

KEY SOLUTIONS

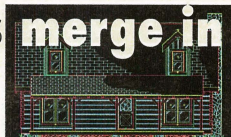
THE PROFESSIONAL JOURNAL FOR CADKEY & DATACAD USERS •

VOLUME 4 NUMBER 3 • APRIL 1995

Techniques merge in log homes

By Claudia Martin

Old Virginia Hand Hewn Log Homes was born in 1981 with the goal to continue an American heritage — handcrafting authentic, Appalachian style log homes — continuing a family tradition. Even in 1995 the homes designed and built by Old Virginia rely on many traditional techniques, tools and materials. The logs are still hand



Front view of log home design

hewn, for example. But modern tools and techniques are also used. DataCAD has been on board since version 4 and modern construction methods and engineering design assure the structures meet HUD and other building standards.

The beginning of the story is best told in the words of owners, Reed and Judy Williams. "Often we are asked how we got into the log home business. It happened quite by accident. When Jimmy Carter went into the White House, I had been a developer and builder in Northern Virginia for several years, with my office on the top floor of the Bank of Vienna building. Four years later, the interest rates had soared, the economy had soured, and we were both looking for a job. I returned to my roots, Lee County, Virginia.

I always knew that someday I would build a log home and it looked like now was as good a time as any. The more brochures I looked through, the more confused I became,

with each manufacturer claiming to be the best. I quickly saw their best just wasn't what I wanted, so I decided to build my own.

My dad's Great-Grandfather Ambrose Eagle and both his grandfathers, Emmett Eagle and Joseph Williams, were handcrafters and builders of log homes, 'log-smiths', as they were called in those days. With this in mind, Judy and I simply took a framing square, level and common sense and went up the hill to an old log house which had been handcrafted by Ambrose Eagle about a year after the civil war and studied the techniques he had used. We integrated modern technology and a few modifications of our own, and devised what we think is a near perfect system. Later, it seemed fitting to call our improved design 'The Eagle System.'

My dad, 'Babe', was a retired coal miner and my uncle, Bob Williams, a retired carpenter. Combining their knowledge and expertise in hewing and handcrafting and my experience in construction, we began to build our first log home. The handcrafting was done on site, next to the foundation. The logs were hand hewn, the dovetail corners notched, then the logs were placed in the wall, one at a time.

See HOMES, Page 8

FLYING HIGH

CADKEY takes off

By S. J. Kyle

The following is the first in a series of articles about CADKEY users in sports-related industries. Their products are diversified and yet have all been developed or improved as a result of the power, ease of use, and flexibility of CADKEY and products that work with CADKEY. The image above is from the working drawings of the first company profiled. It shows the load ribs for the airfoil of a paraglider.

Passing as he looks out into a clear, deep blue sky and a 180° horizon over Reno, Nevada, Clyde Blincoot takes a deep breath and launches himself into space from the airplane. Free falling from 10,000 feet, and adjusting to the sound and rush of the approaching ground at terminal velocity, he experiences something very few of us will ever know.

Licensed as a Professional Exhibition Skydiver by the United States Parachute Association, a rated jumpmaster and instructor, and currently licensed by the FAA as a master parachute rigger, pilot, and hot air balloon repairman, Clyde is also a designer of aeronautical equipment who has found that CADKEY, better than any other mechanical CAD package around, provides him with the tool to develop new and better parachutes, paragliders, balloons, and powered aircraft.

While skydiving remains his first love, Clyde has taken to the sport of paragliding in a big way, and is designing his first paraglider. This paraglider is not motorized, but is rather a foot-launched parachute designed to fly like a hang glider. He sees this as a coming sport craze in this country. It has already taken over much of Europe and other parts of the world.

Currently, Clyde is about a month away from the first working prototype paraglider which he designed using CADKEY 7 and the full version of FastSURF with the UNWRAP module. "Airflow analysis with my parachutes, and their flight characteristics, really seems to indicate positive results with what I have done. I hope that the ideas work as well in the paraglider as they do in the parachute. As paragliders go, it is definitely different from some because the wing has a changing anhedral (curvature across the top) and is twisted as it extends to the sides and tapers to the ends—elements which help to control air flow."

Clyde is a man of many talents and interests. In the late 1960s and early 1970s he built race cars (mostly Sprint cars—more commonly recognized as the old "Indy" cars) and a prototype development machine

See FLYING, Page 25



QUALITY FUNCTION DEPLOYMENT:

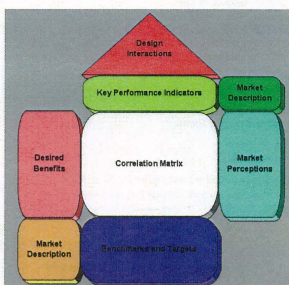
Identifying and integrating 'The Voice of the Customer'

By Robert Farrell, Jr.
Manta Corporation, Milford, Ohio

Today, perhaps more than ever before, the key to an organization achieving its goals is to develop a product which is superior to its competitor's at satisfying customer requirements. At the same time, these organizations are searching to satisfy business considerations associated with making the product easier to develop, produce, distribute, and maintain. Even in the service industries, the same principles apply.

Computer-Aided Engineering and other simultaneous engineering programs offer tremendous advantages to those organizations who have implemented the tools and technologies. But it is important to remember that the end product will fail if it is not what the buyer wants, no matter how quickly or efficiently that product was developed.

Significant amounts of time and money are spent researching customer wants and needs—only to drop the ball and fail to use that data throughout the product development process. Consequently, the industrial community is looking for a method to drive the development process using what the customer asked for as the starting point. This up-front product definition phase is the most critical part of the whole development



An intricate aspect of QFD is the matrix often referred to as "The House of Quality." Here is a matrix with the different "rooms" labeled. The rooms represent lists of information and the correlation between those lists.

product definition process known as Quality Function Deployment (QFD) for help. QFD enables organizations to focus all functional areas (design, engineering, and manufacturing processes) on developing a product definition to satisfy the requirements of all important customers.

About QFD

QFD was developed in Japan as an effort to get engineers to consider quality early in the design process. It started in the Kobe shipyards as a way to expand and implement the view of quality as taught by W. Edwards Deming and others. From there it was developed much further by the Japanese automo-

tive industry. Toyota, in particular, used it to significantly impact development time and costs. It was very successful in reducing the required change orders after production was started. This technology is widely credited as being one of the keys to their success.

Because of the success of their Japanese competitors, American companies started to investigate how these over-seas companies operated. They discovered QFD, and brought the technology to the United States where it was further developed and enhanced. Today QFD is taking root throughout virtually all industries in the U.S. and around the world.

In 1993 an organization was formed in the United States for the purpose of further developing and promoting the use of the technology throughout business and industry.

That organization, called the QFD Institute, is a non-denominational, non-competitive, non-profit organization. "It is the goal of the institute to work toward improving customer satisfaction with quality designed goods and services and to advance the use of QFD throughout North America," says Glenn Martin, Executive Director of the Ann Arbor, Michigan, based organization. "Members of the Institute are actively involved in numerous development programs related to QFD and associated technologies — as well as assisting in its integration and implementation throughout industry."

How QFD Works

The QFD process is a systematic way of

See QFD, Page 22



KEYTALK Off-line musings about going on line

BY CLAUDIA MARTIN • EDITOR

Till very recently I've been what is best described as "on-line-impaired" ... this in spite of many pressures to fire up my modem and dial in. In fact, three years ago Dana Seero, a Cadkey VAR in Marblehead, Maine, gave me regular "pep talks" about getting on CompuServe so we could transfer files easily and not make FedEx any richer than they already are, but I didn't listen. Oh, I had lots of excuses: our pre-historic phone system could not accommodate modem activity; my computer was down; my modem was on permanent loan to another department, etc.; but mostly I was just a slow starter. I'm glad to report I finally have my own shiny new 14,400 baud, my computer is operational and reliable, and the phone company devised a funky fix which allows us to actually use modems in the office. It turns out that Dana was right. (Thanks Dana!) Transferring files is easier, faster and cheaper.

The truth is the Internet will surely revolutionize the way the world does business and communicates. It seems "instant" is the operative word in every milieu nowadays. The last evolution of a similar nature was the facsimile machine. Can anyone remember the dark ages B.F. (Before Fax) and how we managed to get by? KEYSOLUTIONS has constant tight monthly deadlines, and I appreciate being able to get articles and drawing files from writers, like *right now*. CAD users everywhere who share files with distant locations will recognize this advantage.

The Internet is an incredible and powerful commu-

nication and learning tool, but I find I'm a little put off by all the media hype. First, when there's that much hoopla and hustle you *know* someone somewhere is making a lot of money or at least trying to. Caveat Emptor as the old saying goes. Many of the ads and shows project the image of Internet users as "cool", smart, "in" and having riotous fun. Then there's all the cutesie lingo (information super highway, "net surfing", etc) that's already become trite and nauseating. If you're not "surfing the net" you're left out, behind the times, and really missing something.

Maybe, maybe not. But you don't have to have the soul of a "hacker" to find value in the Internet. It doesn't have to become addictive and consume big chunks of your life. I have limited time to just go exploring down the Internet byways, but tapping in to the DataCAD- and CADKEY-specific stuff is easy and doesn't have to take a lot of time unless you want it. The activity on the DataCAD DBUG has included fascinating interchanges from all over the world on topics from multi-scale plotting (reprinted in this issue), laptops with DataCAD, 3D modeling tips, and more.

The July 1995 issue of KEYSOLUTIONS will focus on products and issues surrounding the Internet and some tips and tricks for getting around and finding CAD information. Send us your letters and messages that describe your experiences. Our Internet address is: key.solutions@on-ramp.ior.com.

KEYSOLUTIONS

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CONTENTS

APRIL 1995

TRENDS & ISSUES

- 1 **Quality Function Deployment** Identifying & Integrating "the voice of the customer" by Robert Farrell, Jr.
- 6 **Where is 3D Software & Hardware Going?** Reflections on the progress and future of 3D graphic accelerators by Jake Richter

CADKEY and DataCAD at Work

- 1 **CADKEY Takes Off** A CADKEY user designs a paraglider by S. J. Kyle
- 1 **Old & New Techniques Merge in Log Homes** Designing Appalachian-style log homes with DataCAD by Claudia Martin

PRODUCT FOCUS

- 12 **Virtual Prototyping & Motion Simulation** Saving time and money with Working Model by Rich Werneth
- 20 **VIEWPORT** BGL's high speed, large format laser printer; XI's PENTIUM CAD system with upgrade options; CORE CAD notebook

DATACAD TECHNICAL

- 11 **DataCAD Tips** Internet Intercept
- 11 **DataCAD Tutor** DataCAD for Architects & Designers by Carol Buehrens
- 19 **DataCAD Productivity Tools** Drawing Manager by Phil Hart
- 23 **Free Electronic Catalogs for Architects**

CADKEY TECHNICAL

- 10 **Creating Smart Macros** by Craig Storms, Usman Rashid and Kurt Chase
- 11 **CADKEY Productivity Tools ACTools** by Calvin Miller
- 27 **CADKEY LISP** More with DXF Codes by Ron Brumbarger and Scott Workman
- 28 **CADKEY Corner** Modeling Scale Structures for Dioramas by Walter Silva

DEPARTMENTS

- 2 **KeyTalk** 15 **New Products**
- 2 **Advertiser Index** 26 **Solution Mart**
- 4 **CADKEY Communiqué**

ADVERTISER INDEX

PG	Advertiser	Product/Service	Card #
11	Applied Production, Inc.	ProFab	212
26	Arcdraft America	Typefaces for CADKEY & DataCAD	223
5	Baystate Technologies	DRAFT-PAK	303
3	Cadkey, Inc.	DataCAD 6	201
29	Cadkey, Inc.	CADKEY for Windows	229
19	CAD Warehouse	Digitizers and Plotters	228
6	CIMTECH Training Center	CADKEY, DataCAD, etc. training	304
13	Computer Aided Technology	CADKEY Tech Support/Training Services	218
25	CORE Microsystems	Pentium CAD Workstations	230
12	Corsair Technologies	Photo-Realistic Ray Tracing	225
30	Cutting Edge Technologies	CAM software with surfaces	211
32	Ergo Computing, Inc.	ThunderBolt 120MHz Pentium	202
31	FastSURE	FastSURE	209
6	FPLOT Corp.	Pen Plotter Emulator	312
6	HighRES, I.	HIGHRES 7.1	220
26	Information Technology Int'l. Corp.	CADView software	306
26	Innovative Design Consultants	MENU COMMANDER	307
26	Insight Development Corp.	PrintAPI, Scggle, RenderPrint	314, 315, 316
20	JRL Systems, Inc.	Printers and Plotters	226
8	Krusc Inc.	Forms Control document management	231
26	Lindsey Design	MetalWorks	313
11	Nomades	Digitizer Tables	204
22	Paladin Enterprises	Paladin Tools multi-media trainer	227
23	Paradigm	POWER TOOLS BUNDLE 3.0	205
6	Poolad Design Quorum	GEORGE	309
3	Quannon CAD Systems	POWERstation 90	215
6	Quannon CAD Systems	CADKEY Reseller	311
21	SURFCAM	SURFCAM	216
26	Technical Software	DataCAD Technical Support	317
9	Texas Instruments	TravelMate 4000M Series	224
16, 17	Tri Star Computer Corp.	Tri-CAD Expert PCI	221
7	Unitech, Inc.	Cadkey products and options	207
24	XI Computer Corp.	200MHz CAD Pentium	213

CADKEY IN THE NEWS

■ Cadkey Inc. Debuts on Internet

Cadkey, Inc. has launched a new electronic technical support and news forum on the Internet for CADKEY and DataCAD. The newsgroup resides on alt.cad.cadkey.

The forum is an unmoderated newsgroup. In addition to technical support for Cadkey products (CADKEY, CADKEY Analysis, and Advanced Modeler), other topics will include information on third party software products, trade show and user group information, company and product news, software bug reporting, pricing information, technical tips, educational programs, and information on creating third-party programs for Cadkey products via CADL, CDE and DCL.

Cadkey offers a similar CADKEY forum on CompuServe (GO CADKEY). For more information, contact Cadkey at 203/298-8888. An electronic support forum is also available for users of DataCAD, DataCAD Velocity, DataCAD Estimator, and RenderStar from RenderStar Technology. DBUG is a subscription-based forum established, monitored, and managed by the publishers of *Cheeptricks*. *Cheeptricks* is a newsletter which is dedicated to keeping DataCAD users informed of new products, services, and shareware. To subscribe to DBUG, simply send an e-mail to: majordomo@world.std.com. In the body of the message, type: subscribe datacad-dbug.

■ Cadkey and the IndustryNET

Cadkey Inc. has a "home page" within the IndustryNET - address <http://www.industry.net>. Complete information on Cadkey, Inc., the company and its products, is listed. This information includes a company profile, "short" product descriptions and pricing, recent press releases, a "case history of the month", product reviews, a list of U.S.-authorized training centers and distributor referral information, and a list of upcoming events, seminars and user group meetings, etc. At a later date scanned brochures, demo software for DataCAD and CADKEY, and technical tips will be included.

■ 1995 Shows

Cadkey will be exhibiting at The Remodeler's Show at the Atlanta Convention Center, Atlanta, GA, November 3-5, 1995.

■ DataCAD Future Profiled at DBUG Meeting

Ken Parrish, head of the AEC Group at Cadkey discussed some of the latest developments taking place in the DataCAD product during a visit to the February meeting of the DataCAD Boston Users Group. First, the bi-directional DWG translator (comparable with AutoCAD 12) is in alpha/beta testing and will be released soon. It will work as a shell-out utility and be command driven from a DOS prompt. Second, a new updated VESA driver is available on the Cadkey Bulletin Board (203/298-6405) and a new driver for the S3 chip on PCI buses (Pentiums) is under construction.

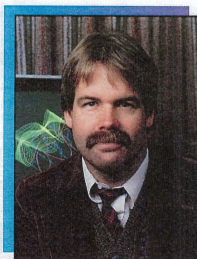
■ DataCAD Product Manager Seeks Suggestions

Charley Ferrucci, Cadkey VP Alternate Channels, is now managing the DataCAD product line. He is actively soliciting input from DataCAD users on types of enhancements and features they would like to see added to DataCAD. He recently published the following on the DataCAD DBUG Internet Forum: "The DataCAD product team is investigating possible enhancements to DataCAD 6. We would very much like your suggestions regarding the future of the DOS product. We are also developing the (semi)final product specification for Cadkey Architect. Your advice regarding this long awaited product would also be appreciated."

■ DataCAD 5 Now \$49.95 While Supplies Last

Cadkey, Inc. has lowered the price of DataCAD 5 from \$149.95 to \$49.95, while supplies last. DataCAD can produce a complete architectural design, from 2D annotated production drawings to 3D photorealistic renderings and fly-throughs. It contains 1,600 2D and 3D symbols for common objects such as landscape symbols, furniture, windows, and doors. You can also create your own symbols. Built-in macros automate many routine drafting tasks. Over 50,000 professional architects, builders, and "do-it-yourself" home users currently use DataCAD.

DataCAD 5 is fully upward compatible with DataCAD 6, the current version of the product. Upgrades to version 6 cost \$69.95. DataCAD runs on 386, 486, and Pentium IBM-compatible DOS-based personal computers. A math coprocessor is required. Minimum system requirements are 4MB RAM, 8MB RAM or more are recommended for optimal performance. All DataCAD products come with 30 days free telephone technical support and a money-back guarantee. For sales information, please contact Cadkey at 800/282-1368.



PRESIDENT'S PERSPECTIVE

BY LIVINGSTON DAVIES • PRESIDENT, CADKEY

Targeting high performance

to the maturing and omnipresence of personal computing. It is clear that the Cadkey community is playing a major part in the current economic cycle of growth. It is equally clear that we all need to work smarter and with a clear focus in order to continue playing a major role.

At Cadkey, Inc. we have just completed the first quarter of our fiscal year 1995 (which began on November 1, 1994). I am pleased to report that revenue is up from last year and that we have been profitable every month of the quarter. This kind of performance is possible only with the focused effort of everyone on staff and of each one of our suppliers and value added resellers. But even more importantly, our success is due to the success of our customers.

It is CADKEY's mission to refer viable tools which improve the

productivity of our users. If we provide tools which make you more productive and actually save you money, then we win. We are winning right now, but we do not intend to rest on past success. We are relying on you to tell us what we need to do to keep saving you money. We are committed to continue providing products with outstanding price performance ratio.

Last month I attended a meeting in Rocky Hill, Connecticut, at which around 300 users saw CADKEY for Windows for the first time. From the reaction and participation of the audience, I know we are on the right track. Continued focus on end-user productivity will keep us on target. Feedback from our customers is very important to us. Please become an active member of the Cadkey team by communicating your ideas and suggestions to your local dealers and Cadkey representatives.

KEYMAL

Dear KEY SOLUTIONS:

I wish you would section your magazine off for DataCAD & CADKEY.

Fred Marlund, Taseca Homes, Vancouver, WA
Thanks for the suggestion. This is something we are trying to do as much as possible and is an ultimate goal. When we can't make it work because of layout problems, we will label technical material as clearly and boldly as we can to help readers find their way.

Dear KEY SOLUTIONS:

I just updated to DataCAD v.6 and have tried to learn it myself, but many questions and problems arise that are not properly documented in the manual. It might be a worthwhile investment to seek professional training. I would therefore be thankful if you would direct me to such a service in my area.

Kloumns Ghobad, Van Nuys, CA

We were glad to be able to provide a list of DataCAD training centers in the March 1995 issue of KEY SOLUTIONS. This will be updated throughout the year.

Dear KEY SOLUTIONS:

Congratulations on the new look. The color and content are great, and the promise of net issues a year is welcome. In the best of worlds, it would be nice (hardier) to have an 8 x 10 or 8 1/2 x 11 magazine size that fits more easily on a desk, but that's a secondary consideration.

Tom Savage, Nicholson Mfg. Co., Seattle, WA
Others have also made this comment. We agree that the size might be awkward in some situations, but it was a trade-off made so we could produce ten issues a year. We will assess this as the year progresses.

CADKEY, INC. PRICE LIST EFFECTIVE THROUGH APRIL 30

U.S. / Canada Master Price List (U.S. Dollars)

To order, contact your local authorized CADKEY/DataCAD dealer or call the CADKEY Sales Dept at 203-298-8888.

Product Name	Suggested Retail Price	Product Name	Suggested Retail Price
CADKEY 7 FOR WINDOWS		All Previous CADKEY DOS to CADKEY	
CADKEY 7 Windows (3-1/2" or CD ROM) -	\$ 495.00	Professional 7	\$1745.00
Introductory price valid thru 4/30/95		Contact your local CADKEY dealer for upgrade programs not listed	
CADKEY / Window (3-1/2" or CD ROM) -	\$ 795.00	DataCAD & DataCAD UPGRADES	
SRP after 4/30/95		DataCAD 6 Professional (3-1/2" or CD ROM)	\$ 149.95
CADKEY		Upgrades from DataCAD 5	\$ 69.95
CADKEY Professional 7 (3-1/2")	\$1995.00	Estimator	\$ 99.00
CADKEY 7 DOS (3-1/2" or CD ROM)	\$ 795.00	TOUCH-UP Macro	\$ 49.95
CADKEY 7 Windows (3-1/2" or CD ROM)	\$ 795.00	Command Performance Macro	\$ 49.95
CADKEY Light 7	\$ 99.95	BLOCKER Macro	\$ 49.95
Advanced Modeler	\$ 495.00	All Three Macros above	\$ 129.95
CADKEY Analysis 7	\$ 99.00	SOFTWARE FOR EDUCATION	
CADKEY UPGRADE CONTRACTS - (12 MO.)		EduCAD America Program - DataCAD & CADKEY	
CADKEY Professional (Upgrades for CADKEY and Analysis, Advanced Modeler)	\$ 350.00	Call for Program Details/Costs	
CADKEY 7 DOS & WINDOWS	\$ 250.00	(Contact: Pete Mancini, Cadkey Education Dept., 203-298-6420 or FAX 203-298-6590)	Call for Quote
CADKEY UPGRADES & TRADE-UPS			
CADKEY 7 to CADKEY Professional 7	\$1495.00		



Dr. Leonard Nasman

Dr. Leonard Nasman is an educator with many years experience in engineering and CAD. He is the author of several CADKEY and DataCAD textbooks and has just completed *CADKEY 101 - The Complete CADKEY 7 Textbook*. He has taken time to share his views on CAD and education. He was interviewed by Pete Mancini, Educational Programs Manager at Cadkey, Inc.

Q: When were you first introduced to CADKEY & DataCAD?

A: Several years ago, Gary Bertoline and I were teaching in the Engineering Graphics Department at Ohio State University. Gary, then a graduate teaching assistant working on his Ph.D., is now a professor at Purdue University. At that time he had done considerable consulting in CAD, and discovered that CADKEY was very cost and time effective software for mechanical design. Gary and I saw a lack of good CAD instructional material, so we collaborated on the first CADKEY video tapes, which were for version 1.4. Then a few years later, I found myself teaching a service course for the School of Architecture at Ohio State. Before I inherited this course, it consisted mainly of an introduction to BASIC programming, data bases, and spreadsheets and was not very popular with the students. I first added a little CADKEY, and when it became available, DataCAD. After introducing DataCAD, I had to almost beat the students out of the lab with a stick—even after the final exam was finished and the course was over. DataCAD can become quite addictive.

Q: Why did you decide to write CADKEY and DataCAD textbooks?

A: I had created study guides to accompany the initial videotapes, but I soon realized it would be better if the study guide could work with or without the video tapes. So I switched to writing the books first, and then creating the video tapes based on the books' contents. I believe this results in a much better learning tool. Like everyone, I have a finite amount of time to spend learning new software, writing books, and making video tapes. Because CADKEY and DataCAD are specialized for either mechanical or architectural design, they have less over-

head than programs that try to be everything for everyone. They are also quicker to learn and easier to use.

Q: Do you have any new books planned for 1995?

A: A revision of *Intro to DataCAD* is planned for 1995. It includes information on using the new Frame-It macro and Render Star, the most significant differences between release 5 and 6. As soon as CADKEY Windows is available, I will be working on a CADKEY Windows book. A revision of *Beginning CADKEY Light* will be released sometime in 1995. Barbara, my Administrative Assistant, has a strong interest in DataCAD and is working on a Kids Architectural Drawing Workbook. We are also considering subject-specific materials, like an interior design DataCAD workbook.

Q: What is your opinion of CAD versus traditional drafting?

A: My opinions on CAD versus traditional tools have been warped by my background as a drafter. My first paying job was as a draftsman at Bell Telephone Laboratories. Because I consider myself pretty good with a pencil, I have been a skeptic about replacing traditional tools. But my opinions have gone through several phases. In the early days, the CAD systems I could afford were not capable of serious work. Later, I had to admit that you could make changes to a drawing with CAD faster than I could with a pencil, but I still could make original drawings faster with traditional tools. Now with DataCAD 5 and CADKEY 6, I can produce original drawings with CAD much faster than with traditional tools. As a matter of fact, there are drawings I can produce in a few minutes with CAD that I would not have attempted with traditional tools because of the excessive time required.

Another example: when I taught architectural drafting at a Colorado community college a number of years ago, students only did two or three perspective views near the end of the two year program. There was not enough time to do more. Now using DataCAD, I have students doing multiple perspective views within the first couple of hours with the software. This opens new avenues to explore and improves 3D visualization skills by quickly showing the relationship between the

plan and pictorial views.

With my CADKEY 7 Workbook, I have students completing slanted exploded pictorial views of parts they have created and complete dimensioned detail drawings, all in eight easy lessons. There is no way, using traditional tools, I could expect the same drawings from students in the same amount of time.

Q: How else has CAD changed education?

A: In the early days of CAD, and even with some software today, the user interface was so difficult that CAD was introduced as a new subject. Because of the time required to learn CAD, fewer traditional topics could be covered. With the latest versions of CADKEY and DataCAD, the software simply becomes an electronic pencil. The real course is architectural or mechanical drawing and design, not CAD. Because the software is very fast and powerful, more content can now be covered using CAD than with traditional tools.

Q: Can schools today afford CAD?

A: They can't afford not to because it's not that much more expensive. Traditional drawing "hardware" is the furniture. A professional-grade drafting table cost about \$2,500, another \$500 for a track drafting machine. Student-grade tables cost \$500 and up. Traditional drawing "software" is the instrument set. Student instrument sets cost from \$30, for a couple of triangles, pencils, and basic compass and divider, to \$100 for more complete kits. Even though computer hardware requirements for CAD are increasing, costs are decreasing. A professional entry level CAD computer system can be obtained for under \$2,000. DataCAD 6 and CADKEY 7 have
See ISSUES, Page 24

CADKEY Strategic Partner

Other products available from Baystate Technologies:

- Bill of Materials Database Generator
- Professional Tablet Overlay
- 2D Mold Designer
- POINT 3™ Continuous Improvement Software

VIEWER/REDLINER NEW!

View and redline notations in CADKEY (.prt) files and raster files without having to install CADKEY and without changing the original part files. Runs in Windows™ so there's no need to know CADKEY to run it. Users can copy and paste data to other applications for more efficient communication of changes back to the designer. Ideal for customer service reps, shop floor people, sales engineers, and technical support applications.

DRAFT-PAK

The Machine Design Handbook for CADKEY.™

Created by Mechanical Designers, DRAFT-PAK Productivity Software dramatically accelerates routine design and drafting operations and reduces the burden associated with tight deadlines and short design cycles. **It's like having a Machine Design Handbook in your computer!**

- Dynamic, WYSIWYG Interface
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A PC GRAPHICS PROFESSIONAL REFLECTS ON THE PROGRESS AND FUTURE OF 3D GRAPHIC ACCELERATORS

Where is 3D Software and Hardware Going?

By Jake Richter

In a big proponent of getting 3D hardware and software onto the PC desk. This is one reason I helped start a VESA committee (the VAGI or VESA Advance Graphics Interface committee) to standardize a free 3D API which would foster acceptance of 3D technology.

If more applications were 3D enabled a demand for broad, affordable 3D hardware support would be created. Conversely, widely available, low cost 3D hardware justifies the development of 3D enabled software. The obvious problem is that this is a chicken and egg situation - which one will happen first?

PC users need to be educated as to what 3D really is in terms of PCs, and be shown the benefits of PC 3D, ... as solutions/environments that stand up on their own.

- Jake Richter

designed the Win/G interface to provide fundamental memory to screen blitting capabilities for Windows applications. In 1994 at COMDEX, DOOM was running under Win/G. Argonaut and RenderWare libraries also support Win/G.

The visual performance of these software-only renderers leaves one wondering why 3D hardware is even necessary. Then you see Jurassic Park, T2, or some other 3D graphics animation feature, or play with the newest Virtual Reality games, and realize software may be fine for some things, but powerful graphics hardware is required for real improvements in display performance. On the PC this will happen and, I argue, must happen as part of the normal evolutionary process in PC technology. However, low-cost 3D software based on software rendering needs to happen first to provide for future extensions which deal with hardware acceleration.

3D Performance
All this talk of visual 3D performance poses the question of how one measures such performance, and once measured, what does it actually mean?

Over the last year, I've had over a half dozen aspiring vendors of 3D graphics hardware quote some large numbers, such as "this chip will do 250,000 gouraud shaded triangles per second", (frequently the number is repeated twice, apparently to help me understand that this is a really good thing). I'm sure that a sophisticated graphics workstation user, who probably also deals with multi-tasking, multi-threaded operating systems and has a \$50,000 per seat purchasing budget for computer equipment, has a reasonable sense of what this all really means.

But, until recently, such numbers had no real meaning for me, and I'm ashamed to say that even now my pulse doesn't quicken when being quoted big triangle numbers, although I am better at visualizing what they represent. Considering that I've been involved in personal computer graphics (including pre-IBM PC systems) for about 15 years and still can't comfortably correlate the triangles/second rating to reality, how do you think the average PC user is going to feel when he gets these large unrelatable numbers whipped at him? Especially as the 3D PC hardware wars heat up.

Consider this a strong suggestion to create a 3D performance measurement that relates to the experience of the average PC user who will be targeted as the purchaser of the new generation of 3D PC hardware. For instance, the DOOMmark could measure how many frames per second of DOOM play you get at a given resolution, on a given system.

Another aspect of the whole triangles/second measurement is that while the graphics hardware can support such amazing drawing rates, frequently the systems these graphic devices are located in can issue drawing requests for only a small number of triangles per second. I've heard that a 60 MHz Pentium system can only generate between 50-50K 2D triangles per second based on the assumption that the CPU has to perform the

transformation on the original 3D triangles to generate a 2D windowed triangle. The exact numbers aside, bandwidth issues are very real limiting factors, even with today's Pentium systems and local bus adapters.

One other 3D performance issue I think needs to be addressed is that of expectations. There are known limitations inherent in PCs and graphics hardware. I, therefore, can state with confidence (at least for the time being) that a sub-\$5000 system combination will not be able to produce the same real-time graphics performance a high-end SGI system can. However, if the typical PC user uses clips from CNN, scenes from Jurassic Park or Lawnmower Man, and the capabilities of his or her Super Nintendo as a reference point, his PC 3D will look rather disappointing. Heck, DOOM, a software-only 3D program, looks better and responds faster than much of what I've seen so far on the expensive PC 3D graphics boards.

PC users need to be educated as to what "3D" really is in terms of PCs, and be shown the benefits of PC 3D, not as a comparison to unrealistic portrayals in the media and elsewhere, but as solutions/environments that stand up on their own.

The Workstation Mentality
Many of the misconceptions about PC 3D graphic hardware can be attributed to what I call "The Workstation Mentality". This term stems from the fact that many new entries in the 3D hardware market are from companies that have no experience in the PC market, but lots in the more expensive workstation market. Typical symptoms of this mentality include:

- Thinking that because their hardware is 3D, PC people will automatically buy it.
- Pricing their product(s) with board level implementations in the \$1500 to \$4000 range because that's "competitive" in the workstation market. In the PC market, the range for high-end graphics boards is \$600-\$1000.
- Assuming that the PC market is full of 3D applications that can immediately take advantage of their hardware.
- Figuring that Windows NT will be the platform of choice for anyone wanting 3D technology. In reality, the largest volumes will probably be under a combination of Windows 3.1, DOS and Windows 95, assuming that 3D APIs, which really do take advantage of accelerated 3D hardware, start shipping on these platforms. Mind you, Windows NT (Daytona's OpenGL, actually) is probably the best 3D platform right now on the PC, but I still haven't seen many OpenGL applications announced for NT.
- Assuming that all monitors in the PC market are created equal, since that's the case in the workstation market.
- Believing that on-board (or not-on-chip) VGA compatibility is not required. This is a major fallacy. All PC graphics boards should have VGA compatibility, but it should be "disable-able" for devices with a dual screen configuration. VGA compatibility should be on-board or on-chip because many power users (the most likely early adopters of 3D technology) are likely to

have fully loaded systems and will not want to devote two slots to graphics boards.

Human Interfacing with 3D

The other side of the problem is the PC users themselves. Most do not understand what 3D means in a computer context. Several different things contribute to this confusion. Displays. These are all 2D which makes it tough to see the back of the object without doing some "contortionistic" manipulations on your input device.

Input Devices. Most PC users only have mice or keyboards. Some might have 3D/6D input devices, but with the exception of the Logitech Cyberman (\$80 or so), all the rest are bloody expensive.

Our childhood. While many of us got to play with blocks, tinker toys and other "3D" toys in our early years, society has forced us to think

and deal more in 2D, even to the point of taking 3D words around us and applying it in 2D. We even applied such efforts and apply labels like "Realism" to them. Sigh!

All in all, we need to make people 3D-aware by making them deal with the world as a 3D entity. People need to be able to think in 3D and manipulate in 3D in order for 3D to become completely natural on the desktop. Obviously, that's not going to happen tomorrow, especially to people who are beyond their childhood years and thus have a more difficult time (re)learning basics. What we can all do, however, is try to come up with a portable standard 3D interface paradigm that will make using 3D applications, and therefore 3D hardware acceleration, much more intuitive.

For 3D hardware to truly become the premiere PC product category of 1995 (or 1996 if you're a pessimist) there must be 3D graphics software which can be dynamically adapted to support 3D hardware acceleration by just replacing DLLs, runtime libraries, etc. The new breed of smart, software-only renderers must evolve to support such hardware. Alternately, something like VAGI needs to be marketed, and/or Intel and Microsoft need to be encouraged to further expand their 3DR and 3D DDI interfaces across multiple operating systems, as well as include general support for more advanced graphics functionality. Finally, some sort of standardization for input devices for 3D applications and software is needed to help further promote the growth of 3D software acceptance. Jake Richter is President of Panacea, Inc., a leading developer and provider of commercial and OEM display drivers in the PC market. Jake can be reached at "jake@panacea.com", FAX 603-434-2461 or PH 603/437-3022 x230. This article originally appeared in *Jon Peddie Associates' industry newsletter, "PC Graphics Reporter"* in 1994.

...if the typical PC user uses clips from CNN, scenes from Jurassic Park or Lawnmower Man, and the capabilities of his or her Super Nintendo as a reference point, his PC 3D will look rather disappointing.

- Jake Richter

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Side view of an Old Virginia Hand Hewn Log Home.



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stores, blacksmith shops, summer camp buildings, church retreats, community buildings, Appalachian Trail shelters, and a museum.

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Dave Ramey has been the chief draftsman at Old Virginia since the mid 80s. He has used DataCAD since version 4 and appreciates CAD's power when it comes to all the custom work done at Old Virginia. He estimates that it at least doubles his productivity. He jokes that this increased capacity is a double-edge sword. People know he has CAD and seem to want and expect a lot more changes these days. It's easy, right?

When Dave started with DataCAD, his previous CAD experience enabled him to be really productive in less than a month. Now he has built his own library of symbols related to log house construction. The only thing he draws manually these days is the log cutting sheets used in the yard. If he can find time to write a macro for this phase, he will eventually automate this as well.

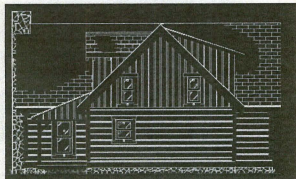
In these days of impersonal glass, concrete, steel and plastic structures that often all look alike, the story of Old Virginia and their homes are like a refreshing breeze. They provide a balance to the "glitzy" modernities which bombard us at every turn and a needed link to the past.

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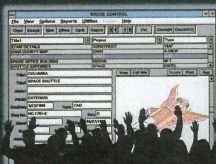
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The following publishing schedule is in effect for the first 10 issues of KEY SOLUTIONS Journal. We will not publish an issue in May or November of 1995.

- February '95
- March '95
- April '95 issue
- June '95 issue
- July '95 issue
- August '95 issue
- September '95 issue
- October '95 issue
- December '95 issue
- January '96 issue

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PRODUCTIVITY TOOLS

ACTOOLS - FOR ENHANCED EDITING AND DETAILING

By Calvin Miller

I've been in CAD/CAM for over 17 years and have never found any CAD software that has everything and fills every need. That's why third-party software exists. ACTools is one of those "must have" programs that can make you comfortable and very productive in CADKEY. ACTools, a set of over 40 CAD utility programs and macros, supplements the basic CADKEY tool set and runs under CADKEY. Each tool can be independently "bound" to a key or tablet, placed in the CADKEY menus, selected from a "pop-up" list, or added to an icon panel. The tools do not replace CADKEY's functions, but enhance them.

I can't describe all the things ACTools does, but I have included what I see as some of the most beneficial programs of the set. The first is the ACTDIM utility. The generic dimensions used by this program are different from regular dimensions in the following

ways: up to nine line segments can be used which makes multiple leaders and broken view lines possible; they are selectable on any of their elements; and CADKEY's detail/change and update affects the generic text string only, not the views, leader and arrow segments. A few of ACTDIM's other options include: text alignment, justification, attribute and placement options, arrow precision and tolerancing options, and leader, linear, parallel, offset and isometric dimension construction plane construction.

ACTools' Balloon Labels utility program provides five different balloon types (circle, triangle, hexagon, square, and target) with four leader tip styles (arrow, bullet, slash and point). You can use the current CADKEY attributes for dimensions with the balloons, or modify the CADKEY dimension and text attributes specifically for the balloons. You can make the balloon the size you want by making the text height a function of the bal-

See ACTOOLS, Page 23 ☐

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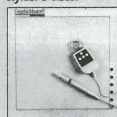
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Working Model

Virtual prototyping and motion simulation saves time, money

By Rich Werneth

What is Virtual Prototyping and who needs it?

The typical development cycle of a mechanical product involves up-front design, typically on a CAD system such as CADKEY; the manufacture of single or multiple prototypes; testing the prototype; and then refining the initial design. Virtual prototyping, an adjunct to this traditional process, can streamline the product development cycle by integrating the prototyping phase more closely into the CAD design phase. This methodology utilizes software that greatly reduces and, in some cases, even eliminates the need for costly physical prototypes. In addition, up-front analysis allows for design optimization and the associated reductions in manufacturing costs. In a nutshell, these benefits make every design that involves moving parts a potential application for virtual prototyping.

What Can a PC Designer Do?

Until recently, virtual prototyping software was only available in the workstation environment. Now *Working Model* from Knowledge Revolution (San Mateo, California) provides a powerful PC-based (or Macintosh) toolkit for motion simulation, prototyping and anima-

tion. Created specifically for engineers and designers, *Working Model* integrates a powerful kinematics/dynamics engine with a state-of-the-art graphical user interface. This exciting new software tool can save time and money throughout the design process because engineers can create and analyze mechanical systems on a desktop computer before building costly prototypes.

Working Model can be used throughout the design-to-production process. Initially, it can help put together a "napkin sketch" of a product concept. In the design phase, its analysis tools ensure the concept meets design criteria. In the product testing phase, *Working Model* can eliminate the need for multiple prototypes and allow for design iterations to be quickly evaluated and modeled. On the shop floor, design and troubleshooting of production machinery can be accomplished.

Is Working Model easy to use?

Working Model was developed with both the everyday and occasional user in mind. The graphical interface is structured so that even the infrequent user will not have to relearn the functions of the software, yet is flexible enough to accommodate the full-time analyst. The usual arrangement in a company typically involves several experienced engi-

neers who possess the combined "knowledge base" of company designs. *Working Model*'s experience available to everyone involved in the design process, from freshman engineers to management.

Working Model Case Study

Working Model has been used for applications such as automotive suspension systems, mail handling equipment, mountain bicycles, heavy construction equipment, and surgical equipment. A current real-world example of *Working Model* in action is Snorkel Economy of St. Joseph, Missouri, a manufacturer of heavy construction equipment.

Snorkel is an OEM of self-propelled aerial work platforms or "cherry pickers". Their main customers include construction companies, aerospace companies and rental equipment yards.

A Snorkel Economy machine is stabilized solely on its tires; it doesn't have outriggers, extensions or braces. In the initial design process, one of the key specifications considered is the vehicle's balance in all possible boom and machine configurations. Recently, engineer Dave Engvall analyzed an articulated boom with 27 pin joints, including a telescopic extension with a basket on the end that serves as the work platform. The boom had three main lift cylinders and two other cylinders for leveling the basket. Two aspects of the design were crucial: the stability of the entire vehicle, and the load on each of the 27 pin joints.

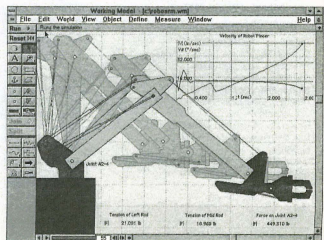
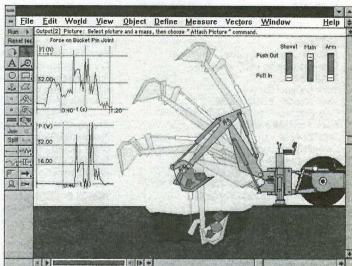
To test the design's feasibility, CAD files were imported into *Working Model* via DXF translators. Specific design parameters were assigned, including component weights and materials, forces acting on this basket at different extensions, and various ground inclines. As a result, Engvall quickly aban-

doned unrealistic models and was able to narrow his design to one that would work in the real world.

"I placed my model in a known critical stability orientation and then added the counterweight until I made the situation stable," said Engvall. In just a few seconds, *Working Model* demonstrated at what point the mobile lifter was stable. "I had great confidence in the results," confirmed Engvall. "And it's much more enjoyable to watch the machine tip over in my mechanism model than in the real world. Using *Working Model* has greatly streamlined the calculations necessary to match the boom structure weight with the counterweight."

Measuring the load stress or static force balance on individual pin joints was the other major application that *Working Model* helped Engvall simulate. The software was used to assign the proper weight to each component, then put a pin joint at each location so the components could move, and then let the simulation run. This determined the pin loads

See PROTOTYPING, Page 22



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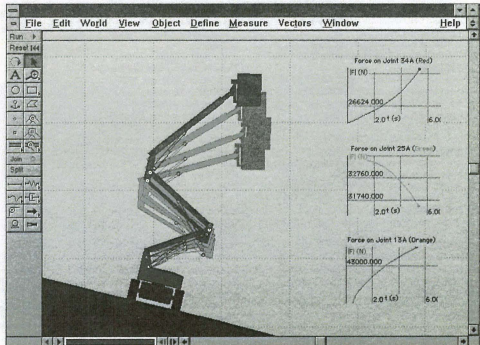
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Software evangelists on every corner

By Jake Richter

It started a few years ago. Certain large companies such as Apple and Microsoft started blessing key employees with the spiritual title of "Evangelist." It was the Evangelist's mission to go forth and spread the gospel of whatever product and/or philosophy the company wanted the masses to worship.

At first, it was a novelty. You'd get a business card, read the title ("Software Evangelist," etc.) and a beatific smile would form on your face, expressing a sentiment similar to that of your grandmother about to pinch your cheeks and tell you how much you've grown since she's last seen you. In other words, it was cute.

But, as time has shown with Barney the Dinosaur, even cuteness has its limits when it gets ballistic and is perpetually "in your face." Nowadays, it seems like everyone has an evangelical title of some sort. The irony of the whole thing is that in the 80s, evangelists (of the television kind) were perpetually paraded in front of us as examples of the depravity of human nature. Do we really want technology evangelists associated with the likes of Jim and Tammy Faye Baker, Oral Roberts, or Jimmy Swaggert?

What does the title of Evangelist really mean in our industry? A quote from a recent elevated Microsoft evangelist was, "Whenever Microsoft designates a person to be an evangelist in a given technology, it means that Microsoft intends to dominate that technology area in the near future." That's an uncommonly honest and blunt definition, but it does say it all. However, with the blatant overuse of the Evangelist title, it's not clear that all companies who employ evangelists have the

position as clearly defined as Microsoft. So, as a means to allow companies with differing philosophies to better categorize their employees, we'd like to suggest the following new generation of secular/semi-secular technology titles (imagine them preceded by "Software," "Hardware," etc.).

Atheist - Doesn't believe in technology at all and can't understand why anyone does believe. Workstations Evangelists tend to be PC Atheists.

Believer - Someone converted by an Evangelist or the like. Probably brainwashed to the point that they don't question anything - they accept what they are told without needing supporting facts.

Buddhist - Believes in all technologies, and that with time and inner awareness all technologies will ultimately become one. One could argue that Bill Gates could be deemed part-Buddhist as he believes that all technologies will ultimately become Microsofts.

Communist - Feels that all technology belongs to a single entity, no matter who actually developed it, and that the entity should use such technology to benefit the entity, which should benefit all those associated with the entity. Software pirates occasionally are part of this category.

Deity - This is the most knowledgeable person, world-wide, in a given technology field. No one else comes close to that person. This should be a earned position, over many years of effort, and not given lightly. Sometimes also referred to as God.

Democrat - Believes that no matter what the technology is (although it tends to be quite bulky and ill-defined), it should cost more than it brings in, while being freely available to any group of people who claim

that they need it, as long as they aren't rich. Such technology should also be administered by as many people as possible. Coincidentally, the National Information Infrastructure seems to fit the type of technology a Democrat would promote.

Gadfly - Is excited about every new technology that comes along, but just for a brief period of time (i.e. until the next cool technology is presented). However, during the brief period of excitement, they evangelize with the best of the dedicated Evangelists. Editors and writers for computer publications are frequently Gadflies.

Hippie - Truly feels that all technology should be freely available to all those who want it, and everyone should be happy as a result. Ever hear of the Free Software Foundation and GNU?

Libertarian - Doesn't care what technology anyone else believes in or promotes as long as it doesn't interfere with anyone else's way of life. Libertarians are proud of the fact that they still use DOS and don't buy the latest upgrades.

Luddite - Fears all technology and wants to see it destroyed. These people are either locked up or lurking just around the corner.

Mercenary - Will evangelize any technology for a reward, usually monetary. Could be one technology one day, and a competing technology the next. Mercenaries frequently take the guise of independent IT and marketing professionals, although some employees have gone to market to assume the role as well, usually with disastrous results for the employer.

Nihilist - Wants to destroy all technology for the sake of its destruction. May pair with the Luddite for convenience's sake. Needless to say, you don't want a Nihilist working for

you.

Preacher - An Evangelist whose technologies have time and time again become the leading technologies in the market on their own merit. There's also the False Prophet, who has managed to evangelize leading technologies by coercion instead of merit, and done so many times (see "Terrorist").

Republican - Believes that while technology can be a good thing, it's best not to rush things too much. Technologies should be thoroughly analyzed to make sure that they are safe to start using, and should be administered by lots of smaller disparate groups that should be able to communicate with one another. COBOL is still widely used because of Republicans. Opposite of the Democrat.

Scrooge - Favorite line is "bah-humbug!" in response to a question about the latest technologies. Also known as an Un-Believer. Opposite of the Gadfly.

Terrorist - An Evangelist that's gone over the edge in trying to convert the faithful to his or her technology. Uses market pressure, coercion, threats, and unethical means to force people to adopt his or her view. This title may also be applied to marketing and sales people, as the Terrorist does not need to really have a technical background. Terrorists may also be Mercenaries.

Whisperer - A Believer that is too far gone to even consider questioning reality, even if it means to harm those around them. Fans of Gadflies are sometimes Whisperers. *Jake Richter is the Founder and CTO of Panacea Inc., the leading developer and provider of commercial and OEM display drivers in the PC market. Jake can be reached electronically as "jake@panacea.com" Article Copyright (c) 1995 by Panacea Inc. - All rights reserved.*

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INDUSTRY BRIEFS

Product Development Forum Launched

Conceptual Product Development, Inc. has launched the Product Development Forum (PDF), an interactive membership for professionals who want to exchange information on techniques and services that help bring products to market more quickly. Anyone involved in product development - design, engineering, manufacturing, packaging, quality control, marketing, sales or corporate management - are invited to join.

Finding the right information quickly and keeping current on new technologies are two of the most common impediments to engineering productivity. The PDF enables members to seek advice and get answers to question such as "what is the most cost-effective method of prototyping this type of product?" or "who provides CAD solid modeling services in my area?" Members exchange knowledge via an information request phone and fax service, electronic membership directory, and The PDF Report, a monthly publication filled with member-contributed articles, tips, and a classified ad/bulletin board section.

Individual memberships cost \$89 per year within the U.S. and \$125 per year outside the U.S. Corporate memberships are available for \$649 within the U.S. and \$750 outside the U.S. A complimentary issue of The PDF Report can be obtained by contacting "Virtual Marketing" at 203/347-5042 or FAX 800/395-3208. The Product Development Forum is managed by Conceptual Product Development, 623 Eagle Rock Avenue, Suite 150, West Orange, NJ 07052.

Panacea Inc. & Spacetic ILC Merge

Spacetic ILC Corporation of Lowell, MA and Panacea, Inc. of Londonderry, New Hampshire have completed a merger. Panacea, a leader in PC performance graphics display technology, has become a wholly-owned subsidiary of Spacetic ILC, world leader in interactive motion control 3D hardware and software. Panacea's founder and mentor, Jake Richter, will remain President and Chief Technology Officer of Panacea.

Spacetic ILC's products include SpaceController @ 3D-I Controller which works directly with CADKEY. The company is about to launch a hand-held multi-functional advanced 3D-I games controller called Spacetal Avenger™, which provides breakthrough interactive 3D control capabilities in popular PC 3D action games such as DOOM, DOOM II, Rise of the Triad, Dark Forces, Heretic, and Descent.

NASA Awards Contract for General Aviation Design System

As part of NASA's plan to revive the domestic General Aviation

industry, a contract has been awarded to DARCorporation of Lawrence, Kansas to develop a General Aviation CAD package that will run on 486 IBM-compatible computers and be priced affordably.

The recently awarded contract is a Phase II Small Business Innovative Research contract which will result in a CAD package to be marketed to individual and small manufacturers of G.A. airplanes, turboprops, and others interested in the design and analysis of airplanes. The program will include modules that will take the designer from conceptualization through plan-drawings, including aerodynamic, flight dynamic, and structural analysis.

ViewSonic and Optquest Join Forces

ViewSonic, one of the world leaders in the computer monitor industry, and Optquest, a major supplier of monitor and UPS products, have announced a strategic alliance. The two companies will unite their sales and marketing efforts to provide the market with a diverse range of products for all applications and budgets. Optquest monitors will become the value line of ViewSonic and be referred to as "Value Line Monitors by ViewSonic".

New CD-ROM Products Provide Business Information

The Economist Intelligence Unit, global business information arm of the Economist Group, announced the introduction of new CD-ROM based products that provide business intelligence on key countries and regional markets. The new CD-ROM collection provides authoritative, long-term economic, political and business outlooks (both quantitative and qualitative analysis) for the Americas, Asia-Pacific, Eastern and Western Europe, the Middle East, and Africa. EIU's "Country Forecast on Disk" service is updated every other month and contains full text information with statistical tables from January 1993 to the present. The service is available in DOS and Windows versions. For further information contact Lou Celli (New York office) 212/554-0060 or Matthew Bantock (London) 0171 379 3404.

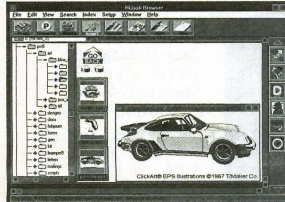
Universal Schematic Technology for PCI Bus Solutions

CMD Technology Inc. of Irvine, California has introduced its Universal Circuit Board Schematic which enables CMD's line of PCI to IDE controller chips to be interchanged in all PCI motherboards with little or no modifications. The Universal Schematic eliminated the need for redesigning motherboards and makes future upgrades easy; simply remove the old chip and replace it with the new one.

SOFTWARE

Evergreen Notes™ for Windows™

Now Windows users can attach a reminder or reference note anywhere in their applications. Rather than having notes stuck to your monitor, keyboard or CPU, Evergreen Notes for Windows stores your notes and calls them only when needed. The user can save voice, sound, and text messages as additional information to documents without altering the original document in any way. Notes can be attached to location on a document or application. Notes are not restricted to short sounds or text, but can include pictures, budgets, personal files, etc. Evergreen Notes uses 120K, requires Windows 3.1+, and works with all Windows-compatible sound cards. Contact Evergreen International Technology, Inc. at 604/936-6121 or FAX 604/980-7121.



Hijaack Browser

Hijaack, Graphics Suite™ for Windows

Inserts Hijaack Graphics Suite version 3.0 for Windows features enhancements to Hijaack Browser with better graphics organization and cataloging. IGOR™ for converting raster to vector graphics file formats with tolerance settings, unidither, and speck removal; support for CD, EPS, WMF, and RLE; Hijaack Smuggler for smuggling graphics into any application that supports pasting from the clipboard; Hijaack TouchUp which enhances raster graphics with text, color, special effects, etc.; and Hijaack Draw which has vector graphics with drawing tools, object manipulation, and professional text editing. Registered users of Hijaack Pro 2.0 can receive an upgrade for \$49.99 plus shipping and handling. The purchase includes over 3000 pieces of clip art and full color images. Inset offers an unconditional money back guarantee. Contact Inet Systems, Inc. at 203/740-2400 or FAX 203/775-5634.

Myriad™ for Windows in German

Informative Graphics Corporation and PlanNet GmbH (Europe) have collaborated to develop a German version of Myriad for Windows. Myriad for Windows lets users view, redline, and plot over 100 vector, raster, word processing, database, and spreadsheet file formats. Myriad also has hybrid viewing, point-to-point measure, batch printing, export to clipboard, and native CAD drawing file viewing. DDE/DLL and Microsoft Mail support is included. A network plot spooler enables printing to numerous devices. Contact Informative Graphics at 602/971-6061 or FAX 602/971-1714.

HARDWARE

Bose MediaMate™ Speaker

The new MediaMate computer speakers by Bose offer dual channel input, mixing capabilities, and are specially equalized for near-field listening. Special proprietary circuitry provides good bass tones at low listening levels and prevents audible distortion at high volumes. These speakers take up less room than most diskette storage boxes, and can be mounted to the sides of the computer. Each

speaker enclosure measures 7.5" x 3.5" x 8.5" and is priced at \$339. Contact Bose Corporation at 800/444-BOSE (2673).

MultiPad™ Graphics Tablet

The MultiPad 609J graphics tablet features a cordless pen, 2540 lines per inch resolution, 256 levels of pressure sensitivity, 128 levels of tilt (4/-60°) for drawing and printing applications, 205 points-per-second read rate for fast pen-to-scan drawing, and 0.007" accuracy. The pen's switches can emulate all three mouse buttons to point and click in other applications. The tablet measures about the size of a mouse pad, and weighs just over one pound. The MultiPad will be available in five models for Windows, DOS, Macintosh, IRIX OS, Solaris, and HP-UX platforms. Suggested list price is \$249 for PC models and \$269 for Macintosh.

Contact Hitachi Digital Graphics (USA), Inc. at 408/747-0777.

SummaJet™ 2 Series Plotters

Summagraphics Corporation has begun volume shipments of its new SummaJet 2 Series large-format, monochrome and color ink-jet plotters. The four models of the SummaJet 2 Series feature refillable and interchangeable print cartridges, software upgradability, optional Ethernet adapter and memory upgrades, and upgradability from monochrome to color. Prices start at \$2,799.

Contact Summagraphics Corporation at 512/835-0900 or FAX 512/835-1916.

MISCELLANEOUS

Free Hewlett-Packard Paper Feed Cleaning Kit

Users of the Hewlett-Packard DeskJet 520, 530, 540C, or the DeskWriter 520 who are experiencing paper feed problems can call 1-800-656-2324 and request a free HP Paper Feed Cleaning Kit. The kit shipped at no charge will allow users to fix the problem on their premises in about 20 minutes. Each kit cleans up to 10 printers. These printers are still fully covered under Hewlett-Packard's three-year warranty. Contact Hewlett-Packard at 1-800-656-2324.

On-Line A/E/C Tradeshaw

Ideal Scanners and Systems, Inc. and A/E/C Systems, Inc. are bringing A/E/C Systems 95 to the IDEAL Internet Shopping Mall. The A/E/C Systems 95 on-line tradeshaw provides comprehensive show and conference information ranging from an exhibitor directory and conference speaker bibliography to hotel information. The IDEAL Internet Shopping Mall is also providing exclusive on-line conference registration for the June 5-8 tradeshaw being held at the Georgia World Congress Center. To register for the A/E/C Systems 95 on the IDEAL Internet Shopping Mall, use the address: <http://www.ideal.com>.

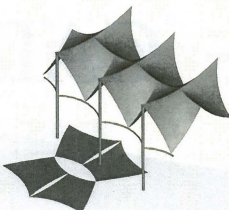
Contact A/E/C Systems, Inc. at 800/451-1196, FAX 203/666-4782, or E-mail 73511.101@compuserve.com.

ENGINEERING

Aero-D Aeronautical Design Package

Aero-D is an integrated aeronautical design and analysis package which consists of three programs for surface definition, flow analysis, and data visualization: Loftsmn/P is a lofting program for wings and fuselages; Cmacr is a low-order panel method inviscid fluid flow analysis code based on NASA's Pmacr-12 which has been translated from FORTRAN to C; and Postmacr is a graphic postprocessor which provides rotate and

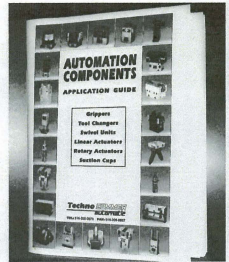
zoom views, color mappings, vector arrows representing local velocities, pressure distributions along any cross-section, and animated on- and off-body streamlines and wakes. Aero-D runs on any IBM/PC and requires 386 or better CPU, DOS and Windows 3.1, at least 4MB of RAM, and a math-co-processor. The complete package is priced at \$2,500, not including Cmacr source code. Contact Peter Garrison at 213/665-1397 or FAX 213/953-8378 or E-mail 73113.2167@compuserve.com.



Awning rendering in FastSURF

FastSURF 7.03

FastSURF of California is now shipping FastSURF version 7.03 for UNIX, SUN, and SGI platforms. FastSURF 7.03 runs with CADKEY 6.0. The price is \$2,195. Also available is FS-CAM, which machines FastSURF surfaces with a ball-or-ballnose end-mill, and can also place a cutter "on" any of CADKEY's primitive curve geometry. FS-CAM sells for \$750. FastSURF UNWRAP develops flat (2D) patterns of compound (3D) surfaces. The flat pattern can serve as a template for sheet metal layout, sail making, etc. UNWRAP sells for \$750. Contact FastSURF at 209/536-0591 or FAX 209/536-0592.



Automation Components Guide

Automation Components Application Guide

A new, free 32-page guide, "Automation Components Applications Guide, H903", is available from Techno-Sommer Automatic tools. The guide contains application and selection guidelines for over 2,300 of their off-the-shelf automation components and highlights a variety of robotic grippers, application tips for pneumatic tool changers, swivel units, linear cylinders and suction cups. The components discussed are available on a special free trial evaluation basis. Contact Techno-Sommer Automatic at 516/928-3970 or FAX 516/926-8827.

Cubital America, Inc.

Cubital America's new North American managerial, new technology, and new computing environment have produced significant

price-performance advantages that have led to increased market acceptance of its rapid prototyping systems worldwide. Cubital offers the Solider 4600 and 5600 systems, whose Solid Ground Curing process avoids many of the drawbacks of other rapid prototyping systems. They deliver 10 to 15 times the throughput for less money than other high-end systems, and can produce fully functional assemblies in a single run. Contact Cubital America, Inc. at 810/585-7880 or FAX 810/585-7884 or E-mail cubitalnae@attmail.com.

McAE Introduces Inertia 5

Modern Computer Aided Engineering recently released Inertia version 5, an FE software running under Windows that can immediately analyze solid models. Inertia gives the user the ability to import a solid model from a CAD system and automatically create a mesh, eliminating the time-consuming process of manually connecting curves to create congruent surfaces. Other features include shading and rendering, and rotate, zoom, and pan functions. The Inertia engineering system supports all major graphic operating environments, including Windows and Macintosh. Inertia sells for between \$5,000 and \$15,000.

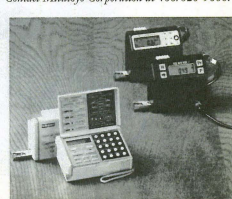
Contact McAE, Inc. at 800/444-6223 or FAX 317/469-4130.

CGTech's "Total Verification System"

CGTech's Machine Tool Simulator Module provides full machine tool simulation and constant collision detection between machine components, holding fixtures, and tool assemblies. The Machine Tool Simulator Module operates in synchronization with RevPost II and VERICUT to alert users about dangerous collisions that may damage the part, machine, or possibly endanger bystanders. VERICUT is a software program that simulates and displays the material removing process of an NC toolpath on a computer monitor. It depicts milling, drilling, and turning operations with 2-axis through 5-axis simultaneous motion. Using VERICUT, the NC programmer verifies the quality and correctness of the toolpath and corrects inefficient motion or programming errors without using the NC machine tool. Contact CGTech at 714/753-1050 or FAX 714/753-1053.

Electronic Function Measuring Tapes

Minutoyo has introduced new measuring tapes with multiple electronic functions. The Digidic Snap-Lox tapes provide direct LCD readout of the unit's blade extension. Special functions include Preset to enter any starting point; Floating Zero, memory of up to 8 measurements; Hold to freeze the display; and Data Output to print-out and analyze readings via Minutoyo's portable data processors. Also available are the Converter/Calculator models which feature a built-in electronic calculator with a flip-up lid. The models perform all basic math functions as well as Pythagorean calculation and measuring unit conversions. The blades on all models are 16 feet long and graduated in both inches and millimeters. Contact Minutoyo Corporation at 708/820-9666.



Electronic Function Measuring Tapes

The following is an edited excerpt from chapter 13 of the new book *DataCAD for Architects & Designers* by Carol Buehrers.

Template Fields

When you create templates you're prompted to add fields to the template form. Fields are information areas attached to each of your symbols that can be extracted for schedules, counts, and other needs. For example, if you used outlet symbols in your electrical layout, you could easily extract how many were used and the total cost with it!

This information, which is added when the symbol is saved to the template, can be modified at any time. The actual report forms are created with simple text files found in the DCAD6\FRM directory. Several forms are included with DataCAD and you can create more.

Fields 1 through 6 are defined internally in DataCAD and you're prompted to supply information for them every time you create a symbol. They are: 1. Item name; 2. Manufacturer; 3. Model number; 4. Remark 1; 5. Remark 2; and 6. Cost. Most of the time, you'll only worry about the Item Name for your symbol because it appears in the message area when you hold your cursor over the symbol in the template box.

Creating Symbol Reports

To extract a symbol report from a drawing (an electrical layout, for example), the symbols CANNOT be exploded. Exploding symbols breaks them into regular entities and database information is no longer connected to them. To follow this exercise, use your own drawing or create a test drawing.

1. Call up the drawing that contains the symbols. If you don't have one, pick the Default option, pick the PLAN_1-4 default, name this new drawing: reports, then press Enter.
2. If this is a new drawing, you must add some symbols to it before you can run a report.
3. Press T to go to Template.
4. Bring up the template you'll use. The template must be displayed to extract a report. For example, to retrieve an electrical template, pick NewPath. Pick the "u" option, and then pick ELEC to set your path to tp\elec. Press Enter. Pick the appropriate template, such as RCPTCL (receptacles).
5. If you're creating a test drawing, make sure Explode is NOT active, then pick the symbols to add. For example, you can add a few Triplex Rec Outlets, some Duplex Recp Outlets, and a number of Trip Rec Split Wired symbols. You'll want a good variety. Your drawing might look like Figure 1.
6. Once the symbols have been added to the drawing, pick the Reports option.
7. The available reports will be listed as options. (The path name for report form files is DCAD6\FRM.)
8. Pick the report called DCADCOST.
9. The report will be displayed on your screen. Notice how each box contains certain information, and some might not contain any at all. You can edit this information. For example, you might want to change the cost and vendor in the Item Name by running the report for.
10. Press Enter to continue.
11. Next, choose an option for the destination of the report. Pick ToPrint for a nice looking printout. If you don't have a printer connected, you could pick the ToDwng

- option, then follow steps 12 through 17.
12. A Text menu is displayed. Pick FontName.
13. It's important to pick a font that's monospaced so that the columns of your report line up. Pick Orig. You might have to pick SerifWid to find this font.
14. Pick Aspect. You might want the aspect adjusted to 12. Then press Enter.
15. Drag the cursor out on your screen. Notice that the cursor has changed to represent the current text size of your report. If you want the text bigger, pick the Size option and adjust it now.
16. Pick a place for the report on your drawing. Keep in mind that your pick will indicate the upper-left-hand corner of the report, as in Figure 2. The report will be added to your drawing as regular text.
17. Press mouse button 3 to return to the Template menu.

Changing Report Information

You might want to change the Cost and Manufacturer fields to fit your need, along with other fields that are used in this report. The tag field, however, must be changed in the text file, which appears in the \Mead6\Frm directory as dcadcost.frm.

1. Pick the EditFields option from the Template menu.
2. Pick the template box that contains the symbol you want to edit, such as the Triplex Recp Outlet in the RCPTCL template.
3. Pick the first Manufacturer option on the list.
4. Type in a vendor's name, such as: AV Cost Sup and press Enter.
5. Pick the Cost option.
6. Type in a new cost for this symbol, such as: 1.39 and press Enter.
7. Pick the first Model Nu option on the list.
8. Type in a number for the outlet, for example A013-2, and press Enter.
9. The remark fields can be used for color and model description. Pick Remark 1.
10. Type in a color for the outlet, for example Ivory and press Enter.
11. Pick Remark 2.
12. Type in a description of the model type, such as Designer and press Enter.
13. Press mouse button 3 to return to the EditFields menu.
14. Pick the next symbol you want to edit.
15. Follow this procedure to edit all fields you wish to use in your report.
16. When you're done, press mouse button 3 to return to the Templates menu.
17. Pick the Reports option again, and pick DCADCOST.
18. Now the fields will display the changes made in the previous steps.
19. Press Enter to continue.
20. Pick either To Print or ToDwng. If you're adding the

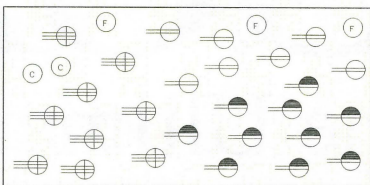


Figure 1: Electrical outlets have been added.

This is the placement point You'll want to edit the symbol fields

Item	Item Name	Manufacturer	ModelNo	Remark1	Remark2	Qty.	UnitCost	TotalCost
Duplex	AVCost	AV	A013-2			100	0.00	0.00
Triplex	AVCost	AV	A013-1			91	0.00	0.00
Triplex	AVCost	AV	A013-2			71	0.00	0.00
Clock Mini	AVCost	AV	A013-2			21	0.00	0.00
Van Range	AVCost	AV	A013-2			31	0.00	0.00
TOTAL ITEMS: 31							TOTAL COST:	0.00
							Tax(4%):	0.00
							GRAND TOTAL:	0.00

Figure 2: Example of the DCAD Cost Report.

Item	Item Name	Manufacturer	ModelNo	Remark1	Remark2	Qty.	UnitCost	TotalCost
Duplex	AVCost	AV	A013-1	Ivory	Designer	101	1.631	163.30
Triplex	AVCost	AV	A013-2	Ivory	Designer	91	1.461	132.91
Duplex	AVCost	AV	A013-2	Ivory	Designer	71	1.391	97.73
Clock Mini	AVCost	AV	A013-2	White	Grade2	21	2.151	45.16
Van Range	AVCost	AV	A013-2	White	Grade2	31	2.751	85.25
TOTAL ITEMS: 31							TOTAL COST:	51.99
							Tax(4%):	2.08
							GRAND TOTAL:	54.07

Figure 3: The changed report.

Using the ORIG font and new text size

Item	Item Name	Manufacturer	ModelNo	Remark1	Remark2	Qty.	UnitCost	TotalCost
Duplex	AVCost	AV	A013-1	Ivory	Designer	101	1.631	163.30
Triplex	AVCost	AV	A013-2	Ivory	Designer	91	1.461	132.91
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Van Range	AVCost	AV	A013-2	White	Grade2	31	2.751	85.25
TOTAL ITEMS: 31							TOTAL COST:	51.99
							Tax(4%):	2.08

Figure 4: A better looking report.

report to your drawing, move your cursor into the drawing area, and pick. The new report will be created and the changes you've made will appear, as in Figure 3.

A hint for better-looking reports

When adding the report to your drawing, the Factor (line spacing) option doesn't work. To work around this problem create the text in the report larger than needed (try twice the size as necessary). Then, once the report is created, use Change, Text, Size to change the text to a smaller size. You can use Group to select it. Now the text lines will be nicely spaced, as in Figure 4.

To get a copy of *DataCAD for Architects & Designers* (ISBN 0-07-08914-0, \$39.95 paperback), contact McGraw/Hill at 800/822-8158 or FAX 800/932-0183.

We found the following great DataCAD tips on the Internet *along from... For those who have neither the time, interest nor inclination to print the text, they are reprinted here. They may even inspire you to get "on-line".*

Tips for Multi-Scale Plotting

Dirk Arnold, Brisbane Australia - darnold@ozemail.com.au asked: Who has got the best method for multi-scale plotting? Typically, I have an overall layout plan of my building, say, in scale 1:20 (I want to print details in, say, 1:20 and 1:5 around the layout on the same sheet. As the details developed from the overall layout in real world dimensions, what can I do to avoid enlarging them including text? I still want to keep a reasonable small sized text. If I do multi-plotting (one plot for each scale) what is the best way to accurately

place the details on the overall sheet?
Rick Moore of ICAI, Architects in Boston, MA - rmoore@world.std.com responds: I share your frustration with plotting multi-scale elements on one sheet. It remains one of the biggest problems with the DataCAD product, and I have hunted Cadkey about it on a number of occasions. A "view grouping" feature is desperately needed to facilitate the printing of construction documents. While I may not have all the answers, I can tell you how I work around the problem, and perhaps others will offer some other techniques.

Method One: Multi Plot with Layout Grids

1. Create a symbol which contains the outline of your drawing sheet and a grid that divides the sheet into a reasonable number of columns and rows. I use a 6x9 proportion. Also

include a marker at the plot-center of the sheet to use for aligning multiple plots. You will need a symbol for each scale you intend to plot. You will turn off the grid layer when plotting, or you draw the grid in a color to which you assign a zero pen value.

2. Compose your sheet, utilizing multiple layers, one for each scale. When laying out the sheet, remember how much real estate each element takes up. That is, the plan might hop the first five columns and three rows; and the details can fill in the rest at a larger scale. I like to keep a small guide sheet by my side where I can take notes as I go along. It also helps to create a Go-To view for each scale and sheet.

3. Plot each view in turn, snapping the plot window to your center marker each time. For those who do not know the trick

See TIPS, next page >

BGL

High speed, large format laser printer

By Calvin Miller

How many times have you waited impatiently for a complex plot — maybe even cursing at the slowness of the printer? One solution to this problem is a device with a really fast printer controller such as BGL's line of laser printer/plotters that use their revolutionary HSGC-4 (High Speed Graphics Controller) controller. The family boasts speeds of from 16 to 40 pages per minute at up to 600x600 dpi. There is an option for 1200x600 dpi. I was amazed at how fast the printer printed a 30-page report that includ-

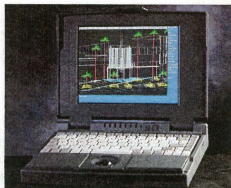


LaserLeader Mark 9320-3

ed CAD drawings and other graphics. It was complete in a matter of minutes.

Eleven standard emulations make it versatile. For CAD, it emulates HPGL, HPGL/2, and CalComp. The controller comes with Microsoft Windows drivers. BGL recommends using HP2000 emulation for most DOS based PCL printing applications. For letter-size Postscript printing, it uses the Apple Laserwriter II NTX emulation and several Postscript emulations are available for ledger size printing including Dataproducts 2665.

See BGL, next page >



CORE CAD Notebook

CORE CAD NOTEBOOK

Portable computing and more...

By Robert Martin

If you always stay in your office a full-sized computer system is dandy. But if you must travel or work in the field or at home, you really need a notebook computer. Unfortunately, notebooks can be awkward. First, many do not have the power required by applications such as DataCAD and CADKEY, so you end up compromising the kinds of tasks you can perform and sacrificing performance. Second, if you don't have a good tool and/or system for transferring files back and forth to a desktop computer, life can get messy.

The new CORE CAD Notebook, designed specifically to meet the portable CAD professional's needs, addresses both problems with finesse. In the power department, the 486DX processor is available with 33, 66, or 100MHz. It has 36MB RAM and 810MB hard disk drive capacity, PCMCIA slots, and an optional docking station. Unbelievably, this all weighs a mere six pounds and the standard configuration (486DX-66, 4MB RAM, 340MB hard disk, dual batteries, carrying case and adapter) costs only \$2,195. A Pentium version will be released this year.

The docking station is the option that can turn this notebook into a main computer. It also neatly solves the file transfer problem. You just "plug" the unit into the docking station and continue working. The docking station replicates the ports on the base unit: an external VGA port for a monitor, an external keyboard port, one parallel and two serial ports, line-in and line-out jacks, and two speakers. The CORE docking station has four 16-bit AT-bus slots and two full length 32-bit VESA local bus slots. It also has one 3.5" and one 5.25" drive bays for CD-ROMs or other peripherals. Cost? Only \$475. Without peripherals the whole setup is slightly over \$2,600.

The CORE CAD Notebook also has some user friendly features: two internal batteries let you "hot swap" batteries - changing batteries without powering down the system. An external battery charging unit and additional sets of batteries are available. The removable hard disk drive design allows for easy upgrades and flexibility. More than one person can share the system with each having their own hard disk drive.

Video capabilities are everything a CAD user could want. On the notebook sharp color is provided on an active color LCD screen. For external monitors, the on-board video controller has 1MB of video RAM and supports external monitors with up to 1280x1024 resolution. An additional video accelerator can be installed for higher resolutions.

The system is configured with Microsoft DOS and Windows, supports Windows NT, OS/2, and Novell, and is backed with excellent support.

For more information contact CORE Microsystems at 800/886-2752 or 408/383-9090; Fax: 408/383-9149.

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Xi PENTIUM

A powerful CAD system with upgrade options

By Robert Martin

Power today and room to grow is what power CAD users need and that's what they get with Xi's P90 MTower Pentium. I had the pleasure of testing this machine for several weeks and was extremely impressed with its performance. Using it also made me understand why the accolades it has received from industry publications are well deserved. BYTE Magazine called it the most expandable Pentium in the USA. It also received the 1994 CADalyst Highly Recommended Award and a Recommended rating by PCDigest's National Standard Test Lab (McGraw Hill) in October 1994.

Xi is a company that brings a lot to the CAD table. They are a strong, established company that specializes in computer systems for CAD which is their primary market. Many staff members have 18+ years experience in the field. They know how to put a CAD system together.

The machine we tested was configured with a 64Bit Pentium 90MHz CPU, Xi PCI Local Bus system board, 1MB Flash AMI BIOS, 32MB RAM, a 1.05GB FAST & WIDE SCSI-3 hard drive, a Diamond Stealth

BGL from Page 20

The BGL printers can print up to B-size drawings (17x17"). The model we tested offers standard paper handling of one 250-sheet and one 100-sheet input cassettes, 5"x7.5" through 11"x17" paper sizes, envelopes, transparencies, vellum and labels. A 250-sheet or 500-sheet input cassette may be added.

Thirteen interface choices provide multi-network functionality and make the printer adaptable to nearly all network situations. The controller we used came with one interface card. However, it can handle up to four. You generally need one card for each protocol required. Supported protocols include Novell, TCP/IP, DECnet, and EtherTalk, and several popular LANs.

Because BGL packages its print engine and controller separately, users can be selective about choosing a print controller that will meet their needs. BGL actually sells the acclaimed HSGC-4 controller to other OEMs and end users. Other users of the HSGC-4 controller claim that it is two to fifteen times faster than anything on the market. In most environments, the HSGC-4 will process data at 30,000 to 80,000 bytes per second sustained and up to 300,000 bytes per second in bursts. The Pentium controlled unit, the HSGC-5, is approximately 1.7 times faster than the HSGC-4.

When I set up the printer, I found the manual perplexing and the section on installation and setup confusing and incomplete. But armed with my list of questions, a phone call to tech support solved my problems quickly and I was up and running in a matter of minutes. Either the tech people are real good or they get the same questions so often they were easy to answer.

BGL offers a wide selection of intelligent laser printers and plotters for CAD/CAM/CAE, desktop publishing, high speed document imaging retrieval applications and provides superior multi-network connectivity. Prices range from \$4,495 to \$15,995.

For more information contact BGL Technology Corporation at 805/987-7305 or FAX 805/987-7346.

64 video adapter with 2MB RAM, one 3.5" floppy and one CD drive, and a 17" IDEK Vision Master monitor capable of 1600x1280 resolution. It was setup as a Windows NT 3.5 Workstation with dual boot for DOS 6.2 and Windows. All this for a very reasonable price of \$4,299.

The system's blazing speed is the result of Xi's special components and configuration. The primary elements are the special SCSI-3 hard drive and Xi PCI controller. The disk access speed has peak transfer rates of 20Mbyte/sec. I worked on some "heavy duty" surfaces and Picture-It renderings of my airplanes which can bring some computers to their knees - you know, the all night processing routine. Much, much faster!

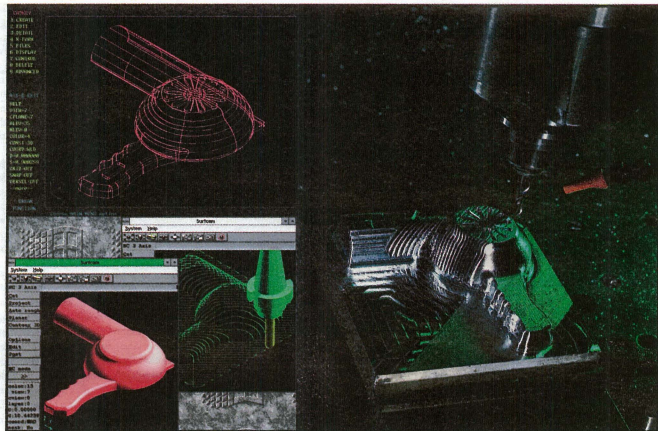
Best of all, the XiP90 allows plenty of room for growth. The compact MID tower holds seven exposed bays, three more accessible bays, and eight slots plus I/O. There are lots of options in a little space. Even though NT's time hasn't quite come yet, it is having it in place as an advantage if you will be gradually changing over as more software becomes available. The new CADKEY Windows version will run in either Windows or Windows NT. Speed tests on the differences between the system are not in yet, but NT offers some advantages (e.g., more than one application open at a time and longer file names) that should win us all over. Anyway, this configuration gave me all the choices I could desire.



Xi Pentium

For more information call Xi Computer Corporation at 800/432-0486, 714/498-0838, or FAX 714/492-6711.

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comparing and contrasting basic lists to identify the root customer wants and needs that the end product must satisfy. The process allows users to identify what is really important and isolate all activities toward ensuring that the end-product reflects those wants and needs by incorporating them into the design and development of that product or service.

Forming a Team

The initial phase of virtually any QFD project is to assemble a team. Duties of the team include gathering and prioritizing information to make key decisions along the way. This is true whether you're using QFD to design a building, develop a new bicycle, or formulate a strategic plan.

While teams should not be large, they should at the same time consist of a good mix of those influencing the product, and at least one person who is skilled in using QFD to help facilitate the process. In this way we are certain to accurately hear all of the critical viewpoints influencing the final decisions.

Understanding "The Big Picture"

It is imperative that each team member clearly understand the big picture of what is going to be accomplished. While this phase of the project can be easily glossed over as

menial, rest assured that unless the team has clearly identified their objectives and each member thoroughly understands these issues, major stumbling blocks will crop up further into the process.

This initial "buy-in" is important because it puts all team members on the same page and "clears the air" from the beginning. This is the stage where key decisions are made that will drive the whole process, so it is important that the team be committed to the notion that "The Voice of the Customer" should help drive those decisions.

The Matrix

A very basic table within QFD is the matrix. The matrix is used because it can clearly represent two sets of information and indicate how they relate to each other. The matrix performs calculations and comparisons between the lists that we feed into it. For example, a matrix can be used to relate company actions to customer wants. Usually, some minor calculations are involved so that one set of data (i.e. the company actions) are prioritized based upon how each action relates to the customer wants. Effective use of a matrix requires that a development team be able to identify both what they want to get done, and also what they are going to get the input (market research, benchmarking, etc.).

Since a development project typically has many issues which need to be resolved by the team, more than one matrix is usually required. A key part of each project involves identifying the issues which need to be addressed. The data required to correctly address the issue must also be selected. The team then designs a "Road Map" which organizes matrices to address all of the issues using the available input data.

Prioritization

Key to QFD is that it enables the user to understand who his customers are. Most products or services generally have more than one set of customers; the list may include internal as well as external customers — each with specific and varied wants and needs. Because of the many customers with many diverse requirements, QFD enables the user to understand and prioritize both the customers and their requirements. The process allows an organization to identify the major concerns of their most important buyers and plan how they are going to address these concerns.

QFD Tools

The leading provider of QFD tools and technologies is Milford, Ohio's International TechneGroup Incorporated (ITI). ITI's QFD/Capture™ program is the world's most popular QFD software tool. It automates the collection and prioritization of QFD data, performs all of the calculations, and helps the team analyze the data to understand the information it contains. Finally, the software generates the matrices which QFD is known for. In short, this program captures the "Voice of the Customer" and assists the user in incorporating these requirements into the product or service early in its design stage — before a major commitment of time and money. This is a critical aspect of Concurrent Product / Manufacturing Process Development (CP/MPD), Concurrent Engineering and other Simultaneous Engineering philosophies. QFD/Capture's flexibility enables it to be utilized throughout a variety of industries and functions — from Banking and Retail through all aspects of Manufacturing as well as product design, strategic planning and so on.

"This technology enables users to not only build these requirements into the product, but also into that product's manufacturing process," says Robert Hales, ITI's Director of Decision Support Systems. "Customer requirements are converted into product characteristics which are in turn converted into process characteristics," continues Hales. "Production controls are established so that everyone involved in the development and production (suppliers, manufacturing personnel, and so on) of the product knows exactly how his or her function directly impacts product quality and satisfying the customer."

Better Products through QFD

The "Voice of the Customer" can and should be used to drive the product definition and development process. Through proper implementation, QFD technologies can help organizations realize significant savings associated with time and cost — along with an increase of market share. QFD can be used to identify areas of waste, cost reduction, and process improvement. Because of its flexibility, it is showing up in all disciplines of the organization — from the shop floor to the board room.

Today's global economies with world-wide competition make it imperative that products or services be tailored to satisfy specific

requirements of the buyer. Technological resources are available to provide a competitive edge to those organizations who truly understand what it means to be customer-driven.

QFD Case Study Situation

An agricultural implements manufacturer was struggling with implementing Concurrent Engineering to reduce development time and cost. They also faced serious product differentiation problems because they were often perceived as a "me too" vendor and were forced to differentiate themselves mostly on price. The product being developed would be produced at fairly low volumes so they could not afford to "do things in a big way".

Approach

It was decided to implement Concurrent Engineering using QFD as one of the main drivers. Prior to starting the project, the Marketing organization spent a considerable amount of time meeting with users and dealers to understand their requirements and the relative importance of each requirement. They had also spent a lot of time understanding how competitive products were perceived by discussing their performance with dealers and customers. They came to the meeting prepared to represent the Customer's interests on the team.

The cross-functional team was complete with good representation from Marketing, Finance, Development, Manufacturing, and Quality. Team members were company experts in each of their areas.

User Spoken/Excitement Requirements, Basic Expectations, and Operations Requirements were analyzed and converted into Key Performance Indicators which would help the development team predict whether their design would be successful at addressing the wants and needs of the customer. They also used these Key Performance Indicators as selection criteria enabling them to select a design concept which would satisfy all of the requirements as cost-effectively as possible. The process took them a total of five days.

Results

As a result of this project, the product was ready for production in 12 months instead of the normal 18 months for a product of this type. The company has now adopted QFD as a fundamental part of their product development process.

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PROTOTYPING from Page 12

on all the joints. Engvall was able to accurately measure the forces for finite element analysis of the pin joint components.

Using Working Model has saved Snorkel Economy countless man-hours. It used to take more than a week to create a model, both performing static load calculations. Now, both operations can be done in a single morning, and the simulations themselves take a matter of minutes to complete. "For what it costs and what it does, Working Model is an astounding piece of software," Engvall concluded.

How is a Virtual Prototype created?

You exercise complete control over the simulation environment and everything in it,

including constraints like pin-joints, actuators, and motors, along with parameters like mass, friction, gravity, elasticity, and force fields. Analysis tools allow design parameters to be measured, graphed or exported to another application. Also, dynamic input controls allow real-time simulation interaction. In addition, Working Model's function language provides a means to describe complex non-linear simulation elements, such as spring hysteresis. DDE and AppleEvents allow dynamic linking for data exchange to other applications such as Excel or Lotus spreadsheets. A DXF translator is included for import and export of your CADKEY designs.

Working Model was recently named 1994

Architectural 3D CAD software available for \$49.95

Windsor, CT — Cadkey, Inc. has lowered the price of DataCAD® 5, its 2D and 3D architectural-Computer-Aided Design (CAD) software from \$149.95 to \$49.95 while supplies last.

DataCAD can produce a complete architectural design, from 2D annotated production drawings to 3D photo-realistic render-

ings and fly-throughs. It contains 1,600 2D and 3D symbols for common objects such as landscape symbols, furniture, windows and doors. You also create your own symbols. Built-in macros automate many routine drafting tasks. Over 50,000 professional architects, builders, and "do-it-yourself" home users cur-

rently use DataCAD.

DataCAD 5 is fully upgradable compatible with DataCAD 6, the current version of the product. Upgrades to version 6 cost \$69.95. All DataCAD products come with 30 days free telephone technical support and a money-back guarantee. For sales information, please contact Cadkey at

(800) 282-1368.

DataCAD runs on 386, 486 and Pentium IBM-compatible DOS-based personal computers. A micro-processor is required. Minimum system requirements are 4MB RAM. 8MB RAM or more are recommended for optimal performance.

Free electronic catalogs for architects

By Claudia Martin

Frequently, architects design and build structures—from cabins to large commercial structures—that incorporate commercially available components such as windows, doors, skylights, etc. You don't have to draw these from scratch or make substitutions in the drawing because several manufacturers' products provide literature in electronic format. Like their printed counterparts, they make it easy for architects to find a particular product and specify its use in building construction. Many also contain predrawn details in DXF format that can be inserted in drawings and specifications that can then be cut-and-pasted directly into project specifications. Most come in two versions: one for AutoCAD and one for use with other programs, like DataCAD, that accept DXF files.

Obviously, the manufacturers are trying to gain a competitive edge by making it easy for building designers to use their products. Some even use proprietary language in the specification output and place notes on the drawings that "lock in" their products to the exclusion of other products in a competitive

bid situation. In some cases, the DXF drawings are only in 2D. Still, these tools have the potential for saving lots of time and the best news is they're free.

The following electronic catalogs are free to qualified design professionals. Other products are also available, many for a nominal charge.

CATALOG SOURCES

Andersen CAD-D1

The Andersen DXF symbol library creates 2D elevation and plan views and cross-sectional details of most Andersen windows. A separate disk includes specification text files written in CSI format for every Andersen product.

Andersen Windows, Inc.
612/439-3150 or FAX 612/430-5279

Manville Roofing Accessories

The Manville CADlog contains product information and detail drawings in DXF format for roofing accessories, including prefabricated flexible flashing, expansion joint covers, roof drains, fascia, and vents. You can browse and view selections before placing them.

Manville Roofing Systems
A Division of Schuller International, Inc.
800/445-1500 (includes Canada) or
FAX 207/784-0125
207/784-0125 (inside Maine)
Marvin Design System

This complete stand-alone Windows program that produces DXF output, can also create a database of exterior doors and windows on a project basis which allows you to create reports. You can insert plan views, elevation views, complete 3D windows, or head, sill, and jam details directly into drawings. CSI specifications are controllable through selecting options. This product is complete, well thought out and easy to use with clear documentation.

Marvin Windows and Doors
800/346-3363 or FAX 612/452-3074

Pella Designer CAD

Pella has a comprehensive library of 2000 DXF files of Pella windows and doors. Elevations and cross sections are included. Editable text files are provided in ASCII and WordPerfect format as a starting point for construction specifications.

Pella Corp.

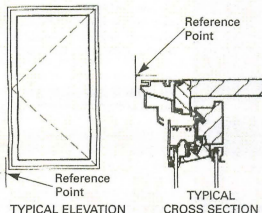
FAX your request for information to Jerry Lockridge at 515/628-6070

Velux VELCAD

VELCAD is a stand-alone Windows 3.0 application that allows you to select roof-mounted Velux windows and skylights, and to output detail drawings or basic specifications for the window model chosen. It utilizes a rule-based product selection process, a one-step-at-a-time process that can be tedious. Drawing notes and specifications are in CSI three-part format, but they need heavy editing for use in construction document specification. Drawings are in DXF format, but are very basic.

Velux
800/888-3589 or FAX 800/388-1329
3M Deck Catalogs

The 3M CADlog contains details and specification text for liquid-applied waterproofing coatings suitable for pedestrian and vehicular traffic areas. Details and specifications text need some editing to be useful for design professionals, but could still save time when detailing liquid-applied membranes.
3M Construction Markets
612/733-1140 or FAX 612/736-0611



Examples of DXF files from Pella Corp.'s library.

ACTOOLS from Page 11

loon size, or the balloon radius a function of the text height. Balloon tag and tip options include left, right, or no leader, and a special jog it option for the leader.

ACTools' Centerline utility option creates centerlines for any arc or circle. The centerlines are always created in the construction plane of the arc or circle. Options provide for both the horizontal and vertical centerlines, or either can be depressed independently. The centerlines can be rotated at any angle or aligned with existing slope geometry. The center point diameter can be defined for those extra large or extra small circles that always look rather funny with standard centerline programs. The centerline size can be set to be determined by ratio of the diameter of the circle or arc.

A Notes program has unique features including isometric notes (those appearing to lay in the current construction plane) which are useful when preliminary isometric layout drawings get used on the factory floor for final assembly. You can also order and align, or join and break up existing notes. And notes can be generated on an arc, scroll or skewed path.

Here are some of the other CADL and macro programs in ACTools Utilities:

- Drag Ortho-lines, i.e. horizontal and vertical lines
- Create offset profiles and drafted profiles
- "Explode" polylines, polygons, X-hatching and dimensions
- Extend or shorten a line by a specified distance
- Move just one end of a line or arc
- Dynamically edit arcs by end, edge, or between
- Show and hide levels by selecting entities on those levels
- Step through only those levels which have entities
- Change the system units of any part file
- Create lines tangent to an arc at a specified angle
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ACTools costs \$195 and is available from Allan CAD Tools at 503/659-1262.

TECH TIPS

Faxing directly from CAD

A question recently asked on the DBUG Internet Mailing List was how to save a DataCAD DCG file as a TIF, PCX or DCX for faxing. Vince Henderson offered a solution that should work for CADKEY as well as DataCAD and any other CAD program.

"I use a more direct method of faxing from a CAD program. Plot your drawing to a file using a Postscript printer driver and use LA Software's Postscript to Winfax conversion utility. Very simple, easy and automatic, especially when using a multi-tasking OS like Windows NT or WARP. I use this all the time with ACAD, and there is no reason it won't work with DataCAD. I just have not need-

ed to yet, so haven't tried. Here's some information for LA Business Systems. They have three utilities for Winfax: one converts Laserjet 2 files to Winfax (\$29); the second converts Postscript files to Winfax (\$39); and the third is a DOS viewer for Winfax (\$10). I have not tried number one; two works great; and three is not very useful or easy to use."

For more information you can contact David Aronson, LA Business Systems, 1866 Sheridan Road, #216, Highland Park, IL 60035; CompuServe 71722.2553; PH 708/433-6477 or FAX 708/433-7676.

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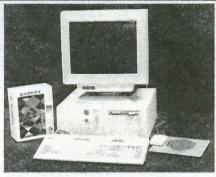
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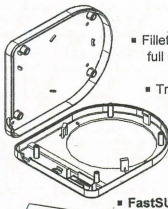


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CIRCLE 205 ON CARD

AUTOSTRETCHING can save you from RSI

By Claudia Martin

The growing RSI epidemic has spurred the development of ergonomic equipment and furniture. Ergonomics, in fact, is commonly touted as the way to avoid RSI injuries caused by repetitive motions in unnatural positions (such as typing or propping a mouse for hours each day). Not so, says Jern Hamberg, M.D., a Swedish orthopedist and director of Sweden's Alfa Rehab Center. Hamberg says that ergonomics at best reduces the damage to muscles and tendons, but scientifically based stretching can prevent and even actually reverse the damage by getting to the organic root of the problem. "Repetitive motions make muscles and tendons shorter, thicker and tighter, causing a variety of disorders, from carpal tunnel syndrome to low back pain," Hamberg said. "We prescribe stretching exercises that make muscles and tendons longer, leaner and looser, preventing these disorders." The most common problem areas for computer users are wrists, elbows, necks and shoulders,

Scientifically-based stretching can prevent and even reverse damage caused by RSI

and lower back.

The doctors and physical therapists at Alfa analyze the repetitive motions of particular groups of workers and prescribe precise stretching sequences to counter the damage to muscles and tendons associated with those motions. Dr. Hamberg has many years experience in this field. He has been a physician for 38 years, of which almost 30 have been spent on his research of muscle stretching as a cure for often crippling work related injuries. As of today, he has produced more than 15 research papers, seven text books, and 300 video films on his concept of Autostretching.

There are several sources of information on these techniques in the U.S. One is AUTO-

STRETCHING USA, a Los Angeles based company that provides consulting services to corporate clients for preventing RSI and reducing Worker's Compensation claims. President, Joseph Halper, explains that RSI is expensive to employers and employees alike, and his company's comprehensive approach can provide results that will make employees healthier and also be demonstrated on the bottom line. With a typical client, AUTOSTRETCHING USA assesses activities that present a RSI potential, videotapes employees performing those activities; has an orthopedic physician analyze the tape and prescribe a set of Autostretching exercises; and conducts an on-site training program for employees and supervisors.

You don't have to be a big corporation to use these methods. AUTOSTRETCHING USA also sells a package developed for single users. This package consists of software and documentation and a seven minute training video which helps the user understand the nuances of the

See STRETCHING PAGE 30 >

ISSUES from Page 5

been available for \$99 per copy, about the same as the cost of a good drawing instrument set. For those on limited budgets who are used to the \$30 traditional tool kit, CADKEY Light and DataCAD Plus are available for under \$50. Either can provide a good introduction to 3D CAD. All things considered, if I was starting a new drawing program, I would replace the traditional tools with DataCAD 6 and CADKEY 7. I would, however, increase the amount of technical sketching in the drawing course. I would also keep in mind that the subject is architectural or engineering drawing, not CAD.

Q: In your "spare time," are you still teaching?

A: I maintain an affiliation with Ohio State University. I have developed custom curriculum materials for the Engineering Graphics Department, assisted in improving applications of instructional technology, and do some part-time team teaching. This and the CAD workshops I conduct around the country, helps me see how new users react to the instructional materials I create. This is very important as I continue to develop and improve books and videos.

Q: What is your vision of the future of CAD?

A: I believe I have met the future of CAD and it is now. Most of us still have a long way to go to learn how to use the tools already available, and to develop strategies in helping new users take advantage of these tools. As much fun as these new tools are, we must not get too happy. Folks who think it's silly to drive a tractor trailer rig to the corner store to pick up a carton of milk think they need the most powerful expensive software on the market to introduce students to CAD. Most one-year programs can not exhaust the capabilities of CADKEY Light. However, the world we live in is three-dimensional. Any CAD system that does not make it easy to design in three dimensions is brain-damaged or obsolete. We can now do 3D design with DataCAD and CADKEY on very affordable systems, even on a teacher's budget.

Just a few years ago, only a privileged few at very large corporations had the power available in CADKEY or DataCAD. To get a peek at what you'll be doing on personal computers in a couple of years, take a look at what is currently available on those \$20,000 workstations. We're talking real-time shaded animation of three dimensional models, and real-time updating of data bases. Imagine changing the diameter of the cylinder of an engine block and having the associated dimensions of the piston and piston rings automatically updated, as well as having the drawings for the inspection jigs and fixtures for each part also being automatically updated. This is happening now on the high-end systems. As the price-performance of computer hardware and software continues to move in our favor we will be duplicating what the big guys are doing on their workstations today on our home computers tomorrow.

I consider myself extremely lucky to be living in one of the most exciting times in history. I have more and better toys to play with than I ever dreamed possible. Now, if I only could find more time to play with all of these great toys.

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and fabrication shop. Although those days are remembered fondly, he says, "I sure wish that I would have been into computer aided design then!"

In 1976 he started in aviation learning to sky-dive and to fly airplanes, gliders, and balloons. Not content to fly using existing equipment, he began to experiment with some of his own ideas, and searched for the best platform to translate concepts into reality.

"I first set out in the late '70s to learn CAD on the Amiga but that I was using for other graphics and video work. XCAD Professional and XCAD 3D are extremely powerful programs, especially considering their platform. I really liked the 2D

version for quick shop plans, but there were just too many things that I couldn't do, especially unfolding my

patterns. DYNA CADD was also great for some things on the Amiga but I could not insert things properly in 2D space and once again unfold my patterns. After I moved to the IBM platform, I used mostly DesignCAD 3D which was really good at some things, but lacked certain 3D measurement capabilities that I couldn't do without, and it could not unfold a pattern. Notice that unfolding a pattern is very important to me, since 3D design is so necessary to what I do."

"I have designed and built three square ram-air parachutes for sport jumping, and one round recovery parachute for emergency use in hang gliders and paragiders. All of these fly extremely well and outperform much of the competition, but there are already too many builders in these markets to warrant a lot of development," Clyde says. "On most of my previous work, the templates were generated by hand, measurements were collected in lists, and then new parts were drawn. Sometimes this was slow, but it worked. However, some of my parts have twisted surfaces, which make that process tedious and sometimes just flat unworkable."

He uses a Gateway 2000 60MHz Pentium model with 16 megs of RAM and he can't wait for a little more to speed things up. He uses CADKEY 7 because it works and it does the things he needs to do. It came highly recommended by several friends in the aeronautical engineering business, and it has more features than he expects to use for a while. "I very quickly outgrew and found too many missing or non-specifying features on the last three CAD programs that I bought."

Friends recommended CADKEY for the power, but Clyde appreciates the fact that it is ultimately intuitive for him and comes logically to the way he works. For example, he tries to group certain entities and positions by layers so that he can work on more than one

I keep finding more and more uses for CADKEY and FastSURF all the time.

- Clyde Blincoe

thing at a time, or be able to separate assemblies into individual parts.

According to Clyde, "The paraglider project is moving along much faster with CADKEY and FastSURF, and has been much easier. CADKEY's interface was the easiest to learn of any I've come up against, and it's very compatible with my methodology of work and design." Ultimately, the paraglider design is being developed for sale or manufacture, even by himself if necessary.

"I have also used CADKEY for a variety of other design projects around the shop. Building a combined jet inlet and canopy cover for a MIG 15 just wasn't getting it by hand. Nothing fit, even on the second or third try, but CADKEY really saved the job."

"I am really just getting into the uses for CADKEY and FastSURF, but I keep finding more and more all the time. I have also located on some plans for special shaped balloons (cold air, unmanned), which is a project that I have had to put off for a long time because I didn't have suitable software.

The aeronautical prototyping business is booming at Clyde's company, InStead, but he and some associates are gearing up for an unlimited air race plane project—a labor of love. It should be well under way in the next six to eight months. Nearly all the component design (engine, landing gear, fuselage) will be designed on CADKEY.

For a guy who's not averse to a little risk, he believes his gamble on CADKEY has more than paid off.

"A couple of months before I actually bought new software, I was prepared to buy a much more expensive package. As it stands, even at a higher price, I find it very hard to believe there could be any more value than what I get from CADKEY."

Clyde Blincoe can be reached at InStead at 702/972-6493 (Voice/EXD). Left: Paraglider airfoil with suspension lines.

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By Walter Silva, President
Conceptual Product Development

Don't overlook CADKEY's powerful three dimensional modeling tools for constructing scale models for dioramas of factory areas. In fact, using CADKEY as the structure modeling tool instead of a traditional architecturally oriented package (such as ProCAD) makes sense in many situations. For example:

1. When the designer rarely does architectural work and doesn't have access to an architectural modeling package.
2. When large machine parts normally designed in CADKEY will be included as part of the model.
3. When rapid prototype models (including machinery components) are required for producing a physical scale model of the project.

The steps for creating a model of a small air compressor room presented below illustrate CADKEY's versatile intermediate renderings of the components and a final rendering of the completed facility are also presented. This compressor room model is a simple example of how CADKEY can be used to produce realistic renderings of plant areas. This approach could be adapted to produce a diorama model of any structure in a manufacturing plant or office complex.

The rapid processing speed of Picture-It combined with a disciplined approach to building the model and segregating distinct geometries created a wireframe file which rendered in less than 20 seconds on a 486-DX-100 MHz PC with 32MB RAM. The wireframe model took less than three hours to create, including running of test bearings to verify mathematical closure at each stage of the construction.

BUILDING THE MODEL

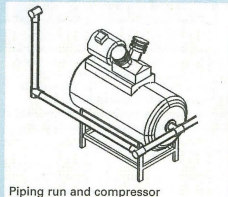
Modeling Tip: When building dioramas, the objects modeled are primarily measured in feet. So build the model in feet and enter any inch measurements using "inch value" / 12. This eliminates the need to convert back and forth between units. If you retrieve patterns of standard machine components from your main database which were built in inches, remember to use a 1/12 scale factor during the retrieve process.

The Room

1 - The Slab: In View 1 create a slab with overall room dimensions; construct a rectangle of the desired width and height. Then extrude this in the Z direction using XFORM/DELTA/JOIN to the desired thickness. Move this geometry to Level 10.

2 - The Walls: Switch to View 7. Select the slab's top surface as the construction plane using the intersection of two top corner edges. Using a different color, create walls using parallel command on top surface, trim corners, and extrude this geometry upwards a distance of 8 feet. On the right hand wall, construct horizontal and vertical lines on the exterior wall surface to create a 3.5 foot wide by 7 foot high door opening; then use XFORM/PROJECT/JOIN to extrude through to the interior wall. Build the window opening on the right wall in a similar manner. Move all the wall geometry to Level 11.

3 - Windows and Doors: Construct the window and door frames using a different color than used in the wall geometry. Establish a construction plane on the right, exterior wall. Create lines parallel to the door opening edges at a distance equal to the desired frame thickness. Trim out the corners. Duplicate the lines which form the wall opening. Using XFORM/DELTA/MOVE, lift the frame geometry off of the wall surface a distance equal to the desired frame reveal on the wall. Next use XFORM/DELTA/JOIN to extrude this geometry through the wall a distance equal to wall thickness plus two reveal thicknesses. Repeat the process on the rear wall for the window frames. Move door frame entities to Level



Piping major and compressor

12. Move window frame entities to level 13.

Compressor Components

4 - The Tank: Establish a construction plane on the inner surface of the left wall. Using a new color, create a cylinder end to a compressor tank with a circle of the desired diameter. Use XFORM/DELTA/JOIN and extrude this geometry to create the length of the tank. Use standard concentric circle construction to create the hemispherical end and duplicate for the other end. Create port geometry on right end to accept piping. Move all cylinder entities to Level 15.

5 - The Saddle Block: Use a different color to create the compressor saddle to duplicate the block. Duplicate the cylinder circle and trim it to create horizontal and vertical edges. Create fillets at top corners. Extrude this geometry and move to Level 16. Use a different color to create the pyramidal support block profile for the compressor cylinders and extrude it to the required distance. Move these geometries to Level 18.

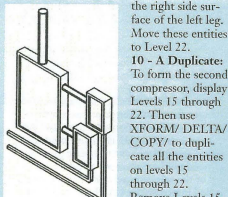
On one of the oblique planes, create a construction plane. Using a different color, create the fitted cylinder using a series of circles joined by tielars. Duplicate this geometry on the other oblique plane. Move the cylinder geometries to Level 17.

6 - The Motor: Establish a construction plane using one of the fillets on the left end of the compressor saddle. Create a circle equal to the motor diameter, positioned above the top surface of the saddle, centered on it, and tangent to it. Extrude this to create the body of the motor; then establish a construction plane on the right end of the motor and create the motor shaft and pulley by continuing to create circles and extrude them. Move these entities to Level 19.

7 - The Wiring Box: Create the motor wiring box in a manner similar to that used to create the compressor saddle in step five. Be sure to use a color different from the motor body. Move these entities to Level 20.

8 - The Legs: Establish a construction plane using the circle at the right end of the compressor tank. Use a different color to create the legs for the right end by constructing a series of parallel lines. Trim the intersecting lines into a shape like the letter "H". Extrude this profile to create the first set of legs. Duplicate the leg at a distance equal to 2/3 of the tank length. Then switch to View 1 and use EDIT/BOX/MOVE to move the legs to a position symmetrical with the tank. Move these entities to Level 21.

9 - The Braces: Establish a construction plane using two intersecting edges of the far left side of the right end leg. Using a different color, create rectangles equal to the cross section of the longitudinal braces at the appropriate positions. Use XFORM/PROJECT/JOIN to extrude these geometries to



Electrical box

the right side surface of the left leg. Move these entities to Level 22.

10 - A Duplicate: To form the second compressor, display Levels 15 through 22. Then use XFORM/DELTA/COPY to duplicate all the entities on levels 15 through 22. Remove Levels 15-22. Using masking by color, move each of the entity groups to levels 115 through 122. For example, the second tank will move to Level 115 since the first tank was on Level 15.

Note: This attention to detail here simplifies working with the model and tremendously improves rendering speed and accuracy in Picture-It.

The Electrical Components

11 - The Panel: Establish a construction plane on the rear inside wall surface. Create rectangles for the main electrical panel and two compressor motor switch boxes. Extrude these geometries out from the wall to a

desired depth. Establish a construction plane on the front surface of one of the boxes. Create the frame lines using CREATE/LINE/PARALLEL; then trim out the corners, and extrude these frames back into the boxes to create the rim effect on the front surface of each of the boxes. Establish a construction plane on the top surface of the main panel. In the center create a circle equal to the diameter of the main service conduit. Extrude this up to the top of the perimeter wall. Create similar conditions between the main panel and the switch boxes. Move these entities to Level 23.

12 - The Conduits: Establish a construction plane on the inner surface of the rear wall. Using a color different from the electrical boxes, create the conduit runs on the rear wall. To conserve memory and simplify construction, we will represent the smaller diameter conduits by square cross sections. After building the traces on the rear wall, extrude them out a distance equal to their width. Move these entities to Level 24.

13 - The Traces: Establish a construction plane on the inner surface of the left wall. Create the traces for the conduits on this

plane and extrude these geometries out the same distance used in step twelve. Move these entities to Level 25.

14 - Join Elements: Establish a construction plane on the right surface of the just extruded geometries. Create two squares equal in cross section to the previous runs at the front end of the runs. Using XFORM/PROJECT/JOIN extrude these geometries to the left side surface of the motor wiring boxes on each of the compressors. Move these Entities to Level 26.

15 - The Tees: Establish a construction plane on the right hand surface of the compressor port geometry of the first compressor. Using a color different from the compressor tank, create a cylinder equal to the diameter of the pipe TEE; side leg. Using a different color, create cylinder at right angles to this equal in diameter to the body of the TEE. Using the various XFORM commands duplicate this TEE at each spot needed in the main piping run. (Hint: The TEE on the front of the second tank is created using XFORM/OLD-NEW/COPY. The TEE in the line can be created using XFORM/DELTA/COPY using the just created TEE as the original. The next TEE along the line can be created by copying one of the TEES at the end of the line and rotating it 180 degrees in View 1, then 90 degrees in View 5.)

When the tees are completed, move all of the side TEE geometries to Level 27. Move all of the body TEE entities to Level 28. It is NOT necessary to trim these geometries. Since they are on different levels, they will process without a problem. This technique is useful when producing conceptual models because of the time and memory saved. It does NOT create an accurate model for engineering purposes, but that is not critical in this situation.

16 - The Pipe Runs: Using a color different from the colors used in the TEES, create the pipe runs by establishing a construction plane on the end diameter of a TEE, creating a circle equal to the pipe diameter on that plane, then using XFORM/PROJECT/JOIN to extrude the pipe to the end surface of the next TEE in line. Continue in this way for each pipe run. Move all of the pipe run entities to Level 29.

17 - The Aftercooler: Create the aftercooler body by establishing a construction plane on the rear end of the fifth TEE. Create a circle equal to the aftercooler body diameter and extrude this using XFORM/DELTA/JOIN. Move these entities to level 30.

18 - Aftercooler Brackets: Establish a construction plane using the front end circle of the aftercooler. Create the profile of a bracket using line entities. Extrude this profile to create the first bracket. Using XFORM/DELTA/COPY duplicate this bracket at the desired distance. Move to View 5 and use EDIT/BOX/MOVE to move the brackets into position along the length of the aftercooler. Move all of the bracket entities to Level 31.

RENDERING THE MODEL

Since we carefully moved each entity group to a unique level for processing, we can now modify colors to produce a pleasing rendering. The groupings below are an example of how the model can be organized.

ITEM	LEVELS	COLOR
Room Walls, Floor Slab	10,11	Cyan
Window, Door Frames	12,13	Blue
Compressor Tanks	15,115	Magenta
Compressor Saddle Block, Pyramidal Support Block, Cylinders	16,17,18,116,117,118	Green
Compressor Motor, Wiring Box	19,20,119,120	Red
Compressor Legs, Leg Braces	21,22,121,122	Gray
Electrical Boxes, Conduits	23,24,25,26	Gray
Piping and TEES	27,28,29	Green
Aftercooler	30	Magenta
Aftercooler Brackets	31	Green

With all levels displayed, use Picture-It to produce a rendering of the diorama. In the processing menu, select level for the model attribute to move the brackets into position along the length of the aftercooler. Move all of the bracket entities to Level 31. This type with large numbers of small cylinders, a segmentation value of 8 is a good first choice to minimize processing time.

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Classes are structured to allow maximum use of hands-on training, balanced with lectures and discussions. Class size never exceeds ten students to allow for the maximum in individual attention, and to allow for the various paces that different people work at.

Courses are taught in Windsor in the same building as Cadkey Inc's headquarters. Instruction is given using a permanently

installed high resolution overhead projection monitor. Our facility offers running tracks, basketball courts, walking trails and a putting green to unwind after a hard day of studying, or even a pick-me-up during lunch hour. Twenty minutes north of Hartford, our facility offers easy access to Bradley International Airport.

Classes are scheduled from 8:30 a.m. to 4:30 p.m. each day and include lunch. The cost is \$200.00 per day of training. The introductory course for CAD is a three-day course, immediately followed by a two-day advanced course. The introductory course for CAM is a three-day course as well. A check or money order will confirm your reservation in the class.

LISP from Page 27

output either a COLOR command or the X, Y, and Z coordinates of a point to the output file. Note that the coordinates are separated by a single blank space.

To execute the program, load the FILEMAKE.LISP file into CADKEY LISP and type FILEMAKE at the command line. Supply the name of an output file and select all of the geometry in the part file by typing ALL when asked to select objects. The lines and arcs from the drawing will be output to the specified file and any other entries in the drawing will be printed to the screen. After the output file has been created, try creating a new part file or starting the entire drawing and executing the FILEDRAW program from the last article using the newly created command file.

Conclusion

We have discussed how to retrieve and use the attributes of existing geometry using the enter function and the DXF code list that is returned. Using the DXF codes of geometry, it is possible to retrieve any information needed about the geometry in a drawing. While the selection of geometry was required by the FILEMAKE program, the method of selecting geometry in CADKEY LISP was just touched upon. In future articles, we will discuss various methods of selecting geometry using the CADKEY LISP programming language in detail.

Source Code Availability

The source code for FILEMAKE.LISP can be downloaded from the CADKEY library of the CAD/CAM/CAE Vendor form on CompuServe. Go CADDVPE to access the forum.

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

STRETCHING

from Page 24

stretches which appear in the software. The Windows-based software can be set to give you stretching breaks automatically based on how long you've been working or at times of day you specify. Or, you can manually start the exercises whenever you wish. BIG type on the screen and pictures guide you through the stretches. The manual suggests doing the exercises once for each 1-2 hours spent at the keyboard or with the pointing device.

Another resource is a 248-page book entitled AUTOSTRETCHING: The Complete Manual of Specific Stretching by Dr. Jern Hamberg and Olaf Evjenth. Originally written for physicians and physical therapists, it is comprehensible to the layman as well. This manual is available for \$29.95 (plus \$2 shipping) from Chataanooga Group, P.O. Box 489, Hixson, TN 37342-0489. AUTOSTRETCHING USA can be reached at 310/459-0598 or FAX 310/454-1816.

FOR QUESTIONS, ADDITIONAL INFORMATION, OR REGISTRATION FORMS, PLEASE CONTACT CETI AT (203) 298-6433.

1995 Spring Training Courses offered by CETI, Training Division

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Introduction to CAD with CADKEY 7 May 8, 9, 10	Introduction to CAD with CADKEY 7 June 12, 13, 14
Advanced CAD Training with CADKEY 7 May 11, 12	Advanced CAD Training with CADKEY 7 June 15, 16
Introduction to CAD with Cutting Edge May 22, 23, 24	

Courses are filled on a first come, first served basis.

Payment is due by the first day of class, unless otherwise specified.

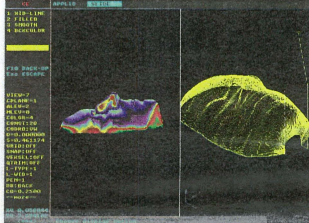
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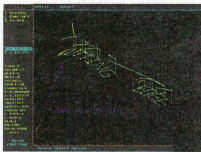


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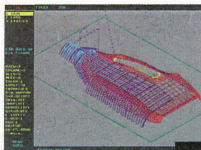


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