Chapter 20

Tom Lazear and VersaCAD

Tom Lazear joined Southern California Gas Company in 1957 after receiving his B.S. in mechanical engineering from the University of California (Berkeley). His position was as an Associate Design Engineer working on the design of piping systems, pumping stations and similar projects. He then joined Fluor Corporation in 1959 as an associate computer engineer.

After taking a week long programming course, he began working with one of Fluor's senior structural engineers, Eli Czerniak, who had fought for Israel's Haganah during its war for independence in 1948 and then emigrated to America. Czerniak had recognized the potential of digital computers for solving engineering problems and once Lazear started working for Fluor, Czerniak decided that they would work together to develop a series of structural analysis and design programs.

In 1959 Fluor was using a Burroughs Datatron 205 computer. This machine was originally developed by Consolidated Electrodynamics Corporation (CEC) whose ElectroData division was subsequently spun off and went public. ElectroData was then acquired by Burroughs in June 1956 and became a key component of that company's subsequent computer activities.

The Datatron 205 was a vacuum tube machine that had a drum memory with 4,000 10-digit word capacity. The primary means of input and output was via a punch paper tape Flexowriter which also served as a console printer. The Datatron 205 was a fairly advanced machine for its time with index registers, floating-point arithmetic and magnetic tape data storage. It was physically quite large, nearly filling a 20' by 30' room, and requiring 20 tons of air conditioning. In many respects, the Datatron 205 was comparable to IBM's 650 although the Datatron machine was physically much larger and cost considerably more.

The programs Lazear and Czerniak created facilitated the design of reinforced concrete foundations for vertical and horizontal pressure vessels as well as the design of pressure vessels themselves. The foundation programs calculated the size of the foundations as well as the reinforcing steel needed based upon fairly straightforward input data provided by the design engineer. One form of output included specific dimensional data printed out on small sheets of vellum which were then attached to full size drawing sheets. These programs were documented in publications such as *Petro/Chem Engineer*[1] and *Consulting Engineer*[2].

The first automated drafting application Lazear was associated with involved producing isometric piping diagrams on a Stromberg Carlson SC4020 film recorder. The process involved writing instructions for how the piping was to routed, keypunching the information and then processing those punch cards on a mainframe computer. The computer generated instructions on magnetic tape which was then used by the SC4020 to produce film images. The film was reproduced on a Xerox Copyflow machine to create

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[1] *Petro/Chem Engineer* February 1962
[2] *Consulting Engineer* August 1961 and March 1963

vellum drawings. Fluor invested about a year of effort in developing this process. According to Lazear, it was "pretty awkward and never quite made it as a production system."[3] It wasn't until ten years later when Fluor acquired its first M&S Computing (Intergraph) system that computer generated isometric drawings became practical.

While working for Southern California Gas Company and Fluor, Lazear picked up a MS degree in electrical engineering from UCLA. As the use of computers became more prevalent at Fluor, Lazear became responsible for much of this activity. In 1968 he became director of computer services for the company, a position that would probably be called CIO today. After going back to school and receiving an MS degree from MIT's Sloan School of Management, Lazear became an assistant to the senior vice president and general manager of Fluor's Southern California Division. He served in this role until 1979 when he left to join T&W Systems on a full-time basis.

Early days at T&W Systems

T&W Systems was started as a part-time endeavor in 1977 by Lazear and William Yunek. (Lazear says he would laughingly tell people that T&W stood for Tom and Wife but that a woman's rights person objected so that he stopped doing it.)[4] The initial staff at T&W consisted of Tom Lazear, his wife Sandy, his daughter Debbie who was a student at the University of California Irvine (UCI) and his son Mike who was a freshman at Cal State Long Beach (CSLB).

The first software developed by T&W Systems was a medical billing application. Sandy Lazear worked for an orthopedic surgical practice where William Yunek was the office manager. The doctors from this practice invested $30,000 to help get T&W Systems started.

Lazear did an extensive review of available computer systems prior to starting work on the medical billing system and eventually selected a CADO computer for this application. It had 8" floppy drives, a big monitor and a simple operating system that used a combination of COBOL and Basic. The Lazears took a programming course on a Saturday in 1977 and began work on the billing application the following Monday. They invested about 1,000 manhours in the software and sold the first copy for $5,000. A few additional systems were sold but the product was not sufficiently successful to base the future of the company on it.

The focus subsequently switched to the developing of piping design software and eventually Computer-Aided Design software. Lazear realized that they needed a more powerful computer for these applications and had actually purchased a Digital PDP-11 with an RSX-11 operating system and a FORTRAN compiler in 1976. It sat in a box in his home unopened while they looked for an office in which to house T&W Systems.

At some point in 1978, Lazear met the local salesman for Terak, Dick Mitchell, who convinced him that the Terak was the right computer system for T&W to use. The first software the company developed for this machine was a piping isometric drafting package they called T-Square. The software was sold to about half a dozen companies during the late 1970s. Unfortunately, isometric drafting software appealed primarily to

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[3] *Computer Graphics,* February 2001
[4] Email from Tom Lazear, March 7, 2003

large design firms and these companies preferred to buy key applications from major CAD players such as Intergraph and Calma.[5]

About the same time the company began the development of its first general purpose CAD drafting product which was also called T-Square (sometimes referred to as Electronic T-Square). It was initially shipped to users in late 1979 and went into production mode in 1980 at the University of Arizona in Tucson where it was used for a course called Introduction to Computer Aided Design.[6] Ever since then, the software and its derivatives has been well thought of as an educational tool.

Terak was a small computer company in Scottsdale, Arizona, founded by Bill Mayberry, Dennis Kodimer and Brian Benzar. Its primary product was the Terak Model 8510/a which was the machine used by T&W for T-Square. It was based upon the Digital Equipment Corporation LSI-11/03 16-bit processor. The Digital PDP-11 was a fairly substantial machine that was marketed by Digital in several different versions. The LSI-11/03 was primarily an OEM product.

A Terak 8510/a could support up to 128KB of main memory if the 11/03 was replaced with a LSI-11/23. Hard disks up to 40MB in capacity were also available. A basic 8510/a was priced at $8,935 with a monochrome 320 x 240 resolution display. A color version of the machine was also available with 8-color 640 by 480 resolution for an extra $10,550.[7]

Figure 20.1
Terak Model 8510/a

The Terak computer incorporated the UCSD Pascal or USCD-P operating system developed at the University of California at San Diego by Dr. Kenneth Bowles. This operating system was also available as an option on the Hewlett-Packard HP9836 and HP200 series workstations, the Apple II and the IBM PC. Programs written in Pascal were compiled into "p code" (the p stood for pseudo code not Pascal code) which was stored in a compact ASCII format. This p code was then executed using an interpreter which ran in the UCSD-P operating system environment. According to Lazear, the result was fast executing code that could be easily overlaid with new modules in main memory as needed.

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[5] Email from Tom Lazear, March 15, 2003
[6] Email from Tom Lazear, March 7, 2003
[7] http://www.threedee.com/jcm/terak/

In 1979, Lazear quit Fluor and joined T&W Systems on a full time basis. The UCSD-P programming environment was somewhat difficult for programmers to get their arms around. Lazear decided to send the entire programming team to Salt Lake City where they met for two days with Dick Brant, a professor at the University of Utah. Brant was an expert in using UCSD-P and had written a number of programs for the Terak system. He taught the T&W programmers how to develop graphic applications on the Terak and how to structure large programs for that machine. According to Lazear, "That little trip paid huge dividends."[8]

A T-Square system including a Terak 8510/a with 64KB of memory, two floppy disks, a Houston Instruments HIPAD 11" tablet, a Houston Instruments HIPLOT DMP-7 11" by 17" plotter and basic drafting software was priced at $23,500.[9] This was at a point in time when most minicomputer-based systems sold for upwards of $125,000 per seat. T-Square software was targeted at schematic drafting applications such Process and Instrumentations Diagrams (P&IDs). The first trade show that T&W Systems attended as an exhibitor was COMDEX in the fall of 1981 where the company displayed T-Square in the Terak booth. This was followed by A/E/C SYSTEMS in Chicago in the spring of 1982.

T-Square is ported to the Apple II

T&W reprogrammed T-Square for the Apple II computer and introduced it as CADapple in May 1982. Apple was a hot computer company and the decision to support the Apple II rather than the IBM PC was a logical decision at that time. History would eventually prove otherwise. A CADapple system including an Apple II computer with 48KB of memory, two floppy disks, a joystick for cursor control, a Houston Instruments DMP-7 plotter and software sold for $9,995. A tablet cost an additional $1,000 while the software alone sold for $2,475. By 1983, CADapple was the number one selling CAD package on the Apple II with the primary competition coming from Cascade Graphics. Within seven years the price for CADapple was just $395.

The initial T-Square software was written primarily by Mike Lazear. While in college he had done some work on drawing generation and serial drivers for peripheral devices that were incorporated into the Terak software. One of Mike Lazear's classmates at CSLB, Chris Stammen, was recruited to work on the Apple implementation of T&W's CAD software. Lazear describes Stammen as "one of the most intense, and good programmers I have ever met."[10] Paul Barr, who was Debbie Lazear's boyfriend at the time, joined the team on a part time basis along with several high school students, Brian Martin, Richard Endo and Ken van Hyning. They were bright young programmers who accomplished much while working for T&W. Martin went on to get a PhD in mechanical engineering from UCI and currently works on defense and aerospace programs such as the Predator drone.

Programming T&W's software for the Apple II was complicated by the fact that the computer being used by Chris Stammen had two floppy disk drive and no hard drive. The source code for CADapple filled 20 floppy disks. Each program compilation required that the disks had to be fed into the computer one at a time in sequence. If

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[8] Email from Tom Lazear, March 7, 2003
[9] *Anderson Report* April 1982
[10] Email from Tom Lazear, March 7, 2003

something went wrong, the entire process had to be restarted. According to Lazear, "He was the happiest man on the planet when we finally could afford to buy a 5 MB hard drive."[11]

Tom Lazear gives much of the credit for the quality of the CADapple and eventually VersaCAD software to Mike Lazear. Mike created the documentation methodology the company followed as well as the organization of the software code itself. According to Tom Lazear, "He brought in the new folks, trained them in the way we did things, parceled out the work, and carried the code up to over 1,000,000 lines of code that was originally in Pascal and then later in C…"[12]

The VersaCAD era begins

In November 1982, Autodesk introduced AutoCAD at COMDEX. Although no early comparisons have been found, it appears that CADapple had greater functionality than did AutoCAD at that point in time. T&W Systems soon had a PC version of its software. In January1983 the company introduced the T-Square software renamed VersaCAD for the PC, priced at $1,995. It used the UCSD-P operating system and essentially the same Pascal code that ran on the Terak system. The company also provided its software for rebranding by other system vendors including E2000 through Carrier Corporation for the Hewlett-Packard 9863, Terak MarsCAD through Staedtler Mars and OmniDRAFT through AT&T's OmniCAD Division. Staedtler Mars also resold VersaCAD on the HP9836 computer as MarsCAD. All these systems used the UCSD-P operating system.

In a paper presented at the 1983 NCGA Conference[13], Lazear described a typical Apple-based CAD system consisting of an Apple II computer with 64KB of main memory and a third-party floating-point card. Complete with a graphics monitor, two diskette drives, a plotter, a digitizer, and a comprehensive software package such as CADapple, these systems cost about $10,000 in 1983. At that price, a hard disc was not included. Lazear saw such systems being used as preprocessors to larger CAD systems or in situations where the expected productivity improvement did not justify a high-end system.

The balance of his 1983 paper went on to describe the functionality needed in a low-cost system. One important characteristic Lazear pointed out was that the user should always be working on a copy of the drawing, never on the original. The original would only be updated when the working copy was saved. This sounds like standard methodology today, but many systems of that era had users working on the saved copy of a drawing.

The early implementation of VersaCAD required an IBM-compatible PC with 128KB of main memory, two floppy disk drives, a monochrome monitor, a color monitor, two RS-232 serial ports, a digitizer and a pen plotter. The monochrome monitor was used for program messages and menus while the color monitor was used for graphics. Since VersaCAD drawings were stored in a floating-point format, a math co-processor was highly desirable.

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[11] Email from Tom Lazear, March 20, 2003
[12] Email from Tom Lazear, March 7, 2003
[13] NCGA *Proceedings* 1983 pg 492

Four PC CAD packages were profiled in the July 24, 1984 issue of *PC Magazine*: AutoCAD, VersaCAD, Drawing Processor (BG Graphic Systems), and CADplan (Personal CAD Systems). AutoCAD and VersaCAD were clearly seen by the author, Allen Meilach, as being the market leaders. AutoCAD was supported on more PC platforms than VersaCAD and took advantage of a wider range of peripheral devices. In particular, AutoCAD supported the use of a mouse for cursor control as well as tablets while VersaCAD required a tablet. AutoCAD also scored better in regards to the user's ability to customize menus, the creation of user defined cross-hatch patterns and nested graphical objects.

VersaCAD, on the other hand, was considerably faster than AutoCAD since it only had to scan active layers when it regenerated an image on the monitor. Other advantages VersaCAD possessed included the ability to dynamically track the size, position and orientation of symbols prior to placing them, the ability to place and edit fillets, the use of Bezier curves, and the use of a workfile concept for data recovery.

While a hard disk was not required, Meilach recommended one since this data recovery technique required frequent disk accesses. He also pointed out that although VersaCAD was more expensive than AutoCAD, it included many features that were optional with the latter program. Also, the VersaCAD buyer received free upgrades for the first year while AutoCAD users had to pay for them. Regarding VersaCAD, Meilach commented "The program is aggressively updated and should be a leading contender in the micro-CAD market."[14] By the end of 1984, T&W Systems had annual revenues of slightly over $2 million.

VersaCAD is ported to MS-DOS

By 1983, Microsoft's MS-DOS was clearly becoming the personal computer operating system of choice. An MS-DOS version of VersaCAD came out in 1984, or about two years late according to Lazear.[15] During the next six years, T&W Systems released a continuous stream of VersaCAD enhancements. A 3D surface geometry module with wireframe and hidden line removal for $495 was released in April 1985. According to *CAD/CIM Alert* "Incidentally, now that it is available for the IBM PC, T&W's VersaCAD may well rival AutoCAD's hold on the PC CAD market."[16] Since VersaCAD had been available on the PC since August, 1983, I am assuming that the newsletter was referring to the MS-DOS version of VersaCAD.

In October 1985, the company made a significant move when it introduced a UNIX version of VersaCAD for the Sun 2 workstation. As with many software packages of that period, the UNIX copy carried a price premium, $4,000 versus $1,995 on the PC. A Japanese language version of the package was also made available about the same time. This might well have been the first Japanese language version of a PC CAD package. The company also began to see large companies buying its software, utilizing its corporate site licensing agreement. For example, GE Aircraft Engine had over 3,000 active seats of VersaCAD at one time.[17] Other large users included defense contractor

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[14]Meilach, Allen, "Getting the Picture", *PC Magazine*, July 24, 1984
[15] *Computer Graphics,* February 2001
[16] *CAD/CIM Alert,* April 1985
[17] *Anderson Report,* October 1985

AAI with 1,000 seats, AT&T with 1,000 seats and the California Department of Transportation with 300 seats.[18]

In December 1985, T&W Systems introduced VersaDATA, a relational database management system for the PC version of VersaCAD priced at $3,000. Then in March 1986, VersaMODEL, a solids modeling package licensed from Caetec Technology in Atlanta, Georgia was introduced with prices starting at $8,200. Shortly thereafter, the company extended its UNIX offering to include Apollo and IBM workstations. T&W Systems began to market EasyCAD in April 1986 priced at $495.[19] EasyCAD had been developed by Mike Riddle, the developer of the initial version of AutoCAD. EasyCAD was able to share files with both AutoCAD and VersaCAD.

The March 11, 1986 issue of *PC Magazine* contained an extensive article on PC CAD, its first since the previously mention 1984 article. This time it was written by contributing editor Glenn Hart and covered 11 different packages. Overall, Hart's comments regarding VersaCAD Advanced (the then current name for the 2D version of VersaCAD) were fairly positive. He liked the fact that the previous hardware protection which had required a plug-in card that took up an expansion slot in the PC had been replaced by a software technique called *SuperLok*. The software now supported the use of a mouse for cursor control and only a single monitor was needed. Menus appeared along the left side of the screen while messages and coordinate values were at the bottom.

Some of the other VersaCAD features Hart liked included:
- The use of single letter commands for frequently used actions.
- The ability to create temporary guidelines.
- The use of symbol outlines with internal detail suppressed to speed up display operations.
- The selection of symbols from individual libraries by entering the symbol number and library identification.
- The ability to calculate the area and perimeter of irregular areas as well as the ability to calculate cross section properties including moment, center of gravity, etc.
- The optional solids modeling module was considered superior to anything Autodesk currently offered but less functional than CADKEY.
- The optional bill of material module, VLIST, was considered to be particularly effective.

On the other side of the equation, there were a number of areas where Hart felt that VersaCAD needed to be improved. These included:
- The user interface, while "perfectly usable" was not up to the best of the competition.
- Dimensioning was considered limited – as an example, if a dimension did not fit, the user had to resize the dimension text.
- Drawings could only contain 100 different symbols.
- Crosshatching was still fairly limited with no predefined patterns and no ability for the user to define patterns.[20]

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[18] Email from Tom Lazear, March 20, 2003
[19] *CAD/CIM Alert*, April 1986
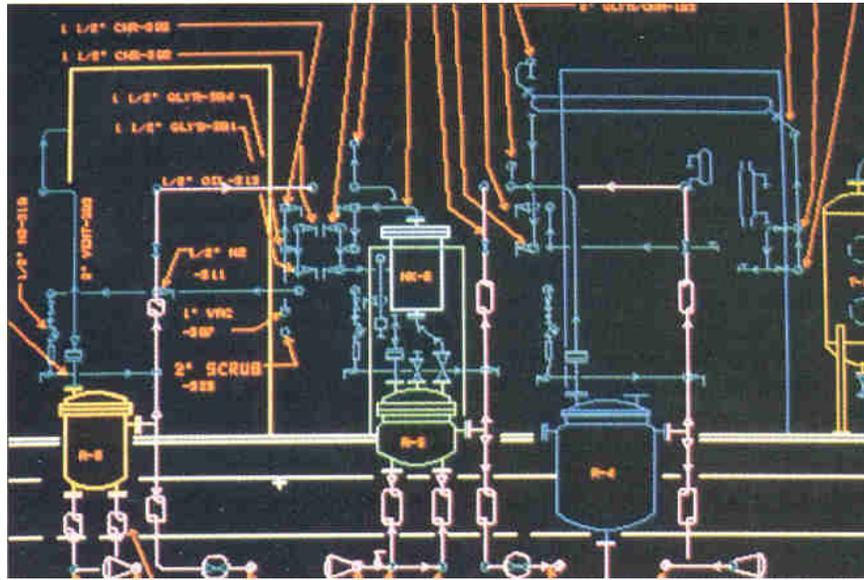[20] "Complex CAD Software for the PC" by Glenn Hart *PC Magazine*, March 11, 1986

Figure 20.2
VersaCAD Advanced Screen Image[21]

T&W and VersaCAD begin to mature

In 1986 T&W Systems changed its name to Versacad Corporation (Note different spelling of company name and product name). It had revenues of $5.5 million during the fiscal year which had ended July 31, 1986. According to Daratech Associates, the company had 30,000 users at the end of 1986 including 6,000 CADapple seats and 1,000 EasyCAD seats. By early 1987 the company's product line consisted of the following software packages:[22]

- VersaCAD Designer which included both VersaCAD 2-D and VersaCAD 3-D - $2,995 (The 2-D and 3-D modules now had a consistent user interface)
- VersaCAD 2-D - $2,495 (Earlier called VersaCAD Advanced)
- VersaCAD 3-D - $995 (This package required VersaCAD 2-D but was priced separately so that a user could start with 2-D and then move to 3-D)
- Expert Symbol Libraries - $495 each (symbol libraries were available for mechanical engineering, pipe fittings, heating, ventilation and air conditioning, industrial controls, hydraulic schematics, architectural, mapping, and electrical and electronic schematics)
- VersaData -$495
- VersaMODEL - $8,000 and up
- EasyCAD - $495
- CADAPPLE - $1,495
- CADAPPLE Entry Level - $99 (A limited function version of CADapple intended for education purposes)

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[21] "Complex CAD Software for the PC" by Glenn Hart *PC Magazine*, March 11, 1986
[22] *CAD/CAM CAE Survey, Review and Buyers' Guide*, Daratech Associates, 1987

Around this time, Versacad had slightly over 200 resellers around the world distributing its software including Tandy/Radio Shack, MicroAge and SPI SoftPac International. The company was one of the few in the CAD industry that sold corporate site licenses, a marketing strategy that it would resurrect in 1999. Versacad software was used extensively at educational institutions. The company claimed at the time that over 50,000 drafters were being trained annually at 1,300 educational institutions.

VersaCAD 2-D was particularly well suited for drafting architectural floor plans. The software handled multi-line walls with automatic corner cleanup as well as the ability to insert windows and doors into these walls. Most other CAD packages required a separately priced architectural add-on to handle these functions. This package also enabled users to automatically convert two dimensional drawings into isometric drawings. VersaCAD 3-D was a surface design package that handled a wide range of geometric primitives and produced shaded images or wireframe images with hidden lines removed.

VersaCAD Release 5.2 in early 1987 supported mass properties and automatic orthographic views. The company also introduced VersaCAD/Mechanical which contained a number of mechanical drafting enhancements including geometric tolerancing, priced at $495. In a press release that month, the company claimed that it had shipped 10,000 copies of VersaCAD 3-D during the prior five months.

A Macintosh version of VersaCAD became available in August 1987. According to Versacad, performance of VersaCAD on the Macintosh was about 2 to 2.5 times that of an IBM PC/AT and about the same as the new 80386 PCs. The major problem with this portion of the company's business was that Apple never did market its computers aggressively to the engineering community. Consequently, there was not much demand for Macintosh design software outside of the architectural area in spite of its ease-of-use characteristics which should have appealed to engineers. By mid-1987 Versacad had grown to 67 employees and had approximately $8 million in annual revenue.

Prime acquires Versacad

A significant change occurred in October 1987 when Prime Computer acquired Versacad for somewhat less than $6 million including $2 million up front and the balance based upon the subsequent performance of the VersaCAD product line. The intent was to continue the operation of Versacad as a separate business entity under the existing management. At the time, Prime had no other PC CAD business activity. Its primary CAD business was centered around Medusa which ran on the company's large minicomputers. Also in 1987, VersaCAD 5.3 was released with multiple 3D viewports.

In February 1988, Prime acquired Computervision, adding that company's Personal Designer PC CAD software to the corporate product mix. Lazear remembers this development being very disturbing to the Versacad employees.

> "….instead of being the only PC CAD part of Prime, we became one of two, and worse, we were general purpose doing $8 million per year and CV Personal CAD was targeting machine design software and doing about $25 million. Also, they were right next door in Bedford, MA while we

were way out in California. We went from favored son to the 'other PC CAD in California.'"[23]

Then in January 1989, Prime completed the acquisition Calma. Lazear had spent nearly six months assisting corporate headquarters in arranging this deal. Bob Fischer was responsible for what Prime now called its Computervision Division in Bedford, MA and Lazear was a group vice president reporting to Fischer and responsible for Versacad, CV's Personal Designer and the Calma products. Overall, Lazear was responsible for about $100 million in revenue and 500 employees

Lazear, was quoted in a Dataquest study as predicting at NCGA '88 in Boston that PC operating systems would shift from MS/DOS and OS/2 to UNIX. The first was expected to decrease from 80% to 40% while UNIX on PCs increased from 0.7% to 30% and Macintosh would go from 18% to 30%. Lazear also predicted growth in the use of relational database management systems to support CAD applications and increased use of IGES. Artificial intelligence "is where the gold is."[24] He was quite accurate in regards to his observations on database management systems but severely underestimated Microsoft's eventual domination of the PC market.

By early 1989, there were 75,000 copies of VersaCAD in use. The price for the Macintosh version was $1,995 while VersaCAD Design for PCs and other platforms sold for $2,995. The software was considered by some to be easier to use than AutoCAD but the company's marketing efforts fell short of what Autodesk was doing.[25] During the next year just 5,000 additional copies were sold.[26] In fact, this 80,000 user figure was still being used in 1994 although Lazear believes that it peaked at about 100,000.[27] During this period, there were few significant product developments in regards to VersaCAD.

Lazear leaves Prime Computer and forms Archway Systems

Tom Lazear left Prime Computer in late 1989 to form Archway Systems, initially to provide a vehicle through which Lazear could provide consulting services back to the Computervision division of Prime. Mike Lazear left Computervision a year later and Archway became a reseller of CAD systems, first for Computervision products including VersaCAD and later for Bentley Systems. Today, Bentley products form the biggest portion of Archway's business followed by VersaCAD as described below.

In March 1991, Prime closed the VersaCAD facility in Huntington Beach, CA and consolidated its PC CAD operations in Bedford, MA. At this point in time, Computervision was selling three PC versions of VersaCAD: VersaCAD/386 designed to run in extended memory on 80386 or later PCs ($3,495), VersaCAD Design for pre-80386 machines (initially $2,995 but subsequently reduced to $1,995) and VersaCAD Drafter which supported limited 2D drafting ($595). The company also continued to sell a Macintosh version of VersaCAD for $2,995 as well as a UNIX version for Sun Microsystems systems.

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[23] Email from Tom Lazear, March 7, 2003

[24] *CAD/CIM Alert*, October 1988

[25] *CAD Rating Guide – First Edition,* 1989

[26] *Anderson Report*, February 1990.

[27] *CAD Rating Guide- Fourth Edition*, 1994

The February 23, 1993 issue of *PC Magazine* had a major article on 2D drafting solutions which was the last one I am aware of to include a detailed description of VersaCAD Version 7. This review was done by Rod Taylor. It doesn't appear that any major changes had been made to the software since the earlier *PC Magazine* review in 1986 although the software now incorporated Computervision's proprietary CAD programming language, CPL, and supported ANSI standard Y14.5M-1982 dimensioning and tolerencing. CPL was initially developed at Versacad in the mid-1980s by Paul Barr. It provided a library of routines that enabled a user to access the VersaCAD drawing file. As an example, one customer, Gary Miller, used it to create a program which automated the design of reinforced concrete parking structures.[28]

The software package now included a hidden line removal and shading module called QuickRender. Like most other PC systems, VersaCAD enabled the user to assign macro commands to tablet menus. VersaCAD Overlay, licensed from Image Systems Technology, enabled VersaCAD to read in raster images and use them as background images. Taylor particularly liked the fact that in a networked environment, a file currently in use could not be modified by another user.

The major complaint Taylor had concerning VersaCAD was the way the software managed memory. When the software was installed, the user was required to define the maximum workfile size. This determined the maximum number of entities in a drawing. Some drawing tasks such as cross hatching generated a large number of entities and could easily overflow this predefined limit. Selecting too high of a value on a machine with limited memory could restrict the software's ability to perform other operations.[29]

Once the PC CAD operation was moved back to Bedford, little attention was paid to the VersaCAD portion of the product line. As an example, at Computervision's annual user conference in September1993 there were ten papers presented involving Personal Designer but none from users or company personnel regarding VersaCAD.[30] By 1997, Computervision did not even feel it necessary to provide data on VersaCAD to the *CAD Rating Guide.*[31]

In 1992, the CAD software portion of Prime Computer had regained the Computervision name and it once again became a publicly traded company as described in Chapter 12. Computervision struggled throughout the balance of the 1990s to regain its former momentum without a great deal of success. Finally, in January 1998, Computervision was acquired by Parametric Technology Corporation which clearly was not interested in the VersaCAD product line. PTC had acquired Computervision primarily to get access to the latter company's large defense, aerospace, automotive and industrial equipment accounts. VersaCAD continued to languish, forgotten by all except its loyal users.

Emerald Forest morphs Into Pelorus
One aspect of Prime's acquisition of Versacad that is not well known is the linkage between an advanced development project at Versacad called "Emerald Forest"

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[28] Email from Tom Lazear, March 20, 2003
[29] "2-D Drafting: Why Pay More" *PC Magazine,* February 23, 1993
[30] Fifteenth Annual Computervision User Conference Proceedings, September 1993
[31] *CAD Rating Guide- Fifth Edition*, 1997

and a subsequent technology initiative launched by Computervision several years later called "Pelorus." Emerald Forest started at Versacad in 1986 with the intention of applying two of the latest software development concepts, the use of object-oriented software technology and the combination of OS-2 and the Presentation Manager user interface. This was a substantial undertaking that was led by Chris Stammen. By mid-1987, Stammen and his development team had a prototype up and running.

In October 1987, Lazear and Stammen went to a major technology announcement hosted by Microsoft and IBM at the Gugenheim Art Museum in New York regarding the plans these two companies had for OS-2 and Presentation Manager V2.0. Versacad was one of 12 developers that had been invited to demonstrate software using these products. At the time, Microsoft and IBM were jointly involved in the development and promotion of OS-2 although the relationship was tenuous at best.

Lazear remembers Bill Gates and Steve Ballmer touring the tables where the invited developers were set up to show their new OS-2 software. When they got to the Versacad table, Ballmer introduced Lazear and Stammen to Gates who said "I've been meaning to ask, why do you CAD guys use floating point arithmetic?" Lazear says that he used as an example designing a large structure such as the Golden Gate Bridge to fairly fine tolerances using complex trigonometric calculations. He said that he clearly remembers the date since it was the Monday that the stock market crashed in 1987.

After Prime acquired VersaCAD in late 1987, Emerald Forest development continued at the company's Huntington Beach, CA office but no products explicitly based upon this technology were introduced as part of the VersaCAD product line. Eventually, the development of Emerald Forest was moved to Prime's Calma facility in San Diego, CA. Subsequent to the company being resurrected as Computervision this software was renamed Pelorus and marketed by the company as a new-generation CAD development environment. Computervision attempted to license the technology to other software companies as well as use it as the basis for the company's own applications. One such package introduced by Computervision was called DesignPost. It was intended to be the successor to VersaCAD but never made much of an impact in the market and eventually disappeared from sight.[32]

Archway reacquires rights to VersaCAD

Archway Systems meanwhile had grown to be a respected reseller of both AEC and mechanical design software products. In particular, Archway was a significant reseller of Bentley Systems' MicroStation software in Southern California. In mid-1999 PTC notified VersaCAD users that as of a predefined future date, PTC would stop selling additional copies of VersaCAD and would only provide support for a short period thereafter. Lazear saw a business opportunity regarding VersaCAD and contacted some people he knew from his Prime/Computervision days. They put him touch with Steve Walske, PTC's CEO and after three months of legal wrangling they worked out a deal.

As of October 1999, Archway took over full responsibility for supporting VersaCAD and its installed base. Apparently, the only cost for doing this was an obligation by Archway to provide a VersaCAD to Pro/ENGINEER file converter. The first problem faced by Archway was contacting existing VersaCAD users. The only

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[32] Email from Tom Lazear, March 20, 2003

mailing list available was nine years old. A mailing to that list, however, turned up 200 users with over 1,500 licenses in use.

Since reacquiring VersaCAD, Archway has reduced the price for a new license to $795 with an unlimited corporate license set at $5,495, ported the software to Windows, signed up numerous users to a maintenance and support plan, launched a new release of the Macintosh version and continued to enhance the overall package. Several of the original developers including Mike Lazear and Paul Barr are once again involved in supporting VersaCAD along with Mike's son Josh Lazear. Nothing like keeping it in the family for three generations.

Lazear believes that there are still 20,000 VersaCAD users and he intends to provide them the support he feels they deserve. A total of 600 organizations representing an estimated 6,000 seats of VersaCAD have signed up for Archway's software support program. The company continues to sell new VersaCAD licenses to schools, to existing users, to users who move to new companies, to companies looking for low cost CAD and to Macintosh users.

The Macintosh version of VersaCAD is an interesting situation. Although VersaCAD is one of only a few generalized CAD packages available for the Macintosh platform, the PC version outsells the Macintosh version ten to one. Fundamentally, Apple continues to do a poor job of marketing its computers to technical users. Complicating the Macintosh situation for Archway is that the new operating system of choice for that platform is OS X. Converting VersaCAD to UNIX-based OS X was a substantial undertaking, one that Archway completed in 2006.

Why Did Autodesk Win this War

The major issue surrounding VersaCAD is why Autodesk's AutoCAD package began to outsell it by a large margin within several years of the latter's launch in late 1982. VersaCAD was on the market first, was easy to use and had greater functionality during the early years of competition between the two products. There seems to be a number of reasons for Autodesk greater success.

- Once Mike Ford joined Autodesk, it became significantly more marketing oriented than Versacad, spending a substantially greater portion of its capital on marketing. One example provided by Lazear involved an early A/E/C SYSTEMS conference in Anaheim, CA. Ford sent free airline tickets to a number of speakers prior to the show inviting them to visit Autodesk in Sausalito, CA. As a consequence "every speaker talked about what they had seen at Autodesk."[33]
- Autodesk built a larger reseller channel and did so faster than Versacad.
- Autodesk was more proactive in supporting 3rd party developers and user groups.
- Several industry analysts feel that the fact that VersaCAD utilized hardware protection for its software while Autodesk did not except for a brief period of time, was a significant factor in Autodesk's relative success.[34] Lazear agrees that the company's own market research confirmed this perception. When T&W Systems dropped all hardware

[33] Email from Tom Lazear, March 7, 2003
[34] Personal conversation with Dr. Joel Orr, February 28, 2003

protection in 1985, the company did not see a significant improvement in sales based upon this action, however.[35] My conclusion is that hardware protection may have been a contributing factor to Autodesk's relative success but was not a dominating factor.

- Autodesk supported MS-DOS from the start while it took some time for VersaCAD to be ported from UCSD-P to MS-DOS. T&W Systems selected UCSD-P over MS-DOS because it felt that the former operating system was technically superior to the Microsoft product. Current readers may not be aware that there were perhaps as many as ten different operating systems to choose from during the early days of the PC. Lazear was not impressed by the early versions of MS-DOS. "I remember evaluating it in 1980 and saying 'this is trash' very inefficient and awkward. It didn't have all the features or support that UCSD-P had."[36]
- Autodesk gave away a large number of licenses to educational institutions while T&W Systems continued to sell software into this market. According to Lazear, "We were reluctant to give away the badly needed revenue."[37]
- VersaCAD was priced at $1,995 and then $2,995 at a time when basic AutoCAD was being sold for $1,000.

[35] Email from Tom Lazear, March 7, 2003
[36] Ibid
[37] Ibid