in 1987. There were 185 public testing and research centers in 1985. By comparison, SBA loans in the U.S in 1989 were $47 million and U.S. federally guaranteed loans to SB were $3.6 billion. Japan provides about 20 times the level of U.S. financing. Small businesses in this country do not enjoy these advantages.

Why has the U.S. been so slow in the assimilation of technology? According to the Robotic Industry Association there are four basic reasons. First, there has been an overall lack of interest in manufacturing. Several interrelated factors have contributed to this lack: senior management has not focused on manufacturing; most small/medium companies have poor manufacturing engineering skills combined with a lack of awareness of how to apply new technologies. These have been compounded by a desire to limit risk.

Second, an infrastructure for technology commercialization has not existed. Research, education and capital are the keys here. For example, the United States government traditionally has funded basic, not applied research (except for defense industries). Our trade competitors have systems for sourcing and commercializing technology from the U.S. With these systems they have been able to take our inventions (we're a creative lot), make them better, produce them more efficiently and then sell them back to us -- often dominating the market for these products. Well known examples include VCRs, camcorders and TVs.

Third, the U.S. lacks a technology education infrastructure, particularly in the area of manufacturing technology. And finally, access to capital has been limited. Not only is it expensive, but it has been generally unavailable, especially to small businesses.

America's industrial malaise can seem overwhelming looked at as a whole. According to the National Center for Manufacturing Sciences, we take an average of 55 years to fully assimilate a new manufacturing technology, while Japan takes an average of 25 years. When you break the problem down into its individual components, it becomes apparent that the solutions are not impossible and are well within the range of our capabilities. They do however require aggressive action. At the 1992 NACFAM conference in Washington D.C., I recently presented recommendations from the Robotic Industries Association and the Automated Imaging Association for stimulating U.S. industry. These recommendations address the issues of education, capital availability, taxes/tax credit, and technology advancement. They are all based on the tenet that government and business leaders must publicly support the importance of manufacturing in the United States. The RIA also endorses the Clinton/Gore document "Manufacturing for the 21st Century:Turning Ideas into Jobs" released September 8, 1992. The following briefly outlines these recommendations.

Education

The U.S. must improve its manufacturing education and technology dissemination infrastructure. This means expanding beyond the traditional university, trade school environment. Engineers, technicians, and managers in small to medium size businesses need knowledge in a hurry. There are two ways to address this problem - businesses helping businesses and government technology centers. Both should be expanded.

Motorola offers a model of business helping itself. Motorola has an extensive vendor training

THE INVESTMENT TAX CREDIT, INVESTMENT IN PRODUCER'S DURABLE EQUIPMENT AND THE EMPLOYMENT/POPULATION RATIO

Year/Quarter	Producer's Dur. Equip. Outlays % Change	Producer's Dur. Equip. Ave. Annual Growth Rate	Employment/ Pop. Ratio Ave. Annual Growth Rate	Date of Change in ITC
1957:1-1961:4	2.70	0.60	-0.70	ITC not yet instituted
1962:1-1966:3	63.90	11.60	0.60	ITC of 7% effective 1/62
1966:4-1967:1	-3.80	-14..40	-0.80	ITC suspended 10/66
1967:2-1969:1	11.40	6.40	0.70	ITC of 7% reinstated 3/67
1969:2-1971:1	-5.60	-3.20	-1.20	ITC eliminated 4/69
1971:2-1974:4	27.50	7.20	0.50	ITC of 7% reinstated 4/71
1975:1-1985:4	64.00	4.70	0.90	ITC increased to 10% 1/75
1986:1-1992:2	13.60	2.10	0.30	ITC eliminated 1/86

Calculations by the American Council for Capital Formation Center for Policy Research
1750 K Street N.W., Suite 400, Washington, D.C. 20006 (202)293-5811

program. They currently offer over 135 courses, ranging from Q.C. to JIT, to their vendors. This approach has been valuable to them and bears imitation and expansion. Regional manufacturing technology outreach centers should be expanded. A handful currently exist. Japan has 185.

Investment Capital

The RIA feels it is critical to improve capital availability, especially to small and medium size businesses. Small business loans have been nearly impossible to get, but a system of "guaranteed" loans could help get money where it's needed. These "guaranteed" loans might be partially or wholly guaranteed by larger businesses who are customers for small businesses. They don't necessarily have to be guaranteed by the government.

Tax Credits

RIA supports a targeted investment tax credit (ITC). The chart above shows how historically the status of the ITC has stimulated investments in production equipment and employment. This tax credit should be retroactive to December 4, 1992, per Rostenkowski and Bensten, and should not be offset by additional business taxes. This tax credit must be creditable against the alternative minimum tax. The current system is counter-productive. According to Andrew Lyon in "An Analysis of the Alternate Minimum Tax," AMT firms now have 17% higher cost of capital when installing robots.

Conclusion

This is a very crucial time. It is also a time for action. The new administration has made commitments and promises. There will be a flurry of new legislation regarding these matters in the next six months. We must get involved by telling our elected representatives our needs, wants, and concerns. The solutions are at our fingertips but we - America's industries, business leaders, legislators, and educators - must commit and work together toward a common end.

NACFAM

The National Coalition for Advanced Manufacturing (NACFAM), a non-profit, industry-led association headquartered in downtown Washington, D.C., is a rapidly growing coalition of firms, centers and associations committed to action at the national level to facilitate the modernization of America's industrial base. Specifically, NACFAM advocates: the creation of a national industrial extension program to assist small and medium-sized manufacturers; a fundamental reprioritization of the $76 billion federal R&D budget to increase funding for advanced manufacturing process technologies; closer cooperation between industry and national labs; a targeted investment tax credit for industrial machinery and equipment and related implementation costs; and greater federal support for vocational-technical education, skill standards, apprenticeships, "Tech Prep," and other programs to improve the skills of industrial workers.

As the focal point in Washington for industrial modernization, NACFAM has enjoyed a high success rate in securing new federal policies and programs to help achieve these goals. NACFAM's record of success in transforming public policy options into concrete change owes much to the size and strength of the coalition. NACFAM has 220 member organizations; 50 corporations (including several Fortune 500 companies); 150 centers of manufacturing technology extension, education and research (making NACFAM the largest association of such centers); and 24 national trade and technical training associations - representing between them over 70,000 firms and 25,000 technical education and training institutions.

For more information contact NACFAM, 1331 Pennsylvania Ave. N.W., Suite 1500 - North Tower, Washington, D.C. 20004-1703, (202)662-8960.

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CIRCLE CARD 208

Solving A Design Problem : A Coin Press

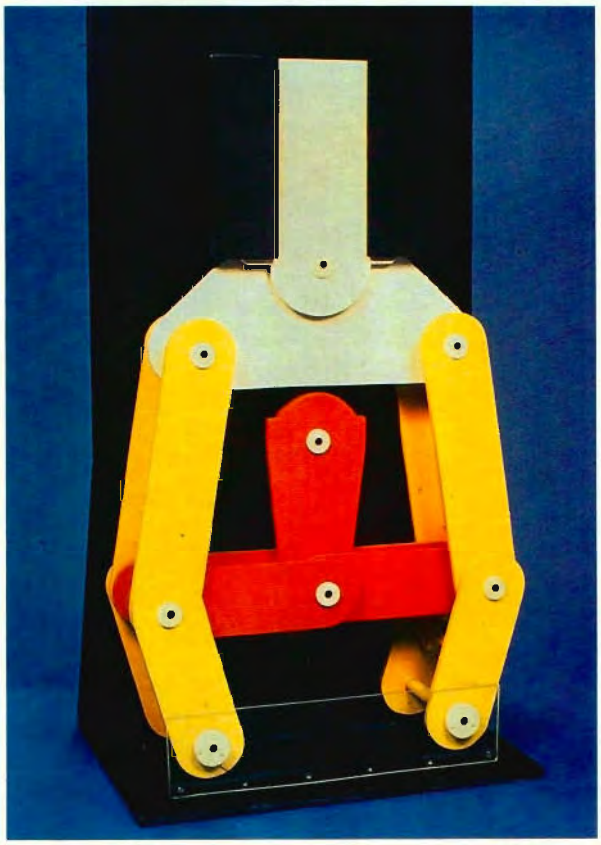
by Martin Faulkner

The staff and students of Cranfield Institute of Technology's School of Industrial and Manufacturing Sciences work closely with industrial manufacturers to solve real-world engineering problems. A good example is an analysis project recently completed for Verson Wilkins Ltd., Wednesbury, West Midlands, United Kingdom, a member of Verson International Group. The company was designing a coining press for the Royal Mint which provides twice the 600 stroke per minute speed of its current coining presses.

The most critical design issue was configuring the links between the crank and die to obtain sufficient dwell time at the bottom of the stroke so that a new blank could be inserted without jamming the press. Using traditional hand calculations and conventional CAD, the institute's staff and students were only able to limit die movement to 1.0 mm within 120 degrees of travel. Then they heard about a personal computer based kinematics package called De/Mec which uses a new technique called Genetic Optimization to optimize mechanism parameters. Modeling the mechanism and running an optimization routine made it possible to reduce die movement to 0.2 mm within 140 degrees of travel while maintaining crankshaft throw and centers to minimize modification cost.

Cranfield Institute of Technology offers a unique combination of theory and practice. Each year graduate students and staff of the institute form groups and tackle practical engineering problems in partnership with various industrial concerns. The groups have the same kind of objectives, budgets and deadlines found in real-world engineering. The project mentioned previously was partially funded by the Science and Engineering Research Council and the Department of Trade and Industry.

The goal was to produce a coining press with a target speed of 1200 strokes per minute with a peak load capacity of 160 tons force. A group of students looked into possible designs and came up with what seemed to be a reasonable approach. The bottom die lifts the blank coin into a collar where it meets the stationary top die. Then, as the bottom die comes back down, the top die is given a kick to eject the coin. Another blank is moved into position along a slot by a pair of fingers while the bottom die is in the lower dwell position. About 2/3 of the cycle time is required for lifting and forming the die leaving 1/3 for blank insertion. It was considered critical that the bottom die rest as still as possible for as long as possible in the bottom position so the blank could be inserted without jamming. It should be noted that the drive mechanism consists entirely of fixed links thus making it impossible to achieve absolute cessation of movement during dwell. A fixed link drive was considered to be essential to avoid springs or hydraulics in the drive mechanism and thus provide maximum reliability during high speed operation.



Model of the press mechanism with the crank at top center. The most critical design issue was configuring the links between the crank and die to obtain sufficient dwell time at the bottom of the stroke so that a new blank could be inserted without jamming the press.

A kinematic package was available on the mainframe computer based CAD/CAM system used by the school. However, building and altering the model took so much time that the students had to augment the computer output with purpose-written software programs, as well as hand calculations. They attempted to maximize dwell by lengthy and elaborate calculations on a series of designs using different link lengths and crank throws and centers. It soon became obvious the

number of possible combinations was so huge that only a very small proportion could be tried. After a considerable amount of work, the students found a configuration that would hold the bottom die position fixed to within 1 mm over 120 degrees of travel. Students and staff members were disappointed that the design had not been optimized but felt that this was the best that could be achieved within the time and cost constraints of the project. Verson began prototype construction.

It was at this point that a staff member heard about the De/Mec program. Like conventional kinematics packages, the program allows a mechanism to be modeled and its operation to be simulated on a computer. The unique feature of the program is its ability to automatically optimize a design according to constraints selected by the user. The user defines a set of target criteria consisting of any combination of positions and angles. These target criteria are to be achieved by system components at a particular time within the mechanism's age. The user can also specify the maximum and minimum values for the length of each component which serve as constraints during the optimization process. In addition, selected components can be held to a fixed size. Mechanism pivot points can also be held within a specified spatial region during the optimization process.

Cranfield staff and students modeled the drive mechanism and set up an optimization routine which would affect only the lengths of the link while the crank throw and center, and link pivot positions on the fixed frame were held constant. The reason was to minimize the cost of changes to the prototype which was already under construction. Minimum movement of the lower die in terms of position and time was specified as the goal of the optimization.

Once the goals and constraints were specified, the program was set up to optimize the dimensions of the components which it was allowed to vary. This was accomplished with a Genetic Optimization technique in which De/Mec examines thousands of possible alternatives within the specified constraints. The program recorded the results of each iteration and compared it with previous runs to see if improvement was shown. If the change was effective, the program would continue moving dimensions in that direction. If not, another tack would be taken.

The optimization continued until the goal was met or execution was stopped by the user. A series of optimizations were run on the same model which produced different but generally consistent designs. The program was set to run over several evenings to optimize the problem. Out of the 8 designs that resulted, the two most promising were selected for further optimization runs with the goals significantly increased. One of these optimization runs resulted in the best overall design. It had only 0.2 mm movement within 140 degrees of travel. Compared to the original design, the new design is expected to offer substantially easier feeding and a reduction in the risk of jamming which is especially critical in high speed operation.

It is interesting to note that in each of the optimized designs, the two horizontal links driven by the con rod were driven over center into an inverted vee. This was acceptable because there were no external loads to lock up the press. The design generated by the computer also reduced the actual movement of the die from 9 mm to 6 mm. This should be acceptable since new tooling which has recently been designed will require a lower compression allowance. The first prototype will be completed according to the original design. Once the first prototype is completed, tests will be performed to assure that the 6 mm die movement of the new design is acceptable. If it is, the second prototype of production models will incorporate the optimized link parameters.

Aside from convincing several confirmed skeptics of the value of computer-aided optimization, the De/Mec program has also demonstrated a number of other benefits. Force, torque and power results from the analysis can be exported in ASCII form and then imported into a spreadsheet to generate bearing load plots. CAD geometry and user defined loading functions can be imported into the program. All in all, the program has proven to be an essential addition to the design toolkit.

Part of Cranfield Institute of Technology's School of Industrial and Manufacturing Sciences campus.

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Selecting A CAD Platform

A Common Sense Approach

by Kenneth Billing

The operating systems war continues to rage and confusion over selection is everywhere. From the smallest shop to the Fortune 500 company, many CAD professionals are unsettled about what operating system or platform they should use for CAD. Nothing seems to be a safe bet. Yet budgets, futures, and careers are at stake.

The choices are many and attractive. DOS machines are cheap, plentiful and getting stronger daily. Unix workstations are powerful and getting more economical. Will there be a dominant platform by the year 1995? 2000? Should you switch to a different CADKEY platform now to be in a better position later? How can you benefit from one of the alternatives?

Choosing a platform for CADKEY needn't be a frustrating search. The right answers lie in basing your decisions on sound business goals and common sense. Let's take a reality check, a history lesson, and a business pulse to put things in perspective. With a basic survey of platform benefits you can easily make a wise platform choice.

DOS AND WINDOWS

Everyone is at least familiar with DOS. The large majority of CADKEY users work on DOS machines, but many are unsure about the future and how long DOS will exist. I've been criticized in the past for suggesting that DOS is dying. The fact is that DOS, as it was originally designed, is nearly dead today. The bulk of leading-edge application development takes place under DOS extenders and windowing systems. Cadkey, for example, has said farewell to 640K DOS and uses the Phar Lap DOS Extender for its DOS products.

If it were not for the abilities of technologies such as DOS extenders and Windows to kludge DOS, it would not have survived as long as it has. Microsoft even announced, years ago, that it would cease development of DOS, only providing incremental bug fix updates. It has only been because of its need to enhance DOS's support for Windows and to compete with Digital Research's DR DOS that it has continued to slowly evolve. I say slowly, because there is only so much you can do with an 8-bit, single-user, single-tasking, restrictive memory architecture.

The installed number of DOS machines will continue to keep DOS alive for many years to come.

But fear not. The installed number of DOS machines will continue to keep DOS alive for many years to come. Not everyone will migrate to something else anytime soon. And Microsoft has apparently recanted and will release a 32-bit DOS 6.0 in the near future. If you are happy with the performance and productivity you are getting from DOS machines today, after looking at the possibilities provided by the other platforms, then there is no reason to worry about alternatives.

Windows is the big news of the nineties. Windows 3.0 was an unexpected success, Windows 3.1 convinced some skeptics, and Microsoft is betting the farm on Windows NT. Nearly all software developers are writing for Windows, and Windows is more popular than DOS was in its "Wonder Years." Even though CADKEY will probably not have a Windows version in the foreseeable future, CADKEY users will continue to be confronted with Window's existence at every turn. Just the fact that some third party packages run under Windows and hook into CADKEY make it important that CADKEY users learn to deal with the phenomena -- even if they choose not to do Windows.

First, don't expect the Windows gushing to subside anytime soon. Microsoft has the marketing, developer, distribution, and media support to keep the parade going for years if not seriously challenged. However, in its simplest form, the current Windows product is a DOS power-user's bag of tricks all rolled into one package. Windows is a graphical menu system, DOS extender, virtual memory program, programming interface, and

common application memory space, all piled on top of meager old DOS. It provides 16-bit program execution, limited multi-tasking, and much more memory space to the single user.

It's the equivalent of an exotic sports car kit - the beauty and trimming of a high performer built on a makeshift framework and a junkyard engine. Pretty enough to fool most of the people most of the time, but not good enough to really race. And there don't appear to be any competitive challengers around. Or are there?

OS/2 AND UNIX

IBM has squarely positioned OS/2 to compete with Windows and, to some degree, Unix as the next-generation operating platform. And if you view OS/2 from a technical perspective, it is clearly a success. The entire architecture of OS/2 is a generation ahead of both DOS and Windows. Its 32-bit preemptive multi-tasking, multi-threaded power, object-oriented work place shell, and ability to integrate DOS, Windows, and OS/2 programs are a potent combination. Many in corporate America have committed to OS/2 and stand loyally with IBM.

The entire architecture of OS/2 is a generation ahead of both DOS and Windows.

Sadly though, IBM is no match for Microsoft in marketing.

In addition, a great deal of time, energy and resources were wasted in 16-bit versions before 2.0, and people's confidence in IBM is not what it used to be, especially in light of IBM's partnership with Apple in developing the PINK operating system.

Unix represents the only other viable option for the engineering desktop. Unix offers a 32-bit, programmer-friendly environment for building virtual memory, multitasking, multi-user programs for a variety of windowing and character mode interfaces portable to practically any computer. Yet it is Unix's flexibility and origin that haunt it with no binary standard for programs across different computers, resulting in thousands of only nearly compatible products.

Unix as a whole has never enjoyed successful marketing and standardization by one manufacturer. Its different versions are scattered over dozens of competing workstation vendors - Sun Microsystems, Digital Equipment Corp., Hewlett-Packard, Silicon Graphics, and others. If they were all united under a common standard, they would make a powerful adversary. In fact, several alliances have been attempted, but none have succeeded. And some say that Unix's opportunity to succeed DOS has passed.

As it now stands, each Unix version has its own dedicated following. Each of the various Unix platforms has benefits for the CAD user. For example, Sun Microsystem's products have enjoyed high popularity from a good price/performance value, software support, and open standards. DEC users enjoy compatibility with Digital's high end systems, long-standing support, and aggressive new PC and DECstation 5000 series offerings. The Silicon Graphics Iris Indigo represents a presentation graphics and multimedia dream machine with high-powered 24-bit graphics and stereo sound. And CADKEY runs on them all.

CHOOSING A PLATFORM

The compass for steering your organization straight through platform selection confusion should be basic problem-solving logic, the same logic that made computerizing your drafting department sensible. That logic is to apply the right tool for the job. Computers have become the right tool for most types of drafting and design. Apply the same logic to your choice of platforms for CADKEY, and you won't go wrong - at least not as far as anyone of us can see into the future of an industry that eclipses itself with progress every several years.

The key is to choose a platform on the basis of the tools needed by the particular user. Drafters who spend the majority (80 percent) of their day producing working drawings don't need sophisticated multitasking machines to get their work done. They run CADKEY alone most, if not all, of their day. They also represent a high number of CADKEY users, as opposed to engineers and designers, in most organizations with dedicated drafting departments. Therefore, it makes the best business sense to equip them with the highest performance single-tasking computers available - DOS. You can outfit a drafting work group with more performance for less money in DOS machines than any other platform. And your investment will provide productivity for more years. Five-year-old DOS machines are still at work (albeit probably in a lesser capacity), while many five-year-old Unix workstations are collecting dust.

Each of the various Unix platforms has benefits for the CAD user.

Designers and engineers, however, pose a different opportunity. They typically spend about 30 percent of their day actually documenting their work graphically. The remainder of the time is spent producing other documents, performing research, calculating, in meetings, on the phone, and so on. Their expense to the organization is higher in terms of compensation and benefits. Their value to the organization is higher in terms of producing revenues. And their numbers in the organization are often lower than drafters. Such diverse activities need the flexibility of a multitasking environment.

Their value demands optimum performance in order to be productive. And their numbers and expense justify the higher cost of premium computing tools.

For the DOS user unwilling to take on the complexities of the Uni: operating system, an OS/2 system may be in order. If Unix poses no threat to the designer or engineer, and commitment to Unix applications from the organization is assured, then one of the popular engineering workstations would fit well. The old rule of thumb for buying computers applies here to Unix platform selection as well: choose the needed applications first, then buy the computer they run on. Find the design and analysis software tools you need, then look for a workstation that supports them.

Make the most informed decision you can based on your organization's business objectives and your user's needs. And you don't need to standardize on only one, either. Connectivity options abound to network most types of computers today, and CADKEY operates among them easily.

Choose the needed applications first, then buy the computer they run on.

All such choices represent a time/opportunity risk anyway. At any particular time, you can seize the opportunity provided by the choices, leverage the productivity they give, and profit from them. Or you can lose time, miss opportunities, waste productivity, and suffer financially by procrastinating. Use reviews to educate yourself on the possibilities. Take the marketing hype with a grain of salt. Then see a CADKEY dealer who supports the equipment you're interested in. See it in action for yourself and arrange for an in-house evaluation if you can. Then make a decision with confidence and the knowledge that there are very few vindicated fortune tellers in the CAD business.

Users Speak Out for UNIX

— by Paul Bergetz

Today workers are required to process more information in a shorter time frame. With Unix workstations, complex problems can be handled simultaneously, allowing the worker to be more productive. For example, a designer may want to have multiple copies of a design on the system. One may contain an assembly with other windows having the individual piece parts available while running analysis programs in the background. This kind of productivity is not possible on DOS platforms. Also workers have a greater capacity when networked. While tolerating DOS hassles, people have begun to look for better solutions. Unix, a multitasking, high speed operating system, can be the answer. Unix has been around for many years, but hasn't shared DOS's popularity: the hardware platforms were considerably more expensive, the learning curve was very high, and the number of general applications was limited or just weren't available. Most of these limitations are changing. Indisputably the Unix operating system is complex, but it provides several very powerful features including speed, multi-tasking and excellent graphics.

Over the last five years the Unix environment has been changing dramatically. Hardware and software developers have designed new intuitive GUIs (Graphical User Interface). This means users no longer need to master Unix's esoteric intricacies. The operator can use the point, click, and drag methods without entering involved commands. Also during this time, the price of Unix workstations have been coming down and are now affordable for smaller businesses. I'm a VAR and Cadkey dealer and here's what two of my customers recently told me about their Unix systems.

Ray Johnson of Uarco, Inc. purchased a Unix based system recently. "During 1990 I was considering the purchase of Uarco's next CAD system. We had CADKEY on a 386 DOS platform and while we liked CADKEY, the 386 was not adequate for our needs. I felt Uarco needed something beyond even a DOS 486, so I chose a Unix based workstation. The main reason for switching to Unix was its ability to handle multiple processing. The Unix based system we purchased can print, plot, and run a (MS-DOS compatible) network in the background. All this while you're working on a job. Also we get superior graphics and the ability to upgrade. Our productivity increase was well over 50%."

Another case is the Middleby Marshall Cooking Group Inc. According to Loren Veltrop, the Silicon Graphics workstations they purchased allows CADKEY users in his department to share drawings and patterns at speeds equivalent to local hard disk drives. "The most important benefit is the ability to have multiple windows open at the same time. A user can have several copies of CADKEY open simultaneously and copy from one drawing to another... and the word processor can be active at the same time for preparing engineering change notices. On a DOS system they had to complete one operation, shut down the application and start another application to do the next task. Another benefit of our system is the ability to run DOS programs in a DOS emulation window. This is important because not all software we use is available on the Silicon Graphics. With Soft PC, an application like Lotus 123 and Microsoft Word can be used on the SGI."

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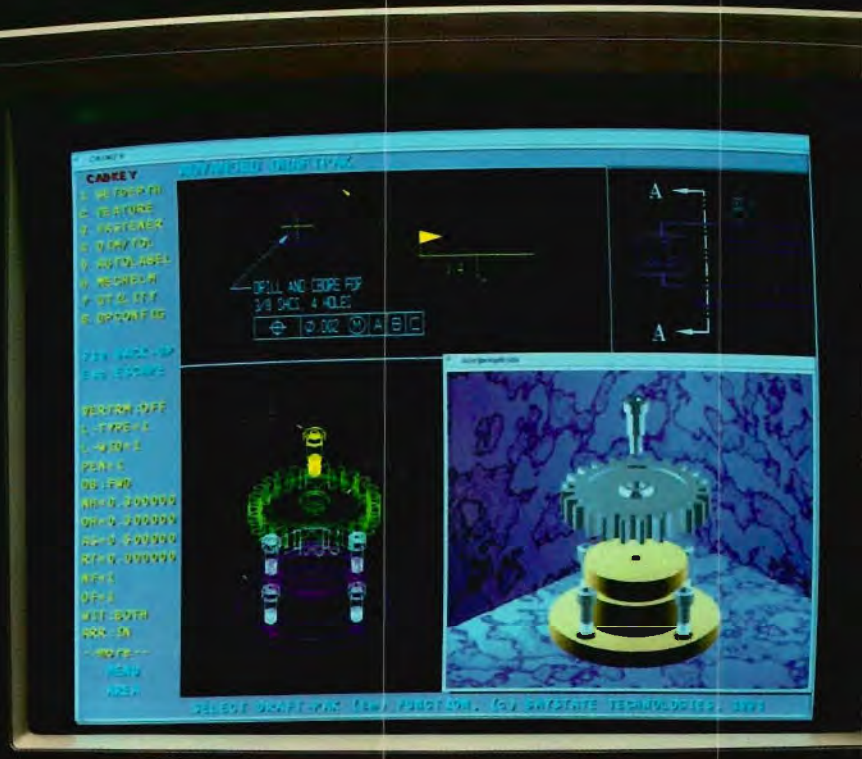
me·chan·i·cal de·sign (mĭ-kăn´ i-kəl dĭ-zīn) *n.* **1.** the creation and rendering of machines and mechanisms using a CADKEY® 6.0 system equipped with DRAFT-PAK. **a.** parametric generation of geometry for features, fasteners and mechanical elements from raw engineering data. **b.** split-second insertion of dimensions, details, labels, callouts and symbols by supplying only the most essential information. **c.** rapid production of multi-view CADKEY drawings on minimal instructions from a designer or draftsman. **2.** the facility to maintain a consistent, accurate database throughout a design process. **a.** instantaneous access to a vast computer library of ANSI/ISO and machine designer's standards and specifications. (*see also*, DRAFT-PAK Professional Tablet Overlay, Bill of Material Database Generator, DRAFT-PAK/Mold and DRAFT-PAK/Die)



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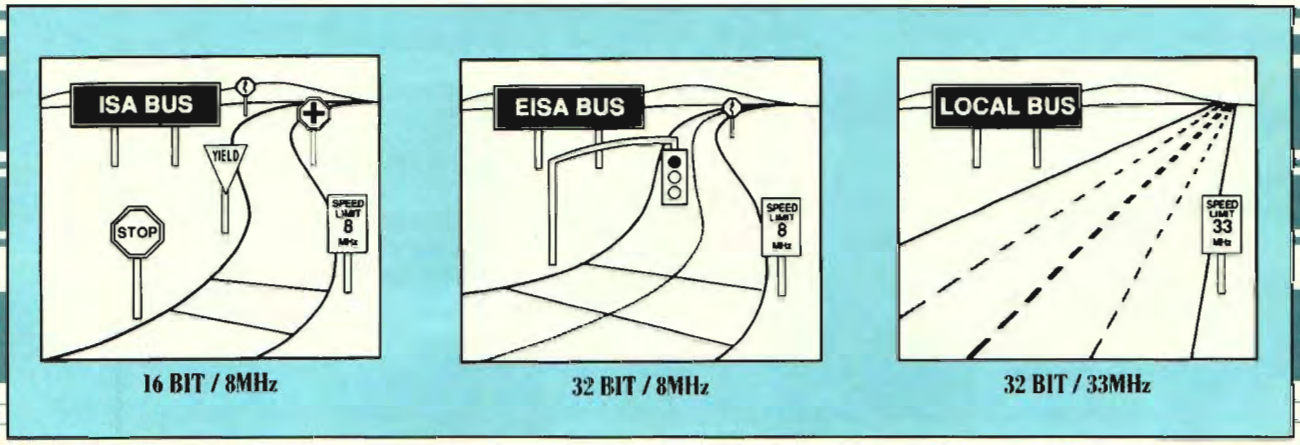
CIRCLE CARD 246

LOCAL BUS AND OTHER PC SPEED ENHANCERS



The Local Bus provides a wider roadway and operates at CPU speeds. Optimal Local Bus Architecture allows speed critical peripherals- graphics, disk and network -to interface directly with the Local Bus moving data at CPU speeds. Illustration courtesy of Appian Technology Inc.

by Claudia Martin

If you're after optimal CADKEY performance on a PC, it's important to understand the complex components that affect system performance. Although speed and performance appear to be a homogenous issue from the user's standpoint (how fast can I draw, autoscale the screen, revise and plot), a system is more than the sum of its parts. CPU speed, graphic cards, and bus capabilities affect processing, graphics, and data transfer speed in separate ways.

BUS ARCHITECTURE

ISA - EISA - LOCAL?

Local VL-Bus technology represents the biggest price performance breakthrough for PCs to date and is probably the most confusing and least understood option. A "bus" is the pathway for data transfer within a computer and from the computer to its peripherals (for example, from the CPU to the monitor, keyboard, digitizer, plotter, printer, etc.). A bus is rated by the number of bits of data it can transfer at a time. The higher the number, the faster the transfer rate. Common bus configurations are ISA, EISA and Local. ISA-based systems are locked into a 16-bit bus configuration operating at 8.33MHz. EISA-based systems have a 32-bit bus, but like ISA are limited to 8.33MHz. VL-Bus-based systems, on the other hand, have a 32-bit bus running at up to 33MHz. In practical terms, this means that ISA and EISA cannot take total advantage of the new crop of 32-bit graphic accelerators; the VL-bus can.

Local bus technology has existed for some time, but until recently there was no industry standard -- a real problem for the consumer. True, a few proprietary versions were produced, but making or buying proprietary "anything" in the PC world can be like shooting yourself in the foot. For the user, it limits the peripherals available and limits upgrade options. In fact, peripheral manufacturers (for example, high resolution graphic accelerators) waited. Wisely, they were not ready to invest in development for a potentially restricted market.

Then in August of 1992, the Video Electronics Standards Association or VESA, the industry's committee for PC graphic standards, established a VESA standard for local bus computers. A flurry of development followed as computer, graphic accelerator, and peripheral manufacturers raced to be first with the most. Last fall only a handful of VESA bus computers and graphic cards could address the VESA-VL 32-bit standard; by this fall nearly all major manufacturers will be (pardon the pun) on board.

The VESA VL-Bus architecture has many features to improve performance levels: 32-bit hard drive bus mastering can increase data transfer rates for things like plotting and file operations; true 32-bit graphics accelerators provide revolutionary graphic performance even at 1280x1024 resolution; and capabilities for future processor and BIOS upgrades are expanded.

Do you need a local bus for CADKEY? That depends on your needs and your budget. If your drawings are very large and/or you see the need of radically speeding

up design and drawing productivity, you should consider the option seriously, especially since the PC price wars have made even top-of-the-line equipment reasonable.

CLOCK DOUBLERS

For years Sun and other RISC workstations have run their CPU's at xMHz externally and 2xMHZ internally, a technology known as clock doubling. Clock doubling effectively allows for 100% performance gains. For example, a doubler chip inserted into a special socket on the mother board beefs up a 486/33Mhz to 66Mhz. The only catch is the mother board must have a socket to accept the chip. If you're going to purchase an entry level 486 or even 386, be sure it has a socket. Last year Intel began producing 486/50Mhz and 66Mhz DX2 CPU chips that incorporate clock doubling technology.

MISCELLANY

Other factors like disk access speed, type of math coprocessor and graphics accelerator affect system performance. For example, although a math coprocessor is built into every 486, special FPUs like the Intel RapidCAD can improve CPU 386 or 486SX performance significantly. Changing from Super VGA to a 32-bit graphics accelerator with a large-screen, high-resolution monitor can help the graphics display (where we humans really work) keep up with the CPU and the CAD operator.

WHAT'S NEXT?

Intel is already going beyond the 486 with the Pentium, slated for release in 1993. Intel has not dubbed their latest and greatest the "586" since it is a technically different animal. Industry sources say, however, that it will bring 64-bit capabilities to the DOS-PC world.

Operating on the likelihood, that those who purchase a 486 system now may not be ready to switch horses soon, manufacturers of high-end 486 systems are beginning to include a Pentium ready socket on their mother boards.

A Wish List

.. for a Top-of-the-Line PC Workstation for CADKEY

- 486DX processor
- VESA local bus
- Hard disk speed - as fast as you can afford
- Hard disk capacity depends on your needs; allow room to grow
- At least 8MB of RAM, more if you have very large drawings
- High speed graphics accelerator with high resolution (at least 1024 x 768 but 1280 x 1024 is better)
- Monitor - flat non-glare screen (at least 17"; bigger is better)
- Networking capabilities
- Rich Upgrade path

SCSI, RAM, Slots/Ports

If you can't have everything on your wish list, a good rule of thumb is to get the best and/or fastest you can afford and make sure upgrading is easy and affordable.

NEW GENERATION

Key Solutions evaluated four CAD-configured 486s for this article. Our goal was not to perform board-level or hardware performance bench marks, but subjective assessments involving how well CADKEY performed from a user's perspective - such things as speed of loading drawings and performance of complex operations. We used the standard CADKEY drawings Tractor and Analysis, because both are over 400K and quite complex. In addition to basic CADKEY operation, system considerations included graphics resolution and quality, options in the upgrade path, and ease of set up with CADKEY. In general, we found all these high-end 486s excellent in speed and performance. Any would be an invaluable tool in a high production environment. You just have to select the feature set and price that most closely fits your needs.

TRI-CAD ZX-350

The TRI-CAD VESA 486/66 (and all Tri-Star systems) combines the VESA VL-Bus standard with several other new technologies. The TRI-CAD systems are based on a direct processor-to-video 32-bit linkup, a true 32-bit VL-Bus graphic accelerator and DX2 486 processor clock doubling.

TRI-STAR uses the new ATI Mach 32 graphics accelerator which can actually operate at top speed with the VL-Bus. The AT Mach 32 also provides non-interlaced 1280 x 1024 resolution with 256 colors. The VL-Bus can also improve hard drive performance. For example, TRI-CAD's integrated 32-bit VL-Bus IDE controller can have a 32-bit SCSI II controller capable of Bus Mastering which offers significantly faster data transfer than EISA. It also has support for up to seven SCSI devices including SCSI-II hard drives from 210MB to 1.7GB. "Upgradability" is one of TRI-CAD's strengths. The modular system board includes eight slots (six ISA and two VESA VL) and room for four 5.25" exposed and four 5.25" internal devices. There is an Intel Overdrive socket and an Intel Flash EPROM BIOS.

TRI-STAR designs, assembles, markets and supports high performance microcomputers and hardware products. They specialize in CAD and LAN applications.

PowerDraft 486/50VLB

The Auto-Draft, CAD configuration offers solid and serviceable CADKEY performance. Even though it's not quite as fast as the local bus 486s when dealing with huge CADKEY drawings, it's basic 486 50Mhz, ISA bus is much faster than a 386. It also has a simpler feature-set, but if you don't need something, why pay for it? The price range on the Auto-Draft systems is lower and their expandability quotient is high. It works well with CADKEY as is, and you can upgrade as your needs grow.

At the time of the evaluation, Auto-Draft had not completed their VESA local bus configuration. Auto-Draft local bus 66MHz computers are now available which are comparable to the other units described here. Auto-Draft also has a complete range of configurations and prices.

Auto-Draft has unique and extensive service/support capabilities. These include a 30 day Customer Satisfaction program and free remote diagnostic service through S.O.S. Software from Landmark International via the built-in internal modem. In addition to direct support of the CAD systems, Auto-Draft offers many other services to CAD customers. They sell software for multiple disciplines, CAD specific peripherals and supplies through seven U.S. distribution points. A complete catalog comes with every system. An Auto-Draft CAD Services division provides national coverage for customers needing plotting and scanning services.

PCs FOR CAD

CADStation 486

Appian makes high performance CAD stations. Period. This means features which are options on many other 486s are standard on the Appian. These include dual monitor support, networking interfaces, and built-in network and disk security.

The small CPU 3"-high pizza box design looks like a traditional Apollo or Sun workstation, but it has a large capacity SCSI or IDE hard disk, a high end graphics card, a bus mouse, and two built-in ethernet ports built around sophisticated architecture. The only real concession to space is that there is only one 3.5" internal floppy drive.

We found the graphics display especially fine and fast with CADKEY. It is a little slow with Windows, probably not an obstacle for most CADKEY users. The CADStation is optimized for 1280x1024 resolution and speed. Even the base configuration comes with a TI 34020GSP, coprocessor-based graphics controller. Super VGA on the local bus lets you have high performance 1024 resolution on a second screen. Network, disk interface and graphics are all placed on the local bus for maximum speed. Expansion slots are EISA.

Servicing is simple. Appian has a unique modular, "snap-together" construction that permits the entire system to be taken apart and put together quickly. Even major assemblies snap out and can be replaced without tools.

Appian was formed from the merger of Renaissance, producer of the high performance graphics card Renaissance GRX, with ZyMOS Corp., a major developer of PC controllers and system architecture.

Xi Netserver 466EL

KEY SOLUTIONS 1993 WINNER EDITORS AWARD

Although we looked at Xi's top-of-the-line, Xi offers a complete range of affordable 386 and 486 machines -- all completely upgradable. Even the Netserver 466EL, which is a real power platform, has an amazingly low price tag. It is based on EISA architecture with a VESA Local Bus extension. Clock doubling is already part of the standard configuration, and by the time this is in print, Xi systems will be shipping with an Intel Pentium socket on board.

The performance was very fast and the graphics resolution and performances provided by the Orchid card was great. Technically, by providing two Local bus extensions for video and network/hard drive interfaces, the Xi466EL reaches the bus mastering data transfer rate 132MByte/sec, about 15 times the 16 bit ISA. In addition, the four EISA slots on the mother board allow the installation of multiple network cards and hard disk controllers at the standard 32MBytes/sec. EISA transfer rates are 4 times the ISA performance.

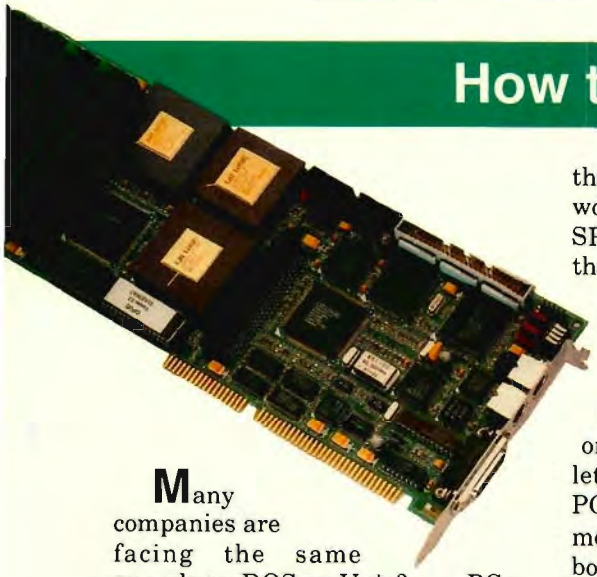
Xi is so proud of their speed and components that they will mail or fax potential buyers a complete set of benchmark results on their system of interest to compare with the benchmarks of their competitors. They are also proud of the fact that all their systems are "Made in U.S.A." and exported all over the world.

486 PC Workstations

	CADStation 486 *Appian Technology*	*PowerDraft 486/50VLB* *Auto-Draft*	*Tri-CAD ZX-350* *TRI-STAR Computer Corp.*	*Xi466EL Netserver* *Xi Computer Corp.*
STANDARD FEATURES				
Direct Price	$5295 - $6295	$3585 - $4385	$3300 - $6000	$3799 - $4139
Bus/Architecture	32-bit Local bus	ISA	VESA/VLocal bus	EISA + VESA Local bus
CPU	Intel 486DX2 33-66Mhz	Intel 486DX 50	Intel 486DX2 50/66Mhz	Intel 486DX2 66Mhz
BIOS	FLASH		Flash EPROM	AMI
Hard Disk Opts.	210MbIDE or 213 or 450MB SCSI 540MB SCSI	Maxtor 213IDE(15ms) or 213MB SCSI EISA available	Maxtor 210MB 15ms SCSII	215MB Maxtor (420MB Fuji/12ms)
Floppy Drives: 1.2/1.44	0/1	1/1	1/1	1/1
System RAM standard/max	16MB/128MB/8MB/32MB	8MB/16MB/32MB/128MB	8MB/64MB	8MB/128MB
RAM Cache	128K	256K	256K	256K write back
Case	Slim desktop/3" high	Full Tower	Full Tower	Full Tower
Power Supply	145 W Autoranging	250 W	230 W	300 W
Ports:Parallel/Serial	1/2/bus mouse	1/2	1/2	1/2/bus mouse opt.
Graphics Brd	Rendition TMS34020	Stealth 24 VL 32-bit	ATI 32-bit VESA-VL 2MB VRAM	S3 86C805 VL-B
Monitor: size/config/max.res.	17" or 21" flat 1280x1024	17" flat 1024x768	20" MPR-II Flat 1280x1024	IDEK 2317/1280x1024
Dual monitor Support	Yes	optional	Yes	Optional
EXPANDABILITY				
Intel Overdrive Socket	Yes	Yes	Yes	Yes
SCSI Support	Yes	Yes	Yes	Optional
Network Interface	2 built-in ethernet ports	Available	Optional card	Optional card
Free/total 32-bit slots	2/1 Eisa	2/2	2VL-bus	3/5
Free/total 16-bit slots	n/a	4	6 ISA 16-bit	6/8
SPECIAL FEATURES	Ethernet & disk on the local bus	Internal modem 3-button mouse	Lifetime toll-free tech support & labor	EISA bus w/ 2 VESA compliant local bus ext. Pentium socket
SERVICE & SUPPORT				
Warranty	One year parts & labor	Two years	30 day return/24 Month Limited	One year parts & labor 30 day money back
On-site service price/term	One year/ free	One year available	Free 1 year NCR	On-site free replace- ment
Turnaround Days	24-hr parts	Overnight parts	48-hr parts	24-hrs ports
Toll free tech support	Yes	Yes -lifetime	Yes	Yes
Daily support hours	M/F 8-5 PST	M/F 8-5 PST	M/F 7-6 MST	M/F 9-6 PST
CONTACT	Appian Technology Inc. 477 N. Mathilda Ave. Sunnyvale, CA 94086 800/737-7426 408/730-5473 408/730-5400	Auto-Draft 3100 Airway #106 Costa Mesa, CA 92626 800/733-7238 fax 714/751-5208 714/751-8501	TRI-STAR Computer Corp. 120 S. Weber Dr. Chandler, AZ 85226 800/729-7488 fax 602/961-4010	Xi Computer Corp.. 980 Calle Negocio San Clemente, CA 92672 800/432-0486 fax 714/492-6571 714/498-0858

The Dilemma: DOS or Unix?

How to Have the Best of Both Worlds



Many companies are facing the same quandary: DOS or Unix? PCs or workstations? Critical questions include: how to maximize the investment in existing hardware and software while taking advantage of new computing capabilities; how to continue to rely on the tried-and-true DOS spreadsheet, word processing, database, communication, and internally developed software, while also taking advantage of the powerful graphical interfaces, multi-tasking, networking, and sheer processing power offered by SPARC and Unix?

One alternative is to install a workstation beside each PC. But this is costly in terms of purchase and maintenance dollars, not to mention precious desktop real estate. Another alternative is to replace PCs with workstations. But simply switching hardware is just the beginning. You also have to migrate applications, data, peripherals *and users* to a new environment. What about the cost of replacing existing DOS software with comparable Unix applications? Who is going to migrate internally-developed DOS applications? What about the loss of productivity as users load new software and learn a new system?

SPARCard Solution

The Opus SPARCard™ is an add-in board that can provide powerful RISC SPARC-based workstation capabilities to ISA/EISA PCs. SPARCard 1+ is a 25 MHz board that provides a 15.8 MIPS SPARC workstation inside the PC and SPARCard 2 is a 40 MHz board that delivers 28.5 MIPS to the desktop. With SPARCard plugged into your PC, MS-DOS and Unix run simultaneously on your existing hardware, each in native mode on its own processor. This setup lets operating systems share the PC's existing keyboard, monitor, mouse and floppy disk drive. Since both DOS and Unix run native mode on their own processors, there is no loss of performance.

A touch of a hot key or mouse click switches you between DOS and Unix. Jobs started in one operating system environment continue to process after you switch to the other environment. Imagine the benefits of processing DOS and Unix applications concurrently.

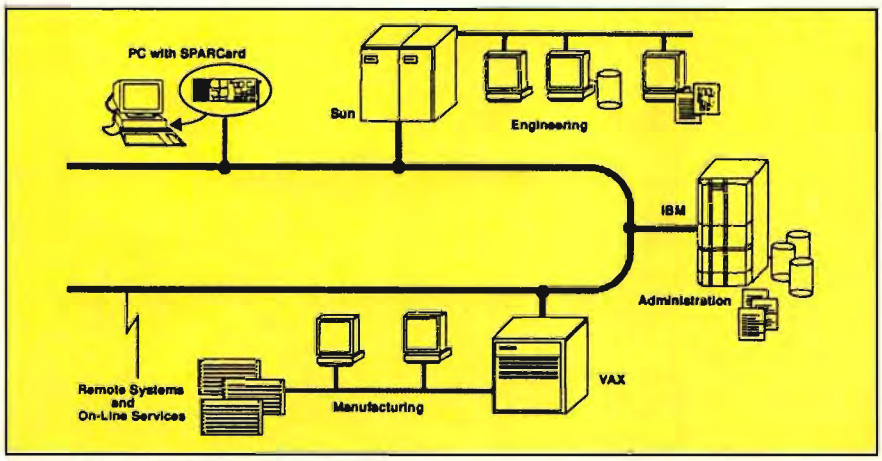
SPARCard 2 includes software for file transfer between environments; existing data is accessible from both DOS and Unix. A user with an Opus SPARCard and Opus FS software can share information and resources with high performance workstations, minicomputers, and mainframes running Sun Microsystem's Network File System (NFS™) protocol. With OpusFS software, DOS and Windows users can take advantage of the compute, print, and mass storage resources on an NFS network. In addition, Unix data files and applications are available to OpusFS PC users.

Unix system control through Windows 3.0 interface relieves the PC user from having to learn the arcane command language of the Unix system. Cut-and-paste capabilities exist between DOS and Unix applications, just like within any single operating environment.

SPARCard System Architecture

SPARCard 2 is a complete SPARC main-processor board laid out as a PC add-in card. It includes a custom ASIC which allows SPARCard to communicate directly with the PC/AT bus. The board layout includes an Ethernet™ interface, SCSI interface port, dedicated floppy drive interface, expansion capability for up to 64MB of main memory, SBus expansion slots, two RS-232 serial ports, keyboard/ mouse port, and audio I/O port. Optionally included is a video frame buffer that can be used with nearly any VGA, Super VGA, Extended VGA or Sun-resolution monitor.

SPARCard is certified SCD-compliant by SPARC International, assuring compatibility with thousands of SPARC applications.



SPARCard-enhanced PCs running OpusFS provide PC users with seamless access to corporate-wide mainframe, minicomputer and workstation resources.

STUDENTS + CADKEY 1.4 = LEARNING and RESULTS

by Frank Simpson

A Sophisticated Plankton Sampler

When Cadkey, Inc. donates software to schools as part of its educational grant program, Version 1.4E is the tool normally sent. Some CADKEY purists and hot shots might think this older version couldn't be adequate, but students at the University of New Hampshire debunked that idea by producing a sophisticated plankton sampler for oceanographic research using CADKEY 1.4 and some good old-fashioned Yankee ingenuity and talent.

Getting the REPPS (REmote Programmable Plankton Sampler) ready for submersion.

Before their successful REPPS (REmote Programmable Plankton Sampler) project, no satisfactory method existed for gathering zooplankton samples significant enough for aquatic food chain research. Zooplankton, a special variety of the free-floating organisms common in fresh and salt water, forms a crucial link in the biological food web of aquatic systems.

A multidisciplinary team of four students led by professors Kenneth Baldwin (mechanical/ocean engineering) and Randy Olson (zoology) took on the challenge in 1990. The students were Jeffrey Chace (zoology), Jonathon Miner (computer science) and Kevin Landerman and Christopher Quinn (mechanical/ocean engineering).

The team's goal was to design and build a portable plankton sampling system. The specs were tough. Mechanically it had to be fully automated, programmable, submersible to a depth of at least 100 feet, able to operate continuously under water for periods from 24 to 48 hours, and require only two people to operate. Scientifically, the system needed to be able to collect a variety of samples and other critical research data with minimal effort and maximal research flexibility.

Based on the failure of an earlier 1988 UNH design attempt, the 1990 team decided that their plankton sampler should contain no moving parts - or at least as few as possible. Several initial designs were created in CADKEY for comparison and analysis. The backbone of the final design selected is a manifold that distributes water from an intake pump to 12 individually programmable collection chambers that are lined with 75-micron nytex mesh. A solenoid valve controls each collection chamber and a thirteenth solenoid controls a purge valve that flushes the system before every sampling operation.

Tattletale Model IV, a battery-powered, single-board, date logger/controller, operates the solenoids. As the Tattletale performs its sampling program, each sample taken into a collection chamber is preserved by a formalin sponge at

the bottom of the tube-like chamber. The Tattletale also records environmental data critical to the plankton population being sampled. Flow, temperature and conductivity data are recorded from a flow meter mounted in front of the intake pump; probes mounted next to the intake pump monitor temperature and conductivity.

Prototype to Production

With a design on paper, the students then built the prototype with polyvinylchloride (PVC) plumbing parts and parts machined at UNH. They tested the REPPS three times at three varied loca-

The team used good, old-fashioned Yankee ingenuity and talent

tions. It worked so well in prototype that the four not only earned "A" grades for the project, but the following summer the University of New Hampshire, Northeastern University, and Brown University jointly commissioned the manufacture of three production models. Janco, Inc. of Dover, New Hampshire, a manufacturer of custom industrial plastic and electronic products won the project. Janco hired Kevin Landerman to handle the job. Kevin took time off from school, but when the REPPS were delivered to the Universities for final testing, he returned to finish his degree in mechanical engineering in December 1992.

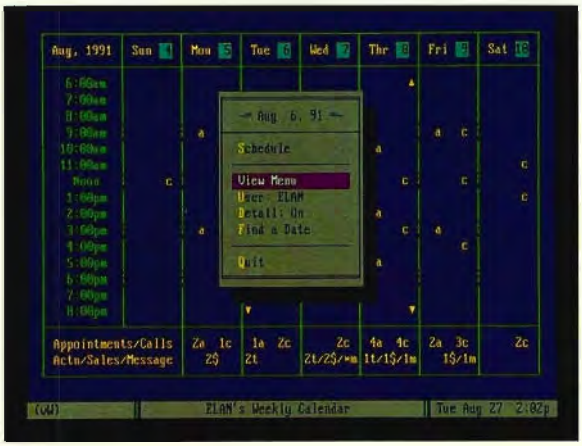
Kevin gives a final report on the success of the plankton sampler. "In September, Northeastern University successfully deployed the REPPS to a depth of 100 feet for 48 hours and brought back loads of plankton. I really had a lump in my throat as I thought about how much time and effort I put into this. It really works!"

Editors Note to Kevin: Those are the "perks" and what engineering's all about! By the way, Cadkey is pleased to have contributed to the education of a good engineer. Congratulations!

GOLDMINE 2.5

by Claudia Martin

When the GoldMine contact manager arrived, it seemed unlikely that a program normally advertised as a sales tool could have value for **Key Solutions** readers because concurrent engineering professionals and projects have special needs - especially on a network. I was wrong! Obviously, "hard-core" engineering and manufacturing issues and expertise are the core of any concurrent engineering endeavor, but communications, organization and scheduling are equally important. That's where GoldMine can fit in. It is a powerful productivity tool for anyone who needs to keep track of people, activities and schedules.



Basically a relational database, GoldMine lets you keep track of people (names, addresses, phone numbers) with detailed history (contacts, outcomes, comments) and notes. It lets you schedule meetings, phone calls, and other activities and display them on a weekly or monthly calendar. You can set an alarm to remind you of any scheduled item. Many contact managers do these things, but GoldMine does more.

When it comes out of the box, the fields, screens and resident form letters, reports and memos are set up for a sales organization. Not to worry! It can all be easily customized and it doesn't really take long. In addition to the 20 predefined and 15 user-definable fields, you can add an unlimited number of fields and/or create your own entry screens, form letters, labels and reports. On a network this means each department can have a personalized setup, but use the same system and data.

We were able to use this program quite proficiently in a couple of hours, although it's so powerful we were discovering exciting features for days. The pull down menus are logical, clear and uncluttered. The excellent documentation (a rarity) has a well thought out and unique indexing system, helpful illustrations and is logically organized and well written. Context sensitive on-screen help is also available.

Network Features

While other contact managers offer similar features, most were originally designed for the single computer user. Based on the Groupware principle, GoldMine's networked version offers superior features for staff and department interaction - its real advantage for a concurrent engineering environment.

The group scheduling features rival stand-alone network schedulers. It lets you quickly schedule users and resources, finding available times automatically -- all with R.S.V.P. verification. You can delegate tasks and track results automatically.

"Remote transfer synchronization" is a unique GoldMine feature that can update remote GoldMine systems with changes, merging the changes on records at the field level. This means even remote notebook users can transfer data electronically, allowing them to update and be updated with the home office.

Security

In a multi-user setting security is always an issue, but GoldMine has this base covered too. It has a two-tiered system for more flexible access control in which each contact record can contain an optional "owner" or can remain a "public" record. It also provides five levels of security for the network. The system administrator can quickly and easily upgrade a user's security settings without manually changing various menu-level access settings. In addition, sophisticated record curtaining allows the system administrator to hide information on a contact record from users who do not possess ownership.

Output

Output options are many. They include mail merge, fax merge, an unlimited number of forms (letters, memos, fax forms), custom reports, direct faxing via CAS Fax board or shared Fax server, and document management tracking. On a system with a modem, GoldMine will dial calls and faxes for you. The built-in text editor is clunky and rudimentary,

but GoldMine lets you link to your favorite word processor and import text files from anywhere into your documents. User chat and message taking is available for network users. The program is dBASE compatible and can import/export ASCII, DBF, and SDF files.

GoldMine is an integrated program that takes full advantage of the networked environment. Currently available for DOS, GoldMine 2.5 runs on any IBM-compatible portable, desktop or networked PC. A Windows version in the works should be released later this year. GoldMine has a suggested U.S. list price of $295 for a single user, $895 for each network five-user increment. Site licenses are available.

Contact ELAN Software at 800/654-3526 or Fax 818/999-9903.

Using a FAX-Modem with GoldMine

SupraFAXModem V.32bis

Fax-modems are wonderful productivity tools which let you send faxes directly from files in your computer, bypassing the sometimes temperamental mechanical and scanning processes of standard fax machines. We found one incredibly useful during the GoldMine evalution. We used the SupraFAXModem™ V.32bis from Supra Corporation. GoldMine dialed the fax numbers, transmitted the faxes, and took care of the entire process transparently. Setup was relatively easy and the software and hardware functioned smoothly together - a good combination.

The SupraFAXModem features 14,000 bps data transfer rate for sending and receiving faxes, supports Class 1 and 2 commands and is compatible with millions of Group 3 fax machines in use. It senses the speed (from 300 to 14,400 bps) of the sending or receiving unit and adjusts. This feature worked great from our end, but after transmitting to contacts with older, slower modems, we suggested that they definitely look at new, faster models.

Versions are available in Windows™, DOS™ and Macintosh™ packages. Voice capabilities and caller ID can be added later this year. The 14,000 bps version costs $399, the 9600 bps version $299.

For more information call Supra Corporation, 800/727-8667.

PROTOTYPES ON THE DESKTOP

"Economical, expeditious, small prototype" used to be a double oxymoron and there were no good alternatives. The smaller NC units available were pretty flimsy with marginal to questionable accuracy, so most companies did not use them. Prototype production on a full size NC machine or in a model shop took a l-o-o-o-n-g time and was(is) very expensive. The Roland Digital CAMM-3 3000 mill, released late last year, changes all that.

The CAMM-3 is touted as a "desktop modeler," but don't be put off by the terminology. The CAMM-3 is the real thing, a solid, well-engineered, professional 3-axis milling machine - definitely not a toy. It's just diminutive, which is the advantage. **Key Solutions** staff just ran the CAMM-3 Model 3000 through its paces with CADKEY and CADKEY®NC (CUTTING EDGE).

The Hardware

The two CAMM-3 models have similar features. Both cut wax, plastic, wood or other non-ferrous materials, provide a mechanical resolution of 0.0004", serial and parallel interfaces, an LED display, and accept a maximum tool size of 0.375". The larger 3000 measures 19.5" x 23" x 23". It has the larger cutting range with an axis travel area of 7" x 6" x 6" and an X-Y table size of 19.5" x 6.5". The 3000's maximum cutting speed is 0.79 ips and spindle speed range is 3,000 -10,000 rpm. Slightly smaller, the Model 2500 measures 14.17" wide x 17.72" high x 15.75" deep. The 2500 has a cutting speed of 1.18 ips and a spindle speed range of 3,000 - 12,000 rpm. Other 2500 specs include an axis travel area of 4.72" x 3.9" x 3.9", and an X-Y table size of 14" x 5.3".

A vice supplied with the mill holds the raw stock. The cutter is zeroed using a simple mill machinist edge finder. This is easy to accomplish because of the detachable pendant control attached to the front of the mill by permanent magnets. The control has four categories for controlling mill movement: jog, positioning, data input and control. Three thumb wheels control movement in the three axes. Buttons labeled +X, +Y, -X, -Y, +Z, and -Z allow the user to rapidly traverse in any of these directions. To position the "Z" axis, an LED sensor switch is placed on top of the material and sensed in the "Z" axis movement, stopping at a preset distance from the material surface. Spindle speed is set from the pendant control; feed rate is set from the G-code file.

CAMM-3 Model 3000

The Software

CAMM-3 comes with Roland's Basic CAD/CAM Software and G-Code Driver, but CADKEY and CADKEY®NC users won't normally need (or even want) to use it. CADKEY®NC has more complete post processors, drivers, and features for the CAMM-3, and CADKEY is by far a more full-featured 3D modeler. With the CAMM-3 / CADKEY®NC combination you can perform standard straight wall pocketing, hole drilling, peripheral straight wall milling and surfacing from simple to complex contours with NURBS surfaces.

Hands On

We primarily experimented with machining in plastic and wax because both provide an excellent, inexpensive alternative to stereolithography for prototypes. Not only is stereolithography expensive, it's far from perfect. When a part comes back from stereolithography, additional cleanup machining is often necessary. Machining wax models for investment casting is one of the fastest prototyping methods we know. CAMM-3 machines wax well and Roland supplies ample quantities of model makers wax.

We tested the CAMM-3 with aluminum, brass, wood and plastic. It can also cut machinable ceramic. We had to slow the feed rate down with metals to avoid breaking the carbide end mills or put too much load on the spindle bearings. Nevertheless, we were pleased with the speed and efficiency with which we were able to accomplish our task. Once we started sending data, the chips started to fly. We could stop the cutter movement using the pause

button on the pendant. All in all, the CAMM-3 acted like a full sized NC machine.

CAMM-3 comes with an affordable price tag of $10,000 to $12,000 and a precision unmatched in this price range. We were impressed with its overall price/performance and envisioned several practical applications. Engineers could create small prototypes and finished parts right at their computer workstation or it could be a thrifty choice for light to medium production of finished parts. Other applications could include PC board drilling, 3-axis machining, and other processes normally requiring expensive stereolithography or NC production machinery. It also has a place in education; students learning to edit G-code can output designs to CAMM-3 for proofing and review, eliminating the need for expensive CNC machines. Best of all, a design engineer with this type of setup in his work area can produce many types of prototypes similar to the production part without tying up costly production equipment and NC staff time.

Prototypes created on the CAMM-3

For more information, contact Roland Digital at 714/975-0560.

CADKEY Gets 12x Performance Boost with Vibrant Graphic Device Drivers!

DL-Xpress/CK™ is the new high performance graphics device driver for CADKEY®6. Expanding on Vibrant's ProRes™ CADKEY driver, DL-Xpress/CK features a 32-bit display list using Vibrant's TRUE ERASE™. TRUE ERASE ensures the use of minimum system overhead with maximum graphics performance on **any** DOS-based PC graphics board. Real-time panning is also available in DL-Xpress/CK by using the SHIFT key in conjunction with the cursor positioned at any screen edge. DL-Xpress/CK™ is included in every copy of CADKEY®6 at no charge.

Soft Engine™/CK will begin shipping in May 1993 to all new CADKEY®6 customers and CADKEY Maintenance Contract owners. Soft Engine/CK extends DL-Xpress/CK by adding advanced user interface features such as Birds Eye, Worms Eye, and icons. Birds Eye provides an overall view of the current drawing which can be attached to any viewport(s), allowing real-time dynamic zooming and panning within the viewport. Worms Eye is like a magnifying glass view within a drawing, allowing the user to examine drawing areas at a very deep zoom level without zooming the entire drawing. The icons are graphical entities which can be assigned user-specified functions or a series of functions, so repetitive operations can be executed with a single button press.

Soft Engine/CK delivers improved graphics performance. Depending on the specific CADKEY operation, Soft Engine/CK has shown performance improvements from 30 percent to up to 30 times. A demo of all Soft Engine/CK features is included on every DL-Xpress/CK.

Vibrant has been doing good things for CADKEY for several years. Pro Res CADKEY, the first CDE driver for CADKEY, eliminated the need to preload a driver before CADKEY could execute. It listed 131 different graphics boards with options for selecting any color depth or graphics resolution that each board supports. Newer versions of Vibrant's graphic drivers for CADKEY are available to users via the Cadkey BBS. Check the BBS first if you're having driver problems or if your driver version doesn't support your graphics board. Vibrant Graphics has a commitment to support every major graphics board or graphics chip set in the industry. New drivers are released often.

Vibrant Graphics-A Closer Look

Vibrant Graphics, located in Austin, Texas was founded in 1989 to create a software-only display list driver for AutoCAD®. When the first version of Soft Engine for AutoCAD was released, Vibrant immediately became recognized as a significant player in the driver business. They quickly expanded beyond the AutoCAD business. Even in the beginning a principal software developer of Soft Engine (a consultant to Vibrant at the time) was continuing independent development of a CADKEY driver. Then in 1991, the company changed hands and the principals decided to greatly expand the Vibrant vision and product line. They began actively developing

	Redraw Time	Zoom Time	Pan Time	Overall Time
With 8514				
ProRes Cadkey	151	201	404	756
DL-Xpress/CK or Soft Engine/CK	*33*	*16*	*9*	*58*
With Super VGA				
ProRes Cadkey	163	220	436	820
DL-Xpress/CK or Soft Engine/CK	*40*	*32*	*36*	*108*
With S3				
ProRes Cadkey	154	202	402	756
DL-Xpress/CK or Soft Engine/CK	*34*	*15*	*9*	*58*

CADKEY/Vibrant Graphics Benchmarks show up to 44X speed gains. All times are in seconds. All benchmarks done on a 486/25 MHz with 1024x768 resolution at 256 colors.

drivers for CADKEY, all of Autodesk's DOS protected-mode products, and MicroStation. And Vibrant grew -- from five people in 1991 to 24 as of January 1993.

The Cadkey/Vibrant Alliance

Early on, Vibrant realized that success as a driver company depended on strategic partnerships with major CAD companies and graphics board manufacturers. With that goal in mind, Vibrant Graphics, Inc. and Cadkey, Inc. formed a strategic partnership in March of 1992. Vibrant became the driver development company for Cadkey, Inc. Vibrant's first goal was to develop a Cadkey Dynamic Extensions (CDE) based "base level" driver to ship with every CADKEY and CADKEY®NC. Pro Res CADKEY was the result. Their second goal was to develop an advanced high level display list driver. Soft Engine/CK was the result.

Cadkey, Inc. realizes some real advantages through the Vibrant alliance. By assigning graphic driver development to the experts in the industry, Cadkey frees a tremendous amount of its engineering resources to focus on core CADKEY product development and enhancements. Vibrant's history shows they can and will provide state-of-the-art driver products and dedicated customer support. In short, all parties win as third party vendors enter the CADKEY product mix.

Vibrant Graphics Inc. is excited about future driver products possible within a 3D CAD package such as CADKEY. The Vibrant engineering staff is already gearing up for the challenges that lie ahead. Soft Engine/CK is the first major step.... and the future is wide open!

Zeta Provides High End Pen Plotting Capabilities

Pen plotters are alive and well and are expected to remain competitive for many years because of their multi-color output quality, large format, media versatility, software compatibility and overall price/performance. But, they're not all created equal. While some manufacturers are shifting their pen plotter focus to the low-end market, the Zeta E-size 936 and D-size 924 offer a wide range of versatile features for the most discriminating pen plotter user.

Two features that make the Zeta 900 series easy and efficient to use are paper handling and pen/ink. PenMinder™ is an optional system that uses an infrared beam to sense when a pen has run out of ink, then switches to the next available pen or suspends printing until the pen is replaced. The plotters support eight pens and a full range of pen types.

All standard media may be used including cut-sheet, plain roll and pin drive paper. Tractor feed for sprocket-fed paper assures straight paper feeding on plots up to 120 ft. long.

PS models include the optional power take-up stand for continuous, unattended plotting. Converting between cut-sheet mode and roll operation takes less than one minute.

Zeta 936is Pen Plotter with PenMinder™ Ink Sensing System

We did an 11ft. plot on the Zeta that would have choked most inexpensive plotters. The Zeta handled it with relative ease.

All Zeta plotters support GML, HP-GL, Tektronix Plot 10, and CalComp 960 plotting languages. An optional built-in 32/70 coaxial interface is available for direct connection to IBM mainframes. It also supports a variety of international character sets, including U.S., German, French, Spanish, Swedish, Danish and JIS ASCII.

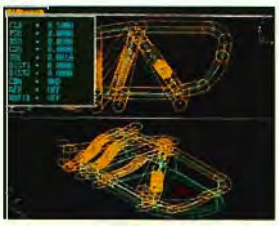
The Zeta, being a workhorse of plotters, is relatively maintenance free. Therefore it has tremendous market acceptance.

For more information contact Zeta Graphics Corporation - 510/372-7566 or fax 510/372-7431.

YOU'RE LOOKING AT A $5,500 ERROR THAT COULD HAVE EASILY BEEN AVOIDED.

CAD/CAM data incompatibility and transfer errors are big problems for automated machine shops. A recent NTMA* study found that ***51%*** of companies surveyed experienced data translation difficulties, and ***25% had to completely re-create data.*** Every "miss" costs between $4,000 and $5,500 in scrap, rework and delivery delays, not to mention a reduction in competitive position and lower profits.

Why take chances? With CADKEY® and Cutting Edge® you'll have 100% failure-free CAD to CAM data transfer. You can also transfer files from another CAD with IGES, DXF and CADL® utilities included with Cutting Edge.

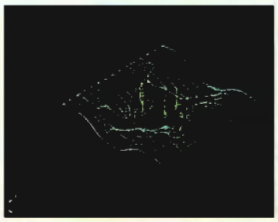


Cutting Edge features simultaneously active viewpoints (tool path shown here).

Cutting Edge can also be used as a stand alone CAM system for 3-axis milling, drilling, boring, reaming, slotting, pocketing, tapping and contouring. Tool path prove out — the immediate and complete verification of the tool path before cutting — reduces material waste. A choice of 100 post processors assures maximum flexibility.

Cadkey's family of desktop concurrent engineering tools now make the seamless integration of *all* design, analysis and manufacturing functions not only possible, but affordable.

CADKEY is easy to learn and use. A common data base makes it possible to integrate reverse engineering, inspection, rendering, solids and surface modeling tasks into any design and manufacturing operation.



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CIRCLE CARD 205

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CIRCLE CARD 250

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.

SOLIDS

• If you are trying to process a part through SOLIDS, and repeatedly get a graphical error file, even though the geometry appears correct, there are several steps to take. First, check in the SOLIDS configuration defaults to make sure that the segmentation limits are not too high - start by setting them at eight and four (minimum/maximum). Once the model processes, start increasing the levels until you get the appearance you want.

If the geometry is so complex that a wireframe is ambiguous, you can surface each complex boundary with a polygon mesh. Then, by selecting only lines and polygons to output to CADL, you will have defined the volume more precisely. For corners and other intersections of three or four curved segments, you MUST use this technique to define the wireframe. Use CREATE POLYGON MESH, then select the appropriate options to apply the "skin." (See Fig. 1)

If you have more than one part to process, make sure that each part is grouped. When you output the CADL file, be sure to output the group table (first) as well as the geometry.

If you just want a shaded representation of the part, you can treat the input model as a solid object. This will not compute the volume or mass properties, but will process as a shaded image.

With SOLIDS/386, you can now process very complex models for hidden-line removal, mass properties, or shaded images.

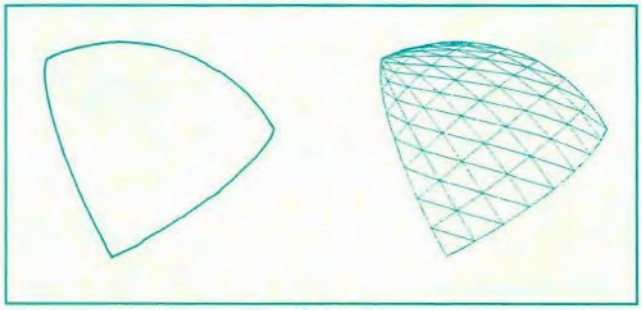


fig 1

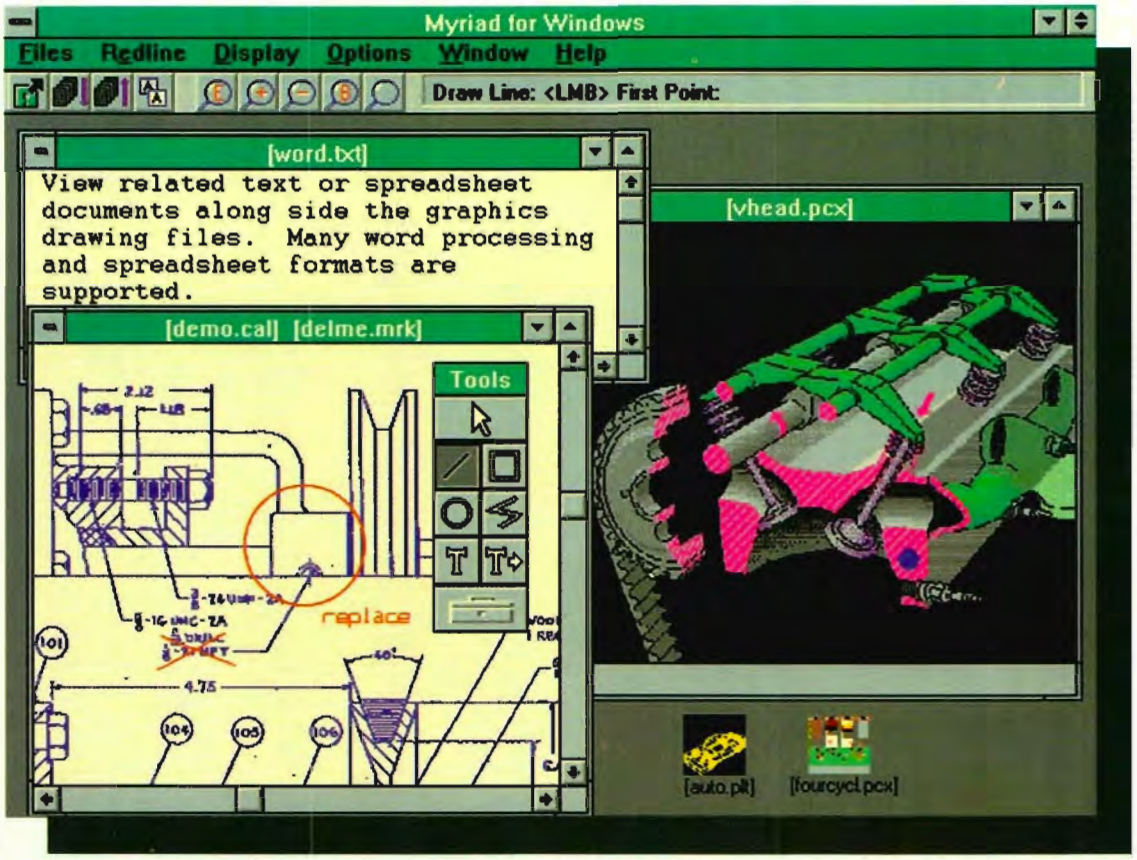
• Part SOLID1.PRT, used for the 4.06 SOLIDS tutorial, is corrupt. To correct the problem, output a CADL file using FILES CADL OUTPUT SELECT LEVEL (1) DONE. Execute the CADL file in a blank part file, then resave it as SOLID1.

• If you want to output a solid file to a stereolithography system, you must load CDL2STL.EXE from the CADKEY disks.

MASK

• You can access CADKEY's powerful masking features within any command. Hit ALT-M, and the masking menu will appear. You can select multiple items to mask on by hitting ENTER after each selection. Select DONE when you have finished the selections.

• If you want to select an entity from the midst of a complex assembly, you can use the MASK controls to make selection easier. Use the immediate mode command ALT-M. Select the feature you want to mask on (color, entity type, etc.). You can select more than one filter by pressing ENTER after each selection, so that you can mask on green circles, etc.



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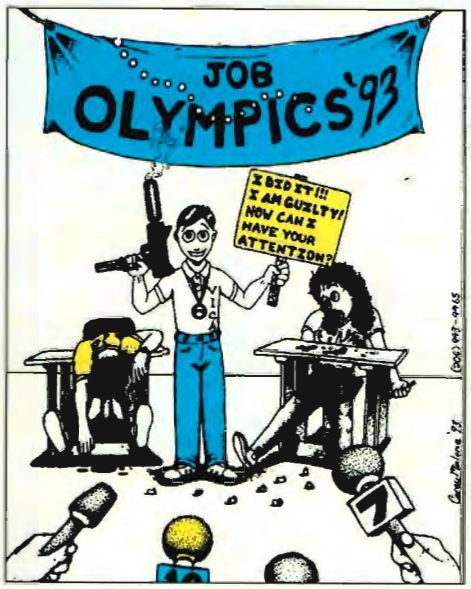
CIRCLE CARD 283

"TEENAGERS BLOW AWAY..."

by Ron Shea



When we turn on the "NEWS", we are barraged by SENSATIONALISM laced with a lot of negativism about young people. We hear about gang killings and how a small minority can rule neighborhoods; about how drugs are killing our children and the robberies, burglaries and deaths that occur to support the money flow; about the dead teenager on the road due to alcohol; and about schools that are required to have armed security for the students to get their basic education.

What will it take to have our society recognize the efforts of responsible students? They exist and are actually the majority. We must start recognizing the GOOD that these young people do. Yet, most of us are not willing to get involved.

A large part of the problem lies in our educational system. When you look closely, you find that while it's geared for the college bound student, only 20% of our work force will be required to have a college degree. Why then are we failing to meet the needs of the 80% majority? Ask yourself, "What skill, trade or occupation will my high school graduate be able to do when entering the job market?" If you're like I was when my son graduated, the answer is NONE. What are you doing as teachers and parents to ensure the success of your children? Are they learning a vocation?

VOCATION? I remember what a vocational class is! That's the class they put all the "special" students in. Like wood shop, auto repair and industrial arts. And to this day, vocational education is still stereotyped in a negative way. Well, it's time for us to THINK! Which people actually get things done in this country? Where would you be without the carpenter, nurse, TV repairman, mason, auto body repairman, jeweler, chef, bank teller, painter, etc.? I know I would be in a world of hurt.

I'll tell you exactly what vocational education really is or should be -- the training of our future work force and not a "special" class for dumping the problems. The stereotype of the vocational student was more than apparent on the January 6th airing of 90210. Shown on the opening screen was a sign in the background of the Vocational Industrial Clubs of America (VICA). However, one of the main characters was on his way to detention. It was obvious that this was a classroom in the automotive area, but the undertones present were typical of vocational education everywhere.

The truth of the matter is that teens must be given more recognition for the successes that occur as a direct result of their efforts. While many in the U.S. only see them, as shown on the 90210 show and in the news, as car racing, irresponsible children, the reality is that many students display extremely professional and reliable behavior. For example, those belonging to VICA (Vocational Industrial Clubs of America) compete against peers in their chosen profession within each state. The first place winners then compete against each other at the U.S. Skills Olympics. The best of the best. In fact, there are 35 contests at the International level. They include Fitting, Instrument Making, Turning, Construction Steel Work,

Electric Welding, Wall/Floor Tiling, Sheet Metal Work, Industrial Electronics, Commercial Wiring, Bricklaying, Painting/Decorating, Cabinet Making, Carpentry, Ladies' and Men's Hairdressing, Automotive Mechanics, Waiting (restaurant), Agricultural Mechanics, Milling, Engineering Drawing, Computer Aided Drafting, Graphic Design Cookery, CNC Machining and the list goes on and on.

Even industry does not recognize these dynamic young adults. Chris Hennessey, for example, was the Silver medalist at the International Youth Skills Olympics CAD competition. While Chris did not use CADKEY, his efforts are admirable. Do you see people like him on the Arsenio show? NO WAY! Yet Chris, to date, has not received a job offer. WHY? He is second in the entire world! Wouldn't you like to have this employee?

VICA is advised by the Youth Development Foundation. This organization consists of 22 business leaders from all areas of business. They include Caterpillar Inc., Sears, Black & Decker, Allied-Signal Aerospace Co., Chrysler Corporation, General Dynamics Corporation, General Motors Corporation, Miller Electric Mfg. Co., AM Multigraphics, PACCAR Inc., PPG Finishes, SERVISTAR Corporation, Shouvlin Associated Inc., Snapon Tools Corporation, Toyota Motor Sales U.S.A., Westinghouse Electric Corporation and my company Quality CAD, Inc. Our cooperative efforts raise money, visibility, and exposure. Last year we raised approximately $6.5 million dollars which allowed more than 7000 student competitors to "show their stuff" at the U.S. Skills Olympics. In addition to money, VICA receives considerable volunteer time from people in industry to set up the contest rules (a special thanks to Paul Mailhot of Cadkey, Inc. for his dedication), judge the competitions and donate equipment.

So unlike Phil, Sally Jessie, and Geraldo, who raise controversy but do not tell the viewers how to change it, I offer these suggestions:

1) GET INVOLVED!

2) Ask your schools if they

participate in leadership organizations such as VICA and FBLA (Future Business Leaders of America) and if not, why not?

3) Ask your sons and daughters if they participate and if not, why not?

4) Contact the national VICA headquarters to see if you can help.

5) GET INVOLVED!

6) Use the VICA employment services to hire deserving students.

7) GET INVOLVED!

8) Ask your employer to be a sponsor. Contests are held at the regional, national and international levels. The help of many companies is needed.

9) Host a VICA competition at your work area or be a judge.

10) GET INVOLVED!

I have a final suggestion that will cost you the most. It will cost you time and money but increase your self esteem. Contact your legislators! They really do work for you! In Washington state we are lucky to have a governor who has been an advocate of vocational education for years. I am not beyond calling the governor and giving him my two cents worth, nor my legislators, nor my U.S. representatives. I hear some say, "One person cannot make a difference." BS! BS! BS! Get on the phone and make your voice heard. Enough is enough! We sit around in this country and complain about how bad everything is. Write a letter to your legislators. Better yet address them all to Bill Clinton. After all he is the President of this corporation we call the United States of America.

One final note. Remember NEGLECTED TEENAGERS DON'T GO AWAY THEY JUST BLOW AWAY! Have you hugged your children today? Have you recognized them for their successes today? Have you hugged their teacher? Remember the future of our children is in the hands of their teachers. Teachers are with YOUR CHILDREN more each day, than most family members. I am 40 years old and I still remember Robert Cathy, a favorite high school teacher who inspired me to "be all that I could be". Do you remember your special teacher? Isn't it about time we recognize the most important professionals in the world...THE TEACHER!

To *GET* involved contact:
NATIONAL VICA
P.O. BOX 3000
LEESBURG, VA 22075
PH (703)777-8810
FX (703)777-8999

All cartoons in Key Solutions were drawn by Cory Malone, a high school senior at New Market Vocation Skills Center. Cory's dream is to work for Darkhorse Comics, but he currently does freelance work and can be contacted at (206) 943-9465.

S.O.S.

Save Our Schools

By Robert Martin, Technical Editor

Not long ago a unique presidential candidate said, "We need to base our economy on computer chips, not potato chips." Right on, Ross! Technology truly is one of the most important issues of the 90's and it needs to be addressed in our schools. However in 1993, vocational education in most public schools is outdated and rarely relevant to the real job market. Sometimes it's nonexistent and schools are in a catch-22. Even though most educators are dedicated professionals who realize the urgency of teaching technical skills, their hands are tied by shrinking funds and escalating costs.

These facts provided the stimulus for the S.O.S. (Save Our Schools) program, an experimental technical/vocational education project sponsored by Key Solutions Magazine and Cadkey, Inc. The goal of S.O.S. is to form a voluntary alliance between the business/industrial community, concerned individuals and public schools working together to shift the focus of vocational education to technical fields, and provide schools with the materials they need to teach. The beneficiaries of this plan will be the industrial/technical community which will gain a pool of well-qualified entry-level technical employees and **non**-college bound high school graduates (80%) who will have a chance to gain real skills for a "head start" in the changing job market.

I believe that to reach the maximum number of students, "heavy-duty" technology must be incorporated into the regular curriculum. Some outstanding public school technical education programs are beginning in urban areas like Phoenix Prep in Arizona and New Market Vocational Center in Puget Sound. We immediately notice that these programs are in cities. Suburban and rural school districts have been overlooked. The rule seems to be - if they're small and quiet -- ignore them. It may be true that the squeaky wheel gets the grease, but it's not fair. The needs are great everywhere. Since we published a few short paragraphs about the school project in the last issue of Key Solutions, we have received requests for help from many non-urban school districts across the United States. Obviously, we tapped a nerve!

The S.O.S. School

S.O.S. has selected Selkirk High School in Metaline, Washington as the first test case. Located in the extreme northeast corner of Washington state, 100 miles north of Spokane and 10 miles south of the Canadian border, Selkirk is a small district with 200 students in grades 7 -12. They have eager students, a supportive administration, intense community involvement, and an enthusiastic and capable vocational education teacher. The problems and needs at Selkirk are typical of thousands of small school districts from coast to coast. Specifically, the selection was based on the following criteria:

- They are incredibly poor, but are not eligible for special federal and state funds because the academic achievement level, while less than the national average, is over the border line and discipline and deportment are good.
- They are located a long way from an urban center.
- The economy of the community is in transition as the timber industry falters, the mines close, and the unemployment rate, one of the highest in Washington state, hovers around 10-12%.
- The vocational curriculum is due for an overhaul. For example, forestry and agriculture are still major curriculum items even though the reality is that the few available jobs in these fields are becoming fewer every day.
- They desperately need equipment, technical advise and money. Currently they only have a few, over-used computers for the business education classes and library, and a well equipped machine shop that gathers dust and cob webs because the annual vocational education budget of $2,600 (two thousand - we're not kidding) just doesn't stretch.
- Community involvement is high. A Vocational Advisory Committee meets regularly.
- The staff, administration and community advisors are willing to make major changes to the curriculum in both the vocational area and the core subjects that relate to technical training.

Selkirk's Plan

A committee of community leaders has already been formed. They have written a two-year plan and assigned tasks. Dr. Charles

Taylor, owner of Omni Link Computer Services, a state approved retraining center, will provide input on curriculum and instructional techniques. James Collin, Superintendent of Seattle City Light, will provide technical assistance from the engineering department of Seattle City Light and assist in procuring supplies and material needed in the machine production of the project. James Taylor of the U.S. Forest Service will assist in developing a layered map-making program based on CADKEY applications, with local and regional informational displays for integration into the Natural Resources, Geography and Science curriculum. Larry Jungblom, Selkirk vocational education teacher, is the project leader and Robert Martin, technical editor of Key Solutions, is the technical adviser.

The base plan revolves around CADKEY. In a phased implementation, students will begin with design and drafting in 1993 and progress to producing a cost efficient machine, tool or device by June 1994. The first group of students will complete the program by June 1994. A complete copy of the Selkirk plan is available.

The Next Steps

The Pend Oreille River is scenic. A PE class (for non-athletes) called Life Skills goes fishing several days each semester and freezes the catch for a big school barbecue. But the students and the staff want Life Skills to include much more than fishing. What they need is CAD, machine shop, electronics, etc. and other classes to provide job skills.

The plan is taking shape, the students are ready, but computers and other equipment still need to be acquired. Key Solutions and the school district are setting up a trust account for donations which will be jointly monitored. Progress reports and tax credit slips will be provided to all who donate. I am the technical adviser, but one of the primary rules is that the school administration and staff must take the initiative to plan and administer the program so that the program can eventually be self perpetuating.

There are still many things that need to be done, but they require equipment or cost money. Companies, individuals, advertisers, hardware/software vendors, and Key Solutions readers are being invited to support the program with equipment, materials, volunteer time, and money. If you can help or would like more information, please write Robert Martin c/o Key Solutions, P.O. Box 11978, Spokane WA 99211-1978 or fax 509/445-1146.

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CIRCLE CARD 210

CONCURRENT ENGINEERING WORKSHOP

PART 1

Conceptual Design with CADKEY

by Craig Storms and Ken Fortier

This is the first in a multi-part series designed to familiarize you with several Cadkey concurrent engineering tools. You will learn methods for taking a part from design concept to reality.You will use CADKEY, CADKEY ANALYSIS, and CUTTING EDGE. In this session you will create a simple conceptual design of a cylinder bracket in 2D and learn the intricacies of the TRM command. Basic assumptions are made regarding the cylinder diameter -- slightly less than three inches. After the 2D geometry forming the top view of the part is finished it will be extruded to create the 3D model. The 3D transformation completes the model. This 3D model can be used to obtain mass properties and solid rendering using CADKEY SOLIDS.In future installments we will perform a stress analysis on the part using CADKEY ANALYSIS and redesign the part for greater structural integrity and savings in material. Then we will create a detailed drawing layout and finally, in the last installment, create tool paths with CUTTING EDGE.

DESIGNING A CYLINDER BRACKET

1. Begin by drawing a rectangle

- Choose CREATE, LINE, RECTANG, WID/HT from the main menu.
- Enter 6 as the width and 2.5 as the height. (Inches)
- Choose the KEY-IN menu option to position the lower left corner of the rectangle and enter 0,0,0 as the position.
- Use the autoscale option ALT-A to center and resize the display.

2. Mark the center of the lower line for a reference point for a later mirroring operation

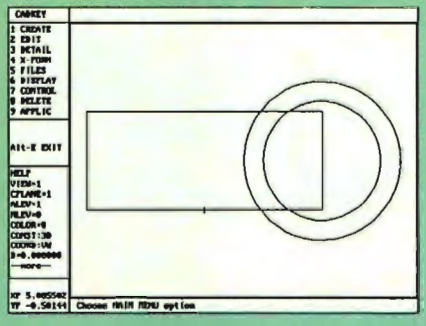
- ESC to the main menu and choose CREATE, POINT, POSITION, CENTER.
- To place the point on the center of the lower line, move the cursor near the line and click the left mouse button.

3. Draw a circle at the right end of the rectangle

- ESC to the main menu and choose CREATE, CIRCLE, CTR+RAD.
- Enter 2 as the radius.
- Choose the CENTER option to position the circle. Select the right hand vertical line to place the circle at the midpoint of the line.

4. Draw a smaller circle inside the first circle

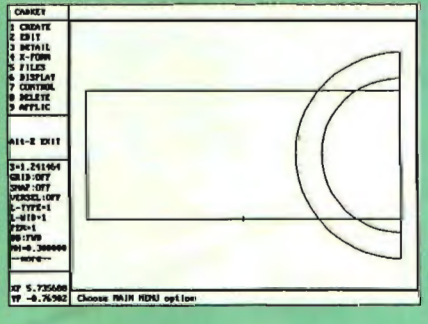
- BACK-UP once, and enter a new radius of 1.5 inches.
- Again use the CENTER option to position the smaller circle at the center of the larger circle. Pick the circle to indicate the position.
- ESC and autoscale the display with ALT-A.



Steps 1 thru 4

5. Trim the circles

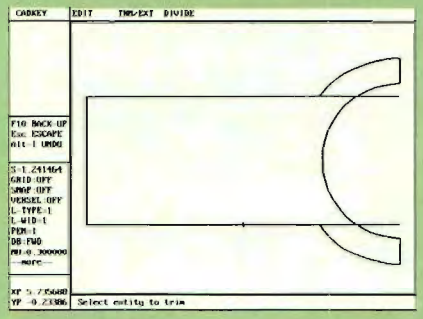
- Choose EDIT, TRM/EXT, DOUBLE.
- Select the left side of the smaller circle as the entity to trim. Select near the top and bottom of the right hand vertical line as the trimming entities.
- Trim the larger circle in the same way.
- Continuing the DOUBLE option, trim the right-most line to the upper and lower-most endpoints.



Step 5

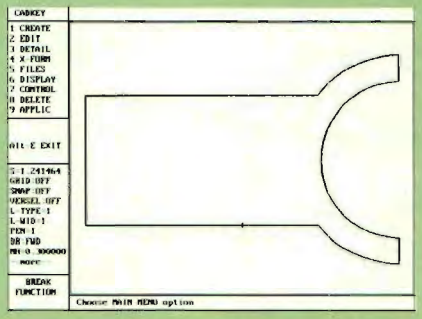
- BACK-UP once and choose the DIVIDE option. Select the left-most arc as the entity to trim, and the upper and lower lines of the rectangle as the trimming entities.
- DIVIDE the right rectangle line as shown.

Step 5 cont.



BACK-UP once and choose the First option. Select and trim the two horizontal lines to the left-most arch. Select each line in the region you want to keep.

Step 5 cont.

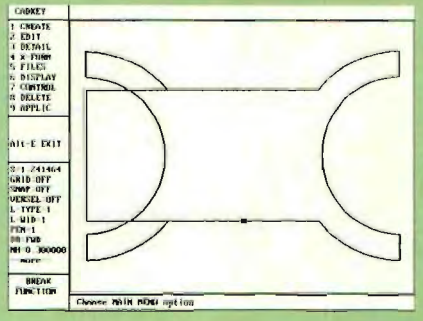


6. Mirror the right side of the geometry

- ESC to the main menu. Choose X-FORM, MIRROR, COPY.
- Choose the top-most arc to start the chain, and indicate a chaining direction by cursor, picking anywhere near the upper right corner of the screen.
- End the chain by selecting the lower-most arc. Inspect the highlighted selection and press <Enter> to accept the transformation.
- Choose the 1 PT V mirror option. Make POINT the active menu option and select the point centered on the lower line.

Inspect carefully before continuing!
Use the UNDO feature if needed.

Step 6

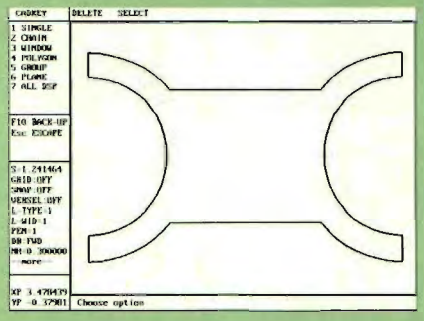


7. Trim the left side of the geometry

- ESC and choose EDIT, TRM/EXT, FIRST
- Trim the two horizontal lines by selecting the part you want to keep and trimming to the two large arcs.
- ESC to the main menu and delete the remaining left lines using CTRL-Q. Use care to select near its center since overlap occurs in other regions.

8. Erase the reference point

- ESC to the main menu. Choose DELETE, SELECT, WINDOW, ALL-IN and window around the point.

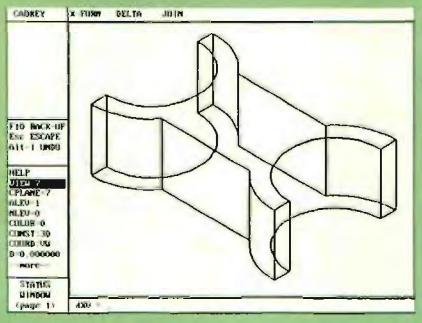


Step 8

FROM 2D TO 3D

1. Extrude the 2D geometry

- Choose X-FORM, DELTA, JOIN, ALL DSP, ALL. Enter 1 copy.
- Enter dXV=0, dVY=0, DZV=-2 (negative 2). The geometry appears unchanged as we are in view 1, the top view.
- Pick VIEW in the status window and enter 7 to switch to the isometric view.
- Autoscale the display (ALT-A) and ESCAPE to the main menu.
- Save using CTRL-F. Name the file CEL1.



Final 3D Model

Next Time **Workshop** features design revision using data from CADKEY ANALYSIS

CADKEY CORNER

by Al Torizzo

LAYOUT

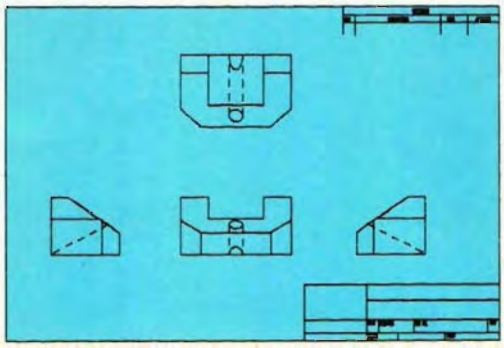
Plot Organizer, Engineering Tool and More

The LAYOUT feature in version 5.0 simply appears to provide a quick, visual method for assembling drawing files for final plotting. However, it is much more than that and generally under utilized. I hope the following gets you excited about LAYOUT's strengths and capabilities so you can integrate it into your everyday CAD scenario as needed.

First, here's an overview of the situation. CADKEY 5 has two major modes in which you can work - MODEL and LAYOUT. Previously, MODEL mode was used for designing and also for final output of hard copies. Now LAYOUT provides an interactive option for laying out, planning, arranging, compiling, and saving the entire finished drawing from the part file created in the MODEL mode.

All the views and entities in a LAYOUT drawing come from the 3D model in your part file. They are called up and can be placed inside a preselected border in LAYOUT mode. This new "layout" becomes the final drawing. In fact, from one 3D part file, you can create up to 200 different final drawings.

LAYOUT can be many other things, including used as a utility, an organizer of drawing variations and part modifications, a control for drawing updates, and so forth. This is where you can really apply your logic and creativity to meet your particular CADKEY needs. For example, your layouts are more easily organized than the 3D model part file because LAYOUT allows up to 20 letters for the file name and a 42 letter description.



A typical layout drawing.

In my world, the phrase "never means never" translates into the reality "nothing is final". Because entities on the 3-D model remain LINKED between the two modes, strange and unique opportunities await. Any changes you make in the MODEL mode are reflected in the LAYOUT mode. Conceptually, the "layouts" are like final hard copies, while the "model" is the computer's eye view of the 3D object. When using the two modes, planning ahead helps. Be sure to create all the views you will need while in MODEL mode.

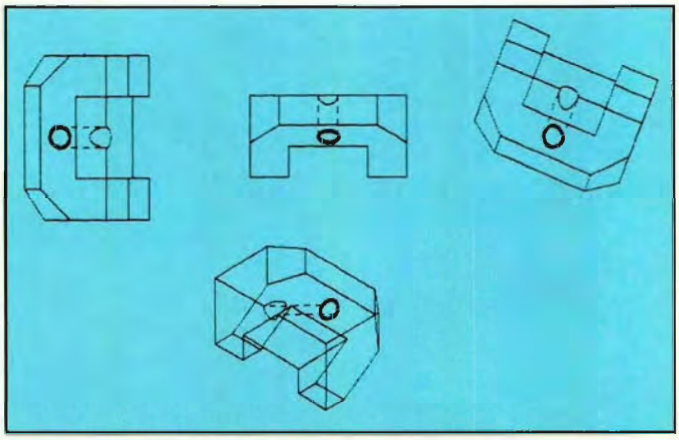
Associativity is our first tool here. What you change on the model is also changed on the layout. This remains true for each of the 200 layouts you can make. However, what you change in the layout does not affect the original model. Here's your first tool and safe haven. And, there are more "neato" tools. You can easily (and wisely) make a copy of your layout while in the LAYOUT mode to protect your work.

Another related feature. On final layouts, you can make further changes called "modelizing". Each view called up from the model and placed onto your layout is called an instance. Modelizing breaks the associativity between the model and that particular instance. When one of these instances is worked on in LAYOUT mode, it must first be "modelized". Doing so locks the particular view from being affected by any changes done if you go back to the model in MODEL mode. You don't have to be afraid to label what's been modelized or changed in any mode or instance.

Take advantage of the SET option in the LAYOUT mode. Among other things, it allows you to see changes made since the last drawing session. You will also be able to view the existing entities which remain as instances.

Do not overlook LAYOUT's ALIGN feature. It's an automatic

method for aligning the instances (views) as they are placed on the layout sheet. ALIGN lets you use a specific entity for the alignment reference. Thus, views can be aligned, for example, by the location of a center, corner, or other geometric feature, a most valuable engineering feature.



Objects aligned via center top thru hole

Here are some miscellaneous things to know about how LAYOUT works:

* Entities can be masked by level.

* Dimensions and cross-hatching will rotate.

* Pattern files retrieved will be layout-specific.

* Cross-hatch or mesh only between like entities, i.e. layout or instance specific.

Do imprint this into your human ROM onboard memory! You must always save the model, to save the new layouts before you exit CADKEY. And if you wish to return specifically to either mode upon start up, exit in that mode.

The BIG question! Should you use the LAYOUT mode simply because it's there? It's not required and can be simpler at times to complete your drawing while in the MODEL mode. But, you should consider what demands will be placed on the 3-D model. LAYOUT will give you much greater overall dexterity later, if needed.

THE 386 BLUES

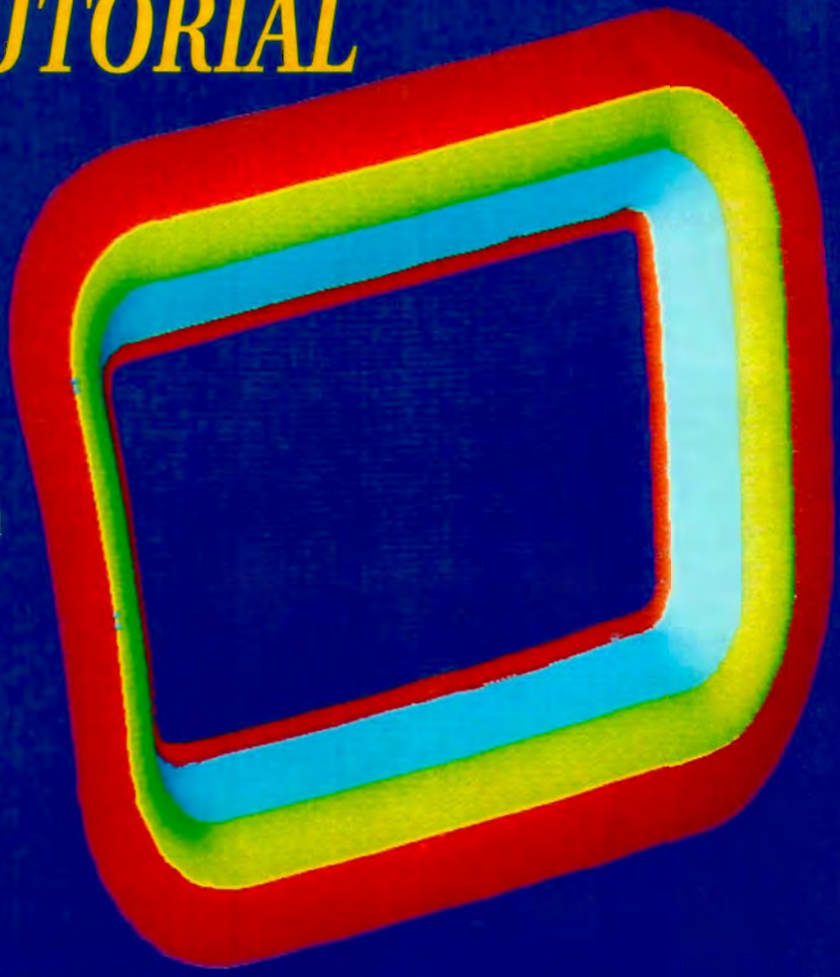
In the land of massive amounts of tiny data (bytes), we welcomed the 386 chip. Now a river of new and bigger and faster chips floods our dreams and workstations. In general, these hardware improvements are great for CAD, but not great for those of us who had to upgrade rooms of computers to run CADKEY 5 which runs only on 386 and later machines. (If you need to run version 5 drawings on pre-386 workstations loaded with less than version 5, see **Key Solutions**, Dec '92.)

By the way, my choice became a 386DX-33. That's a DX meaning full 32 bit architecture and a very quick 33 megahertz processor, plus the needed math coprocessor chip. CADKEY 5 runs quite nicely on a 386, but do be certain to get 8 megs of RAM memory, and 256k of cache is also nice to consider. RAM memory will be an increasing need in the future so be sure your machine is expandable to at least 32 megs of RAM.

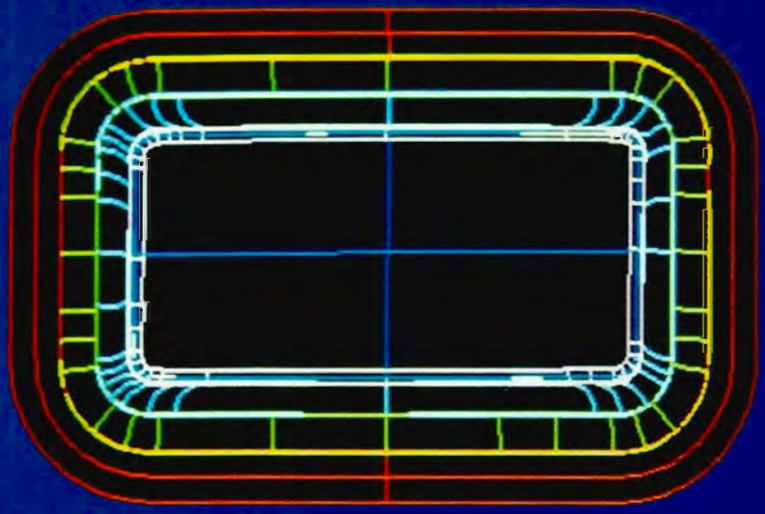
That a 486 will be my next machine is likely, but I'm still waiting for the chip wizards to do more real magic on it. And, just around the corner is the P5 (colloquially called the 586). I never rush. I prefer to get what I need and need what I get. I wait for the bugs to be removed and design problems solved. And, I prefer to let the software groups decide which way they are going before I venture to follow.

Till next time!

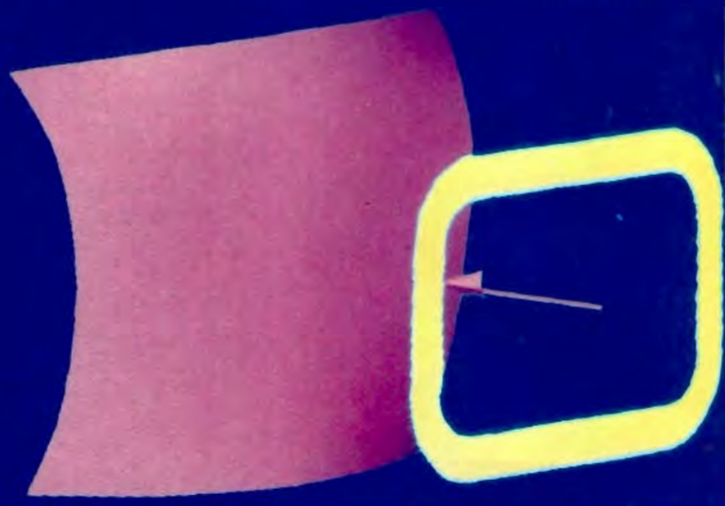
FastSURF TUTORIAL



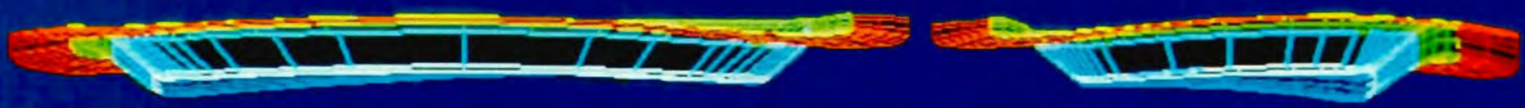
This article is the first in a series of six tutorials on using the FastSURF surface modeler. These tutorials could be collected and assembled into a manual at the end of the year. The material can also be down loaded off of FastSURF's BBS in the form of a CADKEY part file.



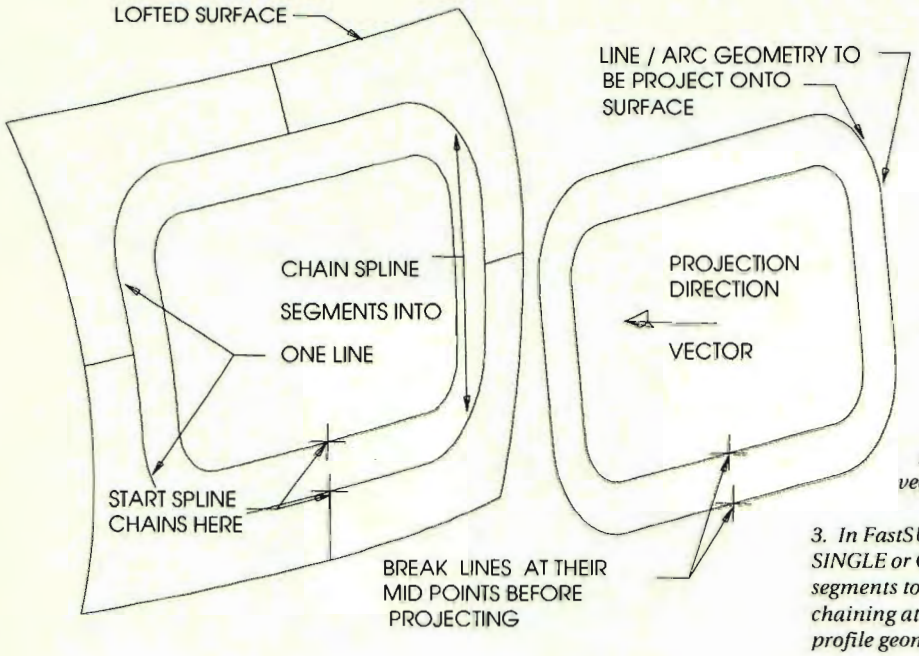
The orthographic top view of this part suggests that the geometry is deceptively simple.



The surface modeling begins by projecting the planar profile geometry onto the lofted surface.



The front and end views show the complexity of the part. This geometry could not easily be designed or manufactured without using a surface modeler. These surface modeling techniques are typical of the methods used to design parts for the automotive, aerospace, and consumer products industries.

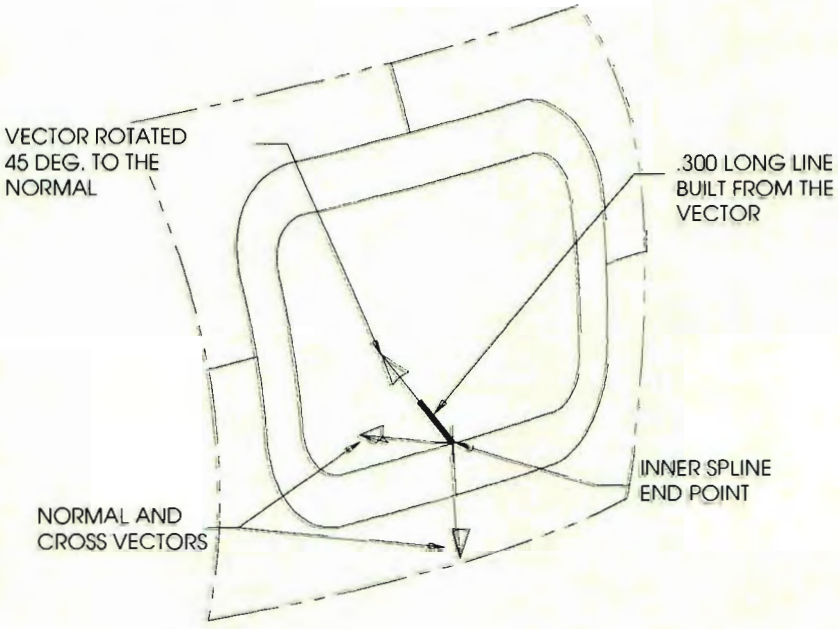


The following is a key stroke by key stroke listing of all the steps needed to create the part in this article using CADKEY and FastSURF. To clarify the meaning of the following instructions, the word "choose" means to pick a menu option, and the word "select" means to pick geometry on the screen.

1. In CADKEY, choose - EDIT : BREAK : POSITION : CENTER : select each labeled line and its mid point.

2. In FastSURF, choose - PROJECT : SURFACE : SKEWED : enter 0.0 as the offset value : choose "VECTOR" for the method for defining the projection direction : select the vector : select the surface : select all the curves to project.

3. In FastSURF, choose - CREATE : SPLINE : CHAIN : choose either SINGLE or CHAIN for the selection method: and then select the spline segments to be joined into one single spline. Be sure to start the spline chaining at the position that corresponds to the mid point on the profile geometry.



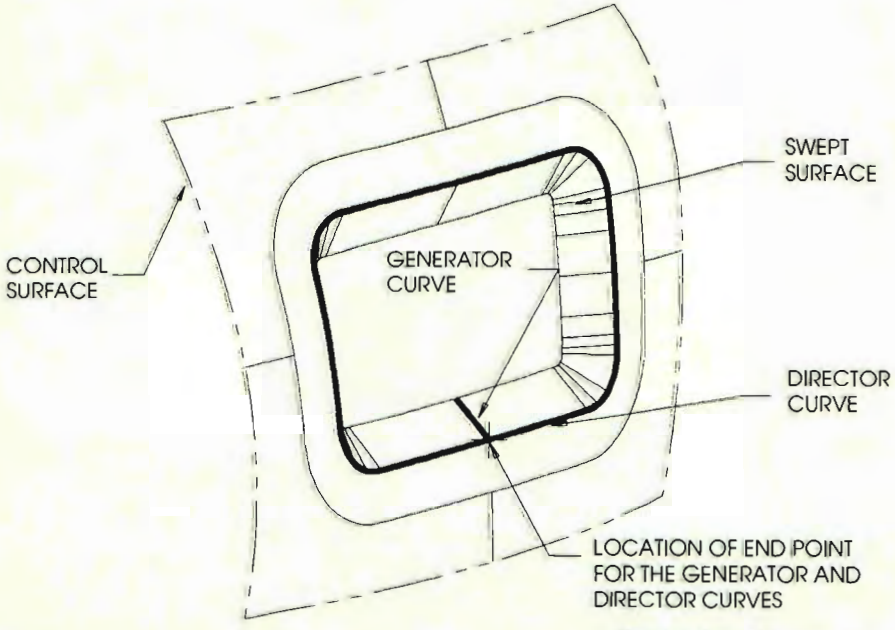
4. In FastSURF, create the two surface vectors - DISPLAY : GRIDS : choose "NORMAL" and "CROSS" vectors from the selection list and "POINTS" as the "SPACING METHOD" : select the surface : then select the end point of the inner spline.

5. Rotate the surface normal vector away from the cross vector by -45 deg. - CREATE : VECTOR : ROTATE : select the normal vector, then the cross vector, and enter a -45 deg.

6. Turn the vector into a line - CREATE : VECTOR : VR2LN (vector to line) : select the vector.

7. In CADKEY, trim this line into a .300 long segment.

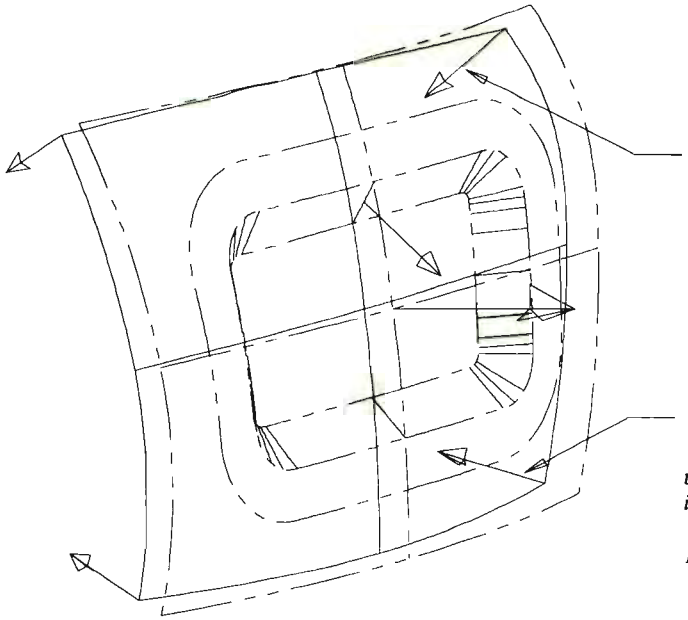
The above technique is the classic method used to create a line or vector at a given angle to a surface.



The next step is to build a swept surface which is everywhere 45 deg. to the outer control surface.

8. In FastSURF - CREATE : SURFACE : SWEPT : choose 1 GENERATOR and 1 DIRECTOR with a "NORMAL TO SURFACE" "ORIENTATION" method. Select the director curve and its end point; select the generator curve and its end point; then select the outer surface for the "normal to surface" control.

Normal to surface sweep is a powerful method of adding a little more control during the swept surface process. Many times the control surface is constructed just to support the swept surface process, and can be discarded after the swept surface is built.



SOMETIMES IT IS NECESSARY TO DISPLAY SEVERAL NORMAL VECTORS ON A SURFACE IN ORDER TO VISUALIZE THEIR DIRECTION.

Next, we will build a tangent fillet surface between the floor of the part and the 45 deg. side wall. The floor is just an offset of the outer lofted surface.

9. In FastSURF, choose - CREATE : SURFACE : OFFSET : select the surface to offset, then enter the offset value.

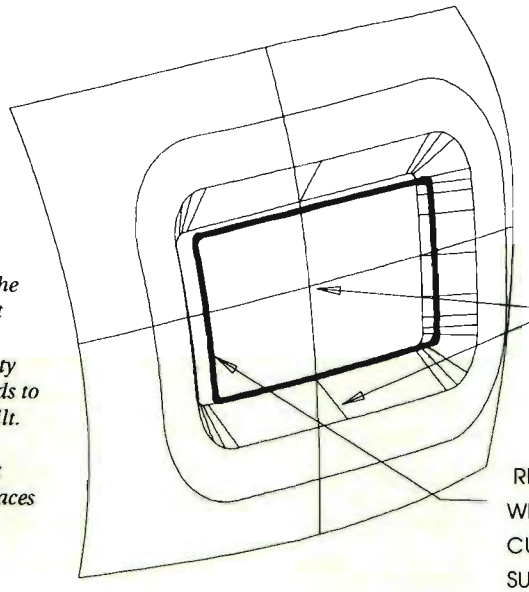
It is time to examine the sense of direction for each of the surfaces on the part. The normal vector of a surface points toward the positive side of that surface. It is important to know which side is positive for a surface before performing a surface to surface intersection with an offset value because "+" or "-" offsets are allowed.

10. In FastSURF, choose - DISPLAY : NORMAL : then select the surface.
- or -
EDIT : SURFACE : INVERT : select the surface : then toggle the displayed normal vector as needed.

11. Another way to display surface normal vectors is - DISPLAY : GRIDS : choose "NORMAL" from the selection list : choose "UV grid" as the spacing method : enter 2 X 2 for the U & V density : then select the surface.

The fillet surface routine in FastSURF needs a "spine" curve supplied by the user to help position the fillet surface on the correct side of the two tangent surfaces. This "spine" curve is most easily modeled using the surface to intersect function; although it can be modeled by a variety of other techniques. The "spine" curve only needs to be "near" the center of the fillet surface to be built.

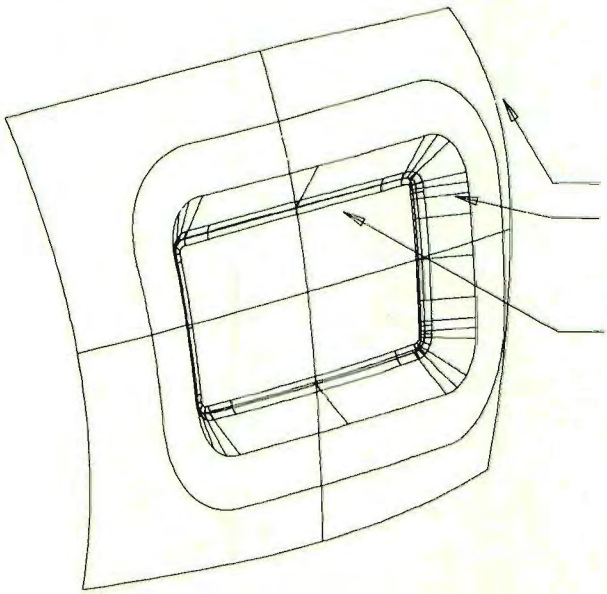
12. INTERSECT : SURF x SURF : enter the offset values for each surface : then select the two surfaces to intersect.



INTERSECT THESE TWO SURFACES.

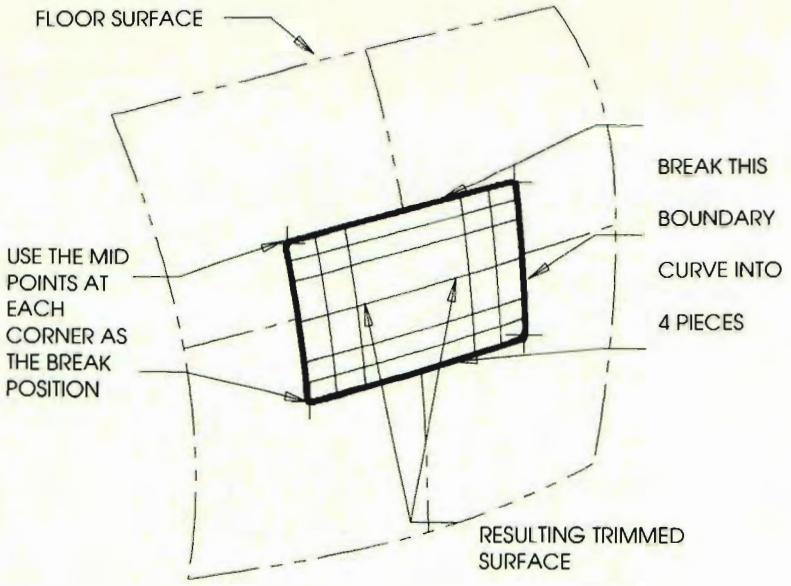
RESULTING INTERSECTION CURVE WILL BE USED AS THE "SPINE" CURVE FOR THE TANGENT FILLET SURFACE ROUTINE.

13. CREATE : SURFACE : FILLET : enter the fillet radius : select the two tangent surfaces : then select the "spine" curve.



THE FLOOR AND WALL SURFACES ARE USED TO CREATE THE TANGENT FILLET SURFACE

Many times it is desirable to trim a surface back to new boundaries. In this example, both the floor and wall surfaces need to be trimmed back to the edge of the tangent fillet surface. There are many techniques for trimming surfaces. Sometimes it is appropriate to use FastSURF's "TRIMMED" surface routine, and other times it's better to rebuild a grid of curves within the new boundaries of the trimmed region and use the "GENCURV" routine to reconstruct the trimmed surface.



14. To trim the floor, extract the U-spline from the tangent fillet surface that lies on the floor and encircles the region of the trim. DISPLAY : GRIDS : choose U-spline : at points : select the fillet surface : then select the end point of the inner spline of the fillet surface.

15. Break this boundary spline into four equal pieces. In CADKEY - EDIT : BREAK : POSITION : select the spline : and cursor select a screen position near the mid point of each corner.

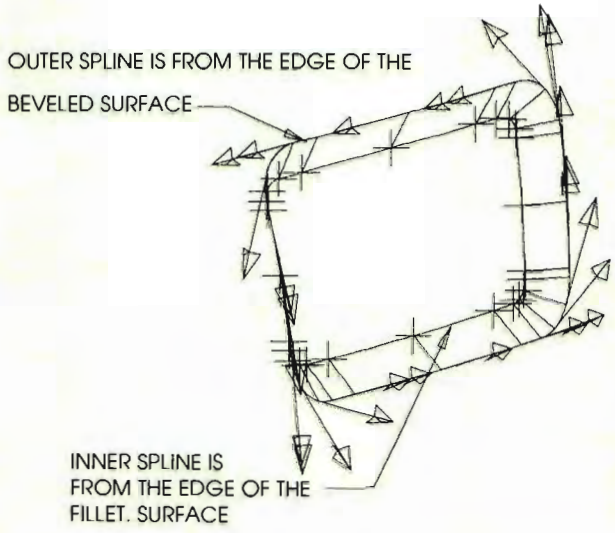
16. The geometry is ready to perform the trim - CREATE : SURFACE : TRIMMED : 4 CURVE : select the floor surface : then select the four trim curves.

A TECHNICAL NOTE - The splines that make up the display of a FastSURF surface have a CDE flag set that suser from performing a trim or break on them using CADKEY. If you need to break a surface boundary curve, then you need to duplicate it using "DISPLAY : Grids". Splines produced this way have no CDE flags sey limiting their use.

17. The 45 deg. beveled surface also needs to be trimmed back to the tangent fillet surface. Careful attention needs to be paid to the curves that reconstruct this surface. The strategy will be to extract the fillet boundary spline on the beveled surface plus the outer boundary spline of the beveled surface by using DISPLAY : GRIDS.

18. By displaying the node points on the inner spline and creating tangent vectors opposite those points on the outer spline, a new spline representing the outer boundary can be rebuilt. In CADKEY - CREATE : POINTS : ON SPLINE : select the inner spline. In FastSURF - CREATE : VECTOR : TANGENT : AT EXISTING POINTS : select the outer spline : then individually select the node points on the inner spline.

19. Using these newly created vectors, create a spline - in FastSURF - CREATE : SPLINE : POINT-VECTOR : alternatingly choose the word "TANGENT" from the menu, and select the sequence of vectors in order.



20. Rebuild the beveled surface - CREATE : SURFACE : GENCURV : select the inner spline and the newly created outer spline.

21. The last surface to build is the outer flange around this part. It will be a 3 curve trimmed surface taken from the original lofted surface. It is left as an exercise to figure out how to do this.

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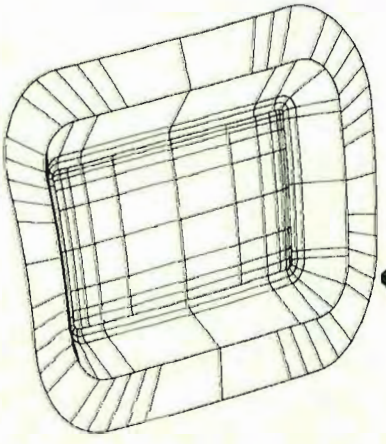

PenMap.cdp

CADL can be used to query and manipulate the CADKEY data base. Geometry can be added or deleted, and all data associated with CADKEY entities can be accessed. Attributes such as color, line type, pen number, etc. can be identified and changed as needed. This issue's CADL TOOLBOX deals with this type of data base manipulation.

In particular, it focuses on a task most important to most users - plotting. And for many the pen number attribute is of key interest, yet one which remains hidden in the data base. Color, line type, line weight, and level attributes all reveal themselves clearly on-screen, but the pen number remains unseen. Exactly what pen numbers are assigned to what entities? The CONTROL VERIFY ATTRIB function allows individual entity pen numbers to be verified, but this is tedious if many entities are of interest.

PenMap.cdp is a program providing quick and clean data base management, with a focus on pen number that can easily be extended to any entity attributes. The program is a good example of data base access and attribute manipulation.

PenMap.cdp is an entity management utility. It acts on all currently displayed entities or on the entire data base, allowing the user to generate a pen# report, assign pen# by indicating screen colors, or create an on-screen view of plotting results by changing all colors to match pen# values.

Menu options include:

MAP PEN: Changes entity colors to match the entity pen number. This option is useful as a quick viewing utility for displaying on-screen how a drawing will plot.

MAP COL: Allows the user to choose a color and assign a pen number to all entities of that color.

REPORT: Gathers all pen number data and creates a report on-screen. The user can place this report in the drawing, if desired.

HELP: Executes a simple text-only help screen. This is coded as a subroutine (PenHelp.cdp) and requires that the separate file be present to compile properly.

Once a PenMap option is selected, a second menu appears with the options:

ALL DISP: Selects all entities currently displayed. This is similar to the ALL DSP option found in CADKEY's selection menu.

ALL ENTS: Selects all entities in the database which may be plotted from the current view. This includes entities beyond the screen limits and those on hidden levels.

A single subroutine is used for the HELP option. To compile this code place the files PenMap.cdp and PenHelp.cdp in a directory with the CADKEY ccomp files (ccomp.exe, ccomp1.exe, ccomp.txt) and type:

CCOMP PENMAP

This creates the file PENMAP.CDX, a binary executable CADL file. Place this file in the current CADL directory (CDL is the default) and execute the program by choosing FILES, CADL, BINEXEC and entering the name of this file. For faster access, this command sequence can be stored as a macro and bound to a key or added to the CADKEY menu structure.

by Craig Storms, Applications Training Manager, Cadkey, Inc.

```
/* Variable declarations */
local winx1, winx2, winy1, winy2, $str1, $str2
int idnum, mapmode, pnum, pcolor, newpen, curcol, \
   selnum, allents, enttype, totents, nument, i
array pentotal[8] = {0, 0, 0, 0, 0, 0, 0, 0}
array oldisp[16]
newpen=1
pcolor=1

:start
getmenu "Select PenMap Option", \
      "MAP PEN", "MAP COL", "REPORT", "HELP",,,,,, 1
switch (@key)
 {
 case -3
  goto end
 case -2
  goto end
 case 1
  mapmode=1
  break
 case 2
  mapmode=-1
  break
 case 3
  mapmode=0
  break
 case 4
  dosub penhelp
  goto start
 default
  goto start
 }

:entopt
getmenu "Choose Entity Selection Option", \
      "ALL DISP", "ALL ENTS",,,,,,,, 2
switch (@key)
 {
 case -3
  goto end
 case -2
  goto start
 case 2
  allents=1
  break
 default
  allents=0
  break
 }

/* if all entities to be checked save window coords and  *
 * level mask, turn on all levels, get ents on all levels */
if (allents)
 {
 /* grab original window setting for primary viewport */
 winx1=@xmin
 winx2=@xmax
 winy1=@ymin
 winy2=@ymax
 /* grab original levels display mask */
 for (i=0;i<16;i=i+1)
     oldisp[i]=@levels[i]
 /* turn on all levels, autoscale behind scenes, getall  */
 levels 1, 1, 256
 set masklevel, 0
 auto -1
 }
```

```
/* skip mapping options if REPORT or MAP COL selected */
if ((mapmode==0)||(mapmode==-1))
 goto searchDB

:getmap
getcolor "Select color to be mapped to a new pen number", \
       pcolor, 1
if (@key==-3)
 goto end
if (@key==-2)
 goto entopt
:getpen
getint "Enter new pen number for mapping (%d)", \
      newpen, newpen
if (@key==-3)
 goto end
if (@key==-2)
 goto getmap
if ((newpen <= 0) || (newpen >= 9))
 {
 pause "ERROR: Pen Number Range is 1-8.  Press <Enter>"
 newpen=1
 goto getpen
 }

:searchDB
if (mapmode==0)
 prompt "Extracting Pen Number Data . . . please wait"
else
 if (mapmode==1)
  prompt "Mapping color# %d to pen# %d ... please wait", \
       pcolor, newpen
 else
  prompt "Mapping pen# to color# ... please wait"

/* use getall and process each entity in selection list  */
clearsel 1
getall nument
defattr color, pen
while (nument > 0)
 {
 getnext enttype, , idnum
 /* 2 cases: pen# in INTDAT or detail types in ENTATT  */
 if (@numint < 3)
  pnum=@entatt[3]
 else
  pnum=@intdat[6]
 if (mapmode==0)
  pentotal[pnum-1]=pentotal[pnum-1]+1
 else
  if (mapmode==-1)
   {
   /* auto color: set color to match the pen number */
   setattr idnum, (pnum),
   if (allents==0)
    drawent idnum, 0, -1
   }
  else
   if (mapmode==1)
   {
   /* map pen: if color = pcolor, change pen# */
   if (@numint < 3)
    curcol=@entatt[1]
   else
    curcol=@intdat[3]
   if (curcol==pcolor)
    setattr idnum, , newpen
   }
 nument = nument - 1
 }

/* if all ents processed reset system */
if (allents)
 {
 set levelmask, oldisp
 window winx1, winy1, winx2, winy2
 redraw -1
 }

if (mapmode==1)
 goto start

if (mapmode==0)
 {
 prompt "Summary of Pen Number Data"
 $str2 = "PEN NUMBER SUMMARY \n"
 for (i=0;i<8;i=i+1)
  {
  sprint $str1, "Pen #%d: %d entites \n", \
       i+1 , pentotal[i]
  call strcat, $str2, $str1
  }
 cls
 mode draw
 note (@xmin+(@xmax-@xmin)/6), (@ymax - (@ymax-@ymin)/6), \
    $str2, 0, (@xmax-@xmin)/24 , 0.8, , , , 1
 mode normal
 getmenu "Place note in drawing? (NO)", "YES", "NO"
 switch (@key)
  {
  case -3
   goto end
  case -2
   goto entopt
  case 1
   break
  default
   goto end
  }
 }
 else
  goto end

redraw
getpos "Indicate SUMMARY note postition", 1
if (@key==-3)
 goto end
if (@key==-2)
 goto entopt
note @xview, @yview, $str2, 0, (@xmax-@xmin)/36, 0.8 ,,,, 1

:end
clear oldisp, pentotal, idnum, mapmode, pnum, pcolor, newpen, curcol, \
     selnum, allents, enttype, totents, nument, i
clearsel 0
```

```
/* penhelp is a subroutine called by penmap.cdp */

mode draw
cls
note (@xmin+(@xmax-@xmin)/11), \
    (@ymax-(@ymax-@ymin)/11), \
    "PenMap is an entity management utility. It acts  on all currently displayed
entities or on the entire data base.

PenMap offers 3 menu options:

 MAP PEN: Allows the user to choose a color and map new pen numbers
to all entities of that color.
MAP COL: Changes entity colors to match the entity pen number. This
option is useful as a quick viewing utiltiy for displaying on-screen how a drawing
will plot.
REPORT:  Gathers all pen number data and creates a report on-screen.
The user can place this report in the drawing, if desired." , \

0, (@xmax-@xmin)/48 , 0.8, , , , 1
mode normal
pause "PenMap Help ... press <Enter> to continue"
redraw
```

CADL Plug: Look for the new guide to Cadkey Customization due out in March: **Exploring Cadkey's Open Architecture.**

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L'Association des Utilisateurs de CADKEY meets every six weeks in the greater Montreal area at 170, Montee de Liesse, Ville Saint-Laurent, Quebec H4T 1N6. For information contact Manon Dubé at PUCE PLUS, 884, Rue A. Fauteux, Boucherville, Quebec, J4B 6V7, or by phone at 514/449-1755.

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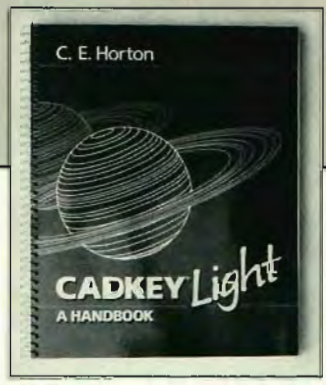

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Clifford E. Horton, University of Colorado, Colorado Springs

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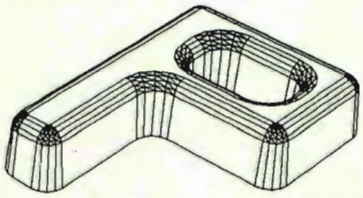

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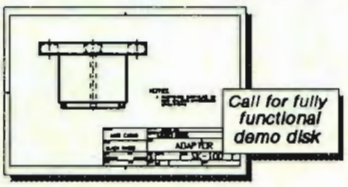

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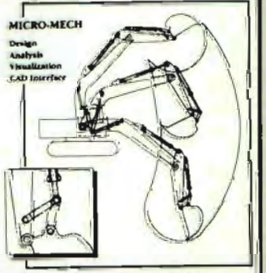

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CIRCLE CARD 221

SOLUTION MART

A smart choice for effective, economical advertising!

For more information call

Jo Schmidt

(509) 445-1748

Because You Need to Analyze Complex Designs ...

COSMOS/M

Let's get serious. The parts which you design are not normally 2 dimensional or axisymmetric. So why simplify the model when COSMOS/M can make it easy for you to conduct 3D analyses fast on your real model, on the PC or workstation? If you still haven't looked into it, here are three compelling reasons why you should.

CADKEY™ Compatibility

Engineers from around the world have taken advantage of the combined power of CADKEY and COSMOS/M to create more reliable designs in less time. Since COSMOS/M is so easy to use, transferring your CADKEY model is a cinch. And don't worry - the translation process is so simple that it minimizes the introduction of human errors. Also, COSMOS/M's powerful pre- and postprocessor will allow you to modify your model for further analysis without having to return to CADKEY. With COSMOS/M, you inherently simplify the design process.

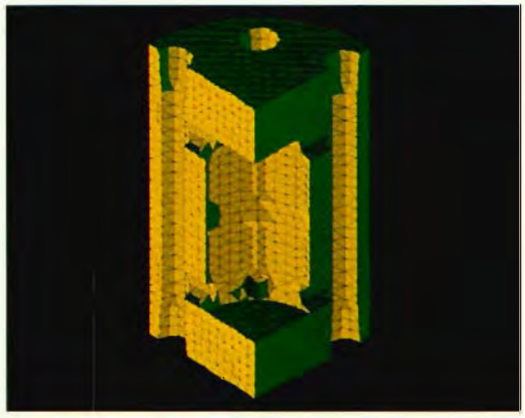
3D Automatic Meshing

Obtaining an optimum mesh manually for complex designs is slow, hard work. So let COSMOS/M do it for you! With a single command, the system places the nodes, creates the elements and generates the mesh. This is even easier, and simpler than the boundary element method. Also, COSMOS/M's adaptive H- and P-Methods iteratively solve the problem within specified error limits so you know the accuracy of your solution. Need to take a closer look with COSMOS/M? You can refine the mesh for a critical area without remeshing the entire model, so you save time and increase accuracy.

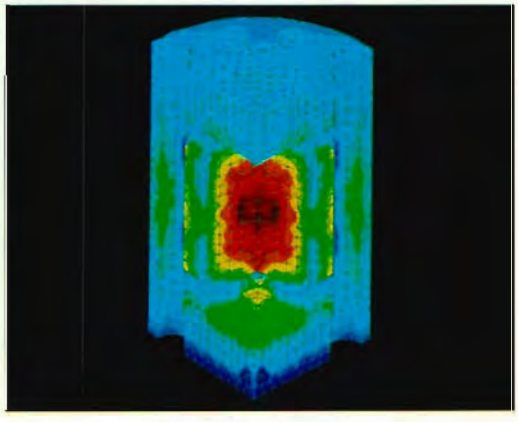
Extensive Analysis Capabilities

To ensure that you can fully analyze your models, COSMOS/M offers a wide array of 2- and 3D analysis capabilities:

- Linear & Nonlinear Statics
- Fluid Flow
- Shape Optimization
- Electromagnetics
- Linear & Nonlinear Dynamics
- Linear & Nonlinear Heat Transfer
- Fatigue
- Advanced Dynamics
  (Modal time history, response spectra, random vibration and steady state analyses)



The model is meshed using state of the art technology such as automatic meshing. The model is now ready to be submitted for analysis.



Detailed results can be viewed to gain additional insight into the behavior of the model. Additional changes to the model can then be directly made in COSMOS/M and the analysis can be repeated effortlessly.

But don't take our word for it. Call us and we will send you a FREE 50-node version of COSMOS/M to test on your own models. So ... *do you still think that 2D analysis is all you need when you can have so much more?*

STRUCTURAL RESEARCH & ANALYSIS CORPORATION

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Santa Monica, CA 90405 USA
Tel 310-452-2158
Fax 310-399-6421

CIRCLE CARD 244

SURFCAM™

Powerful CAM software for CADKEY users

SURFCAM's menu structure and view numbers are similar to CADKEY's for a clean and consistent interface.

SURFCAM includes bi-directional CADL support for seamless data translation between CADKEY and SURFCAM, including 2D & 3D geometry and NC toolpaths.

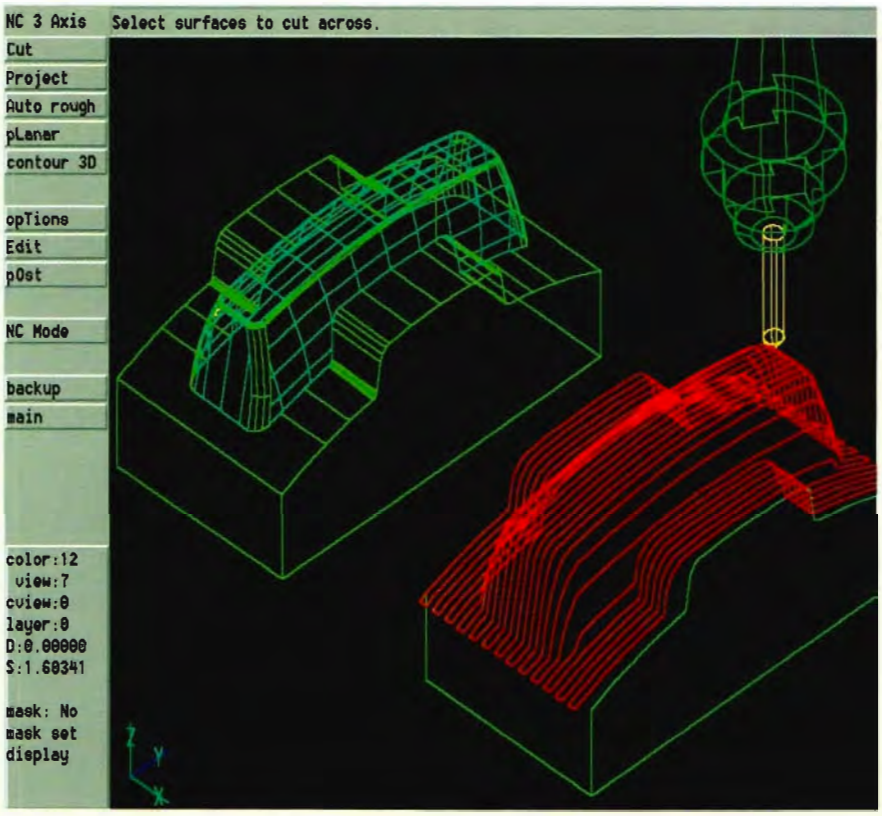
SURFCAM translates CADKEY's Bezier Surfaces from the Super Patch format into SURFCAM Bezier surfaces. (SURFCAM supports highest degree Bezier surfaces.)

SURFCAM out-performs most high-end workstation systems in speed and features, yet has been judged the easiest-to-learn all-around CNC machining system.

SURFCAM's NURBS features: a) One-step, gouge-free surface cutting of hundreds of trimmed surfaces, b) Contain cutter paths within boundary splines to allow gouge-free cutting to adjacent surfaces, c) Import IGES trimmed NURBS surfaces.

SURFCAM creates true surface models and optimized toolpaths with gouge avoidance for 2 axis through 5 axis CNC mills, lasers, waterjets, routers, digitizers, CMMs. Includes support for simultaneous 4 and 5 axis machining.

SURFCAM 32-bit DOS and 32-bit Windows versions require a 386/486 PC computer with 4 MB memory.



SURFCAM's Surfaces

Proven over 5 years.

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- ❑ **3D surface design, modeling and machining**
- ❑ **Powerful 2 axis, 3 axis, 4 axis and 5 axis systems**
- ❑ **Workstation speed & power at PC prices**
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SURFCAM™

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The JDL ExpressPlotter II – *the Total Plot Management System*™

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