3-D WORLD

News For The CADKEY/DataCAD User

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Ergo Computing's 8" x 11" x 3" Brick (on the left side of the monitor) displaying the original CADKEY part file from which it was built.

Ergo Computing Designs and Builds Bricks UsingCADKEY!

Tom Spalding believes that a small company with the right tools can compete with giants and accomplish great things. Spalding, President of Ergo Computing, Peabody, Massachusetts, and designer of the innovative Brick™ computer, credits the use of CADKEY software with allowing his small team of engineers to complete this highly complex design project under a very tight deadline. "If Ergo is the David among the Goliaths of computer makers, then CADKEY is our slingshot," Tom says. "It was the big reason why we were able to get the Brick to market quickly."

The process began in late 1988, when Tom Spalding and Keith Kowal, Ergo's Vice President of Hardware Engineering, saw the need for a portable personal computer that did not trade power and performance for the convenience of portability. They defined a 386SX system that was no bigger than a standard Webster's dictionary (3 x 8 x 11 inches). To be truly useful, the system had to fit into half a briefcase. "Everyone who came into Ergo got *the briefcase test*," Tom said. "We made sure that our prototype would fit into a standard briefcase." After only eleven months of design time, in November 1989, Tom and Keith were able to demonstrate the system. In May 1990, they formally introduced it.

Tom Spalding co-founded Ergo Computing (formerly known as A.I. Architects) in 1986 to develop hardware and software add-in products that would expand the capabilities of DOS-based personal computers. When they embarked on hard-

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CADKEY, INC. and Parmenter Systems Decide to Go Separate Ways

CADKEY, INC. and Parmenter Systems, Inc. of Wellesley, Massachusetts, jointly announced on December 13, 1990, that the merger proposal offered by Parmenter Systems has been rejected by CADKEY's Board of Directors. Each company wished the other well in its future business activities.

"Following record sales in our fiscal year 1990," said Livingston Davies, President of CADKEY, "we shall continue to pursue vertical marketing strategies, with our sights focused on the mechanical design, reverse engineering, quality inspection, manufacturing, and A/E/C markets. We shall emphasize networking, and both UNIX and DOS platforms. CADKEY will also continue to explore true computer-integrated manufacturing."

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ware and software development to produce complete computers, the company changed its name to Ergo Computing.

Need for a New Type of Portable Computer

Keith and Tom had talked frequently in 1988 about the need for a new type of modular computer for which the user would have a display monitor and a keyboard in more than one location, and would transport the full-blown processing power, application software, and data between the locations. PORTABLE OFFICE magazine would later dub it "the commuting computer" in its December 1990 issue. "The Brick is the first computer to make major advances in mechanical design, electronic design, and industrial design, all at the same time," Tom said.

Incredibly Tight Design Constraints

Keith and Tom both have experience in mechanical engineering, and Keith is also an electrical engineer. To achieve the form factor with functionality that they wanted, they knew that they would be working with incredibly tight design constraints. "Many of our clearances are less than 30 thousandths of an inch," Tom said. "We had to design in 3-D, and we already knew that the best 3-D CAD software on the market was CADKEY." In March 1989, Ergo contracted with an award-winning industrial-design firm, also CADKEY users, Bleck Design Group of Chelmsford, Massachusetts, to collaborate in the mechanical design of their computer, and to give it an ergonomic and aesthetic package.

The Brick was designed entirely in CADKEY, except for the electronics. Keith and his design team, Aomsak Audcharevorakul and Dave Dion, used software from LSI Logic, Inc., Milpitas, California, to design four, large, application-specific integrated circuits, using gate-array technology, for the Brick's disk drive interface, system bus manager, modem interface, and graphics interface. These four ASIC chips allowed them to miniaturize everything to fit the concept of creating an 80386-level computer, with one to eight megabytes of random access memory, and between 44 and 212 megabytes of hard disk storage, that would fit into a 3 x 8 x 11-inch form factor.

Given the power of the electronic circuitry inside their computer and its limited physical size, heat dissipation posed a significant problem. Keith and Bleck Design recommended that Ergo use liquid-thermal-transfer technology developed by 3M Corporation, coupled with an exterior case of aluminum (acting as a wrap-around heat sink), to dissipate the heat. This mechanism works so efficiently that the ventilation fan for air cooling rarely needs to operate.

Need to Get to Market Quickly

After the Ergo team knew that their new-product idea was feasible, they realized that they had a very narrow window of opportunity to get their product to market. They had to cut the time involved in the design and manufacturing cycles. Ergo contracted with LSI Logic to manufacture Keith's four custom-designed ASIC chips, and Ergo engaged Philips North America to manufacture the printed-circuit boards that Keith's team had designed. Through Bleck Design Group, Ergo made contact with several specialized manufacturers. It is significant to note that the basic reason why Ergo selected Bleck Design Group and most of its manufacturing vendors for the Brick, other than the quality of their workmanship, was the fact that they use CADKEY or products that link with CADKEY.

Almost Paperless Design and Manufacture

"We designed and built the Brick by exchanging databases with our collaborators and vendors," Tom Spalding said. "We did not create detailed, dimensioned hard-copy drawings until after the Brick was done, and we needed to produce the technical documentation for it." Jim Bleck, President of Bleck Design Group, echoed Tom's thoughts. "Controlling the design process by the database rather than by paper drawings frees us to spend more time creating innovative design and packaging," Jim said. "Models cost less to produce from a 3-D database than from detailed drawings, and they get done more quickly."

John Thrailkill, Bleck Design Group's Director of Engineering, emphasized that Ergo and Bleck had worked with manufacturers who either use CADKEY themselves, or who use manufacturing software that interfaces directly with CADL™ (CADKEY Advanced Design Language), or whose computer-numerical-control (CNC) equipment accepts IGES files as input. "CADKEY IGES files were a critical part of producing the Brick on time," John said.

Bleck Design's engineers and technicians have considerable experience with computer-aided design. They had previously worked with Autodesk's AutoCAD™, Computervision's CADDS 4X™, Calma's DDM3™, Hewlett Packard's ME10™, and

McDonnell Douglas' McAUTO UGII™. For a short time, Bleck Design used a combination of CADKEY and Automatix' AX-4000™. Now Bleck Design uses CADKEY exclusively, according to Jim Bleck. "CADKEY has given us the highest cost/benefit ratio of any CAD product," Jim explained. "It was important for us to distribute the power to design in 3-D throughout the company. It has freed us to spend more time creating innovative designs. A designer's task is, first of all, to think. CADKEY's 3-D gives us a clean transfer of information to our clients for parallel development efforts."

"We have standardized on CADKEY for all of our work," John Thrailkill said. "We are very comfortable with CADKEY. It's dependable."

"Because of the fixed outline of Ergo's proposed product," John added, "from a mechanical point of view, it was an effort at miniaturization which would have been almost impossible on the drawing board or in 2-D CAD. That's where CADKEY came in."

Attention to Detail

"Scott Wakefield, one of our industrial designers, created the external appearance of the Brick," John continued. "He paid particular attention to the ventilation pattern and details in the bezels." One significant detail is the placement of the light-emitting diodes (LEDs) in the front bezel. Scott took advantage of the pattern of ventilation holes in the front bezel to mount the operational LEDs inside the computer, where they are protected from damage, yet where each LED's light is clearly visible. "Scott also designed the shock-absorbing corner pieces that give the Brick its distinctive appearance, as well as protection to the interior electronics, in case the computer gets dropped," John added.

A Variety of Specialized Manufacturers

Bleck Design Group sent its database of files to another CADKEY user, Santin Engineering of Beverly, Massachusetts, to have a quick model made. "Using the CADKEY database, Santin Engineering produced the model even more quickly than they had agreed to do," Jim Bleck said.

After receiving the model, Bleck Design sent CADKEY part files or CADKEY IGES files to several specialized vendors to manufacture various parts for the Brick. Using CADKEY IGES files with a Computervision system, Bermo, Incorporated of Circle Pines, Minnesota, produced 14 different sheet-metal parts within 10 working days. PTA Corporation of Des Plaines, Illinois, used CADKEY IGES files with a Calma system to build the tooling for plastic injection molding of the Brick's front and rear bezels. PTA shipped the first injection-molded bezels to Ergo within eight weeks. "The size and number of ventilation holes in the front bezel presented us with some manufacturing problems at first," said Rudy Dirr, Engineering Manager at PTA, "but everything worked well in the end." Tech Prototype of Merrimack, New Hampshire, another CADKEY user, produced 12 other injection-molded parts for the Brick. They, too, designed the tooling, built the molds, and produced finished parts for Ergo's Brick in eight

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Ergo Builds Bricks

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weeks, according to Bob Husson, Vice President of Engineering.

Leominster Die Service of Leominster, Massachusetts, also received CADKEY IGES files from Bleck Design Group to design and produce injection-mold tooling for the Brick's corner pieces. Leominster Die used the CADKEY IGES files with their SmartCAM™ CNC manufacturing system. They delivered the finished injection molds to Custom Molded Plastics, Inc., also of Leominster, in eight weeks. Custom Molded Plastics did the actual injection molding of the corner pieces using Ato-Chem, Inc.'s PEBAX™, a new, nylon-based, rubberlike plastic. Fred Beermunder and Earl White of Custom Molded Plastics encountered processing problems in working with this new material, especially in matching the PEBAX's color and finish to the color and finish of the Brick's exterior case. Yet, they still succeeded in delivering finished corner pieces to Ergo in two weeks.

Chatel Engineering Co. of Lowell, Massachusetts, made the aluminum extrusions for the Brick's exterior case. Using aluminum contributed to achieving not only the heat dissipation necessary for the Brick's compact electronics, but also the Brick's weight of 8.3 pounds. Although Chatel Engineering does not yet use computer-aided design, Lou Chatel, Sr., President of the company, furnished the extrusion-related data to John Thrailkill for entry into Bleck Design Group's Brick database.

Unexpected Bonus

When the technicians at Ergo assembled the parts into their first working prototype Brick, they were amazed to find that everything fit together perfectly the first time. "I grew up in my father's machine shop where he made parts for racing cars," Tom Spalding said. "The typical scenario when you are assembling a race car, with components made from different vendors, is that you have to do a little fiddling when you get all of the pieces together. There always seem to be a few things that want to occupy the same location. With the Brick, we were pleasantly surprised that everything fit together the first time, even with as much as we had packed into our little box, and with clearances in the few thousandths. This was only possible because of the 3-D software."

Afterword

Dana Seero, President of Computer-Aided Products in Marblehead, Massachusetts, used an Ergo Brick to demonstrate CADKEY 386™ at the Leominster Plastics Fair, Oct. 11-12, 1990. Using part files created in making the Brick, he described CADKEY as "the Swiss Army Knife of CAD tools." "People at the Plastics Fair were amazed," Dana said, "at what they saw the Brick and CADKEY do."

CADKEY, INC. Opens European Subsidiary

CADKEY Europe, B.V., a Netherlands corporation and wholly owned subsidiary of CADKEY, INC., will open its offices at Zettachring 6 (Businesspark), Stuttgart, Germany, in January 1991. CADKEY Europe represents a new thrust by CADKEY to increase its presence in the European market.

"CADKEY has experienced explosive growth in overseas sales during the past year," said Livingston Davies, President and co-founder of CADKEY, at the announcement of CADKEY Europe in October 1990. "We feel that we have only begun to tap the potential which will exist when European trade barriers are removed in 1992."

Three-Stage Process

CADKEY Europe plans to implement a three-stage strategy for increasing CADKEY's presence in Europe. All three stages are designed to bolster and support the highly successful efforts of CADKEY's existing distributors. Stage One involves opening the company's new international headquarters in Stuttgart and staffing it predominantly with technical-support personnel.

"CADKEY has always maintained a commitment to keeping the international versions of our products on the same technical track as our U.S. versions," said Jeff Hall, CADKEY's International Sales Manager. "By having a strong technical staff immediately accessible to our European distributors, we shall be able to provide an even higher level of support for CADKEY's products."

In Stage Two, CADKEY Europe will add a new Business Development unit designed to expand CADKEY's distribution into new areas around the world, and to strengthen areas where distribution is weak. "Today, CADKEY® is distributed in more than 30 countries around the world, through a network of experienced international distributors," Jeff noted. "By 1992, we hope to double that."

In Stage Three, CADKEY Europe will add a marketing group dedicated to unifying and coordinating CADKEY's international marketing program. This will include giving CADKEY's trade press, advertising, trade shows, and technical literature a common look and theme.

Participating in the Global Market

"The software industry is going to have to enter into the global economy in a significant way if it is going to continue the growth it has enjoyed in the past," Livingston said. "The creation of our European subsidiary is another step in positioning CADKEY to take advantage of these new developments."

THIRD-PARTY NEWS

MULTICADL ROBOT SIMULATOR Seeks Testers

MULTICAD Studio, Ltd. of Budapest, Hungary, introduced its MULTICADL OFF-LINE ROBOT SIMULATOR SYSTEM™ at the European Conference of CADKEY and DataCAD distributors in Milan, Italy, November 8-9, 1990. The MULTICADL ROBOT SIMULATOR™ integrates with CADKEY® through CADL™ (CADKEY Advanced Design Language). The robotic path-generation and simulation software allows you to create kinematic models of any standard robot or custom-designed robot that exists as three-dimensional part files in CADKEY. You can also store this motion data in standard

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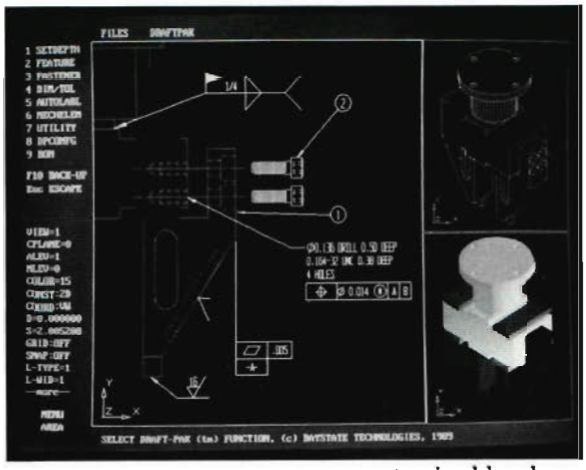
With its many new features and complete 150 page documentation package, DRAFT-PAK will save you valuable design and detailing time through powerful 2-D and 3-D parametric programs built right into the CADKEY menu. DRAFT-PAK's many valuable enhancement functions include:

- English/metric and ANSI/ ISO support.
- Construction plane and multiple viewport support.
- Automatic grouping option.
- Familiar tree structured CADKEY menu interface.



- 3-D parametric features including drilled, tapped, counterbored, countersunk, counterdrilled holes, slots and pockets.
- Automatic hole labelling utilities-with ANSI/ISO and custom label capabilities.
- Parametric fasteners: automatically generates all types of screws, bolts, nuts with optional washer creation.
- Geometric dimensioning and tolerancing to ANSI/ ISO standards to generate callout symbols based on datums, true positions, and features such as flatness and perpendicularity.
- Automatic weld symbol creation.
- Automatic generation of surface finish symbols, datum targets, dimensioning symbols, bolt circles, center lines, section lines and balloon notes.
- Automatic creation of 2-D/3-D mechanical elements such as springs, racks and gears using true involutes.
- Design/Detailing Utilities such as:

-Depth and attribute setting functions.

-Unique level manager and text based picture manager.

-Drawing/part statistics function.

-Automatic drawing layout function, that allows you to create a multiview drawing from a 3-D wireframe in seconds.

-Border/Chart script files to automatically fill in customized borders and charts with text.

- 3-D to 2-D part compression function removes overlapping/duplicate entities, and compresses arcs and circles on edge into lines.
- Table generation/Hole list utility.
- Dual dimensioning utility (metric/English).

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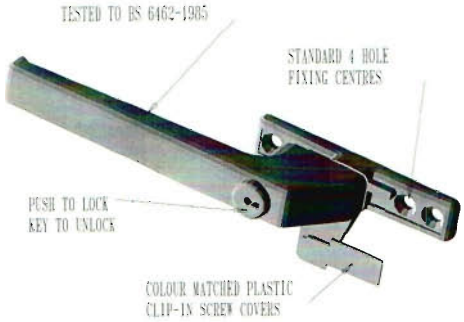
Interlock Uses CADKEY To Design Locks and the Dies to Make Them!

In an economy that has experienced one of its lowest ebbs since the Great Depression, Interlock Hardware Developments, Ltd. of Auckland, New Zealand, has been swimming successfully against the tide. Interlock designs and manufactures hardware fittings for doors and windows using CADKEY® and CADKEY SOLIDS™. Brett May and John Paterson founded the company in 1984 with some new ideas about door and window locks, which they patented worldwide in 1985. Their customers already span the globe, and the number of Interlock's employees has swelled to 110.



One of Interlock's left-handed window fasteners.

Lock Design

Interlock features left-hand and right-hand models of its locking hardware. The locks are manufactured from die-cast zinc alloy. Some window locks feature a nylon flap that extends and retracts as the window is locked or unlocked, to prevent damage to the window sash.

"Our designers do everything using CADKEY in 3-D, right from the initial concept on the computer screen," said Brett May. Interlock's door and window hardware include many interchangeable parts for which they have created a library of pattern files. "After building a wire-frame model of a lock," Brett continued, "we generate a solid model of the lock in CADKEY SOLIDS. This solid model serves two purposes. We use the solid model, first, to check for interference. Then, the solid model also creates an image that we use as an illustration in our catalogue. It lets the customer *see* the product without having to build a prototype."

Die Design

Interlock's tool designers have created a standard set of die blocks as pattern files in CADKEY. Using the volume of the solid model of the lock generated by CADKEY SOLIDS, they calculate the cavity volume for the die that will be used to make the lock. Then, they copy the pattern files of the die blocks into CADKEY part files and modify them to create a new die. The tool designers also design the placement of water lines and cooling channels. "We attempt to maximize the cooling efficiency of the die," Brett added, "so that we can run the die fast. That reduces the cost per part."

Interlock does not manufacture its own die sets. An outside manufacturer produces the tools for them. "Die casting involves two parts, the fixed half and the movable half," Brett said. "You clamp the movable half to the fixed half and inject the molten metal into the cavity through a nozzle connected via a gooseneck tube to a vat of molten zinc alloy. The molten metal is then forced into the gooseneck tube by a hydraulic piston."

Profitable Productivity

"A prospective customer in the United Kingdom had received a proposed product design from us," Brett said, "but they required an adjustment to a sculptured handle which they sent to us by fax. We modified the design in CADKEY and, the next day, we faxed them a print produced on a laser printer. The next morning we received a fax from them with a firm order for 120,000 locks."

DataCAD Tech Tip
Inserting and Removing Doors and Windows

by Steve Falusi

A door or a window does not have to reside on the same layer as the wall into which it is inserted. The process of inserting a door or a window into a wall on a different layer is not difficult, once you know how to do it.

Before inserting a door or a window, use the **Identify** function found in the EDIT menu to determine the layer in your drawing on which the wall lines that you want to cut are located. Make sure that both wall lines that you want to cut reside on the same layer. After you have located the appropriate layer, enter the **Architct** menu, and select **DoorSwng** (door swing) or **Windows**. Pick **LyrSrch** (layer search), and select the layer that contains these wall lines. If you do not do this correctly, when you try to insert the door or window, you will receive an error message: *No walls found to cut*. Use the Tab key to change the active layer to the layer onto which you plan to insert the door or window. Then, insert the door or the window.

Note: the **Cut Wall** option in the **Architct** menu works in a similar manner. However, it cuts and caps the walls without inserting any entities.

To remove a door/window from a wall, DataCAD Version 4.0 now has a **Remove** function in the **DoorSwng** and **Windows** submenus of the **Architct** menu. After you select **Remove**, the system prompts you to draw a box around the door or window that you want removed. If the door/window that you want to remove resides on a different layer than the wall lines, be sure to turn on **LyrSrch** in the **Remove** submenu. After you select the door/window, DataCAD will delete it and restore the wall. When you are drawing the box around the window or the door, keep in mind that **only the wall lines** should extend beyond the perimeter of the box.

DataCAD Version 4.05 Available

In August 1990, CADKEY, INC. released DataCAD™ Version 4.0. Our users gave it an enthusiastic reception, and the feedback from them has been quite positive. As a normal follow-up to Version 4.0, DataCAD, Version 4.05 fixes some minor bugs revealed after extensive use in the field.

We are making Version 4.05 available, on request, to any user of DataCAD Version 4.0, currently enrolled in the DataCAD Maintenance Program, who has been experiencing problems resulting from these minor bugs.

If you feel that you need this update, please call CADKEY Customer Service and request DataCAD Version 4.05. Telephone (203) 647-0220, ext. 8030. Please have your DataCAD serial number handy.

If you have a question about a suspected bug, or about whether a specific bug is fixed in Version 4.05, call CADKEY Technical Support at (203) 647-0220, ext. 7300.

DataCAD Printer Utility

In the early part of first quarter 1991, we will be releasing the DataCAD Printer Utility. This utility program will allow DataCAD users to plot to a printer. It will be useful to those users who do not possess a plotter, or who want output but don't want to wait for a full size plot to be completed. The program supports over 20 different printers including a variety of dot-matrix, ink jet, and laser printers. It is an external program requiring the user to first plot to a file, then exit DataCAD, and execute the Printer Utility in order to print. After it is released, it will be made available to all DataCAD Version 4.0 users who are in the DataCAD Maintenance Program.

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Frank Simpson, Editor. TEL.: (203) 647-0220. FAX: (203) 646-7120.

Design and Construction of a 60-room Hotel and Restaurant

DataCAD drawing of the Northwest perspective of the hotel, designed by Jacques Lioret, under construction at Boussy-Saint-Antoine.

The construction of economical yet luxurious hotels is a rapidly expanding market in France today. This new type of hotel construction around the outskirts of cities typically includes a facility of 48 to 60 rooms, on two or three floors, with a separate restaurant a short distance from the hotel itself, all under one management.

In February 1990, Jacques Lioret, Architect and Managing Director of ABACAD, S.A.R.L. in Neuilly-sur-Seine, a suburb of Paris, received a commission to design this type of hotel. Lucien Sanz, Managing Director of Gehor, S.A. and leader of this hotel project, signed the contract with Jacques Lioret for the design of the facility, with the stipulation that Jacques would do everything necessary to have the hotel ready to open early in 1991.

Two Challenges in One

Jacques, an architect of more than 20 years' experience, whose architectural firm has used computers for almost 10 years, accepted the challenge of such a tight deadline. Jacques had been using CADKEY(R) to design buildings in 3-D ever since CADKEY's introduction into France in 1986. However, he had just been introduced to DataCAD(R) in January, 1990. Instead of using CADKEY this time, Jacques decided to design this hotel project entirely in DataCAD.

Jacques participated actively in DataCAD's formal introduction into the French market at MICAD '90 in Paris, February 13-16, 1990. Instead of presenting a formal demonstration of DataCAD, Jacques began to design the hotel, live, in CADKEY's booth at the trade show. At the same time, he answered visitors' questions. (See **3-D WORLD**, May/June 1990, page 7.) He was ready to present a preliminary design of the project to his client shortly after MICAD '90.

Construction

Construction of the hotel began on July 25, 1990, on 3,700 square meters of land in Boussy-Saint-Antoine, a suburban town, Southeast of Paris, not far from the site of the future Disney World at Marne-la-Vallée. Construction is in reinforced concrete, stone, and brick, with prefabricated bathrooms, completely finished at the factory, then set in place by a crane onto each reinforced slab of concrete flooring. Completion is scheduled for March 1, 1991.

The hotel includes 60 rooms on three levels, in two wings linked to a central nucleus. Rooms on the ground floor are directly accessible by outside covered walkways. Rooms on the upper floors can be reached through interior corridors. The restaurant is designed to seat 100 people, and features an open grill in the main dining room. It also includes a function room on the second floor.

Appreciation

"DataCAD's ease of use is really conceived for the architect," Jacques said. "Its numerous 3-D functions, and especially its possibilities of visualization in perspective, won me over. DataCAD allowed me to create the documents required for a construction permit in record time, and then a complete set of detailed construction plans."

At the same time, Jacques used CACAO(TM), an architectural and construction project-management software that he himself created, to manage all of the non-graphical aspects of a project, including: quantitative estimates needed to accompany the graphical documents and plans used for consultation with contractors, work in progress, costs, and timely payment of vendors during the construction period. In France, an architect must calculate with precision the costs of a construction project, in addition to the detailed technical specifications. These construction costs must agree with the budget for the operation. And, all of this must be done before any consultation with contractors.

As of **3-D WORLD**'s press time, construction of the hotel at Boussy-Saint-Antoine is proceeding on schedule for opening on March 1, 1991.

Editor's Note: For information about CACAO(TM), contact Jacques Lioret, ABACAD, S.A.R.L., 18 Avenue Charles de Gaulle, 92200 Neuilly-sur-Seine, France. Telephone (from outside of France): 33-1-47-47-62-90. FAX: 33-1-47-47-20-79.

DoDDS and CADKEY Launch New Opportunities for Students

Six hundred students from 27 high schools in the Germany Region of the U.S. Department of Defense Dependent Schools (DoDDS) participated in the **Technology Fair** at Frankfurt-am-Main on June 1, 1990. Jim Zucchetti, Career Education Coordinator for the DoDDS secondary schools in Germany, said that approximately 100 students took part in the architectural-engineering and mechanical-engineering competitions included in the program.

This was the sixth annual **Technology Fair** among the DoDDS schools in Germany. The program was expanded this year to include computer-aided design in addition to traditional Mechanical Drawing. Three competitions highlighted the expanded program. One event featured live, on-site CAD competitions in mechanical engineering, using CADKEY. And, two competitions involved portfolios, submitted by students, of projects completed during the academic year in architectural engineering and mechanical engineering. The students had used CADKEY to create all of the material in their portfolios.

Coincidentally, five students, all from Wiesbaden High School, won the nine top prizes and trophies. Frank C. Pendzich, President of the Overseas Technology Educators Association, and Bruce Polderman of CADKEY, INC. presented the prizes and trophies. Dawn Jonas, a sophomore, won first place for the on-site CAD competition. She was awarded DataCAD(R) (Version 4.0) because of her interest in architectural engineering. Klaus Vik, a freshman, received CADKEY 3™ (Version 3.5) for second place in the live CAD competition. And, Jeremy Nix, a junior, won third prize in the competition: a trip as the representative of the Germany Region of DoDDS to the International Technology Education Association's 53rd Annual Conference in Salt Lake City, Utah, March 19-20, 1991. Harvey Watson, a senior, won the trophy for the best architectural-engineering portfolio, and Un Hui Bridges, also a senior, won the trophy for the best mechanical-engineering portfolio.

"CADKEY and DataCAD software are the only CAD products currently approved for use in DoDDS," said Jim Zucchetti. "We are using CADKEY 3 (Version 3.5) and CADKEY SOLIDS in our Technology Education programs. We shall include DataCAD and DC Modeler beginning in September 1990."

DoDDS' Germany Region has 92,000 students, Kindergarten through 12th Grade, in 140 schools. Fifty of these schools are at the secondary level, with approximately 30,000 students in Grades 7 through 12. There are 3,500 students enrolled in Technology Education programs. "Our goal is to expose, at least, all of our TE students to CAD using CADKEY and DataCAD," Jim added. "We shall have our CAD program completely operational in the 1990-1991 school year."

"Several teachers have played key roles in getting CAD into the Technical Education programs in our schools," Jim continued, "prominent among them are Byron Smith (Wiesbaden High School), David Izzo (Ramstein High School), John Henk (Stuttgart High School), and Rick Hoffman (Mannheim Middle School)."

"We are already planning our next **Technology Fair** to take place in the third week of May 1991."

CADKEY National Users' Group to Meet During NDES '91

The CADKEY National Users' Group will meet in conjunction with **NDES '91** at McCormick Place, in Chicago, Illinois, on Tuesday, April 9, 1991, from 5:00 to 9:00 p.m. The meeting will include a tour of CADKEY's booth (#211) at the show. CADKEY invites all users to participate.

CADKEY/DataCAD Trade Show Update

See CADKEY(R) and DataCAD(R) at these trade shows in 1991:

National Association of Home Builders '91, Jan. 18-22, Congress Center, Atlanta, GA, Booth #1752.

FOSE '91, Mar. 3-7, Washington Convention Center, Washington, DC, Booth #G4220.

WESTEC '91, Mar. 18-21, Los Angeles Convention Center, Los Angeles, CA, Booth #P699.

National Design Engineering Show NDES '91, Apr. 8-11, McCormick Place, Chicago, IL, Booth #211.

AEC '91, May 7-10, Washington Convention Center, Washington, DC, Booth #1111.

AIA '91, May 17-19, Convention Center, Washington, DC.

Call Danielle Cote, Events Manager, for the availability of discounted admission tickets one month before the show, (203) 647-0220, ext. 7150.

CADKEY/DataCAD at International Trade Shows

MICAD '91, Feb. 11-15, Paris, France, SYSECA.

CeBit '91, Mar. 13-20, Hannover, Germany, SOFT-TECH.

TRAINING SCHEDULE AT CADKEY, INC.

We have Training dates scheduled through April 1991. Please call Customer Service to register: (203) 647-0220, ext. 8030.

Course	Jan.	Feb.	Mar.	Apr.
Introduction to CADKEY	21-23	18-20	11-13	8-10
Introduction to DataCAD	7-9			
Advanced Geometric Modeling	24-25	21-22	14-15	11-12
CADKEY SOLIDS	28-29			

CADKEY/DataCAD Training In U.S. & Canada

Many authorized CADKEY and DataCAD Training Centers have scheduled courses in addition to the training available at CADKEY's world headquarters here in Manchester, CT. The following is a list of who is doing what, where, and when:

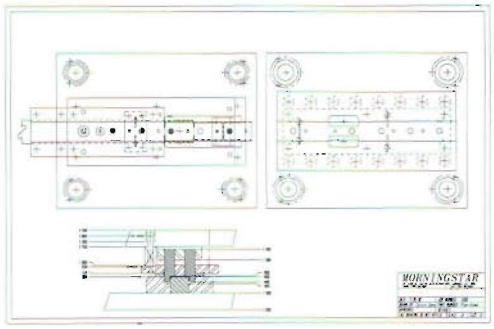
State	CTC	Location/Contact	Course	Dates
Ark.	Crowley's Ridge Vo-Tech School	I40 and Crowley's Ridge Rd. Forrest City, AR Charles Coleman (501)633-5411	*Intro. to CADKEY*	Jan 10-11, 17-18 Feb. 1-2, 14-15 Feb. 28 Mar. 1, 7-8, 14-15 Apr. 11-12, 18-19 May 16-17, 22-24
Calif.	CAD MicroSystems	5120 W. Goldleaf Cir. Suite 100 Los Angeles, CA Monica Hunter (213)291-2000	*Intro. to CADKEY* *Advanced CADKEY* *CADKEY SOLIDS*	Jan. 9-11 Feb. 5-7 Mar. 12-14 Jan. 23-24 Jan. 22
	Consulting Services International	14621 Titus St. Van Nuys, CA Bob Messamer (818)994-8881	*Intro. to CADKEY* *Advanced CADKEY*	3rd full week of each month. Scheduled on request.
	Desktop Productions	18200 Yorba Linda Bd. Yorba Linda, CA Carol Buehrens (714)579-3066	*DataCAD for the Architect* Mon./Wed. or Tue./Thurs. or Wed./Fri. *DC Modeler* *Advanced DataCAD* *DataCAD Keybd Macros*	Jan. 9-18 Jan. 15-24 Feb. 4-14 Feb. 19-28 Mar. 4-13 Mar. 12-21 Jan. 10, 23 Feb. 6, 20 Mar. 5, 15, 20 Jan. 25, Feb. 13, Mar. 28 Jan. 29, Feb. 27, Mar. 26
	Evergreen Valley College	3095 Yerba Buena Rd. San Jose, CA Loren Fromm (408)274-7900	*Intro. to CADKEY*	Jan . 11, 12, 19 Mar. 25-27
	Golden West College	15744 Golden West St. Huntington Beach, CA Jack North (714)895-8209	*Intro. to CADKEY*	Mar. 1-3

Progressive Die Design with CADKEY

by Calvin Sams

Today's marketplace for tool and die work is very competitive. Very few shops in this business today can survive, and have the competitive edge that one must have, without using some form of computer-aided manufacturing.

Tool and die shops have not been very progressive in the CAD/CAM marketplace until a few years ago. If a tool and die shop had CAD/CAM, they were really ahead of their time. Today is different. Without CAD and/or CAM, a shop cannot survive the demands of industry. These demands are: shorter lead times, better quality of tools, and accurate drawings of these tools.



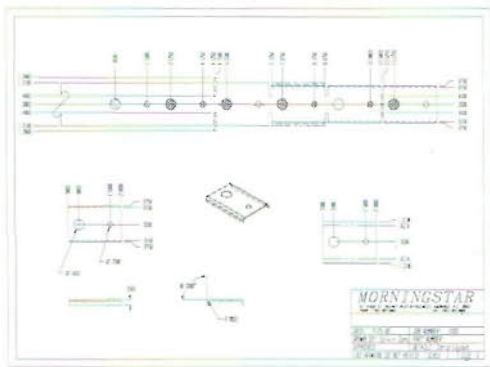
Plan views of progressive die.

Advantage of CAD

To design a tool or die in CAD, let's look at some of the advantages of CAD. These include faster turn-around of designs, cleaner and more accurate drawings, the ability to make easier changes to the drawings when necessary, less chance of dimensional errors, and the ability to transfer data electronically. This electronic transfer of data can be to CAM systems or to the customer for verification of the tool design.

Now that we know some of the advantages, let's take a die from conception to detail drawings. The first thing that a designer will do is to take the part drawing and analyze the part. Sometimes it is good for a customer to send a part, if at all possible. The designer will look for

the following: (1) What is the material and what are its hardness and strength factors? (2) Which hole dimensions are critical; what are their sizes and locations? (3) What surfaces are critical to the part? (4) What forms are required, and what are their tolerances? (5) Is the grain direction of the material critical? (6) What are the production requirements of the part? (7) What are the specifications of the punch press in which the die will run: shut height, bolster area, clamping area, bolster clearance area, strokes per minute, tonnage, feed height, type of feeder, maximum length of progression for feeder, and part-ejection methods? (8) What safety standards must the press and the die meet? After these details are known, the designer will start to lay out the part.



Strip layout of progressive die.

Advantage of CADKEY

This is the area where the designer can put CADKEY to real use. When first starting to lay out a part, it is a good idea to go ahead and draw the part in 3-D. Designing directly in 3-D is not yet the most common approach to die design. The die design itself can basically be done in 2-D alone. This includes the strip layout, the die plan, the punch plan, and the stripper plan. Most of the detail work can also be done in 2-D. However, designers are finding that the ability to design in 3-D has distinct advantages.

Drawing in 3-D allows you, the designer, to see what the part will be. If possible, have the customer bring the drawings to you on disk. If the part was not originally designed in CADKEY, you can translate the geometry into

CADKEY/DataCAD Training in U.S. & Canada (continued)

State	CTC	Location/Contact	Course	Dates
	Poelman's Design Service	901 Campisi Way, #360 Campbell, CA Mike Poelman (408)377-3585	*Intro. to CADKEY* *CADKEY* *SOLIDS* *CADL*	Feb. 25-27 Mar. 25-27 Jan. 28-30 Apr. 22-26
	Ukiah High School	1000 Low Gap Rd. Ukiah, CA Jim Howlett (707)463-5253, x284	*Intro. to CADKEY*	Jan. 4-6 Feb. 1-3 (Weekends)
Colo.	University of Colorado at Denver	1200 Larimer St. Denver, CO Andreas Vlahinos (303)556-2370	*Intro. to CADKEY* *Advanced CADKEY*	Call for schedule.
Conn.	DATAMAT Programming Systems	9 Mott Avenue Norwalk, CT Matt Reuben (203)855-8102	*Intro. to CADKEY*	Jan 28-Feb. 1 Mar. 18-22 Apr. 22-26 May 20-24
	University of Hartford	S.I. Ward College of Technology 200 Bloomfield Av. W. Hartford, CT Don De Bonee (203)243-4763	*Intro. to CADKEY*	Jan. 22 to May 2 (Tues. & Thurs. mornings)
Fla.	Gateway Computer Learning Center	10901B Roosevelt Blvd. St. Petersburg, FL Terri Long (813)576-0549	*Intro. to CADKEY* *Advanced CADKEY* *CADKEY SOLIDS*	Jan. 21-23 Feb. 11-13 Scheduled on request. Scheduled on request.
	Indian River Community College	3209 Virginia Av. Fort Pierce, FL Bill Sigurdson Dean Zirwas (407)468-4700, x4269	*Intro. to CADKEY*	Mar. 1-3 (weekend) Individualized audit courses available.
Ill.	PFB Concepts	2525 E. Oakton Av. Arlington Heights, IL Bob Konczal (708)640-1853	*Intro. to CADKEY* *Advanced CADKEY* *CADKEY SOLIDS* *CADL* (weekend) *CADKEY Light* *PageMaker for CADKEY*	Jan. 9-11 Jan. 23-25 Feb. 6-8 Mar. 6-8 Apr. 10-12 Feb. 20-22 Apr. 24-26 Mar. 21-22 May 23-24 Mar. 16-17 May 18-19 Feb. 15 Apr. 19 Jun. 14 Feb. 28-Mar. 1 May 2-3
Ind.	Tri-State University	Technology Division Angola, IN Ed Nagle (219)665-4262	*Intro. to CADKEY*	Feb. 9, 16, 23 (Saturdays full day)

Two CADKEY Users' Groups Consolidate

The Atlanta Area CADKEY Users' Group in Decatur, Georgia, and the Georgia/Southeast CADKEY Users' Group in Marietta, Georgia have consolidated into one group according to Lisa Maier and Tom Knesel, the contact people for the two groups. Tom Knesel of APPLIED COMPUTER TECHNOLOGIES, 450 Franklin Street, Marietta, Georgia, (404) 424-3785, is the contact person for the combined group.

CADKEY/DataCAD Training in U.S. & Canada (continued)

State	CTC	Location/Contact	Course	Dates
Iowa	Iowa Lakes Community College	300 South 18th St. Estherville, IA Roger Patocka (712)362-2604	*Intro. to CADKEY*	Special schedules by request.
Mass.	Springfield Technical Community College	1 Armory Square Springfield, MA William White (413)781-7822	*Intro. to CADKEY*	Jan. 7-9 Mar. 19-21 Jun. 3-5
	Worcester Polytechnic Institute	100 Institute Road Worcester, MA Sean Anzoni Pat Scavone (508)831-5633	*Intro. to CADKEY*	January, March, June (2nd or 3rd full week of month) Call for dates.
Mich.	CIM and Future Solutions	5900 N. Lilley Rd. #101 Canton, MI Paul Zwarka (313)981-7455 FAX: (313)981-7473	*Intro. to CADKEY* *Advanced CADKEY*	Feb. 19-21 Mar. 19-21 Jan. 14-15 Feb. 11-12 Mar. 11-12
	Washtenaw Community College	Occupational Ed. Bldg. 4800 E. Huron River Dr. Ann Arbor, MI Belinda McGuire (313)973-3300	*Intro. to CADKEY* *CADKEY SOLIDS*	May 13-15 Jun. 3-5 May 21-22 Jun. 11-12
Minn.	Albert Lea Technical Institute	2200 Tech Dr. Albert Lea, MN Larry Gilderhus (507)373-0656	*Intro. to CADKEY* *Advanced CADKEY*	Scheduled on request.
	Anoka Ramsey Community College	11200 Mississippi Blvd. Coon Rapids, MN Tom Loftus (612)427-2600 (Customized classes at CTC or on site scheduled on request.)	*Intro. to CADKEY* *Advanced CADKEY* *Adv. Geom. Modeling CADKEY SOLIDS*	Jan. 14-Feb. 4 (M. & W. eve.) Feb. 18-Mar. 11 (M. & W. eve.) Mar. 25-27 (Day course) Mar. 27-28 (Day course) Apr. 1-17 (M. & W eve.)
	Moorhead State University	Industrial Studies Dept. Moorhead, MN Wade Swenson (218)236-2466	*Intro. to CADKEY*	Mar. 4-6 Jun. 3-5
	St. Paul Technical Institute	235 Marshall Ave. St. Paul, MN Michael Haffner (612)221-1307	*Intro. to CADKEY*	Call for schedule.
Miss.	Mississippi Delta Community College	Highway 3, Box 668 Moorhead, MS Tony Honeycutt (601)246-5631, ext.103	*Intro. to CADKEY*	Jan 28-30
Mont.	Montana Tech	West Park St. Butte, MT Dick Johnson (406)496-4452	*Intro. to CADKEY*	Jan. 7-9

CADKEY format through IGES or DXF translation. CADKEY has IGES and DXF translators that work really well.

Flat-Pattern Layout and Strip Layout

After the part file exists in CADKEY, you can unfold the part, that is, make a flat pattern of the part, using a third-party program like Profold™ from Applied Production, Inc. This program allows a designer to fold or unfold parts with a complete user interface for radius compensation and angles.

The designer can take the flat-pattern layout and make the strip layout for the die. This is very easy to do in CADKEY because you know the length of the part. All that you need to do is to copy the geometry using the functions: X-FORM, TRANS-R, COPY. You select the geometry, specify the number of copies desired, and key in the x, y, z coordinates required. The coordinates in most cases will be the length of the part plus material thickness multiplied by 2, according to the formula: [LOP+(MT*2)]. This is the point where a designer's discretion enters the picture. In most cases, you will know what your customer expects.

An easy-to-use reference procedure, using drawing numbers with different letter extensions, can keep multiple drawing files in order. For example, use the number 1000-P as the drawing number/filename when referring to a part drawing and/or to a flat-pattern layout. Use 1000-S to refer to the strip layout. From this you can start to see how to place the cuts needed to achieve the part's geometry. After completing this, use X-HATCH to designate the cut areas.

Strip Carriers

Your next step is to decide on the best location for the strip carriers. These carriers actually carry and keep the strip together while the part progresses through the die. Then, you need to decide where to form the part in the die, and to X-HATCH the areas where the forming of the part will take place. With CADKEY's EDIT and BREAK functions and its various line types, it is very easy to show where all these actions take place in a die.

After the initial strip layout, review what you have done. It may be possible

to merge stations together to shorten the length of the tool. Avoid unnecessary stations and secondary operations, if at all possible. After you have made any corrections that appear necessary, you need to show cross-sectional views of what happens in the form areas of the die. Most companies require a die designer to supply a cross-sectional view of the die. Customers also want to see what happens in the form areas. The form areas are very clearly visible when they have been designed in 3-D. 3-D allows the designer and the customer to see exactly what is expected to happen in each one of the stations.

Die Plan

After you have completed the strip layout, the die plan is your next step. This process involves laying out the die-cutting sections and the die-forming sections. Then, if necessary, lay out the die chase. A die chase, or some form of holding all of the die's components in a solid section of steel, is not required for every die.

Your next decision is what die set to use. If you have the option of not needing to use a purchased die set, you can very easily design a custom die set. Many die-set manufacturers will make a customized set of dies for a customer, according to their drawings.

Punch Layout

The punch layout is the next step in the process of die design. CADKEY makes this easy to do. Make a different level of the part file active, and use the functions X-FORM, MIRROR, and COPY to create the punch layout on that active level of the file. You must decide how to locate the punches. You can determine individual punch locations, or you can locate all of the punches with a chase. After you have determined the location of the punches, make a pattern file of the die plan and of the punch plan. Then, you can create a blank part file and insert the pattern file of the die plan and the punch plan. This keeps the size of your die's original part file very workable.

The next step is the stripper layout. The punch plan allows you to determine where to place the die springs and shoulder bolts.

CADKEY/DataCAD Training in U.S. & Canada (continued)

State	CTC	Location/Contact	Course	Dates
N.C.	Entré Computer Center	110 Charlotte Plaza Charlotte, NC John Murphy (704)332-1557	*DataCAD I* *DataCAD II* *DC Modeler*	Scheduled on request.
N.H.	Portsmouth Senior High School	Alumni Drive Portsmouth, NH Kenneth Webber (603)436-7100	*Intro. to CADKEY*	Call for schedule.
N.M.	New Mexico State University	P.O. Box 30001 Dept. 3450 Las Cruces, NM Maurice Hamilton (505)646-3501	*Intro. to CADKEY* Advanced CADKEY	Mar. 11-13 May 6-8 Jul. 8-10 Mar. 14-15 May 9-10 Jul. 11-12
N.Y.	American Training Center, Inc.	118-21 Queens Blvd. Forest Hills, NY Arkady Kleyner (718)544-8100 (800)273-ATCI (N.Y. only)	*Intro. to CADKEY* *Advanced CADKEY* *Intro. to DataCAD* *Advanced DataCAD*	Jan. 7-9 Feb. 4-6 Jan. 10-11 Feb. 7-8 Jan. 14-16 Feb. 11-13 Jan. 17-18 Feb. 14-15
	Iona College	715 North Av. New Rochelle, NY Flory Netsch (914)235-1360	*Intro. to CADKEY*	Jan. 10
	Rochester Institute of Technology	1 Lomb Memorial Dr. Rochester, NY Dr. Robert Hefner (716)475-2205	*Intro. to CADKEY* *Advanced CADKEY*	Feb. 4-6 Jan. 14-16
	S.U.N.Y. at Farmingdale	School of Engineering Lupton Hall Farmingdale, NY Harriet Kaiser (516)420-2158	*Intro. to CADKEY* *Advanced CADKEY*	Feb. 11-Mar. 18 (Mon. evenings) Apr. 8-May 13 (Mon. evenings)
Ohio	Progressive Computing Corp., Inc.	6964 Spinach Dr. Mentor, OH Jean Kempton (216)255-0460	*Intro. to CADKEY* *Advanced CADKEY* *CADKEY SOLIDS* *CADL and Macros*	Jan. 8-9 Feb. 5-6 Jan. 16-17 Feb. 13-14 Feb. 26-27 Jan. 29
Okla.	Oklahoma State University	301 Cordell South Stillwater, OK Gerald McClain (405)744-5709	*Intro. to CADKEY* *Intermed. CADKEY* *Advanced CADKEY* *Modeling and SOLIDS*	Jun. 12 Jun. 13-14 Jul. 24-26 Mar. 11-13
Ore.	CTR Business Systems	6420 SW Macadam Av. Portland, OR Sandi McNeil (503)293-8627	*Intro. to CADKEY* *Advanced CADKEY*	Courses offered every month. Call for schedule.

CADKEY/DataCAD Training in U.S. & Canada (continued)

State	CTC	Location/Contact	Course	Dates
Ore.	Rogue Community College	3345 Redwood Hwy. Grants Pass, OR Del Harris (503)479-5541	*Advanced CADKEY* *Intro. to DataCAD*	Jan 3-Mar. 14 (Tu. & Th. a.m.) Jan. 3-Mar. 14 (Tu. & Th. eve.)
Pa.	Butler County Community College	College Dr., Oak Hills Butler, PA Mike Aikens (412)287-8711	*Intro. to CADKEY*	Jan. 10-11
	Computer-Land	1360 Harrisburg Pike Lancaster, PA Lori Fraser (717)291-2111	*Intro. to DataCAD* *Advanced DataCAD*	Scheduled on request, on site or in house.
	Edinboro University of PA	G-34 Hendricks Hall Edinboro, PA Peter Mathews (814)732-2592	*Intro. to CADKEY*	Jan. 8-10 Mar. 26-28 May 14-16
	Micro Control Inc.	390 Middletown Blvd. Langhorne, PA. Marion Homan (215)752-5510	*Intro. to CADKEY* *Advanced CADKEY* *Intro. to DataCAD*	Jan. 15-18 Feb. 13-16 Mar. 13-16 Feb. 26-28 Jan. 21-23 Feb. 19-21 Mar. 19-21
Texas	MLC CAD Systems	5316 Highway 290West Austin, TX Barbara Leesley (512)892-6311 A = Austin D = Dallas H = Houston	*Intro. to CADKEY* *Advanced CADKEY* *CADL*	Jan. 8-10 H Jan. 15-17 A Feb. 5-7 D Feb. 12-14 A Jan. 22-23 A Feb. 19-20 A On request.
	Texas A&I University	Industrial Technology Campus Box 203 Kingsville, TX Herschel Kelley (512)595-2608	*Intro. to CADKEY*	Jan. 2-4
	Texas Tech University	P.O. Box 4200 Lubbock, TX Mary Bentancourt (806)742-3451	*Intro. to CADKEY*	Jan. 8-10 Mar. 18-20 May 14-16 Aug. 20-22
Va.	Republic Research Training Center	855 West Main St. Charlottesville, VA Gregg Kendrick (804)296-9747 (800)476-4454	*DataCAD I* *DataCAD II* *DataCAD 3-D*	Jan. 14-16 Jan. 7-8 Jan. 9-10
	Virginia Polytechnic Institute	144 Smyth Hall Blacksburg, VA Allen Bame (703)231-6480	*Intro. to CADKEY*	Mar. 11-13
Wash.	Everett Community College	801 Wetmore Av. Everett, WA Stu Barger Kathy Ardmore (206)388-9429	*Intro. to CADKEY*	Jan. 23-25 Mar. 27-29 Jun. 19-21 Aug. 21-23

Detail Drawings

After a designer has completed all of the plan drawings, it is up to the customer to approve the die design. Only then can the designer start to work on the detail drawings. The time involved in detail drawing with CADKEY is much shorter than with other CAD systems, due to CADKEY's ease of dimensioning. Dimensioning in CADKEY takes 50% to 75% less time than other leading CAD systems, and does not detract from the accuracy of the drawings. This time savings allows you to be more competitive in costing designs.

Completion of the detail drawings means that the design is ready for release to the tool room for building the die. The toolmaker can build a better quality die from the drawings because the drawings are more accurate and cleaner than board-drawn designs. What you, the designer put into the CADKEY system is exactly what will come out in the plots for the detail drawings. With good detail drawings, the tool room has the advantage of fast replacement parts for the die. This speed of replacement can mean the difference between running the die, or waiting for someone to measure and build another part, in the hope that the replacement part will locate properly and function just like a new part.

Editor's Note: Calvin Sams has worked in the tool and die industry for 13 years. He is presently CAD Manager at MORNINGSTAR CAD/CAM/CIM/DNC Specialists, Albemarle, North Carolina.

THIRD-PARTY NEWS

VDAFS - A New Interface for CADKEY

VDAFS™, a DIN-standard neutral format used by the German automotive industry for the exchange of geometric data, especially free surfaces, (DIN 66301) now integrates with CADKEY. For information, contact CGA Dr. Benz Technologiezentrum Mainz, Galileo Galilei Strasse 10, D-6500 Mainz 42, Germany. Telephone: 49-6131-506840. FAX: 49-6131-506819.

ROBOT SIMULATOR

(Continued from page 5)

ASCII format. MULTICAD Studio is seeking CADKEY users, interested in robotics, who would like to test their application software. For additional information, contact MULTICAD Studio, Ltd., 1089 Budapest VIII Elnök u 1, Hungary. Telephone (outside of Hungary): 361-113-8217. FAX: 361-113-9537. English-speaking contact: Gábor Benjámin.

Engineering Fundamentals at Virginia Tech Feature CADKEY

by Dr. C.E. Teske

In 1990 the College of Engineering at Virginia Polytechnic Institute, Blacksburg, Virginia adopted CADKEY™, Version 3.55 as its standard for computer graphics throughout all of the college's engineering departments.

Virginia Tech requires that entering freshmen, approximately 1,200 students each year, purchase a *computer package* that includes hardware and software. Initially the college selected CADKEY 1™, Version 1.4, the student version of CADKEY for integration into the engineering-graphics course in Engineering Fundamentals. CADKEY 1, now called appropriately CADKEY STUDENT™, served to bridge the gap between traditional drafting and CAD technology. The college upgraded to the professional-level of CADKEY as part of the freshman-year computer package to keep pace with the advancements in CAD technology. The college now uses the complete, industrial-level version of CADKEY.

Developing a Feeling for Visualization

CADKEY is replacing the traditional paper-pencil-and-drafting-instruments methods of teaching engineering graphics. Students begin to use CADKEY at the very beginning of their course. It is their main means of creating designs. Students first learn to sketch shapes and to develop a *feeling* for visualization. Sketching extends points, lines, and planes into 3-D spatial relationships, and correlates height, width, and depth with orthographic projection. At the same time, students become familiar with the basics of CADKEY, learning the menus, key sequences, and immediate-mode commands to produce 2-D geometric shapes. They learn to create three-dimensional shapes, initially, by using the coordinates of corners, extrusion, or by a combination of these methods. Students examine the relationships and appearance of inclined and oblique planes by unfolding their wireframe

(Continued on page 18)

CADKEY/DataCAD Training in U.S. & Canada (continued)

State	CTC	Location/Contact	Course	Dates
Wash.	Walla Walla College	School of Engineering College Place, WA Dale Visger (509)527-2712	*Intro. to CADKEY*	Mar. 10-12
Wis.	CAD PROfessionals Inc.	120 Bishops Way, #136 Brookfield, WI Dan Warsh (414)782-9199	*Intro. to CADKEY* *Intro. to DataCAD* *CADKEY SOLIDS* *CADKEY RENDER*	2nd and 4th Tuesdays of every month. *CADKEY SURFACES*
	Lakeshore Technical College	1290 North Avenue Cleveland, WI Robert Moore (414)458-4183	*Intro. to CADKEY*	Jan. 7-9 May 21-23
	Milwaukee School of Engineering	1025 N. Milwaukee St. Milwaukee, WI Marvin Bollman (414)277-7357	*Intro. to CADKEY*	Feb. 27-Mar. 1 May 21-23
	North Central Technical College	1000 Campus Dr. Wausau, WI Michael Clark (715)675-3331	*Intro. to CADKEY*	Courses scheduled on request.
Wyo.	University of Wyoming	3085 Engineering Bldg. Laramie, WY Donald Polson Jean Richardson (307)766-5255	*Intro. to CADKEY*	Jan. 9-11 May 15-17 Jul. 24-26 Aug. 26-28

CANADA

Prov.	CTC	Location/Contact	Course	Dates
British Columbia	Pacific Marine Training Institute	265 West Esplanade North Vancouver, B.C. Mike Davison (604)985-0622	*Intro. to CADKEY*	Courses scheduled on request.
New Brunswick	New Brunswick Community College	P.O. Box 2100, Sta. A CAD/CAM Dept. 1234 Mountain Rd. Moncton, N.B. Wayne Ritchie (506)856-2169	*Intro. to CADKEY*	Scheduled on request. On-site courses available.
Ontario	Algonquin College	200 Lees Av. Ottawa, Ontario Peter Casey (613)594-3888, x5904	*Intro. to CADKEY* *Advanced CADKEY* *System Customization*	Jan.4-Feb. 6 (M. & W. eve.) Feb. 11-Mar. 6 (M. & W. eve.) Mar. 11-Apr. 3 (M. & W. eve.)
Ontario	CADCORP	250 Consumers Rd. Willowdale, Ontario Linda Newstead (416)492-5982	*Intro. to CADKEY* *Advanced CADKEY*	Jan. 21-25 Jan. 16-18

CADKEY/DataCAD Training in U.S. & Canada (continued)

Prov.	CTC	Location/Contact	Course	Dates
Ontario	JB Marketing Associates	82 SprucesideCresc. Fonthill, Ontario John Bradford (416)892-8025	*DataCAD I* *DataCAD II*	Scheduled on request.
	Klear Concept Data	465 Rogers St. Peterborough, Ontario John Punshon (705)742-3354	*Intro to CADKEY*	Customized training scheduled on request.
	Naylor-McLeod Group	1425 Bishop St. Cambridge, Ontario Brian Naylor (519)622-4495	*Intro. to CADKEY*	Scheduled on request.
	Ryerson Polytechnical Institute, C.A.T.E.	350 Victoria Street Toronto, Ontario K. Doddridge (416)979-5106	*Intro. to CADKEY*	Jun. 3-4 Courses scheduled on request.
Québec	APPLICAD	11956 Blvd. Laurentien Montréal, Québec Walid Hadid (514)336-5959	*Intro. to CADKEY*	Courses scheduled on request.

CADKEY and DataCAD Training Centers that would like dates of scheduled training courses to appear in 3-D WORLD, contact Peter Mancini, Educational Programs, CADKEY, INC., 440 Oakland Street, Manchester, CT 06040-2100. Telephone: (203) 647-0220. FAX: (203) 646-7120.

Colorado State University Correspondence Course in CADKEY Fundamentals (Versions 1, 1.4, 2.06M, 2.11, and 3.5), Self-paced introduction to CAD. Developed by Terry T. Wohlers and Dr. Paul J. Resetarits. Contact: Division of Continuing Education, Colorado State University, Spruce Hall, Fort Collins, CO 80523. Telephone: (800) 525-4950.

Virginia Tech and CADKEY

(Continued from page 17)

models into a flat two-dimensional plane. They then construct paper models of the solid shape from its 2-D representation. This enhances the students' skills at interpreting the spatial quality of real things. The students also use CADKEY SOLIDS to convert wireframe models into solid representations, with hidden lines removed or with dashed lines. Then, they examine these shaded renderings of 3-D objects displayed on 2-D media.

Each student receives a class project to produce complete, detailed dimensioned drawings of a three-dimensional object. This project requires students to use every function and capability taught in the freshman-level course.

Engineering Graphics and the Mechanics of Statics

The College of Engineering teaches the mechanics of statics to freshmen during the same semester as their course in engineering graphics. The graphical solution to typical problems in statics serves as their first example of the application of computer graphics to solve engineering problems. The ease with which students can create and manipulate two-dimensional and three-dimensional entities in CADKEY assists them in seeking graphical solutions to typical problems of 2-D and 3-D vector addition, component resolution, and the determination of direction cosines. The use of different levels, colors, and line types adds to their visual understanding. The students also apply engineering graphics to the determination of compressive and tensile forces present in loaded trusses. They even use CADKEY to determine the reactions necessary for equilibrium of a loaded beam. Other engineering properties that students must learn during their freshman year include the computation of areas, perimeters, locations of centroids and moments of inertia in two-dimensional geometric figures. CADKEY's menus make all of these capabilities readily available.

Advanced Computer Graphics

Virginia Tech offers an optional advanced course in computer graphics to extend the engineering students' capabilities with graphics beyond what is required in the freshman course. As with the course in engineering graphics, the elective, advanced computer-graphics course uses CADKEY exclusively. The students develop assembly drawings and exploded-view drawings, as well. They work with all of CADKEY SOLIDS' modeling capabilities, including object rotation, light-source selection, and color changing. The course features Boolean operations with CADKEY primitives to create objects that make use of union, difference, intersection, and plane operations. The course also covers the importing of drawing files generated on other CAD systems into CADKEY, and the exporting of CADKEY files through DXF translation. This aspect of the course has proven to be a great help to students at the College of Engineering who have courses in other colleges within Virginia Tech that use other CAD software in their laboratory assignments. Students learn how to create macros and how to develop CADL programs to perform repetitive tasks. The advanced computer-graphics course concludes with designing a three-dimensional object, processing it through a third-party computer-aided-manufacturing software, and producing a physical part on a numerical-control machine.

Editor's Note: Dr. C.E. Teske is Associate Professor of Engineering Fundamentals at Virginia Polytechnic Institute.

Safe Departure

(Continued from page 20)

He added welds to the wire-frame model to help locate difficult welding angles and to find the total linear length of weld for the container, weld strength, etc.

Using CADKEY, the design engineer was able to design the SSC and produce the Technical Data Package (documentation) all by himself, just as fast as, but with fewer mistakes than, if he had worked with the usual team of an engineer and several drafting personnel.

Doubts about Prototype

When the USADACS team built the first prototype of the SSC, the engineers weren't entirely sure that it could withstand the pressure criteria, let alone the two-foot-drop requirements on the corners and faces of the container. When pressurizing a square box, the box tends to become spherical. However, the first prototype had a 1/4-inch steel-plate body that weighed more than 800 pounds, and it did indeed pass all criteria. It was pressurized up to 15 pounds per square inch gauge.

With a reliable container as a baseline, the USADACS engineers decided to output another wire-frame design to COSMOS™, a finite-element analysis program developed by Structural Research and Analysis Corporation of Santa Monica, California. They wanted to find out if this design could pass the pressure requirements. The results were encouraging. Local approval was granted to produce another lighter container of 3/16-inch steel, weighing 670 pounds, in hopes of having the lighter model approved by the Army before production of the heavier container started. The new lighter container, with minor changes, passed all Army criteria.

On-site Changes for Production

After a U.S. Government-Owned Contractor-Operated (GOCO) facility in Germany was selected to produce more than 5,500 of these containers, a team from USADACS went to Germany to help produce additional prototypes and to verify acceptable differences in materials due to the metric vs. American Society of Testing Materials (ASTM) equivalents. The Technical Data Package required complete conversion, including the incorporation of both English and German notes. A small team of five engineers, responsible for management, design, testing and quality assurance, hand-carried their testing equipment, two laptop computers, and a dot-matrix printer capable of printing on 11x15-inch paper to Germany to accomplish their high-priority assignment.

Jerome H. Krohn, Acting Chief of the Validation Engineering Division of the Logisitics Engineering Office of the U.S. Army, places wooden, vertical-restraint dunnage into a Secondary Steel Container loaded with inert, 8-inch, separate-loading projectiles during a test at the U.S. Army Defense Ammunition Center and School, Savanna, Illinois.

The USADACS team selected European materials, produced prototypes, and performed tests. They certified the German contractor. They also quickly revised the drawings on site. It was an enormous production task to produce more than 80 containers per day, with each container having over 825 linear inches of weld. Quality control of the production process was of paramount importance due to the sensitivity of the items to be transported.

First-article-test (FAT) results and changes in the production process generated several engineering change proposals (ECPs). The team incorporated all of the changes on site, using CADKEY on a laptop computer. The dot-matrix printer produced hard copy of the changes in the drawing package on 11x15-inch paper. The data went by fax back to the United States for configuration-management approval.

The engineering divisions at USADACS had responded promptly to this major international commitment, thanks to the portability of both the on-site project-team members and their tools (a laptop computer, CADKEY and CADKEY SOLIDS). The USADACS' engineering divisions have been moving from "on-the-board" design to CAD since 1987. They currently have more than 20 workstations, with 286 and 386 processors, that can all successfully run CADKEY 386 or CADKEY 3 (Version 3.55M).

Editor's Note: Ken Dreier is a mechanical engineer at the U.S. Army Defense Ammunition Center and School, Savanna, Illinois. Ken served as the designer and project engineer for the Secondary Steel Containers project.

Secondary Steel Containers' Safe Departure Results from Joint Effort

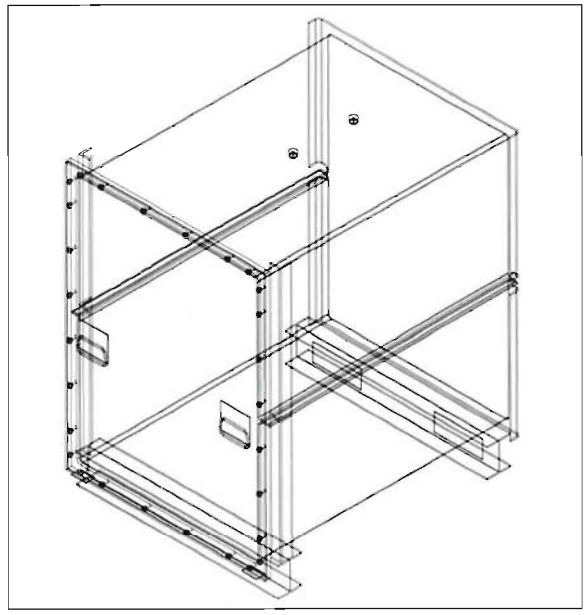
by Ken Dreier

As the two ships safely pulled out of the harbor of Nordenham in the Federal Republic of Germany on September 21, 1990, many German natives, U.S. government officials, Army soldiers, and federal civilian employees breathed a sigh of relief. The smooth operation of the ships' departure was the final segment in the removal of 100,000 projectiles (435 tons) of chemical, nerve-agent artillery shells from German soil. The chemical shells, which had been stored inside the heart of Germany for more than two decades, are now slated for safe destruction.

Many of the employees of the U. S. Army Defense Ammunition Center and School (USADACS), located on the Mississippi River near Savanna, Illinois, also sighed with relief. They had received the assignment from the U.S. Army Chemical Research, Development and Engineering Center (CRDEC), Aberdeen Proving Ground, Maryland, to design, test, approve, and monitor the manufacturing of the vapor-tight Secondary Steel Containers (SSCs) that were being used to transport the chemical shells.

Very Stringent Deadline

When USADACS was initially assigned the task of designing a five pounds-per-square-inch-gauge, vapor-proof container, there was little time allotted to the project. Nevertheless, they were able to design the SSC, have a prototype built, and successfully pass all testing requirements in just over four weeks. CADKEY and CADKEY SOLIDS played an integral part in the first two weeks of design. The SSC turned out to be the very first USADACS project which was completely designed using CADKEY's three-dimensional capabilities.



Wireframe model in CADKEY of the Secondary Steel Container.

A team of engineers formulated several different design concepts. After one week, they sent a concept to USADACS' engineering supervisors. The design was approved, and a design engineer started making the wire-frame model, using the then current military version of CADKEY.

The SSC is a double-weld steel box, with a flat gasket and 28 bolts to hold the door securely to the flange. The design engineer created the wire-frame model with different pieces on different levels, and with each level grouped. He output the completed wire-frame model to CADKEY SOLIDS, which he used to calculate the SSC's mass properties and to produce four rendered views of each part of the box. Then, he dimensioned the rendered views, and added borders to complete the drawings.

The designer expanded the SSC's analysis in CADKEY SOLIDS to include determining its total weight, its external surface area for painting, etc.

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